GHG Platform INDIA

# Webinar: Overview of GHG estimates for India

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**Date: 16 November 2018**

# AGENDA

- Methodology guidance development & Approach by Subrata Chakrabarty, WRI India
- Energy sector analysis by Nikhilesh Dharmala, CSTEP;
- Industry sector analysis by Tirtha Biswas, CEEW;
- AFOLU sector analysis by Raman Mehta, Vasudha Foundation;
- Waste sector analysis by Nikhil Kolsepatil, ICLEI South Asia;
- Q&A

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# METHODOLOGY DEVELOPMENT & GUIDANCE APPROACH

# GENESIS OF THE PLATFORM

- The formation of GHG Platform India was a culmination of process that begun at the sidelines of COP20 – Lima in Dec 2014;

- In COP20, that the findings from similar platform in Brazil called System for Estimation of Emissions of GHG (SEEG) was presented in the side event;

- To explore the merits of establishing similar platform in India, a technical workshop was held at New Delhi in Apr 2015 with participation from 4 Brazilian experts involved with inception of SEEG.

# RATIONALE

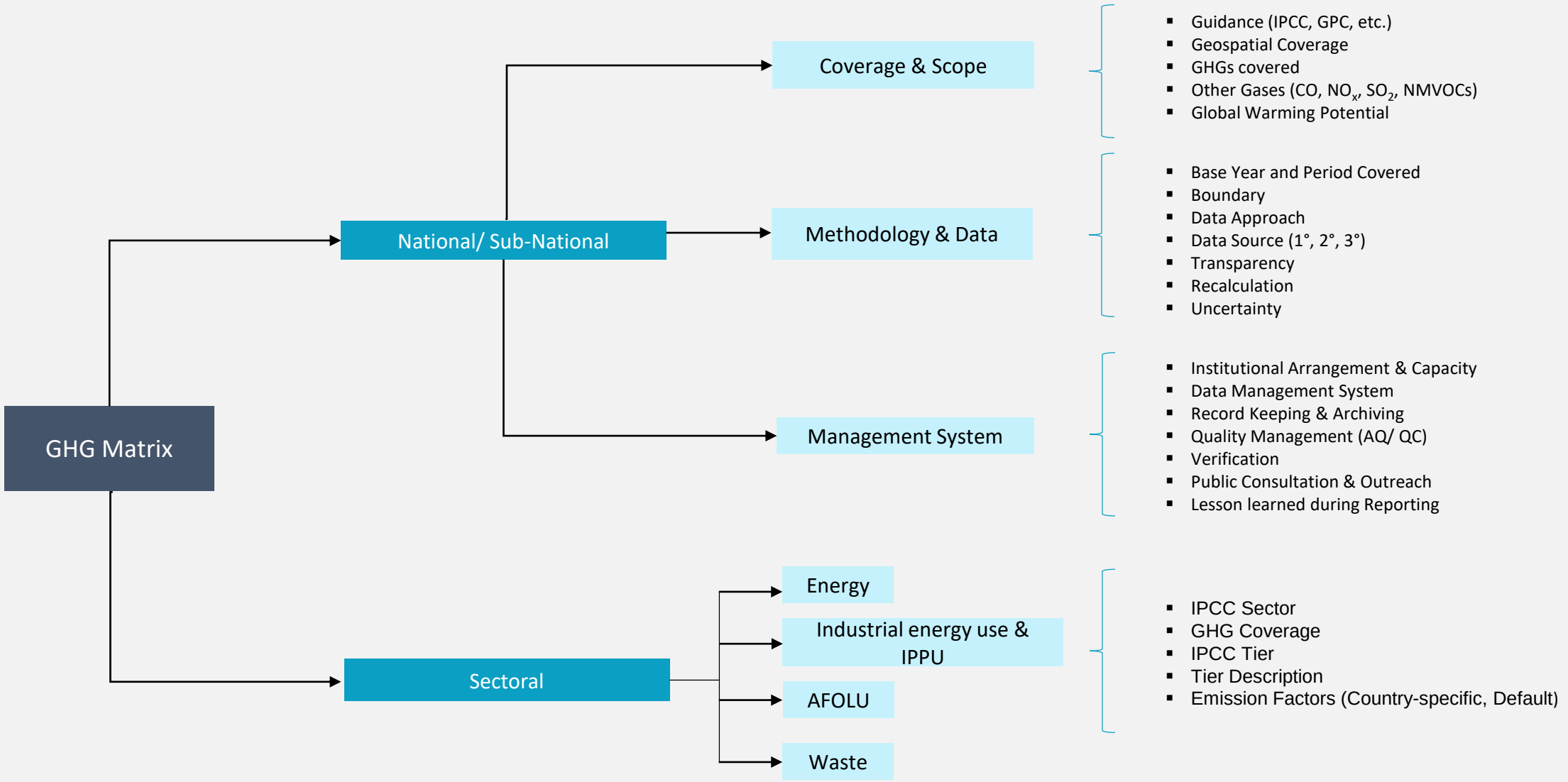
- Creating a starting point to track GHG emissions;
- Understanding GHG emission trends both at national and state level;
- Identify opportunities to establish climate mitigation goals;
- Address gap in GHG data availability at national and state level;
- Enhance accessibility of data from a single platform;
- Help inform policy dialogue and decision making.

# METHODOLOGY & APPROACH

- Requirement of consistent methodology which is internationally acceptable and locally relevant


- Requirement of consistent reporting for all key economic sectors

# DEVELOPMENT OF GHG MATRIX



# KEY FEATURES

## Guidance

Flexibility to choose from IPCC Good Practice Guidance or National Good Practice Guidance.

## Choice on GWP

Reporting based on SAR values for comparability with official reports;
Reporting based on latest AR values to be in-line with IPCC good practice.

## Transparency

Transparency in:
Assumptions;
Proxy data;
Emission factors;
Calculation

## Sample calculation

For each key source categories, sample calculation is included in reports so that reader could understand and reproduce the emission estimates

## QC/QA

Guidance on ensuring quality of GHG estimates
QC measures for AD, EF, assumptions, consistent methods
QA ensured by mandating peer review

## Recalculation

Clear guidance on possible reasons;
Clear guidance on reporting of recalculations to ensure accuracy and completeness.

## Uncertainty

Guidance on type of Uncertainty;
Identifying and Reporting on type of uncertainty.

## Specific Guidance

Agriculture, Forestry and Fishing; On-road and off-road transportation; W2E,
Others.
Clarity on emission source & reporting guidance.

# THANK YOU

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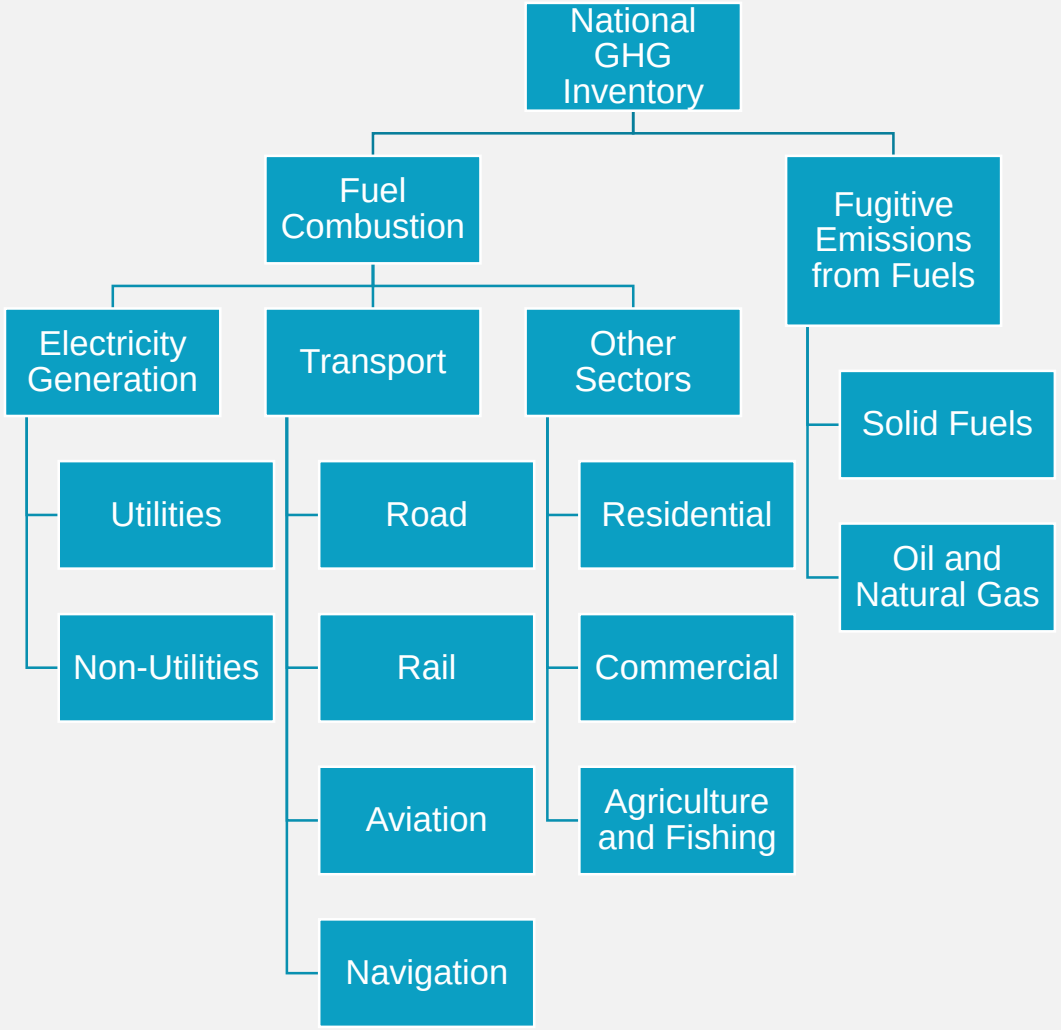
# OVERVIEW OF GHG ESTIMATES IN INDIA: ENERGY SECTOR

# ENERGY SECTOR CLASSIFICATION



# METHODOLOGY

The basic equation used in for calculating the GHG emission is:

**$Emissions_{Gas} = \sum_{Category}$ Activity data (AD) x Emission Factor (EF)**

*For example $CO_2$ emissions are estimated as:*

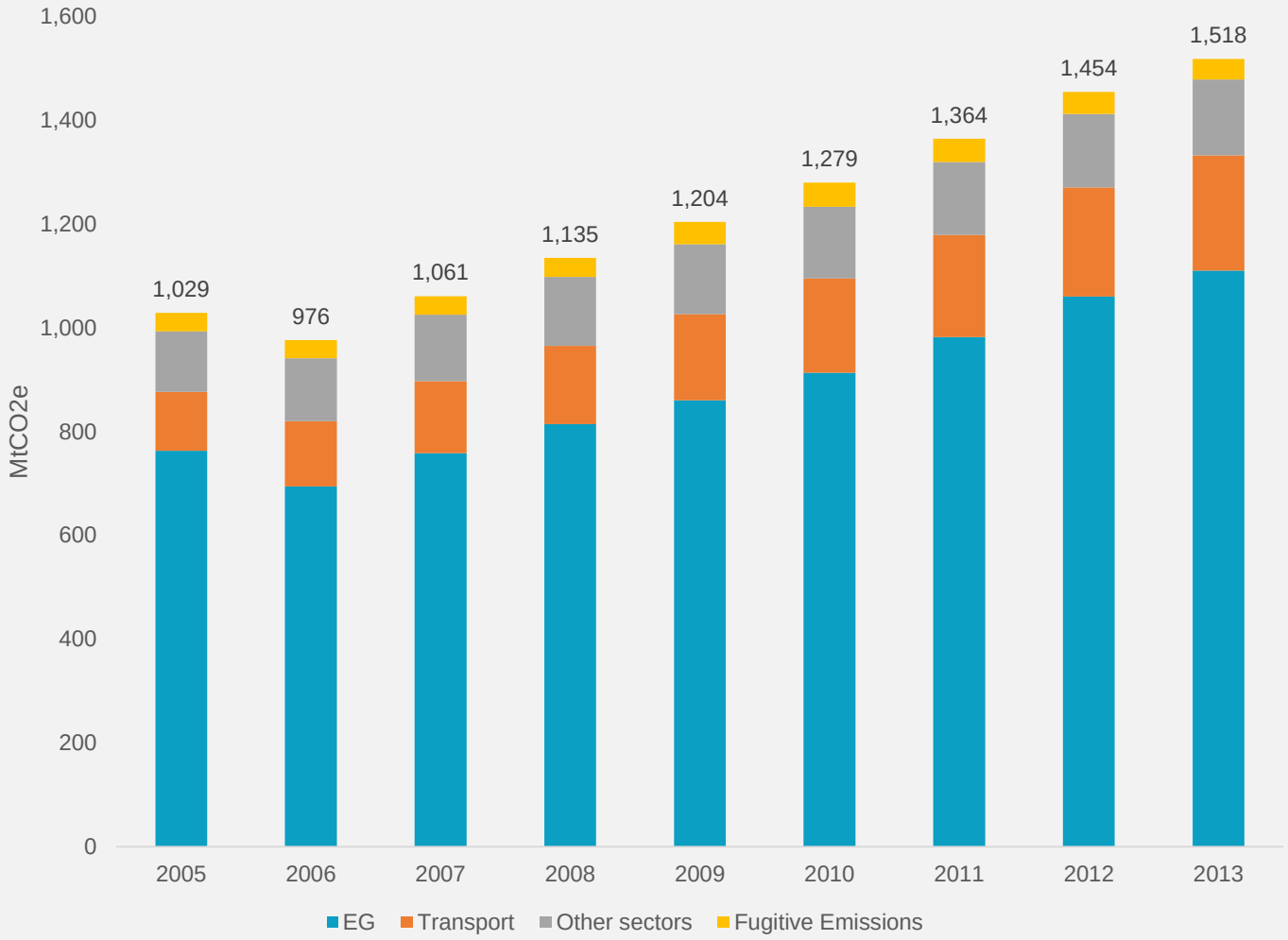
$CO_2$ Emissions = Fuel Consumption x Net Calorific $Value_{Fuel}$ x $CO_2$ $Emission\ Factor_{Fuel}$

- Activity data sourced from various Ministry reports
- Emission Factors are default factors from IPCC guidelines and country-specific publications.
- Gases covered: $CO_2$, $CH_4$ and $N_2O$
- Other data: Fuel calorific values and density parameters

# ACTIVITY DATA

| Fuels | Electricity Generation | Transport | Other Sectors | Fugitive |
|---|---|---|---|---|
| Coking Coal | | | | |
| Non-coking coal | | | | |
| HSDO | | | | |
| LDO | | | | |
| Natural Gas | | | | |
| Firewood | | | | |
| Kerosene | | | | |
| LPG | | | | |
| Motor Spirit/Gasoline | | | | |
| LSHS/HHS | | | | |
| ATF | | | | |
| Fuel Oil | | | | |
| Lignite | | | | |
| Naptha | | | | |

# NATIONAL ESTIMATES




| Sector | Growth rate |
|---|---|
| EG | 4.8% |
| Transport | 8.8% |
| Other sectors | 2.8% |
| Fugitive Emissions | 1.5% |

# SECTORAL CHALLENGES

| Challenges | Sectors |
|---|---|
| Continuous time series data not available | All sectors |
| Country (India) specific emission factors for some fuels are not available | All sectors |
| Lack of sector-wise data for consumption and production of petroleum products | Transport, other sectors, and fugitive |
| Difference in fuel consumption data at the national level and the state level | Transport and other sectors |
| Consumer expenditure survey (NSSO) not conducted after 2011-12 | Other sectors (Residential) |
| Degree of Gassiness for UG Coal not ascribed to depth | Fugitive |
| Leakage rate assumed from literature | Fugitive |

# STRATEGIES USED

- Linear interpolation and extrapolation
- Proxy-based data analysis
- Employed IPCC emission factors for the fuels, on a case-by-case basis
- Consultation with experts
- Informed assumptions (literature)

# THANK YOU

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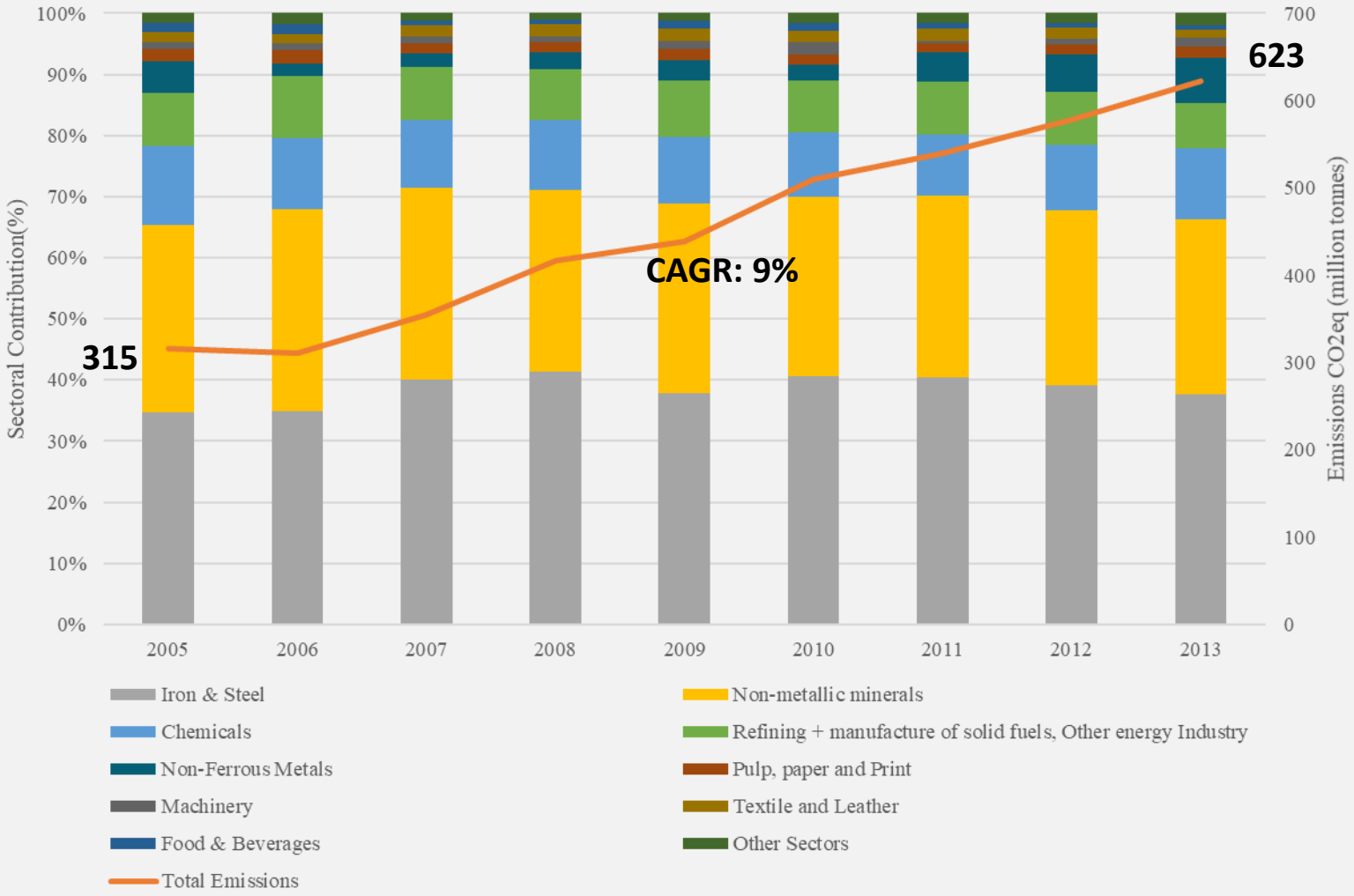
# OVERVIEW OF GHG ESTIMATES IN INDIA: INDUSTRIAL ENERGY USE & IPPU

# GHG emissions overview from energy use and IPPU (2005-13)




**Major contributors (2013):**
Iron and Steel: 38% (234 mtCO2e)
Non-metallic (cement): 29% (178 mtCO2e)

**Share of energy & IPPU**
Energy: 75%
IPPU: 25%

**Coal:** Driver of energy use emissions
**Cement**: Represents more than 50% of IPPU (largely due to limestone)

The share of energy use emissions in India's overall emissions
2005: ~ 19%
2013: ~ 25%

# Methodology employed

## Scope and coverage: (As per IPCC guidelines)

**A. Energy Industries:** Petroleum refining – 1A1b; Manufacturing of Solid fuels – 1A1ci; Mining & Hydrocarbon extraction – 1A1cii

**B. Manufacturing industries*:** 1A2a to 1A2m

**C. Industrial processes and product use emissions:** 2A, 2B, 2C, 2D & 2H

## Exclusions

- **Manufacturing Industries:** Construction (1A2k);
- **IPPU**: Fluorochemical production (2B9), Electronics (2E), Refrigerants (2F), and Electrical products (2G)
- Emissions due to F-gases

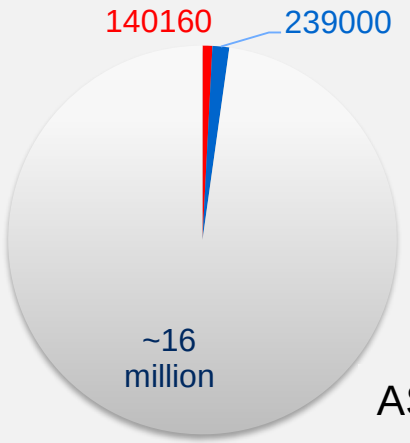
## Uses both Tier I and Tier II methodology

- Energy Use Emissions : Tier II
- IPPU Emissions : Tier I and Tier II

**Emission** = **activity data** x **emission factors**
(***follows IPCC 2006 guidelines***)

*: Excludes emissions from captive electricity generation

# Data Sources (Primarily Annual Survey of Industries)




ASI 2005-06

**ASI covers 96% of energy use emissions and 19% of IPPU emissions**

## What's left out from ASI?

- Informal enterprises: ~ 16 million

## Nature of these firms

- As per NSSO (62nd round) & MSME 4th round of survey:
  - 38.6% of total firms don't require any power
  - 48.2% relies on electricity as a source of energy (covered under energy sector emissions)

## Advantages of using ASI

- **Economy wide coverage at state and sectoral level**
- **Mix of census and survey** – Census units represent **~ 93%** of emissions in 2013
- Captures reporting on **80+ fuel variants**
- **Separate reporting for imported and domestic fuel inputs** – helps in applying appropriate emission factors
- Separately reports fuel use for captive power generation, hence easy to avoid duplicity in reporting

# Challenges and Methodological Assumptions

**Format of reporting in ASI**

- 47% of fuel use reporting is generic, clubbed under solid (coal), liquid, and gaseous (natural gas) fuels.
- **Remodeled such use based on pattern evident from the specified reporting over a period of time with each sector at sub-national level**

**Reporting oversight by certain factories; poor scrutiny mechanism of ASI**

- Erroneous reporting found with certain units for: unit of reporting, quantity consumed, price of fuel
- Triangulation of information helped us fixing such errors.
- Wherever data is missing for quantity, price assumptions are based on similar industry at the state level

**Separation of fuel and feedstock**

- ASI has such provision, poorly followed by industries.
- Proxies and assumptions were made for certain combination of industry and fuel types after consulting industry experts and secondary literature

**Informal sector: Still a black box**

- ASI captures only the major sub-set of formal sector operation
- NSSO and MSME surveys does not appropriately captures the energy use, and are not periodic. Hence paucity of information still exists.

# THANK YOU

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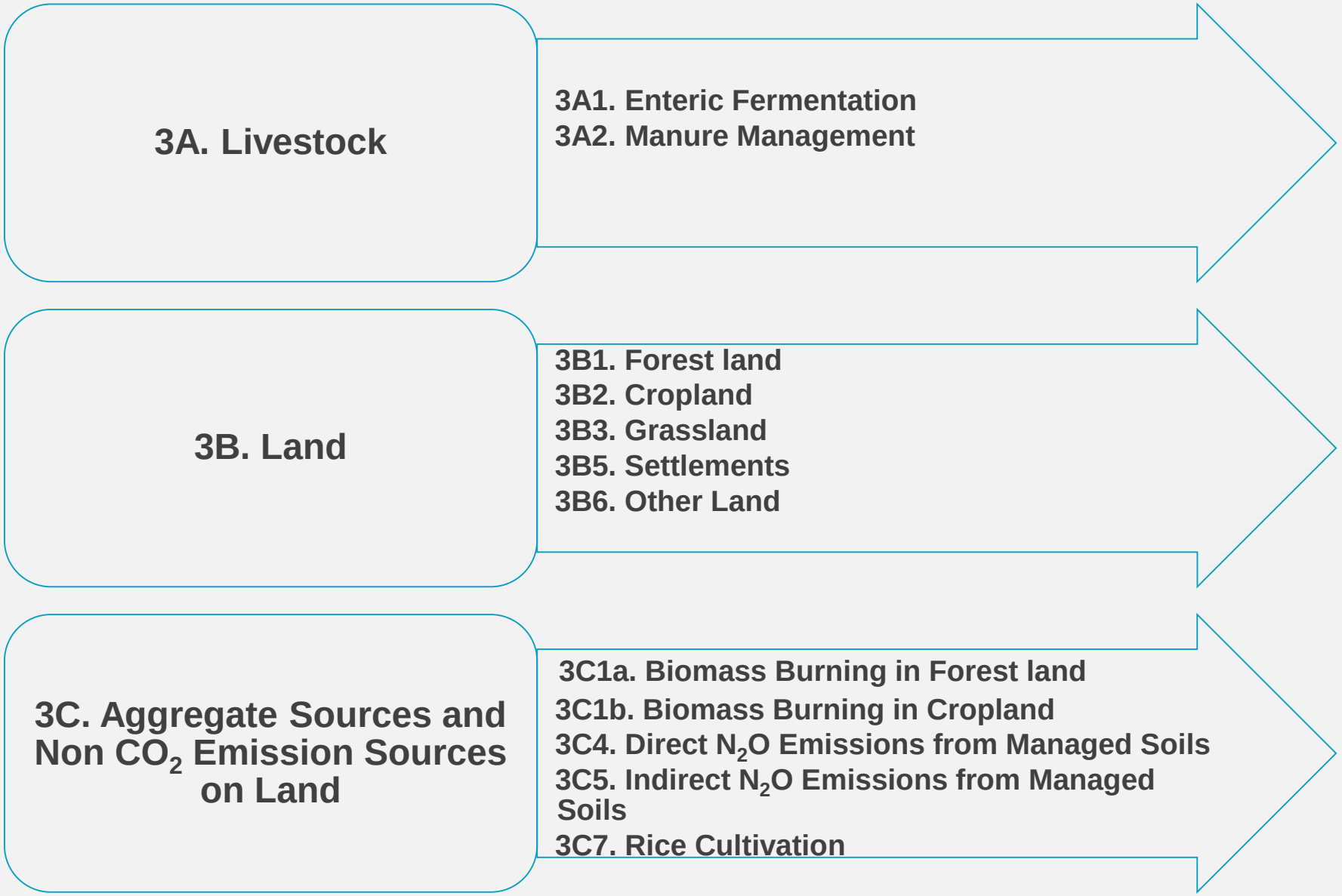
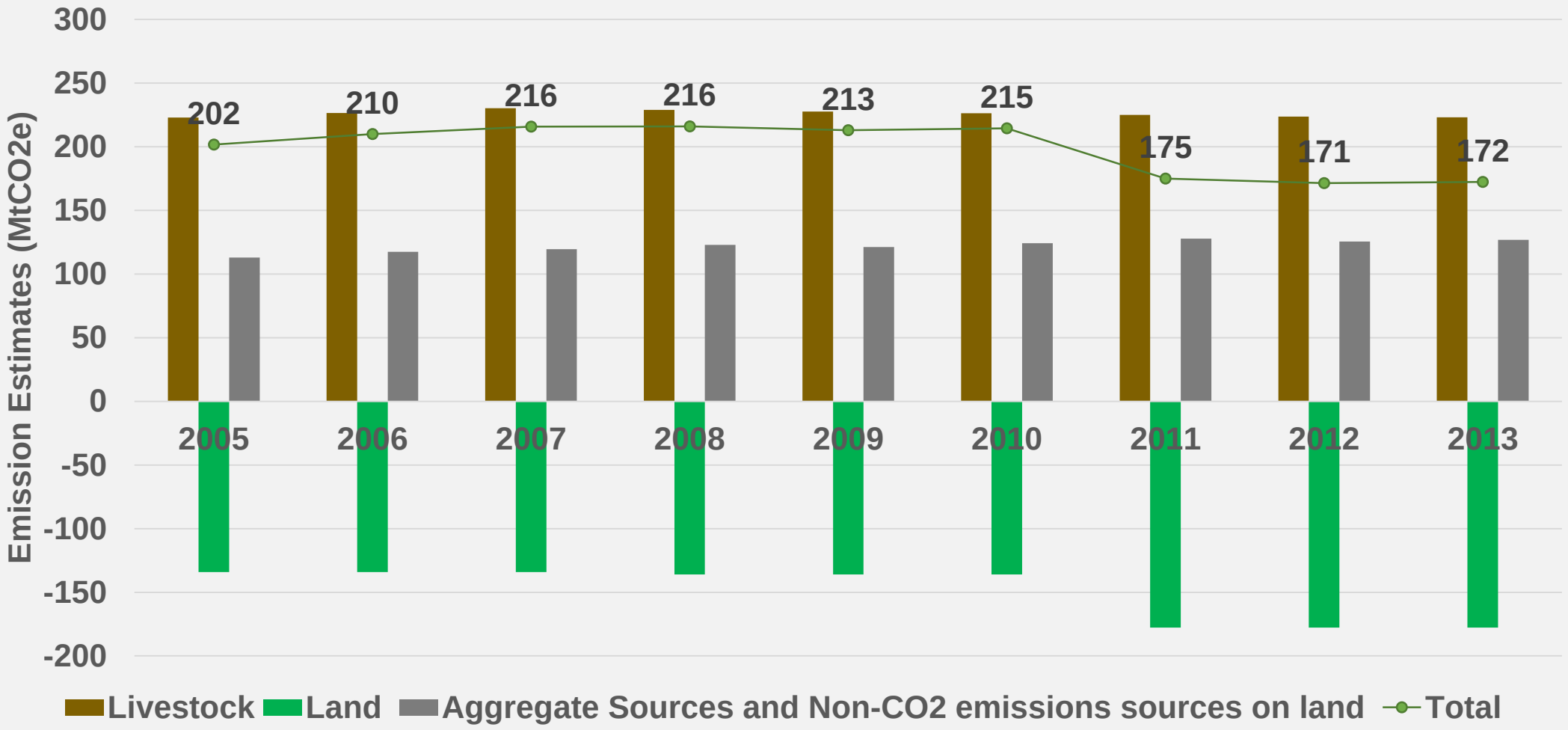
# OVERVIEW OF GHG ESTIMATES IN INDIA: AFOLU SECTOR

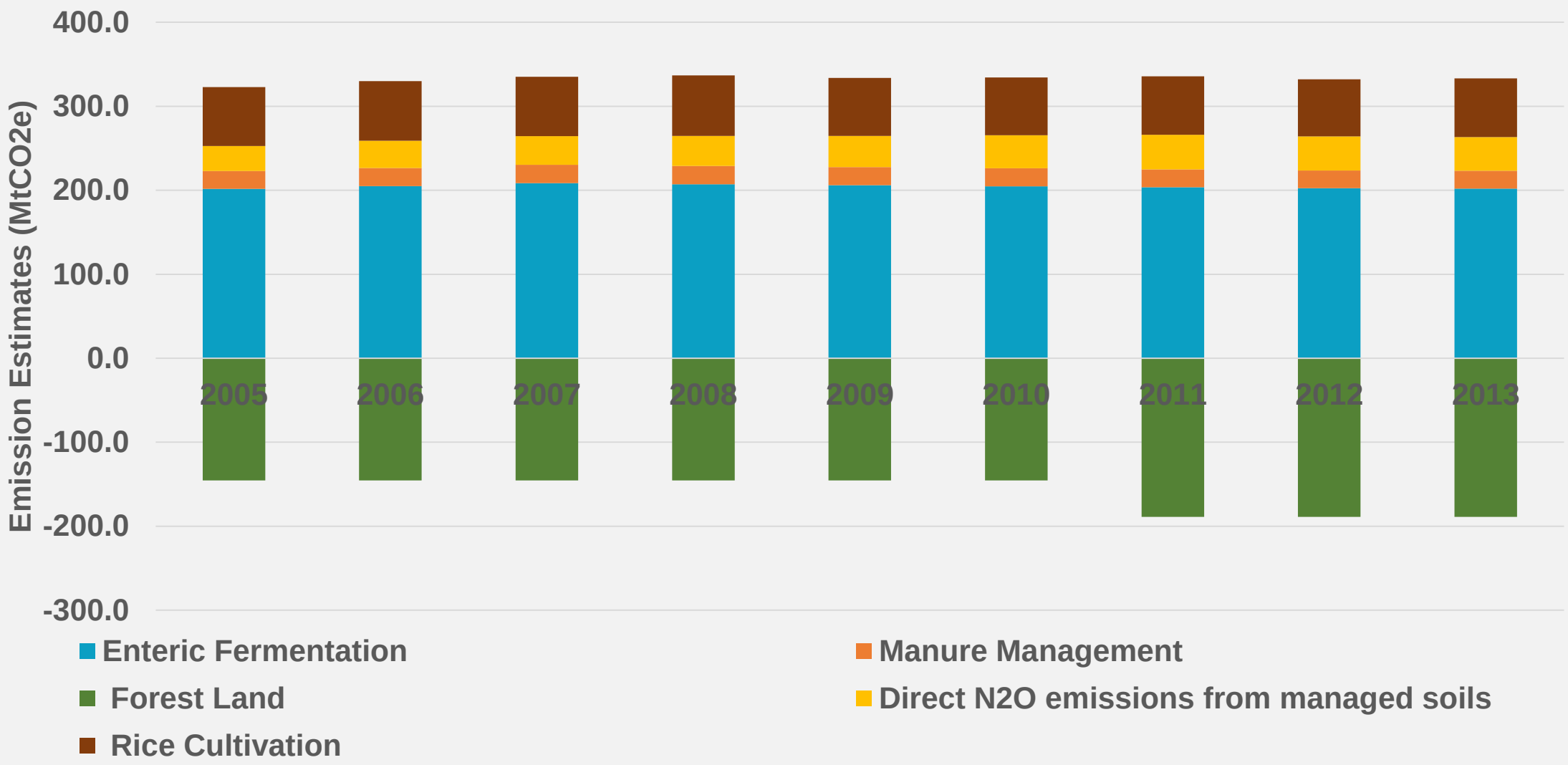
# SCOPE


3A. Livestock
3A1. Enteric Fermentation
3A2. Manure Management
3B. Land
3B1. Forest land
3B2. Cropland
3B3. Grassland
3B5. Settlements
3B6. Other Land
3C. Aggregate Sources and Non $CO_2$ Emission Sources on Land
3C1a. Biomass Burning in Forest land
3C1b. Biomass Burning in Cropland
3C4. Direct $N_2O$ Emissions from Managed Soils
3C5. Indirect $N_2O$ Emissions from Managed Soils
3C7. Rice Cultivation

# Overview of Emission Estimates from AFOLU Sub-sectors from 2005 to 2013



# Major Sources of Emissions/Removals of the AFOLU Sector from 2005 to 2013



# Methodological Barriers and Data Gaps (1/3)

**3A. Livestock**

- Lack of state/regionwise disaggregated data on body weight of bovines
- Lack of availability of disaggregated data on Feed Intake Estimates/Gross Energy Intake
- Lack of detailed data on manure management practices
- $N_2O$ emission factors are still of 1996 vintage.  Not enough information available for deriving emission factors as per IPCC 2006

# Methodological Barriers and Data Gaps (2/3)

**3B. Land**

- Unavailability of Land Use Change Matrix in the public domain. It is estimated by National Remote Sensing Centre (NRSC) but is not accessible.
- Little or no information on the biomass and soil organic carbon content in various land use types to estimate the carbon stock in India.
- Although FSI has a detailed methodology on the carbon stock in Indian Forests, it is not available to the general public. Therefore, crude assumptions have to be made on estimating removals/emissions from Forests in India.

# Methodological Barriers and Data Gaps (3/3)

## 3C. Aggregate Sources and Non $CO_2$ Emission Sources on Land

- No comparable and nationally compiled data is available on the area of forests burnt in India
- Need of more reliable data on paddy crop management practices in India (For e.g. Area of paddy crops under different water management regimes such as Intermittent Multiple Aeration, Single Aeration, Continuous Flooding etc.)
- Lack of availability of emission factors to estimate emissions as per the IPCC 2006 guidelines for paddy
- Lack of sufficiently disaggregated data on fertiliser use, thus making it difficult to use IPCC 2006 guidelines

# THANK YOU

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# OVERVIEW OF GHG ESTIMATES IN INDIA: WASTE SECTOR

# Introduction

## Coverage of the emission estimates (2006 IPCC Guidelines)

- **4A Solid waste disposal:** 4A2 Unmanaged Waste Disposal Sites (urban areas) – *CH4 emissions*
- **4D Wastewater treatment and discharge:**
  - 4D1 Domestic Wastewater Treatment and Discharge (urban and rural areas) – *CH4 and N2O emissions*
  - 4D2 Industrial Wastewater Treatment and Discharge (12 industry sectors) – *CH4 emissions*

**Sources not included**

- 4B Biological treatment of solid waste
- 4C Incineration and open burning of waste

- lack of reliable data
- absence of considerable no. of incineration and composting facilities for reporting period (pre-2010)

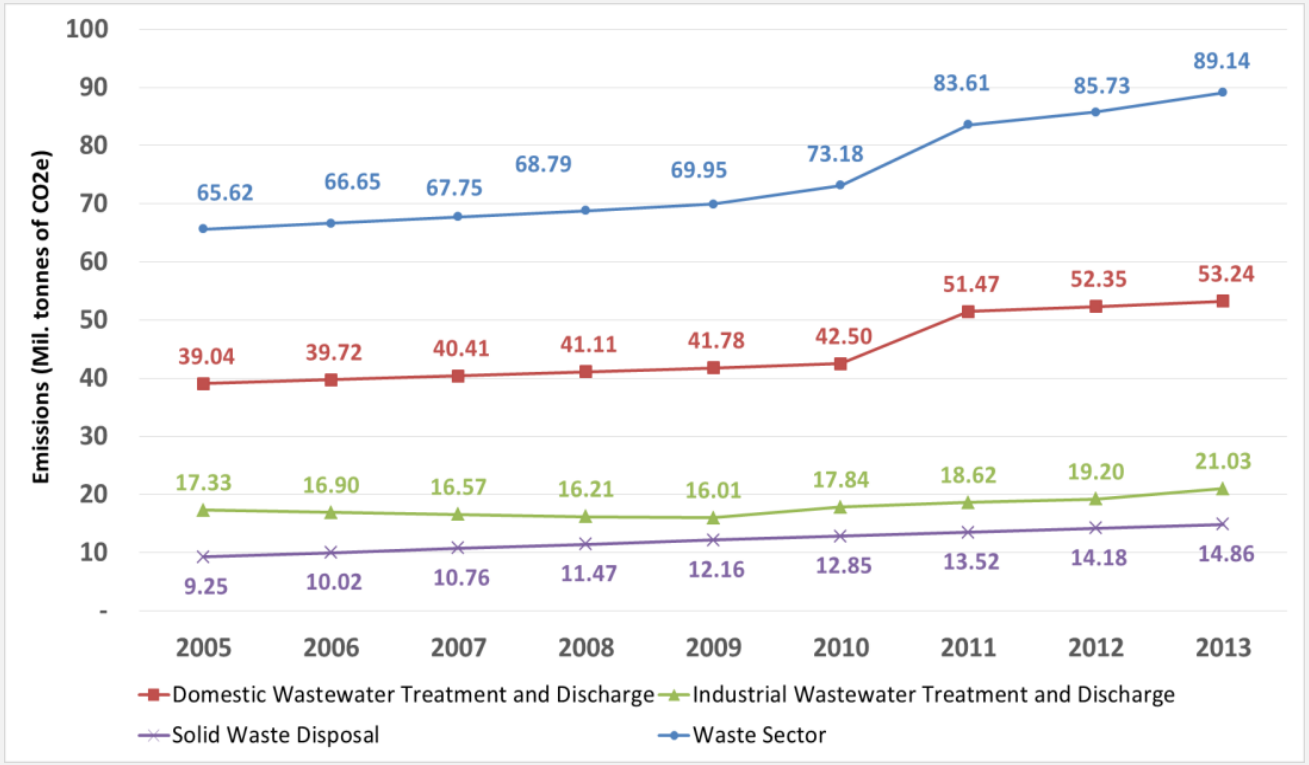
Tier 1 & Tier 2 approach used for emission estimation

# Key Trends –Waste Sector – National Estimates

- Contribution to Waste Sector emissions (2013)
  - Domestic wastewater: 59.8 %
  - Industrial wastewater: 23.5 %
  - Solid waste disposal: 16.7 %

- GHG emissions from Waste:
  - 2005-2013: 36% ↑
  - CAGR: 3.9% ↑

- Emission intensity (i.e. GHG emission per unit GDP)
  - 2005-2013: 23 % ↓
  - CAGR: 3.2 % ↓




*Source: ICLEI South Asia analysis based on GHG platform India-2005-2013 National Estimates – 2017 Series*

# Data Sources

**Waste**

Solid Waste Disposal
Domestic Wastewater
Industrial Wastewater

**2006 IPCC Guidelines; India's NATCOM-II and BUR 2010**

**4A2 Unmanaged Solid waste disposal:** CPCB; NEERI; CPHEEO; Census of India

**4D1 Domestic Wastewater Treatment and Discharge**: CPCB; NEERI; NSSO (MOSP

Census of India

**4D2 Industrial Wastewater Treatment and Discharge**: NEERI; Centre for Science and Environment (CSE)

| | | |
|---|---|---|
| **Steel** - Min. of Steel; Indian Bureau of Mines | **Fertilizer** - Fertilizer Association of India | **Sugar** - National Federation of Cooperative Sugar Factories Limited |
| **Coffee**- Coffee Board of India | **Petroleum** - Petroleum Planning and Analysis Cell (PPAC), Min. of P&NG | **Dairy** – Dept. of Animal Husbandry, Dairying and Fisheries, Min. of Agriculture |
| **Meat** - Dept. of Animal Husbandry, Dairying and Fisheries, Min. of Agriculture | **Pulp & paper** - Central Pulp & Paper Research Institute | **Rubber** – Rubber Board |
| **Tannery**- Food and Agriculture Organization (FAO) | **Beer** - | **Soft Drinks** - |

# Municipal Solid Waste Disposal

❑ **First Order Decay (FOD) method used as per 2006 IPCC guidelines and NATCOM-II**

- emissions from waste decomposition over a period of 50 years prior to 2005 i.e. from 1954-2004

❑ **Key parameters for emission estimation:**

- Urban population
- Per capita solid waste generation (kg/day)
- Proportion of solid waste going to disposal site (%)
- Degradable Organic Carbon (DOC) – based on waste composition

**Challenge:** Non-availability of reliable year-on-year/decadal waste generation for 50 year period

- Unreliable and patchy data on waste processing and disposal
- Lack of data to factor impact of waste processing plants which are sub-optimal/not operational

Lack of data on changing solid waste composition over the years

# Municipal Solid Waste Disposal

Estimated per capita generation values based on reported data on Total quantum of solid waste generated

| State/Union Territory | Per Capita Waste Generation (kg/day) | | | |
|---|---|---|---|---|
| | 1999[1] | 2005[2] | 2011[3] | 2013[4] |
| Andaman & Nicobar | - | 0.760 | 0.348 | 0.466 |
| Andhra Pradesh | 0.216 | 0.533 | 0.408 | 0.380 |
| Arunachal Pradesh | - | 0.340 | 0.296 | 0.321 |
| Assam | 0.088 | 0.200 | 0.261 | 0.140 |
| Bihar | 0.130 | 0.310 | 0.142 | 0.133 |
| Chandigarh | 0.262 | 0.400 | 0.370 | 0.324 |
| Chhattisgarh | - | 0.300 | 0.197 | 0.295 |
| Dadra & Nagar Haveli | - | 0.320 | 0.119 | 0.172 |
| Daman & Diu | - | 0.420 | 0.119 | 0.172 |
| Delhi | 0.333 | 0.570 | 0.451 | 0.485 |
| Goa | - | 0.540 | 0.213 | 0.199 |
| Gujarat | - | 0.296 | 0.287 | 0.334 |
| Haryana | 0.742 | 0.420 | 0.061 | 0.362 |
| Himachal Pradesh | 1.28 | 0.270 | 0.442 | 0.423 |
| Jammu & Kashmir | 0.015 | 0.530 | 0.522 | 0.487 |
| Jharkhand | - | 0.350 | 0.216 | 0.423 |
| Karnataka | 0.191 | 0.390 | 0.275 | 0.35 |
| Kerala | 0.159 | 0.450 | 0.523 | 0.083 |
| Lakshadweep | | | | |

Inconsistent reporting across data sources as well as within the same source

ICLEI South Asia Analysis based on data from CPCB reports

# Domestic Wastewater

## $CH_4$ emissions from Domestic Wastewater

- Key parameters for emission estimation
  - Fraction of Urban population in High Income & Low Income group
  - Degree of Utilization of each treatment type (i.e. proportion of resident population using different wastewater treatment/discharge systems – eg. ***latrines, septic tanks, sewer, none***)
  - Biochemical oxygen demand (BOD) (i.e. organic content in wastewater)
  - Methane Correction Factor (i.e. methane generation potential) based on treatment type used
  - Collected/Uncollected fractions of Wastewater
  - Methane recovery (if any)

*Note: While this depiction is for urban area/population coverage, domestic wastewater estimates prepared under the Platform cover urban as well as rural areas*

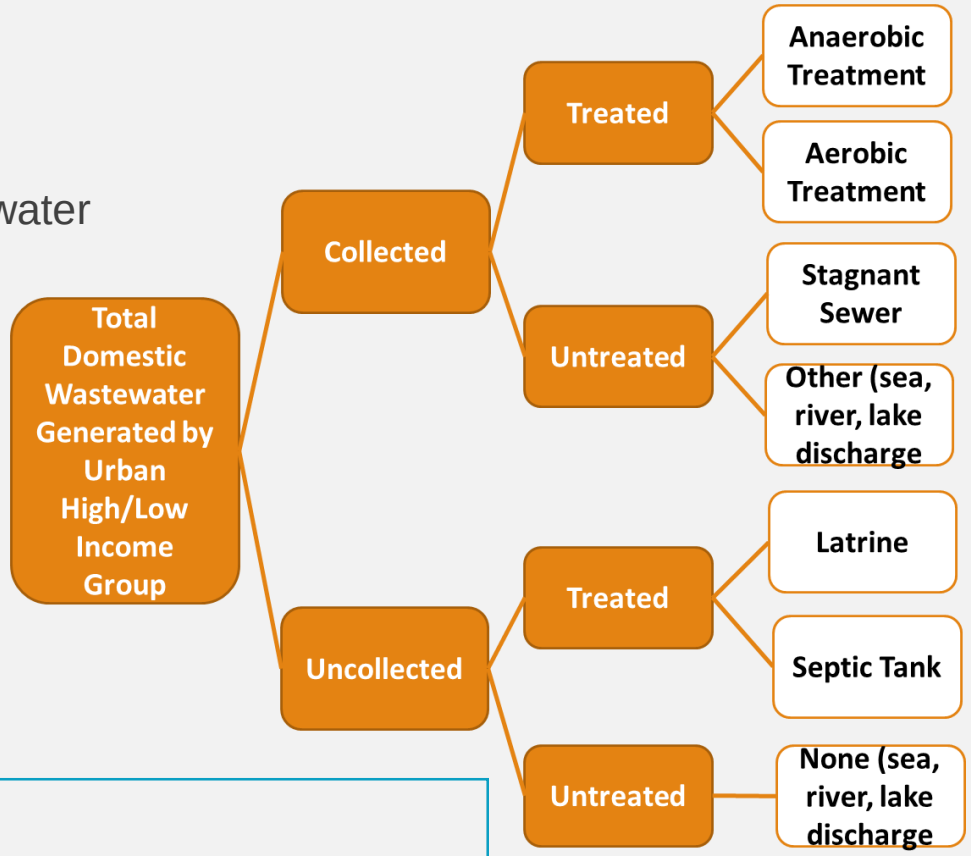
# Domestic Wastewater

## $CH_4$ emissions from Domestic Wastewater

### ❑ *Degree of utilization*

- relates to the proportion of resident population using different wastewater treatment/discharge pathways or systems

| Income Group | IPCC Default Degree of Utilization Rates for Discharge/Treatment Type | | | | |
|---|---|---|---|---|---|
| | Septic Tank | Latrine | Other | Sewer | None |
| Urban High | 18% | 8% | 7% | 67% | 0% |
| Urban Low | 14% | 10% | 3% | 53% | 20% |




**Challenge**

- Non- availability of updated year-on-year data on
  - wastewater generation in urban and rural areas in India
  - Proportion of rural and urban population using different treatment systems
- Operational performance of existing sewage treatment plants – lack of regular, comprehensive and reliable reported data

*Note: While this depiction is for urban area/population coverage, domestic wastewater estimates prepared under the Platform cover urban as well as rural areas*

# Industrial Wastewater

12 Industry sectors generating substantial organic wastewater considered:
*Iron and Steel; Fertilizer; Beer; Meat; Sugar; Coffee; Soft Drink; Pulp & Paper; Petroleum; Rubber; Dairy; Tannery*

❑Emission estimation for each industry sector based on following parameters

- Industrial production in tonnes
- Wastewater generated per tonne of product
- Organic concentration (i.e. characteristic of wastewater)
- MCF based on broad treatment technology used by sector
- Methane recovery (if any)

- Inconsistency in reported data across the years, with significant dips and spurts not reflective of industrial activity
- Data is not available in a metric (i.e. tonnes) that would help in computing accurate emissions

No information on changes in wastewater generation due to technological improvements

Poor information on prevalent treatment technologies and their mix within sectors , impacting choice of EF

| Type of treatment and discharge pathway or system | MCF |
|---|---|
| **Treated** | |
| Aerobic treatment plant (well managed) | 0 |
| Aerobic treatment plant (overloaded) | 0.3 |
| Anaerobic digester for sludge | 0.8 |
| Anaerobic reactor (e.g., UASB, Fixed Film Reactor) | 0.8 |
| Anaerobic shallow lagoon (<2m depth) | 0.2 |
| Anaerobic deep lagoon (>2 m depth) | 0.8 |

**Source: 2006 IPCC Guidelines**

# Challenges

- Limited availability of updated year-wise activity data
- Reliability issues and inconsistencies in official datasets/statistical records
- Usability of reported data for accurate emission estimation

## Way forward

**Periodic, streamlined, accurate reporting to capture on-ground developments and improvements**

- Solid waste composition & generation rates
- Operational/non-operational capacity of MSW processing plants
- Wastewater treatment technologies
- Performance/utilization of sewage treatment plants

**Use existing data management frameworks to capture information required**

E.g. **Annual reports** collected by State Pollution Control Boards and under Swachh Bharat Mission to capture :

- Waste composition, operational capacity/status of processing plants
- Volume of industrial wastewater generated, physio-chemical characteristics (i.e. COD), treatment technology used by registered industries

**Industrial information collected under the ASI** - promote reporting in metrics that better conform to accurate GHG emission estimation

e.g. reporting beverage production in ‘kilolitres’ instead of ‘nos. of bottles’;

fertilizer production in ‘tonnes’ instead of ‘no. of bags’

# THANK YOU

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# Q&A

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