GHG emissions in sanitation sector - calculations, monitoring and satellite imaging

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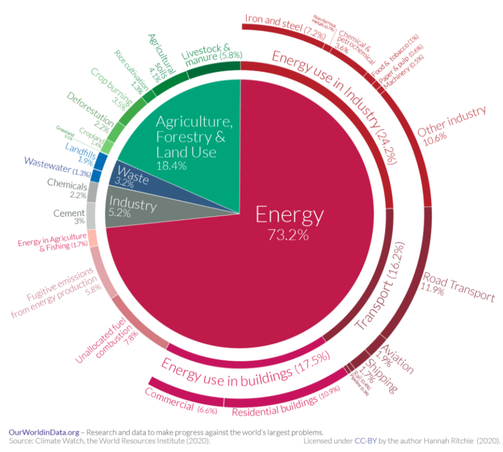
Sanitation sector emissions contributes 4 % of India's direct emissions



- GHG gases directly linked to global warming
- India is the 3rd largest GHG emitter in the world, with net emissions of 4,133 Mt CO2eq and 138th per capita, with 2.9 tons of CO2 per annum as per 2023 EDGAR database.
- Sanitation services contributes of 4 % (165 Mt CO2eq.) of India's direct GHG emissions.

- 56 % contribution of wastewater in India's emissions from Waste sector
- Methane has 34 times more warming potential than CO2 and Nitrous Oxide 294 times

Sanitation sector emissions are equivalent to emissions from the global aviation sector, still lacks attention and accurate quantification

4th highest emitter of methane and contributes about **7 % of global Nitrous Oxide emissions**.

Discharge of **untreated wastewater increases emissions lead to 4 – 5 times** higher emissions from freshwater systems

5 to 35 % of municipal energy usage leading to indirect emissions and fuel used to provide the services is calculated in transport sector

Estimating emissions for the sanitation sector

IPCC a nodal organization working towards developing the standard methodology and approach for quantification GHG emission across 5 essential sectors i.e., Transport, Industry, Energy, Agriculture, Forestry, Other Land Use (AFOLU), and Waste.

Limitation - Development of emissions factor based on limited research studies, absence of various sanitation technologies

Type of emissions

Scope 1 emissions – Direct emissions

Scope 2 emissions – Indirect emissions

Scope 3 emissions – Assets emissions

Need for accurate sanitation emission quantification

- Various studies suggested emissions in WASH sector are underestimated due to below reasons

Lack of context-specific emission factor (Sewer, Septic tank)

Lack of inclusion of different sanitation technologies

Indirect emissions are included in different sector

Leading to

Overall actual emissions potential from sanitation sector will be 2 to 3 times of currently estimated

Approach used for City level emissions quantification from sanitation sector

2 Way Approach adapted for Quantification

On field quantification

- Quantification of emission using handheld gas analyzer sensor
- Validation with lab-based emission values
- Triangulation of lab values, existing theoretical estimates and literature

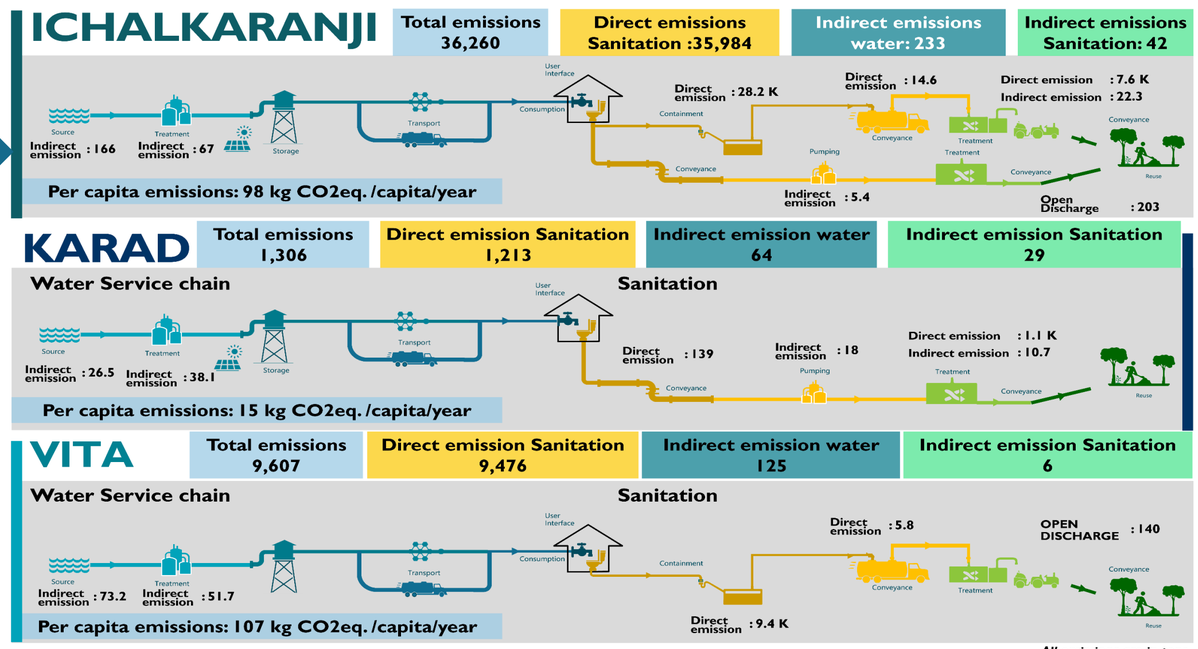
Theoretical estimates using IPPC methodology

- Using standard emission factor
- Using open source GHG estimation toolkits and platform

GHG emission were estimated through excel based toolkit and also using toolkit developed by ECAM, ICLEI

Developing a GHG estimation toolkit with localized emission factors

Updated IPCC methodology (2019) was used to quantify the emissions across the WASH service chain



Septic tanks emissions are major contributor in Sanitation value chain

Moving towards sewer network reduces GHG emissions

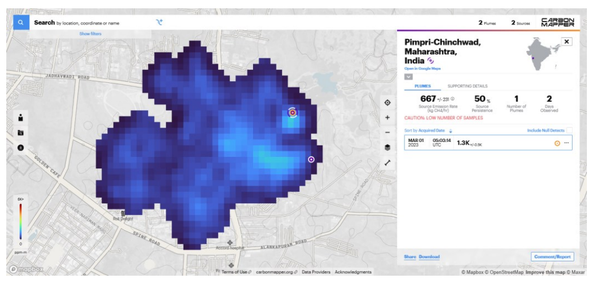
Water sector is major contributor in indirect emissions

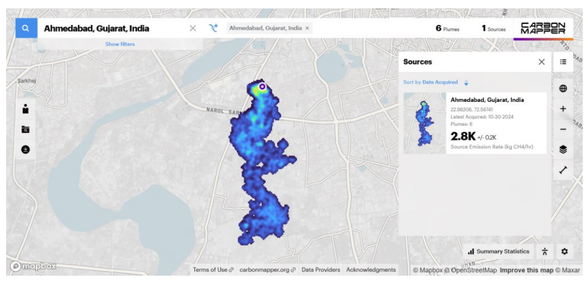
Maintaining treatment facilities and adapting aeration technology reduces GHG emission

City level emissions quantification Assessment and Findings

1. Emission reading found 1.5 times higher to theoretical estimates
2. Variation of emission across time period, Septic tank with lower desludging frequency emits higher methane emissions
3. Indirect emissions are accounted in different sector
4. Decreasing septic tank efficiency leads to pollution and depletion of water bodies
5. Current Estimates lacks to capture the across the service chain detailed emissions and just dependent on standard values
6. Climatic, geographics and demographics factors play huge role in quantification of the emissions

Technology supporting in emissions monitoring





- Satellite and sensors are available to monitor the emissions using the remote sensing technologies.
- Sentinel 5P provides the database for the mapping out emissions at spatial resolution of 1 KM.

Advantages

Reduces the human efforts and provides emission hotspot areas

Real time emission monitoring and assistance in decision making process

Challenges

Requires context specific model development

Can lead to misleading result if inappropriate model is adopted for fetching results

Currents Gap in Emissions Monitoring

- Lack of local-level database of sanitation facilities required for emission quantification
- No detailed sanitation sector emission inventory in current climate action plans
- No policies for monitoring emissions in the sanitation sector.

Leading to

No focus on sanitation sector emissions in national NDCs actions

Benefits of accurate GHG emission monitoring

- **Improving overall public health and GHG health impact**
- **Development of mitigation strategies and GHG gas capture solutions**
- **Enabling in setting up and enhancing the regulatory compliance system**
- **Improving local level service provision and climate related database**
- **Assist in data driven decision making with lens of climate mitigation perspective**
- **Assistance in tapping the climate financing through building sustainable business model**

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