GHG Inventorization for Cities in India using the GPC Protocol

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Internationally, cities have used:

- 1996/2006 IPCC Guidelines for National GHG Inventories
- Emissions Inventory/Monitoring Emissions Inventory Methodology The Covenant of Mayors Initiative (2010)

India, with its rapidly growing cities, needs to know and document its emission sources and devise an abatement plan

- GHG Accounting has been done to an extent at national, sub-national level, city level (ICLEI) and industrial sector level in India
- At city level in India:
  - 1996/2006 IPCC Guidelines for National Greenhouse Gas Inventories have been used to estimate emissions
  - Some cities such as Ahmedabad, Bangalore, Bhubaneswar, Coimbatore, Jaipur and 9 others have used GPC Beta version
  - ICLEI’s HEAT Plus- Harmonized Emissions Analysis Tool, has been applied by 30 local governments of Indian cities, mostly to evaluate smart cities proposals
Under the 5 year UNIDO-GEF 6 project (Sustainable Cities Project), a sub-project on accounting for GHG emissions of five Indian cities was initiated: *Jaipur, Bhopal, Mysore, Vijayawada and Guntur*. It’s an initial step to enable the five cities to *map, track* and *monitor* the GHG emissions within the identified boundaries.

**Project Objectives**

- Formulation of a *methodological approach* for GHG accounting for cities
- Identify and work with *appropriate local partner institutions*, for data collation and building local capacity for updating inventory on a regular basis
- Produce a *city inventory report*
- *Sensitize* the city stakeholders on the methodology used

**About the GHG Accounting Project**
Project Implemented by

In consortium with

City Corporations and Local Partner Institutions

Bhopal: 

Jaipur: 

Mysore: 

Guntur: 

Vijayawada:
Project Approach and Process

- **Project Inception**
  - Dec 2016 - Mar 2017
  - Inception meetings in cities

- **Desk Research on Methodology**
  - Data Formats & Templates

- **Data Collection**
  - Identification of Local Partner
  - Stakeholder mapping & consultation

- **Cities Profiling**
  - Apr - Jun 2017

- **Data Collection**
  - Drafting GHG inventory report

- **Data Compilation in desired formats**
  - Data analysis & calculation of emissions

- **Finalized GHG emissions model**
  - Final results dissemination meeting in cities

- **QA/QC**
  - Jul - Sept 2017

- **Finalized GHG emissions model**
  - Jul - Sept 2017
Protocol adopted for the current project: GPC

- GPC offers a **robust, transparent and globally-accepted framework** to consistently identify, calculate and report on city greenhouse gases
- **More than 100 cities across the globe have used the GPC** e.g. London, New York, Rio, Kampala, Istanbul, Auckland etc
- Allows cities to **measure and disclose a comprehensive inventory of GHG**

In addition to specifying reporting principles and methodology, GPC provides guidance on:

- **GHG inventory boundary** i.e. sets out and defines the inventory boundary, gases, period
- **GHG emissions scope and category** for sector-specific accounting and reporting
- **Sourcing data** and calculating emissions
- **MRV** to set mitigation goals and track performance over time

It requires cities to report **emissions by gas, scope, sector and subsector**

About the GPC Standard

Global Protocol for Community-Scale GHG Emission Inventories (GPC)
### Greenhouse Gases Covered

- Carbon Dioxide \((\text{CO}_2)\)
- Methane \((\text{CH}_4)\)
- Nitrous Oxide \((\text{N}_2\text{O})\)
- Hydrofluorocarbon \((\text{HFCs})\)
- Per fluorocarbons \((\text{PFCs})\)
- Sulfur hexafluoride \((\text{SF}_6)\)
- Nitrogen trifluoride \((\text{NF}_3)\)

### Sectors and Sub-Sectors

#### Stationary Energy
- Residential buildings
- Commercial and institutional buildings and facilities
- Manufacturing industries and construction
- Energy industries
- Agriculture, forestry, and fishing activities
- Non-specified sources
- Fugitive emissions from mining, processing, storage, and transportation of coal
- Fugitive emissions from oil and natural gas systems

#### Transportation
- On-road
- Railways
- Waterborne navigation
- Aviation
- Off-road

#### Waste
- Solid waste disposal
- Biological treatment of waste
- Incineration and open burning
- Wastewater treatment and discharge

**INDUSTRIAL PROCESSES AND PRODUCT USE (IPPU)**
- Industrial Process
- Product Use

**AGRICULTURE, FORESTRY AND OTHER LAND USE (AFOLU)**
- Livestock
- Land
- Aggregate sources and non-CO2 emission sources on land

**OTHER SCOPE 3**
<table>
<thead>
<tr>
<th>Scope</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope 1</td>
<td>GHG emissions from sources located within the city boundary</td>
</tr>
<tr>
<td>Scope 2</td>
<td>GHG emissions occurring as a consequence of the use of grid-supplied electricity, heat, steam and/or cooling within the city boundary</td>
</tr>
<tr>
<td>Scope 3</td>
<td>All other GHG emissions that occur outside the city boundary as a result of activities taking place within the city boundary</td>
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GHG emissions accounting: the context
About the UNIDO-GEF GHG Accounting Project
Overview of the GHG Accounting Methodology: the GPC
GPC emission calculation methodology adopted

Overview of City GHG Inventory Results

Case Example of City GHG Inventory Results: Mysore
Learnings from application of GPC to Indian cities

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GHG emissions across five cities....
GHG emissions across five cities by scope
**Share of GHG Emissions by Sector**

- Stationary Energy: 33%
- Transport: 9%
- Waste: 7%
- AFOLU: 1%

**Distribution of Emissions by Gas**

- CO2: 92%
- CH4: 7%
- N2O: 1%

Total Emissions 15,56,145.66 Mt CO$_2$e

**GHG Emissions by Sector and Gas-Mysore**
GHG Emissions by Sector, by Gas and by Scope - Mysore
Emissions Sub-sector wise-Mysore

**Stationary Energy:**
- Residential buildings highest contributor
- Scope 2 emissions were the largest (accounted by electricity consumption)

**Transportation:**
- On road transportation highest contributor (diesel consumption largest source)
- Scope 1 emissions were the largest (accounted by fuel consumption within city boundary)
- Railways scope 3 emissions largest contributor

**Waste:**
- Solid waste disposed at landfills largest contributors, mostly scope 1
- Gases emitted CH₄ and N₂O

**AFOLU:**
- Emissions from livestock within city boundary the only source, no agriculture within city boundary
- Gases emitted CH₄ and N₂O, mostly from enteric fermentation

**IPPU:**
- Zero emissions as no industries within city boundary
Learnings from the five city GHG accounting project

Key Take Aways from the Project

• City governments were enthusiastic and provided support for the exercise
• Cities wish to undertake the exercise on a regular basis, especially in view of the smart cities programme
• Coordination for data collection with 12-15 city departments was a challenge.
• Suitable scaling factors have to be identified, where primary data was not available
• Fuel consumption data by sector was particularly challenging
• Data collection as per GPC requirements will have to be incorporated into city’s regular data management

Next steps

• There is a clear role for a local city level institution to take lead in accounting for GHG emissions on a regular basis
• Extensive training of the identified institution is needed

• Such an institution will be expected to:
  • Identify an internal team for GHG emissions accounting exercise
  • Work closely with UNIDO-MoUD team to learn and develop capacities
  • Work closely with city municipal corporations
  • Review and improvise on data collection templates, reporting formats and Monitoring & Verification (M&V) procedures best suiting to city needs
  • Engage with identified local government departments for data collection on regular basis
  • Update the GHG inventory on an annual basis
  • Create and manage a data repository for the inventory
  • Identify emissions hotspots and work with respective departments in identifying suitable measures
  • Build capacity of local government departments to collect data in specified formats
  • Represent the city at local, state and national level platforms for GHG emissions accounting related work
Thank You