



# **Overview of US EPA GHG Inventory Data**

CO<sub>2</sub> Urban Synthesis and Analysis  
("CO<sub>2</sub>-USA") Network Workshop

November 6, 2017



- Urban Inventories
- EPA Data Product Examples
  - U.S. GHG Inventory
  - GHGRP
  - CH<sub>4</sub> Gridding
- Opportunities for use of EPA Data

# Urban GHG Inventory Needs



| Sectors and sub-sectors   | Scope 1 | Scope 2 |
|---|---------|---------|
| <b>STATIONARY ENERGY</b>  |         |         |
| Residential buildings   | ✓       | ✓       |
| Commercial and Institutional buildings and facilities                           | ✓       | ✓       |
| Manufacturing industries and construction                                       | ✓       | ✓       |
| Energy industries   | ✓       | ✓       |
| Energy generation supplied to the grid  | ✓       |         |
| 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                             | ✓       |         |
| <b>TRANSPORTATION</b>   |         |         |
| On-road   | ✓       | ✓       |
| Railways  | ✓       | ✓       |
| Waterborne navigation   | ✓       | ✓       |
| Aviation  | ✓       | ✓       |
| Off-road  | ✓       | ✓       |
| <b>WASTE</b>  |         |         |
| Disposal of solid waste generated in the city                                   | ✓       |         |
| Disposal of solid waste generated outside the city                              | ✓       |         |
| Biological treatment of waste generated in the city                             | ✓       |         |
| Biological treatment of waste generated outside the city                        | ✓       |         |
| Incineration and open burning of waste generated in the city                    | ✓       |         |
| Incineration and open burning of waste generated outside the city               | ✓       |         |
| Wastewater generated in the city  | ✓       |         |
| Wastewater generated outside the city   | ✓       |         |
| <b>INDUSTRIAL PROCESSES AND PRODUCT USE (IPPU)</b>                              |         |         |
| Industrial processes  | ✓       |         |
| Product use   | ✓       |         |
| <b>AGRICULTURE, FORESTRY, AND LAND USE (AFOLU)</b>                              |         |         |
| Livestock   | ✓       |         |
| Land  | ✓       |         |
| Other agriculture   | ✓       |         |

Based on BASIC Reporting from: *Global Protocol for Community-Scale Greenhouse Gas Emission Inventories*:

- Emissions from different source categories
  - All scope 1 emissions from Stationary Energy sources (w/ energy production supplied to the grid separated)
  - All scope 1 emissions from Transportation sources
  - All scope 1 emissions from Waste sources (w/ emissions from imported waste separated)
  - All scope 2 emissions from Stationary Energy sources and Transportation
  - Scope 3 emissions from treatment of exported waste
- Ability to track progress / changes over time
- Coverage of urban geographic area
- Different approaches:
  - Bottom-up approach
  - Top-down atmospheric modeling

# Potential EPA Data Sources



- Stationary Energy
  - US GHG Inventory
  - US GHGRP
  - Acid Rain Program
  - NEI
  - NG Star
  - Energy Star
  - Methane gridding study
  - ...
- Purchased Electricity
  - AVERT
  - eGRID
  - Power Profiler
  - ...
- Transportation
  - US GHG Inventory
  - MOVES
  - ...
- Waste
  - US GHG Inventory
  - US GHGRP
  - LMOP
  - Methane gridding study
  - Waste Wise
  - Waste management Decision Support Tool
  - ...
- IPPU
  - US GHG Inventory
  - US GHGRP
  - ...
- Agriculture
  - US GHG Inventory
  - Methane gridding study
  - ...

- Lots of different data collected and provided by EPA
- For all of these can consider applicability to urban inventories:
  - Sectors covered (e.g., scope 1, scope 2, different sources)
  - Ability to track changes over time
  - Geographic coverage
- Can have different applications for bottom-up vs. top-down efforts

# National GHG Inventory



## Background:

- As part of commitments under the UNFCCC, the U.S. Government annually publishes a national inventory of emissions and removals of greenhouse gases due to human activities
- For the most part it involves a bottom-up approach –

$$\text{Emissions} = \text{Activity Data} \times \text{Emission Factor}$$

- Activity data is generally from national level statistics (e.g., based on fuel consumption collected and aggregated to national level by EIA based on EIA surveys and EIA definitions of sectors)
- Emission factors can be mix of IPCC default and country-specific

## GHG Inventory Basics:

- Most inventory work is based on common IPCC framework



- » National GHG Inventories
- » State Level Inventories
- » Corporate GHG Protocols
- » GHG Registries
- » Life Cycle GHG Accounting

# National GHG Inventory



## Applicability to Urban Inventories:

- Ability to track changes over time
  - Annual reporting based on changes in activity data
  - Reflects changes in actual overall emissions (not project based)
  - Annual April release includes two years prior data (April 2018 release will include 1990-2016 emissions)
- Sectors covered
  - Fossil Fuel Combustion (CO<sub>2</sub> and non-CO<sub>2</sub>)
    - Residential
    - Commercial
    - Industrial
    - Transportation
    - Electricity Generation (also reported with electricity allocated to other end use sectors)
  - Non-Energy Use of Fossil Fuels
  - Incineration of Waste
  - Natural gas systems
  - Coal mining
  - Petroleum systems
  - Abandoned underground coal mines
  - Landfills
  - Wastewater Treatment
  - Composting
- Sources reported but not included in totals:
  - International Bunker Fuels
  - Wood Biomass and Biofuels Consumption
- Geographic coverage
  - Reporting at national level as per UNFCCC requirements
  - Data accurate at national totals, less so at further disaggregation
  - Underlying energy use data from EIA can be broken out
    - State level reporting tool from EPA State and Local program has EIA energy data provided at the state level
    - EPA's Local Greenhouse Gas Inventory Tool was developed to support local governments across the U.S. to evaluate GHGs but does not include default data
    - Other sources use the same data and have more detailed breakout (e.g., NREL SLED, etc.)
    - Where data is allocated or proxied at regional/urban level it does not provide for accurately tracking changes over time

# U.S. GHG Reporting Program



## Background:

- Annual reporting of GHGs by 41 source categories, accounting for about 85-90% of U.S. GHG emissions
  - 33 types of direct emitters
  - 6 types of suppliers of fuel and industrial GHG
  - Facilities that inject CO<sub>2</sub> underground for geologic sequestration, enhanced oil recovery, or any other purpose
- 25,000 metric tons CO<sub>2</sub> equivalent (CO<sub>2</sub>e) or more per year reporting threshold for most sources
  - Bottom up reporting
  - Measurements as well as calculations based on fuel use and emission factors

## Applicability to Urban Inventories:

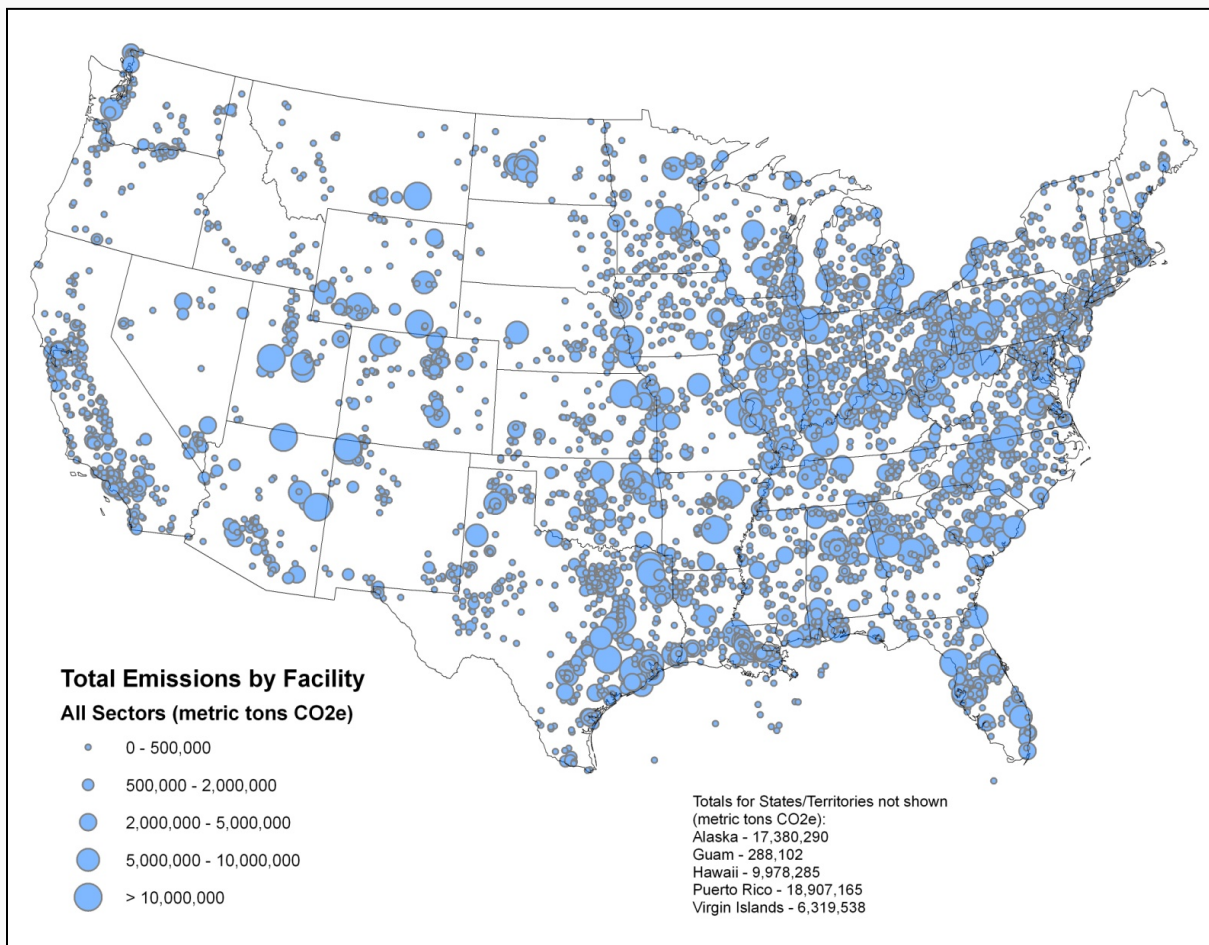
- Sectors covered
  - Emissions reported by gas, facility, subpart, and unit (typically)
    - Subpart C—General Stationary Fuel Combustion Sources
    - Subpart D—Electricity Generation
    - Subpart W—Petroleum and Natural Gas Systems
    - Subpart FF—Underground Coal Mines
    - Subpart HH—Municipal Solid Waste Landfills
    - Subpart II—Industrial Wastewater Treatment
- Ability to track changes over time
  - Emissions reported annually starting in 2010
  - Reported data includes, facility information, calculation method, tests methods used to determine equation inputs (e.g., carbon content), process characteristics (e.g., equipment capacities, # of process units)

# U.S. GHG Reporting Program



## Applicability to Urban Inventories (cont'd):

- Geographic coverage
  - Reporting at the facility and unit level which could be used in developing urban inventories





# CH<sub>4</sub> Gridding Study



## Background:

- A team at Harvard University along with EPA and other coauthors developed a gridded inventory of U.S. anthropogenic methane emissions with 0.1° x 0.1° spatial resolution, monthly temporal resolution, and detailed scale-dependent error characterization
  - Developed using a wide range of databases at the state, county, local, and point source level to allocate the spatial and temporal distribution of emissions for individual source types
  - Paper: Maasackers et. al. 2016, A Gridded National Inventory of U.S. Methane Emissions

## Applicability to Urban Inventories:

- Sectors covered
  - Agriculture methane
  - Coal mining methane
  - Oil and gas methane
  - Waste methane
- Ability to track changes over time
  - Consistent with the U.S. EPA Inventory of U.S. Greenhouse Gas Emissions and Sinks estimates for the year 2012
- Geographic coverage
  - Emissions reported at a 0.1° x 0.1° spatial resolution (~10 km<sup>2</sup>)
  - Some emissions sources were distributed based on coarser dataset, making it harder to track changes

# Opportunities: EPA Data Products



- There are lots of different data tools and sources available from EPA
- Some are more applicable than others to urban inventory efforts
- There are opportunities for EPA to contribute to higher quality local GHG inventories
  - Through the National Inventory
    - Publish more disaggregated inventory data where available
    - Consider downsizing estimates for some categories
    - Gridding of CO<sub>2</sub> emissions
  - Through the GHGRP
    - Communicating the benefits of the GHGRP public data
    - By enhancing GHGRP reporting
  - Through the State and Local Programs
    - Enhancing the tools and resources available
  - Others?



Questions:

Contact Us: [GHGInventory@epa.gov](mailto:GHGInventory@epa.gov)

Upcoming annual reviews of next GHG Inventory report:

- Expert Review (Fall 2017)
- Public Review (Winter 2018)

If you have experience/expertise, please send note indicating your name, title, organization, and interest areas to email above



# Annex

# GHGRP vs. U.S. GHG Inventory



|             | <b>U.S. GHG Inventory<br/>(UN Requirement)</b>  | <b>GHG Reporting Program<br/>(Facility Reporting by Clean Air Act Regulation)</b>  |
|-------------|---|--|
| Scale       | <ul style="list-style-type: none"> <li>National</li> </ul>  | <ul style="list-style-type: none"> <li>Facility</li> </ul>   |
| Coverage    | <ul style="list-style-type: none"> <li>All U.S. anthropogenic emissions                             <ul style="list-style-type: none"> <li>Energy</li> <li>Industrial Processes</li> <li>Agriculture and Land Use</li> <li>Waste</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>~55% US direct anthropogenic emissions</li> <li>~30% US indirect anthropogenic emissions (e.g., fuel &amp; chemical suppliers)</li> <li>Over 8,000 facilities</li> <li>Facilities &gt; 25,000 metric tons CO<sub>2</sub> equivalent per year</li> <li>Excludes agriculture</li> </ul> |
| GHGs        | <ul style="list-style-type: none"> <li>CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, Fluorinated GHGs</li> </ul>  | <ul style="list-style-type: none"> <li>CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, Fluorinated GHGs</li> </ul>   |
| Methods     | <ul style="list-style-type: none"> <li>IPCC higher “tier”</li> <li>Mix of measurement-based emission factors, models, and GHGRP data</li> </ul>   | <ul style="list-style-type: none"> <li>Mix of continuous, periodic measurements, and sampling</li> <li>Engineering calculations &amp; emission factors</li> </ul>  |
| Time series | <ul style="list-style-type: none"> <li>1990 – present</li> </ul>  | <ul style="list-style-type: none"> <li>Annually, since 2010</li> </ul>   |
| Key dates   | <ul style="list-style-type: none"> <li>Annual public review every February</li> <li>Final report every April 15</li> </ul>  | <ul style="list-style-type: none"> <li>Annual reporting deadline March</li> <li>Data published every Fall</li> </ul>   |

# Data Reporting

**EPA GHG Data System**



**EPA EnviroFacts:**  
 (Under Development)  
 Serviceable, searchable and separately hosted copy of non-CBI dataset. Open Access to Public



**Data Verification**  
 EPA-Internal CBI Secure

**State-Specific Service**  
 Oriented data flow over State-EPA Exchange Network (e-GGRT XML Reporting Schema)



**Downloadable XLS, XML & HTML Data Files,**  
 all non-CBI data (e-GGRT XML Reporting Schema). Open Access to Public

**Reporters**  
 Approx. 10,000 Facilities and Suppliers

**e-GGRT,**  
 interactive web-based, CROMERR compliant data reporting tool, 40+ modules

**e-GGRT Database Servers**  
 (Master Data Store)

**Collection (e-GGRT XML Reporting Schema)**

**CBI Redaction**

**e-GGRT Datamart**

**GHGRP Data Website**  
 (ghgdata.epa.gov)  
 GUI with open-source APIs.  
 Open Access to public.

**Publication (Datamart XML Schema)**