Greenhouse Gas Emissions Tools and Datasets for Cities

Executive Summary

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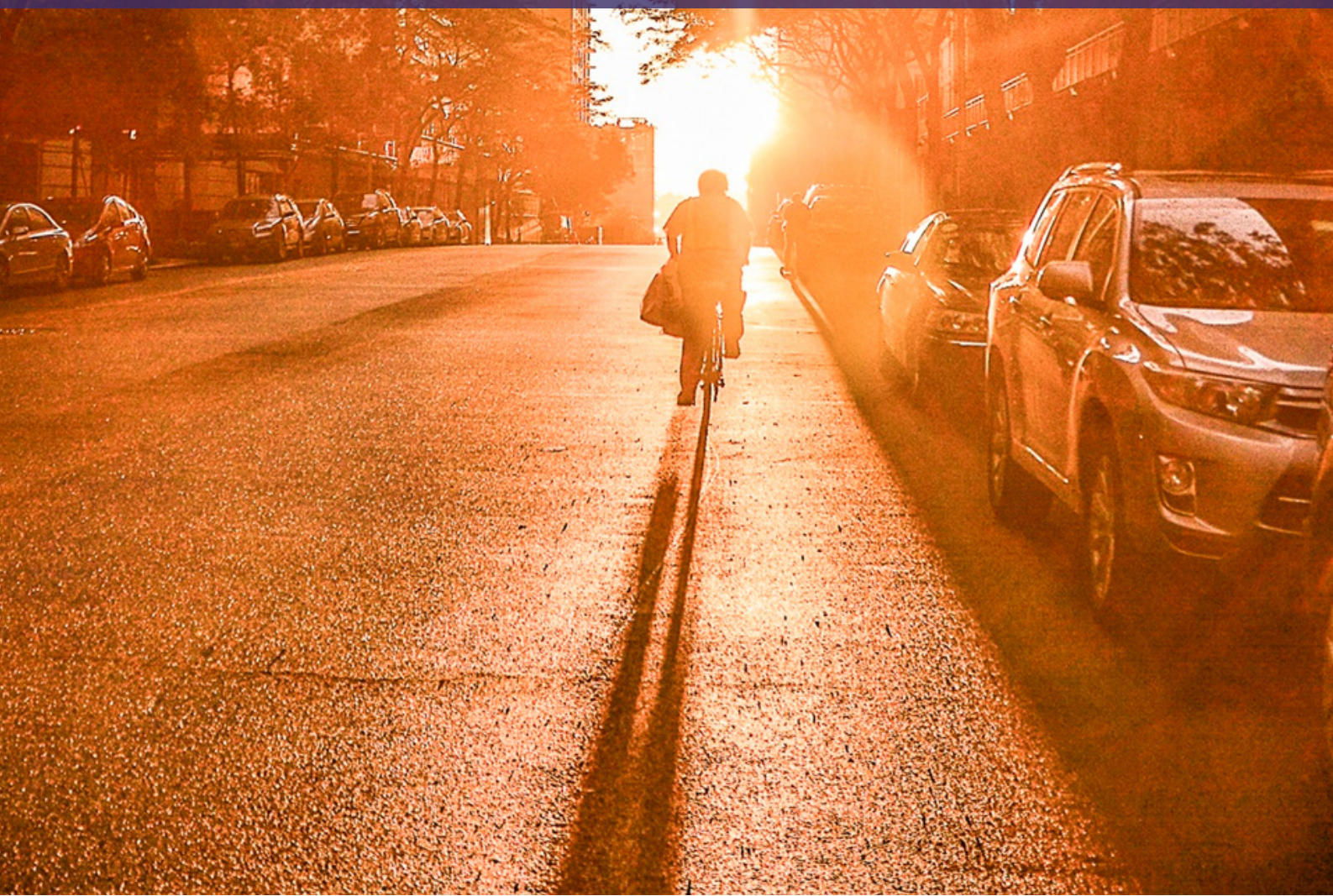

Executive summary

This report gives cities an overview of greenhouse gas (GHG) emissions-monitoring tools and datasets to help them build their emissions inventories.

Climate change is already having a serious impact on ecosystems and communities around the world. We urgently need to cut GHG emissions to limit global warming to 1.5°C above pre-industrial levels and to avoid catastrophic climate change. Accounting for 70% of global emissions and home to 55% of the global population, cities[1] have a critical role to play in this transition.

A key part of a city's journey to taking effective climate action is to understand the GHG emissions generated by different activities within their geographic area, sometimes referred to as 'community-wide' or 'city-wide' emissions. To do this, cities develop an emissions inventory. A GHG emissions inventory provides a breakdown of a city's emissions by activity or sector, and scope (where the emissions physically occur, relative to the city's geographic area). Developing a robust and comprehensive GHG emissions inventory helps cities to establish a baseline, set reduction targets, prioritize climate actions, and track progress.

Read the full report here.

Local emissions data collection is challenging – tools can help

Cities commonly develop their own community-wide emissions inventories by collecting local activity data on their key sectors (eg energy, transport, waste) and converting it to an emissions value by multiplying it by emission factors. Building a comprehensive GHG inventory using real-world local data and well-established tools such as CIRIS and ClearPath remains best practice for cities as it gives the most accurate picture of their emitting activities and sectors. This is critical for identifying the impact of policies and interventions and to track progress in local emissions over time. However, in 2021, 38% of cities did not report a community-wide emissions inventory[2], indicating that many cities are still struggling to measure their emissions, which can be a time- and resource-intensive process. The tools and datasets in this report are a useful first step to developing an inventory, getting cities started on their climate action journey until they have the capacity to collect local emissions data themselves.

Cities typically develop their inventories according to a GHG accounting standard, such as the Global Protocol for Community-Scale Greenhouse Gas Inventories (GPC) or the Global Covenant of Mayor's (GCoM) Common Reporting Framework (CRF). The GPC provides recommendations on the boundary of the emissions inventory, including the time span, the geographic area of the inventory, and the GHGs and emissions sources that are covered.

[1] The term 'city' is used throughout this document to refer to geographically discernible subnational entities, such as communities, townships, cities, and neighborhoods. In this report, 'city' is also used to indicate all levels of subnational jurisdiction as well as local government as legal entities of public administration. Source: GPC.

[2] Analysis based on city responses to CDP-ICLEI Track in 2021, Question 4.0 and Question 4.1 (data extract taken on 13 December 2021).

The CRF provides guidance to cities on how to measure and report their emissions as well as set targets and develop climate action plans. The CRF is fully compatible with the GPC and alignment with the CRF is a requirement of GCoM reporting compliance.

In some cases, the emissions data exists but it is held by other stakeholders (for example, other tiers of government or utilities providers). Accessing that data requires a lot of networking and communication with different stakeholders, delaying inventory development or sometimes resulting in data gaps. This difficulty measuring and accessing emissions data can be a barrier to cities taking further climate action.

In the last five years, there has been a growth in GHG emissions monitoring tools, datasets and approaches[3] that have the potential to support cities to develop their inventories by providing them with data where they have data gaps in their inventory or do not currently have the capacity to collect the data themselves. This can enable cities to progress more rapidly to the next stage of climate planning and action.

From sensors and satellites to scaling down national-level emissions, these approaches and tools are diverse and each comes with strengths and limitations and varying suitability, depending on the local government's aim of developing an inventory (eg to establish an emissions baseline or to track change in emissions over time).

Aim and scope of the GHGI report

This report aims to provide an overview of GHG emissions-monitoring tools and datasets that can provide cities across the globe with community-wide emissions data they can use to build their inventories. Building on the recent Decision-making and Tools Project White Paper by GCoM, Bloomberg Associates and World Resource Institute (WRI), this report provides best practice recommendations on how and when to use different emissions tools and datasets. This will enable cities that do not have the means to develop a complete GHG emissions inventory to get started, removing a key barrier to further climate action.

This report does not cover:

- Well-established tools designed to help cities collect their own activity data to build an inventory (eg CIRIS and ClearPath). These types of tools are comprehensively covered elsewhere.
- Tools that provide cities with local government operations emissions inventories or project-specific emissions inventories.
- Decision-making tools to help cities plan their climate action, project future emissions, or assess the emissions reduction impacts of different climate actions on their inventory.
- Tools that help cities quantify their consumption-based emissions.

For more information on endorsed GHG emissions tools that are not included in this report, visit the GCoM Resource Library.

[3] Turnbull et al. (in review) IG3IS Urban Greenhouse Gas Emission Observation and Monitoring Best Research Practices, https://ig3is.wmo.int/en/events/towards-international-standard-urban-ghg-monitoring-and-assessment

Best practice recommendations for choosing the right GHG emissions tool or dataset for your inventory

When choosing the most appropriate GHG emissions inventory tool or dataset for your city, there are several things to consider. Below are questions and best practice recommendations you should think about to help you decide which tools and datasets are most suitable for your city's needs.

What stage is your city at on its climate action journey?

A city goes through many phases in its climate action journey, from assessing its impact and setting targets, to planning and taking action. Developing an emissions inventory typically falls into the assessment phase of that journey. However, even within the assessment phase, cities can be at different levels of maturity, and this will determine which tools and emissions datasets are most useful for you, and how accurate your inventory needs to be.

1. Establishing an emissions baseline
2. Identifying specific sources of emissions
3. Tracking progress over time

What methodological approach does the dataset or tool take to estimate emissions?

Emissions tools and datasets adopt different approaches to estimating emissions, which each come with their strengths and limitations, depending on a city's stage in its climate action journey.

- Direct atmospheric measurements.
- Local activity data multiplied by emission factors.
- Adapting or scaling data from other sources.
- Near-real-time big data approaches.

Does the tool's data come from reliable and robust sources?

You should prioritize using data from publicly available and reputable sources, for example government data or academic peer-reviewed datasets.

Does the tool's data align with globally recognized emissions accounting and reporting standards?

Global emissions accounting or reporting standards (eg GPC, CRF and the 2006 IPCC Guidelines for National Greenhouse Gas Inventories) provide a robust and transparent framework for developing city emissions inventories. Where possible, you should use emissions tools and datasets that align with global city GHG emissions standards.

Does the tool's data align with your city's inventory boundary?

- The data should cover your city's geographic boundary.
- The data should cover a relevant inventory accounting period.
- The data should cover multiple GHGs. The GPC recommends that cities use emissions data that covers all seven GHGs in the Kyoto Protocol (carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6), and nitrogen trifluoride (NF_3)).
- The data should cover core activity sectors. The GPC recommends that emissions should cover at least the stationary energy, transport and waste sectors.

What are the tool and dataset's other strengths and limitations?

- How often is the data updated?
- Does the tool include additional climate action planning functionalities?
- What is the functionality for downloading or exporting the data?
- How easy is it to transfer the data to other tools and platforms?
- Are there any costs to use the tool/dataset?
- Does the tool enable you to provide your own local data to improve the results?

These best practice recommendations were used to assess existing GHG tools and datasets for cities, which are summarized in the table below.

Summary table of tools[4]

1 Establishing an emissions baseline 2 Identifying specific sources of emissions 3 Tracking progress over time

Global

Tool name	GPC aligned?	GHGs included	Sectors included	Scopes included	Description	Temporal and spatial resolution	Latest data available	Accessibility	Data output	City climate action stage
Carbon Monitor Cities	No	CO_2	Stationary energy; transport (ground and aviation); IPPU (fossil fuel CO_2 emissions only)	1	Near-real time daily CO_2 data developed using a combination of national and local datasets	Daily; 10 km but can be aggregated to city boundary	2021	Free	Export as .xls	2 3
ClimateOS	Yes	CO_2, CH_4, N_2O	Stationary energy; transport; waste	1, 2, 3	Data downscaled from national, regional and global data	Annual; city boundary	2019-2020	Free	Export as .xls, import into CDP-ICLEI Track	1
Data Portal for Cities	Yes	CO_2, CH_4, N_2O	Stationary energy; transport; waste	1, 2	Data downscaled from national, regional and global data	Annual; city boundary	2015-2017	Free	Export as .xls, import into CDP-ICLEI Track (through CIRIS)	1
EverImpact	Yes	CO_2, CH_4, N_2O	Stationary energy; transport; waste	1 (2 & 3 possible through partner)	Direct measurement from satellite data	Hourly to annual; 3km^2	2022	Free; cities can pay for higher resolution data	Access data through dashboard/export through API	2 3
Futureproofed Cities	Yes	CO_2, CH_4, N_2O and CFCs from energy use	Buildings; transport; waste; AFOLU and IPPU	1, 2, some 3	Data downscaled from national and regional data, local data is prioritized where available	Annual; city boundary	2020	Pay	Export as .xls	1
Google Environmental Insights Explorer	Yes	CO_2, CH_4, N_2O, HFCs, PFCs, SF_6, NF_3	Transport; buildings	1, 2, 3	Data upscaled from local transport activity data and building footprint data	Annual; city boundary	2021	Pay	Export as .xls	1 2 3

[4] For information on the countries covered by each tool, please see the individual tool profiles in the 'Available tools and datasets' section in the full report.

Asia Pacific

Tool name	GPC aligned?	GHGs included	Sectors included	Scopes included	Description	Temporal and spatial resolution	Latest data available	Accessibility	Data output	City climate action stage
Snapshot	Yes	CO_2, CH_4, N_2O	Stationary energy; transport; waste; agriculture; land use change	1, 2, 3	Data downscaled from national and regional data, combined with Google EIE data	Annual; city boundary	2020-2021	Free for summary data; pay for detailed activity and emissions data	Export as .xls, import into CDP-ICLEI Track	1

Europe, Middle East and Africa

Tool name	GPC aligned?	GHGs included	Sectors included	Scopes included	Description	Temporal and spatial resolution	Latest data available	Accessibility	Data output	City climate action stage
Ecospeed Region	Yes	CO_2, CH_4, N_2O	Transport; buildings; waste; AFOLU; IPPU	1, 2, 3	Data downscaled from national and regional data	Annual; city boundary	2021	Pay	Export as .xls	1
Enersis Gaia Platform	Yes	CO_2, CH_4, N_2O, HFCs, PFCs, SF_6, NF_3	Transport; stationary energy; waste; AFOLU and IPPU	1, 2, some 3	Data downscaled from national and regional data and upscaled from local data	Annual; city boundary	2021	Pay	Export as .xls	1 2
Klimaschutz-Planer	No	CO_2, CH_4, N_2O	Transport; buildings (private and municipal); energy used in industry	Not disaggregated by scopes	Data downscaled from national and regional data, local data is prioritized where available	Annual; city boundary	2020	Pay	Export as .xls	1
OpenGHGMap	No	CO_2	Transport; stationary energy; industrial facilities; farms and refineries	1	Data downscaled from national and regional data	Annual; city boundary	2018	Free	Export as .xls	1
Proxy Data Tool	Yes	CO_2, CH_4, N_2O	Stationary energy; transport; waste	1, 2, some 3	Data downscaled from national and regional data	Annual; city boundary	2019	Free	Export as .xls, import into CDP-ICLEI Track (through CIRIS)	1
SCATTER	Yes	CO_2, CH_4, N_2O	Stationary energy; transport; waste; AFOLU and IPPU	1, 2, some 3	Data downscaled from national and regional data	Annual; city boundary	2019	Free	Export as .xls, import into CDP-ICLEI Track	1

Latin America

Tool name	GPC aligned?	GHGs included	Sectors included	Scopes included	Description	Temporal and spatial resolution	Latest data available	Accessibility	Data output	City climate action stage
SEEG (System for Estimating Greenhouse Gas Emissions)	No	CO_2, CH_4, N_2O, HFCs	Stationary energy; transport; waste; AFOLU; IPPU	Not disaggregated by scope	Data downscaled from national and regional data	Annual; city boundary	2019	Free	Export as .xls	1

North America

Tool name	GPC aligned?	GHGs included	Sectors included	Scopes included	Description	Temporal and spatial resolution	Latest data available	Accessibility	Data output	City climate action stage
MEED (Municipal Energy and Emissions Database)	Yes	CO_2, CH_4, N_2O	Transport; buildings; stationary energy sources; waste	1, 2	Data downscaled from national and regional data	Annual; city boundary	2018	Free to use	No export functionality, but will be available in future update	1
Crosswalk Labs	Yes	CO_2	Stationary energy (residential, commercial, industrial); transport (on-road, non-road, commercial marine vessels, aviation, rail); IPPU (cement production only)	1	Near-real time hourly CO_2 data developed using a combination of national and local datasets	Hourly to annual; <1 km up to city/state boundary	2020	Free to use; pay to use custom service also available	No export functionality	2 3

Future directions

There are many GHG emissions tools and datasets to help cities that are facing barriers to measuring their emissions get started with developing an inventory or filling in data gaps. These tools have different strengths and limitations and have varying applicability, depending on where the city is on its climate action journey and its geographic location.

Many of these tools and datasets are developing and evolving, and geographic scope and data availability and access is likely to expand and improve over the next few years, enhancing cities' abilities to measure and track their emissions.

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For more information about annual disclosure, please visit the Cities page on our website. If you have any questions, visit the CDP Help Center Home - CDP Help Center.

Declaration of competing interests
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