



Greenhouse Gas Emission Inventory Resources for Subnational Governments: Final Report

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Submitted to:
The Climate Group, secretariat of
the Under2 Coalition

Submitted by:
ICF



SECRETARIAT THE CLIMATE GROUP

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I. Conducting a GHG Emission Inventory – Summary of ICF Recommendations and Considerations

Based on ICF’s experience conducting greenhouse gas (GHG) emission inventories and a review of GHG emission inventory protocols and guidelines, the following sections provide recommendations and considerations, first to the Under2 Coalition, and second recommendations and considerations to Under2 jurisdictions.

1. Recommendations and considerations to the Under2 Coalition

ICF recommends the Under2 Coalition:

- Review the framework for comparing and aggregating emissions from various jurisdictions that was developed by the Compact of States and Regions (CoSR), with an emphasis on whether any adjustments need to be made to incorporate cities into this framework for use within the Under2 Coalition.
- Develop a GHG emissions inventory training toolkit for Under2 jurisdictions, linked to flexible training and mentoring that explicitly recognizes the range of capacities and capabilities in the Under2 Coalition.
- Engage the IPCC Task Force on National Greenhouse Gas Inventories (TFI) to provide guidance to subnational governments aiming to be consistent with national inventories in the next update to the IPCC Guidelines due out in 2019.

In addition, the Under2 Coalition should consider:

- Making recommendations to its members on how to define inventory boundaries for characterizing and including emission sources.¹ Recommendations would include how to draw the geographic boundary for direct emissions within a jurisdiction, as well as how to characterize indirect emissions (i.e., emissions that are physically emitted outside a jurisdiction’s geographical boundary). At a minimum, Under2 jurisdictions should be separating direct GHG emissions and indirect GHG emissions as this separation will be critical for aggregating emissions.
- Whether to actively encourage flexibility for reporting on more or less sectors and emission sources depending on the resources and relevant sectors of the jurisdiction. For example, GHG Protocol’s Global Protocol for Communities (GPC) provides a BASIC approach which focuses on the energy and waste sectors while the BASIC+ approach is more comprehensive and includes emissions from the industrial processes and land use sectors.

¹ The IPCC 2006 Guidelines provide a framework for direct emissions within the geographical boundaries of a nation. However, defining boundaries for subnational jurisdictions can be more complex, as many jurisdictions will want to include activities such as electricity consumption that can release GHG emissions outside of the jurisdiction’s geographic boundary.

- Developing a supplemental reporting format that Under2 jurisdictions should map to in addition to how they currently report. This would assist considerably in reporting consistency and allow transparency in reporting including comparison between Under2 members.

2. Recommendations and considerations to Under2 jurisdictions

While the Under2 Coalition does not plan on requiring a specific GHG emission inventory protocol or guidance document at the moment, below are a few key characteristics of compiling a GHG emission inventory that Under2 jurisdictions are recommended to follow. These recommendations are also applicable to subnational jurisdictions as a whole.

ICF recommends jurisdictions in the Under2 Coalition:

- Follow consistent reporting conventions with their national government counterparts, including:
 - Reporting on all seven GHGs required by the United Nations Framework Convention on Climate Change (CO₂, CH₄, N₂O, HFCs, PFCs, SF₆, NF₃) and reporting on each gas separately for each emission source.
 - Using 100-year Global Warming Potentials (GWPs) that are consistent with the latest national inventory requirements. These are currently the GWPs from the IPCC Fourth Assessment Report (AR4).
 - Reporting GHG emissions in metric tons.
- Report direct GHG emissions (i.e., emissions within the geographic boundary of the jurisdiction) separately from indirect GHG emissions (i.e., emissions outside of the geographic boundary).
- Specify sectors and emission sources in a manner that is equivalent to or can be directly mapped to sectors and emission sources in the IPCC Guidance. For example, GHG Protocol's Global Protocol for Communities (GPC) provides a mapping of emission source categories from the protocol to IPCC categories.²

In addition, jurisdictions in the Under2 Coalition should consider:

- Ensuring consistency of GHG emission inventory approach with the respective national inventories of Under2 members, while also promoting comprehensive GHG emissions inventory approaches to encourage best-practice methodologies at national level.
- The balance between accuracy and comprehensiveness against flexibility and a jurisdiction's human resource capacity to conduct a GHG emission inventory. Section II.2 below provides a range of human resource estimates for conducting a GHG emission inventory.

² GHG Protocol Global Protocol for Community-Scale Greenhouse Gas Emission Inventories, Table A.3: <http://www.ghgprotocol.org/city-accounting>

II. GHG Emission Inventory Capacity Requirements and Resources for Subnational Governments

The [Under2 MOU](#) is a commitment by sub-national governments to reduce their greenhouse gas (GHG) emissions towards net-zero by 2050. Central to this is the commitment that all signatories publicly commit to limit their GHG emissions by 80-95%, or 2 metric tons CO₂-equivalent per capita, by 2050. The Under2 Coalition provides a global forum that supports the 136 Under2 MOU signatories in developing impactful strategies that create climate resilient economies. The Climate Group, as Secretariat of the Under2 Coalition is beginning to look at resources for the Under2 jurisdictions to assist with their greenhouse gas (GHG) Measuring, Reporting, and Verification (MRV) efforts. ICF has been collaborating with Under2 Coalition to recommend potential resources that would help further the efforts of these jurisdictions, and assist the organization in fulfilling commitments to GHG reductions.

Subnational governments may benefit from putting in place a GHG emission inventory through:

- Identifying key emission categories and GHG emission sources within the jurisdiction.
- Establishing the foundation for developing GHG mitigation strategies and GHG reduction targets, and obtaining international financing.
- Establishing the foundation for tracking progress towards reducing emissions and meeting GHG reduction targets.
- Providing a consistent framework for comparison against GHG emission inventories and mitigation efforts from other jurisdictions, including national government GHG emission inventories.

This research focuses on a high-level review of GHG emission inventory protocols and guidelines available to subnational governments to conduct a GHG emission inventory for their jurisdiction. ICF reviewed 26 protocols and guidance documents and created a matrix that details key features of each resource, including: the emission sectors covered; the geographic audience for the resource; and the GHG emission inventory framework topics covered, to name a few. These resources were selected because they provide guidance relevant to subnational governments conducting a GHG emission inventory. Some resources are broad in their scope, while other resources focus on a particular GHG emissions sector or geographical region. While this list is reasonably comprehensive, ICF had not attempted to provide an exhaustive review of all GHG guidance materials that exist. ICF and the California EPA also surveyed the capacity requirements for conducting a GHG emission inventory at various subnational levels using estimates gathered at the state and city level in California.

For any enquiries about this report and the associated research on GHG emission inventory resources, please contact: insights@theclimategroup.org

1. GHG emission inventory resources available to subnational governments

This section covers the various types of protocols and guidance documents available to Under2 jurisdictions at the initial stage of developing their GHG emission inventory. This section starts by reviewing foundational resources for Under2 jurisdictions, followed by a description of how

additional protocols and guidance documents can complement the foundational resources, before discussing additional resources that are available outside of GHG emission inventory protocols and guidance documents.

ICF reviewed 26 protocols and guidance documents that subnational governments can potentially use to compile their GHG emission inventories. These resources were selected because they provide guidance relevant to subnational governments conducting a GHG emission inventory. Some resources are broad in their scope, while other resources focus on a particular GHG emissions sector or geographical region. Table 1 lists out all the resources reviewed for this research. A detailed look into each of these resources can be seen in *Appendix B. GHG Emission Inventory Resources* and *The Greenhouse Gas Emission Inventory Resource Matrix for Subnational Governments*.

Table 1 List of GHG Emission Inventory Resources

Organization	Guidance Document / Protocol Name
IPCC	IPCC 2006 Guidelines
ICLEI/GHG Protocol/C40	GHG Protocol Global Protocol for Community-Scale Emissions
ICLEI	International Local Government GHG Emissions Analysis Protocol (IEAP)
UNEP	International Standard for Determining Greenhouse Gas Emissions for Cities (ISDGC)
PAS	PAS 2070: Specification for the assessment of greenhouse gas emissions of a city
IPCC	IPCC 1996 Guidelines
ISO	ISO 14064-1: 2006
CDSB	Climate Change Reporting Framework
GHG Protocol	GHG Protocol Scope 2 Guidance
GHG Protocol	GHG Protocol Agriculture Guidance
IPCC	IPCC Good Practice Guidance for Land Use, Land-Use Change and Forestry
IPCC	2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands
UNFCCC	National Reporting to the UNFCCC
TCR/CCAR/CARB/ICLEI	Local Government Operations Protocol
TCR	The Climate Registry General Reporting Platform (GRP)
ICLEI	US Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions
British Columbia	Community Energy & Emissions Inventory (CEEI)
California AEP	AEP California Community-Wide Greenhouse Gas Baseline Inventory Protocol White Paper:
NYSERDA	Greenhouse Gas Inventory Guide for Local Government Operations
British Columbia	2017/17 B.C. Best Practices Methodology for Quantifying Greenhouse Gas Emissions
Municipal Association of Victoria	Low Carbon Guide for Victorian Councils

California AEP	“California Supplement” in 2013 to the ICLEI 2012 Community Inventory
Covenant of Mayors	Covenant of Mayors: How to Develop a Sustainable Energy Action Plan
GHG Protocol	Agricultural Protocol for Ethiopia
GHG Protocol	GHG Protocol's Agricultural Guidance for Brazil
USDA	Quantifying Greenhouse Gas Fluxes in Agriculture and Forestry: Methods for Entity-Scale Inventory

1.1 Foundational resources

Prior to the Paris Climate Agreement, under the United Nations Framework Convention on Climate Change (UNFCCC), developed (Annex 1) countries submitted National Inventories annually and regular National Communications to the UNFCCC, while most developing (Non-Annex 1) countries submitted National Communications (NCs) and Biennial Update Reports (BURs) that contained data on their national GHG emission inventories.³ These reports have provided countries with the ability identify significant sources of greenhouse gas emissions, track trends over time, and information to inform their Nationally Determined Contributions (NDCs) under the Paris Climate Agreement. The Paris Climate Agreement has kept this framework in place, however the gap between responsibilities between Annex 1 and Non-Annex 1 countries has shrunk as efforts towards inventory reporting and transparency has increased. These efforts will be phased in and require all countries to report on their greenhouse gas emissions every two years, and subject these reports to expert technical review and peer review.⁴

Subnational governments can look to the GHG emission inventory of their respective national government as a valuable resource, as these reports can act as a resource for country-specific activity data, emission factors, and applied methodologies which will become more valuable over time as nations refine their GHG emission inventory reports. Nations must use the IPCC 2006 Guidelines to compile their national inventories.⁵ These guidelines present the framework (e.g., boundaries, gases, sectors, emission sources) and calculation methodologies that nations must use to compile their inventory. The IPCC is working on an update of the IPCC 2006 Guidelines due out in 2019 that will provide:

- Supplementary methodologies for sources or sinks of greenhouse gases only where necessary (e.g. for sources or sinks that are not well covered by the 2006 IPCC Guidelines);
- Updated default values of emission factors and other parameters based on the latest available science only where significant differences from current default values are identified, and;
- Additional or alternative up-to-date information and guidance, where possible, as clarification or elaboration of existing guidance in the 2006 IPCC Guidelines.⁶

³ http://unfccc.int/national_reports/items/1408.php

⁴ <http://www.c2es.org/newsroom/articles/post-paris-transparency-under-united-nations-framework-convention-climate>

⁵ <http://www.ipcc-nggip.iges.or.jp/public/2006gl/>

⁶ http://www.ipcc.ch/news_and_events/docs/SBSTA-44/tfi_presentation_18_may.pdf

Subnational governments may look to the IPCC Guidelines for guidance on areas such as calculation methodologies, which greenhouse gases to include, global warming potentials, defining geographic boundaries⁷, and direct emission sources (i.e., emissions within the defined geographic boundary). Most other resources included in this research are consistent with the IPCC 2006 Guidelines, but provide additional detail depending on the purpose of the resource.

The Under2 Coalition includes a diverse set of subnational governments, including cities, states, and regions around the globe. While the IPCC 2006 Guidelines is intended for direct emissions, many subnational governments, including cities and smaller regions, will have significant indirect emissions from emission sources such as electricity consumption and waste, which can result from consumption within the geographical boundary even if emissions take place outside this boundary. For subnational governments with potentially significant indirect emissions, the GHG Protocol's Global Protocol for Community-Scale Greenhouse Gas Emissions (GPC)⁸ provides a framework that is consistent with the IPCC 2006 Guidelines, but is tailored to communities.

1.2 Compatibility of resources with each other

Jurisdictions may consider three foundational resources to conduct comprehensive GHG emission inventories:

- IPCC 2006 Guidelines
- National Inventory submissions, NCs, and BURs submitted to the UNFCCC
- The GPC

However, subnational governments may want to look at other resources that are either tailored to their geographical region, or go into sector-specific guidance (e.g, guidance on land use and agriculture, indirect emissions from electricity consumption) where those sectors are thought to be significant within a jurisdiction. Geographical region-specific resources may contain region-specific data and methods, and point to region-specific tools. Sector-specific guidance typically provide methods consistent with IPCC guidelines where relevant, but provide more detail than the IPCC Guidelines. Sector-specific guidelines may also provide sector-specific tools and data sources. Most of these resources are complementary to the foundational resources listed above, and jurisdictions can review the last two columns of the GHG emission inventory resource matrix, "What does this guidance offer beyond the IPCC 2006 Guidelines or the Global Protocol for Communities" and "Overall recommendations and considerations" for how subnational governments can best make use of these resources.

1.3 Additional resources

While the scope of this research is limited to the review of GHG emission inventory protocols and documents, there are additional resources Under2 jurisdictions can leverage to conduct a GHG emission inventory. There are an abundance of tools, software, templates, and databases for jurisdictions to consider using, many of which are listed in *Appendix C. List of Tools and*

⁷ While the IPCC 2006 Guidelines are describe how to define national geographic boundaries, these concepts can also be adapted to subnational jurisdictions.

⁸ <http://www.ghgprotocol.org/city-accounting>

Templates Available for Subnational Governments. Many of these resources build off of the IPCC Guidelines and can help to streamline the GHG emission inventory process.

2. Capacity requirements for conducting a GHG emission inventory

For subnational governments to compile a GHG emission inventory, they must devote the appropriate amount of economic and human resources to meet their needs. The resources required for an inventory depend on many factors, including:

- The size of the jurisdiction;
- The emission sectors and sources to be quantified;
- The data available to the jurisdiction; and
- The complexity of the selected calculation methods (default or Tier 1 calculations versus more detailed modeling methods, and default emission factors versus location-specific emission factors).

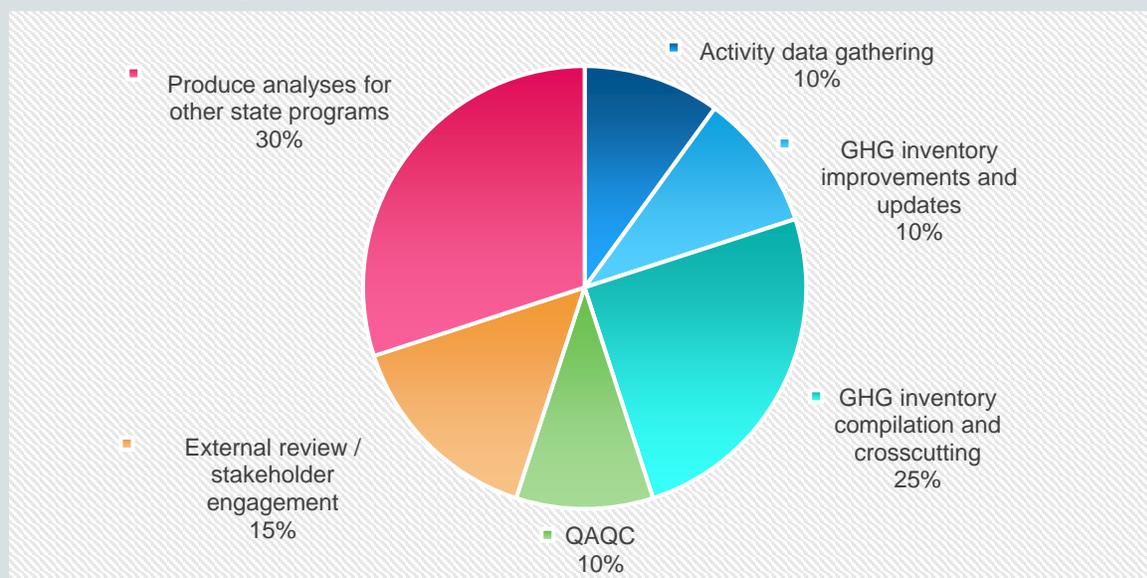
GHG Emission Inventory Resources Spotlight: California

California compiles their GHG emission inventory using internal government staff, and is now in their 8th year.

Staffing requirements: California has five full time staff and one manager devoted to the state's GHG emission inventory. Two additional staff with subject matter expertise give about 15% of their time towards the GHG emission inventory.

Comparisons between the initial inventory and updates: California's first GHG emission inventory under the Air Resources Board (ARB) required significant development of emissions quantification methods, models, database infrastructure, and webpages, as well as a full board approval process. The first update took about four times as long as the subsequent annual updates.

Inventory activity breakdown: Resource allocation for the compilation of California's inventory is broken down into the following activities:



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While some jurisdictions may have one GHG inventory coordinator that works with other government staff or consultants, large jurisdictions with robust and comprehensive GHG emission inventories such as California have many staff involved in the process.

Based on GHG emission inventories that have been performed throughout small regions and cities in California, the number of hours needed to perform the work will vary depending on the sectors included and the complexity of the calculation methods used. Table 2 provides a comparison of the hours needed to compile a GHG emission inventory depending on the complexity of the analysis, while Figure 1 provides a general estimate of what activities the estimated hours are used for. While California jurisdictions already have access to established data sources, jurisdictions with less established data sources may spend additional hours collecting activity data and emission factors. In addition, the hours estimated here assume fully trained experts are conducting the inventory, and therefore does not include any resources for training and capacity building that may be required.

Table 2. Comparison of estimated hours for performing GHG emission inventories based on the complexity of the analysis

GHG Emissions Inventory Type	Estimated Hours
1. Basic scope (stationary energy, transport, waste), and basic methods (e.g., emission factors)	100-200
2. Basic scope (stationary energy, transport, waste), and sophisticated methods (e.g., modeling / direct measurement)	200-400
3. Comprehensive scope (Also includes agriculture / forestry), and basic methods (e.g., emission factors)	300-600
4. Comprehensive scope (Also includes agriculture / forestry), and sophisticated methods (e.g., modeling / direct measurement)	500-900

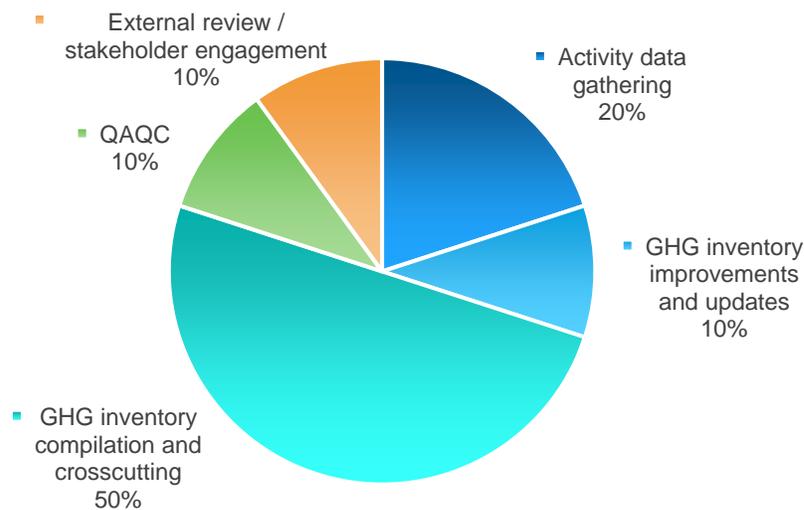


Figure 1. Resource allocation estimates by GHG emissions inventory activity

The GHG emission inventory resource matrix provides some indicators for how resource intensive GHG protocol or guidance document may be to follow. For instance, the “Method Types Available” field indicates whether the methods available include emission factor based

methods, or modeling and direct measurement methods, though most resources cater to multiple types of methods for a given emission source. The GPC also presents a BASIC and BASIC+ framework for conducting a community-wide inventory, with the BASIC framework focusing on emissions from the energy and waste sectors, while the BASIC+ framework also includes emissions from the industrial processes and land use sectors.

Appendix A. Current State of Reporting for the Compact of States and Regions (CoSR)

ICF and the California EPA reviewed recent GHG emission inventory submissions to the CDP from 59 CoSR jurisdictions to see what jurisdictions have been using as their primary protocol, and which greenhouse gases they are reporting. Highlights from the 2016 data submissions from CoSR states and regions to the CDP as part of the Compact of States and Regions' disclosure initiative are provided below. While many states and regions that are signatories to the Under2 MOU are also members of the CoSR, city signatories to the Under2 MOU are not represented in these findings.

- GHG emission inventory reporting is increasing among the CoSR members. There are 59 CoSR jurisdictions that submitted reports to CDP in 2016, up from 47 last year.
- Not all jurisdictions that submit reports to CPD are reporting gross GHG emissions data. Only 46 CoSR jurisdictions submitted gross emissions data in 2016, an increase of only 2 jurisdictions from the 44 that submitted gross emissions data last year.
- Out of the 59 states and regions that submitted reports to CDP, 37 of these are part of the Under2 Coalition.
- Thirty-seven percent of CoSR members in 2016 list the IPCC 2006 Guidelines as their primary source to calculate GHG emissions, followed by IPCC 1996 Guidelines (10%), U.S. EPA methodologies (7%), The Climate Registry General Reporting Protocol (2%), and International Emissions Analysis Protocol (2%). Twenty-seven percent of reporting jurisdictions used other primary sources, while 15% did not specify which primary source they were using (see Figure 2).

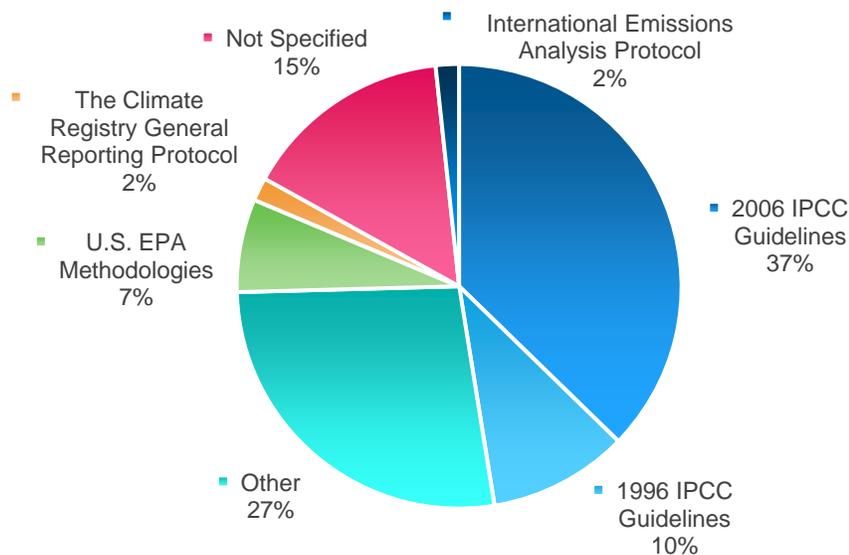


Figure 2. Primary resource used by CoSR jurisdictions to calculate GHG emissions

- The IPCC guidelines now require reporting of seven greenhouse gases (CO₂, CH₄, N₂O, HFCs, PFCs, SF₆, and NF₃). Only 25% of CoSR members are reporting all of these gases, while 5% are only reporting CO₂ emissions (see Figure 3).

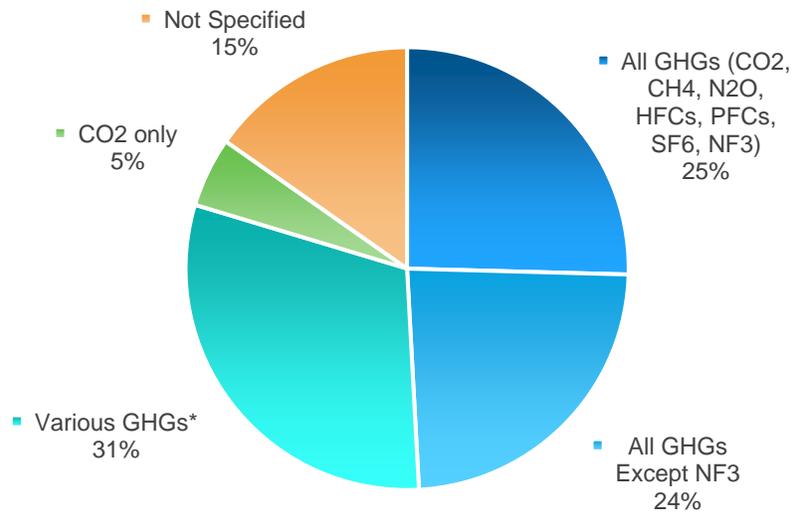


Figure 3. Greenhouse gases included in CoSR GHG emission inventories

* Of the 18 jurisdictions reporting more than CO₂ but less GHGs than “All GHGs except NF₃”, 10 of these jurisdictions reported CO₂, CH₄, and N₂O, while 8 jurisdictions reported other combinations of GHGs.

Appendix B. GHG Emission Inventory Resources

ICF reviewed 26 protocols and guidance documents that subnational governments can potentially use to compile their GHG emission inventories. These resources were selected because they provide guidance relevant to subnational governments conducting a GHG emission inventory. Some resources are broad in their scope, while other resources focus on a particular GHG emissions sector or geographical region. While this list is reasonably comprehensive, the authors have not attempted to provide an exhaustive review of all GHG guidance materials that exist. These resources have been organized in the following way:

- Resources that are applicable to all geographical regions (12). Of these resources:
 - 8 resources cover multiple emission sectors
 - 4 resources are sector-specific
- Resources that are intended for a particular geographical region (14). Of these resources:
 - 10 resources cover multiple emission sectors
 - 4 resources are sector-specific

Table 3 shows the structure of the GHG Emission Inventory Resource Matrix.

Table 3. GHG Emission Inventory Resource Matrix Structure

Field Name	Description
Primary purpose of the document	Description of document, what is it to be used for?
URL	Link to resource
Publication Date	Date of publication
Cost (USD)	Cost
Region Type	Is the guidance applicable at the city or regional level?
Specific geographical region	Is this a geographical region-specific document?
Notes on region type / geographic coverage	If so, which regions?
Emission sectors covered	What emission sectors are covered?
Notes on emission sectors	Provides details on the specifics of each sector covered.
Level of guidance on LULUCF sources	To what extent land use, agriculture, and forestry emissions are discussed
Inventory framework topics covered	Inclusion of topics on how to structure a GHG inventory (e.g., boundaries, sectors, greenhouse gases, classification of direct and indirect emissions)
Method Types Available	Indicator for how resource-intensive the available methods are in the resource
Provides references to IPCC 2006 calculation methodologies	Yes/No
Whether the document gives examples to illustrate best practices	Yes/No

Field Name	Description
Available languages	What languages is the document available in
What does this guidance offer beyond the IPCC 2006 Guidelines or the Global Protocol for Communities	Other documents may provide region-specific data / guidance, more detailed methodologies, best practice examples.
Overall recommendation	Discussion of whether and how this resource will be useful to certain Under2 MOU jurisdictions and in the context of other documents

While all resources are available in one place in the GHG Emission Inventory Resource Matrix Excel file, these resources are compiled below in a printable format for convenience.

2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories (IPCC 2006 Guidelines)

Purpose: These guidelines provide internationally agreed methodologies intended for use by countries to estimate greenhouse gas inventories to report to the United Nations Framework Convention on Climate Change (UNFCCC).

Publication Date: 2006

Cost: Free

Available languages: English, Arabic, Chinese, French, Russian, Spanish

Includes examples of best practices: No

Provides references to IPCC 2006 calculation methodologies: Yes

Method Types Available: Both emission factors and measurement / modeling

URL <http://www.ipcc-nggip.iges.or.jp/public/2006gl/>

Region Type Both

Geography-specific

No

Region Notes: N/A

Emission sectors covered: All

Notes on emission sectors

- Energy: Stationary combustion; Mobile combustion; Fugitive emissions; Carbon dioxide transport, injection, and geological storage.
- Industrial Processes and Product Use: Mineral industry; Chemical industry; Metal industry; Non-Energy Products from Fuels and Solvent Use; Electronics Industry; Emissions of fluorinated substitutes for ozone depleting substances.
- Agriculture, Forestry, and Other Land Use: Forest land; Cropland; Grassland; Wetlands; Settlements; Other land; Livestock and Manure Management; N₂O emissions from managed soils and CO₂ emissions from lime and urea application; Harvested wood products.
- Waste: Generation, composition, and management; Solid waste disposal; Biological treatment of solid waste; Incineration and open burning of waste; Wastewater treatment and discharge.

Level of guidance on LULUCF sources: Specific guidance on Agriculture, Forestry, and Other Land Use

Inventory framework topics covered

- Data collection
- Uncertainty assessment
- Key category analysis
- Time series consistency
- Quality Assurance and Quality Control
- Precursors and indirect N₂O emissions
- Reporting

What does this guidance offer beyond the IPCC 2006 Guidelines or the Global Protocol for Communities (GPC)

Provides calculation methodologies for emission sources (many of which are referenced by the GPC) under the tiered approach (Tier 1, Tier 2, Tier 3). IPCC also sets the standard for national inventories (for which subnational inventories should be consistent with) regarding consideration of direct emission sources, global warming potentials (GWPs), and greenhouse gases to include

Overall recommendation

ICF recommends Under2 jurisdictions should use IPCC Guidelines as the foundation for calculation methodologies, setting geographical boundaries, data collection methods, default emission factors, uncertainty methods, GWPs, and GHGs to include.



GHG Protocol Global Protocol for Community-Scale Greenhouse Gas Emission Inventories: An Accounting and Reporting Standard for Cities (GPC)

Purpose: This guidance provides cities and local governments a robust, transparent, and globally-accepted framework to consistently identify, calculate, and report on city greenhouse gases. This guidance established credible emissions accounting and reporting practices that help cities develop an emission baseline, set mitigation goals, create more targeted climate actions plans, and track progress over time.

Publication Date: December 2014

Available languages: English

Provides references to IPCC 2006 calculation

methodologies: Yes

URL

<http://www.ghgprotocol.org/city-accounting>

Cost: Free

Includes examples of best practices: Yes

Method Types Available: Both emission factors and measurement / modeling

Region Type

Both

Geography-specific

No

Region Notes: While the GPC is primarily designed with cities in mind, it provides a framework that can be used by any subnational government and explicitly states this claim.

Emission sectors covered: All

Notes on emission sectors

- Energy:
 - 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: Industrial processes; Product use.
- Agriculture, Forestry, and Other Land Use: Livestock; Land; Aggregate sources and non-CO2 emission sources on land.

Level of guidance on LULUCF sources: Specific guidance on Agriculture, Forestry, and Other Land Use

Inventory framework topics covered

- Boundaries (scope 1, 2, or 3)
- Reporting requirements
- Aggregating emissions from multiple jurisdictions inventories
- Tracking progress and setting goals
- Managing quality and verification
- Divisions by sectors, sub-sectors, and sub-categories

What does this guidance offer beyond the IPCC 2006 Guidelines or the Global Protocol for Communities (GPC)

While the IPCC 2006 Guidelines is intended for direct emissions, many subnational governments, including cities and smaller regions, will have significant indirect emissions from emission sources such as electricity consumption and waste, which can result from consumption within the geographical boundary even if emissions take place outside this boundary. The GPC provides a framework that is consistent with the IPCC 2006 Guidelines, but is tailored to communities. The GPC introduces "scopes" framework which provides a framework to account for emissions beyond the jurisdiction boundary but influenced by the jurisdiction (e.g., electricity consumption, cross-boundary transportation trips, landfill emissions). Also splits out energy into stationary energy and transportation. Introduces "BASIC" and "BASIC +" options to allow subnational governments different levels of inclusion for emission sources depending on their resources and the significance of sectors.

**Overall
recommendation**

For jurisdictions considering significant indirect emissions, ICF recommends using the GPC framework, supplemented with sector-specific or geographically-specific guidance as needed. The GPC can be used by any jurisdiction assessing the GHG emissions of a geographically defined, subnational area. It requires cities to measure and disclose a comprehensive inventory of GHG emissions and to aggregate these using two distinct but complementary frameworks: one focusing on geographically defined emissions, the other on city-induced emissions.



International Local Government GHG Emissions Analysis Protocol (IEAP)

Purpose: The purpose of this protocol is to promote understanding of a local government's and community's impact on climate change and enable practitioners to develop complete and accurate emissions analyses for the community level. This document supports comparison of different communities in a consistent, detailed, policy-relevant way and provides easily understandable metrics for a wide audience. Finally, this guidance enables other networks and entities to define custom reporting requirements within the context of the Local Government GHG Emissions Analysis Protocol and function in tandem with existing or potential regulatory requirements and emissions certification opportunities.

Publication Date: October 2009

Cost: Free

Available languages: English

Includes examples of best practices: No

Provides references to IPCC 2006 calculation methodologies: Yes

Method Types Available: Both emission factors and measurement / modeling

URL

http://carbonn.org/fileadmin/user_upload/carbonn/Standards/IEAP_October2010_colr.pdf

Region Type Both **Geography-specific** No

Region Notes: N/A

Emission sectors covered: All

Notes on emission sectors

- Energy: Stationary energy, Transport, Fugitive Emissions
- Industrial Processes and Product Use
- Waste: Waste and Wastewater Treatment
- Agriculture, Forestry, and Other Land Use: Agriculture; Land use, land use change, and forestry

Level of guidance on LULUCF sources: Limited specific guidance on LULUCF

Inventory framework topics covered

- Boundaries
- Scopes
- Reporting

What does this guidance offer beyond the IPCC 2006 Guidelines or the Global Protocol for Communities (GPC)

Superseded by the GPC

Overall recommendation

This document has been superseded by the GPC and should not be used anymore by Under2 members



International Standard for Determining Greenhouse Gas Emissions for Cities

Purpose: This document outlines the guidelines that cities should follow for determining greenhouse gas emissions. Cities should use the principles and methods developed by the IPCC.

Publication Date: June 28, 2010

Cost: Free

Available languages: English

Includes examples of best practices: No

Provides references to IPCC 2006 calculation methodologies: Yes

Method Types Available: N/A

URL http://www.unep.org/urban_environment/PDFs/InternationalStd-GHG.pdf

Region Type City

Geography-specific

No

Region Notes: N/A

Emission sectors covered: All

Notes on emission sectors

- Energy: Stationary and mobile sources
- Industrial Processes and Product Use
- Agriculture, Forestry, and Other Land Use
- Waste

Level of guidance on LULUCF sources: Recommends following IPCC 2006 guidance, which contains specific guidance on Agriculture, Forestry, and Other Land Use

Inventory

framework topics covered

- Boundaries
- Reporting
- Uncertainty assessment and quality assurance

What does this guidance offer beyond the IPCC 2006 Guidelines or the Global Protocol for Communities (GPC)

Superseded by the GPC

Overall recommendation

This document has been superseded by the GPC and should not be used anymore by Under2 members



PAS 2070:2013 Incorporating Amendment No. 1. Specification for the assessment of greenhouse gas emissions of a city: Direct plus supply chain and consumption-based methodologies

Purpose: PAS 2070 aims to provide a robust and transparent method for consistent, comparable and relevant quantification, attribution and reporting of city-scale greenhouse gas (GHG) emissions. This will encourage more holistic GHG assessments, greater disclosure and more meaningful benchmarking to help city decision makers identify key emission sources and their drivers, the carbon dependence of their economy, and opportunities for more efficient urban supply chains.

Publication Date: October 2013

Available languages: English

Provides references to IPCC 2006 calculation methodologies: Yes

URL

<http://shop.bsigroup.com/Browse-By-Subject/Environmental-Management-and-Sustainability/PAS-2070-2013/>

Cost: Free

Includes examples of best practices: Yes

Method Types Available: Both emission factors and measurement / modeling

Region Type

City

Geography-specific

No

Region Notes: N/A

Emission sectors covered: All

Notes on emission sectors

- Energy: Stationary sources; Mobile Sources
- Industrial Processes and Product Use
- Agriculture, Forestry, and Other Land Use
- Waste
- Other: Goods and services- water provision, food and drink and construction materials

Detailed case study on London is provided:

http://shop.bsigroup.com/upload/PAS2070_case_study_bookmarked.pdf

Level of guidance on LULUCF sources: Some specific guidance on Agriculture, Forestry, and Other Land Use

Inventory framework topics covered

- Boundaries (greenhouse gas emissions boundaries and assessment boundaries)
- Time-related coverage
- Avoiding double counting

What does this guidance offer beyond the IPCC 2006 Guidelines or the Global Protocol for Communities (GPC)

This guidance presents both the Direct Plus Supply Chain (DPSC) methodology which is consistent with GPC and IPCC, and a Consumption-Based (CB) methodology which is not recommended to use since it does not directly account for direct, scope 1 emissions. The DPSC methodology includes additional indirect sources to the GPC such as upstream emissions from food and drink and construction.

Overall recommendation

The PAS 2070:2013 DPSC method is consistent with GPC and IPCC 2006. Jurisdictions measuring indirect emissions may consider this document for a comprehensive case study on London, and additional guidance on estimating scope 3 emissions beyond what the GPC provides.



Revised 1996 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories

Purpose: The guidelines should be used as methodologies for estimating anthropogenic emissions by sources and removals by sinks of greenhouse gases.

Publication Date: 1996

Cost: Free

Available languages: English, French, Spanish, Russian

Includes examples of best practices: No

Provides references to IPCC 2006 calculation methodologies: No

Method Types Available: Both emission factors and measurement / modeling

URL

<http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.html>

Region Type

Both

Geography-specific

No

Region Notes: N/A

Emission sectors covered: All

Notes on emission sectors

- Energy: Fuel combustion activities; Fugitive emissions from fuels
- Industrial Processes: Mineral products; Chemical industry; Metal production; Other production; Production of halocarbons and Sulphur hexafluoride; Consumption of halocarbons and Sulphur hexafluoride; Other
- Solvent and Other Product Use: Paint application; Degreasing & dry cleaning; Chemical products, manufacture & processing; Other
- Agriculture: Enteric fermentation; Manure management; Rice cultivation; Agricultural soils; Prescribed burning of savannas; Field burning of agricultural residues; Other
- Land-Use Change & Forestry: Changes in forest and other woody biomass stocks; Forest and grassland conversion; Abandonment of managed lands; CO₂ emissions and removals from soil; Other
- Waste: Solid waste disposal on land; Wastewater handling; Waste incineration; Other

Level of guidance on LULUCF sources: Guidance on Land-Use Change and Forestry

Inventory

• Boundaries

framework topics

• Documentation

covered

• Double counting of emissions

What does this guidance offer beyond the IPCC 2006 Guidelines or the Global Protocol for Communities (GPC)

These guidelines represent the precursor to the 2006 IPCC guidelines. They lack all of the same characteristics as the 2006 guidelines. The 2006 guidelines include new sources and gases as well as updates to the previously published methods whenever scientific and technical knowledge have improved since the previous guidelines were issued.

Overall recommendation

Jurisdictions should not use the IPCC 1996 Guidance, this has been superseded by IPCC 2006.



ISO 14064-1:2006 Greenhouse gases -- Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals

Purpose: This part of ISO 14064 standard details principles and requirements for designing, developing, managing and reporting organization- or company-level GHG inventories. It includes requirements for determining GHG emission boundaries, quantifying an organization's GHG emissions and removals, and identifying specific company actions or activities aimed at improving GHG management. ISO 14064 is GHG program neutral.

Publication Date: March 2006

Cost: \$119.34

Available languages: English, French, Russian, Spanish, Arabic

Includes examples of best practices: No

Provides references to IPCC 2006 calculation methodologies: No

Method Types Available: Both emission factors and measurement / modeling

URL http://www.iso.org/iso/catalogue_detail?csnumber=38381

Region Type

Both

Geography-specific

No

Region Notes: Subnational jurisdictions are not explicitly mentioned in this standard, however many topics contained in the standard will be relevant to subnational governments.

Emission sectors covered: None Specifically

Notes on emission sectors

- Specific emission sources and sectors are not prescribed.

Level of guidance on LULUCF sources: Minimal

Inventory framework topics covered

- Inventory Design and Development
- Boundaries
- Uncertainty
- Data Management
- Documentation

What does this guidance offer beyond the IPCC 2006 Guidelines or the Global Protocol for Communities (GPC)

Provides a high-level overview of best practice organizational-based GHG accounting consistent with GHG Protocol organization-level guidance. While the GPC goes into more detail, ISO standards provide instructions on "what" organizations should include in a GHG inventory without going into much detail on how to do it.

Overall recommendation

Jurisdictions may consider using this resource as an international best practice guide for high-level guidance on structuring a GHG inventory; Provisions within this resource are consistent with the GHG Protocol. There are few provisions on specific emission source categories and methodologies.



Climate Disclosure Standards Board Climate Change Reporting Framework: Advancing and aligning disclosure of climate change-related information in mainstream reports

Purpose: This document is a voluntary framework to be used for the disclosure of climate change related information in, or linked to mainstream financial reports. It contains requirements about how climate change-related disclosures shall be determined, prepared and presented.

Publication Date: October 2012

Available languages: English

Provides references to IPCC 2006 calculation

methodologies: No

URL http://www.cdsb.net/sites/cdsbnet/files/cdsb_climate_change_reporting_framework_edit ion_1.1.pdf

Cost: Free

Includes examples of best practices: No

Method Types Available: Both emission factors and measurement / modeling

Region Type Both

Region Notes: N/A

Geography-specific

No

Emission sectors covered: None Specifically

Notes on emission sectors

- High-level guidance

Level of guidance on LULUCF sources: None

Inventory

framework

topics covered

- Boundaries

- Scopes

What does this guidance offer beyond the IPCC 2006 Guidelines or the Global Protocol for Communities (GPC)

Frame of reference for linking reporting of emissions to financial reports.

Overall recommendation

Jurisdictions may consider this resource for very high-level guidance, does not provide additional detail that IPCC or the GPC would have.



GHG Protocol Scope 2 Guidance

Purpose: This guidance acts as an amendment to the GHG Protocol Corporate Standard, providing updated requirements and best practices on scope 2 accounting and reporting. This guidance also codifies two distinct methods for scope 2 accounting, a location-based method and a market-based method,

Publication Date: 2015

Cost: Free

Available languages: English

Includes examples of best practices: Yes

Provides references to IPCC 2006 calculation methodologies: N/A

Method Types Available: Emissions Factors

URL http://www.ghgprotocol.org/scope_2_guidance

Region Type

Both

Geography-specific

No

Region Notes: Relevant to cities and also regions where scope 2 emissions are a significant consideration.

Emission sectors covered: Energy

Notes on emission sectors

- Covers emissions from purchased or acquired electricity, steam, heat, and cooling

Level of guidance on LULUCF sources: None

Inventory framework topics covered

- Boundaries
- Scope 2 Accounting Approaches
- Double Counting
- Energy attribute certificates and claims

What does this guidance offer beyond the IPCC 2006 Guidelines or the Global Protocol for Communities (GPC)

Provides detailed framework for accounting for electricity and other scope 2 emissions.

Overall recommendation

Jurisdictions may consider this resource for accounting for electricity consumption and other scope 2 emissions. Provides framework for accounting for emissions from contracted electricity purchases (e.g., local renewable energy projects and purchases) as opposed to the average grid mix. The GPC provides a high level framework while this guidance provides significant detail.



GHG Protocol Agriculture Guidance

Purpose: The guidance is a supplement to GHG Protocol's Corporate Standard and covers all agricultural subsectors, including livestock, crop production, and land use change.

Publication Date: May 2014

Cost: Free

Available languages: English

Includes examples of best practices: No

Provides references to IPCC 2006 calculation methodologies: Yes

Method Types Available: Both emission factors and measurement / modeling

URL <http://www.ghgprotocol.org/standards/agriculture-guidance>

Region Type

Both

Geography-specific

No

Region Notes: Guidance is technically for corporations but can be used by subnational jurisdictions

Emission sectors covered: Agriculture, Forestry, and Other Land Use

Notes on emission sectors

- Agricultural emissions sources including Mechanical sources (electricity, machinery, and refrigeration and A/C equipment) and non-mechanical sources (soil drainage and tillage, additions to soils, enteric fermentation, rice cultivation, manure management, land use change, burning of savannahs and crop residues, managed woodland, composting, and oxidation of horticultural growing media).

Level of guidance on LULUCF sources: Guidance on LULUCF sources relevant to the agricultural industry.

Inventory framework topics covered

- Boundaries
- Tracking GHG fluxes over time
- Accounting for carbon stocks
- Scopes

What does this guidance offer beyond the IPCC 2006 Guidelines or the Global Protocol for Communities (GPC)

Provides scopes-based accounting framework for agriculture and provides guidance on boundaries. Also provides comprehensive appendix of tools and protocols to calculate emissions from the agricultural sector. Focuses on sector-wide and organization-wide accounting.

Overall recommendation

Jurisdictions may consider this resource for more detailed methods and tools to account for emissions from the Agriculture sector. Distinction between direct and indirect emissions can be useful for setting boundaries.



IPCC Good Practice Guidance for Land Use, Land-Use Change and Forestry (GPG LULUCF)

Purpose: The GPG-LULUCF provides supplementary methods and good practice guidance for estimating, measuring, monitoring and reporting on carbon stock changes and greenhouse gas emissions from LULUCF activities

Publication Date: 2003

Cost: Free

Available languages: English, Arabic, Chinese, French, Russian, Spanish

Includes examples of best practices: No

Provides references to IPCC 2006 calculation methodologies: Yes

Method Types Available: Both emission factors and measurement / modeling

URL <http://www.ipcc-nggip.iges.or.jp/public/gpplulucf/gpplulucf.html>

Region Type Both

Geography-specific No

Region Notes:

Emission sectors covered: Agriculture, Forestry, and Other Land Use

Notes on emission sectors

- Covers LULUCF activities

Level of guidance on LULUCF sources: Supplementary guidance to IPCC 2006 on LULUCF

Inventory framework topics covered

- Basis for Consistent Representation of Land Areas
- Cross-Cutting Issues

What does this guidance offer beyond the IPCC 2006 Guidelines or the Global Protocol for Communities (GPC)

Consistent with but superseded by the IPCC 2006 guidelines

Overall recommendation

Superseded by IPCC 2006 Guidelines



2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands

Purpose: This report assists countries in compiling complete national inventories of greenhouse gases to include significant land-use and management activities occurring in lands with wet and drained soils, and constructed wetlands for wastewater treatment. The guidance has been structured so that any country, regardless of experience or resources, should be able to produce reliable estimates of emissions and removals of these gases.

Publication Date: 2014

Available languages: English

Provides references to IPCC 2006 calculation

methodologies: Yes

URL

<http://www.ipcc-nggip.iges.or.jp/public/wetlands/>

Cost: Free

Includes examples of best practices: No

Method Types Available: Both emission factors and measurement / modeling

Region Type

Both

Geography-specific

No

Region Notes:

Emission sectors covered: Agriculture, Forestry, and Other Land Use

Notes on emission sectors

- Land Use: Drained inland organic soils; Rewetted organic soils; Coastal wetlands; Inland wetland mineral soils; Constructed wetlands for wastewater treatment;

Level of guidance on LULUCF sources: Specific guidance for land-use categories

Inventory

framework topics covered

- Ensuring time series are consistent

What does this guidance offer beyond the IPCC 2006 Guidelines or the Global Protocol for Communities (GPC)

This supplemental guidance extends the content of the 2006 IPCC Guidelines by filling gaps in the coverage and providing updated information reflecting scientific advances, including updating of emission factors. It covers inland organic soils and wetlands on mineral soils, coastal wetlands including mangrove forests, tidal marshes and seagrass meadows and constructed wetlands for wastewater treatment. This document also allows countries with more information and resources to use more detailed country-specific methodologies and country-specific data while retaining comparability and consistency between countries. The scope of this supplement is broader than the coverage of Wetlands in the 2006 IPCC Guidelines, where managed wetlands are defined as lands where the water table is artificially changed or those created through human activity and that do not fall into Forest Land, Cropland, or Grassland categories.

Overall recommendation

Jurisdictions may consider using this resource for a more detailed wetland assessment. The emissions and removals from wetlands and drained soils addressed in the Wetlands Supplement can occur under any land-use category or other relevant category of the 2006 IPCC Guidelines



National Reporting to the UNFCCC

Purpose: This resource provides submitted national GHG inventories for Annex I parties and information on national GHG inventories for non-Annex I countries.

Publication Date: Varies

Available languages: Varies report by report

Provides references to IPCC 2006 calculation methodologies: Yes

URL http://unfccc.int/national_reports/items/1408.php

Cost: Free

Includes examples of best practices: Yes

Method Types Available: Both emission factors and measurement / modeling

Region Type Both

Geography-specific

Yes

Region Notes: National GHG inventory reports for each country

Emission sectors covered: All

Notes on emission sectors

- Sectors should be consistent with IPCC 2006 Guidelines

Level of guidance on LULUCF sources: Provides application of IPCC methods at the national level

Inventory

framework topics covered

Reports should be consistent with IPCC guidelines

What does this guidance offer beyond the IPCC 2006 Guidelines or the Global Protocol for Communities (GPC)

Provides practical application of methods and data at the national level that are consistent with IPCC guidance

Overall recommendation

ICF recommends jurisdictions use their country's reports for applied IPCC methods and country-specific data. Jurisdictions should aim to be consistent with their country's national GHG inventory. These reports are more useful for direct emissions than indirect emissions.



Local Government Operations Protocol: For the quantification and reporting of greenhouse gas emissions inventories

Purpose: This protocol is designed to provide a standardized set of guidelines to assist local governments in quantifying and reporting GHG emissions associated with their government operations. The Protocol provides the principles, approach, methodology, and procedures needed to develop a local government operations GHG emissions inventory. It is designed to support the complete, transparent, and accurate reporting of a local government's GHG emissions. The Protocol guides participants through emissions calculation methodologies and reporting guidance applicable to all U.S. local governments.

Publication Date: May 2010

Available languages: English

Provides references to IPCC 2006 calculation methodologies: Yes

URL

<https://www.theclimateregistry.org/wp-content/uploads/2014/12/2010-05-06-LGO-1.1.pdf>

Cost: Free

Includes examples of best practices: Yes

Method Types Available: Both emission factors and measurement / modeling

Region Type Both
Region Notes: United States

Geography-specific Yes

Emission sectors covered: Multiple

Notes on emission sectors

- Energy:
 - Facilities: Direct and indirect stationary combustion; Fugitive Emissions from refrigerants and fire suppression equipment
 - Vehicle Fleet: Mobile combustion; Fugitive emissions from motor vehicle air conditioning
 - Power Generation Facilities: Stationary combustion; Scope 2 Emissions from transmission and distribution losses; Fugitive emissions
- Waste:
 - Solid Waste Facilities: Estimation; Composting
 - Wastewater Treatment Facilities: Emissions unique to wastewater treatment

Level of guidance on LULUCF sources: None

Inventory

framework topics covered

- Organizational boundaries
- Operational boundaries (scope 1, scope 2, scope 3)
- Reporting

What does this guidance offer beyond the IPCC 2006 Guidelines or the Global Protocol for Communities (GPC)

Provides detailed guidance for jurisdictions also aiming to inventory emissions from local government operations

Overall recommendation

U.S. jurisdictions may consider using this resource to inventory government operations. Other jurisdictions may consider this protocol for a framework for inventorying local government operations, but should make sure to use local data and emission factors.



The Climate Registry General Reporting Protocol for the Voluntary Reporting Program

Purpose: This document provides guidance on determining the specific emissions sources that must be reported and how emissions data should be categorized and consolidated. It also provides the methodologies approved by the Climate Registry for quantifying emissions from various emissions sources and describes the process for reporting emissions to the Climate Registry once they have been quantified.

Publication Date: January 2016

Available languages: English

Provides references to IPCC 2006 calculation methodologies: Yes

URL

<https://www.theclimateregistry.org/wp-content/uploads/2014/11/General-Reporting-Protocol-Version-2.1.pdf>

Cost: Free

Includes examples of best practices: Yes

Method Types Available: Both emission factors and measurement / modeling

Region Type

Both

Geography-specific

Yes

Region Notes: North America

Emission sectors covered: Multiple

Notes on emission sectors

- Energy: Stationary combustion; Mobile combustion; Indirect emissions from electricity use; Indirect emissions from a CHP facility, imported steam, district heating, and cooling\
- Industrial Processes and Product Use: Direct fugitive emissions from the use of refrigeration and air conditioning equipment
- Waste: Municipal Solid Waste

Level of guidance on LULUCF sources: None

Inventory framework topics covered

- Boundaries (either complete or transitional reporting boundary)
- Geographic boundary
- Organizational boundary
- Reporting options

What does this guidance offer beyond the IPCC 2006 Guidelines or the Global Protocol for Communities (GPC)

The General Reporting Protocol provides a good source of region-specific data and emission factors.

Overall recommendation

The General Reporting Protocol is aligned with international standards and best practices. North American jurisdictions may consider using this resource which provides a good source of region-specific data and emission factors.



U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions

Purpose: This document is designed to inspire and guide U.S. local governments to account for and report on greenhouse gas (GHG) emissions associated with the communities they represent. It establishes reporting requirements for all community GHG emissions inventories, provides detailed accounting guidance for quantifying GHG emissions associated with a range of emission sources and community activities, and provides a number of optional reporting frameworks to help local governments customize their community GHG emissions inventory reports based on their local goals and capacities.

Publication Date: July 2013	Cost: Free
Available languages: English	Includes examples of best practices: Yes
Provides references to IPCC 2006 calculation methodologies: No	Method Types Available: Both emission factors and measurement / modeling
URL	http://icleiusa.org/publications/us-community-protocol/

Region Type	Both	Geography-specific	Yes
Region Notes: United States			

Emission sectors covered: Multiple
Notes on emission sectors

- Energy: Built Environment; Transportation
- Waste: Solid Waste; Wastewater
- Other: Agricultural Livestock Emission; Use of Materials and Services; Consumption-Based

Level of guidance on LULUCF sources: None

Inventory framework topics covered	<ul style="list-style-type: none"> • Boundaries: sources vs. activities • Reporting recommendations • Government Consumption • Fuel Consumption-based inventory • Life Cycle Emissions of Community Businesses
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What does this guidance offer beyond the IPCC 2006 Guidelines or the Global Protocol for Communities (GPC)

The U.S. Community Protocol provides an emphasis on emission sources and activities that U.S. local governments have the authority to influence. Provides U.S. - specific data sources and methods.

Overall recommendation

U.S. jurisdictions may consider using this resource, which provides detailed guidance and tools for conducting a GHG inventory. Provides detailed sectoral guidance. Does not use "scopes" framework, but distinguishes between direct "sources" of emissions and "activities" in the jurisdiction which cause emissions. Jurisdictions must take care to properly distinguish "activities" between those causing direct vs indirect "out of geographical boundary" emissions.



British Columbia Community Energy & Emissions Inventory

Purpose: The Community Energy and Emissions Inventory collects data from GHG source sectors from utilities, public agencies and other trusted partners, in order to calculate the size of each sector's carbon footprint in each local government jurisdiction across British Columbia.

Publication Date: February 2014

Available languages: English

Provides references to IPCC 2006 calculation

methodologies: Yes

URL

<http://www2.gov.bc.ca/gov/content/environment/climate-change/reports-data/community-energy-emissions-inventory>

Cost: Free

Includes examples of best practices: No

Method Types Available: Both emission factors and measurement / modeling

Region Type

Both

Geography-specific

Yes

Region Notes: Canada: British Columbia

Emission sectors covered: All

Notes on emission sectors

- On-Road Transportation
- Residential Commercial and Industrial Buildings
- Municipal Solid Waste
- Land-Use Change – Deforestation
- Agriculture - Enteric Fermentation

Level of guidance on LULUCF sources: Deforestation guidance

Inventory

framework topics covered

- Boundaries

What does this guidance offer beyond the IPCC 2006 Guidelines or the Global Protocol for Communities (GPC)

Provides British Columbia specific buildings, energy, transportation, waste and GHG emissions figures

Overall recommendation

Jurisdictions in British Columbia may consider using this resource for regional data.



Association of Environmental Professionals California Community-Wide Greenhouse Gas Baseline Inventory Protocol White Paper

Purpose: The purpose of this white paper is to provide recommendations to jurisdictions (cities and counties) on what could be included within a communitywide GHG emissions baseline inventory and methodology for determining the geographic/jurisdictional boundary. This White Paper is not intended to present every acceptable methodology, but rather to lay out a reasonable approach for considering GHG emissions sectors to include in a communitywide baseline emissions inventory.

Publication Date: June 2011	Cost: Free
Available languages: English	Includes examples of best practices: No
Provides references to IPCC 2006 calculation methodologies: Yes	Method Types Available: Both emission factors and measurement / modeling
URL	http://califaep.org/images/climate-change/Community-wide_GHG_Protocol.pdf

Region Type	Both	Geography-specific	Yes
Region Notes:	United States: California		

Emission sectors covered: Multiple

Notes on emission sectors

- Energy: Mobile sources; Stationary and area sources; Purchased electricity
- Waste: Water and wastewater; Municipal solid waste related emissions
- Agriculture, Forestry, and Other Land Use: Agriculture; Carbon sequestration in natural lands

Level of guidance on LULUCF sources: Guidance on carbon sequestration in natural lands and on agriculture

Inventory framework topics covered

- Boundaries

What does this guidance offer beyond the IPCC 2006 Guidelines or the Global Protocol for Communities (GPC)

This resource provides methods for estimating solid waste that IPCC 2006 and the GPC do not have.

Overall recommendation

Jurisdictions in California may use this resource for California-specific methods and data sources. All jurisdictions may consider this resource for additional methods for estimating emissions from solid waste (e.g. future methane/generation, waste in place (WIP)/site-based, lifecycle) and methods for estimating carbon stock/sequestration.



New York State Climate Smart Communities: Greenhouse Gas Inventory Guide for Local Government Operations

Purpose: This guide is intended to help quickly provide an understanding of the process of developing a local government operations GHG inventory, and will provide tips and helpful resources designed to save time and resources in the inventory process.

Publication Date: 2014

Cost: Free

Available languages: English

Includes examples of best practices: Yes

Provides references to IPCC 2006 calculation methodologies: Yes

Method Types Available: N/A

URL http://www.midhudsoncsc.org/documents/CSC%20Govt%20Ops%20Inventory%20Guidance_MAR%202014_FINAL.pdf

Region Type Both

Geography-specific

Yes

Region Notes: United States: New York State

Emission sectors covered: Multiple

Notes on emission sectors

- Energy: Stationary and mobile combustion; Purchased electricity; Fugitive emissions
- Waste: Process emissions

Level of guidance on LULUCF sources: None

Inventory

framework topics covered

- Boundaries: organizational and operational
- Reporting

What does this guidance offer beyond the IPCC 2006 Guidelines or the Global Protocol for Communities (GPC)

This guidance provides resources and technical assistance to communities to advance their climate protection efforts and achieve the program's goals of reducing greenhouse gas emissions, adapting to a changing climate, and saving taxpayers money. The guide is specific to New York State and provides many links to tools for assistance in the greenhouse gas inventory process.

Overall recommendation

Jurisdictions may consider this resource for an overview on GHG management principles. Jurisdictions in New York may consider using this resource for tools and data sources.



2016/17 B.C. Best Practices Methodology for Quantifying Greenhouse Gas Emissions: Including Guidance for Public Sector Organizations, Local Governments and Community Emissions

Purpose: This document sets out the current best practices for quantifying and reporting greenhouse gas emissions from B.C.'s provincial public sector organizations, local governments and communities. This document provides a consistent approach for measuring emissions that will allow any organization that is required to or wishes to voluntarily measure their greenhouse gas emissions a way to do so that is consistent with up to date best practices, and provides comparable emissions reporting province-wide.

Publication Date: May 2016

Available languages: English

Provides references to IPCC 2006 calculation methodologies: Yes

Cost: Free

Includes examples of best practices: Yes

Method Types Available: Emission factors

URL http://www2.gov.bc.ca/assets/gov/environment/climate-change/policy-legislation-and-responses/carbon-neutral-government/measure-page/2016-2017_bc_best_practices_methodology_for_quantifying_ghg_emissions.pdf

Region Type Both

Geography-specific Yes

Region Notes: Canada: British Columbia

Emission sectors covered: Multiple

Notes on emission sectors

- Energy: Stationary sources; Mobile Sources
- Industrial Processes and Product Use: Supplies (paper)

Level of guidance on LULUCF sources: Limited - includes agricultural emission factors

Inventory framework topics covered

What does this guidance offer beyond the IPCC 2006 Guidelines or the Global Protocol for Communities (GPC)

This document represents a robust and continually improving catalogue of emission factors and emissions calculation methodologies that have drawn heavily on established protocols and authoritative sources.

Overall recommendation

Jurisdictions may consider reviewing this document for internationally applicable emission factors if none are available through IPCC.



The Victorian Local Government Guide to Reducing Carbon Emissions

Purpose: The Guide provides Victorian local governments with a consistent approach to reporting and calculating their corporate greenhouse gas emissions. Further it provides a simple basis to make informed decisions regarding greenhouse gas (GHG) emission mitigation options, obligations and reporting requirements. Today this is a template by which local governments' calculate their carbon footprint and identify approaches to mitigation and offsetting.

Publication Date: 2010

Cost: Free

Available languages: English

Includes examples of best practices: No

Provides references to IPCC 2006 calculation methodologies: No

Method Types Available: N/A

URL http://www.arup.com/projects/local_gov_reducing_carbon_emissions

Region Type Both

Geography-specific Yes

Region Notes: Australia: Victoria

Emission sectors covered: All

Notes on emission sectors: N/A

Level of guidance on LULUCF sources: None

Inventory framework topics covered

- Boundaries
- Scopes
- Carbon management Principles

What does this guidance offer beyond the IPCC 2006 Guidelines or the Global Protocol for Communities (GPC)

Carbon management principles and region-specific data

Overall recommendation

This resource provides limited specific guidance on creating a greenhouse gas inventory. Jurisdictions may consider this as a good resource on carbon management principles and relevant links for further information for jurisdictions in Victoria, Australia.



Association of Environmental Professionals Climate Change Committee's "The California Supplement to the United States Community-Wide Greenhouse Gas (GHG) Emissions Protocol"

Purpose: With the issuance of the Community Protocol, the AEP Climate Change Committee and the OPR recognized that California jurisdictions would benefit from a California Supplement to the Community Protocol that focuses on how to best apply the Community Protocol when preparing GHG inventories designed to meet CEQA requirements including recommendations about scoping, tools, and methodology.

Publication Date: December 2013

Cost: Free

Available languages: English

Includes examples of best practices: No

Provides references to IPCC 2006 calculation methodologies: Yes

Method Types Available: Both emission factors and measurement / modeling

URL <https://www.califaep.org/climate-change/196-the-california-supplement-2013>

Region Type Both

Geography-specific Yes

Region Notes: United States: California

Emission sectors covered: Multiple

Notes on emission sectors

- Energy: Electric Power; Residential and Commercial Energy; Residential and Stationary Combustion Equipment (Residential/Commercial and Industrial); Transportation Energy
- Waste: Water and Wastewater; Recycling and Waste

Level of guidance on LULUCF sources: None

Inventory framework topics covered

- Boundaries
- Aggregating

What does this guidance offer beyond the IPCC 2006 Guidelines or the Global Protocol for Communities (GPC)

Provides methodologies that go beyond other community-wide protocols.

Overall recommendation

Jurisdictions may consider this resource for sequestration methods. These methods may be applicable to subnational jurisdictions outside of California.



Covenant of Mayors: How to develop a Sustainable Energy Action Plan

Purpose: The purpose of the guidebook is to help the European Covenant of Mayors signatories to reach the commitments they have taken by signing the Covenant, and in particular to prepare within the year:

- a Baseline Emission Inventory (BEI);
- a Sustainable Energy Action Plan (SEAP).

This document is intended to help beginner towns/cities/regions to initiate the process and guide them through it. It should also provide experienced local authorities with answers to specific questions they are faced with in the context of the Covenant of Mayors, and if possible, with some fresh and new ideas on how to proceed.

Publication Date: 2010

Cost: Free

Available languages: English, Dutch, Spanish, French, Italian

Includes examples of best practices: Yes

Provides references to IPCC 2006 calculation methodologies: Yes

Method Types Available: Emission factors

URL http://www.eumayors.eu/IMG/pdf/seap_guidelines_en.pdf

Region Type Both

Geography-specific

Yes

Region Notes: European Union

Emission sectors covered: Energy

Notes on emission sectors

- Not designed with non-energy sectors in mind. Refers users to ICLEI and IPCC for sectors outside Energy.

Level of guidance on LULUCF sources: None

Inventory framework topics covered

- Boundaries
- Scopes (only requires scope 1 and 2 emissions, (option for LCA emission factors which include embedded scope 3 emissions)
- GHGs (CO2 emissions only)
- GWPs

What does this guidance offer beyond the IPCC 2006 Guidelines or the Global Protocol for Communities (GPC)

Limited scope compared to GPC and IPCC, provides additional, European-related data sources

Overall recommendation

Jurisdictions should not look to this resource as a comprehensive framework, however jurisdictions may consider this resource for European-specific data sources for energy-related emissions. This resource was published in 2010 so users should check for data updates from any sources provided.



GHG Protocol: Agricultural Protocol for Ethiopia and supplementary guidelines for Soil, Aboveground Biomass, and Livestock

Purpose: The GHG Protocol Agricultural Guidance is intended to help fulfill the need for robust MRV systems and support the Climate Resilient Green Economy initiative. It does so by outlining recommendations for compiling and reporting GHG inventories of agricultural sources at the level of individual farming entities.

Publication Date: February 2016

Cost: Free

Available languages: English

Includes examples of best practices: No

Provides references to IPCC 2006 calculation methodologies: Yes

Method Types Available: Both emission factors and measurement / modeling

URL

<http://www.ghgprotocol.org/standards/agriculture-guidance>

Region Type

Both

Geography-specific

Yes

Region Notes: Applicable for local and regional governments in Ethiopia

Emission sectors covered: Agriculture, Forestry, and Other Land Use

Notes on emission sectors

- Agricultural emissions sources including Mechanical sources (electricity, machinery, and refrigeration and A/C equipment) and non-mechanical sources (soil drainage and tillage, additions to soils, enteric fermentation, rice cultivation, manure management, land use change, burning of savannahs and crop residues, managed woodland, composting, and oxidation of horticultural growing media).

Level of guidance on LULUCF sources: Guidance on LULUCF sources relevant to the agricultural industry.

Inventory

framework topics covered

- Boundaries
- Tracking emissions over time

What does this guidance offer beyond the IPCC 2006 Guidelines or the Global Protocol for Communities (GPC)

Provides Ethiopia-specific agricultural guidance and data.

Overall recommendation

This guidance was developed since the GHG Protocol Global Agricultural Guidance was not fully suited to Ethiopia's Agricultural sector with a preponderance of smallholder farms and should be considered by Ethiopian jurisdictions. While the guidance does not explicitly mention its suitability for jurisdictions in other countries, jurisdictions with many small farms with diverse products may consider this guidance for a more basic approach to accounting for GHG emissions from the agricultural sector.



GHG Protocol's Agricultural Guidance for Brazil

Purpose: Corporate GHG accounting guidance for agricultural companies in Brazil. This guidance helps companies understand whether and how individual GHG emissions sources should be included in GHG inventories.

Publication Date: May 2014

Cost: Free

Available languages: Portuguese

Includes examples of best practices: No

Provides references to IPCC 2006 calculation methodologies: Yes

Method Types Available: Both emission factors and measurement / modeling

URL

http://www.ghgprotocol.org/Agriculture-Guidance/Brazil-Agriculture-Guidance_Project-Overview

Region Type Both

Geography-specific

Yes

Region Notes: Applicable for local and regional governments in Brazil

Emission sectors covered: Agriculture, Forestry, and Other Land Use

Notes on emission sectors

Level of guidance on LULUCF sources: Guidance on LULUCF sources relevant to the agricultural industry.

Inventory

framework topics covered

- Scopes

What does this guidance offer beyond the IPCC 2006 Guidelines or the Global Protocol for Communities (GPC)

Provides Brazil specific agricultural guidance, data, and accompanying calculation tool. Focuses on large-scale agriculture and land use.

Overall recommendation

Subnational governments in Brazil should consider using this resource. This resource is intended for "Governmental and non-governmental initiatives seeking to develop tools or metrics for assessing the GHG emissions from agriculture." An accompanying Excel tool is included with the guidance.



U.S. Department of Agriculture: Quantifying Greenhouse Gas Fluxes in Agriculture and Forestry: Methods for Entity-Scale Inventory

Purpose: The objective for this report is to create a standard set of GHG estimation methods for use by USDA, landowners, and other stakeholders to assist them in evaluating the GHG impacts of their management decisions. The methods presented in the report address GHG emissions and carbon sequestration for the entire entity or operation and also provide the opportunity to assess individual practices or management decisions.

Publication Date: 2014

Cost: Free

Available languages: English

Includes examples of best practices: No

Provides references to IPCC 2006 calculation methodologies: Yes

Method Types Available: Both emission factors and measurement / modeling

URL http://www.usda.gov/oce/climate_change/estimation.htm

Region Type Both

Geography-specific

Yes

Region Notes: United States

Emission sectors covered: Agriculture, Forestry, and Other Land Use

Notes on emission sectors

- Agriculture, Forestry, and Other Land Use: Cropland and grazing land systems; Managed wetland systems; Animal production systems; Managed forest systems; Land-use change

Level of guidance on LULUCF sources: Guidance is specifically for Agriculture and Forestry

Inventory

framework topics covered

- Scopes
- Boundaries

What does this guidance offer beyond the IPCC 2006 Guidelines or the Global Protocol for Communities (GPC)

Detailed applications of methods for the agriculture and forestry sector

Overall recommendation

Provides applications of methods on urban forests that may be considered for more urban jurisdictions. Methods may be tailored to non-U.S. jurisdictions with regional data.



Appendix C. List of Tools and Templates Available for Subnational Governments

While the scope of this research did not cover tools, there are many tools out there that can help jurisdictions compile their GHG emission inventories. These tools include calculators, models, and templates that can be used for a particular emissions source, or tools that can be used to compile an entire GHG emission inventory. These tools are listed below in Table 4.

Table 4. Tools for subnational governments to consider to assist in compiling a GHG inventory

Developer	Name	URL
ICLEI	ICLEI ClearPath	http://icleiusa.org/clearpath/
IPCC	IPCC Emission Factor Database	http://www.ipcc-nggip.iges.or.jp/EFDB/main.php
U.S. EPA	U.S. EPA State Inventory and Projection Tool	https://www.epa.gov/statelocalclimate/state-inventory-and-projection-tool
U.S. EPA	U.S. EPA Local Greenhouse Gas Inventory Tool	https://www.epa.gov/statelocalclimate/local-greenhouse-gas-inventory-tool
National Renewable Energy Laboratory (NREL)	Agriculture and Land Use National GHG Inventory and Mitigation Analysis Software Tool (ALU)	www.nrel.colostate.edu/projects/ALUsoftware/
National Institute of Environmental Studies (NIES)	Asia-Pacific Integrated Model (AIM)	www-iam.nies.go.jp/aim/index.html
United Nations University, Institute of Advanced Studies (UNI-IAS)	Co-benefits Evaluation Tool for the Urban Transport	tools.ias.unu.edu/node/1
United Nations University, Institute of Advanced Studies (UNI-IAS)	Co-benefits Evaluation Tool for Urban Waste Management	tools.ias.unu.edu/node/1
EcoTransIT® World Initiative (EWI)	EcoTransIT World	www.ecotransit.org/index.en.html
Enerdata	EnerFuture	www.enerdata.net/enerdatauk/knowledge/subscriptions/forecast/enerfuture.php
U.S. EPA	Environmental Benefits Mapping and Analysis Program - Community Edition (BenMAP-CE)	https://www.epa.gov/benmap
The World Bank	Environmental Impact and Sustainability Applied General Equilibrium Model (ENVISAGE)	go.worldbank.org/8DTXIDMRM0
Food and Agriculture Organization of the United Nations	Ex Ante Appraisal Carbon-Balance Tool (EX-ACT)	www.fao.org/tc/tcs/exact/en/
Institute for Global Environmental Strategies (IGES)	GHG Calculator For Solid Waste	pub.iges.or.jp/modules/envirolib/view.php?docid=4273
PBL Netherlands Environmental Assessment Agency	Integrated Model to Assess the Global Environment (IMAGE)	themasites.pbl.nl/tridion/en/themasites/image/

Developer	Name	URL
National Renewable Energy Laboratory (NREL)	Job and Economic Development Impact (JEDI) Model	www.nrel.gov/analysis/jedi/
Partnership for Economic Policy (PEP)	Modelling and Policy Impact Analysis (MPIA) Program Models	www.pep-net.org/pep-standard-cge-models
CPB Netherlands Bureau for Economic Policy Analysis (CPB)	WorldScan	www.cpb.nl/en/publication/worldscan-model-international-economic-policy-analysis
U.S. EPA	Institutional Arrangements for National Inventory Systems (IA)	https://www3.epa.gov/climatechange/EPAactivities/internationalpartnerships/capacity-building.html#National
World Resources Institute	Climate Analysis Indicators Tool—CAIT 2.0	http://cait.wri.org/
Food and Agriculture Organization of the United Nations	Global Livestock Environmental Assessment Model	http://www.fao.org/gleam/en/
LEDS Global Partnership	Climate Change, Agriculture and Food Security (CCAFS) Mitigation Option Tool	http://ledsgp.org/resource/climate-change-agriculture-food-security-mitigation-option-tool/?loclang=en_gb
Cool Farm Alliance, Sustainable Food Lab	Cool Farm Tool	https://www.coolfarmtool.org/
Agriculture and Agri-Food Canada	Holos	http://www.agr.gc.ca/eng/science-and-innovation/results-of-agricultural-research/holos/?id=1349181297838
Intergovernmental Panel on Climate Change	IPCC Inventory Software	http://www.ipcc-nggip.iges.or.jp/software/
USAID	AFOLU Carbon Calculator	http://afolucarbon.org/
World Agroforestry Centre	REDD Abacus SP	http://www.worldagroforestry.org/output/tools/redd-abacus-sp-more
Greenhouse Gas Protocol	Sector Specific Tools for Direct Emissions	http://www.ghgprotocol.org/calculation-tools/sector-toolsets
Greenhouse Gas Protocol	Cross Sector Tool: Allocation of Emissions from a Combined Heat and Power Plant	http://www.ghgprotocol.org/calculation-tools/all-tools
Greenhouse Gas Protocol	Cross Sector Tool: GHG emissions from purchased electricity	http://www.ghgprotocol.org/calculation-tools/all-tools
Greenhouse Gas Protocol	Cross Sector Tool: GHG emissions from stationary combustion	http://www.ghgprotocol.org/calculation-tools/all-tools
Greenhouse Gas Protocol	Cross Sector Tool: GHG emissions from transport or mobile sources	http://www.ghgprotocol.org/calculation-tools/all-tools
Greenhouse Gas Protocol	Cross Sector Tool: Measurement and Estimation Uncertainty of GHG emissions	http://www.ghgprotocol.org/calculation-tools/all-tools
Greenhouse Gas Protocol	Cross Sector Tool: Uncertainty Calculation Tool	http://www.ghgprotocol.org/calculation-tools/all-tools
U.S. EPA	Confidentiality Agreement and Amendment Template	https://www3.epa.gov/climatechange/Downloads/EPAactivities/Confidentiality%20Agreement%20Template.docx

Developer	Name	URL
U.S. EPA	Memorandum of Understanding Template	https://www3.epa.gov/climatechange/Downloads/EPAactivities/Memorandum%20of%20Understanding%20Template.docx
U.S. EPA	Contact Form and Supplemental Information	https://www3.epa.gov/climatechange/Downloads/EPAactivities/Contact%20Form%20Supplemental%20Information.docx
U.S. EPA	Inception Memorandum Template	https://www3.epa.gov/climatechange/Downloads/EPAactivities/Inception%20Memo.docx
U.S. EPA	Sample Statement of Work	https://www3.epa.gov/climatechange/Downloads/EPAactivities/Sample%20Statement%20of%20Work%20(SOW).docx