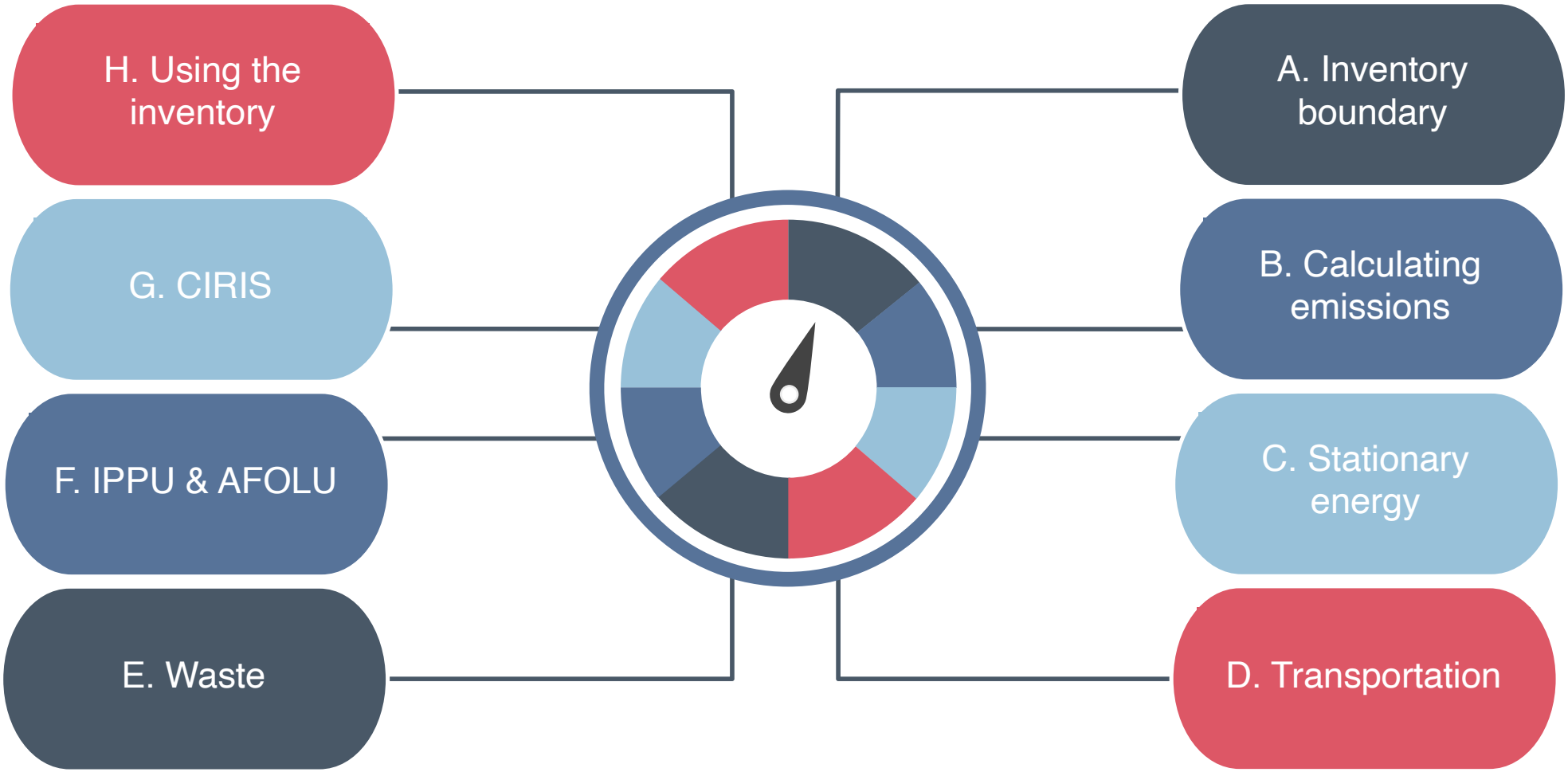
Green Technology Application for the
Development of Low Carbon Cities (GTALCC)

City-wide GHG accounting

08 March 2021

Aims of the training

- Build understanding of how a GHG inventory can support climate action planning
- Develop a comprehensive understanding of emission sources in your city
- Introduce requirements of the Global Protocol for Community-scale Greenhouse Gas Emission Inventories (GPC) and the Common Reporting Framework (CRF)
- Explore data requirements and learn how to manage data gaps and apply good data management practices
- Learn how to use of the GPC reporting tool (CIRIS) and waste calculators
- Develop a draft GHG inventory
- Develop inventory development action plan to meet the requirements of the GPC/CRF


H. Using the inventory
G. CIRIS
F. IPPU & AFOLU
E. Waste
A. Inventory boundary
B. Calculating emissions
C. Stationary energy
D. Transportation

You will need

Key data about your city: population, GDP and km^2

A map of your city

A calculator (on laptop / phone or other)

Access to Mentimeter (on laptop / phone): www.menti.com

Basic Excel skills

Third Biennial Update Report:
https://unfccc.int/sites/default/files/resource/MALAYSIA_BUR3-UNFCCC_Submission.pdf

National Energy Balance 2017:
https://meih.st.gov.my/documents/10620/f85ba3ae-fd44-4ea4-a69d-400c5f96b3ea

Materials

Presentations

Quizzes (Menti)

Exercises (workbook)

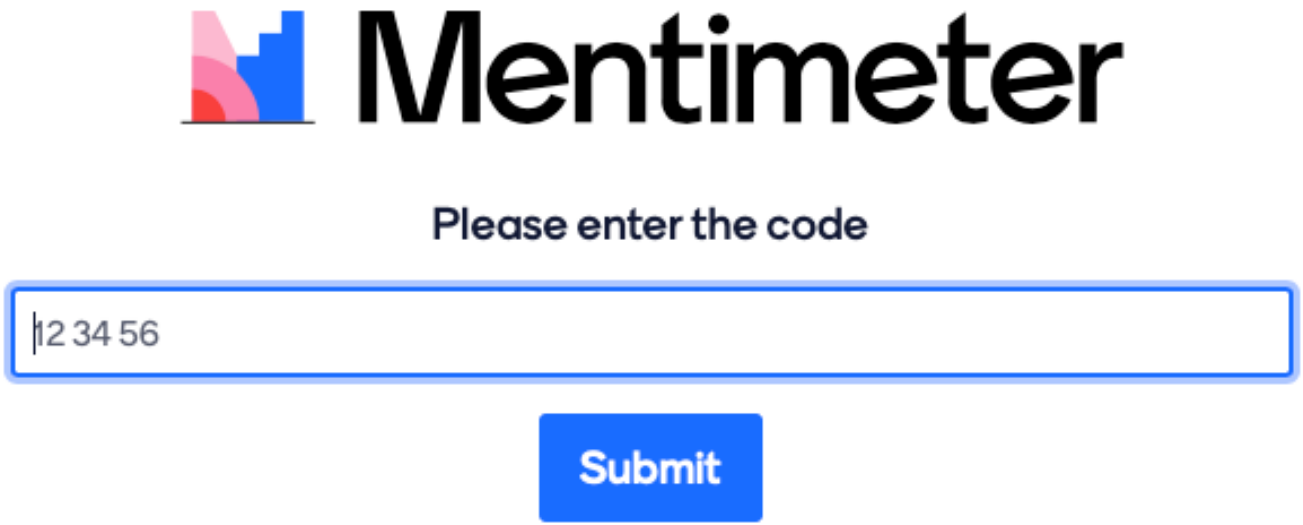
CIRIS

Exercise: Acronyms

Acronym	What it stands for
GPC	
CIRIS	
GHG	
GWP	
AFOLU	
EF	
QA/QC	
BAU	

Menti

Go to www.menti.com
Enter code: 86 79 28 91



MODULE A

Inventory boundary

Module A: Inventory boundary

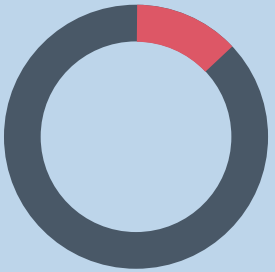
Why compile a GHG emissions inventory? 01	Why measure GHG emissions at city level? 02	Introduction to the GPC 03	Accounting and reporting principles 04
Setting the inventory boundary 05	Categorising GHG emissions 06	Reporting requirements 07	Common Reporting Framework 08

Module A

Inventory boundary

01

Why compile a GHG emissions inventory?



What is an inventory?

GPC GHG Summary Tables BASIC

NAME OF CITY:	London, United Kingdom	**POPULATION:**	8.416.500
BOUNDARY:	Administrative boundary of a local government	**LAND AREA (km2):**	1.595
INVENTORY YEAR:	2013	**GDP (US$ bn):**	481,06

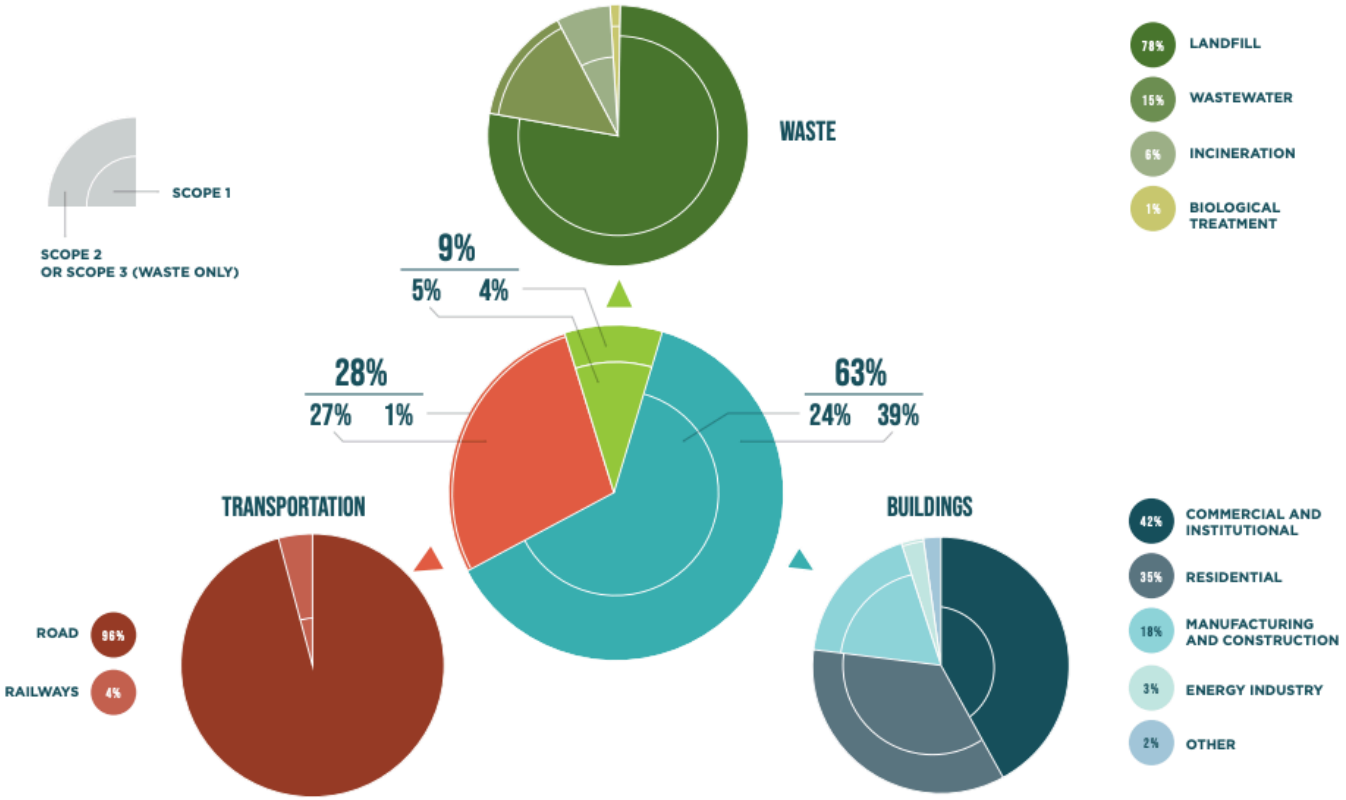
GHG Emissions Source (By Sector)		Total GHGs (metric tonnes CO2e)					
		Scope 1	Scope 2	Scope 3	BASIC	BASIC+	BASIC+ S3
STATIONARY ENERGY	Energy use (all emissions except I.4.4)	13.637.779	16.967.254	1.450.756	30.605.033	32.055.789	32.055.789
	Energy generation supplied to the grid (I.4.4)	2.558.704					
TRANSPORTATION	(all II emissions)	6.224.956	1.064.893	1.034.075	7.289.849	8.323.924	8.323.924
WASTE	Waste generated in the city (III.X.1 and III.X.2)	397.017		1.455.375	1.852.392	1.852.392	1.852.392
	Waste generated outside city (III.X.3)						
IPPU	(all IV emissions)						
AFOLU	(all V emissions)						
OTHER SCOPE 3	(all VI emissions)			NE			
TOTAL		22.818.456	18.032.147	3.940.206	39.747.274	42.232.105	42.232.105

GPC ref No.	GHG Emissions Source (By Sector and Sub-sector)	Total GHGs (metric tonnes CO_2e)			
		Scope 1	Scope 2	Scope 3	Total
I	STATIONARY ENERGY				
I.1	Residential buildings	8.332.651	5.836.566	499.046	14.668.263
I.2	Commercial and institutional buildings and facilities	5.293.341	11.130.687	951.710	17.375.739
I.3	Manufacturing industries and construction	IE	IE	IE	
I.4.1/2/3	Energy industries	IE	IE	NE	
I.4.4	Energy generation supplied to the grid	2.558.704			
I.5	Agriculture, forestry and fishing activities	IE	IE	IE	
I.6	Non-specified sources	NO	NO	NO	
I.7	Fugitive emissions from mining, processing, storage, and transportation of coal	NO			
I.8	Fugitive emissions from oil and natural gas systems	11.788			11.788
SUB-TOTAL	(city induced framework only)	13.637.779	16.967.254	1.450.756	32.055.789

II	TRANSPORTATION				
II.1	On-road transportation	6.034.654	IE	IE	6.034.654
II.2	Railways	133.890	1.064.893	91.052	1.289.835
II.3	Waterborne navigation	20.258	IE	NE	20.258
II.4	Aviation	IE	NO	943.023	943.023
II.5	Off-road transportation	36.153	IE	NO	36.153
SUB-TOTAL	(city induced framework only)	6.224.956	1.064.893	1.034.075	8.323.924
III	WASTE				
III.1.1/2	Solid waste generated in the city	290.891		1.219.506	1.510.397
III.2.1/2	Biological waste generated in the city	24		56	80
III.3.1/2	Incinerated and burned waste generated in the city	100.586		234.700	335.285
III.4.1/2	Wastewater generated in the city	5.517		1.113	6.630
III.1.3	Solid waste generated outside the city	NO			
III.2.3	Biological waste generated outside the city	NO			
III.3.3	Incinerated and burned waste generated outside city	NO			
III.4.3	Wastewater generated outside the city	NO			
SUB-TOTAL	(city induced framework only)	397.017		1.455.375	1.852.392
IV	INDUSTRIAL PROCESSES and PRODUCT USES				
IV.1	Emissions from industrial processes occurring in the city boundary	NE			
IV.2	Emissions from product use occurring within the city boundary	NE			
SUB-TOTAL	(city induced framework only)				
V	AGRICULTURE, FORESTRY and OTHER LAND USE				
V.1	Emissions from livestock	NE			
V.2	Emissions from land	NE			
V.3	Emissions from aggregate sources and non-CO2 emission sources on land	NE			
SUB-TOTAL	(city induced framework only)				
VI	OTHER SCOPE 3				
VI.1	Other Scope 3			NE	
TOTAL	(city induced framework only)	20.259.752	18.032.147	3.940.206	42.232.105

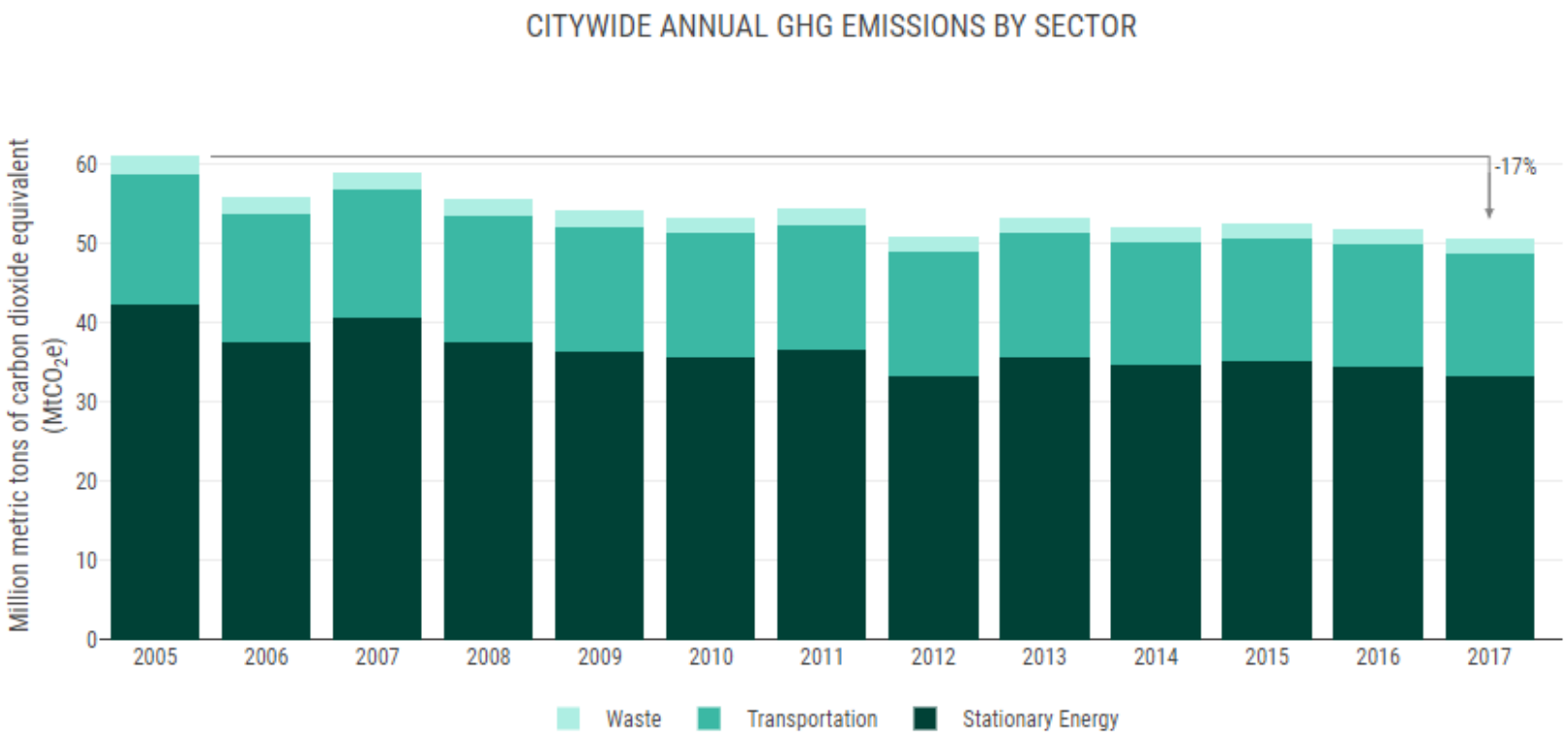
Source: C40

What is an inventory?



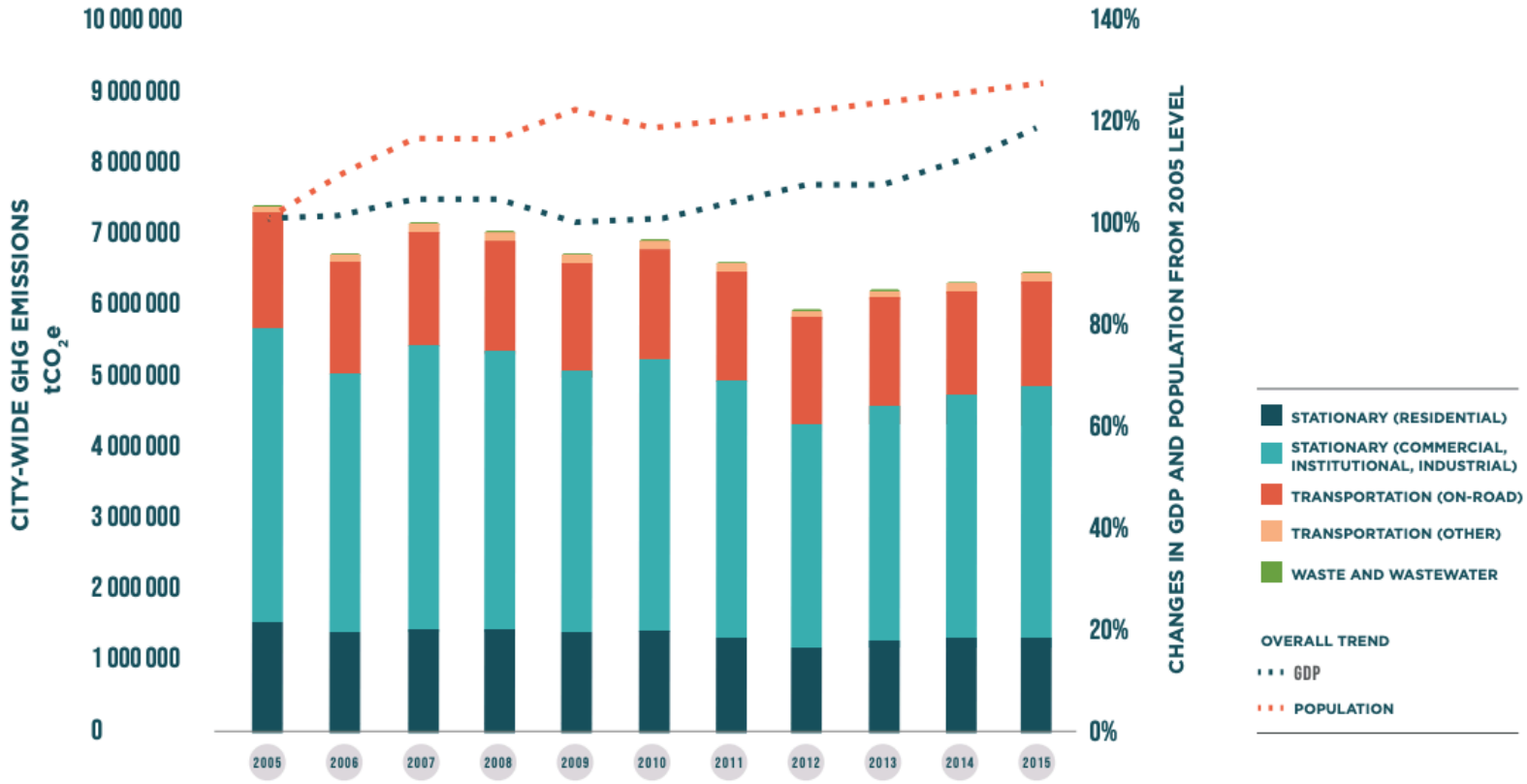
Source: C40

What is an inventory?



Source: C40

What is an inventory?

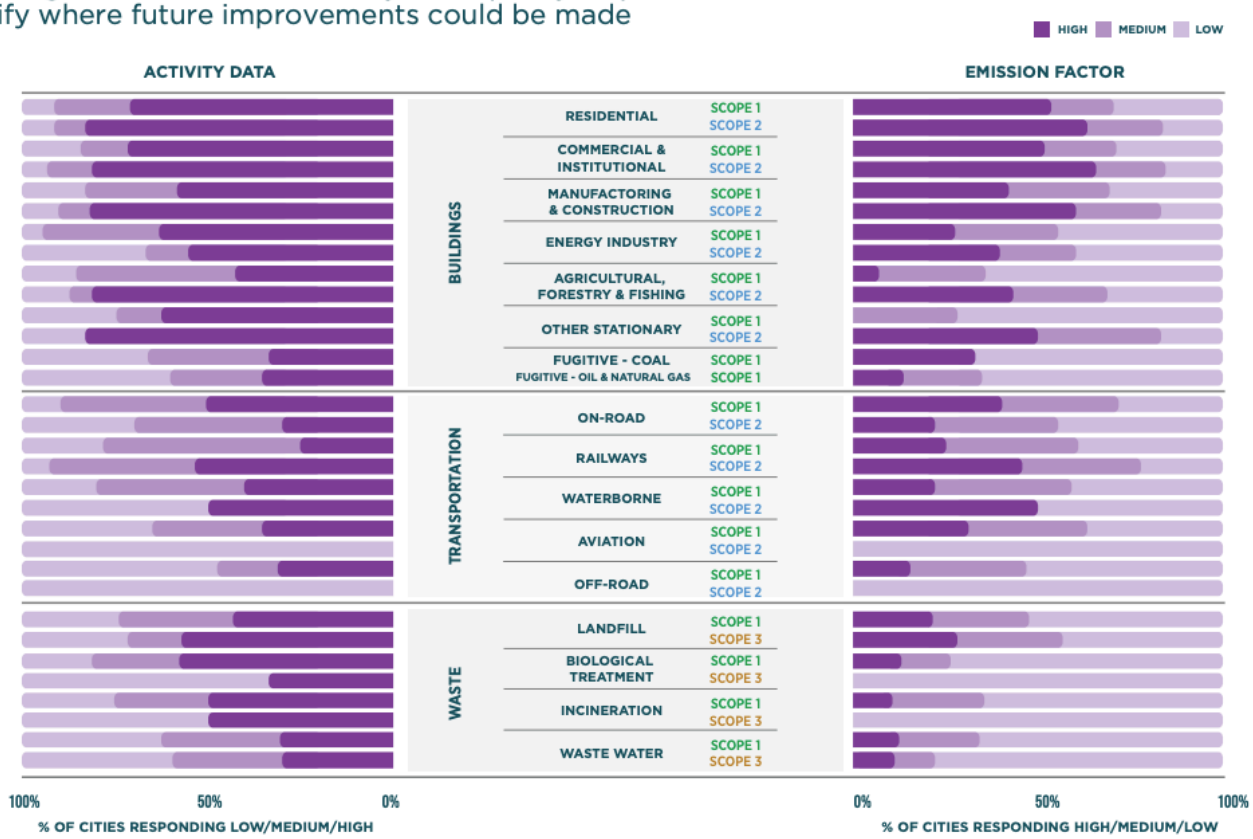


Source: C40

No inventory is perfect

- All cities have gaps in their data and have to make assumptions or use scaling factors to estimate emissions
- This is good practice provided the assumptions are disclosed
- Improving data quality is an on-going and iterative process

Assessing GHG emission inventory data quality helps identify where future improvements could be made



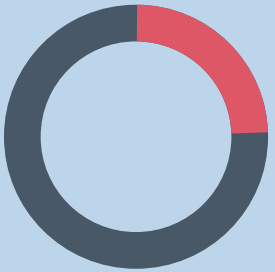
Source: C40

Activity: Why compile an inventory?

City A	City B	City C
Will host large international climate conference next year	No GHG inventory and no emission reduction target	Most recent GHG inventory for 2015, not GPC compliant
Has not updated GHG inventory since 2008	Mayor has committed to the Global Covenant of Mayors	Inventory showed much higher per capita emissions than neighbouring cities
Target to reduce emissions by 80% in 2050 from 2000 levels	Very vulnerable to climate change	Big tourist destination all year round
Does not have a climate action plan	Suffers from air pollution	Important industrial area

Module A

Inventory boundary



02

Why measure GHG emissions at city level?

Why measure emissions at city level?

Planning for climate action begins with developing a GHG inventory:

- Understand the emissions contribution from different sectors
- Establish an emissions baseline and forecast future emissions
- Setting GHG reduction targets
- **Evidence base to support development, implementation and tracking of policies and actions**
- Compare, learn from and share best practices with other cities
- Greater confidence for decision makers and investors
- Reputation enhancement and to attract investment
- Improved communication with residents and businesses
- To achieve compliance with various initiatives and organisations

Why measure emissions at city level?

Monitor progress

Develop an inventory

Implement actions

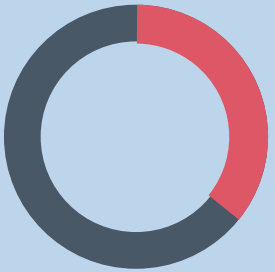
Establish GHG baseline and forecast

Adopt climate action plan

Set GHG reduction target

Module A

Inventory boundary



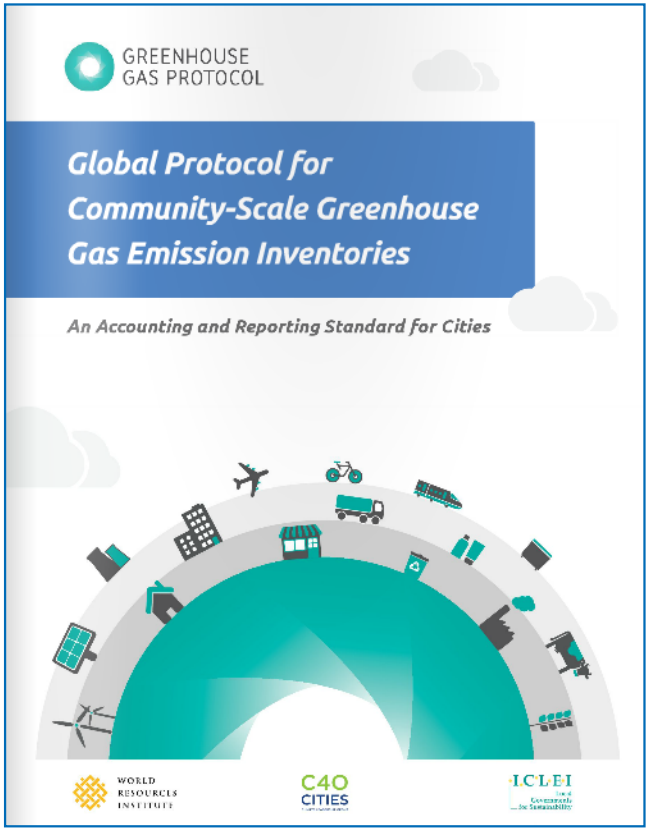
03

Introduction to the GPC

What is the GPC?

The Global Protocol for Community-scale greenhouse gas emission inventories (GPC) is an **accounting and reporting standard** for cities

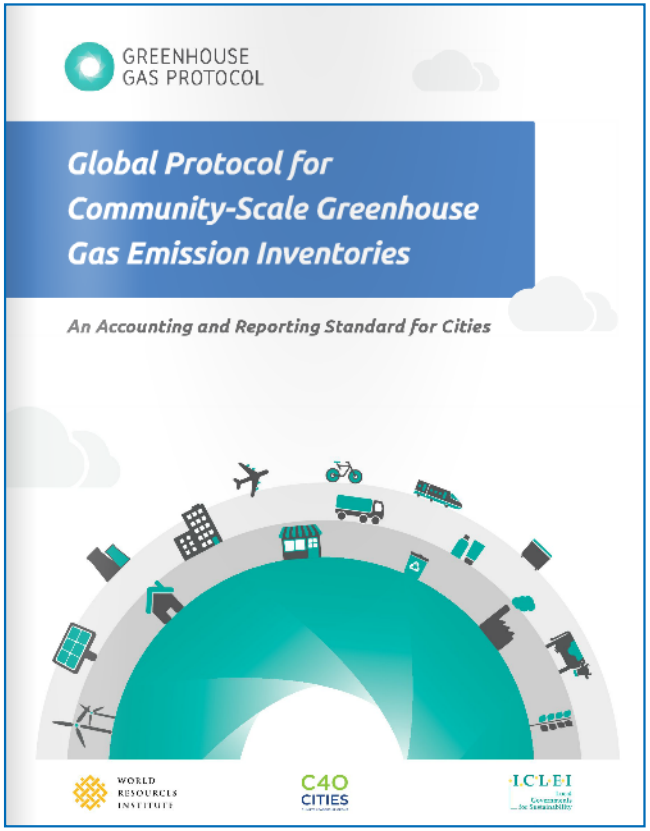
Offers cities a robust, transparent, consistent and globally-accepted framework to identify, calculate and report on city-wide GHG emissions



What is the GPC?

✓ **Requirements**

✗ **Methodology**



What is the GPC?

Shall	Should	May
Indicates what is required in order for a GHG inventory to be in compliance with the GPC	Indicates a recommendation, but not a requirement	Indicates an option that is permissible or allowable

Before

Different types of measurements

Account for only a portion of emissions

Unable to relate to national climate action

After

One measurement

Consistently account for all emissions

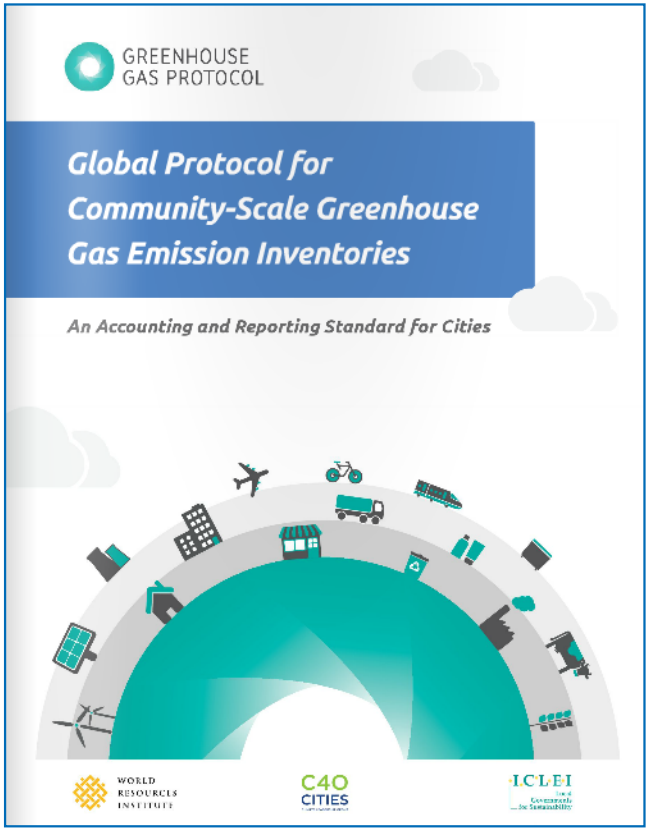
Can measure city's contribution to national climate efforts

What is the GPC?

Part I: Introduction and reporting requirements

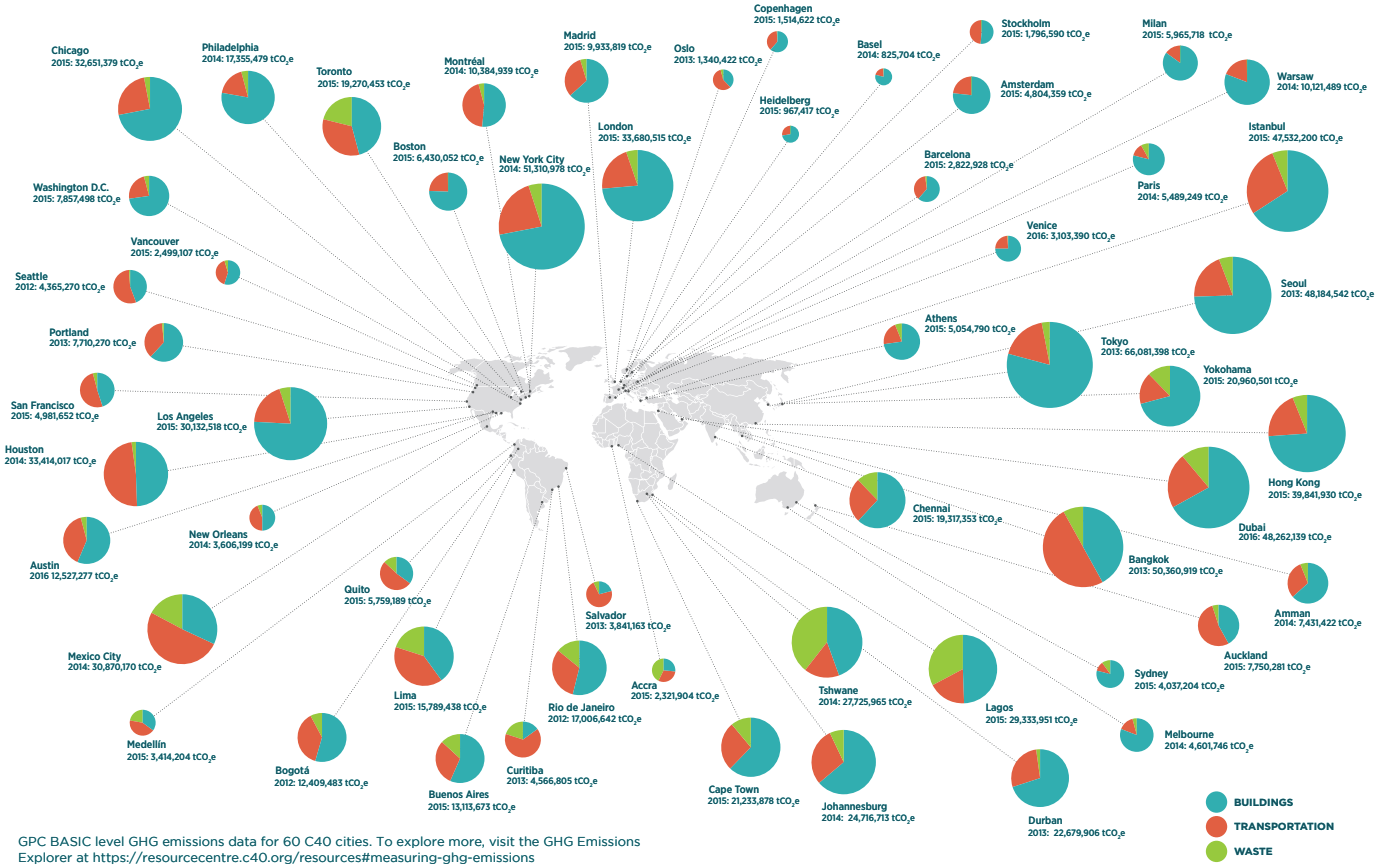
Part II: Calculation guidance by emission source

Part III: Guidance on tracking changes and setting goals



What is the GPC?

A global standard for city-wide GHG emission inventories enables comparison, benchmarking and aggregation



GPC BASIC level GHG emissions data for 60 C40 cities. To explore more, visit the GHG Emissions Explorer at https://resourcecentre.c40.org/resources#measuring-ghg-emissions

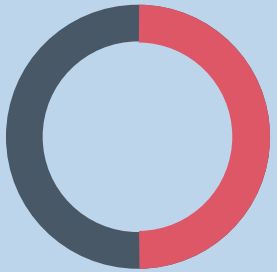
Source: C40

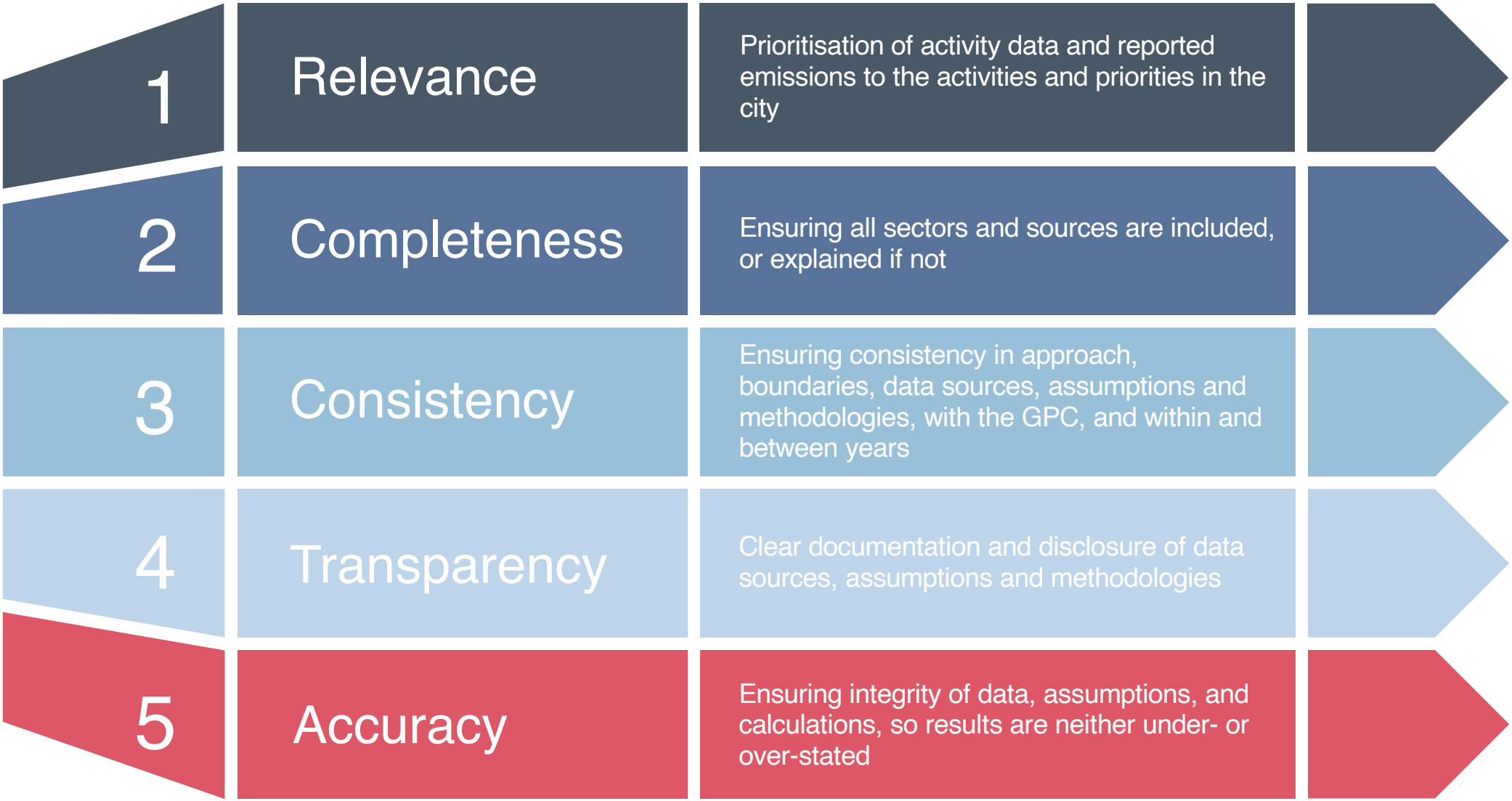
Module A

Inventory boundary

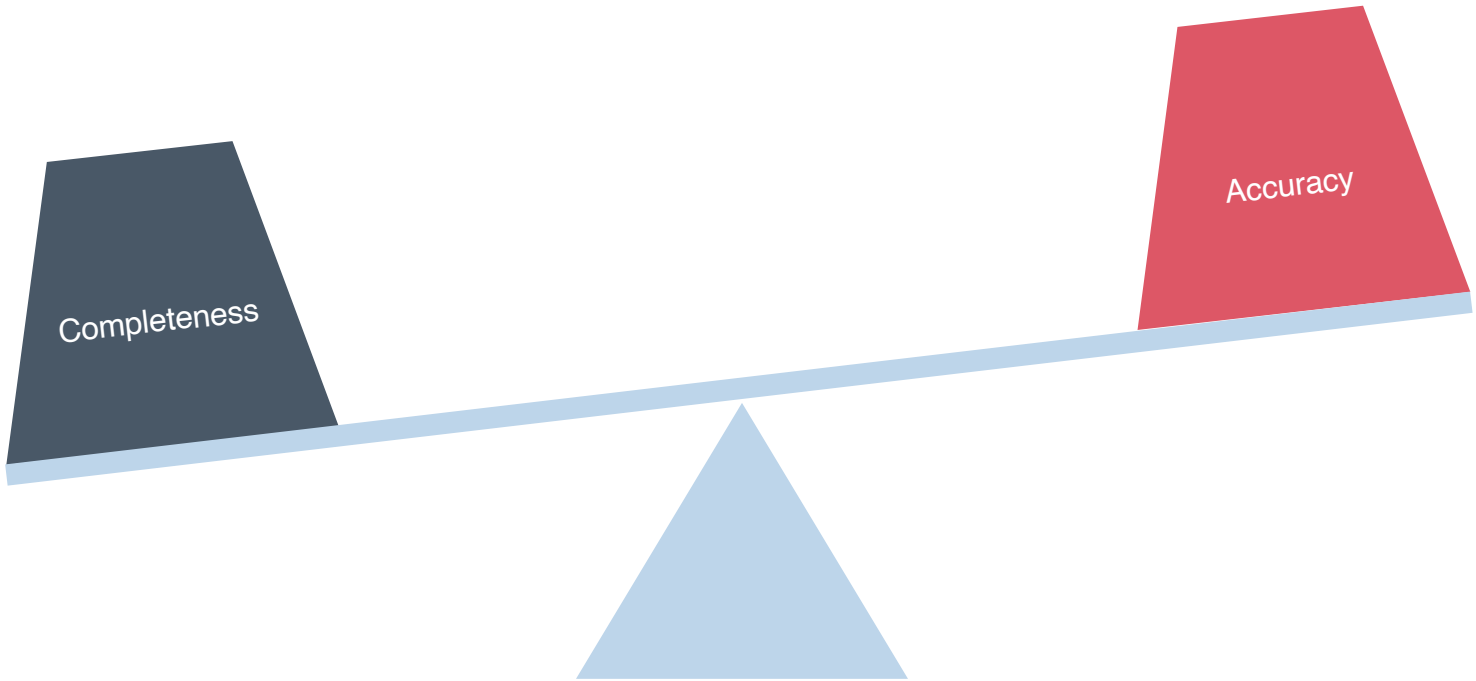
04

Accounting and reporting principles




1
Relevance
Prioritisation of activity data and reported emissions to the activities and priorities in the city
2
Completeness
Ensuring all sectors and sources are included, or explained if not
3
Consistency
Ensuring consistency in approach, boundaries, data sources, assumptions and methodologies, with the GPC, and within and between years
4
Transparency
Clear documentation and disclosure of data sources, assumptions and methodologies
5
Accuracy
Ensuring integrity of data, assumptions, and calculations, so results are neither under- or over-stated

Balancing trade-offs between principles

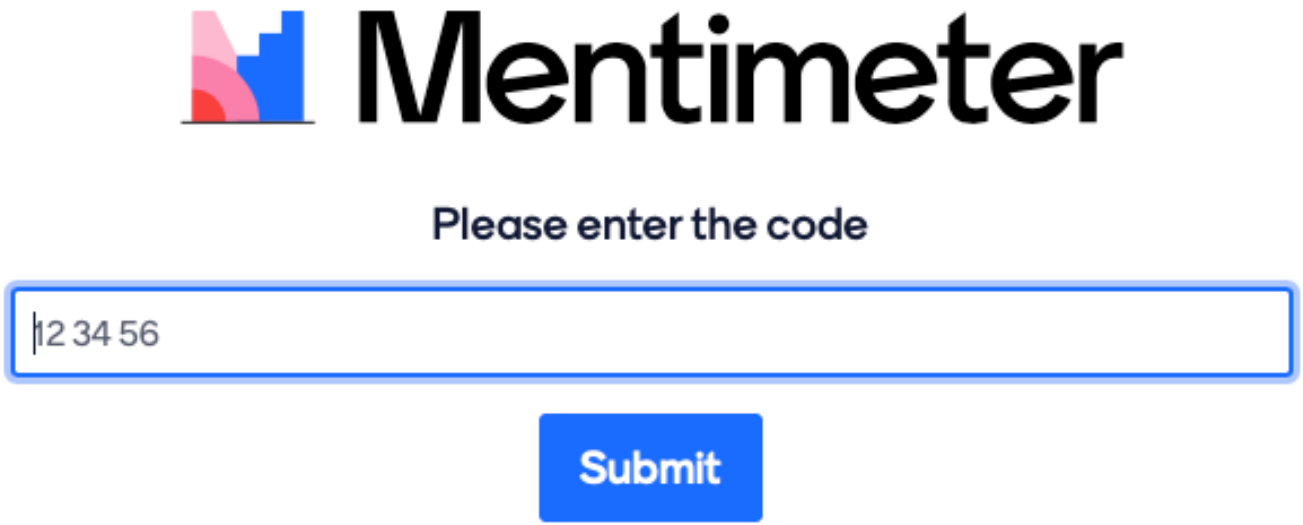


Activity: Accounting principles

Accounting principles	Potential conflict
Accuracy and completeness	
Transparency and completeness	
Consistency and accuracy	
Relevance and completeness	

Menti

Go to www.menti.com
Enter code: 86 79 28 91

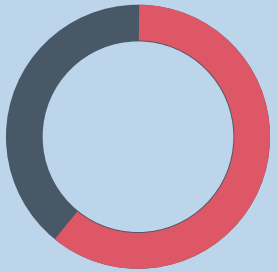


Module A

Inventory boundary

05

Setting the inventory boundary

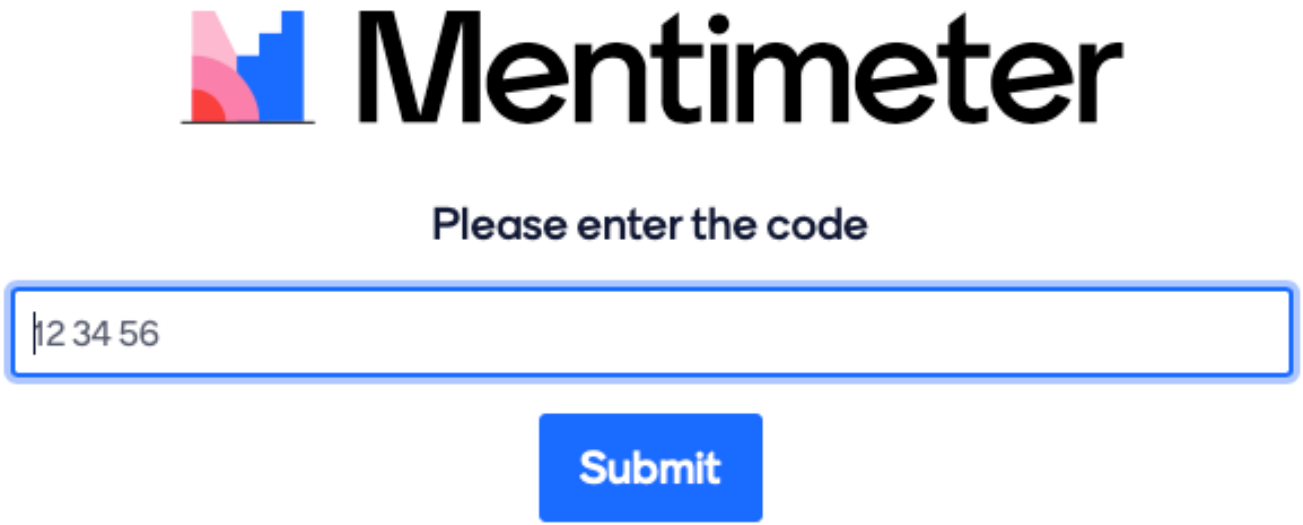


Exercise: Malaysia national inventory

Activity	A	B	C	D
Total emissions excluding removals (in tonnes CO2e)	335 million	251 million	153 billion	439 million
% GHG emissions from Waste sector	25%	40%	15%	8%
Population of Malaysia (in millions)	31.6	40.6	52.5	73.4
Rate of urbanization	80%	46%	75%	63%
Total electricity consumption (in GWh)	211,000	117,000	53,000	363,000
Number of vehicles registered (in millions)	16	27	43	21
% GHG emissions from Road transportation	51%	5%	15%	17%
% GHG emissions from Rice cultivation	2%	5%	<1%	8%

Menti

Go to www.menti.com
Enter code: 86 79 28 91



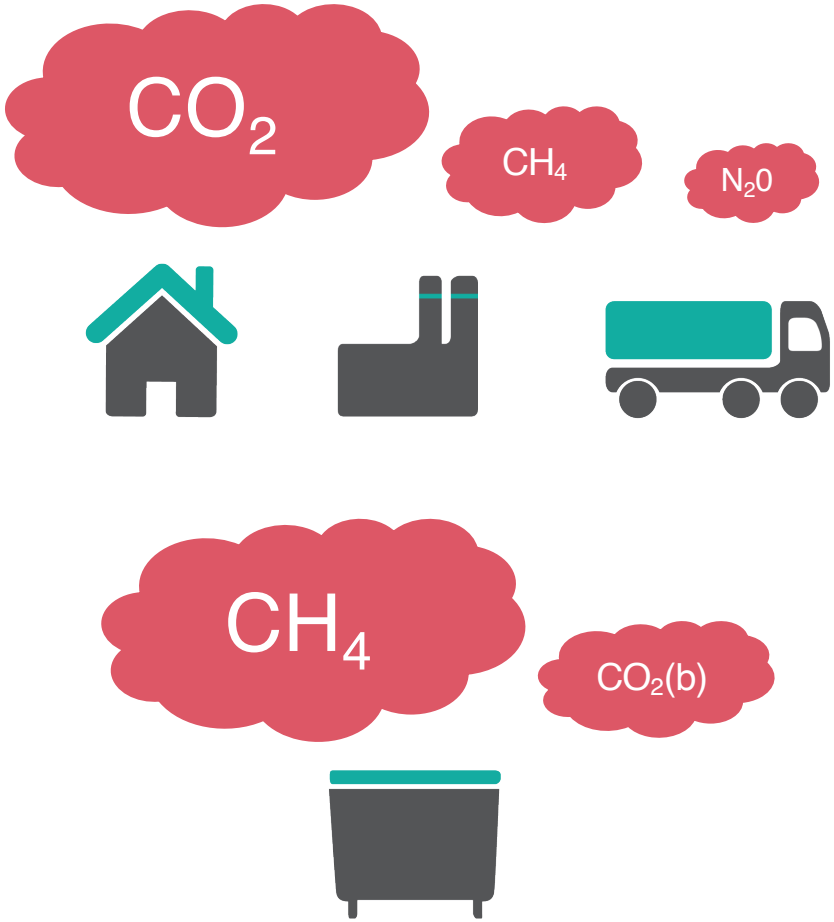
Inventory boundary

Geographic area	Any geographic boundary	
Time span	Continuous period of 12 months	
Greenhouse gases	**Mandatory**: • Carbon dioxide (CO_2) • Methane (CH_4) • Nitrous oxide (N_2O)	**Optional**: • Hydrofluorocarbons (HFC) • Perfluorocarbons (PFC) • Sulfur hexafluoride (SF_6) • Nitrogen trifluoride (NF_3)
Emission sources	**Mandatory**: • Stationary energy • Transportation • Waste	**Optional**: • Industrial processes and product use • Agriculture, forestry, and other land use

Greeenhouse gases

Combustion of fossil fuels in homes, vehicles and power stations release large amounts of CO_2 and smaller amounts of CH_4 and N_2O

The decomposition of organic material in solid waste landfills produces large quantities of CH_4 with some biogenic CO_2



Stationary energy

- Stationary energy sources are one of the largest contributors to a city's GHG emissions
- These emissions come from the combustion of fuel in residential, commercial and institutional buildings and facilities and manufacturing industries and construction, as well as power plants to generate grid-supplied energy
- This sector also includes fugitive emissions, which typically occur during extraction, transformation, and transportation of primary fossil fuels

Stationary energy

- Residential buildings *(I.1)*
- Commercial & Institutional buildings and facilities *(I.2)*
- Manufacturing industries and construction *(I.3)*
- Energy industries *(I.4)*
- Agriculture, forestry and fishing activities *(I.5)*
- Fugitive emissions *(I.7, I.8)*

Transportation

- Transportation covers all journeys by road, rail, water and air, including inter-city and international travel
- GHG emissions are produced directly by the combustion of fuel or indirectly by the use of grid-supplied electricity
- Collecting accurate data for transportation activities, calculating emissions and allocating these emissions to cities can be a particularly challenging process
- To accommodate variations in data availability, existing transportation models, and inventory purposes, the GPC offers additional flexibility in calculating emissions from transportation

Transportation

- On-road
- Railways
- Aviation
- Water-borne
- Off-road

Waste

- Waste disposal and treatment produces GHG emissions through aerobic or anaerobic decomposition, or incineration
- GHG emissions from solid waste shall be calculated by disposal route, namely landfill, biological treatment and incineration and open burning
- If methane is recovered from solid waste or wastewater treatment facilities as an energy source, it shall be reported under Stationary Energy
- Similarly, emissions from incineration with energy recovery are reported under Stationary Energy.

Waste

- Solid waste disposal (landfill)
- Biological treatment
- Incineration and open-burning
- Wastewater

Industrial processes and product use

- GHG emissions are produced from a wide variety of non energy related industrial activities
- The main emission sources are releases from industrial processes that chemically or physically transform materials (e.g., the blast furnace in the iron and steel industry, and ammonia and other chemical products manufactured from fossil fuels and used as chemical feedstock). During these processes many different GHGs can be produced.
- In addition, certain products used by industry and end-consumers, such as refrigerants, foams or aerosol cans, also contain GHGs which can be released during use and disposal

Industrial processes and product use

Industrial processes

Product use

Agriculture, forestry, and other land use

- Emissions from the Agriculture, Forestry and Other Land Use (AFOLU) sector are produced through a variety of pathways, including livestock (enteric fermentation and manure management), land use and land use change (e.g., forested land being cleared for cropland or settlements), and aggregate sources and non-CO2 emission sources on land (e.g., fertilizer application and rice cultivation)
- Given the highly variable nature of land-use and agricultural activity across geographies, GHG emissions from AFOLU are amongst the most complex categories for GHG accounting

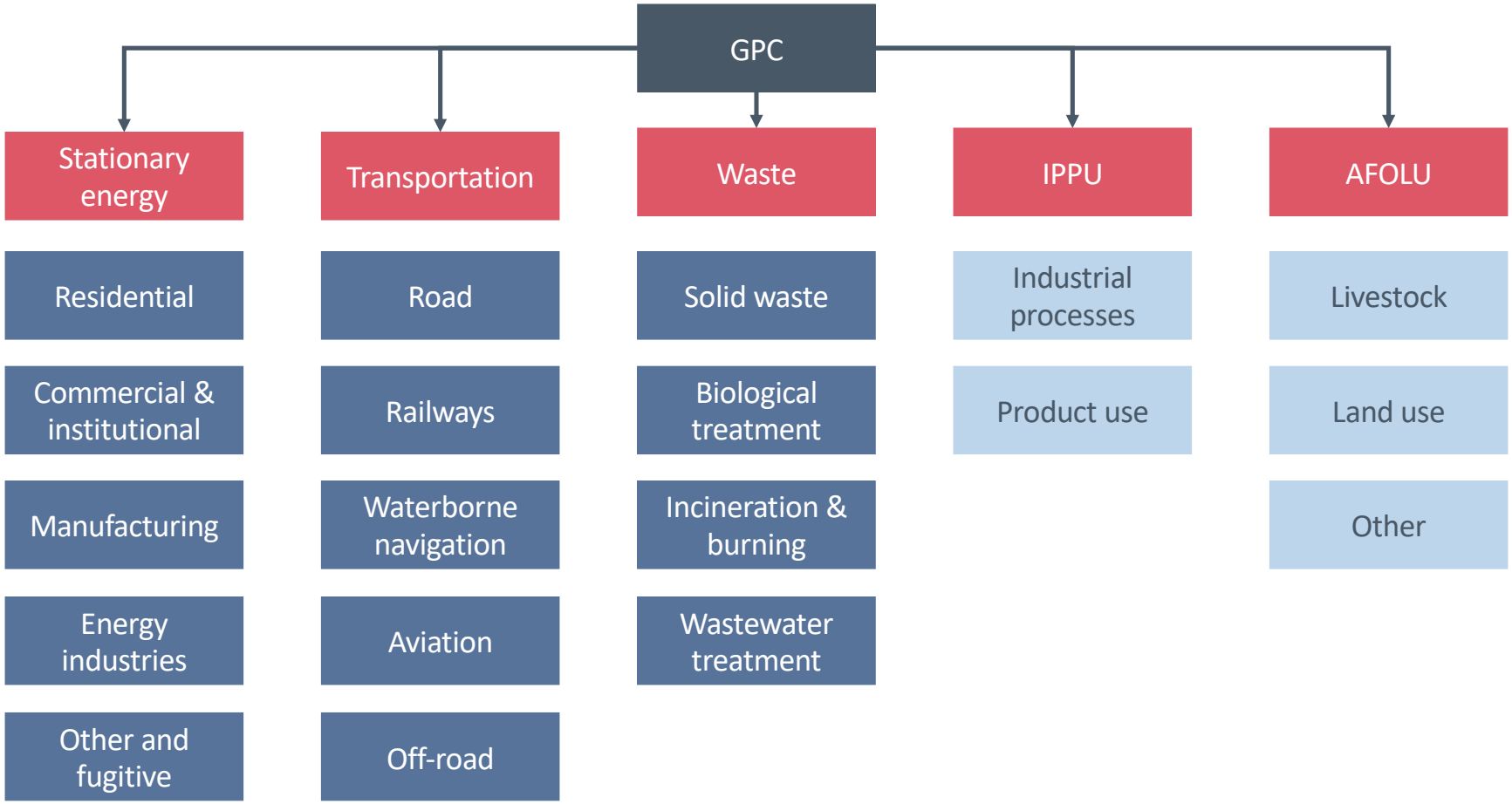
Agriculture, forestry, and other land use

Livestock

Land

Aggregate sources

All sectors

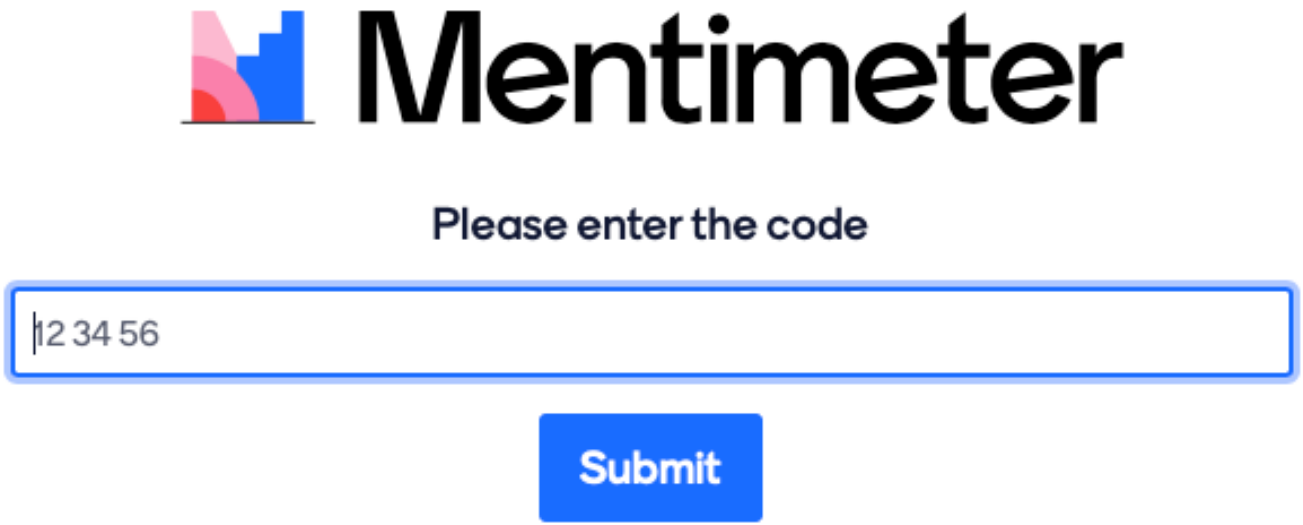

GPC
Stationary energy
Residential
Commercial & institutional
Manufacturing
Energy industries
Other and fugitive
Transportation
Road
Railways
Waterborne navigation
Aviation
Off-road
Waste
Solid waste
Biological treatment
Incineration & burning
Wastewater treatment
IPPU
Industrial processes
Product use
AFOLU
Livestock
Land use
Other

Exercise: Sectors

Emission source	Sector
Diesel used by buses	
Electricity used for street lighting	
Electricity consumption in shopping centers	
Methane gas release from landfill	
Methane gas release from gas distribution network	
Kerosene used by helicopter ambulances	
Composting of organic waste	
Gas used for home cooking	

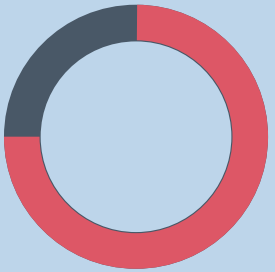
Menti

Go to www.menti.com
Enter code: 86 79 28 91



Module A

Inventory boundary



06

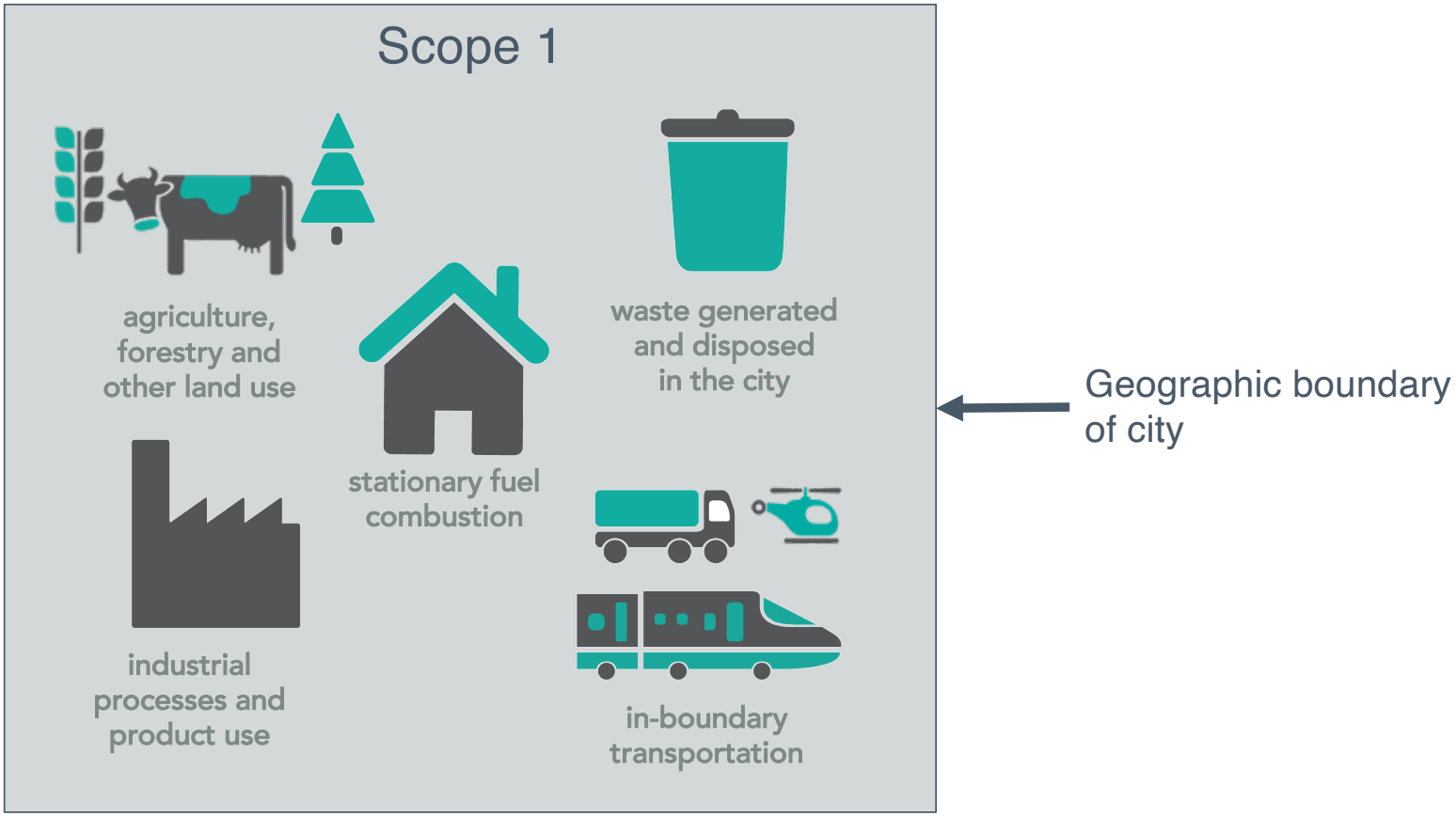
Categorising GHG emissions

Categorising GHG emissions

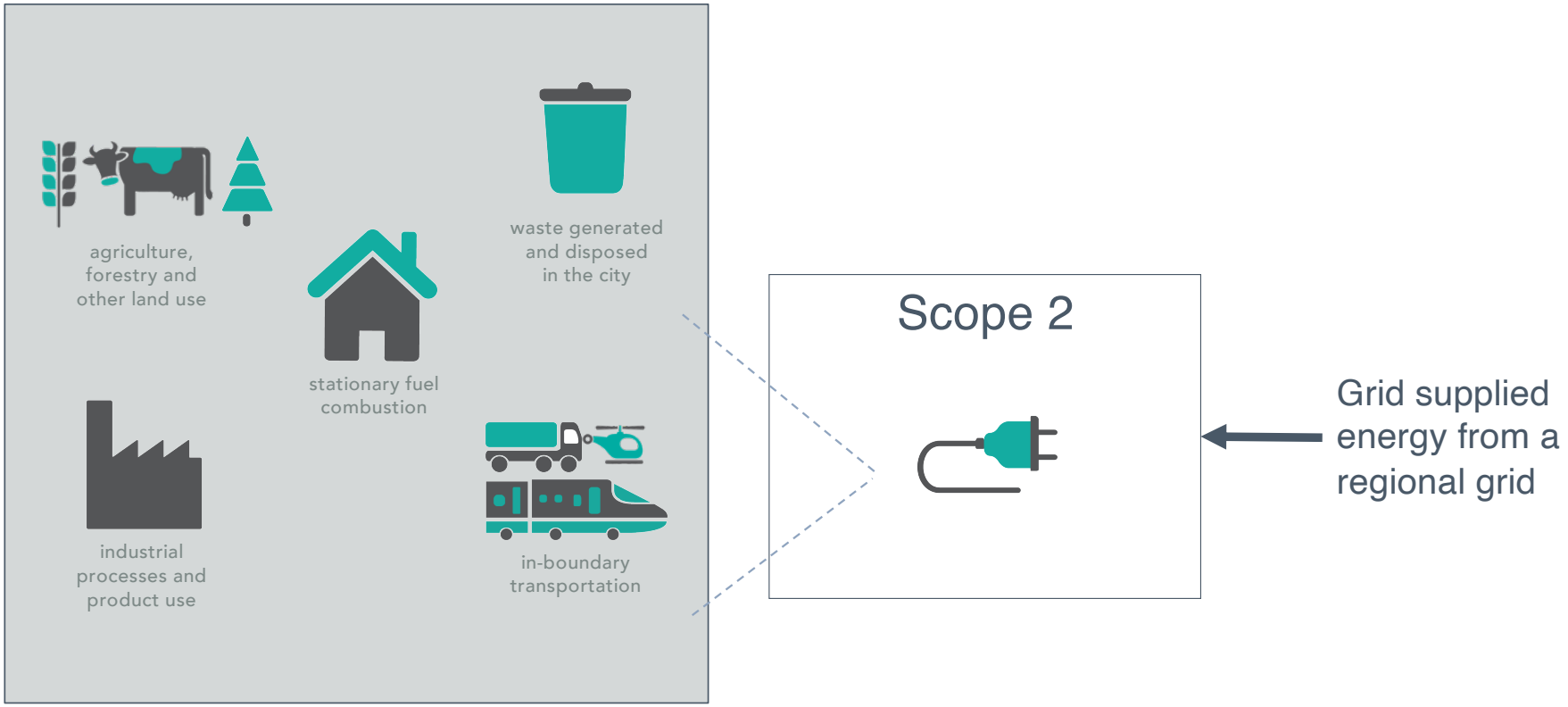
Activities taking place within a city can generate GHG emissions that occur *inside* the city boundary as well as *outside* the city boundary. To distinguish between these, and to avoid double counting, the GPC categorises all emissions into scopes.

Scope	Definition	CRF equivalent
Scope 1	All GHG emissions from sources located within the city boundary	Direct
Scope 2	All GHG emissions from the use of grid-supplied energy (electricity, heating or cooling) within the city boundary	Indirect
Scope 3	All other GHG emissions that occur outside the city boundary as a result of activity within the city boundary	Other indirect

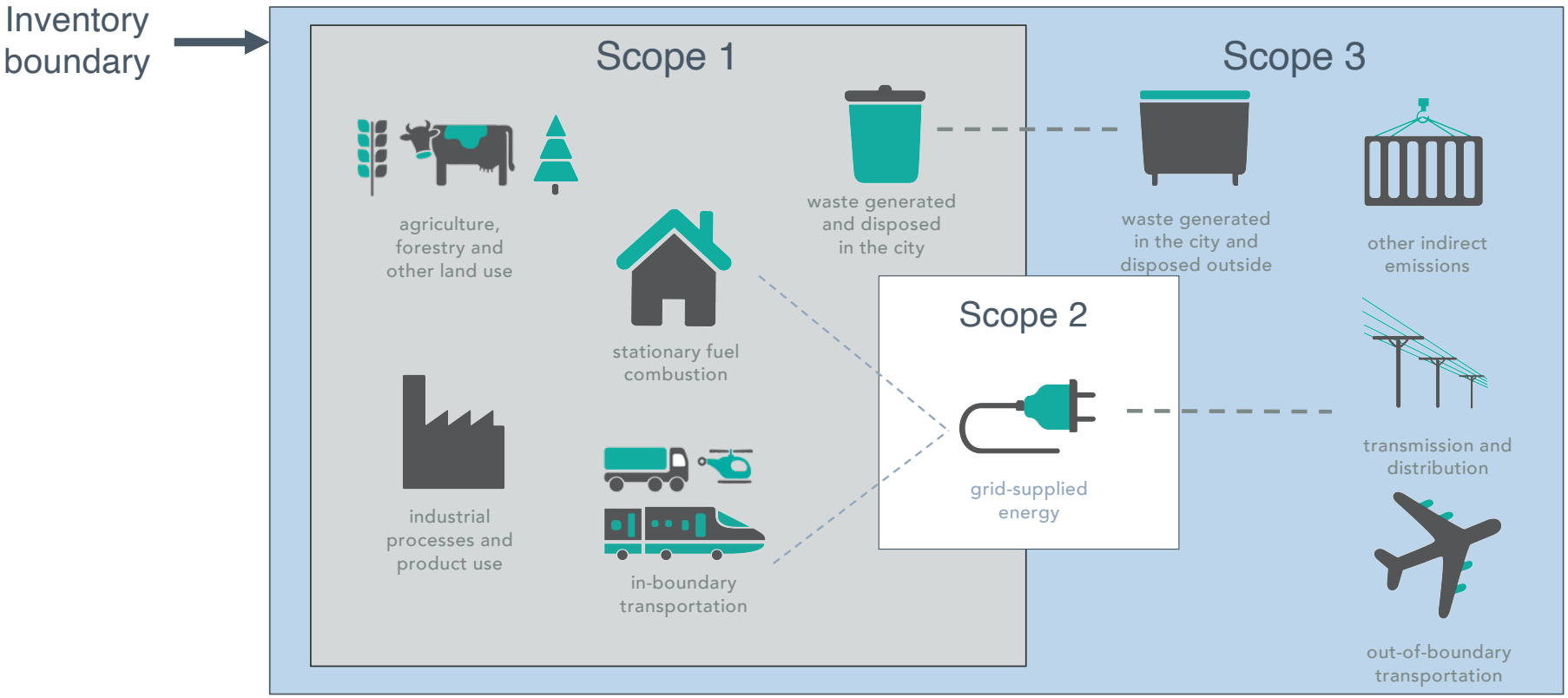
Scope 1 (direct emissions)



Scope 2 (indirect emissions)



Scope 3 (other indirect emissions)

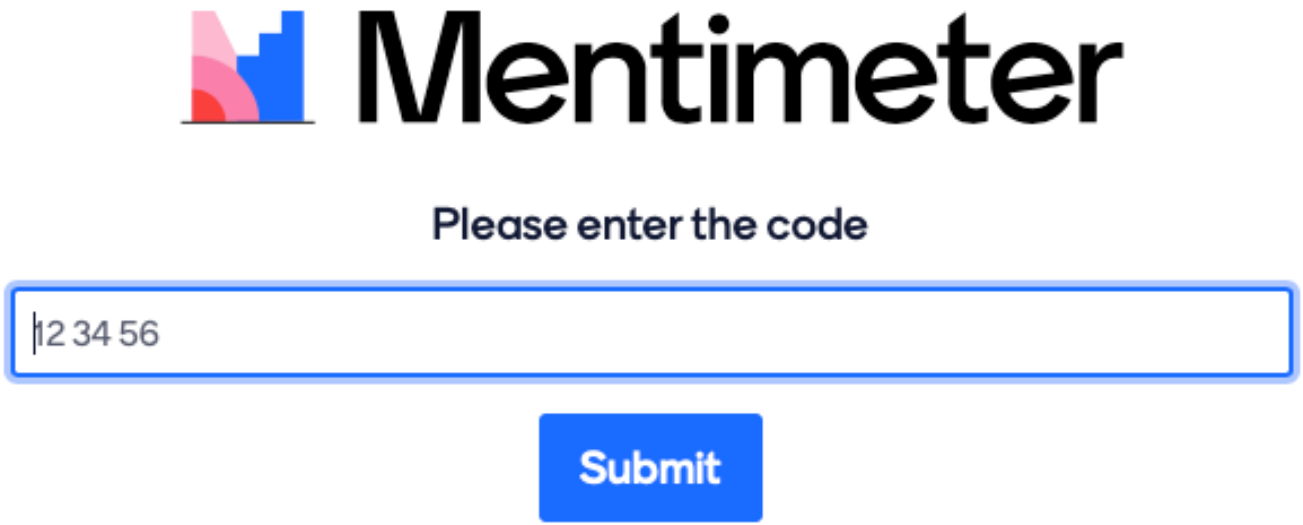


Exercise: Scopes

Emission source	Scope
Diesel used by buses within the city	
Electricity used for street lighting within the city	
Electricity consumption in schools within the city	
Methane gas release from landfill outside the city	
Methane gas release from gas distribution network inside city	
Kerosene used by city helicopter ambulances outside the city	
Composting of organic waste within the city	
Gas used for home cooking within the city	

Menti

Go to www.menti.com
Enter code: 86 79 28 91

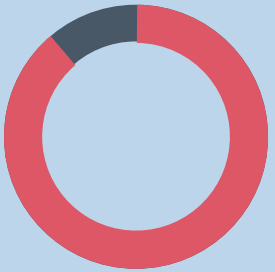


Module A

Inventory boundary

07

Reporting requirements



Two reporting frameworks

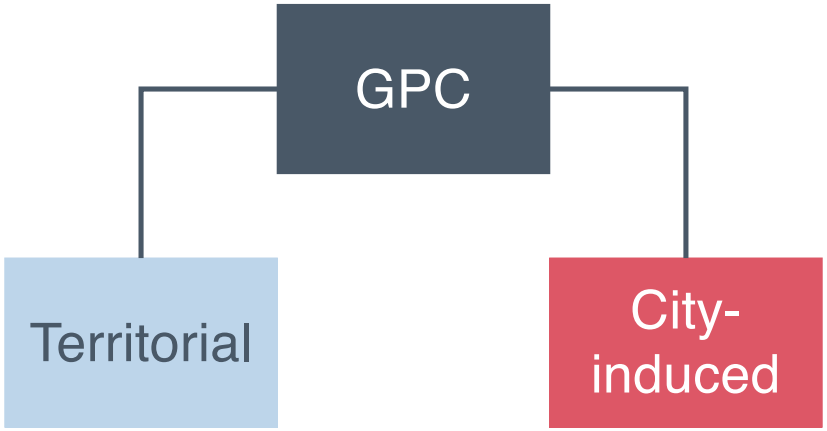
Territorial	Frameworks	City-induced
Scope 1 (or territorial emissions) only		Accounts for all emissions a city is responsible for
Only includes GHG emissions produced within the geographic boundary of the city		Includes emissions both inside and outside the boundary occurring due to activities taking place within the city.
Consistent with national-level GHG reporting		Covers selected scope 1, 2 and 3 emission sources

City-induced

Accounts for all emissions a city is responsible for

Includes emissions both inside and outside the boundary occurring due to activities taking place within the city

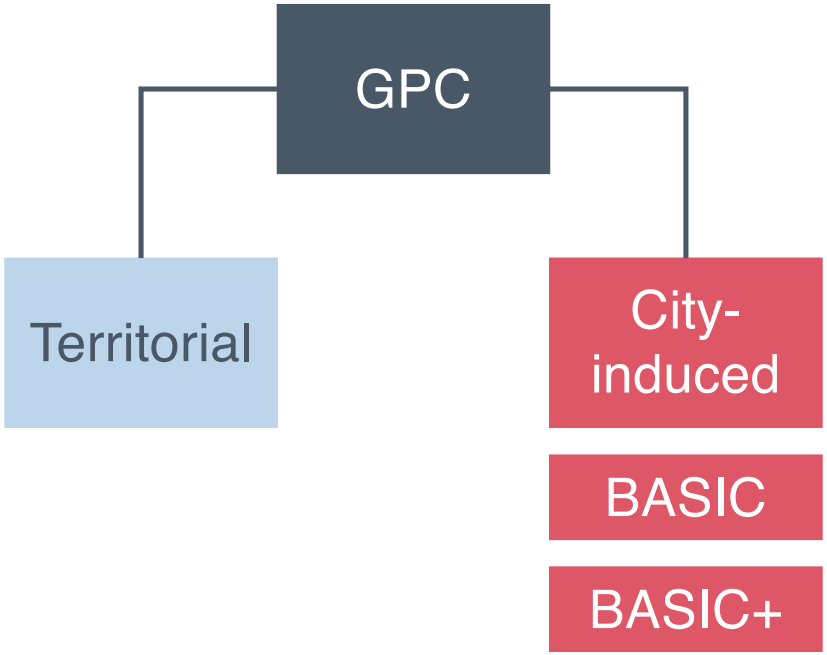
Covers selected scope 1, 2 and 3 emission sources



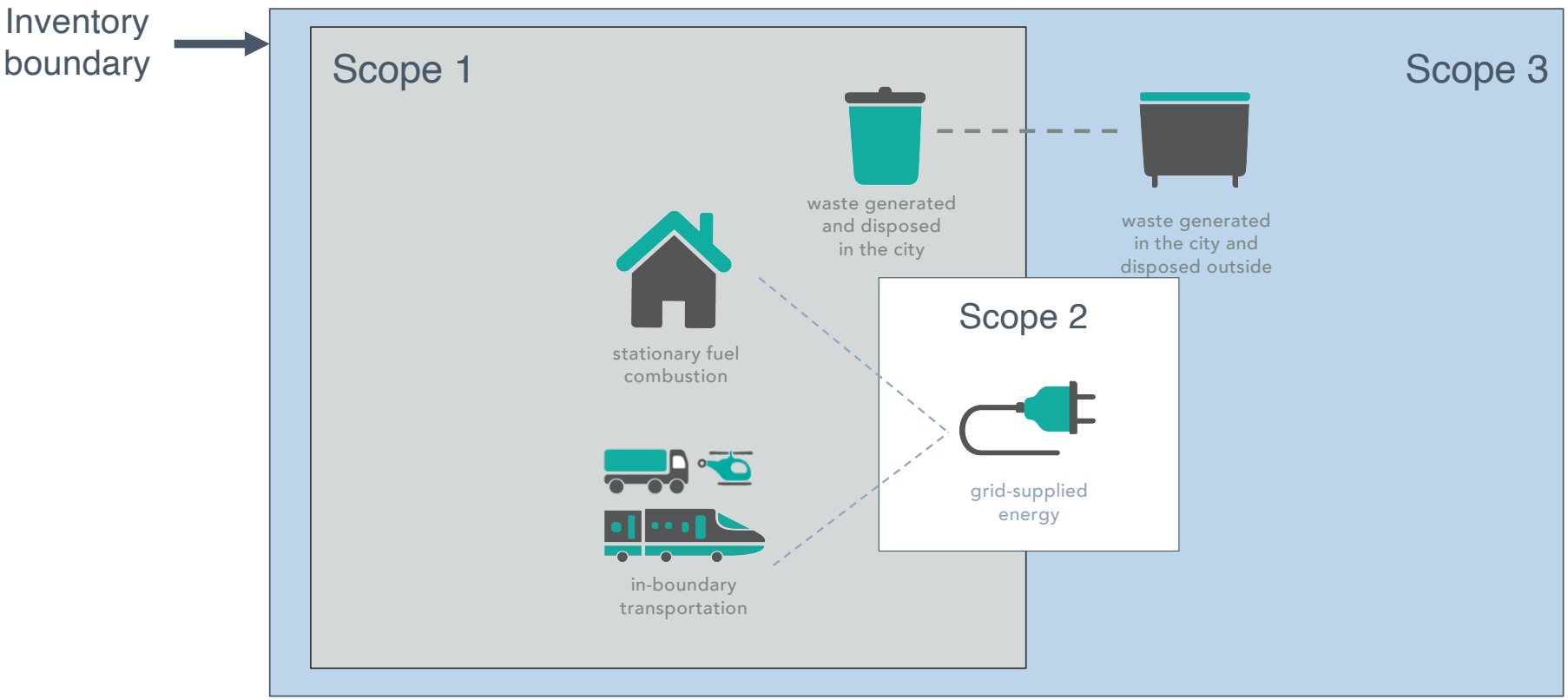
City-induced

Two reporting levels enables cities to be compared against the most common sources

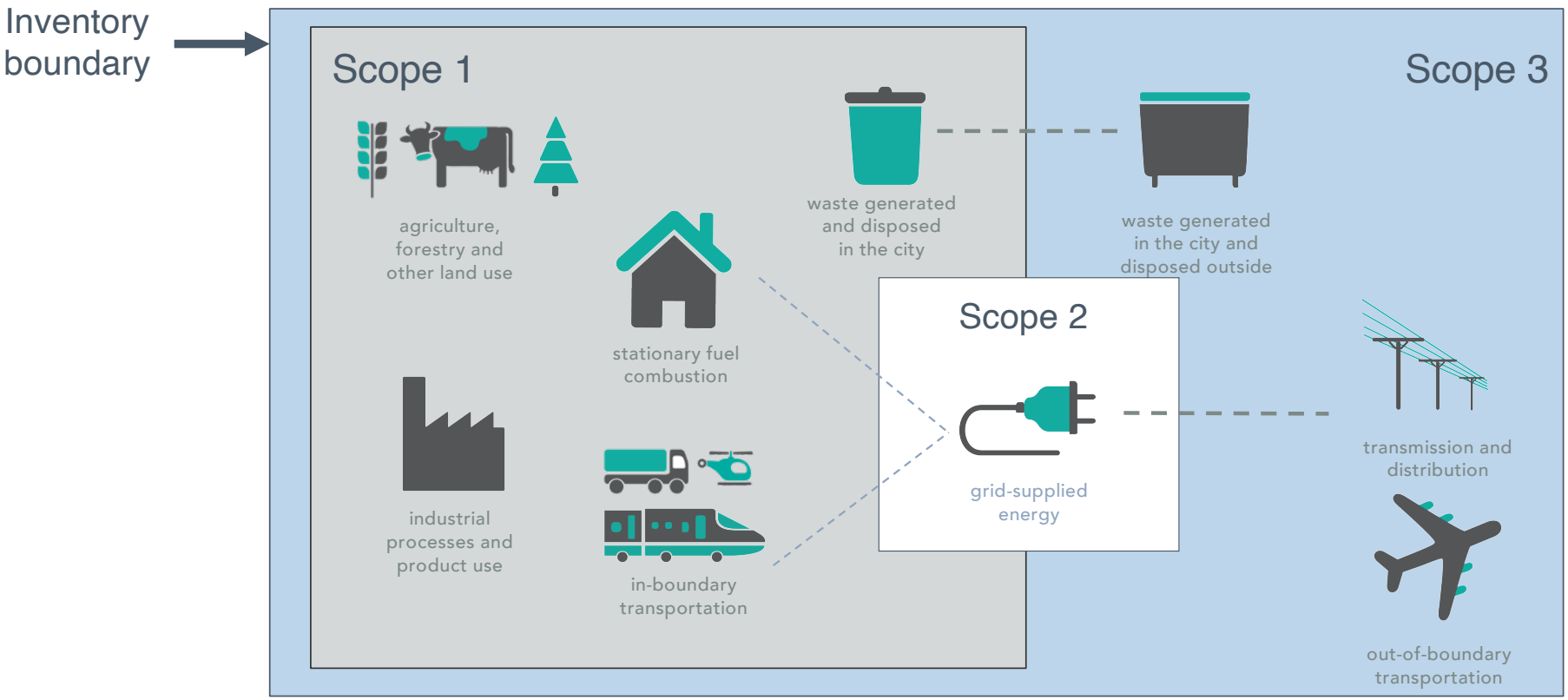
Emissions source	Reporting level	
	BASIC	BASIC+
Stationary energy	✔	✔
Transportation	✔	✔
Waste	✔	✔
IPPU	✖	✔
AFOLU	✖	✔



City induced: BASIC



City induced: BASIC+

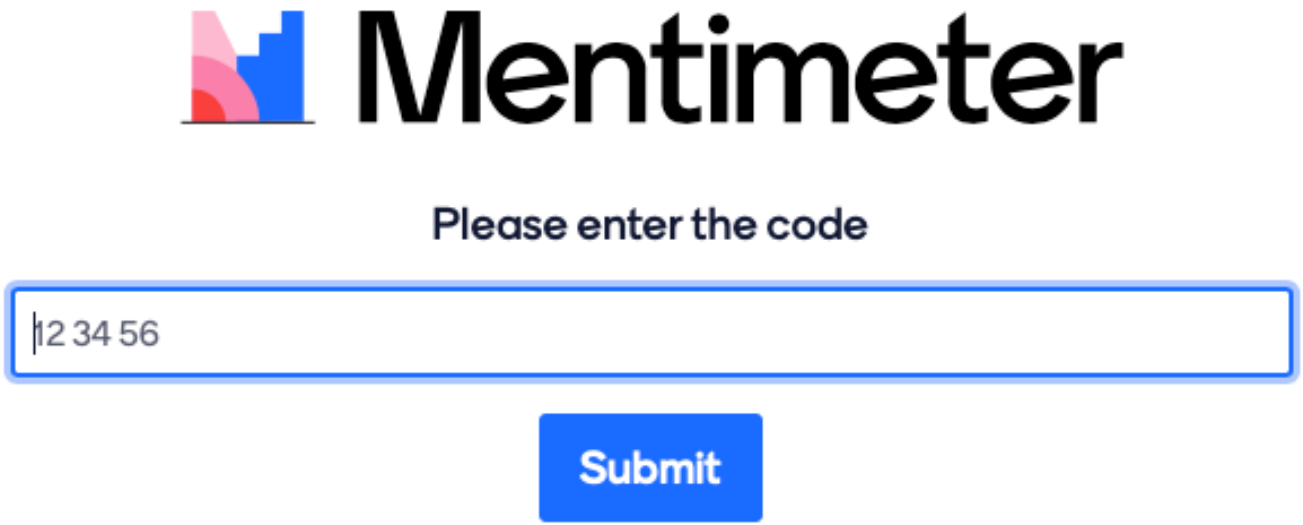


Exercise: Reporting level

Emission source	Reporting level
Industrial processes in the city	
Wastewater generated inside city and treated outside city	
Scope 1 emissions from residential buildings in the city	
Scope 3 emissions from aviation serving the city	
Scope 3 emissions from disposal of solid waste	
Enteric fermentation by cows in the city	
Fugitive emissions from natural gas systems in the city	
Electric trains operating within the city	

Menti

Go to www.menti.com
Enter code: 86 79 28 91

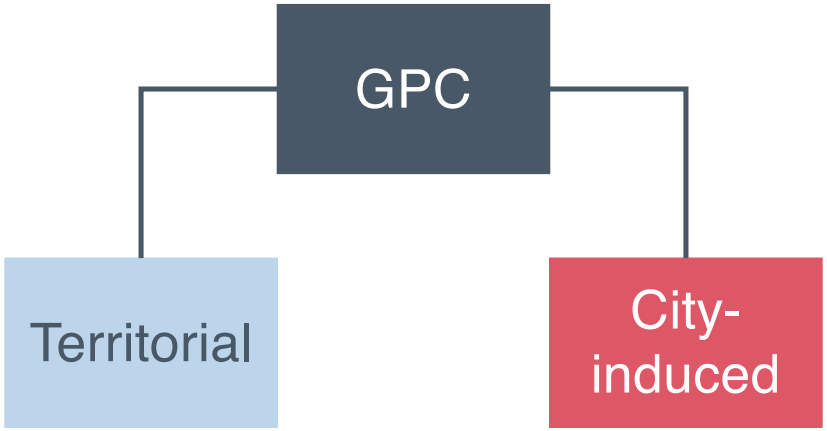


Territorial

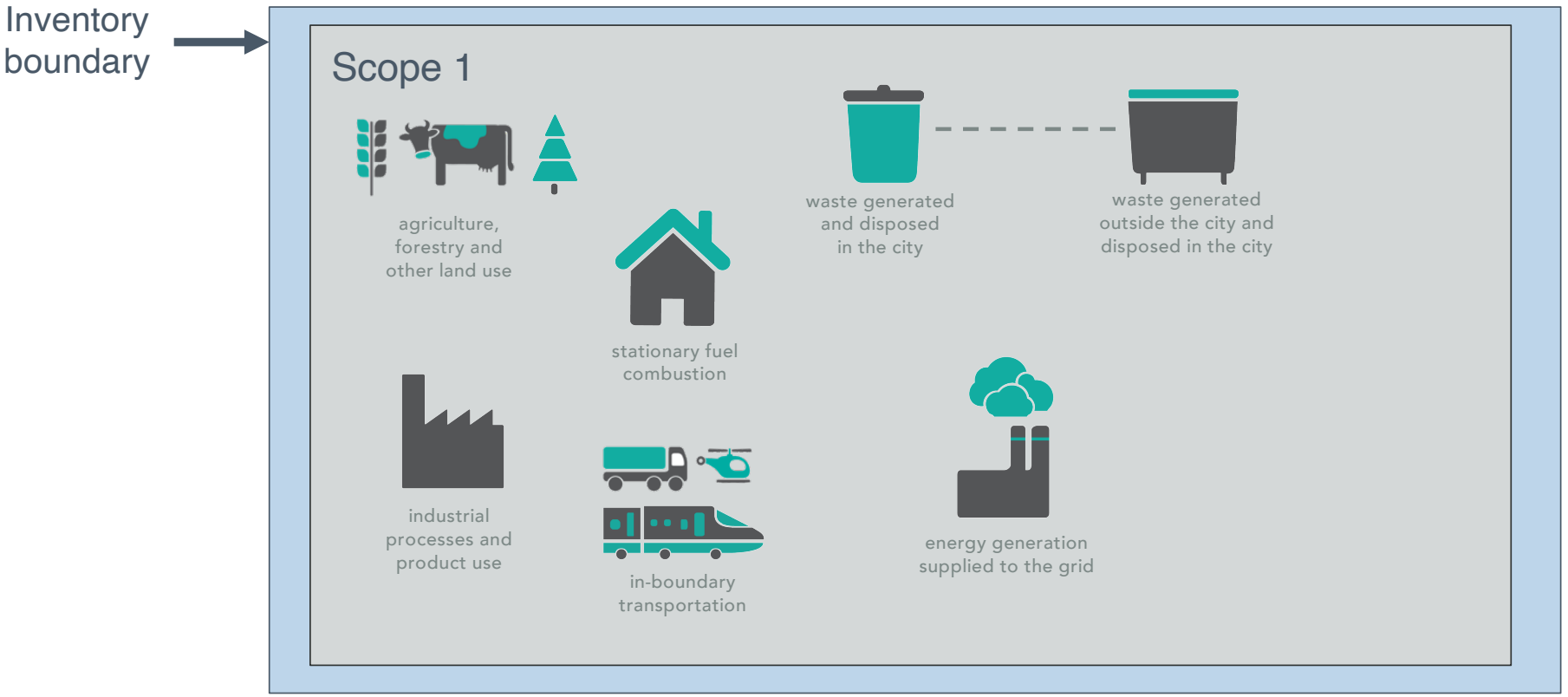
Scope 1 (or territorial emissions) only

Only includes GHG emissions produced within the geographic boundary of the city

Consistent with national-level GHG reporting



Territorial

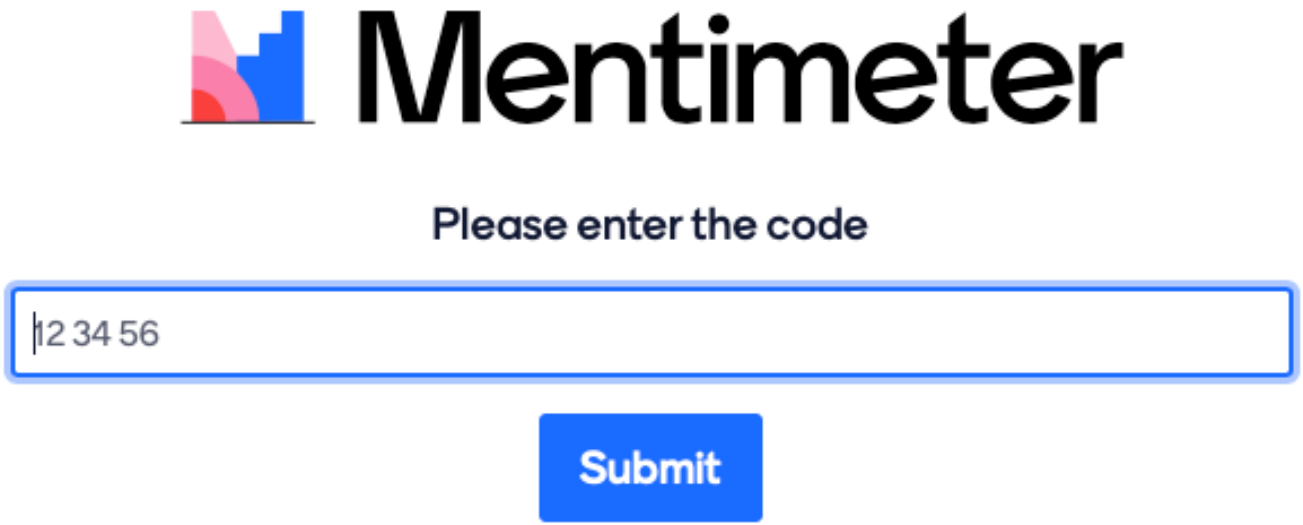


Exercise: Reporting framework

Emission source	Reporting framework
Natural gas combustion for heating (scope 1) in residential buildings inside city	
Wastewater generated outside the city and treated inside city	
Electricity consumption in commercial buildings inside city	
Scope 3 emissions from aviation serving the city	
Solid waste generated inside city but treated outside city (Scope 3)	
Grid-connected electricity generation plants in the city	
Fugitive emissions from natural gas distribution systems in the city	
Electric trains operating within the city	

Menti

Go to www.menti.com
Enter code: 86 79 28 91



GPC BASIC minimum requirements

Inventory boundary	• Geographic area (and map of city boundary) • Time span (12-month reporting period) • City information (population, GDP)
Activities	• Stationary (scope 1 and 2) • Inboundary travel (scope 1 and 2) • Waste (scope 1 and 3)
Greenhouse gases	• Carbon dioxide (CO_2) • Methane (CH_4) • Nitrous oxide (N_2O)
Data	• Activity data • Emission factors (including GWP) • Data sources, assumptions and methodologies • Data quality assessment

Overview: Stationary energy

Stationary energy sub-sectors	Scope 1	Scope 2	Scope 3
Residential buildings	I.1.1	I.1.2	I.1.3
Commercial and institutional buildings and facilities	I.2.1	I.2.2	I.1.2
Manufacturing industries and construction	I.3.1	I.3.2	I.3.3
Energy industries	I.4.1	I.4.2	I.4.3
Energy generation supplied to the grid	I.4.4		
Agriculture, forestry, and fishing activities	I.5.1	I.5.2	I.5.3
Non-specified sources	I.6.1	I.6.2	I.6.3
Fugitive emissions from mining, processing, storage, and transportation of coal	I.7.1		
Fugitive emissions from oil and natural gas systems	I.8.1		

Overview: Stationary energy

Stationary energy sub-sectors	Scope 1	Scope 2	Scope 3
Residential buildings	I.1.1	I.1.2	I.1.3
Commercial and institutional buildings and facilities	I.2.1	I.2.2	I.1.2
Manufacturing industries and construction	I.3.1	I.3.2	I.3.3
Energy industries	I.4.1	I.4.2	I.4.3
Energy generation supplied to the grid	I.4.4		
Agriculture, forestry, and fishing activities	I.5.1	I.5.2	I.5.3
Non-specified sources	I.6.1	I.6.2	I.6.3
Fugitive emissions from mining, processing, storage, and transportation of coal	I.7.1		
Fugitive emissions from oil and natural gas systems	I.8.1		

BASIC

BASIC+

Territorial

Not applicable

Other scope 3

Overview: Transportation

Transportation sub-sectors	Scope 1	Scope 2	Scope 3
On-road	II.1.1	II.1.2	II.1.3
Railways	II.2.1	II.2.2	II.1.3
Waterborne navigation	II.3.1	II.3.2	II.3.3
Aviation	II.4.1	I.4.2	II.4.3
Off-road	II.5.1	II.5.2	II.5.3

Overview: Waste

Waste sub-sectors	Scope 1	Scope 2	Scope 3
Solid waste generated **in** the city and disposed in **landfills**	III.1.1		III.1.2
Solid waste generated **outside** the city and disposed in **landfills**	III.1.3		
Solid waste generated **in** the city that is **biologically treated**	III.2.1		III.3.2
Solid waste generated **outside** the city that is **biologically treated**	III.2.3		
Solid waste generated **in** the city that is **incinerated**	III.3.1		III.5.2
Solid waste generated **outside** the city that is **incinerated**	III.3.3		
Wastewater generated **in** the city	III.4.1		III.4.2
Wastewater generated **outside** the city	III.4.3		

Module A

Inventory boundary

08

Common Reporting Framework

Global Covenant of Mayors

A global alliance for city climate leadership:

- 10,000 cities (78 in Southeast Asia)
- 970 million people

Signatories make a commitment to:

- Develop a GHG emissions inventory
- Assess climate risks and vulnerabilities
- Define ambitious climate mitigation, resilience and energy targets
- Create full climate action plans
- Track progress on mitigation, adaptation and energy access

www.globalcovenantofmayors.org
www.asian-mayors.eu

Common Reporting Framework

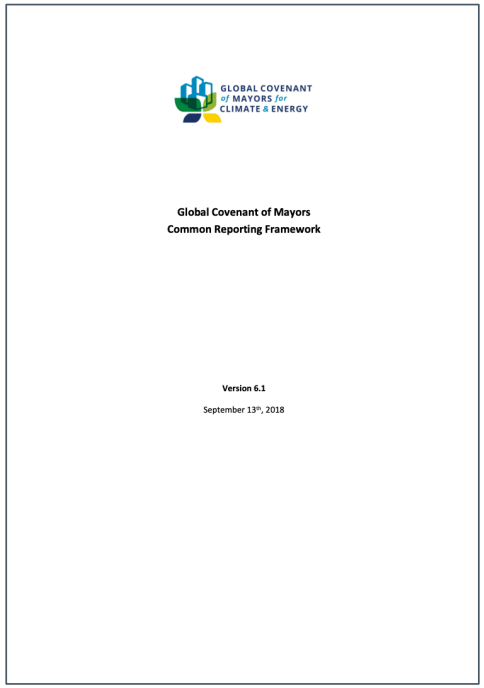
Common Reporting Framework (CRF):

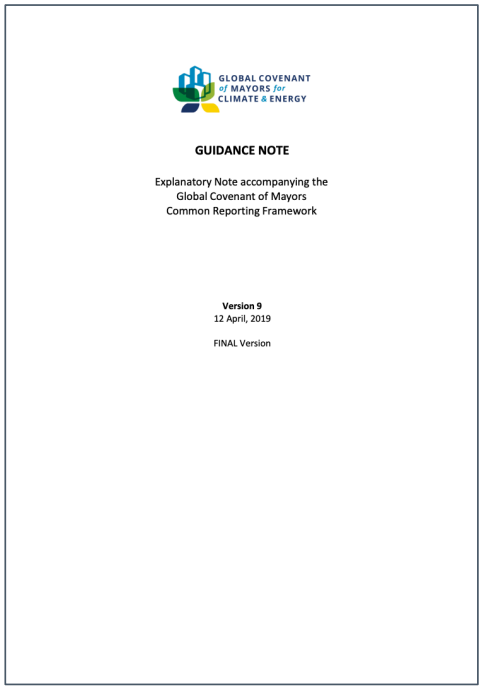
- Standardised measurement and reporting procedures to ensure robust, consistent and transparent reporting of achievements and progress
- Harmonises previous reporting requirements and reporting platforms
- Develop in consultation with partner organisations and local governments around the world

Covers:

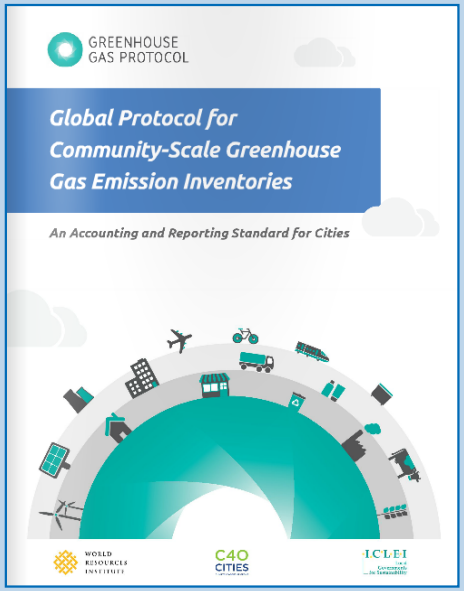
- GHG emissions **inventory**
- **Risk and vulnerability assessment**
- **Target setting**
- Climate action and energy access **plans**

CRF and guidance note available at:
www.globalcovenantofmayors.org/our-initiatives/data4cities/common-global-reporting-framework/





GPC



Standard

CRF

Reporting framework

Common Reporting Framework

CRF inventory requirements are fully aligned with the GPC. Minor differences:

Stationary Energy
- Mandatory disaggregation of commercial and institutional buildings
- No subsector for non-specified sources

Transportation
- On-road and Railways *should* be disaggregated by fleet type: municipal, public, private and commercial transport

Energy Generation (for information only)
- Inclusion of facilities *owned* by the city outside the boundary
- *Should* disaggregate by electricity only, CHP and hot/cold generation

Sectors and sub-sectors in GCoM reporting framework	IPCC (ref no.)	GPC (ref no.)	European CoM reporting framework (subject to revision)
Stationary Energy			Final energy consumption in the 'buildings, equipment/facilities, industries' sector
Residential buildings	1A4b	I.1.1, I.1.2	Residential
Commercial building and facilities	1A4a	I.2.1, I.2.2	Tertiary/commercial
Institutional buildings and facilities	1A4a		Municipal (incl. public lighting)
Industrial buildings and facilities	1A1, 1A2	I.3.1, I.3.2, I.4.1, I.4.2	Industry
Agriculture	1A4c	I.5.1, I.5.2	Agriculture/Forestry/Fisheries
Fugitive emissions	1B1, 1B2	I.7.1, I.8.1	Other emissions (incl. fugitive emissions)
Transportation			Final energy consumption in the 'transport' sector (several sub-sectors proposed, incl. municipal, public, private and commercial)
On-road	1A3b	II.1.1, II.1.2	Road*
Rail	1A3c	II.2.1, II.2.2	Rail*
Waterborne navigation	1A3d	II.3.1, II.3.2	Local and domestic waterways*
Aviation	1A3a	II.4.1, II.4.2	Local aviation*
Off-road	1A3e	II.5.1, II.5.2	Other/Off-road*
Waste			Other emission sources (not related to energy consumption)
Solid waste disposal	4A	III.1.1, III.1.2	Waste management Sub-sectors: solid waste, biological waste, incinerated and burned waste *
Biological treatment	4B	III.2.1, III.2.2	
Incineration and open burning	4C	III.3.1, III.3.2	
Wastewater	4D	III.4.1, III.4.2	Wastewater management
Industrial Process and Product Use (IPPU)			Final energy consumption in the 'industry' sector
Industrial Process	2A, 2B, 2C, 2E	IV.1.1	Industry
Product Use	2D, 2F, 2G, 2H	IV.2.1	
Agriculture, Forestry and Other Land Use (AFOLU)			Other emission sources (not related to energy consumption)
Livestock	3A	V.1.1	Agriculture, Forestry and Fisheries
Land use	3B	V.2.1	
Other AFOLU	3C, 3D	V.3.1	
Energy Generation			Energy Supply
Electricity-only generation	1A1	I.4.4	Electricity production (incl. certified green electricity, local electricity production)
CHP generation			
Heat/cold generation			Local heat/cold production
Local renewable generation			Renewable energy generation

GPC & CRF minimum requirements

Figure 2 Sources and scopes covered by the GPC

Sectors and sub-sectors	Scope 1	Scope 2	Scope 3
STATIONARY ENERGY			
Residential buildings	✓	✓	✓
Commercial and institutional buildings and facilities	✓	✓	✓
Manufacturing industries and construction	✓	✓	✓
Energy industries	✓	✓	✓
Energy generation supplied to the grid	✓		
Agriculture, forestry, and fishing activities	✓	✓	✓
Non-specified sources	✓	✓	✓
Fugitive emissions from mining, processing, storage, and transportation of coal	✓		
Fugitive emissions from oil and natural gas systems	✓		
TRANSPORTATION			
On-road	✓	✓	✓
Railways	✓	✓	✓
Waterborne navigation	✓	✓	✓
Aviation	✓	✓	✓
Off-road	✓	✓	
WASTE			
Disposal of solid waste generated in the city	✓		✓
Disposal of solid waste generated outside the city	✓		
Biological treatment of waste generated in the city	✓		✓
Biological treatment of waste generated outside the city	✓		
Incineration and open burning of waste generated in the city	✓		✓
Incineration and open burning of waste generated outside the city	✓		
Wastewater generated in the city	✓		✓
Wastewater generated outside the city	✓		
INDUSTRIAL PROCESSES AND PRODUCT USE (IPPU)			
Industrial processes	✓		
Product use	✓		
AGRICULTURE, FORESTRY AND OTHER LAND USE (AFOLU)			
Livestock	✓		
Land	✓		
Aggregate sources and non-CO_2 emission sources on land	✓		
OTHER SCOPE 3			
Other Scope 3			

✓ Sources covered by the GPC
+ Sources required for BASIC+ reporting
Sources included in Other Scope 3
Sources required for BASIC reporting
Sources required for territorial total but not for BASIC/BASIC+ reporting (*italics*)
Non-applicable emissions

Table 1. GCoM categorisation of emission sources

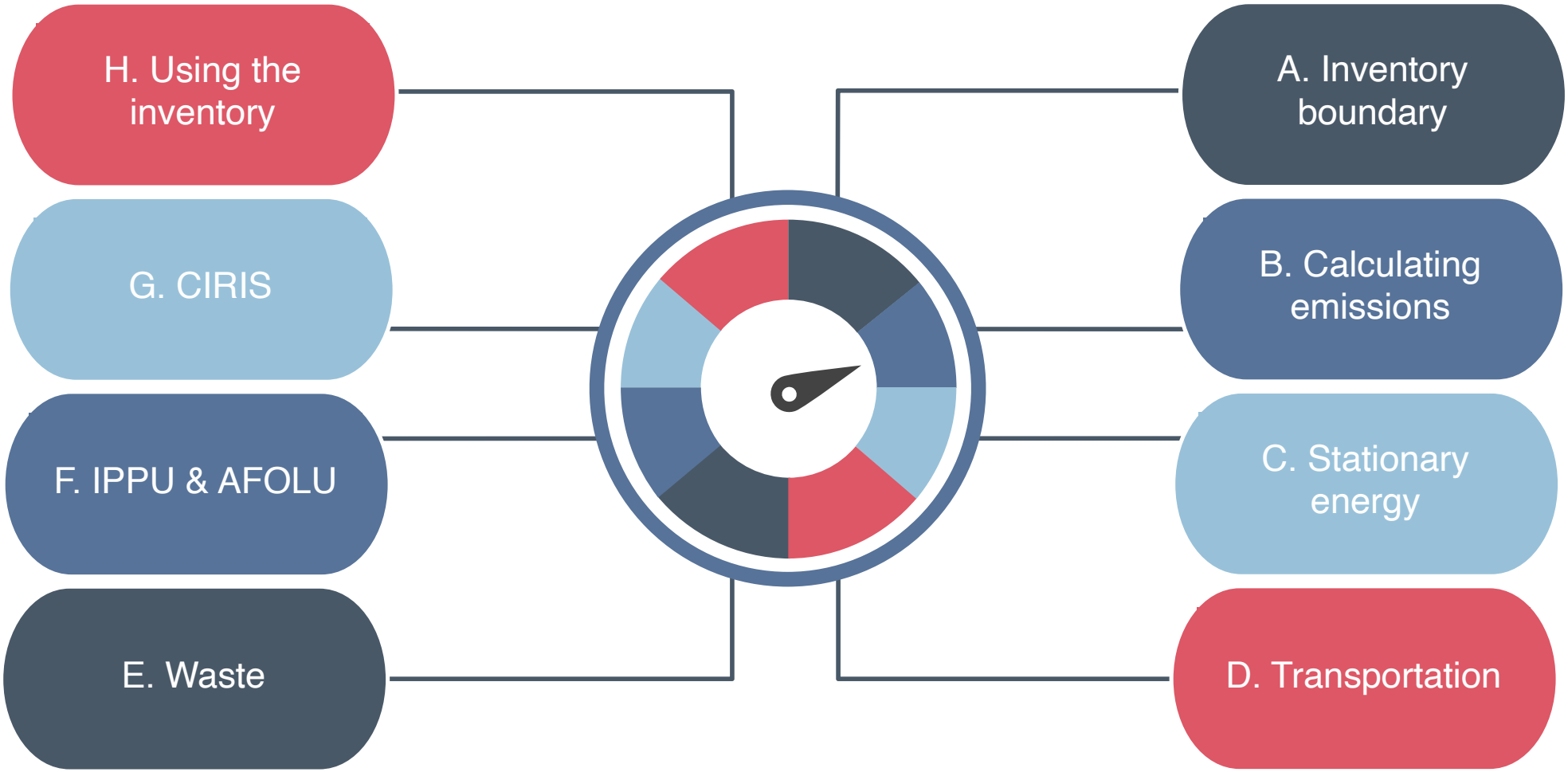
Sectors and sub-sectors	Included? Direct emissions	Included? Indirect emissions	Note	IPCC ref. no.
Stationary energy				
Residential buildings	Required	Required	This covers emissions from fuel combustion and use of grid-supplied energy by buildings, equipment and facilities within city boundary (including transportation and waste facilities), as well as fugitive emissions from production, transformation and distribution of fuels. Emissions from sources covered by a regional or national emissions trading system **should** be identified and described. See section 3.6.1 for detailed guidance and requirements.	1A4b
Commercial building and facilities	Required	Required		1A4a
Institutional buildings and facilities	Required	Required		1A4a
Industrial buildings and facilities	Required	Required		1A1, 1A2
Agriculture	Required	Required		1A4c
Fugitive emissions	Required			1B1, 1B2
Transportation				
On-road	Required	Required	This covers emissions from fuel combustion and use of grid-supplied energy for all modes of transportation activities within city boundary (for waterborne and aviation, cities only need to report journeys fully confined within the city boundary). On-road and rail travel **should** additionally be disaggregated by municipal fleet, public transport, private and commercial transport. See section 3.6.2 for detailed guidance and requirements.	1A3b
Rail	Required	Required		1A3c
Waterborne navigation	Required	Required		1A3d
Aviation	Required	Required		1A3a
Off-road	Required	Required		1A3e
Waste				
Solid waste disposal	Required		This covers non-energy related emissions from disposal and treatment of waste (incl. wastewater) generated within the city boundary, as a result of aerobic or anaerobic decomposition of waste, or incineration. Emissions from waste-to-energy, where waste/wastewater material is used directly as fuel or converted into a fuel, should captured under the Stationary Energy sector. See section 3.6.3 for detailed guidance and requirements.	4A
Biological treatment	Required			4B
Incineration and open burning	Required			4C
Wastewater treatment and discharge	Required			4D
Industrial Process and Product Use (IPPU)				
Industrial Process	Optional		This covers non-energy related emissions from industrial processes, the use of certain products and non-energy use of fossil fuels. See section 3.6.4 for detailed guidance and requirements.	2A, 2B, 2C, 2E
Product Use	Optional			2D, 2F, 2G, 2H
Agriculture, Forestry and Other Land Use (AFOLU)				
Livestock	Optional		This covers non-energy related emissions produced in the digestive processes of livestock and emissions/removals as a result of land use and management. See section 3.6.5 for detailed guidance and requirements.	3A
Land use	Optional			3B
Other AFOLU	Optional			3C, 3D
Energy Generation				
Electricity-only generation	Required		This means disclosure of information on activity and emissions specifically related to energy generation within the city boundary or outside the boundary but can be controlled or influenced by the city. It is for information only and not added to the total emissions.	1A1
CHP generation	Required			
Heat/cold generation	Required			
Local renewable generation	Optional	Optional		

SUMMARY

Module A: Inventory boundary

Module A: Inventory boundary

Why compile a GHG emissions inventory? 01	Why measure GHG emissions at city level? 02	Introduction to the GPC 03	Accounting and reporting principles 04
Setting the inventory boundary 05	Categorising GHG emissions 06	Reporting requirements 07	Common Reporting Framework 08


H. Using the inventory
G. CIRIS
F. IPPU & AFOLU
E. Waste
A. Inventory boundary
B. Calculating emissions
C. Stationary energy
D. Transportation

Feedback

Go to: https://forms.gle/V2n4CMseSLgKeeC7A

The end

Next time: Calculating GHG emissions