

The Value of Using Notation Keys in City Scale Greenhouse Gas Emission Inventories: **Learning From Absent Data**



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The Global Platform for Sustainable Cities (GPSC), managed by the World Bank, is a comprehensive support mechanism to participating cities of the Sustainable Cities Integrated Approach Pilot (SC-IAP) program of GEF that aims to:

- Promote and advise on an improved approach and method to integrated urban planning and performance, to strategically guide the 28 participating cities in the SC-IAP;
- Capacitate and connect the participating and prospective cities on integrated sustainability planning by taking as starting points their concrete contexts, barriers and opportunities to achieve integration with a focus on urban infrastructure, policy, people and investments;
- Provide access to a wide range of existing tools and knowledge relevant to integrated urban planning and implementation that will support the cities to deliver effective integrated urban planning.

The GPSC is designed to support the participating cities of the SC-IAP to address the challenges and opportunities they face in their urban growth, development, and infrastructure and assist “the change process” to a sustainable trajectory. The GPSC supports the cities to scale up their efforts conform to global standards, practices and knowledge and to improve their performances towards low carbon, resilient inclusive and sustainable development.

To succeed, these cities need local and regional government decision-makers and technical staff with diverse new skill sets that are interdisciplinary and able to function across sectors at the local and regional scales.

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National, regional and local governments around the world are taking steps to tackle climate change. In order to do so they need to track and report their climate data. However, in some instances, greenhouse gas (GHG) emissions are hard to accurately track and/or quantify.

1. What are notation keys?

Notation keys are used in greenhouse gas (GHG) emissions inventories where data is absent or incomplete, to indicate why data is lacking. The use of notation keys is an internationally recognized good practice. In fact, a GHG inventory that lacks proper representation of all emissions, either through quantification or the use of notation keys, does not comply with the completeness principle¹.

At the national level, the Intergovernmental Panel on Climate Change (IPCC) reporting guidance requires national governments to use a notation key if the actual emissions have not been estimated or cannot be reported in the tables.

In order to improve climate data, it is not only important to highlight the absence of data but also the reason for absent data. Notation keys are a clear, simple and standardized way to show these two facts: that data has not been reported and to illuminate why it has not been reported.

Table 1.1 Notation Keys

Notation Key	Definition	Explanation
NE	Not Estimated	Emissions and/or removals occur but have not been estimated or reported
NO	Not Occurring	An activity or process does not exist within a country.
IE	Included Elsewhere	Emissions and/or removals for this activity or category are estimated and included in the inventory but not presented separately for this category. The category where these emissions and removals are included should be indicated (for example in the documentation box in the correspondent table).
C	Confidential	Emissions and/or removals are aggregated and included elsewhere in the inventory because reporting at a disaggregated level could lead to the disclosure of confidential information.
NA	Not Applicable	The activity or category exists but relevant emissions and removals are considered never to occur. Such cells are normally shaded in the reporting tables.

Source: IPCC 's CHAPTER 8 REPORTING GUIDANCE AND TABLES - 2006²

Proper use and analysis of notation keys can also communicate more complex information. For example, notation keys can answer questions such as:

- Is a disproportionate amount of effort required to collect specific data that represent an insignificant level of emissions for the overall inventory?
- Is there not a system in place to collect all the relevant data?
- Does data exist that cannot (or may not) be reported?
- Are data reported that cannot be extracted from the primary source of emissions?

Monitoring GHG emissions in the proper units is the primary aim of climate reporting in order to track the current scenario and plan for emissions reductions. However, the importance of monitoring absent data is often underestimated. Absent data can help identify where governments may need support on enhanced data collection, or data disaggregation and calculation.

¹ "Completeness means that an inventory covers all sources and sinks for the full geographic coverage, as well as all gases included in the IPCC Guidelines in addition to other existing relevant source/sink categories which are specific to individual Parties (and therefore may not be included in the IPCC Guidelines)." (Source: IPCC INTRODUCTION TO THE 2006 GUIDELINES)

² IPCC 2006 Guidelines; Chapter 8: Reporting Guidance and Tables. https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/1_Volume1/V1_8_Ch8_Reporting_Guidance.pdf

In climate reporting, the numbers are undeniably important; but to continue driving progress, it is equally important to understand the meaning behind the empty spaces.

2. Why should local governments use notation keys in their climate reporting?

The principle behind the IPCC’s notation keys (originally designed for national governments) can also be applied to local and regional governments. The Global Protocol for Community Scale GHG Emission Inventories (GPC)³ and the Global Covenant of Mayors for Climate & Energy’s (GCoM) Common Reporting Framework (CRF)⁴, which provide guidance for the development of GHG emissions inventories at the city level, have included notation keys in their requirements. One slight difference can be noted at this point; while IPCC includes NA (Not Applicable); GPC and CRF guidelines do not include this code.

Table 2.1 GPC Notation keys

Notation Key	Definition	Explanation
NE	Not Estimated	Emissions occur but have not been estimated or reported; justification for exclusion shall be noted in the explanation.
NO	Not Occurring	An activity or process does not occur within the city.
IE	Included Elsewhere	GHG emissions for this activity are estimated and presented in another category of the inventory. That category shall be noted in the explanation.
C	Confidential	GHG emissions which could lead to the disclosure of confidential information and can therefore not be reported.

Source: *The Global Protocol for Community Scale GHG Emission Inventories, 2015.*

The Global Covenant of Mayors for Climate and Energy also requires the use of notation keys “to accommodate limitations in data availability and differences in emission sources between local governments. Where notation keys are used, an accompanying explanation shall be provided.”⁵

Although the application of notation keys for city reporting is explained through the GPC and GCoM CRF, there is a wide spread misconception that notation keys are just optional and not mandatory for the reporting of emissions.

A considerable share of all inventories developed at the city level and submitted for review as part of the Compact of Mayors (2015 -2017) and the Global Covenant of Mayors for Climate and Energy (2017 – current) demonstrate a misunderstanding of how and why to use notation keys appropriately. Those local governments that have submitted inventories that comply with all the requirements have been supported by their respective city networks such as ICLEI or C40, and received additional guidance on how to use a reporting tool and to complete an inventory.

However, many other GCoM committed local governments that have submitted impressive inventories still lack the level of detail required to analyze trends related to data gaps. It is not that these inventories have incorrect data. The numbers have been well processed and calculated, but the use of the notation keys, as an integral part of the final product, has been overlooked.

3. How notation keys can improve climate reporting and action

Notation keys can be used in several ways for data interpretation and aggregation. Processes for data revision and completeness should stress the significance of notation keys as they can offer a more complete picture of emissions within the inventory and illuminate possible data collection constraints.

As a part of both the GCoM for Climate & Energy, and the Compact of Mayors before that, ICLEI has reviewed

3 ICLEI, WRI, C40, 2014. Global Protocol for Community Scale GHG emissions inventory. <https://ghgprotocol.org/greenhouse-gas-protocol-accounting-reporting-standard-cities>

4 Global Covenant of Mayors for Climate and Energy Common Reporting Framework, 2018. <https://www.globalcovenantofmayors.org/our-initiatives/data4cities/common-global-reporting-framework/>

5 Global Covenant of Mayors for Climate and Energy Guidance Note; 2019. https://www.globalcovenantofmayors.org/wp-content/uploads/2019/08/Data-TWG_Reporting-Framework_GUIDENCE-NOTE_FINAL.pdf

the completeness of over 300 inventories between 2015 and July 2019, and has generated an analysis of notation key usage by region using over 120 compliant inventories⁶ from all regions of the world. This analysis demonstrates how data can be interpreted, showing regional trends of notation key use in reporting.

For example, the extensive use of a particular notation key in certain sectors can tell us a lot. Take a look below at line II.1.2 in the global and regional reports. Line II.1.2 represents emissions from on-road electric vehicles. The extensive use of the notation key IE (Included Elsewhere) shows that this activity takes place in the city, but that many local governments do not have a way to separate the electricity used to power electric vehicles from other energy use. If the cell had simply been left empty (rather than using the IE key), the immediate assumption would be that the activity is not happening. An empty cell does not provide any information, but with the use of the IE notation key, we learn that the activity is happening, and in addition, we learn that separating this data from other energy use is a challenge for local governments. This in turn shows there are challenges in properly monitoring data on electric vehicles at large.

Table 3.1 Corresponding sectors according to the GPC

This table breaks down the corresponding sectors covered in the GPC allowing us to understand which notation keys have been used for which sector. The nomenclature column represents all of the analyzed sectors included in the following graphics. For example, we see here that II.1.2 represents emissions from on-road electric vehicles. Within the transport sector (II), on road vehicles are covered under II.1 and emissions from electricity demand are covered under II.1.2.

*Key

Scope 1 = emissions from burning fossil fuels

Scope 2 = emissions from electricity demand

The definition of scope 3 varies slightly by sector:

- In the energy sector, Scope 3 includes losses by transmission and distribution.
- In the transport sector, Scope 3 includes all those emissions from fossil fuel which happen outside the geographic boundary of the jurisdiction (depending on methodology selection).
- In the waste sector, Scope 3 includes waste generated within the geographic boundary of a jurisdiction but treated outside.

Sector	Sub Sector	Scope*	Nomenclature
Stationary Energy (I)	Residential Buildings (I.1)	1	I.1.1
		2	I.1.2
		3	I.1.3
	Commercial and Institutional Buildings and Facilities (I.2)	1	I.2.1
		2	I.2.2
		3	I.2.3
	Manufacturing: Industries and Construction (I.3)	1	I.3.1
		2	I.3.2
		3	I.3.3
	Energy Industries (I.4)	1	I.4.1
		2	I.4.2
		3	I.4.3
	Agriculture, forestry, and fishing activities (I.5)	1	I.5.1
		2	I.5.2
		3	I.5.3

⁶ A compliant inventory refers to reported inventories which require no revisions meaning that they include appropriate usage of notation keys, activity data, emission factors and global warming potential, among other elements.

Stationary Energy (I)	Non-specified sources (I.6)	1	I.6.1
		2	I.6.2
		3	I.6.3
	Fugitive emissions from mining, processing, storage, and transportation of coal (I.7)	1	I.7.1
	Fugitive emissions from oil and natural gas systems (I.8)	1	I.8.1
Transportation (II)	On-Road (II.1)	1	II.1.1
		2	II.1.2
		3	II.1.3
	Railways (II.2)	1	II.2.1
		2	II.2.2
		3	II.2.3
	Waterborne Navigation (II.3)	1	II.3.1
		2	II.3.2
		3	II.3.3
	Aviation (II.4)	1	II.4.1
		2	II.4.2
		3	II.4.3
	Off-Road (II.5)	1	II.5.1
		2	II.5.2
	Waste (III)	Solid Waste Disposal (III.1)	1
2			III.1.2
3			III.1.1
Biological treatment of Waste (III.2)		1	III.2.1
		2	III.2.2
		3	III.2.1
Incineration and open burning (III.3)		1	III.3.1
		2	III.3.2
		3	III.3.1
Waste water treatment (III.4)		1	III.4.1
		2	III.4.2
		3	III.4.1
IPPU - Industrial Product and Product Use (IV)	Emissions from industrial processes occurring within the city boundary (IV.1)	1	IV.1.1
	Emissions from product use occurring within the city boundary (IV.2)	1	IV.2.1
AFOLU - Agriculture, Forestry and Land Use (V)	Emissions from livestock within the city boundary (V.1)	1	V.1.1
	Emissions from land within the city boundary (V.2)	1	V.2.1
	Emissions from aggregate sources and non-CO2 emission sources on land within the city boundary (V.3)	1	V.3.1
Other S3 (VI)	Other Scope 3 (VI.1)	1	VI.1

Chart 1.1 Global use of notation keys on GPC compliant inventories

The graph reflects the use of notation keys from a global perspective based on 127 compliant city-level GHG inventories between 2015 and 2019. These 127 inventories represent cities from all continents. The trend shows that for fossil fuel consumption, data is always available at residential level (I.1.1) and on-road transportation (II.1.1), as reflected by the lack of notation keys used in those sub-sectors. The use of IE (Included Elsewhere) is mostly used for emissions of electric cars (II.1.2) as currently these cannot be disaggregated and are included under other sub-sectors, especially residential consumption of electricity. IE is shown in green here. Methodology and guidance in modeling and disaggregating this source is required by the users. Not Estimated (NE) although not allowed for mandatory sectors (Scope 1 and 2 for Stationary Energy and transport and Scope 1 and 3 for waste) is mostly used for insignificant emissions.

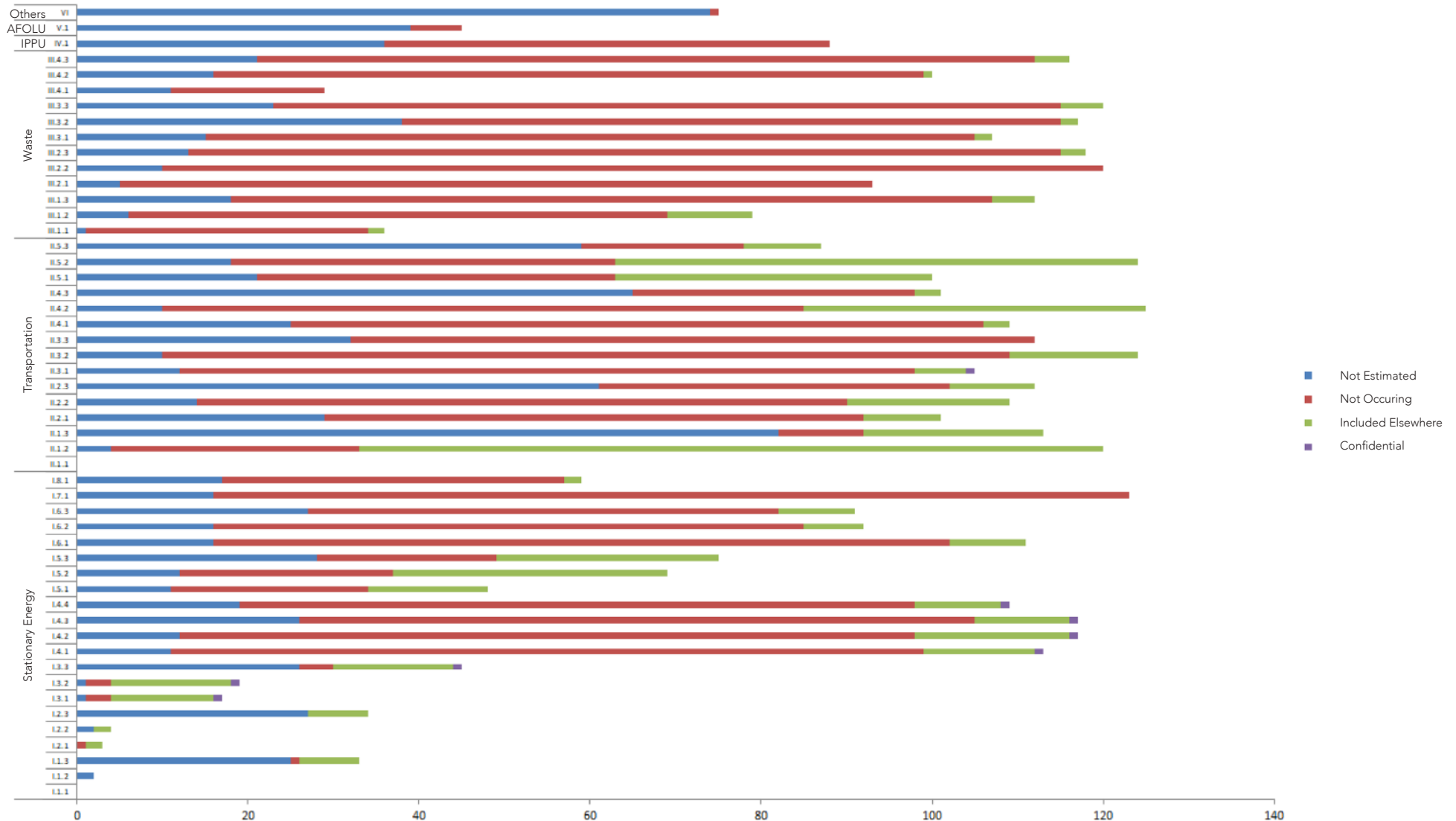


Chart 2.1 Latin America: use of notation keys in GPC compliant inventories

Trends from 68 GPC compliant inventories submitted by local governments in Latin America:

- Data is readily available for stationary energy emissions in commercial sub-sectors for both scope 1 and 2 as showcased by the absence of notation keys in I.2.1 (Emissions from fuel combustion within the city boundary) and I.2.2 (Emissions from grid-supplied energy consumed within the city boundary).
- Emissions from electric transport are occurring but there is no way to disaggregate these (as shown in II.1.2).
- Cities prefer to treat waste water inside the boundaries of their administration (III.4.1)

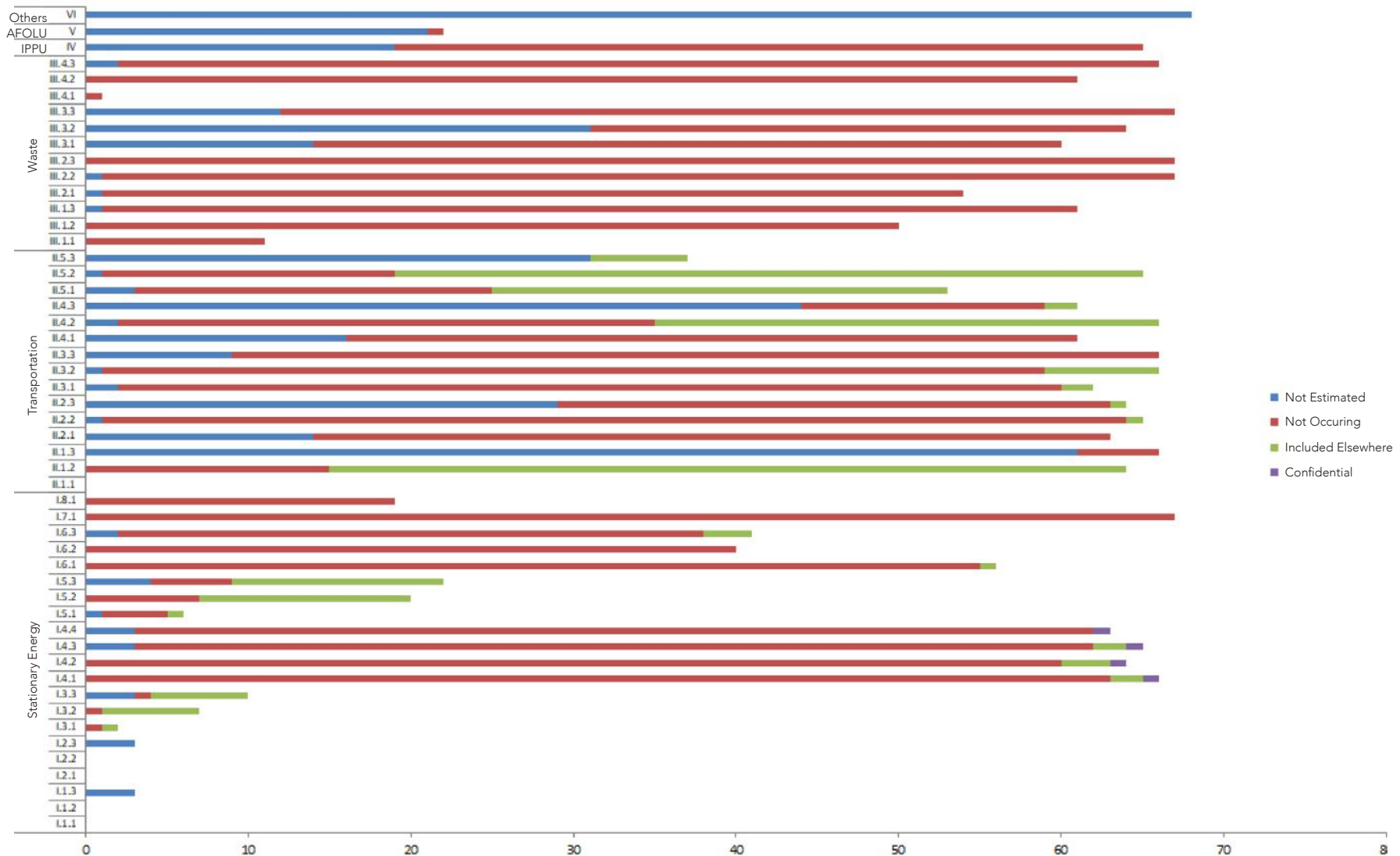


Chart 3.1 Oceania: use of notation keys on GPC compliant inventories

Trends from 14 compliant inventories reported in Oceania:

- Data is readily available for sub sectors residential (I.I.1; I.II.2); commercial (I.2.1, I.2.2) and very common for industrial (I.3.1; I.3.2). It is noticeable how more than half of the cities remark that they do not produce energy within the city limits - only 5 of them do and they cannot disaggregate appropriately.
- Waste incineration does not occur whatsoever (III.3.1; III.3.2) as NO (Not Occurring) is used on all the instances. Most of the waste water treatment plants are located outside city boundaries; again due to the use of NO on III.4.1. When compared to Latin America, we can see that there is some incineration occurring there while in Oceania it is non-existent.
- Regarding waste, it is not common for Oceania cities to treat solid waste generated outside their boundaries (III.1.3); waste water is treated completely outside city boundaries (III.3.1).

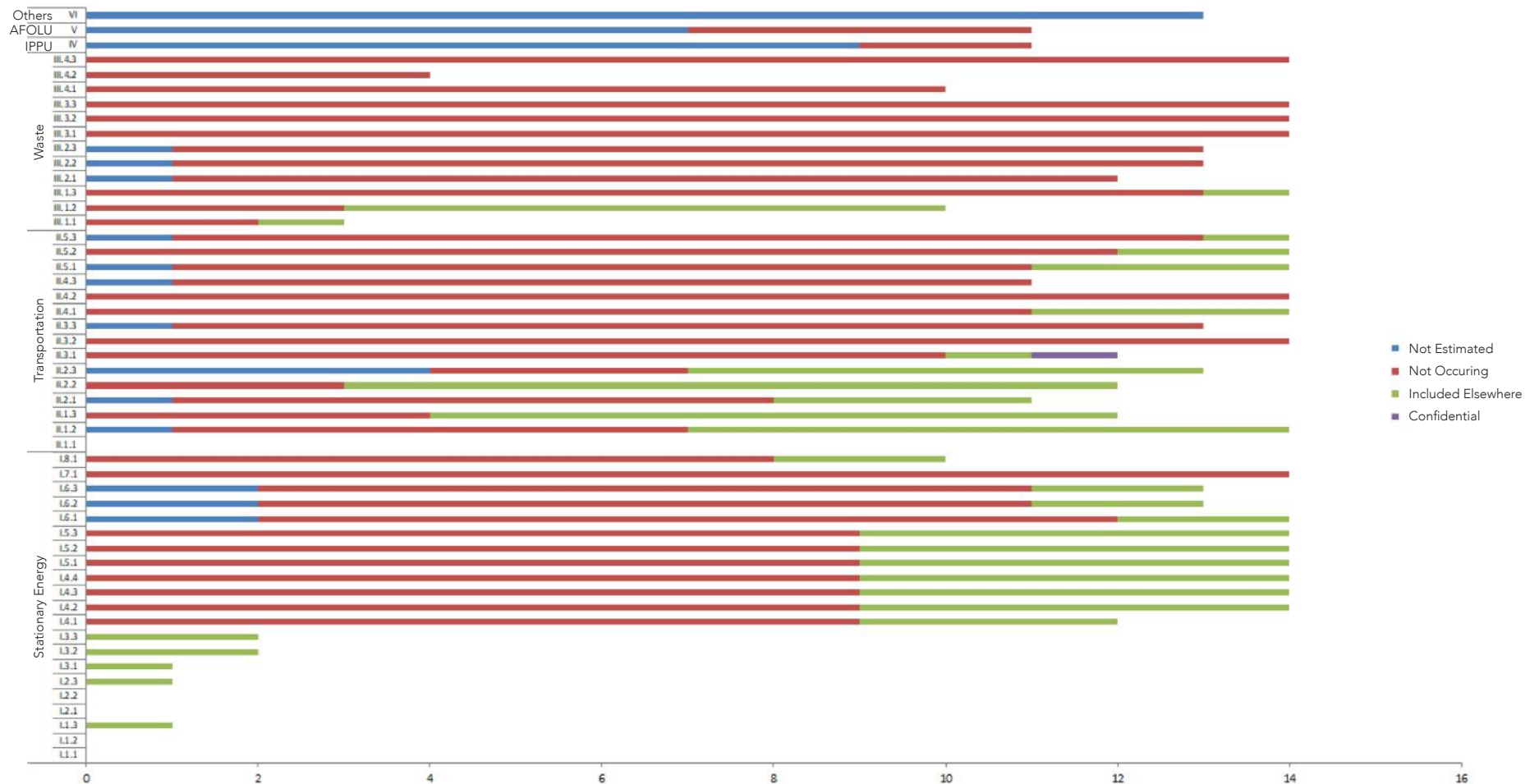
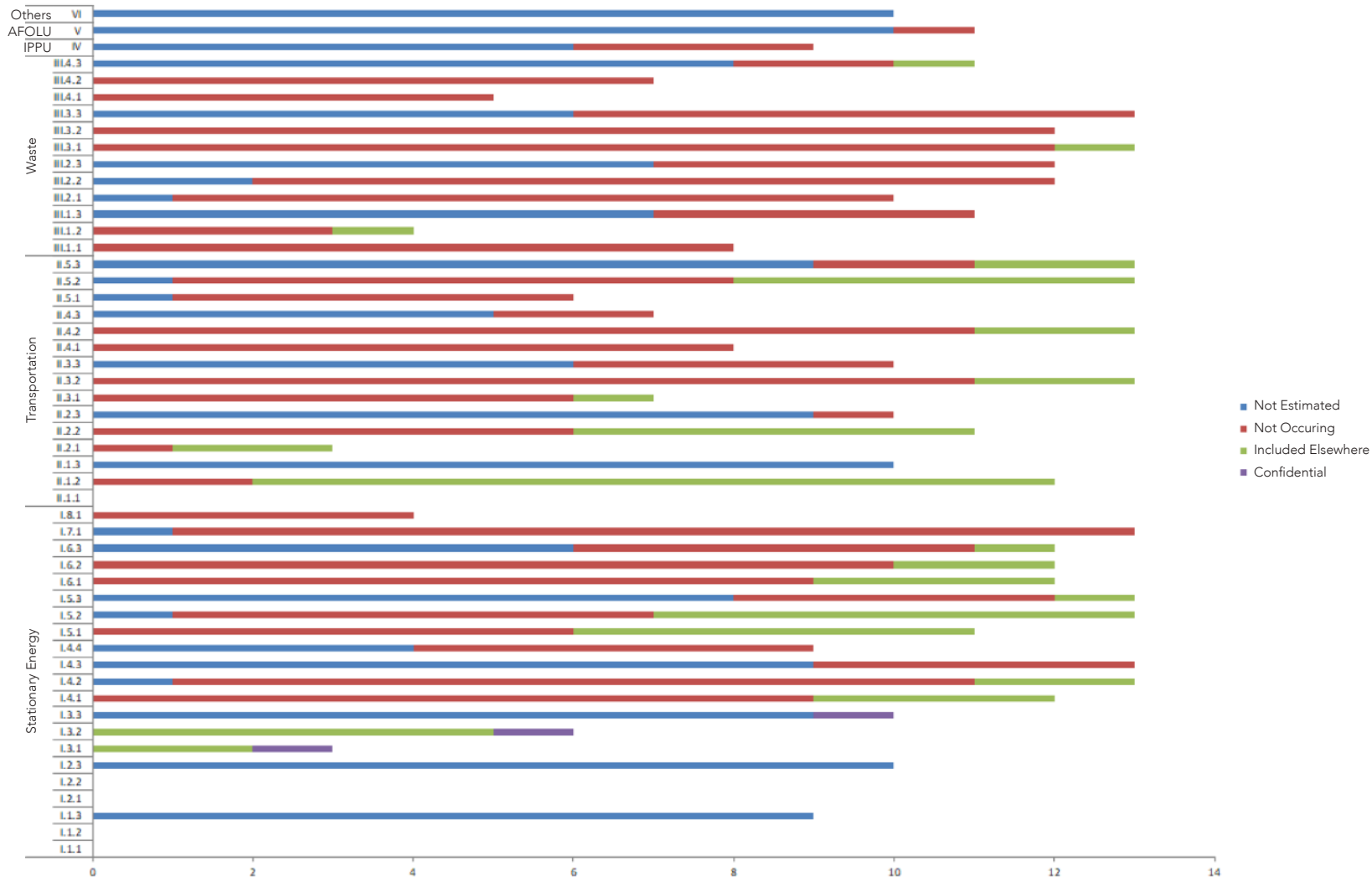


Chart 4.1 North America: use of notation keys on GPC compliant inventories

Trends from 13 North American inventories:

- A higher use of Confidential (C) can be seen here; split between all 3 scopes of industrial emissions.
- Energy consumption data is fully available for residential and commercial sectors.
- However, for the transportation sector, scope 1 (fossil fuel) data is available but scope 2 (electricity) is not readily available for disaggregation. This shows that there is a high volume of electric vehicles but their charging location breakdown is not currently available.



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