Elaboration of GHG inventories by local and regional governments: insights on data availability and quality

September 2021

Prepared by Carla Mariño Viteri and Cesar Carreño (ICLEI World Secretariat)
Contributors: Dr. Ana Maria Roxana Petrescu and Prof. Dr. AJ Dolman (Vrije Universiteit Amsterdam)
Dr. Richard Engelen (European Centre for Medium-Range Weather Forecasts)

Background: As the focal point of the Local Governments and Municipal Authorities at the UNFCCC[1], ICLEI-Local Governments for Sustainability promotes the reporting of local and regional climate-related data, including greenhouse (GHG) inventories, targets of GHG emission reduction, and data on climate action planning. This is done through the CDP-ICLEI Unified Reporting System where entities report in the frame of various climate initiatives to show and track their contribution to tackling climate change (CDP, 2021).

In order to assess opportunities for improvement of GHG inventory elaboration through the support of atmospheric observations, ICLEI has conducted an analysis on a set of GHG inventories, with the aim to identify issues that local and regional governments face in terms of data availability and quality. For this, a list of cities that reported relevant data in 2020 was selected based on the ambition of their climate commitments and their involvement in climate initiatives. The sample was taken in order to assess a defined number of cities, which means that the outcomes of the analysis do not necessarily represent the reality of all reporting entities (e.g., regarding the existence of the described issues, or lack of others), and instead the authors intend to illustrate some of the issues encountered during the current reporting

Introduction: The inventories selected for analysis were reported to the CDP-ICLEI Unified Reporting System[2] by cities with a population between 11,917 and 8,908,081 inhabitants, located across various regions in Europe, North and Latin America, Asia, Africa, and Oceania. Most of the inventories represent the city administration boundary, although in some cases the inventories covered a province, a region or a metropolitan area. Most cities reported according to the Common Reporting Framework (CRF), as per the guidelines of the Global Covenant of Mayors for Climate and Energy, very often having developed their inventories in the first place according to methods such as the Global Protocol for Community Greenhouse Gas Emissions Inventories (GPC), ICLEI's U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions, the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, and city or country specific methods.

Insights on completeness: The most widely used protocols require that cities report GHG i) emissions from sources located within the city boundary (also known as Scope 1), ii) emissions occurring as a consequence of the use of grid-supplied electricity, heat, steam and/or cooling within the city boundary (also known as Scope 2), and iii) emissions occurring outside the city boundary as a result

[1] (ICLEI, 2021)
[2] Data was collected in partnership by CDP and ICLEI - Local Governments for Sustainability (2020)

of city-induced activities (also known as Scope 3)[3]. The emissions are required for various sectors, namely Stationary Energy, Transport, Waste, Agriculture, Forestry and Land Use (AFOLU), and Industrial Processes and Product Use (IPPU) (Global Covenant of Mayors for Climate and Energy, 2019; C40 Cities, ICLEI, WRI, 2014). From the cities that reported under the guidelines of the CRF, **80%** provided values for total **Scope 1 emissions** (excluding energy generation), **67%** for **total Scope 2 emissions**, while only **36%** of cities reported **total Scope 3 emissions**. However, **97%** of cities reported data on Scope 1 emissions from the **stationary energy** and/or the **transport sectors**, even when they did not report totals. Similarly, for **waste**, **94%** of cities reported their total Scope 1 and/or Scope 3 emissions. Only **30%** of cities provided emissions for **AFOLU** and **IPPU** (Scope 1 emissions required). It must be noted that under the current reporting frameworks, these two sectors are optional to report.

Insights on data availability and quality: The following sections present some of the issues reported for ***Scope 1*** emissions, because of their relevance to atmospheric observations capabilities, which can provide access to emissions data on a territorial basis. In general, for all sectors, cities reported all three levels of data quality in their data quality assessment including "Detailed activity data" (high), "Modeled activity data using robust assumptions (medium), and "Highly-modeled or uncertain activity data" (low)[4]. Similarly, cities gathered data to calculate emissions from national, regional, and local institutions of energy, statistics, and environment as well as from service providers, the industry and the academia.

Stationary energy: Emissions from the stationary energy sector as reported represented between 3% and 87% of all Scope 1 emissions (excluding energy generation). Among the encountered issues to calculate emissions was the lack of data on the distribution of fuel consumption between the **residential, commercial and institutional** sub-sectors. The lack of local data disaggregated for specific activities, such as from fuel consumption of boilers in residential and institutional buildings, was also mentioned. In these cases, cities scaled down regional data with population factors corresponding to their locality. Similarly, for the **manufacturing and industries** sub-sector, there has been reported a lack of data on certain fuels used by the industrial sector (diesel oil, natural gas, coal, kerosene, among others). In these cases, cities opted to scale down higher level data with industrial GDP or to project emissions data from previous years. Lastly, cities reported sometimes not having access to data on **fugitive emissions** from mining, processing, storage, and transportation of coal, as this would be data that is usually lying in national institutions, and that in some locations require special requests to be accessed.

Transport: The transport sector represented between 12% and 92% of Scope 1 emissions (excluding energy generation). In order to report emissions from this sector, cities used most of the time the "fuel sales" approach. This method looks at the total fuel sold within the city boundary and treats it as proxy for transportation activity. The data are obtained from fuel dispensing facilities, distributors or tax receipts, then the data is scaled down and multiplied by its GHG emissions factors (C40 Cities, ICLEI, WRI, 2014). Cities using this method reported having access to activity data on fuel

[3] (C40 Cities, ICLEI, WRI, 2014)
[4] (C40 Cities, ICLEI, WRI, 2014)

consumption from national, regional and local institutions with high and medium quality-level or a combination of the two. Fewer cities reported having used the "Geographic" or "Territorial" approach to calculate their emissions. This method looks into the transport emissions that occur within the city boundary regardless of the trip's origin or destination (C40 Cities, ICLEI, WRI, 2014). The cities that reported using this method assessed their data quality as high or medium. Lastly, the "city-induced activity" method looks into transport emissions induced by the city, by assessing the trips that begin, end, or are fully contained within the city. To estimate these emissions, the method uses models or surveys that assess all transboundary and in-boundary trips, yielding vehicle kilometers travelled per vehicle class, with information on vehicle fuel intensity (or efficiency) and fuel emission factors (C40 Cities, ICLEI, WRI, 2014). Cities that used this method assessed their data quality as high, medium and low.

Some of the issues reported for the **on-road** sub-sector are related to the lack of disaggregated data at the local level and the distribution of fuel consumption in relation to other sub-sectors. For the first, cities scaled down regional data with local population data from the municipality. For the second, cities estimated the proportion of fuel consumption for each sub-sector with data from previous years, while others included all of the emissions in one sub-sector. Similarly, the lack of data on specific fuels or activities, such as from freight transportation or from residents' work-related trips, was highlighted. This shortage impacted the cities using the *city-induced* method and was reported also for the railway sub-sector, in these cases cities projected activity data with e.g. work and residents' information.

In the **railway** sub-sector some cities using the *fuel sales* method did not have access to disaggregated data on fuel consumption, specifically for the railway, and opted to project it by using rates of growth of the locomotive sector at the state level; others included the emissions in the on-road sub-sector. Also, cities often reported their inability to disaggregate data on railway fuel consumption corresponding to the city boundary, which impacted cities using the *territorial* approach. In these cases, some cities scaled down national data on emissions from the railway sector with local population factors, while others modelled local emissions with regional data apportioned to municipal boundaries using length of lines and distance of travel.

For the **waterborne navigation** sub-sector, cities reported emissions, being aware of activities taking place that could not be accounted for, from, for example, private tourism and cargo ships. Some cities reported waterborne emissions as included in the on-road sector (as the data was not disaggregated for this sub-sector). For **aviation**, it was highlighted the need to make available data at the local level on public and private aircrafts, as some cities were not able to gather updated data. In such cases, cities projected older data on emissions to the year of the inventory. For both these sub-sectors, cities sometimes considered that these emissions were insignificant but did not have data to be reported. For the **off-road** sub-sector, cities often were not being able to disaggregate the data and instead this was included under other sub-sectors such as the on-road.

Waste: The emissions from this sector represented up to 22% of total Scope 1 emissions (excluding energy generation). Cities also assessed their data quality for this sector as high and medium, but many more cities reported low quality data in comparison to the stationary energy and

transport sectors (this comparison is limited by the fact that that this information was not always reported). The data to calculate emissions was gathered mostly from entities at the local level, although some cities reported using data from regional and national institutions. In regard to the **solid waste treatment** sub-sectors, cities reported a lack of data on various aspects such as data about the composition of the waste, share of waste disposed in landfills, and the characteristics of the landfills to which the waste was sent (e.g., to estimate the fraction of methane recovered). The latter was related to the waste transportation management, which was private sometimes and did not disclose/contain that information. To cover existing data gaps, cities used regional and national data on waste generation per capita, scaled down with local population factors. This was also reported for the case of solid waste biologically treated where direct emissions data was not available. Some cities did not calculate the emissions for these sub-sectors due to the lack of data. Very often cities reported the use of emission factors as per the national average. Similarly, for the **wastewater treatment** sub-sectors, cities often lacked local data about domestic and industrial wastewater treatment and resorted on data on emissions from these sectors from the national GHG inventory, scaling it down with data on local population, generation by industry type, and treatment types. Some cities mentioned not being in charge of wastewater treatment and therefore not having access to the related data.

AFOLU: Most of the values reported for the AFOLU sector represented 7% or less of total Scope 1 emissions (excluding energy generation), with the exception of two cities for which the AFOLU sector represented 25% and 17% of Scope 1 emissions respectively. For the **livestock** sub-sector, cities reported issues to access local data on livestock management, including feeding and manure. In some cases, cities used data from different years, while in others methane and nitrous oxide were estimated by combining high-resolution agricultural statistics from the local level with land cover data, agricultural practice information, and corresponding emission factors. Another approach was to use the national data on the emissions for the sector and scale it down with the number of existing animals locally. These approaches were also used for the **land** sub-sector where cities either used data from different years or scaled down national emissions with information on local land use changes, and other data, as available. Lastly, for the sub-sector of **aggregate sources** cities scaled down national carbon dioxide emissions from liming and urea application, and nitrous oxide emissions from soil management, with local data on the ratios of the city's cropland and grassland to national areas. Some cities did not estimate the emissions from the AFOLU sector due to lack of data.

IPPU: Although most of the reported values represented less than 5% of Scope 1 total emissions (excluding energy generation), there were three cities that reported values that represented 12%, 29% and 43% of total Scope 1 emissions cities. Among the few cities that provided emissions corresponding to this sector, it was reported that cities resorted data from national databases and from surveys. Regarding the latter, cities highlighted that the certainty of these data is limited to that of the surveys. Likewise, it was noted that there is a lack of data or/and access to data on industrial processes and product use. In view of this, various cities opted for scaling down the data from the national or regional GHG inventories from this sector by using local population factors. Cities reported the need to make available city-level data from this sector, especially from the most relevant industries.

Conclusions: The following conclusions only reflect the issues identified by the cities assessed as part of this analysis and do not necessarily represent the issues of other cities and/or cities reporting in different annual cycles.

- Fuel consumption data is one of the most used sources for the calculation of GHG emissions from the stationary energy and transportation sectors; however, cities often report having difficulties to disaggregate the data at the required geographical, sectoral, and sub-sectoral levels as well as from specific activities.
- Cities very often resort on GHG emission inventories from the regional or the national level to account for their local emissions across all sectors.
- Cities have difficulties to access data which is generated and managed by private entities for the sectors of waste, transport and IPPU.

References

C40 Cities, ICLEI, WRI. (2014). Global Protocol for Community-Scale Greenhouse Gas Emission Inventories.

CDP. (2021). CDP. Retrieved September 2021, from Guidance for cities: https://www.cdp.net/en/guidance/guidance-for-cities

CDP, ICLEI. (2020). CDP-ICLEI Unified Reporting System.

Global Covenant of Mayors for Climate and Energy. (2019). Explanatory Note accompanying the Global Covenant of Mayors Common Reporting Framework.

ICLEI. (2021). ICLEI-Local Governments for Sustainability. Retrieved September 2021, from Global advocacy at ICLEI: https://www.iclei.org/en/Advocate.html