Paper 3

GHG PROTOCOL FOR CITIES

Translating the Global Protocol for Community-Scale Greenhouse Gas Emissions Inventories (GPC) for Public Transport Professionals

The GPC, the world's most widely-endorsed greenhouse gas (GHG) accounting and reporting standard for cities, enables local leaders to build more effective climate strategies and track the performance of actions already underway. In collaboration with the C40 Cities Climate Leadership Group, UITP has produced this guide which aims to introduce public transport professionals to the main elements of the methodology as they will play an important role in generating the data and even calculating and reporting city-wide transport GHG emissions under the GPC.

INTRODUCTION

Urban transport accounts for around 40% of emissions from the entire transport sector and are increasingly rapidly. That is why urban transport lies at the heart of the fight against climate change and the transition to a resource-efficient and low carbon urban economy.

As cities become more sustainable, the entire world will reap the rewards. At the UN Climate Summit in September 2014, a number of cities committed to using the GPC as the standard to measure their emissions, build more effective emissions reduction strategies, set measurable and more ambitious emission reduction goals, and to track their progress more accurately and comprehensively[1].

More cities are committing to use of the GPC and it is anticipated that by the end of 2015 around 2,000 cities around the world will pledge to use it and public transport authorities and operators will have an important role to play in contributing to their city's inventory. It is because of this UITP's Sustainable Development Commission in collaboration with the C40 Climate Leadership Group[2] has developed this guide to promote the understanding and use of the standard within the public transport sector as this reporting needs to be in place so that cities can strengthen their goals for efficient use of carbon for public and private transportation.

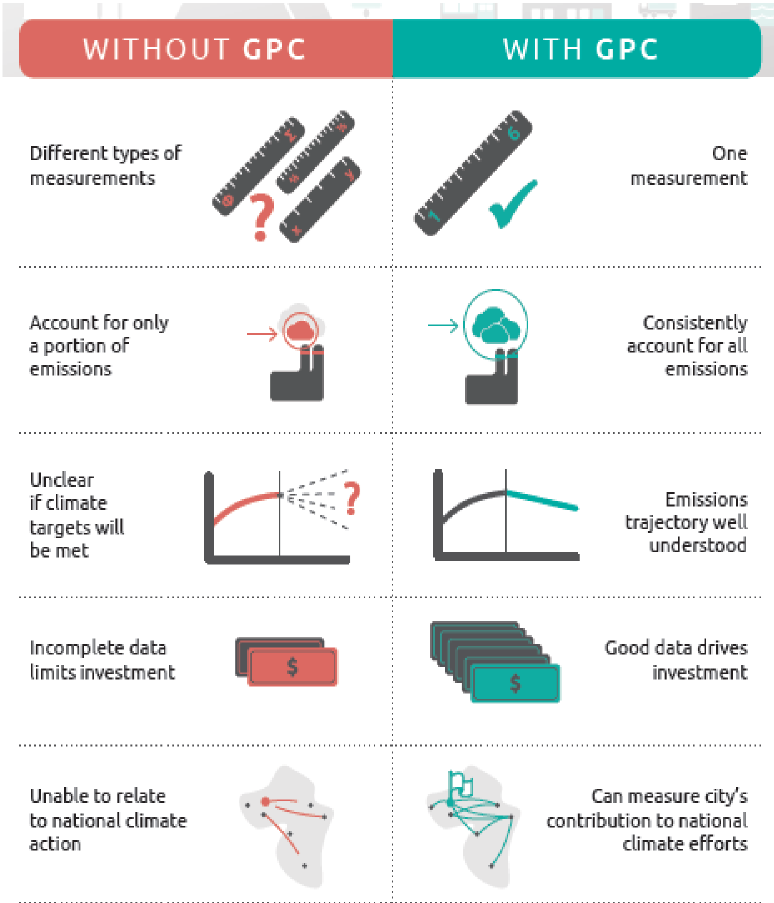
THE BENEFITS OF THE GPC

The GPC is designed to help cities develop a comprehensive and robust GHG inventory in order to support climate action planning. It empowers cities to accurately identify where their emissions are coming from, set credible and achievable reduction targets, and consistently track progress.

To date, cities have used a number of different methodologies to account their emissions and as a result, this inconsistency makes comparisons between cities and initiatives difficult. This is also true in the transport sector but by having a consistent approach to accounting urban transport emissions, it will help highlight the important role that public transport plays in tackling climate change, and facilitate insight and learning by enabling comparable data to be shared. Ultimately, by having a uniform approach to accurately accounting urban

[1] Compact of Mayors
[2] www.c40.org

transport emissions it should also help in gaining improved access to investment for those solutions, such as public transport, that helps drive overall emissions reductions, while still meeting growing demands for mobility.



ALIGNMENT WITH OTHER METHODOLOGIES

With the GPC, cities are required to measure and report a comprehensive inventory of GHG emissions following the same accounting principles established by the 2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories, highlighting the credibility of the GPC.

It should be noted that some cities will commit to using the GPC but may also be required to report in a different format if involved in other initiatives, such as the EU Covenant of Mayors (CoM). In this particular instance, if an organisation is able to report using the GPC methodology it is envisaged that the same organisation would be able to fulfil the criteria laid out for the EU CoM. Ultimately, it is hoped that regardless of the approached taken the result would be the same.

KEY FEATURES OF THE GPC

The GPC has two reporting levels, **BASIC and BASIC+**

- BASIC covers stationary energy, inter-city transport and waste
- BASIC+ additionally covers transboundary transport, industrial processes and product use (IPPU) and agriculture, forestry and land use (AFOLU)

Cities are required to account emissions from each sector using two distinct but complementary approaches: one which captures emissions from both production and consumption activities (i.e. the sources of the emissions); the other categorizes all emissions into "scopes," depending on where they physically occur. It should be noted that accounting transport emissions – notably from public transport sources – is a requirement of the GPC regardless what reporting level a city decides to follow. Public transport organisations will therefore be required to play an important role in feeding to a city's overall emissions GPC inventory. As such, knowledge and capacity on the GPC must be built in the public transport sector.

The following section outlines the main steps that would be taken in order to account transport emissions using the GPC to enable public transport organizations understand how and where they need to feed into the methodology in support of their cities.

DEFINING THE CITY BOUNDARY AND EMISSIONS SOURCES
A city's inventory boundary identifies the geographic area, time span, emissions and sources. The geographical boundary can cover the administrative boundary of a local government, a ward or borough within a city, a combination of administrative divisions, a metropolitan area, or another geographically identifiable entity. The boundary would typically be determined by the city authority but a public transport network could be used as an indicator as to where the city boundary starts and ends. The boundary will ultimately determine which public transport undertakings / modes are captured in the city's inventory

Emissions should be accounted over a continuous 12 month period covering city activities classified in six main sectors – stationary energy, transport, waste, IPPU, AFOLU and emissions outside of the city as a result of its activities (these may be reported separately).

Emissions sources in the six main sectors are then required to be broken down further into sub-sectors. For transport this includes:

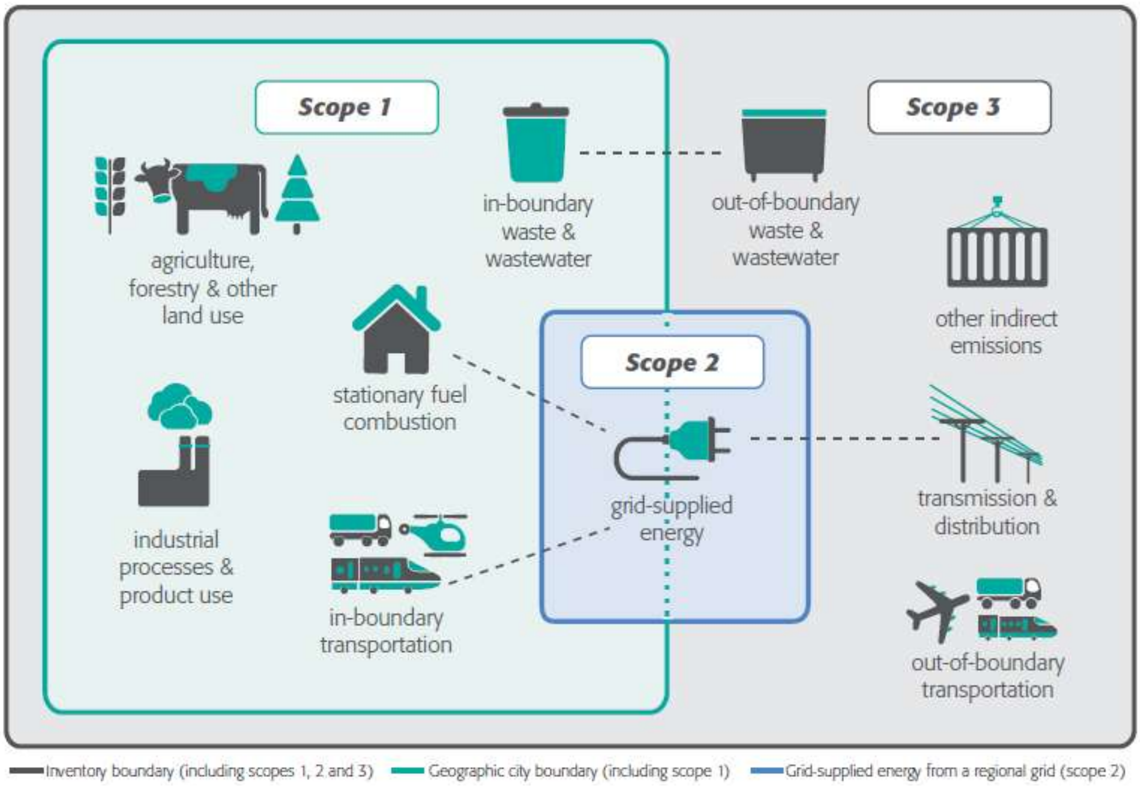
- **On-road transportation**, including electric and fuel-powered cars, taxis, buses, etc.
- **Railway**, including trams, urban railway subway systems, regional (inter-city) commuter rail transport, national rail system, and international rail systems, etc.
- **Water-borne transportation**, including sightseeing ferries, domestic inter-city vehicles, or international water–borne vehicles.
- **Aviation**, including helicopters, domestic inter-city flights, and international flights, etc.

CATEGORISING EMISSIONS
The GPC covers the six gases covered by the Kyoto Protocol and would therefore include emissions in addition to carbon dioxide (CO_2): Methane (CH4); Nitrous oxide (N2O); Hydrofluorocarbons (HFCs); Perfluorocarbons (PFCs); and Sulphur hexafluoride (SF6). These gases will need to be are categorised into three further categories based on where they occur. **Scope 1** emissions are from sources that occur physically within the city, i.e. the combustion of fuel from public and private transport. **Scope 2** emissions originate from emissions as a result of the use of grid-supplied electricity used for electrified transport modes. **Scope 3** emissions are those which occur outside of the city, for example aviation or inter-city rail journeys.

Transportation emissions accounting should include:

- **Inboundary journeys** – All people and freight transportation occurring within the city boundary.
- **Transboundary journeys –** out-of-city portion of all trips that either originate or terminate within the city boundary. This includes large regional transit hubs (e.g., airports or seaports) serving the city, but located outside of the city boundary.

The figure below from the GPC outlines the relationship between scope and boundary of emissions. It is important to note that if cities decide on the BASIC level of reporting, they will need to report Scope 1 and 2 emissions. If they decide the BASIC+ standard, Scope 3 emissions will need to be included in the inventory, in addition to Scope 1 and 2 emissions.



Collecting accurate data for transportation activities, calculating emissions and allocating them 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.

The BASIC+ reporting level involves more challenging data collection and calculation processes and the following table below provides a snapshot of the reporting requirements for each level. It should be noted that data can be gathered from a variety of sources, but for public transport organisations most of the emissions will come from fuel burned in the vehicles themselves (scope 1).

TRANSPORTATION			
On-road	✓	✓	✓
Railways	✓	✓	✓
Waterborne navigation	✓	✓	✓
Aviation	✓	✓	✓
Off-road	✓	✓	

✓ Sources covered by the GPC

Sources required for BASIC reporting

+ Sources required for BASIC+ reporting

Sources required for territorial total but not for BASIC/BASIC+ reporting (*italics*)

Sources included in Other Scope 3

Non-applicable emissions

METHODOLOGIES FOR CALCULATING EMISSIONS

The GPC is not prescriptive in that it does not require specific methodologies to be used to produce emissions data, rather it specifies the principles and rules for compiling a city-wide GHG emissions inventory. For the transport sector, four approaches can be used:

- <u>Fuel sales method</u>

This method calculates on-road transportation emissions based on the total fuel sold within the city boundary. This approach treats sold fuel as a proxy for transportation activity. If a public transport organization has a comprehensive fuel management system or has details of the liters of fuel purchased through their accounts, it may be the case of simply providing this information to necessary body responsible for accounting the city emissions database.

- <u>City-induced method</u>

This method seeks to quantify transportation emissions *induced* by the city, including trips that begin, end, or are fully contained within the city (usually excluding pass-through trips). The method relies on models or surveys to assess the number and length of all on-road trips occurring – both transboundary and in-boundary only. This yields a vehicle kilometers traveled (VKT) figure for each identified vehicle class. It also requires information on vehicle fuel intensity (or efficiency) and fuel emission factors. Public transport energy data, models, travel data or surveys to assess the number and length of all trips occurring etc could be used in support of this method.

- <u>Geographic (or territorial) method</u>

This method quantifies emissions from transportation activity occurring solely within city boundaries, regardless of the trip's origin or destination. Some European traffic demand models quantify these emissions primarily for local air pollution estimates or traffic pricing. Although no out-of-boundary trips are assessed or quantified, additional surveys could be combined in order to report a portion of out-of-boundary transit. Again, for public transport modes, energy data, models, travel data or surveys (etc.) could be used.

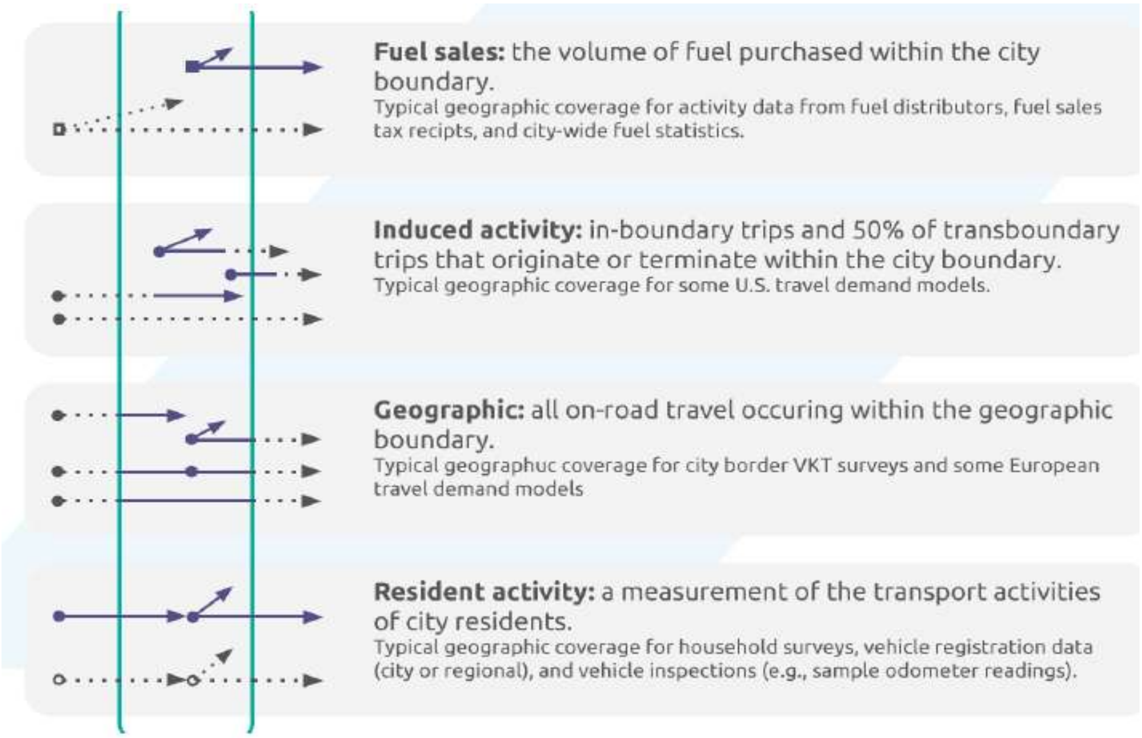
- <u>Resident activity method</u>

This method quantifies emissions from transportation activity undertaken by city residents only. It requires information on resident VKT, from vehicle registration records and surveys on resident travels. While these kinds of surveys may be more manageable and cost-effective than traffic models, their limitation to resident activity overlooks the impact of non-city resident traffic by commuters, tourists, logistics providers, and other travelers. Again, for public transport modes, passenger surveys could be used in support of this methods but this also has its limitations.

COMPARING THE METHODOLOGIES

The graph below provides a comparison between the four methodologies. The bold arrows signify emissions that should be accounted with dotted arrows signifying emissions that can be left out. Depending on which approach taken, cities should use a consistent approach to their inventory. The following table outlines some of the advantages and disadvantages of the different approached that can be taken.

The GPC does not require external verification of data but it can be done through a third party, for example. Alternatively, it can be self-certified and should be done in a consistent and transparent manner.



Methodology	Advantages	Disadvantages
Fuel sales	• More consistent with national inventory practices • Well-suited to aggregation with other city's transportation inventories if all fuel sold in-boundary is classified as scope 1 • Less costly and time-consuming to conduct • Does not require high level of technical capacity	• Does not capture all on-road travel, as vehicles may be fueled at locations outside city • Does not disaggregate the reasons for travel emissions, e.g. origin, destination, vehicle efficiency changes, modal shift • Does not demonstrate mitigation potential • Does not allow for allocating emissions by scope (w/o additional steps)
VKT and model-based (induced activity, territorial, resident activity)	• Can produce detailed and more actionable data for transportation planning • Integrates better with existing city transport models and planning processes	• More expensive, time consuming, and less comparable between cities due to variation in models used

CALCULATING PUBLIC TRANSPORT OPERATIONAL EMISSIONS

Rather than calculating emissions themselves, the city authority may require a public transport organisation to report to them the emissions associated with transport operations / modes over the course of the reporting year. If this is the case, like cities, the issue of boundary becomes relevant at the organisational level when determining its operational / modal emissions.

The 'control approach' is often recommended as a means of attributing emissions associated with their public transport modes. This can be determined by a number of factors, but the 'financial control' approach is typically used. That is wherein a company (i.e. its management) has control over both the company's financial decisions and public transport operating practices. Parent companies taking 'operational control' of subcontractors are common in the transport sector. Subcontractors may simply provide vehicles and drivers – so it will be important that the public transport operator / authority works closely with a subcontractor when defining the boundary of its operational / modal emissions. While there is no right answer the judgement to report emissions data the approach outlined above will help.

Typically, public transport modal emissions (e.g. buses, taxis etc) will be scope 1 emissions and at the basic level, calculating these emissions does not have to be complicated as fuels contain carbon which is released as carbon dioxide when burnt in an engine. It follows that if you know the quantity of fuel used, multiplied by its associated emissions factor you will be able to calculate the associated GHG emissions related to public transport operations / modes. The IPCC Emissions Factor Database contains global emission factors and other parameters with background documentation and technical references that can be used for estimating greenhouse gas emissions. Fuel use data may be easily accessible but if no direct record of the amount of fuels purchased or used, the next best thing to do is estimate fuel use from other information.

Calculating emissions from electrified modes of transport (e.g. rail based) would follow the same simple methodology used to calculate emissions from fuel use: namely the quantity of energy used for operations (e.g. KwH) multiplied by its associated emissions factor. As outlined above, the emissions from electrified transport fall under scope 2 emissions and originate from emissions as a result of the use of grid-supplied electricity. Energy use data can be provided by the electricity provider, for instance through billing information.

It should be noted that national guidance on accounting grid renewable energy varies. For instance, some country guidance on carbon reporting states that all purchased renewable electricity supplied via the national grid should be accounted by using the grid average and not attributed either a lower or zero-carbon emission factor, contrary to what is allowed in some other countries. This position has been explained with reference to a number of fairness, transparency, ownership, additionality and double counting principles. Public transport organisations should therefore consult their city authority / national guidance when accounting emissions associated with grid renewable energy.

TRACKING PROGRESS AND SETTING GOALS

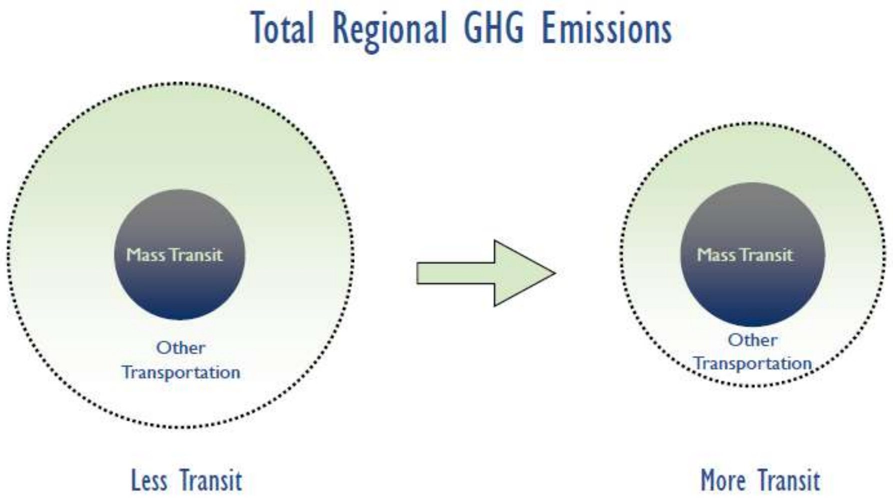
Being able to measure emissions allows for their management and can form the basis for goals and targets as well as tracking performance over time. By setting a base year and targeting an absolute or specific reduction (e.g. GHG per capita), cities can track performance overtime and effectively plan for the future.

At the organisation level, targets to reduce public transport operational emissions can complement those set at the city level. This may be in absolute terms or setting a normalised target which tracks the carbon intensity of transport operations. In the public transport sector this normalising factor is often done through passenger kilometres. Setting intensity goals is a common approach because they hedge against rising emissions through business growth.

However, reducing intensity does not guarantee the absolute GHG reductions, especially from public transport operations, especially as demand for mobility increases in cities. In fact, it may be necessary for absolute emissions in some sectors/sub-sectors to go up, if overall city emissions are to go down.

DELIVERING CITY GOALS - PUBLIC TRANSPORT'S ROLE

Public transport's carbon footprint has an inverse relationship to the global carbon footprint (see graph below). This means that a city's GHG emissions will go down if public transport's footprint increases – this is because for every additional tonne due to more public transport can deliver a reduction of up to 7 tonnes of wider CO_2.



Source: T. Papandreou, LA Metro

This can be explained by the fact that public transport's GHG emissions can be broken down into two categories: GHG emitted directly or indirectly by public transport operation, and GHG emissions avoided in the region as a result of its operations. The net of carbon that is avoided is a result of:

- Mode Shift - Avoided car trips through more use of public transport. On a per passenger-kilometre basis, emissions from single occupancy vehicles are on average four times higher than the per-passenger kilometre emissions of public transport and these figures are even higher during peak times
- Land Use - Infrastructure and urban form are strongly linked to climate mitigation. As urban areas become denser and rely more on public transport, walking and cycling - CO_2 emissions are reduced.
- Congestion Relief - Reduced fossil fuel emissions as a result of reduced congestion.

According to the new study which looked at a high shift scenario to public transport, more than USD$100 trillion in cumulative public and private spending could be saved, and 1,700 megatons of annual CO_2 — a 40% reduction of urban passenger transport emissions —could be eliminated by 2050 if the world expands public transportation, walking and cycling in cities[3].

[3] A Global High Shift Scenario: Impacts and Potential For More Public Transport, Walking, and Cycling With Lower Car Use (November 2014) By Michael A. Replogle, Institute for Transportation and Development Policy & Lewis M. Fulton,

CONCLUSION
While the GPC will not be able to account the full climate benefits of public transport it will help cities strengthen their goals for efficient use of carbon for public and private transportation. Overtime, shifting to public transport will result in emissions reductions being reported at the city level, demonstrating the mitigation potential of public transport enabling the replication of climate solutions. The case study below is a good illustration of this and the value of accounting emissions to target climate action with public transport.

Rio de Janeiro, Brazil, conducted GHG inventories for 2005 and 2012 as part of the GPC pilot program. By using the standard, the city figured out that transport and waste were the biggest contributors to its overall emissions – at 39% and 19% respectively, and that targeting emissions reductions in these sectors would help meet its overall 20% city target. As such, the city has been able to focus its efforts and implemented a series of low-carbon transport initiatives (outlined below), waste management, forestry, and energy efficiency projects. So far, these actions have avoided 378,000 tons of CO_2 emissions but the benefits will be even greater in the years to come thanks to public transport.

For every tonne produced by Rio Metro, Brazil, it helps avoid around 5-7.4 tonnes of CO_2 in the wider region and these gains will continue as the public transport network expands. The city will also have four BRT corridors with a total of 150 km and 165 stations. The Transbrasil line is expected to cater for approximately 500,000 passengers per day and the Transoeste's line is estimated to bring savings of 107,000 tonnes of CO_2 per year.

UITP would like to thank the C40 Cities Climate Leadership Group (www.C40.org) whose material forms the basis of this UITP guide.

Further information on the GCP can be found at the following link, or alternatively please contact UITP's Sustainable Development Manager at: philip.turner@uitp.org

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

University of California, Davis https://www.itdp.org/wp-content/uploads/2014/09/A-Global-High-Shift-Scenario_V2_WEB.pdf