

SYNTHESIS REPORT

Cities Footprint Project
La Paz - Quito - Lima





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With the support of:



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CITIES AND CLIMATE CHANGE

The majority of the world population currently lives in cities. Cities are where the majority of commercial and industrial activity occurs and they offer the opportunity to create wealth and wellbeing for a global society. Equally, they are centres that require vast quantities of resources, and that consequently contribute significantly to climate change and generate great pressure on the environment. Additionally, the impacts of climate change are threatening the way of life of the citizens of the world with increasing frequency and intensity.

More than 50% of the world population lives in urban areas

Even though cities only occupy 2% of the land mass of the planet, they produce around 70% of global greenhouse gas emissions

The GHG emissions generated in cities contribute significantly to climate change

Cities put great pressure on natural resources, which can lead to increasing urban and peri-urban poverty levels

Urban populations use around 75% of the natural resources of the planet

As a region, Latin America and the Caribbean has the highest urbanisation rate in the world, going from 41% in 1950 to more than 81% in 2012



SOLUTIONS

Cities play an important role in solving many worldwide problems, for example by improving energy efficiency in the transport and construction sectors, as well as in water supply systems and solid waste disposal. Cities should orientate their growth towards low carbon and climate resilient development.

Growth towards low carbon and climate resilient development

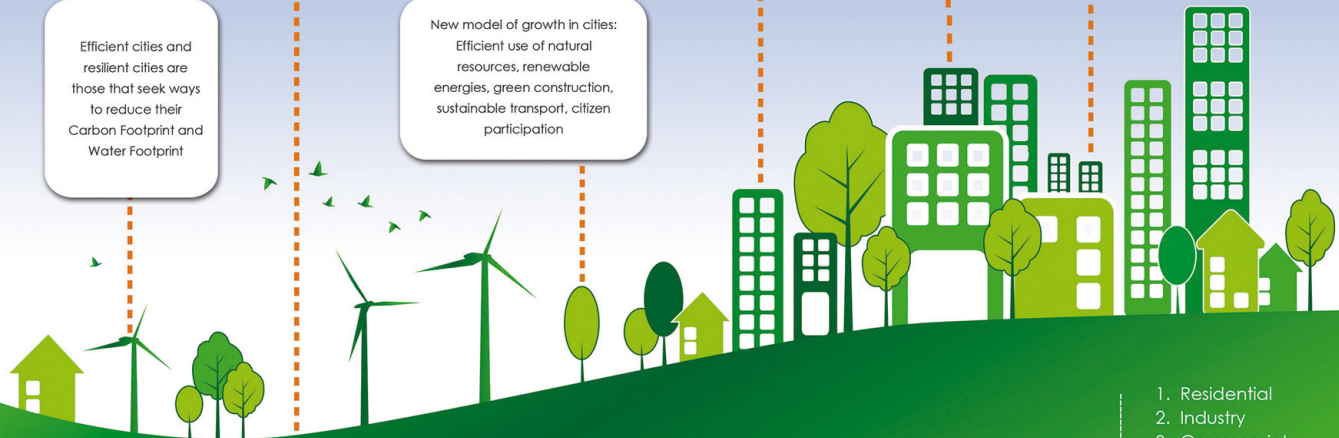
Challenges such as climate change or efficient water management should be treated by intelligent cities as a basis for designing solutions that make the urban metabolism sustainable

Greater access to information on the use of resources enables improvement actions to be identified

The objective of an intelligent city is to combine environmental protection, energy efficiency and economic profitability into the urban model

Efficient cities and resilient cities are those that seek ways to reduce their Carbon Footprint and Water Footprint

New model of growth in cities:
Efficient use of natural resources, renewable energies, green construction, sustainable transport, citizen participation



SECTORS

1. Residential
2. Industry
3. Commercial
4. Public sector
5. Transport
6. Waste

CITIES FOOTPRINT PROJECT

The City Footprint Project arose in the context of the vulnerability of the Andean cities with respect to the effects of climate change, and hence the demand for short term actions to enable them to adapt to these impacts and increase their resilience, as well as the need to orientate their growth towards sustainability and low carbon development.

Specifically, the City Footprint Project seeks to incorporate environmental planning and management tools into the activities of municipal governments, as well as the private sector and citizens in general, giving them access to technical and methodological tools that aid in the identification, prioritisation and development of actions that contribute to adaptation to climate change and the reduction of the Carbon Footprint and Water Footprint.



CITIES FOOTPRINT PROJECT

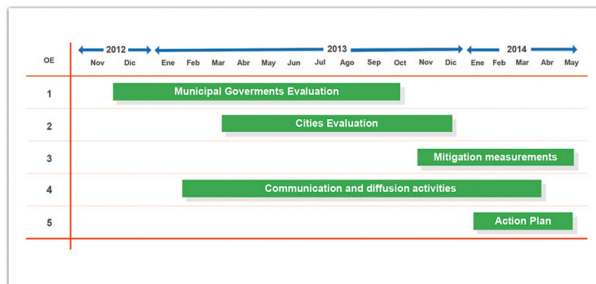
By evaluating the Carbon Footprint and Water Footprint of the municipal governments and cities, the City Footprint Project seeks the following objectives:

- Create a verifiable, solid and transparent technical base that enables the municipal governments to identify and implement actions that aim to reduce the contribution of the city's activities to climate change, through energy efficiency, use of renewable energies and better water management, amongst others.
- Measure and improve the environmental performance of the municipal governments through progressive measurements of their footprints, taking this first measurement as the baseline for these efforts, in order to subsequently promote improvements in the environmental performance in other city sectors (residential, transport, industrial, etc.).
- Define Carbon Footprint and Water Footprint reduction goals for the municipal governments and cities in the short, medium and long term.
- Reduce the operational costs of the activities and public services of the municipal governments in each city.
- Contribute to the process of raising awareness amongst public servants and the general public about the adequate use of resources such as energy and water, translating this awareness into concrete actions and attitudes that encourage better resource management.
- Create indicators that enable comparison between the environmental performance of the municipal governments and cities with other institutions and cities in the region and in the world.
- Promote the leadership of the municipal governments in the fight against climate change, legitimising their discourse so as to be able to demand that citizens and other city sectors join in measuring and managing their footprints.

- Draw up municipal Action Plans oriented towards the reduction of the footprints, including a portfolio of projects, funding sources and the necessary institutional arrangements for the implementation of the plans.
- Implement demonstrative pilot actions that have the potential to be replicated and scaled up to amplify their contributions to reducing the footprints.

Stages of the Project

1. Evaluation of the Carbon Footprint and Water Footprint of the municipal governments and promotion of actions to reduce both footprints on the basis of the results.
2. Evaluation of the Carbon Footprint and Water Footprint of the cities, using international methodologies adapted to local conditions.
3. Promotion/facilitation of emissions reduction and water management actions at municipal level.
4. Facilitation of knowledge exchange between municipal governments, private sector, universities, research centres, NGOs, financial institutions and civil society.
5. Action Plans for each city to amplify the effects and ensure the sustainability of the project.



CARBON FOOTPRINT DEFINITIONS

The Carbon Footprint, also known as the greenhouse gas (GHG) emissions inventory, is a quantitative indicator that reflects the impact of people, organisations, products, events, territories, etc. on climate change. The Carbon Footprint measures the quantity of GHGs emitted into the atmosphere by human activities in a determined time period.

- **Scope 1. Direct GHG emissions:** Emissions sources that are owned by or controlled by the organisation. Reporting scope 1 emissions is obligatory according to the NB-ISO 14064.
- **Scope 2. Indirect GHG emissions from energy:** Indirect GHG emissions that occur as a result of electricity generated externally but consumed by the organisation. Reporting scope 2 emissions is also obligatory according to the NB-ISO 14064.
- **Scope 3. Other indirect GHG emissions:** Indirect GHG emissions that occur as a result of the organisation's activities but are emitted by sources that the organisation does not control. Reporting scope 3 emissions is voluntary according to the NB-ISO 14064.

Emission sources

	Emission sources
Scope 1	Petrol consumption (mobile combustion)
	Diesel consumption (mobile combustion)
	Compressed Natural Gas (CNG) consumption (mobile combustion)
Scope 2	Liquid Petroleum gas (LPG) consumption (stationary combustion)
	Electricity consumption
Scope 3	Consumption of products and materials
	Civil works and construction
	Solid waste generation
	Air travel
	Public transport



Methodologies used to calculate the Carbon Footprint

The methodologies used to calculate the carbon footprint at municipal government level are:

- **ISO 14064-1: 2006** "Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals"
- **MC3** (Compound Method based on Financial Accounts) by Carbonfeel¹

The methodology used for the Carbon Footprint calculations at city level is the Global Protocol for Community-Scale Greenhouse Gas Emissions (GPC), developed at its basic level by ICLEI, WRI, C40, World Bank, UN-Habitat and UNEP. Its levels are as follows:

- **Basic GPC:** Scope 1 and 2 emissions from the following categories are included: stationary units, mobile units, waste, industrial processes and use of products.
- **Basic+ GPC:** All the emissions sources of the Basic GPC plus the emissions generated by land use, land use change and forestry (LULUCF) and scope 3 emissions from mobile units (transport between cities).
- **Extended GPC:** Includes all direct and indirect emissions, as well as emissions generated outside the limits as a result of the exchange/use/consumption of goods and services.

¹ Especially to estimate emissions from consumption of materials

WATER FOOTPRINT DEFINITIONS

The Water Footprint (WF) is a multidimensional indicator of the appropriation (use, consumption and contamination) of fresh water resources, that contemplates two dimensions, direct and indirect, and three types of water: Blue, Green and Grey. Direct use refers to the direct use of water by a consumer or producer, whereas indirect use refers to the volume of water – sometimes known as virtual water – in the whole production chain of a good or service.

	DIRECT USE	INDIRECT USE
WATER CONSUMPTION	Blue Water Footprint	Blue Water Footprint
	Green Water Footprint	Green Water Footprint
WATER CONTAMINATION	Grey Water Footprint	Grey Water Footprint

Source: Hoekstra et al. (2011)

Blue WF: is an indicator of the consumptive use of blue water, that is to say surface or underground fresh water. The consumptive use of water refers to one of the following cases, where the water:

- Evaporates;
- Is incorporated into a product;
- Does not return to the same flow zone, for example if it is returned to a different catchment area or the sea;
- Does not return in the same period, usually taken as one year.

Green WF: Refers to the volume of precipitation water that does not run off or accumulate in underground water, but rather remains in the soil, land surface or vegetation. This volume of water is evaporated or evapotranspired by the vegetation. Green water can be used for growing crops. This footprint is particularly relevant for agricultural or forestry products.

Grey WF: Refers to the quantity of fresh water that an ecosystem needs to assimilate a determined load of contaminants. It quantifies the volume of water that is required to assimilate the contaminants to a level at which the water quality remains above or at the same level as the environmental water quality standard set by local water quality laws.

Methodology used to calculate the Water Footprint

The methodology used to calculate the Water Footprint, both at municipal government and city levels, is that set out in the Water Footprint Evaluation Manual of the Water Footprint Network. Specifically, for the municipal governments, the Water Footprint of a Group of Consumers approach was used, and for the cities the Water Footprint of a geographically delineated area approach was applied, together with the group of consumers approach for certain sectors such as the industrial sector.



The quality parameters used for the municipal government and city Water Footprint calculations were Biochemical Oxygen Demand (BOD5) and Chemical Oxygen Demand (COD).

The reference quality standards taken for La Paz and Quito were Class "D" (BOD5 = 30 mg/l and COD = 60 mg/l) of the Water Contamination Regulations of the Bolivian Environment Law, the corresponding local rules for La Paz. For Quito, the water contamination rules and regulations of the Ecuadorian Environment Law do not establish a concentration limit for BOD5 and COD for non-drinking water use. For Lima, the grey Water Footprint calculation was done on the basis of the maximum concentration for receptor water bodies, set at 15 mg/l for BOD5 and 40 mg/l for COD according to the National Environmental Quality Standards for Water⁵.

⁵ This class of water is "apt for direct contact recreation (swimming, ski, immersion), for aquaculture of species destined for human consumption, drinking water for humans following complete physical-chemical treatment, for industrial supply or for drinking water for animals. It is not apt for irrigation of vegetables eaten raw or thin-skinned fruit that are eaten raw without removing the skin".

⁶ Supreme Decree 002-2008 MINAM, Annex 1, Category 3: Vegetable Irrigation and Drinking Water for Animals

CITIES

The City Footprint Project has focused its efforts on the 3 Andean cities of La Paz (Bolivia), Quito (Ecuador) and Lima (Peru), due to their vulnerability to climate change, especially with regard to water resources. In these three cities there was also a favourable context for the implementation of the project, given that all three already had a significant basis of climate change mitigation and adaptation strategies (plans, policies, programmes and projects). The project is being carried out in these three cities following official requests from the mayors of each cities being received by the project funders, asking for technical support for the evaluation of their Carbon Footprints and Water Footprints and for translating them into climate change strategies.





La Paz



Lima



Quito

Climate change strategies

1. Plan 2040, Sustainable La Paz Strategic Theme.
2. La Paz Municipality Environmental Action Plan.
3. Municipal Integrated Solid Water Management Programme.
4. Autonomous Municipal Law 001/2010: Contribution to Environmental Protection.

1. Metropolitan Climate Change Strategy.
 - 1.1. Ecological Infrastructure and Ecological Urbanism
 - 1.2. Land Use Management and Territorial Planning
 - 1.3. Urban Agriculture and Food Security
 - 1.4. Climate Risk Management
 - 1.5. River basin management and water conservation
2. Climate Change Adaptation Action Plan
 - 2.1. GHG Inventory.
 - 2.2. Ecoefficiency.
 - 2.3. Carbon Market Projects.
 - 2.4. Sector Specific Mitigation Actions (NAMA).

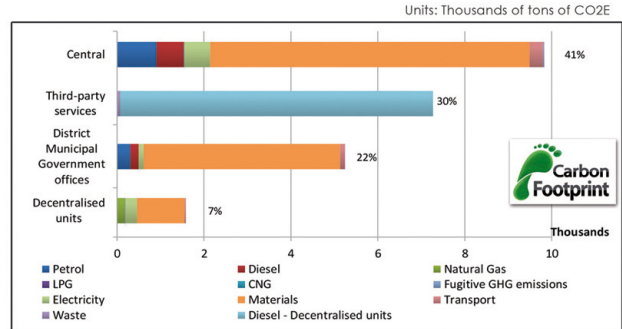
1. Quito Climate Pact.
2. 10 Actions of Quito facing Climate Change.
3. Quito Climate Action Plan (2012-2016).
4. Quito Environmental Agenda 2011-2016.

CARBON FOOTPRINT RESULTS

Municipal Governments

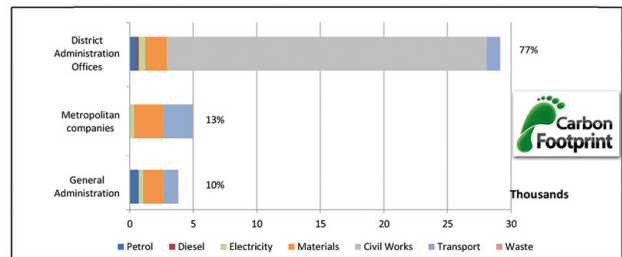
Autonomous Municipal Government of La Paz

Carbon Footprint: 23,913 ton CO₂e.
 Scope 1 emissions: 9% of the total footprint.
 Scope 2 emissions: 4% of the total footprint.
 Scope 3 emissions: 87% of the total footprint.
 Equivalence: Similar to the quantity of emissions generated by the electricity consumption of more than 17,000 Bolivian homes in a year.
 Main contribution by level: Administrative buildings and central municipal units (41%) and the ECLA Company (30%).
 Main contribution by emission source: Consumption of materials (54%) and diesel consumption of the ECLA company (30%).



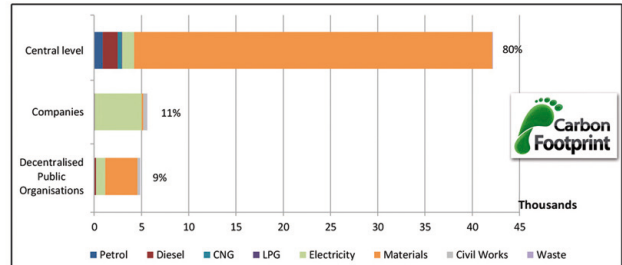
Municipality of the Metropolitan District of Quito

Carbon Footprint: 37,995 ton CO₂e.
 Scope 1 emissions: 19% of the total footprint.
 Scope 2 emissions: 8% of the total footprint.
 Scope 3 emissions: 73% of the total footprint.
 Equivalence: Similar to the quantity of emissions generated by the electricity consumption of more than 42,000 urban homes in Ecuador in a year.
 Main contribution by level: District administration offices (77%).
 Main contribution by emission source: Civil works construction (66%).



Metropolitan Municipality of Lima

Carbon Footprint: 52,637 ton CO₂e.
 Scope 1 emissions: 6% of the total footprint.
 Scope 2 emissions: 14% of the total footprint.
 Scope 3 emissions: 80% of the total footprint.
 Equivalence: Similar to the quantity of emissions generated by the electricity consumption of more than 120,000 urban homes in Peru in a year.
 Main contribution by level: Central level (80%).
 Main contribution by emission source: Materials (79%).

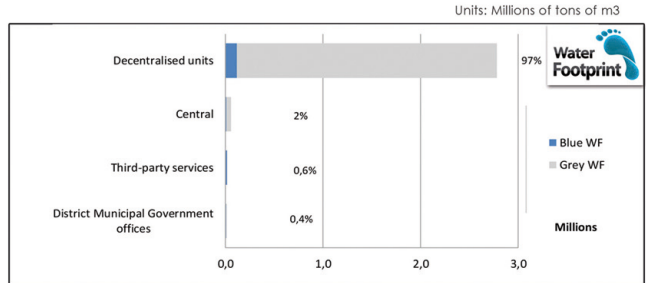


WATER FOOTPRINT RESULTS

Municipal Governments

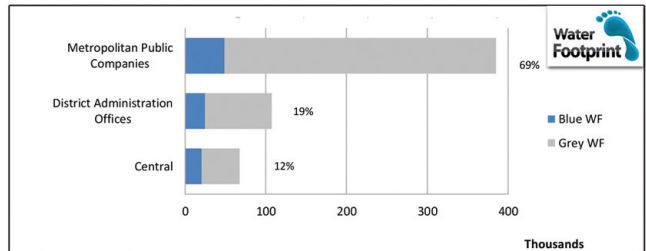
Autonomous Municipal Government of La Paz

Total Water Footprint: 2,867,621 m³
 Blue WF: 5%
 Grey WF: 95%
 Equivalence: the yearly water consumption of 112,000 inhabitants.
 Main contribution by level: Decentralised units: 97%



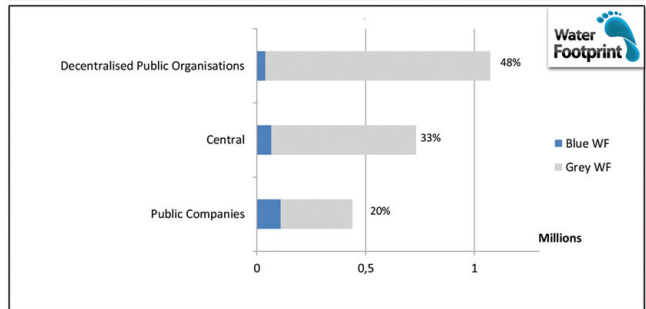
Municipality of the Metropolitan District of Quito

Total Water Footprint: 559,912 m³
 Blue WF: 17%
 Grey WF: 83%
 Equivalence: the yearly water consumption of 12,000 inhabitants.
 Main contribution by level: Metropolitan Public Companies: 69%



Metropolitan Municipality of Lima

Total Water Footprint: 2,247,127 m³
 Blue WF: 10%
 Grey WF: 90%
 Equivalence: the yearly water consumption of 47,000 inhabitants.
 Main contribution by level: Decentralised Public Organisations: 48%



CARBON FOOTPRINT RESULTS

Cities

La Paz

Carbon Footprint: 1,427 MM ton CO2e (millions of tonnes)

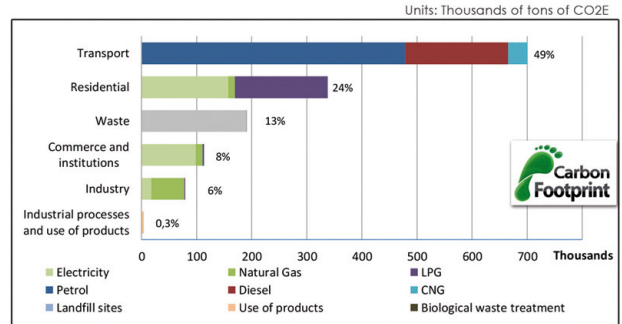
Scope 1 emissions: 81% of the total footprint.

Scope 2 emissions: 19% of the total footprint.

Equivalence: Approximately 14% of the total GHG emissions of Bolivia excluding land use and land use change.

Main contribution by sector: Transport (49%) and Residential (24%)

Main contribution by emission source: Petrol consumption (34%) and electricity consumption (19%).



Quito

Carbon Footprint: 5,164 MM ton CO2e (millions of tonnes)

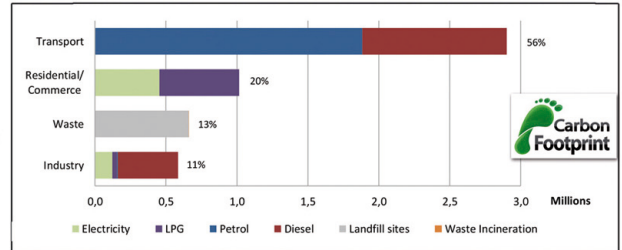
Scope 1 emissions: 89% of the total footprint.

Scope 2 emissions: 11% of the total footprint.

Equivalence: Equivalent to the CO2 emissions generated by the electricity use of more than 15 million urban homes in Ecuador in a year.

Main contribution by sector: Transport (56%)

Main contribution by emission source: Petrol consumption (36%)



Lima

Carbon Footprint: 15,432 MM ton CO2e (millions of tonnes)

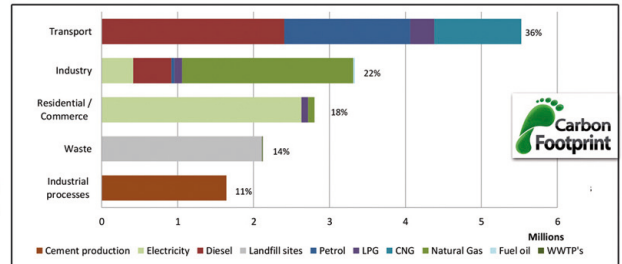
Scope 1 emissions: 80% of the total footprint.

Scope 2 emissions: 20% of the total footprint.

Equivalence: Equivalent to the CO2 emissions generated by the electricity use of more than 36 million urban homes in Lima in a year.

Main contribution by sector: Transport (36%)

Main contribution by emission source: Electricity consumption (17%).



WATER FOOTPRINT RESULTS

Cities

La Paz

Total Water Footprint: 208.489.287 m3

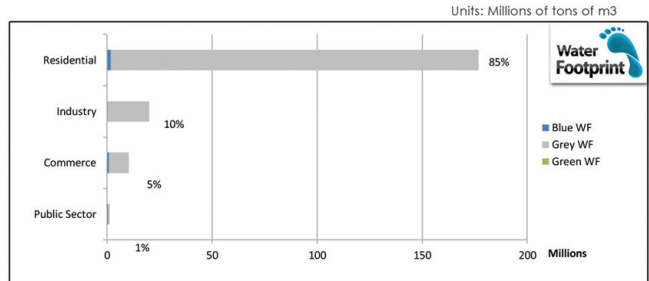
Blue WF: 2%

Grey WF: 99%

Green WF: 0.1%

Equivalence: the yearly water consumption of 5.2 million inhabitants.

Main contribution by level: Residential (85%)



Quito

Total Water Footprint: 1,033,313,394 m3

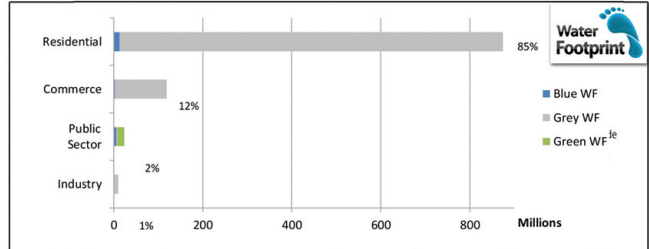
Blue WF: 2%

Grey WF: 96%

Green WF: 2%

Equivalence: the yearly water consumption of 22 million inhabitants.

Main contribution by level: Residential (85%)



Lima

Total Water Footprint: 6,376,434,799 m3

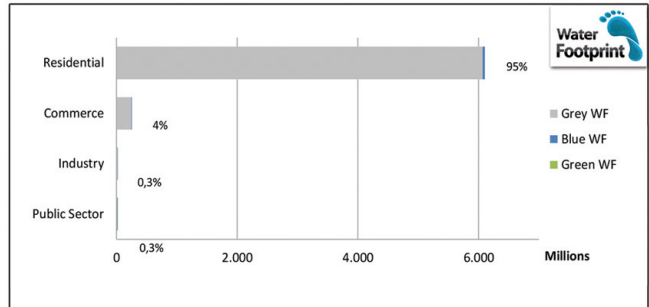
Blue WF: 1%

Grey WF: 99%

Green WF: <1%





























Equivalence: the yearly water consumption of 134 million inhabitants.

Main contribution by level: Residential (96%)



COMPARISON OF RESULTS BETWEEN CITIES

Carbon Footprint (in thousands of ton CO2e)

Emission source	Equivalence	La Paz	Quito	Lima
Petrol	 = 500			
Diesel	 = 400			
Natural Gas	 = 25			
LPG	 = 200			
Electricity	 = 500			
Solid waste	 = 300			
Waste water treatment plant	 = 10			

● Not significant ○ Does not exist

























TOTAL Carbon Footprint (in thousands of ton CO2e)  = 1500			
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Carbon Footprint per capita (ton CO2e/person)  = 1			
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Population (no. inhabitants)  = 1,000,000			
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COMPARISON OF RESULTS BETWEEN CITIES

Water Footprint (in millions of m3)

Type of footprint	Equivalence	La Paz	Quito	Lima
Blue Water Footprint	 = 6			
Grey Water Footprint	 = 2.000			
Green Water Footprint	 = 2			
TOTAL Water Footprint (in millions of m3)  = 2.000 MM				
Water Footprint per capita (m3/person)  = 250				
Population (no. inhabitants)  = 1.000.000				

The results shown in the comparative results tables cover the period of 2011 for Quito and 2012 for La Paz and Lima, both for the Carbon Footprint and Water Footprint.

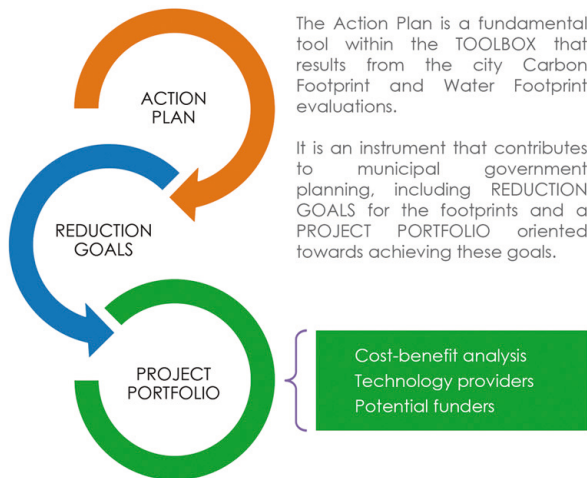
FOOTPRINT REDUCTION MEASURES

Sector	Carbon Footprint	Water Footprint
Residential 	<ul style="list-style-type: none"> - Promotion of low energy consumption artefacts. - Incentives for domestic use of renewable energy (taxes, subsidies, favourable loans). - Green building standards. 	<ul style="list-style-type: none"> - Promotion of low water consumption artefacts. - Installation or improvement of centralised or decentralised waste water treatment plants. - Rainwater harvesting systems.
Industry 	<ul style="list-style-type: none"> - Carbon Footprint measurement and offsetting mechanisms for industries under Corporate Social Responsibility (CSR) schemes. - Cleaner Production Programmes 	<ul style="list-style-type: none"> - Water Footprint measurement and offsetting mechanisms for industries under Corporate Social Responsibility (CSR) schemes linked to Water Funds. - Increased control of industrial waste water discharge to rivers.
Commerce 	<ul style="list-style-type: none"> - Electric equipment retrofit programme. - Natural gas distribution by network. - Green Building certification programme. - Composting programmes. 	<ul style="list-style-type: none"> - Continuous awareness raising campaigns about the importance of integrated water management targeted at the general population. - Registration of water use data by sector for water management decision making purposes.
Public sector 	<ul style="list-style-type: none"> - Switch to efficient streetlamps for public lighting through energy performance contracts. - Institutionalisation of the Carbon Footprint as a management indicator. 	<ul style="list-style-type: none"> - Reparation and maintenance of the drinking water distribution network. - Institutionalisation of the Water Footprint as a management indicator. - Re-use of treated water or water not suitable for drinking for irrigation purposes.
Transport 	<ul style="list-style-type: none"> - Conversion of diesel and petrol vehicles to CNG. - Development of a Sustainable Urban Transport Plan. - Implementation of mass transport systems. 	NA
Waste 	<ul style="list-style-type: none"> - Generation of bioenergy from organic waste in landfills. - Waste separation at source and recycling, using campaigns. 	NA

NA: Not applicable



CITIES FOOTPRINT ACTION PLAN



It forms part of the process of creating synergies and a joint agenda between the key sectors of each city:



The components of the Action Plan contribute to the development and application of public policies oriented towards low carbon and climate resilient development in cities.



Solutions at municipal government level

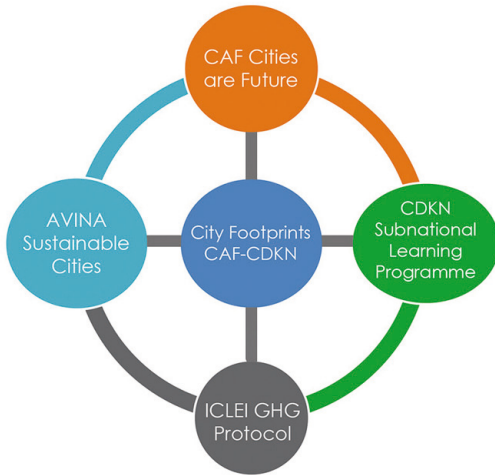
The municipal governments play a key role as protagonists and leaders in the processes of reducing both footprints in their cities.

As part of the project, the Autonomous Municipal Government of La Paz assumed the following ten commitments to reduce the footprints of its installations and the public services it provides to the city:

- 1 Reduce energy consumption through policies, programmes and projects.
- 2 Optimise fuel consumption.
- 3 Minimise paper consumption.
- 4 Encourage sustainable transport systems.
- 5 Promote waste re-use and recycling.
- 6 Implement reforestation programmes and projects.
- 7 Reduce water consumption through policies, programmes and projects.
- 8 Reduce water contamination in effluents.
- 9 Take into account environmental criteria for public contracts and purchases.
- 10 Create and promote the running of an Eco-Efficiency Committee.

STRATEGIC RESULTS

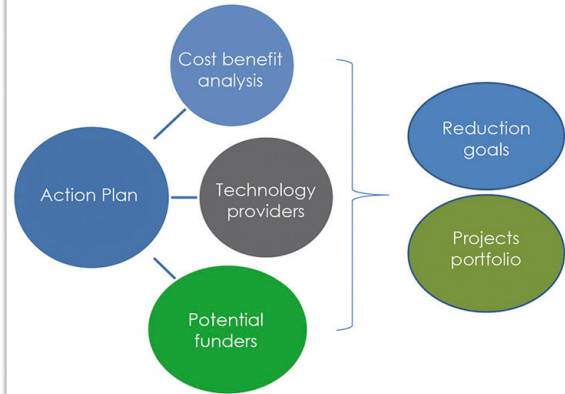
Regional Strategic Positioning



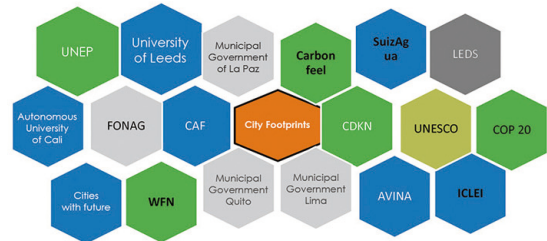
Other related initiatives:

Cities-Observatories Network (AVINA)
 South American Cities Network (REDCISUR)
 UN Habitat – UNDP (TACC Piura-Tumbes)
 UNEP (GEO Cities)
 Rockefeller Foundation (100 resilient cities)
 Gates Foundation (Sustainable cities)
 Clinton Foundation (Clinton Climate Initiative Cities)
 UK AID (ELLA Platform)
 LEDS
 Global City Indicators
 Siemens
 C40
 Mercociudades

Funding opportunities



Creation/strengthening of networks and synergies:



THE PROJECT'S MESSAGE

The opportunities and the risks are clear. Given that cities are called upon to lead the transition towards a low carbon and climate resilient development model (climate compatible development), the Carbon Footprint and Water Footprint are technical tools that are relatively simple to apply and communicate, and that enable the measurement, management and orientation of urban development in this direction. It is fundamental that the periodic exercise of measuring the city footprints is translated into climate compatible development strategies, from public policies to projects aimed at reducing the footprints, through the firm commitment of the local authorities, in public-private alliances, under a governance and shared responsibility framework together with the different sectors that make up the city.

The results of this rich experience of applying the footprint methodologies in the three Andean cities leave lessons that can help other cities to orientate their low carbon development. Equally, they enable the on-going comparison of the performance of each city with itself and with other cities, as well as the sharing of best practice appropriate to each local context. Guaranteeing climate compatible development in the face of current and future growing urbanisation will be one of the greatest challenges over the coming decades, while the development achieved through decades of progress is at risk of regressing as a result of climate change. The time to act is now.

A stylized illustration of a cityscape on a green hill. It includes various buildings of different heights and colors (green, yellow, blue), trees, and wind turbines. The background is a gradient from yellow to green.

City Footprints: Towards low carbon
and climate resilient development



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