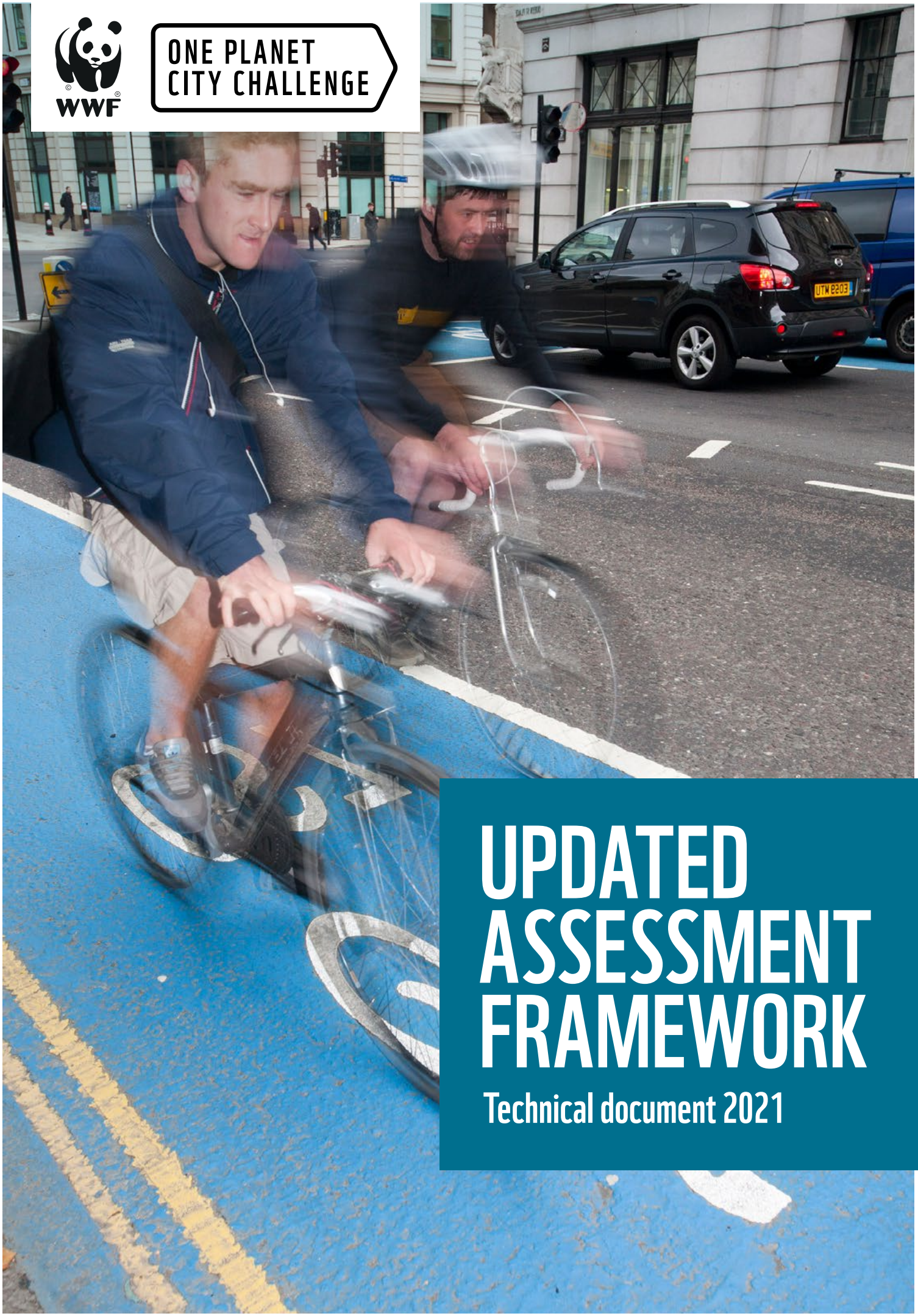
WWF

ONE PLANET CITY CHALLENGE



UPDATED ASSESSMENT FRAMEWORK

Technical document 2021

CONTENTS

THE OPCC IN A NUTSHELL 4

1. INTRODUCTION 5

2. SCORING CRITERIA 6

3. DATA INTEGRITY DIAGNOSIS 10

4. CONFIDENCE ASSESSMENT 11

5. COMPLEMENTARY ASSESSMENT METHODOLOGIES 12

APPENDIX A: OPCC 1.5 °C ALIGNMENT METHOD IN DETAIL 17

WWF

ONE PLANET CITY CHALLENGE

This report is designed to provide local governments with in-depth methodological information on the One Planet City Challenge's Assessment Framework in its 2021 version. It also provides guidance that complements the instructions found in the OPCC's Participants Booklet and CDP-ICLEI Unified Reporting System website.

Contributors
Editor in chief: Tabaré A. Currás (WWF-Sweden)

Special thanks to Dr. Carina Borgström-Hansson (WWF-Sweden), Dr. Christopher Weber (WWF), Christopher Pountney (ARUP), Stephanie Robson (ARUP), Alice Stamp (ARUP) and all members of OPCC's 2019 Advisory Panel for their kind contributions to the preparation of the OPCC Assessment Framework (2019).

Contact information
Questions? Please contact your national WWF office or WWF's international OPCC Technical Helpdesk (at opcc-helpdesk@wwf.se) for specific questions about OPCC's Assessment Framework.

THE OPCC IN A NUTSHELL

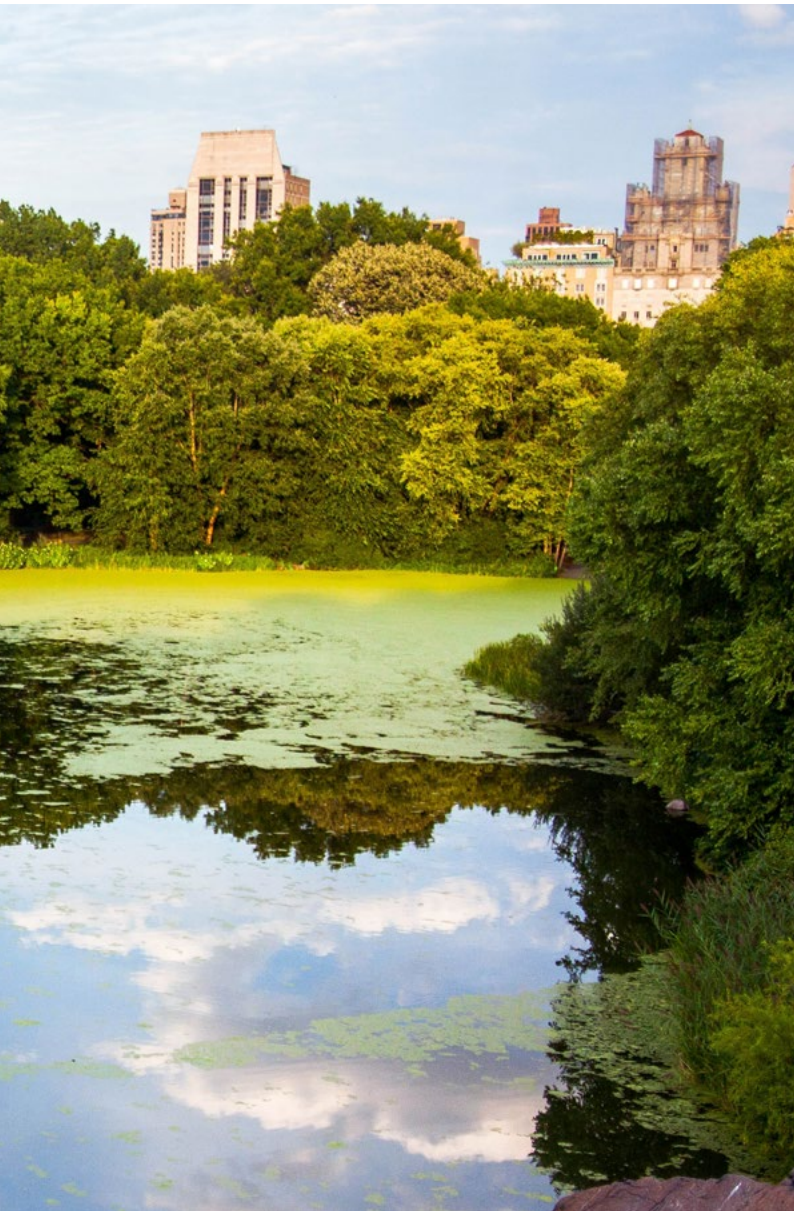
The One Planet City Challenge (OPCC) is a biennial competition organised by WWF to guide cities towards effective climate action, while publicly recognising the most ambitious cities as leaders in the field.

The OPCC aims to develop and disseminate participants' best practices for both climate mitigation and adaptation.

We invite cities to report their work on CDP-ICLEI Unified Reporting System. The OPCC data requirement is aligned with the Common Reporting Framework of the Global Covenant of Mayors for Climate and Energy (GCoM). This kind of public disclosure promotes transparency and accountability, and through international reporting the city can be counted and play a part in the global urban arena.

The OPCC process examines cities' reporting of their climate actions and goals, and measures their alignment with a science-based assessment of each city's fair share of the Paris Agreement's goal of not exceeding a global warming of 1.5 °C. Participants also receive guidance on the most effective actions to help them along this decarbonisation pathway towards net zero by 2050 at the latest.

The OPCC has grown steadily since its inception in 2011. At this point, close to 600 cities from 53 countries on 6 continents have taken part at least once in the OPCC.



1. INTRODUCTION

Our Assessment Framework consists of the criteria by which we assess city's climate targets and their alignment with targets that are consistent with your city's fair share of the Paris Agreement. In addition, we assess how well city's actions align with an evidence-based assessment of the most effective climate action planning. The framework reviews climate data and information publicly disclosed by cities[1] that report in accordance with the Common Reporting Framework of the Global Covenant of Mayors (GCoM)[2]. It uses the 34 indicators listed below. The implementation of the OPCC Assessment Framework results in aggregated scores that reflect the ability of a city to steer towards and achieve climate success.

This document outlines the OPCC Assessment Framework in its 2021 version. It provides an overview of the framework, and its features, and explains how it will be applied during the 2021-2022 OPCC cycle.

This report is split into the following sections:

Section 2 | **Scoring Criteria**

Section 3 | **Data Integrity Diagnosis**

Section 4| **Confidence Assessment**

Section 5 | **Complementary Assessment Methodologies**

1 For evaluation purposes, the OPCC asssess climate related data and information publicly disclosed by cities to the CDP-ICLEI Unified Reporting System. For more information, please contact cities@cdp.net.

2 For more information, please refer to Global Covenant of Mayors Common Reporting Framework in the follow- ing link: https://bit.ly/2wRn1wf

2. SCORING CRITERIA

The data submitted by cities participating in the OPCC will be assessed against a set of s*coring criteria* composed of 34 indicators which are combined into seven sub-categories. These focus on carbon reduction targets, greenhouse gas (GHG) inventories and climate action plans. The criteria have been designed to identify the best climate practices, but the scores can also serve as a current situation analysis from which to further develop a city's climate ambition and action.

The OPCC Assessment Framework aggregates scores in two key dimensions: *'Vision'* represents a city's commitment and ability to drive change (i.e., political commitment, mitigation targets, adaptation targets and emissions reporting), while *'Impact'* represents the reduction potential of a city's current climate action (i.e. climate risk assessment, mitigation actions and adaptation actions).

Table 1 lists the indicators along with corresponding scores i.e., the weighting assigned to each category.

Table 1: OPCC Assessment Framework Scoring Criteria.

CATEGORY	SUB-CATEGORY	INDICATOR	MAX SCORE	SCORING CRITERIA	TAB	NUM-BER	OPCC QUESTION	OPCC MAX SCORE
All	Total score		150	TOTAL SCORE				150
				Political commitment				5
				Mitigation targets				39
				Adaptation targets				5
				Emissions reporting				24
				Climate change risk or vulnerability assessment				23
				Mitigation actions in climate action plan				30
				Adaptation actions in climate adaptation plan				24
Commitments (5)	Political commitment (5)	Commitment initiatives	5	Type: mitigation/adaptation (1.5), both (2.5)	C	1	3.3 & 5	2.5
				# of commitment initiatives: 1 (1.5), 2+ (2.5)	C	2	3.3 & 5	2.5

CATEGORY	SUB-CATEGORY	INDICATOR	MAX SCORE	SCORING CRITERIA	TAB	NUM-BER	OPCC QUESTION	OPCC MAX SCORE
Targets and goals (44)	Mitigation targets (39)	GHG stacked targets towards neutrality	9	Boundary: same as or larger than city boundary (2)	T	1	5	2
				Target aligns with global 1.5°C pathway: yes (2)	T	2	5	2
				Ambition: aligned to higher level government requirements (5)	T	3	5	5
		GHG targets aligned with trajectory based on fair-share budget	20	2030 target: aligned (10) 2050 target: aligned (10)	T	4	5	20
		Renewable energy/ electricity targets towards neutrality	5	Yes - Renewable Energy target (percentage): 25% (1), 50% (1.5), 100% (2.5) Yes - Renewable Electricty target (percentage): 25% (0.5), 50% (0.75), 100% (1.25)	T	5	8.0a	2.5
				Yes - Scale: local government (1), city-wide (2.5)	T	6	8.0a	2.5
		Energy efficiency targets	5	Yes - Percentage: 25% (1), 50% (1.5), 100% (2.5)	T	7	8.3a	2.5
				Yes - Scale: local government (1), city-wide (2.5)	T	8	8.3a	2.5
	Adaptation targets (5)	Adaptation goals and milestones towards a climate resilient city	5	Period: short- (1), mid- (1.5), long-term (2.5) target year of goal	T	9	3.3	2.5
				National alignment: No (1), Yes (2), Yes - but it exceeds its scale or requirements (2.5)	T	10	3.3	2.5

CATEGORY	SUB-CATEGORY	INDICATOR	MAX SCORE	SCORING CRITERIA	TAB	NUM-BER	OPCC QUESTION	OPCC MAX SCORE
Evidence for action planning (47)	Emissions reporting (24)	Up to date emissions inventory	24	Emissions inventory within last 5 years (1)	E	1	4.1	1
		Inventory status		Inventory: no but intending (2), in progress (3), yes (5)	E	2	4.0	5
		Scope of emissions considered		Scope: scope 1 (1), scope 1 and 2 (2), scope 3 (5)	E	3	4.6a / b	5
		Sectors of inventory		Sectors: 2 sectors (2), 3+ sectors (3), all sectors (5)	E	4	4.6a / b	5
		Level of confidence		Level: medium (0.5), high (1)	E	5	4.5	1
		GPC as primary protocol		GPC as primary protocol: yes (2)	E	6	4.3	2
		Gases covered		Gases: all (1)	E	7	4.4	1
		Boundary of emissions inventory		Boundary: smaller (1), partial (2), same or larger (3) than city boundary	E	8	4.2	3
		Consumption-based emissions inventory		Consumption-based emissions inventory (1)	E	9	4.9	1
	Climate change risk or vulnerability assessment (23)	Assessment attached	23	Assessment status: no but intending (1), in progress (2), yes (3)	E	10	2	3
		Boundary of assessment		Boundary: smaller (1), partial (2), same or larger (3) than city boundary	E	11	2.0b	3
		Areas/sectors covered		Sectors: At least one but less than half (1), more than half but not all (2), all (3)	E	12	2.0b	3
		Identification of vulnerable populations		Yes (3)	E	13	2.0b	3
		Impact of hazards		Impact: whether impact characteristics (current probability, current magnitude, future change in frequency, future change in intensity) are identified for over half (1 points per characteristic) or all (2 point per characteristic) hazards identified by the city.	E	14	2.1	8
		Most relevant assets/services identified		Yes for all hazards (1), Yes for more than half but not all (0.5)	E	15	2.1	1
		Social impact identified / mapped		Yes for all hazards (1), Yes for more than half but not all (0.5)	E	16	2.1	1
		Future expected magnitude identified		Yes for all hazards (1), Yes for more than half but not all (0.5)	E	17	2.1	1

CATEGORY	SUB-CATEGORY	INDICATOR	MAX SCORE	SCORING CRITERIA	TAB	NUM-BER	OPCC QUESTION	OPCC MAX SCORE
Climate and adaptation action plans (54)	Mitigation actions in climate action plan (30)	Climate action or energy access plan	30	Plan status: no but intending (0.5), in progress (1.5), yes (2.5)	P	1	5.5	2.5
		Stage of implementation of climate action plan		In development / developed (1), under implementation/ implementation complete (2.5), monitoring/plan update in progress (5)	P	2	5.5a	5
		Areas covered by action plan		Alignment of action plan sectors with inventory sectors (10)	P	3	5.4	10
		Emissions reduction		Actions add up to reduction emissions target (10)	P	4	5.4	10
		Status of mitigation actions		In development / developed (1), under implementation or monitoring (2.5)	P	5	5.4	2.5
	Adaptation actions in climate adaptation plan (24)	Climate adaptation plan	24	Plan status: no but intending (0.5), in progress (1), yes (2)	P	6	3.2	2
		Stage of implementation of climate adaptation plan		In development / developed (1), under implementation (2.5), monitoring (5)	P	7	3.2a	5
		Boundary of climate adaptation plan		Boundary: smaller (1), partial (2), same or larger (3) than city boundary	P	8	3.2a	3
		Alignment with hazards		Actions align with hazards (10)	P	9	3.0	10
		Status of adaptation actions		In development / developed (1), under implementation or monitoring (2)	P	10	3.0	2
		Benefits or improvements from adaptation actions		Identified more than 1 benefit for all actions (2), for at least half of actions (1)	P	11	3.0	2

3. DATA INTEGRITY DIAGNOSIS

Data Integrity Diagnosis is the approach OPCC uses to verify the status of cities' reported data in terms of its quantitative attributes. The diagnosis approach tests data against logical verification criteria. The approach flags data entries which do not conform to data verification standards and proposes corrections and improvements. The data integrity diagnosis approach is applicable to all numerical indicators relevant for the purposes of the OPCC Assessment Framework and complementary assessment methodologies.

The data integrity diagnosis approach assesses city data in terms of quantitative rules which describe expected responses for key indicators. Constraints are defined by: an expected range of results, e.g. between 10,000 and 500,000; an expected order of magnitude, e.g. 10 rather than 10,000; be based on a calculation with reference to another response, e.g. if city population is x, peak energy demand is expected to be in the order of magnitude of [a*x] where 'a' is some constant or other variable. A high-level description of the key indicators and their proposed constraints is shown in Table 2.

Table 2. List of rules verified by OPCC Data Integrity Diagnosis.

DESCRIPTION OF INDICATOR	PROPOSED CONSTRAINTS
Current and projected population figures for years	The current population lies within the expected order of magnitude. The projected population does not exceed reasonable overestimate based on multiple of year.
City-wide emissions by sector breakdowns	Figures lie within the expected order of magnitude and do not exceed reasonable overestimate based on multiple of population. The sum of sector breakdowns matches total emissions.
Historical/base year city-wide emissions inventories	Emissions figures lie within expected order of magnitude and do not exceed reasonable overestimate based on multiples of population and inventory period dates.
City-wide base year emissions reduction targets by sector and total.	Target figures lie within the expected order of magnitude and do not exceed reasonable overestimate. Sub-sector emissions targets sum up to the total target figure.
Renewable energy or electricity target	Target figures lie within the expected order of magnitude and do not exceed reasonable overestimate based on a specified unit.
Current renewable energy installation	Figures lie within the expected order of magnitude and do not exceed reasonable overestimated based on a specified unit.
Energy efficiency targets	Target figures lie within the expected order of magnitude and do not exceed reasonable overestimated based on a specified unit.

4. CONFIDENCE ASSESSMENT

'Confidence' is an indicator of perceived reliability found in the reported data. In other words, it speaks of the quality of information used for the assessment. Both the level of '*Evidence'* (i.e., the level of data integrity and completeness) and the level of *'Agreement'* (i.e., the level of consistency of the data disclosed) are combined to form an overall *'Confidence'* score. In total, eight indicators are used to perform this confidence assessment.

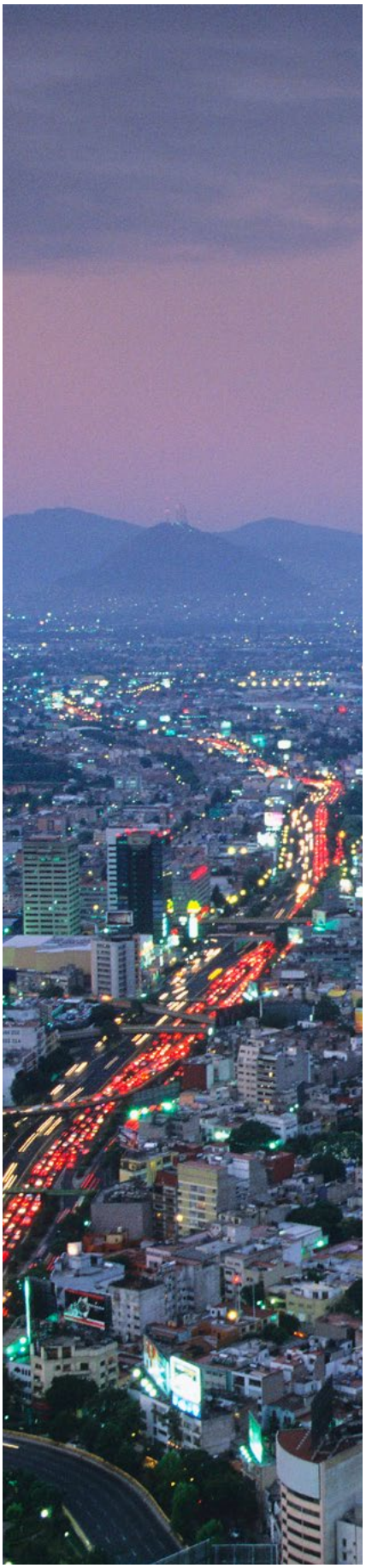
The following tables (Table 3 and Table 4) display the thresholds for the scoring of the level of data confidence, and the indicators to weight the level of evidence and agreement in the data submission.

Table 3. Thresholds for the OPCC's *Confidence Assessment*. The same thresholds are applied to the component calculations for both metrics, the level of *Agreement* and *Evidence*.

Increasing agreement/ evidence/confidence.	>75%	High confidence
	50-75%	Medium confidence
	25-50%	Low confidence
	0-25%	Very low confidence

Table 4. Agreement and Evidence indicators of OPCC's Confidence Assessment.

CATEGORY	INDICATOR	DESCRIPTION
Evidence	Data integrity and completeness	For 'Vision' Indicators only, this is the number of Data Integrity Diagnosis checks the city passes (see Section 4).
	Data completeness	For 'Impact' indicators only, this is an assessment of the completeness of the reported data.
	Data quantity	This relates to the amount of data provided by the city. For both 'Vision' and 'Impact' this includes the number of published (or in-progress) planning documents, as well as an assessment of the quantity of data points relating to inventories, targets and actions.
	Data age	For both, 'Vision' and 'Impact', this assesses how recent the reported data points are. More recently assessed/published/collected information results in a better score for this metric.
Agreement	1.5 °C alignment with 2030 SBT alignment	We assess if the city's self-reported target is aligned to the 2030 science-based target (SBT), which is coherent with the global 1.5 °C pathway. A score is awarded based on the correspondence between the two.
	1.5 °C alignment with net-zero target	This compares the presence of a net-zero target by (or before) 2050 against whether the city self-reported a target aligned with the global 1.5 °C pathway. A score is awarded based on the agreement between the two.
	Action planning alignment	This compares a city's reported hazards and actions to determine whether the city has reported consistent and appropiate actions and hazards.
	Mitigation action alignment	This assesses the alignment between planned emissions reduction and the reported targets.



5. COMPLEMENTARY ASSESSMENT METHODOLOGIES

In addition to the Scoring Criteria and the Confidence Assessment, the OPCC Framework applies two complementary methodologies. The first assesses a city's climate targets in comparison to science-based targets, and the second reviews its actions' alignment to evidence-based climate action planning. Both methods are explained in detail as follows:

5.1 OPCC 1.5 °C Alignment Method

The OPCC has developed a method based on the latest data from the IPCC's Special Report on Global Warming of 1.5 °C[3]; this novel approach builds upon the Deadline 2020 methodology, integrating new considerations of emissions allocation compatible with the 1.5 °C goal. The method is suitable for any type of city that reports in line with the reporting requirements of Global Covenant of Mayors. The method has already been applied to 255 cities participating in the 2019-2020 OPCC cycle.

Building on the regional models presented in the IPCC Special Report, the OPCC requires cities to have a mid-term and a long-term target for Scope 1 and 2 emissions:

- 2030: Reduce per capita emissions in-line with a global reduction of 50%; and,
- 2050: Reduce total emissions to net zero.

Since the IPCC models are applied on a regional scale, the OPCC builds in an additional layer of equity and fairness using the Human Development Index (HDI). This national adjustment is used to require faster decarbonisation from cities in more developed nations. The HDI factor thereby modifies the mid-term target, providing a range of per capita emission reductions targets between 25-65%. Full details, including the step-by-step approach to calculating targets using the OPCC method, are provided in Appendix A.

The OPCC 1.5 °C Alignment Method is recognized by the Science-Based Targets Network (SBTN) and endorsed by the Cities Race to Zero Initiative, within the UN Race to Zero Campaign, as a method that can enable cities to set GHG emission reduction targets in line with the Paris Agreement.

5.2 The alignment of a city's reported actions

The OPCC is designed to offer action-oriented feedback tailored to each participating city. This can be addressed in two ways. Firstly, climate actions in similar cities give a useful indication of typical approaches, some of which are likely to be appropriate in the participating city. However, more useful feedback advises the participating city on the most effective climate action. This 'forward-looking' feedback is especially helpful to enable innovative climate action.

5.2.1 Mitigation Actions

Following C40 & McKinsey (2017), the OPCC suggests the most impactful actions based on six city typologies, each of which differs in their potential for climate action on buildings, energy, electricity generation, transit, mobility, and waste. The city typologies are determined by size, income level and population density. The associated action pathway is tailored to the city using the city's emissions inventory (where available), so that actions that address the largest emissions sectors are

3 IPCC (2018). Summary for Policymakers. In: Global Warming of 1.5 °C. An IPCC Special Report on the impacts of global warming of 1.5 °C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.). Geneva, World Meteorological Organization

prioritised[4]. Table 5 lists the city typology, whereas Table 6 shows the top five priority actions for each city typology, with the corresponding emissions reduction potential.

Table 5. Typological differentiation among cities is based on income levels and population.

TYPOLOGY	GDP CAPITA RANGE (USD)	POPULATION RANGE
Large Low Income Leapfrog City	0 – 4,500	N/A
Low Income Megacity	4,500 – 11,000	N/A
Large Semi-Dense Middle Income City	11,000 – 21,000	N/A
Middle Income Megacity	21,000 – 37,000	N/A
Large Dense City	>37,000	>1,000,000
Small High Income Innovator City	>37,000	<1,000,000

Table 6. Priority mitigation actions by city typology.

#	LARGE, LOW INCOME, LEAP-FROG CITY	LOW INCOME MEGA CITY	LARGE, MIDDLE INCOME, SEMI-DENSE CITY
1	Distributed renewables (36%)	Distributed renewables (40%)	Distributed renewables (24%)
2	Ultra-high-efficiency new building standards (23%)	Ultra-high-efficiency new building standards (22%)	Next-generation vehicles (23%)
3	Mass transit, walking and cycling infrastructure (18%)	Next-generation vehicles (15%)	Centralised renewables (10%)
4	Transit-oriented development (13%)	Mass transit, walking and cycling infrastructure (14%)	Ultra-high-efficiency new building standards (10%)
5	Appliances and lighting upgrades (11%)	Transit-oriented development (13%)	Mass transit, walking and cycling infrastructure (8%)
#	**MIDDLE INCOME MEGA CITY**	**LARGE, HIGH-INCOME, DENSE CITY**	**SMALL, HIGH-INCOME, INNOVATOR CITY**
1	Ultra-high-efficiency new building standards (22%	HVAC and water heating upgrades (24%)	Centralised renewables (54%)
2	Centralised renewables (21%)	Centralised renewables (18%)	HVAC and water heating upgrades (26%)
3	Distributed renewables (15%)	Next-generation vehicles (13%)	Ultra-high-efficiency new building standards (13%)
4	Next-generation vehicles (8%)	Distributed renewables (7%)	Next-generation vehicles (11%)
5	HVAC and water heating upgrades (6%)	Building envelope and heating retrofits (6%)	Building envelope and heating retrofits (9%)

4 It is worth highlighting that, by design, these proposed actions are not tested against actions reported by participating cities.

5.2.2 Adaptation Actions

Participating cities report their major climate risks in their data submissions. While climate risks are certain to vary across cities, the responses to the same climate risks are likely to be the same or similar. Therefore, by analysing existing adaption actions in other cities with similar climate risks, a package of adaption actions can be allocated to each participating city. This does not show which actions are most impactful, but it does suggest which are likely to be achievable. Based on information disclosed by cities, the OPCC provides participants with suggestions of common actions for dealing with climate hazards. See Table 7 for a complete list. Where a city reports fewer than five climate hazards, additional region-specific hazards are included, as well as their corresponding top adaptation actions. These are taken from the tables published in the IPCC AR5 report (IPCC, 2014).

Table 7. Top adaptation actions to most common climate hazards.

CLIMATE HAZARD	TOP 5 ACTIONS				
Air-borne disease	Air quality initiatives	Disease prevention measures	Testing/vaccination programs for vector-borne disease	Community engagement/ education	Incorporating climate change into long-term planning documents
Atmospheric CO_2 concentrations	Air quality initiatives	Tree planting and/ or creation of green space	Community engagement/ education	Projects and policies targeted at those most vulnerable	Incorporating climate change into long-term planning documents
Avalanche	Incorporating climate change into long-term planning documents	Community engagement/ education	Soil retention strategies		
Coastal flood	Flood mapping	Flood defences – development and operation & storage	Sea level rise modelling	Incorporating climate change into long-term planning documents	Crisis management including warning and evacuation systems
Cold wave	Community engagement/ education	Awareness campaign/ education to reduce water use	Disease prevention measures	Projects and policies targeted at those most vulnerable	Real time risk monitoring
Cyclone (Hurricane/ Typhoon)	Crisis management including warning and evacuation systems	Public preparedness (including practice exercises/drills)	Resilience and resistance measures for buildings	Flood mapping	Sea level rise modelling
Drought	Water use restrictions and standards	Community engagement/ education	Awareness campaign/ education to reduce water use	Diversification of water supply	Tree planting and/ or creation of green space
Extratropical storm	Landslide risk mapping	Crisis management including warning and evacuation systems	Community engagement/ education	Real time risk monitoring	Resilience and resistance measures for buildings
Extreme cold days	Projects and policies targeted at those most vulnerable	Community engagement/ education	Retrofit of existing buildings	Hazard resistant infrastructure design and construction	Heat mapping and thermal imaging

CLIMATE HAZARD	TOP 5 ACTIONS				
Extreme hot days	Tree planting and/ or creation of green space	Heat mapping and thermal imaging	Community engagement/ education	Cooling centres, pools, water parks/ plazas	Projects and policies targeted at those most vulnerable
Extreme winter conditions	Public preparedness (including practice exercises/drills)	Crisis management including warning and evacuation systems	Incorporating climate change into long-term planning documents	Community engagement/ education	Projects and policies targeted at those most vulnerable
Flash/surface flood	Flood mapping	Storm water capture systems	Flood defences – development and operation & storage	Crisis management including warning and evacuation systems	Projects and policies targeted at those most vulnerable
Fog	Air quality initiatives	Public preparedness (including practice exercises/drills)			
Forest fire	Crisis management including warning and evacuation systems	Community engagement/ education	Incorporating climate change into long-term planning documents	Real time risk monitoring	Hazard resistant infrastructure design and construction
Groundwater flood	Flood mapping	Incorporating climate change into long-term planning documents	Hazard resistant infrastructure design and construction	Storm water capture systems	Additional reservoirs and wells for water storage
Hail	Crisis management including warning and evacuation systems	Community engagement/ education	Real time risk monitoring	Hazard resistant infrastructure design and construction	Public preparedness (including practice exercises/drills)
Heat wave	Heat mapping and thermal imaging	Tree planting and/ or creation of green space	Projects and policies targeted at those most vulnerable	Cooling centres, pools, water parks/ plazas	Incorporating climate change into long-term planning documents
Heavy snow	Crisis management including warning and evacuation systems	Incorporating climate change into long-term planning documents	Public preparedness (including practice exercises/drills)	Resilience and resistance measures for buildings	Community engagement/ education
Insect infestation	Community engagement/ education	Disease prevention measures	Testing/ vaccination programs for vector-borne disease	Incorporating climate change into long-term planning documents	Biodiversity monitoring
Land fire	Crisis management including warning and evacuation systems	Community engagement/ education	Hazard resistant infrastructure design and construction	Hazard resistant infrastructure design and construction	Heat mapping and thermal imaging
Landslide	Landslide risk mapping	Restrict development in risk areas	Crisis management including warning and evacuation systems	Projects and policies targeted at those most vulnerable	Incorporating climate change into long-term planning documents
Lightning/ thunderstorm	Crisis management including warning and evacuation systems	Public preparedness (including practice exercises/drills)	Community engagement/ education	Real time risk monitoring	Real time risk monitoring

CLIMATE HAZARD	TOP 5 ACTIONS				
Monsoon	Flood defences – development and operation & storage	Community engagement/ education	Water butts/ rainwater capture		
Ocean acidification	Economic diversification measures				
Permanent inundation	Incorporating climate change into long-term planning documents	Flood mapping	Sea level rise modelling	Hazard resistant infrastructure design and construction	
Rainstorm	Flood mapping	Flood mapping	Crisis management including warning and evacuation systems	Incorporating climate change into long-term planning documents	Incorporating climate change into long-term planning documents
River flood	Flood mapping	Flood defences – development and operation & storage	Hazard resistant infrastructure design and construction	Restrict development in risk areas	Real time risk monitoring
Rockfall	Landslide risk mapping	Crisis management including warning and evacuation systems	Soil retention strategies		
Saltwater intrusion	Additional reservoirs and wells for water storage	Sea level rise modelling	Diversification of water supply	Incorporating climate change into long-term planning documents	Water use restrictions and standards
Severe wind	Crisis management including warning and evacuation systems	Hazard resistant infrastructure design and construction	Public preparedness (including practice exercises/drills)	Resilience and resistance measures for buildings	Incorporating climate change into long-term planning documents
Storm surge	Sea level rise modelling	Flood mapping	Community engagement/ education	Crisis management including warning and evacuation systems	Hazard resistant infrastructure design and construction
Subsidence	Landslide risk mapping	Projects and policies targeted at those most vulnerable	Additional reservoirs and wells for water storage	Water use restrictions and standards	Crisis management including warning and evacuation systems
Tornado	Crisis management including warning and evacuation systems	Community engagement/ education	Real time risk monitoring	Resilience and resistance measures for buildings	Retrofit of existing buildings
Tropical storm	Crisis management including warning and evacuation systems	Public preparedness (including practice exercises/drills)	Promoting low flow technologies	Landslide risk mapping	Flood mapping
Vector-borne disease	Disease prevention measures	Testing/ vaccination programs for vector-borne disease	Community engagement/ education	Real time risk monitoring	Projects and policies targeted at those most vulnerable
Waterborne disease	Disease prevention measures	Community engagement/ education	Water use restrictions and standards	Improve water supply distribution method	Public preparedness (including practice exercises/drills)

APPENDIX A:

OPCC 1.5 °C ALIGNMENT METHOD IN DETAIL

BACKGROUND

The OPCC 1.5 °C Alignment Method drew inspiration from the earlier work undertaken by C40 and Arup called 'Deadline 2020' (C40 Cities and Arup, 2016). The OPCC sought to understand how a Deadline 2020-type approach could be applied to a wider number of cities. As this was underway, the Intergovernmental Panel on Climate Change (IPCC) published the Special Report on Global Warming of 1.5 °C (IPCC, 2018) that brought together the latest scientific evidence on the impacts of global warming and significantly revised the global remaining carbon budget. This change drew attention to using and interpreting carbon budgets for policy, especially at citylevel. Following this, the International Energy Agency (IEA, 2018)[5], stated that "*the inherent uncertainty makes it challenging to attribute a specific budget (or a specific emissions pathway) to a particular temperature outcome*". Instead, the IEA noted that the Paris Agreement sets three parameters for emissions trajectories: that GHG emissions peak soon, enter a steep decline and eventually reach net-zero post-2050. They concluded that focusing on a date for zero emissions and certain interim stages provides a more robust method for defining ambition and setting policy.

5 IEA (2018). World Energy Outlook 2018. Paris, International Energy Agency.

TECHNICAL CONSIDERATIONS ON SETTING 1.5 °C-ALIGNED TARGETS

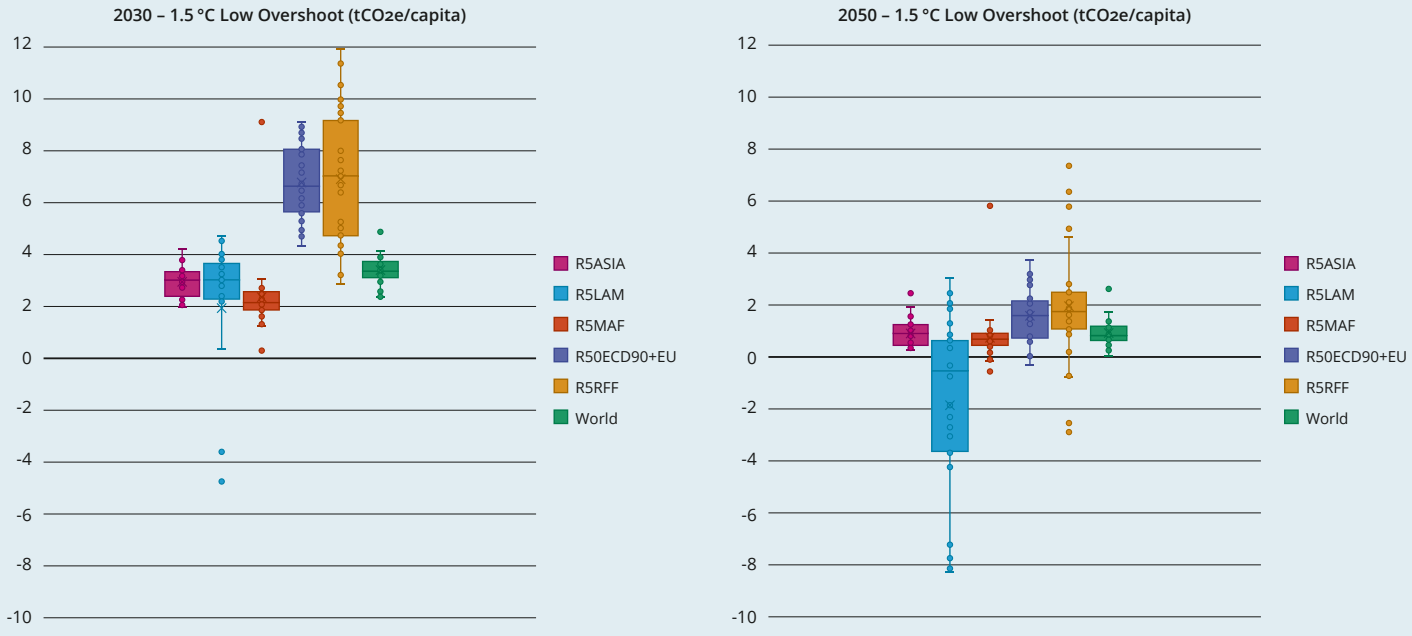
The IPCC SR15 report presented global decarbonisation pathways for different temperature increases based on modelled scenarios. These models account for population and GDP growth by region and illustrate the scale of reductions required.

The challenge with this approach is illustrated below, where the '1.5 °C low overshoot' IPCC scenarios are presented by region for 2030 and 2050. These scenarios were selected as those that limit median warming to 1.5 °C by 2100 with a small (<0.1 °C) overshoot of 1.5 °C before 2100 (55-66% likelihood)[6]. The different models include a variety of assumptions resulting in a wide range of absolute targets, even at the regional level. Moreover, different models assume some regions to have significant potential for afforestation and bioenergy with carbon capture and storage (BECCS). This applies particularly to Latin America (i.e., 'R5LAM'), where the potential for decarbonisation is significant, particularly in 2050.

With respect to the 2050 (i.e. long-term) target, there is an emerging consensus that cities should target zero emissions. If this is only Scope 1 & 2 emissions, then the residual emissions may well align with those presented below. If zero emissions include Scope 3 too, then it simply represents a more ambitious position, with cities taking the lead on climate action ahead of other global actors.

The 2030 (i.e. mid-term, interim) target is less straightforward. Figure 1 shows that absolute targets are difficult to define precisely given the spread of modelled results.

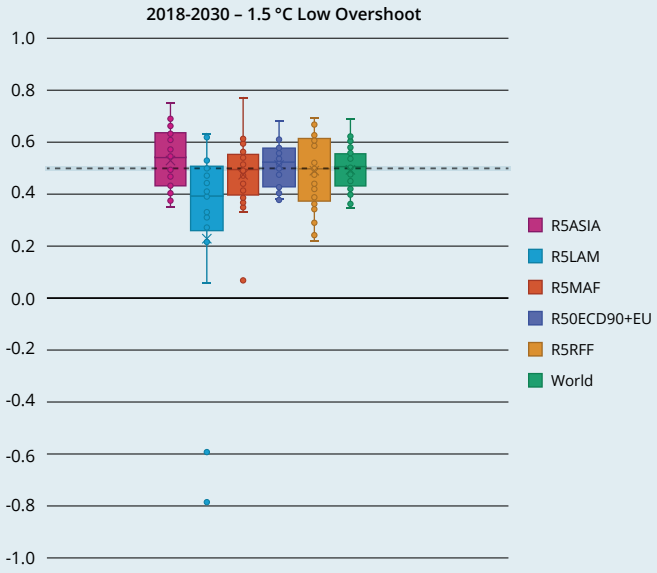
Figure 1. Analysis of the IPCC Scenario Explorer 'per capita emissions' data. Estimates based on '1.5 °C low overshoot' scenario.



6 See Table 2.1, IPCC (2018).

An alternative perspective is to look at the rate of reduction required in each region. Taking the '1.5 °C low overshoot' IPCC scenarios, Figure 2 shows the ratio of per capita emissions reduction required between 2018 and 2030. Compared with absolute values, this presents a much more consistent picture. Leaving aside Latin America, all regions are expected to reduce per capita emissions by 40-60% by 2030.

Figure 2. Predicted reduction in 'per capita emissions' between 2018 and 2030. Estimates based on '1.5 °C low overshoot' scenario.



OPCC CONSIDERATIONS ON SETTING 1.5 °C-ALIGNED TARGETS

Beyond the technical details of setting mid-term and long-term targets, OPCC takes into consideration additional key factors. First, there is a balance between policy pragmatism and analytical robustness. It is essential that the details of any method for target setting are clear and communicable, particularly for low-capacity cities; however, this must not oversimplify the evidence required to demonstrate a 'science-based' approach. Second, the calculation of the target must be easy to follow and replicate. This will allow a larger cohort of cities to be able to design, or evaluate existing, targets in line with a science-based approach.

THE OPCC 1.5 °C ALIGNMENT METHOD

The OPCC requires cities to have:

- a mid-term (2030) target in line with a global reduction of 50% against 2018 per capita emissions (Scope 1 and 2), adjusted using country HDI weighting, and;
- a long-term (2050 at the latest) target which reflects a reduction of total emissions to net zero[7].

We believe that such an approach presents the following advantages and disadvantages:

7 The IPCC defines net zero as that point when "anthropogenic emissions of greenhouse gases to the atmosphere are balanced by anthropogenic removals over a specified period". Global net zero can be defined as a permanent balance between sources and sinks of greenhouse gases.

ADVANTAGES	DISADVANTAGES
Easily communicated and tested Relative to 2018 emissions, so largest emitters have the largest targets in absolute terms Clear link to referenceable IPCC data Larger reductions required from more developed nations Requires all cities to continue to act	Less transparent to the general public. HDI may not accurately represent city development. No consideration of hard-to-measure Scope 3 emissions.

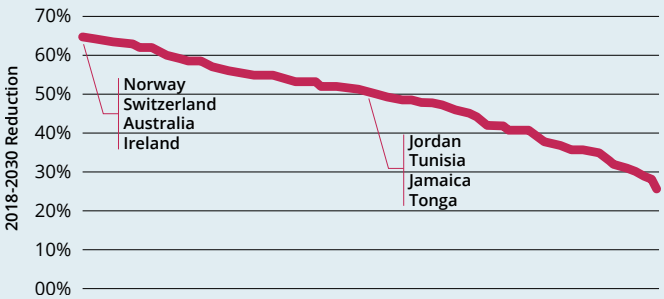
This method sets a relative mid-term target, clearly linked to the IPCC data, with the additional adjustment that raises the bar for cities in developed nations. Setting the target in this way stretches ambition and builds in a layer of equity that goes beyond the assumptions behind the IPCC scenarios.

The Human Development Index is an aggregated measure of several national development metrics. In this case, the 2018-2030 reduction required is calculated as follows:

$$0{,}5 \times \left(1\text{-}\left(\frac{HDI_{Nation} - HDI_{World}}{HDI_{World}}\right)\right)$$

The 2018-2030 reduction required for cities in each nation is shown below. When aggregated based on population, these reductions deliver 50% global emissions reduction.

Figure 3 Required reduction in 'per capita emissions' between 2018 and 2030 after HDI adjustment



CALCULATION METHODOLOGY

1. Gather 2018 Scope 1 and Scope 2 city-wide GHG emissions and divide by 2018 population to obtain baseline per capita emissions. You can do this using the Global Protocol for Community-scale GHG Emissions Inventories (GPC).

2. Use the Human Development Index (HDI) to estimate a reduction target, from 2018 levels, that reflect a fair share of the 50% global per capita emissions reduction by 2030 identified in the IPCC Special Report on Global Warming of 1.5 °C. Find a country's HDI. Use the following formula:

reduction target = 1 - [0.5 x (HDI correction factor)]

where HDI correction factor =
1-[(HDI$_{Country\ where\ city\ is\ located}$-HDI$_{Global\ average}$)/HDI$_{Global\ average}$]

3. Translate the 2030 target to a reduced per capita emissions value. Multiply *1- the reduction target* (step 2) by the baseline per capita emissions value (step 1). That is: baseline per capita emissions x (1 -reduction target).

4. Translate the 2030 reduced per capita emissions value to absolute emissions value. Multiply the 2030 reduced per capita emissions (step 3) by the forecasted 2030 population of the city.

REFERENCES

C40 Cities (2018). Climate Action Planning Framework. London, C40 Cities.

C40 Cities and Arup (2016). Deadline 2020 – How cities will meet the Paris Agreement. London, C40 Cities.

C40 Cities and Arup (2017). Consumption-Based GHG Emissions of C40 Cities. London, C40 Cities.

C40 Cities and McKinsey (2017). Focused Acceleration: A Strategic Approach to Climate Action in Cities to 2030. London, C40 Cities.

CDP (2017). 2017 – City Adaptation Actions. http://data.cdp.net. Accessed: January 2019. EcoAct and WWF France (2018a). Le Défi Climatique des Villes. Paris, WWF.

ICLEI - Local Governments for Sustainability (2018). Multilevel climate action: the path to 1.5 degrees. Bonn, ICLEI.

IEA (2018). World Energy Outlook 2018. Paris, International Energy Agency.

IPCC (2018). Summary for Policymakers. In: Global Warming of 1.5 °C. An IPCC Special Report on the impacts of global warming of 1.5 °C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.). Geneva, World Meteorological Organization.

IPCC (2014). Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Barros, V.R., C.B. Field, D.J. Dokken, M.D. Mastrandrea, K.J. Mach, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.). Cambridge, Cambridge University Press.

OECD (2015). OECD production- and consumption-based CO_2 emission estimates, based on IEA CO_2 emissions from fuel combustion, 2015. For download at http://oe.cd/io-co2. Paris, OECD.

UN Habitat (2015) Guiding Principles for City Climate Action Planning. Nairobi, UN Habitat.

Wiebe, K. and N. Yamano (2016). Estimating CO_2 Emissions Embodied in Final Demand and Trade Using the OECD ICIO 2015: Methodology and Results, OECD Science, Technology and Industry Working Papers, 2016/05. Paris, OECD Publishing.

WWF

Working to sustain the natural world for the benefit of people and wildlife.

together possible™ panda.org