GLOBAL CLIMATE ACTION FROM CITIES, REGIONS AND BUSINESSES

Impact of individual actors and cooperative initiatives on global and national emissions

Edition 2 | 2019

NEW CLIMATE INSTITUTE
DATA DRIVEN ENVIROLAB
PBL Netherlands Environmental Assessment Agency
d·i·e Deutsches Institut für Entwicklungspolitik
German Development Institute
BLAVATNIK SCHOOL OF GOVERNMENT
UNIVERSITY OF OXFORD

AUTHORS

NewClimate Institute, Data-Driven Lab, PBL Netherlands Environmental Assessment Agency, German Development Institute/ Deutsches Institut für Entwicklungspolitik (DIE), Blavatnik School of Government, University of Oxford.

SUGGESTED CITATION

NewClimate Institute, Data-Driven Lab, PBL, German Development Institute/Deutsches Institut für Entwicklungspolitik (DIE), Blavatnik School of Government, University of Oxford. Global climate action from cities, regions and businesses: Impact of individual actors and cooperative initiatives on global and national emissions. 2019 edition. Research report prepared by the team of: Takeshi Kuramochi, Swithin Lui, Niklas Höhne, Sybrig Smit, Maria Jose de Villafranca Casas, Frederic Hans, Leonardo Nascimento, Paola Tanguy, Angel Hsu, Amy Weinfurter, Zhi Yi Yeo, Yunsoo Kim, Mia Raghavan, Claire Inciong Krummenacher, Yihao Xie, Mark Roelfsema, Sander Chan, Thomas Hale.

ACKNOWLEDGEMENTS

We thank the organizations and individuals listed below, whose assistance and feedback greatly enhanced this report:

This work draws on data provided by CDP, Global Covenant of Mayors for Climate & Energy, Global Covenant of Mayors (EU Secretariat), States and Regions Annual disclosure to CDP, in partnership with The Climate Group, and ICLEI carbonn® Climate Registry. It also draws on data from the C40 Cities Climate Leadership Group, Under2 Coalition (Secretariat: The Climate Group), the ClimateSouth project, United States Climate Alliance, United States Climate Mayors, and We Are Still In. Xiyao Fu and James Sun helped gather data on Chinese cities' climate commitments. We thank Andrew Clapper and Andres Chang (CDP) for their support on data preparation and the pre-analysis of the company-level actions. We also thank Nicklas Forsell (International Institute for Applied Systems Analysis) on the land-use sector data discussions, and Junichi Fujino (Institute for Global Environmental Strategies, Japan) and Yuki Ochi (E-konzal) for subnational actors data in Japan.

This work was funded by ClimateWorks Foundation (grant no. 19-1383). We thank the ClimateWorks Foundation, Mission 2020, and the United Nations Framework Convention on Climate Change (UNFCCC) Secretariat for convening several working groups and workshops to discuss Climate Action Methodology, Data and Analysis (CAMDA) across different efforts to analyse climate action. Similarly, we thank all those who participated in these CAMDA work streams and discussions, for providing feedback and suggestions on the scope and content of this report. Special thanks go to Todd Edwards and Sara Stefanini (Mission 2020), Allison Fajans-Turner and Lauren Wolahan (ClimateNexus) and Nicolas Fux and Victoria Fischdick (NewClimate Institute) for providing valuable feedback and support on the communications and outreach of this report.

Data on output performance and the scope and scale of cooperative climate action was collected by the "Strengthening non-state climate action in the Global South" project (ClimateSouth) which is generously supported by the Europe and Global Challenges Fund, a joint initiative of the Volkswagen Foundation, the Sveriges Riksbank, and the Wellcome Trust. The project received additional support from German Development Institute/Deutsches Institut für Entwicklungspolitik's "Klimalog" project, generously funded by the German Federal Ministry of Economic Cooperation and Development (BMZ). We thank Malin Gütschow, Sara Posa, Miriam Lia Cangussu Tomaz Garcia, Eugene Tingwey and Benedetta Nimshani Khawe Thanthrige for their support on data gathering.

Many external reviewers also provided critical feedback on this report. Our thanks to: Tom van Ierland, Olivia Gippner and Miles Perry (Directorate General Climate Change, European Commission); Shannon McDaniel (Global Covenant of Mayors for Climate & Energy); Pieter Boot and Michel den Elzen (PBL Netherlands Environmental Assessment Agency); Ken Tanaka (World Wide Fund for Nature Japan); Yann Robiou du Pont (Institute for Sustainable Development and International Relations: IDDRI); Ann Gardiner (SQ Consult); Julie Cerqueira and Kristin Igusky (United States Climate Alliance); Allison Fajans-Turner (Climate Nexus); Felipe Bittencourt (WayCarbon); Lu Sun and Molly Wang (C40 Cities Climate Leadership Network); Meian Chen (innovative Green Development Program); Jean-Charles Seghers, Henry Quintana and Milimer Morgado (The Climate Group); Maryke van Staden and Chang Deng-Beck (ICLEI – Local Governments for Sustainability); Manjyot Ahluwalia and Mariana Panuncio-Feldman (World Wide Fund for Nature U.S.); and Carla Frisch (Rocky Mountain Institute). We also thank Caren Weeks and Nicole Winter for their contributions to the report's design and layout.

CITIES, REGIONS AND BUSINESS GIVE CONFIDENCE TO BOOST CLIMATE ACTION TO NEW HEIGHTS

By Andrew Higham, Chief Executive of Mission 2020 and Visiting Fellow of Practice at the University of Oxford's Blavatnik School of Government

Climate change is ravaging our planet, and we aren't doing anywhere near enough to stem it.

The fire is engulfing our home, and we're spraying droplets.

We know full well that all governments need to ramp up their efforts to slash greenhouse gas emissions faster than many think is possible. We need to limit the global temperature rise to 1.5°C if we want to avoid trillions of dollars in damages and millions of deaths and species extinctions, but we're headed for more than 3°C.

Yet there is a glimmer of hope: countries are closer than they think to meeting and surpassing the goals they set under the Paris Agreement, thanks to commitments by cities, regions and businesses, according to this comprehensive analysis of climate action outside of national governments.

Add up the commitments made by local governments and companies — in 10 of the world's highest-emitting economies and worldwide through partnership initiatives — and the world is on track to a 2°C limit. This means governments are farther ahead in the race to save humanity than we thought, which gives them more room — and confidence — to shoot for 1.5°C maximum.

Of course, this extra boost should not be taken for granted. We're talking about the potential for cities, regions and businesses to reduce emissions — if commitments are met and scaled up.

It won't be easy. Most of that contribution to a 2°C limit comes from international climate initiatives, where cities, companies, civil society, national governments and others sign up to joint efforts such as boosting energy efficiency, powering company operations on 100 percent renewables, or ending deforestation by 2030. These networks encourage ambition and innovation, but their goals can be much harder to achieve and their memberships tougher to expand.

Still, as governments are asked to jack up their commitments by 2020 under the Paris Agreement, this study tells us they have untapped potential in their own backyards. It shows there is ambition to do more, especially through international partnerships. Now governments must harness that potential, strengthen it considerably, and help turn it into reality, while cities, regions and businesses must make sure they fulfill their promises.

Just look at how local government and corporate commitments contribute to climate action in the 10 high-emitting economies examined in this report.

In the European Union, they could lower emissions by 48 percent by 2030, from 1990 levels. That's well beyond the bloc's Paris goal of at least 40 percent. Suddenly, a new goal of 55 percent by 2030, as many in Brussels are calling for, doesn't seem like such a big jump.

In India, they would add a 9 percent reduction compared to projections for national policies by 2030. The country is already on track to surpass its Paris goal without this extra contribution.

These commitments are especially important in countries where national leaders are backtracking on climate change, like the United States and Brazil. Local governments and companies could help the US meet its pledge for 2025. International initiatives could help Brazil cut emissions by up to 36 percent below what current national policies would do by 2030.

The United Nations' Climate Action Summit on September 23, 2019 is a moment of reckoning, in a year that has seen deadly storms tear through southern Africa and the Bahamas, fires wipe out parts of the Amazon rainforest, Arctic sea ice melt to new lows, and millions of people worldwide — many inspired by children — protesting decades of inaction.

Secretary-General António Guterres is calling on countries to respond by immediately ending support for fossil fuels and taxing them. Swift response, like ending new coal plant construction by 2020, may seem extreme. But it's not, because the space, willingness and ambition to do more is already there. Governments just need to foster this energy, and push it to new heights.

PART OF THE M2020 CAMPAIGN

ABBREVIATIONS AND ACRONYMS

°C	degrees Celsius
ACA	Alliances for Climate Action
AREI	Africa Renewable Energy Initiative
BAU	Business-as-usual
C3	Climate Change Council
C40	C40 Cities for Climate Leadership Group
CAATW	Collaborative Climate Action Across the Air Transport World Initiative
CCAB	Corporate Climate Action Benchmark
CCAC	Climate & Clean Air Coalition
CICC	Mexico's Inter-secretarial Commission on Climate Change
CO_2e	Carbon dioxide equivalent
COP	Conference of the Parties
CPS	"Current national policies" scenario
DIE	German Development Institute/Deutsches Institut für Entwicklungspolitik
ETIP PV	European Technology & Innovation Platform Photovoltaic Initiative
EU	European Union
FOF	Function-Output-Fit
G20	Group of Twenty
GCAS	Global Climate Action Summit
GCFTF	Governors' Climate and Forests Task Force
GCoM	Global Covenant of Mayors for Climate & Energy
GDP	Gross Domestic Product
GFEI	Global Fuel Economy Initiative
GGA	Global Geothermal Alliance
GHG	Greenhouse gas
Gt	billion tonnes = 10^9 tonnes
GW	Gigawatt = 10^9 watt
GWP	Global warming potential
HFC	Hydrofluorocarbons
ICI	International Cooperative Initiative
IIASA	International Institute for Applied Systems Analysis
IPCC	Intergovernmental Panel on Climate Change
JCI	Japan Climate Initiative
LEDS	Low Emissions Development Strategies
LULUCF	Land use, land-use change and forestry
Mt	Million tonnes = 10^6 tonnes
NAZCA	Non-state Actor Zone for Climate Action (NAZCA) portal; rebranded as the Global Climate Action portal
NDC	Nationally Determined Contribution
NDRC	China's National Development and Reform Commission
NYDF	New York Declaration on Forests Initiative
OECD	Organisation for Economic Co-operation and Development
PACCM	Mexico City's climate action plan
PBL	PBL Netherlands Environmental Assessment Agency
RAD-GRK	Indonesia Local Action Plan for Greenhouse Gas Reduction
RAN-GRK	Indonesia National Action Plan for Greenhouse Gas Reduction
REDD+	United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries
RoW	Rest of the World
SBTi	Science-Based Targets Initiative
SCAN-tool	Ambition to Action's SDG Climate Action Nexus Tool
SDG	Sustainable Development Goal
SEAD	Super-efficient Equipment and Appliance Deployment Initiative
SLCP	Short-lived climate pollutant
SR1.5	Special report on warming of 1.5°C by the Intergovernmental Panel on Climate Change
TWh	Terawatt-hour = 10^{12} watt-hour
U4E	United for Efficiency Initiative
UN	United Nations
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
US	United States
USD	United States Dollars
ZEV	Zero-Emission Vehicle

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EXECUTIVE SUMMARY

Cities, regions, and business are vital for achieving national and global climate change goals. Their climate action helps countries deliver and in some cases over-achieve current national pledges under the Paris Agreement. Globally, existing initiatives by these actors, in partnership with national governments, could put the world on track to limit global warming to 2°C, if they deliver their stated goals.

While not yet sufficient to stay below the 1.5°C limit, climate action by cities, regions, and business allows national governments to raise their commitments and helps keep global limits within reach. The Intergovernmental Panel on Climate Change (IPCC) 2018 special report on warming of 1.5 °C (SR1.5) emphasised the need for all actors — state, sub-national, and non-state — to strengthen climate action, and highlighted cooperation between actors as a critical mechanism for halving emissions by 2030 in order to meet the 1.5°C goal.

In addition to helping achieve the goals of the Paris Agreement, climate action by cities, regions and business can support the delivery of other Sustainable Development Goals (SDGs) by 2030. Given the increasing attention to synergies and potentially negative impacts between climate action and other SDGs, cities, regions and business can help ensure that global climate efforts are implemented in a way that supports, rather than hinders, local sustainable development.

This report is the second global analysis of local and regional government and corporate climate contributions, updating "Global Climate Action from Cities, Regions, and Companies" launched at the 2018 Global Climate Action Summit. The 2018 report established the strong potential of subnational and non-state actors to help avoid climate change. This year, we aim to inform the September 2019 UN Climate Action Summit on how mitigation by cities, regions and companies could help national governments boost their ambition beyond their current targets, to come in line with the Paris Agreement's goals. This report aggregates the climate mitigation commitments reported to some of the world's largest voluntary pledging and reporting platforms for city, region, and company climate commitments. The analysis was conducted at a global level as well as for ten major emitting economies: Brazil, Canada, China, the European Union (EU), India, Indonesia, Japan, Mexico, South Africa and the United States (US). In addition, the report features the following new components:

- An updated assessment of international cooperative initiatives (ICIs) and whether their outputs are consistent with their main functions;
- An updated assessment of synergies and trade-offs between non-state international initiatives and SDGs.

Climate action by cities, regions, and business represents a significant portion of the world economy and population

Cities, regions and companies engaged in climate action (including mitigation, adaptation, and supporting activities) represent a significant portion of the world economy and population. While exact numbers vary across studies, the broad universe of climate action includes over 10,200 cities and regions and over 6,000 businesses recording climate action efforts in 2018.

This report focuses on emissions reductions, and therefore analyses only a subset of this wider universe of climate action. We zoom in on those cities, regions and companies in ten of the world's major emitting economies that have made quantifiable commitments to reduce greenhouse gas emissions. These include:

- Approximately 6,000 cities and regions have made commitments to reduce GHG emissions, and share supporting information that makes it possible to quantify their potential impact. The local and regional governments making these commitments represent populations that rival some of the world's largest countries: participating cities represent a collective population of 579 million – more than the combined population of the US and Brazil – while participating regions are home to approximately 514 million people, about four times the population of Japan.
- Roughly 1,500 companies report quantifiable climate action commitments to CDP, representing a combined revenue of more than 20.5 trillion USD, the size of the US GDP.

More than 300 international cooperative initiatives (ICIs) – joint projects in which cities, regions, and business work together across borders, sometimes with national governments and international organisations – also facilitate climate action. We report on the performance of 190 of these ICIs whether initiatives have been taking appropriate steps to deliver their goals, and how this "output performance" has developed over the last six years. Among those that scored well in the output performance assessment, we selected 17 initiatives that have wide emissions coverage and quantified their GHG emissions reduction potential.

Our report therefore focuses on the subset of sub-national, non-state and cooperative climate action most relevant for emissions reductions. It represents, to the authors' knowledge, the most comprehensive analysis to date of the mitigation potential of subnational and non-state climate action. However, despite significant advances in data availability and analysis over the past few years, it remains extraordinarily difficult to obtain a comprehensive measure of what all cities, regions, businesses and other actors around the world are doing on climate change. This report uses the best available current data reported through global networks like the Global Covenant of Mayors for Climate & Energy, CDP, the carbonn® Climate Registry, the Climate Initiatives Platform, among others. They by no means, however, capture the full range or diversity of climate actions occurring globally, particularly those actions that are difficult to quantify, occur in underrepresented regions, or are not formally institutionalised.

Cities, regions, and business can help close the global emissions gap

This 2019 report reinforces subnational and non-state actors' significant contributions in reducing emissions to bring the world closer to achieving global climate goals.

Subnational and non-state actor emissions reductions are calculated based on the commitments they have made and reported to different international databases, accounting for overlaps between actor groups to ensure we do not "double count" actions.

Overall, the report finds that global GHG emissions in 2030 would be 1.2 to 2.0 $GtCO_2e$ lower than the current national policies scenario (Figure ES1), if the recorded and quantified commitments by individual cities, regions and companies in the ten major emitting economies are fully implemented, and if such efforts do not change the pace of action elsewhere, ("Current national policies plus individual actors' commitments" scenario). This range is roughly equivalent to Canada and Japan's combined emissions in 2016. If nationally determined contributions (NDCs) to the Paris Agreement are fully implemented, these commitments by cities, regions, and businesses in just 10 economies could deliver additional emissions reductions of 0.4 to 0.7 $GtCO_2e$ in 2030 ("NDCs plus individual actors' commitments" scenario).

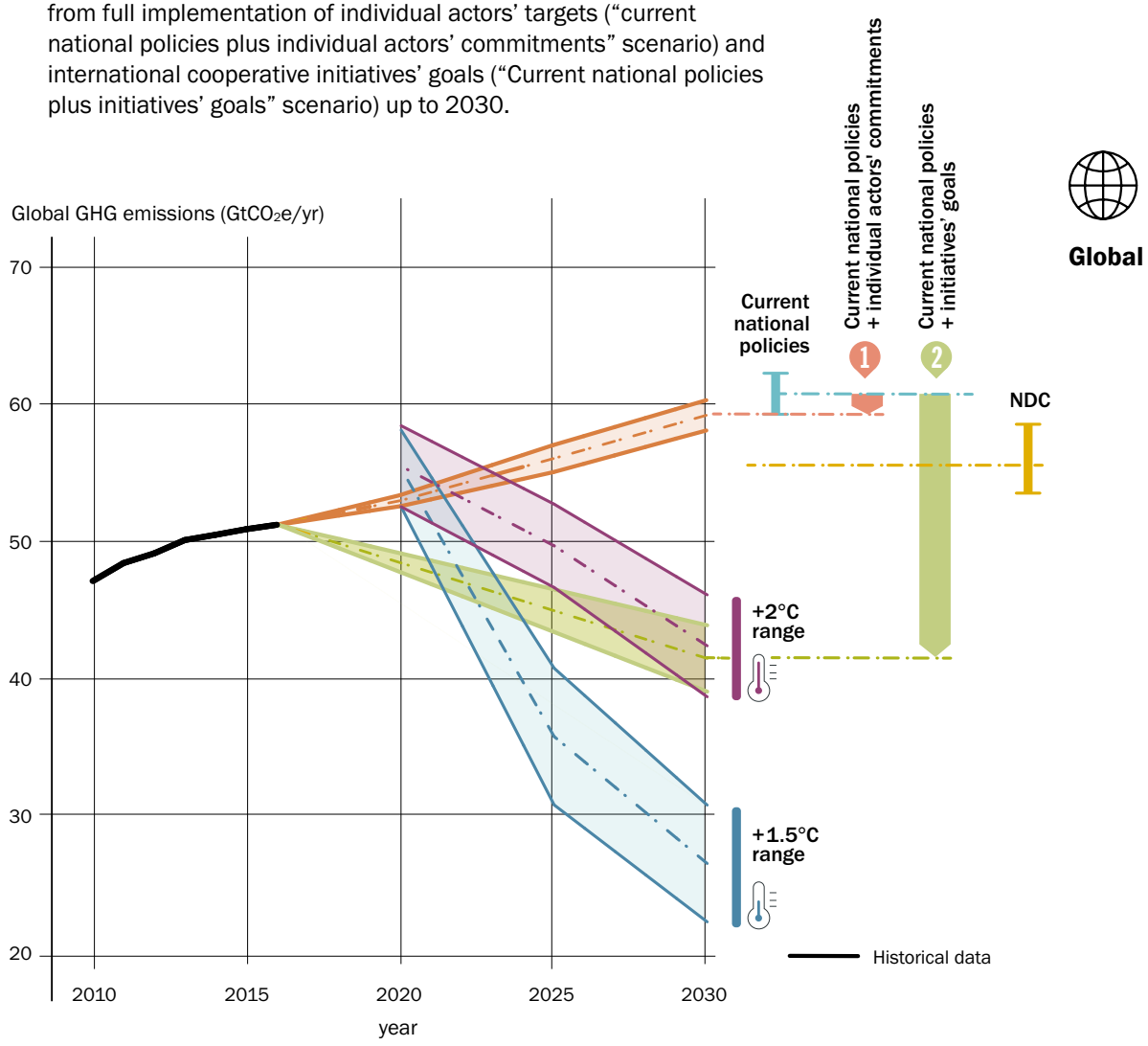
This analysis takes into account the fact that multiple actors aim to reduce the same emissions. We compared emissions levels in the pledged commitments by cities, regions and businesses with the emissions levels implied by the implementation of current national (and EU) policies. For example, if a city was nested in a region and both had the same level of ambition, only the region's actions were counted (see technical Annex).

The biggest potential impact on emissions, however, comes from international climate initiatives. The 17 initiatives we analyse in which cities, regions, businesses, and other subnational and non-state actors work together, often partnering with governments or international organizations, have the potential to reduce global GHG emissions significantly beyond the emissions levels expected from current national policies and NDCs. Our analysis shows that ICIs ("current national policies plus initiatives goals" scenario) can reduce global emissions in 2030 by 18 to 21 $GtCO_2e$ compared to a current national policies scenario

projections (60 to 63 $GtCO_2e$/year), assuming all initiatives analysed meet their goals and efforts do not change the course of action elsewhere (Figure ES1).

If delivered, reductions by these 17 ICIs would close the global emissions gap to 2°C of warming in 2030 (in 2100, 66% chance), although a significant gap remains for reaching 1.5°C (in 2100, 66% chance). If countries also implement the unconditional NDCs submitted under the Paris Agreement ("NDCs plus initiatives' goals" scenario, 55 to 58 $GtCO_2e$/year in 2030), the initiatives have an additional potential aggregated impact of 15 to 18 $GtCO_2e$/year globally in 2030.

Figure ES1. Potential global greenhouse gas (GHG) emissions reductions resulting from full implementation of individual actors' targets ("current national policies plus individual actors' commitments" scenario) and international cooperative initiatives' goals ("Current national policies plus initiatives' goals" scenario) up to 2030.



Data sources: current national policies scenario (CPS) projections from Climate Action Tracker (2018b) supplemented with land use, land-use change and forestry (LULUCF) emissions projections adapted from Forsell et al. (2016), NDC (unconditional) scenario projections from Climate Action Tracker (2018b), 2°C (in 2100, 66% chance) and 1.5°C (in 2100, 66% chance) pathways from UNEP (2018) adapted to global warming potentials (GWPs) from the IPCC Fourth Assessment Report based on the 2016 historical data from PRIMAP database (Gütschow, Jeffery and Gieseke, 2019), impact of individual actors and initiatives: this study.

Cities, regions, and business can help countries (over)achieve their NDCs, creating space for greater ambition

Our results show that cities, regions and companies could help countries deliver their NDCs by taking ambitious actions beyond national policies. In particular we find that the aggregate of individual commitments by cities, regions and companies alone could deliver more emissions reductions than the current unconditional NDCs pledged by governments in a number of countries:

- For the EU, the full implementation of recorded and quantified individual commitments by cities, regions and businesses could (in addition to current national policies) lead to reductions as low as 48% in 2030 from 1990 levels (lower bound of our range, including land use, land-use change and forestry: LULUCF). These values are beyond the current NDC of "at least 40%", although the EU's NDC target does not specify the extent to which LULUCF sinks would be accounted for.
- For India, individual commitments would bring down emissions to about 3,800 to 4,200 $MtCO_2e$/year in 2030, 5.5% below the current national policy scenario projections and about 1,100 to 1,900 $MtCO_2e$/year lower compared to the NDC target emission levels.
- For Japan, individual commitments would bring down emissions by 8% to 12% below the current policies scenario projections by 2030 and up to 70 $MtCO_2e$/year lower than below the NDC target emission levels.

Commitments by individual cities, regions and companies can also help maintain momentum in countries where national governments are rolling back policies:

- Importantly, for the US, the aggregate potential impact of recorded and quantified individual commitments would bring the country close to the upper bound (or least ambitious end) of its 2025 NDC target. The full implementation of initiatives' goals would reduce emissions even beyond the original NDC.
- For Brazil, quantified individual commitments by cities, regions and companies would reduce emissions in 2030 by an additional 40 to 80 $MtCO_2e$/year below current national policies scenario projections

These results have a number of important implications. First, sub- and non-state climate action is helping some countries achieve or over-achieve their NDCs. Second, many countries could raise their NDC ambition by incorporating existing commitments by cities, regions and companies in their national climate policy formulation process. Third, strengthened collaboration between national governments and sub-national and non-state actors together can contribute to sectoral transformations needed for a decarbonised society in line with 1.5°C. We find for a few economies such as the European Union and the United States that the emissions trajectories for "current policies plus initiatives' goals" scenarios are roughly consistent with net zero CO_2 or GHG emissions around mid-21st century.

While many national governments do not seem to fully acknowledge non-state climate action in their climate policy formulation, the results clearly show that national governments could leverage cooperative initiatives to put the world on track to reach long-term carbon neutrality consistent with the Paris Agreement's long-term temperature goal. It is therefore crucial that national governments enhance cooperation with these initiatives to accelerate efforts toward long-term carbon neutrality.

Implementing city, region, and business climate action can help countries achieve their Sustainable Development Goals

It is clear that mitigating climate change can contribute to broader sustainable development. But it must be aligned to ensure that climate action benefits development, rather than disadvantaging certain populations. The shift to low-carbon industries, for example, must be done in a way that creates new job opportunities across the economy. By contrast, a lack of reflection on how broader sustainability affects climate change may result in missed opportunities and limit the political sustainability of climate action.

Cooperative climate initiatives with high mitigation potential have highlighted explicit linkages between their efforts and other sustainability outcomes. Besides SDG 13 (climate actions), initiatives frequently link to SDG 7 (affordable and clean energy); SDG 9 (industry, innovation and infrastructure); SDG 17 (partnership for the goals), SDG 11 (sustainable cities and communities), and SDG 12 (sustainable consumption and production). Explicit mentions mainly concern synergies, however, initiatives are less likely to directly mention possible negative side effects. We find that SDG 11 (sustainable cities and communities), SDG 8 (decent work and economic growth), SDG 15 (life on land), SDG 2 (zero hunger), and SDG 1 (no poverty) represent areas in which trade-offs are most likely to occur, if not managed well.

There is more potential for positive rather than negative effects of climate action on other sustainable development goals, and vice versa. Still, subnational and non-state initiatives should pay closer attention to the potential problems in order to avoid unintended consequences. Making the possible trade-offs explicit, and devising strategies to avoid them, will be necessary to more closely align and simultaneously deliver on climate and sustainability goals.

01

INTRODUCTION

The role of cities, regions and businesses in global climate action has become more important than ever. The special report on warming of 1.5°C (SR1.5) by the Intergovernmental Panel on Climate Change (IPCC) emphasised the need for strengthened and timely action to reduce greenhouse gas (GHG) emissions by all subnational and non-state actors as well as cooperation and partnerships between countries and subnational and non-state actors to limit global warming to 1.5°C (IPCC, 2018b).

Sub-national and non-state climate action is not an alternative to action by national governments; indeed, the literature suggests that subnational and non-state climate action is largely complementary to national policies (Andonova, Hale and Roger, 2017; Roger, Hale and Andonova, 2017). Understanding the potential of subnational and non-state climate action alongside national governments is critical because the mitigation potential of cities, regions, and business is significant. A first quantification of the mitigation commitments of cities, regions and businesses published by Data-Driven Yale, NewClimate Institute and PBL at the occasion of the Global Climate Action Summit (GCAS) held in September 2018 (Data-Driven Yale, NewClimate Institute and PBL, 2018) showed that the emissions gap between the current policies scenario and 1.5°C scenario pathways could potentially be entirely closed if their ambition fully materialised. Subnational and non-state actors are also increasingly responding to calls for action – the GCAS triggered about 500 commitments to strengthen action from a range of subnational and non-state actors (UNFCCC, 2018), some which are leading climate action in countries where national governments are rolling back policies.

Under the Paris Agreement and its "ratchet" mechanism, countries are requested to update their current nationally determined contributions (NDCs) by 2020 with more ambitious ones. Although subnational and non-state actors could potentially become key drivers of strengthened country-level climate action, national governments overall did not fully leverage the potential subnational and non-state actor contributions to the first NDCs (Hsu et al., 2019). It is therefore important to provide national governments with evidence of subnational and non-state climate action to support the necessary increase in ambition.

Climate action is part of the (SDGs), and there is an increasing attention on synergies and trade-offs between climate action and the other UN SDGs. The role of subnational and non-state actors is crucial in this process. The participants of the first UN Climate Action and SDGs Synergy Conference held in April 2019 underscored the key role of subnational and local governments in simultaneously addressing climate change and sustainable development (UN, 2019). The management of direct trade-offs would be crucial to ensure a just transition and that "no one is left behind". To date there are a limited number of studies that assessed quantitatively or qualitatively the potential synergies and trade-offs between SDGs and subnational and non-state climate action.

Against the aforementioned backdrop, this report updates the 2018 Data-Driven Yale et al. (Data-Driven Yale, NewClimate Institute and PBL, 2018) report launched at the occasion of the GCAS to provide the latest insights into the potential aggregate impact of climate change mitigation action from cities, regions and companies up to 2030, and aims to inform the September 2019 UN Climate Action Summit, which convenes a range of actors from around the world, on how subnational and non-state

actor climate change mitigation action could help national governments to boost ambition in line with the long-term goal of the Paris Agreement. As in the 2018 report, we aggregate climate mitigation commitments made by cities, regions, companies and other non-state actors to some of the world's largest voluntary platforms for pledging and reporting on climate commitments. The analysis was conducted at a global level as well as for ten major emitting economies: Brazil, Canada, China, the European Union (EU), India, Indonesia, Japan, Mexico, South Africa, and the United States (US). In addition, the report also features the following new components:

- Up-to-date assessment of synergies and trade-offs between non-state international initiatives and SDGs;
- Up-to-date assessment of international cooperative initiatives (ICIs) on whether they are producing outputs that are consistent with their main functions.

Despite significant advances in data availability and analysis over the past several years, it remains extraordinarily difficult to obtain a comprehensive measure of what all cities, regions, businesses, and other actors around the world are doing on climate change. The world of climate action is vast and heterogenous and cannot be fully captured by current methods. The present report uses the best available current data, looking at sub- and non-state climate action that is reported to global databases and networks like the Global Covenant of Mayors, CDP, ICLEI's carbonn® Climate Registry and the Climate Initiatives Platform, plus the authors' own efforts. Such efforts tend to identify climate action that is explicitly described as "climate" related, and that has greater visibility from linkages to international networks. As such, the present analysis presents a relatively conservative estimate for the scale and scope of climate commitments, and is likely systematically underrepresenting smaller scale actions, those that are not formally institutionalised, or those not described or presented in English or other major languages. To cite just one example, the UN's Global Climate Action (NAZCA) portal records just three instances of climate action in Kenya, but an independent survey of companies listed on the Nairobi Stock Exchange found nearly 50 companies that had a concrete emissions reduction target (ClimateSouth, 2018). Fortunately, an increasing number of platforms are emerging to catalyse, support, and track climate action in the global South. ActionLAC provides a leading example in Latin America, surveying existing regional networks and offering online webinars on climate action in which more than 600 regional stakeholders have participated (ActionLAC, 2019). Similarly, Alliances for Climate Action (ACA, 2019) and its member domestic multi-stakeholder coalitions are systematising the climate commitments made by subnational and non-state actor signatories.

This report is structured as follows. The global landscape of individual commitments by cities, regions and companies as well as of ICIs is presented in Section 2. Section 3 then presents our updated assessment on the global potential impact of subnational and non-state actors' actions on GHG emissions. Section 4 presents the key findings on the analysis of linkages between SDGs and ICIs. Section 5 compiles the key findings from the previous sections for each of the ten major emitting economies. Finally, Section 6 summarises the findings of this study and draws recommendations for policymakers.

02

LANDSCAPE OF SUBNATIONAL AND NON-STATE CLIMATE ACTION

The following section characterises the landscape of subnational and non-state climate change mitigation commitments recorded through some of the world's largest voluntary climate pledging and reporting platforms. While our analysis is not comprehensive – there are instances of global climate action not captured in the platforms we draw from – it provides a window into trends in participation and non-state and subnational climate action. We also provide a descriptive overview of the various timeframes, ambition, and sectors of these actors' mitigation targets.

This section first assesses recorded and quantifiable commitments of individual cities, regions, and companies (section 2.1). We then provide an overview of multi-actor "international cooperative initiatives": multi-stakeholder arrangements through which subnational and non-state actors cooperate across borders to mitigate or adapt to climate change, often in partnership with national governments or international organizations.

2.1 INDIVIDUAL CITIES, REGIONS AND BUSINESSES

This analysis focuses on a subset of the wider universe of cities,[1] regions,[2] companies, investors, civil society groups, universities, religious organizations, and investors pledging to reduce emissions, foster resilience, and unlock financing to address climate change. Specifically, we gathered data from climate action networks and international cooperative initiatives that regularly collect and report information on their members (see Box 1). We narrowed this selection further by focusing on cities, regions, and company participants in these networks that have also set quantifiable commitments[3] to reduce their GHG emissions.

Over 10,200 subnational actors (cities and regions) participate in various membership networks and cooperative initiatives (see Box 1). Over 6,000 of them or about 58% have made quantifiable commitments to reduce GHG emissions in 10 of the world's largest emitting economies: Brazil, Canada, China, the EU, India, Indonesia, Japan, Mexico, South Africa, and the US. Including the current membership of the EU, these subnational actors making quantifiable commitments span 37 countries. Similarly, out of the more than 6,000 companies that responded to CDP's 2018 climate change questionnaire, over 1,500 companies have made quantifiable commitments to reduce GHG emissions in the ten major emitting economies investigated in this study. The sections below explore trends in the cities, regions, and companies making quantifiable commitments to reduce GHG emissions, and in the types of pledges they commit to.

1 "Cities" throughout this report generally refer to administrative units that pledge commitments to a climate action platform, which include municipalities, towns, urban communities, districts, and counties defined by the actors themselves.

2 "Regions," including US and Indian states, German Länder, and Chinese provinces, are larger administrative units that are generally broader in geographic scope and population than cities. They usually have separate governing bodies from national and city governments but encompass lower administrative levels of government; often, they are the first administrative level below the national government. Regions can also include councils of subnational governments acting together.

3 Quantifiable commitments to reduce greenhouse gas emissions generally include a specific emissions reduction goal, target year, and baseline year (e.g., to reduce emissions by 20% compared to 2000 levels by 2020). In addition, calculating these targets' impact on overall emissions requires emissions in the baseline year. See Technical Annex I for more details on how emissions reductions commitments are selected and quantified.

BOX 1: CLIMATE ACTION NETWORKS INFORMING THIS ANALYSIS

The number of nonstate and subnational actors pledging climate actions through various membership networks and cooperative initiatives has grown steadily over the last few years. For this analysis of actors making individual commitments through these platforms, we draw from:

- **Alliance of Peak Pioneering Cities**
- **C40 Cities for Climate Leadership Group**
- **ICLEI – Local Governments for Sustainability carbonn® Climate Registry**
- **CDP**
- **The Compact of States and Regions**
- **Global Covenant of Mayors for Climate & Energy**
- **Global Covenant of Mayors for Climate & Energy (EU Secretariat)**
- **Under2 Coalition**
- **United States Climate Alliance**
- **Climate Mayors**
- **We Are Still In**

These networks, initiatives and platforms define membership, engagement and commitments to climate action in various ways and require members to report varying levels of information regarding their pledges. Some networks focus primarily on galvanizing participation in climate action, while others ask participants to report data and progress on targets annually. Several networks require members to pledge specific climate actions. Signatories of the Global Covenant of Mayors for Climate & Energy (EU Secretariat), for instance, support the implementation of the EU's 40% GHG reduction target by 2030 (EU Covenant of Mayors, 2018).

We collected subnational data by working directly with networks and by collecting publicly available data from their platforms. We worked directly with CDP to include their 2018 Climate Investor and Supply Chain Disclosure Surveys results as the primary source of company-level data. We then identified actors making "quantifiable" commitments to reduce GHG emissions – that is, commitments with a clear target year, emissions reduction target, base year, and base year emissions (see Technical Annex I for more details on the definition and selection of quantifiable targets).

The full universe of bottom-up climate action expands far beyond this subset of actors pledging quantifiable commitments through these climate action platforms. Studies have shown the full extent of climate action often goes un-reported, particularly among actors from the Global South (Chan and Hale, 2015; Hsu et al., 2016; Widerberg and Stripple, 2016; UNFCCC, 2018). Awareness of and resources for reporting and recording climate commitments vary across economic, geographic, and national contexts, and many emissions reductions may go unrecorded.

Additionally, many commitments that lack quantifiable information may still lower emissions, either directly or by creating enabling conditions for climate action. For instance, efforts to establish climate councils or working groups can build the knowledge and stakeholder buy-in needed to later set and meet a mitigation goal. Similarly, while we explore trends in mitigation targets' timelines and goals, this information is meant to be descriptive, rather than evaluative. While all actors will need to shift to a decarbonised society to keep the goals of the Paris Agreement within reach, the most appropriate target and timeline may vary according to actors' emissions profiles, geography, and resources.

While not comprehensive of all actors and climate actions globally, the data evaluated for this study provides a detailed window into bottom-up mitigation efforts, identifying trends, patterns, and gaps in cities, companies and state and regions' responses to climate change.

2.1.1 CITIES AND REGIONS

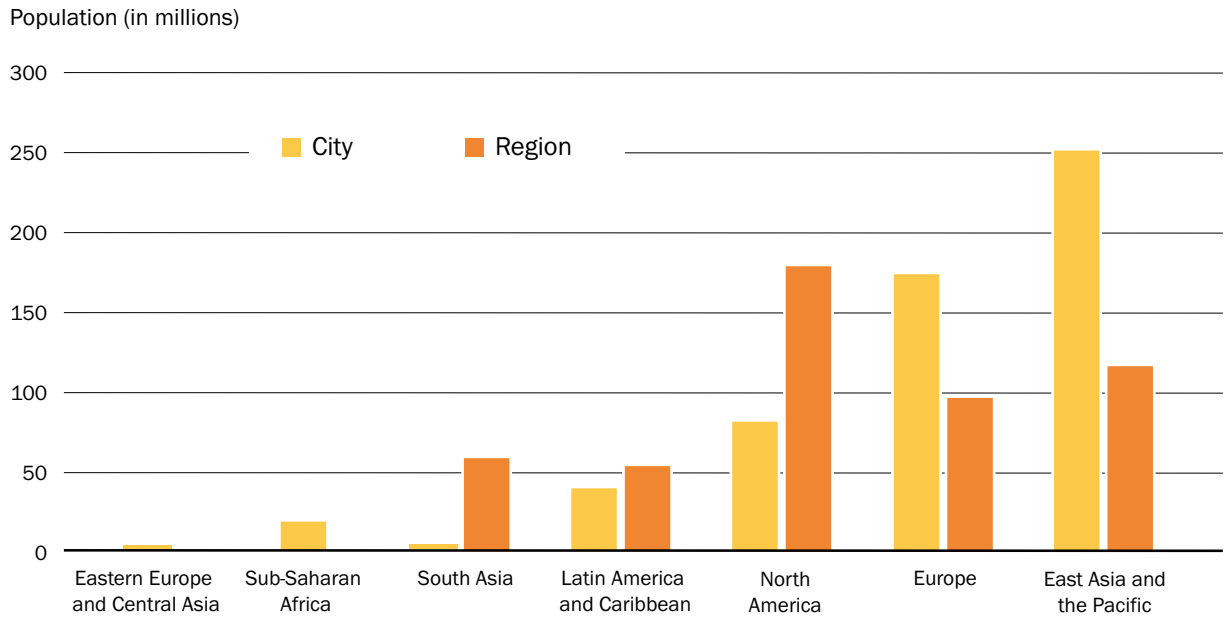
This section focuses on the more than 6,000 cities and regions making quantifiable commitments to reduce GHG emissions in the 10 major emitting economies included in this study. **These cities represent a population of 579 million, while participating regions hold nearly 514 million people.** In other words, they represent a combined population that rivals those of large countries; only China and India have larger populations. Cities taking climate action hold more people than the US and Brazil combined, while regions taking climate action represent a population about four times the size of Japan's (World Bank, 2019).[4]

Europe and North America host the greatest number of cities and regions making quantifiable commitments to reduce GHG emissions. Subnational governments in East Asia and the Pacific, however, represent the largest collective population (See Figure 1). Many of the participating actors in this region are megacities – urban areas home to more than 10 million people – that exercise huge influence over their countries and region's emissions. While relatively few actors are making quantifiable commitments in South Asia and Latin America these cities and regions also represent large populations, giving their efforts substantial influence within their countries. Cities making quantifiable climate commitments in Latin America and the Caribbean collectively hold 41 million people, roughly 4 million more than Canada's 2018 population (World Bank, 2019).

A few common threads emerge from the quantifiable emission reduction commitments included in this analysis. Most of the emission reduction commitments analysed in this report set targets to reduce GHG emissions relative to a prior year (or "base year"), by a "target year." For instance, a city might pledge to reduce its GHG emissions by 25% from 2000 levels by 2020.

The vast majority (93% percent) of local governments' quantifiable emission reduction commitments focus on short-term targets, aiming to reduce emissions by or in 2020. The remaining 7% of targets are split relatively

Figure 1. Population of cities and regions making quantifiable commitments to reduce GHG emissions by geographic region



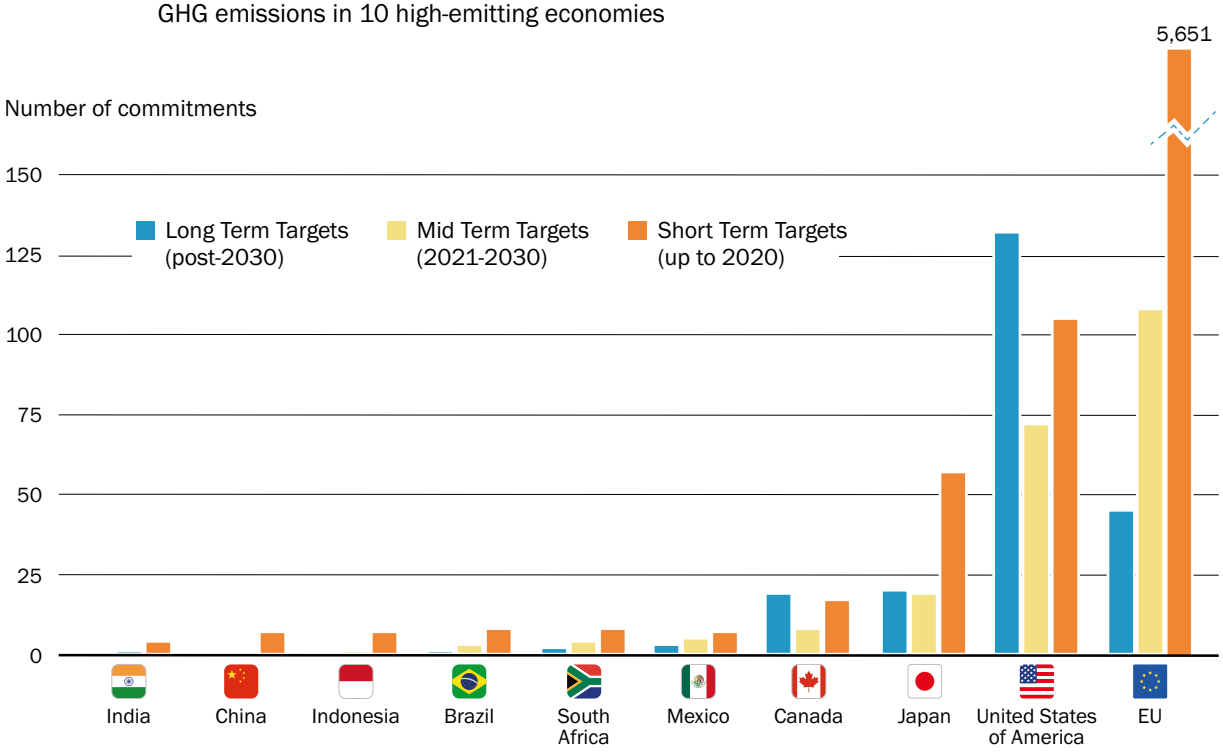
Data source: various

4 Note that these population totals consider cities and regions separately.

evenly between mid-term targets – which set target years between 2021 and 2030 – and long-term post-2030 targets (see Figure 2). The heavy focus on short-term targets reflects, in large part, high levels of adoption of a 2020 goal by the European participants in the Global Covenant of Mayors for Climate and Energy. This trend also applies – less dramatically – across other geographic locations. One exception is the US, which leads in terms of the number of cities and states making long-term quantifiable commitments. More than half of the US cities and states with 2050 targets also had mid-term targets for years after 2025.

The most common GHG emissions reduction target made by cities and regions hovers just above 20%. The average emissions reduction target is 27%, reflecting the short-term (-2020) nature of most of the targets, as mid- and long-term emissions reduction goals typically grow increasingly ambitious with later target years. The most common mid-term (2021-2030) emissions reduction target is 40%, while the most common target for longer-term targets (set after 2030) is 80%. The most common base year for all commitment types (short-, mid-, and long-term) is 2007, though the full range of base years spans 1990 to 2017. The full range of emission reduction goals across all commitments ranges from less than 1%, for a small handful of actors, and stretches up to targets to reduce 100% of emissions. Approximately 65 cities and regions have set net zero or carbon neutrality targets, pledging to bring their emissions to zero, many on rapid timelines. Copenhagen, for instance, aims to become the first carbon neutral capital city by 2025, and the US state of Hawaii has set an ambitious goal of reaching net zero emissions by 2045. In practice, this typically involves a combination of reducing the bulk of an actors' GHG emissions and offsetting any remaining emissions by, for instance, planting and protecting forests or purchasing renewable energy credits.

Figure 2. Number and target years of cities and regions' quantifiable commitments to reduce GHG emissions in 10 high-emitting economies



Data source: see Box 1

2.1.2 COMPANIES

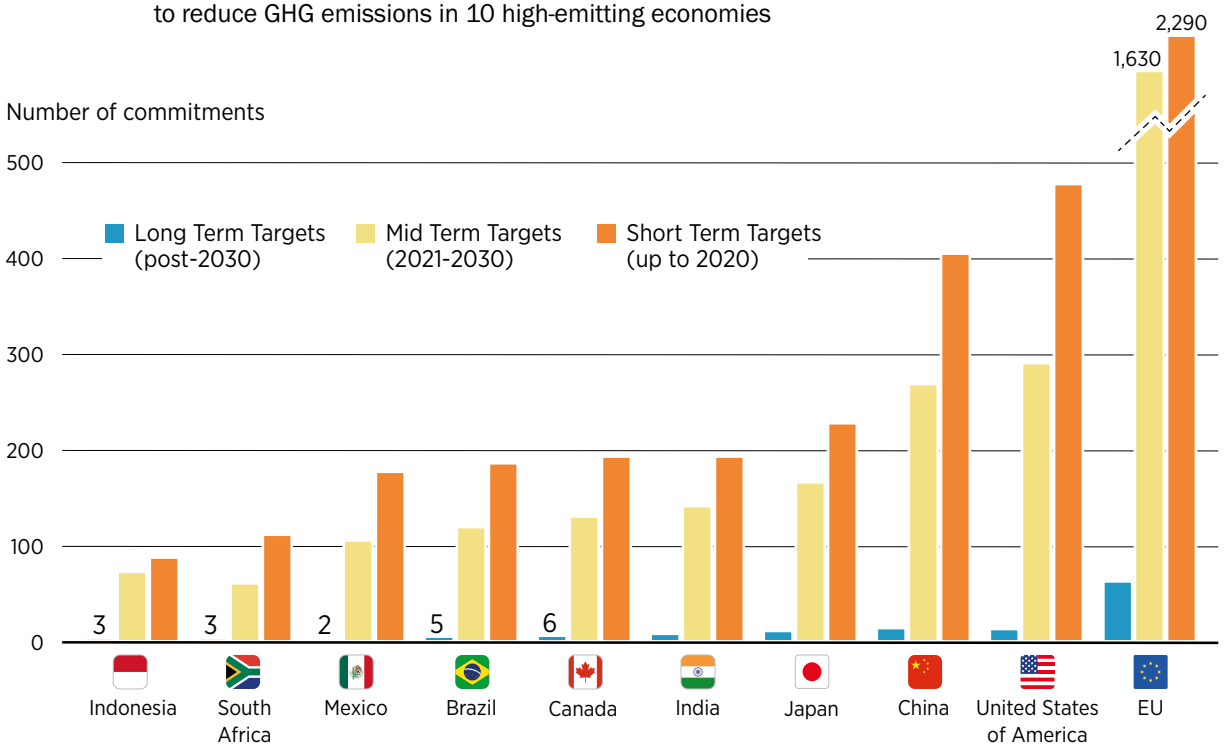
Nearly 1,500 companies, operating within 10 of the world's major emitting economies, have made quantifiable commitments to reduce GHG emissions through CDP. Their combined revenue totals over **$20.5 trillion US Dollars (USD)**, the size of the US GDP (World Bank, 2019). More than 450, or just over 20%, of the world's largest companies – defined in terms of their membership in the 2019 Fortune Global 500[5] and Global Forbes 2000[6] lists – are included in this total.

Across the 10 major emitting economies this report considers, the EU, the US, and China host the greatest number of companies making quantifiable GHG reduction commitments. Targets set by companies headquartered in the US and the EU cover markedly more (self-defined) baseline emissions than companies in other regions, likely reflecting the high level of participation in these locations. Similarly, the largest concentration of revenue is found among companies headquartered in the US, the EU, and Japan.

As with city, state and region commitments, most company commitments focus on short-term timelines, up to or in 2020. Across the GHG emissions reduction commitments made by companies reporting quantifiable emissions reductions to CDP in the 10 major emitting economies, 58% have targets up to or in 2020; 40% aim for target years between 2021 and 2030; and 2% set targets after 2030 (see Figure 3). **The most common GHG emissions reduction target aims to cut GHG emissions by roughly 20%,** with varying base years between 1990 and 2018 (the most common base year is 2014). Unlike the subnational actors, the most common GHG emissions reduction goal of approximately 20% remains fairly consistent across short-, mid-, and long-term targets.

Commitments span a wide range of sectors, with particularly high concentration in the manufacturing and services sectors (see Figure 4). More than 500 commitments each reference renewable energy and fuel efficiency, while over 350 commitments mention energy efficiency, and nearly 200 mention transport.

Figure 3. Number and target years of companies' quantifiable commitments to reduce GHG emissions in 10 high-emitting economies

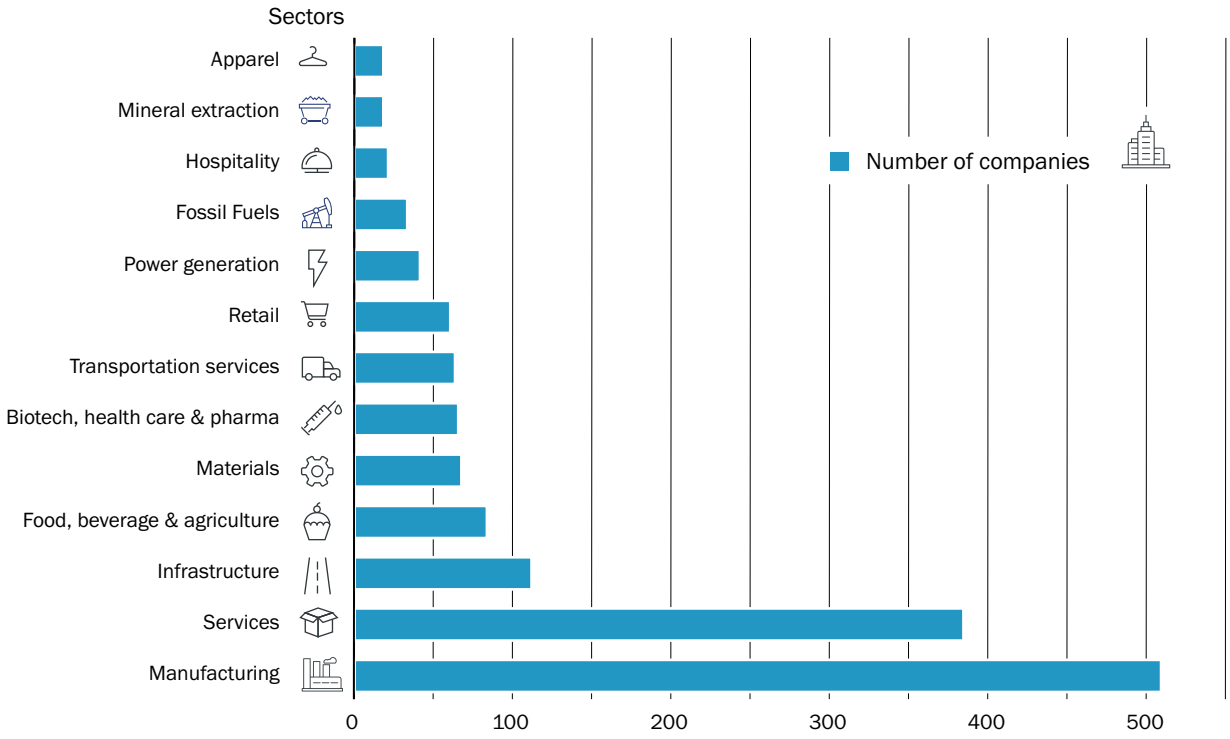


Data source: CDP Corporate Climate Targets Dataset 2018

5 The Fortune Global 500 list identifies the world's largest companies, according to revenue.

6 The Global Forbes 2000 list identifies the world's largest public companies, according to four metrics: sales, profits, assets, and market value.

Figure 4. The distribution of companies making quantified GHG emissions reduction commitments by sector



Data source: CDP Corporate Climate Targets Dataset 2018

2.2 INTERNATIONAL COOPERATIVE INITIATIVES

International cooperative initiatives (ICIs) are multi-stakeholder arrangements that aim to mitigate the GHGs that cause climate change and/or help to adapt to impacts of climate change. They are joint projects in which subnational and non-state actors work together across borders, often with national governments and international organizations.

International cooperative initiatives have been in the spotlight in recent years for their possible role in reducing global greenhouse emissions (see section 3 in this study; see also UNEP (2018). In addition to direct mitigation impacts, ICIs are seen as important tools of experimentation, innovation, and diffusion of knowledge and resources across actors (Bernstein and Hoffman, 2018; Hermwille, 2018; Abbott, 2017). Decarbonization and adaptation approaches in one area, or by one actor, can spread to others, potentially driving larger transformations. Such catalytic effects could eventually also affect government policies (Hale, 2018). Moreover, ICIs have the potential to simultaneously deliver on other aspects of sustainable development (see section 4 in this study). Although most observers agree on the great potential of these initiatives, in particular vis-a-vis closing the global emissions gap, most studies do not provide evidence on their actual performance and effectiveness.

2.2.1 OVERVIEW

This section analyses 190 ICIs that have been active between 2014, when the previous UN Secretary General's Climate Summit was held, to the first half of 2019. The sample was obtained by recording the initiatives launched at similar global summits, at COPs, and at other relevant fora. To be included in the sample, ICIs needed to have participants in two or more separate countries and to explicitly target climate mitigation and/or adaptation measures. Note that initiatives are related to but distinct from two similar categories: individual projects and networks, coalitions, or associations (see Bulkeley et al. 2014 for further discussion). For example, the RE100 initiative may support many individual projects to install renewable energy capacity around the world, but those individual projects are not recorded here. Similarly, the RE100 initiative is supported by the We Mean Business coalition, a global association of businesses, but it is the initiative, not the parent network, that we focus on in this analysis.

The authors are confident that the 190 ICIs analysed here include the vast bulk of initiatives globally, but the sample likely under-represents smaller and more informal initiatives. We do not analyse domestic cooperative initiatives (i.e., those that only include actors from the same country) though these are also an important aspect of climate action around the world. Most of the 190 initiatives in the sample are currently active, though some have concluded.

The quantitative estimates of ICIs' GHG emissions reductions in section 3 applies additional selection criteria to focus on 17 of these 190 cooperative initiatives. The results presented in this section instead describe the broader membership of 190 initiatives.

Five years of global summits have driven a rapid increase in the number of initiatives. Of the 190 initiatives, 170 are "active" as of mid-2019, nearly three times the number active before the 2014 UN Climate Summit and a 36% increase from the 125 initiatives active at the time of COP21 (see Figure 5). Most initiatives emerge around major global summits (see Figure 5), and more initiatives will be launched at the United Nations Secretary General's Climate Summit in September 2019. In 2018, 18 new initiatives were launched.

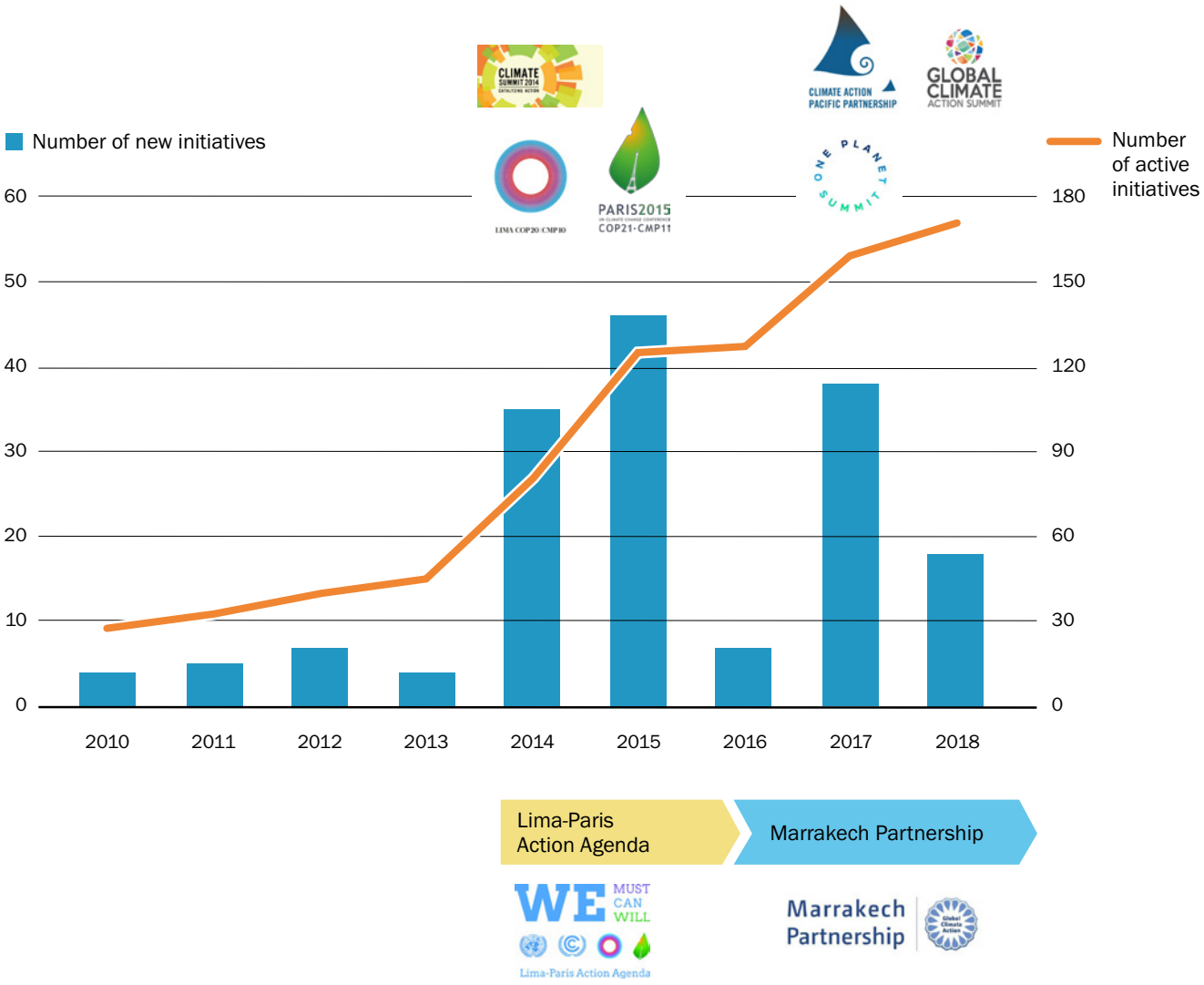
Consistent with earlier studies, we observe a massive scale and scope of participation in ICIs. Across the 190 ICIs, we identify nearly 29,000 "instances of participation" of actors in these initiatives. This figure differs from the individual actors' analysis in section 2.1, because the same city or business might participate in more than one initiative. This provides an additional, complementary way to gauge not just the breadth but also the depth of climate action. Measured in this way, sub-national governments and businesses account for the lion's share of participation, representing almost 40% of ICIs' membership each, with state, international organizations, and research bodies making up the rest.

A few ICIs are very large, involving hundreds or thousands of participants, but most are more modest in scale; the median number of participants in an initiative is 39. It is important to note that the aggregation of mitigation potential in Section 3.2 focuses on larger initiatives with high mitigation potential. This is an appropriate focus for the present report, but it is important to consider that such initiatives are not necessarily representative of all initiatives.

Actors from developing countries account for a quarter of participation in ICIs, but **make up** nearly half of **lead partners**. Although the number of actors from non-OECD countries who participate in ICIs has continued to grow since the Paris Agreement in 2015, actors based in developing countries still represent only 23% of instances of participation. This gap reflects the high levels of participation from European cities and businesses in some of the largest initiatives. However, actors from developing countries are better represented in the leadership of ICIs, now making up nearly half of all lead partners. Previous studies found just a quarter of developing country lead partners. This increase suggests that efforts by, for example, the High-level Climate Champions to spur more initiatives focused on developing countries have delivered results.

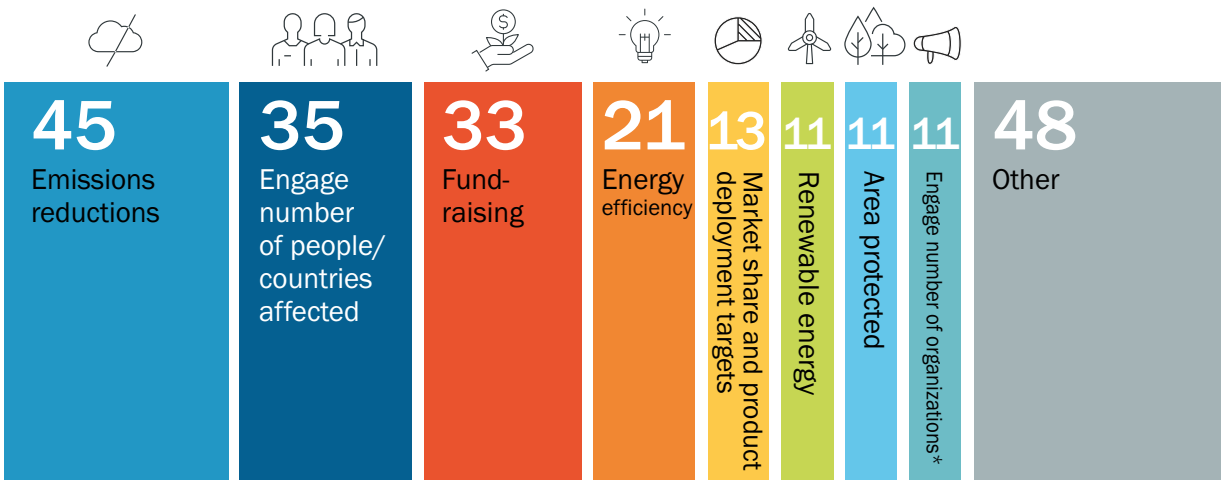
While ICIs address all areas of climate action, emissions reductions remain the dominant focus. The landscape of ICIs is very diverse, including large and small initiatives that target a vast spectrum of outcomes across all areas of climate action. Nonetheless, 60% of ICIs mainly focus on mitigation, 17% mainly on adaptation, and 23% on both equally.

Figure 5. Number of active initiatives by year and number of new initiatives by year



At a more granular level, initiatives pursuing mitigation, adaptation, or both employ a range of strategies and targets (Figure 6). Emissions reductions are the most common target, but many ICIs focus on targets like engaging a certain number of sub/non-state actors or individuals, raising funding, or other aspects of climate action.

Figure 6. Types of targets of initiatives



*(businesses/NGOs/subn. Gov)

2.2.2 PROGRESS OF INTERNATIONAL COOPERATIVE INITIATIVES

This section focuses on the progress of this set of 190 ICIs and asks whether initiatives have been taking appropriate steps to deliver their goal, and how output performance has developed over the last 6 years. The analysis updates previous work conducted by the ClimateSouth project in since 2017, previously also reported in the 2017 and 2018 Yearbook of Global Climate Action by the Marrakech Partnership for Global Climate Action (ClimateSouth, 2018; UNFCCC, 2018; United Nations Climate Change Secretariat, 2018)

2.2.2.1 Approach

Measuring the performance of a diverse set of ICIs presents significant challenges. As shown above, ICIs have very different kinds of targets. Moreover, data on outputs, outcomes and impacts is scarce, and – if available – difficult to compare. Some authors have evaluated ICIs by their design characteristics, for instance: the presence of secretariats and accountability mechanisms; whether targets and goals are specific and time-bound; and whether organizational capacities are in place that might indicate a higher likelihood that desired impacts may be achieved (e.g. Michaelowa and Michaelowa, 2017). The current analysis goes beyond the more familiar analysis of design characteristics and aims to understand the output performance of climate initiatives.

Outputs include a wide variety of tangible and attributable production by climate initiatives, including new or enhanced infrastructure or installations, training seminars, course material, campaign materials, conferences, studies, etc. These outputs do not ensure that initiatives reach their targets. However, initiatives that produce fitting outputs are more likely to generate desired environmental or social outcomes, such as emissions reductions or sustainable development benefits.

To indicate the performance of non-state and subnational climate actions, we applied the Function-Output-Fit (FOF) methodology that assesses the fitness of initiatives' functions and their respective outputs (see Technical Annex II) (see Pattberg et al., 2012; Widerberg and Stripple, 2016; Chan et al., 2018; United Nations Climate Change Secretariat, 2018). FOF is therefore a way to track whether initiatives are producing the kind of outputs that demonstrate progress in light of their functions. For instance, an initiative that aims at flood risk reduction through infrastructural adjustments should be expected to enhance or install new infrastructure for it to accomplish its desired impacts. An initiative that aims at raising awareness can be associated with very different expected outputs, such as campaigning materials and public events. The FOF methodology is appropriate for comparing very heterogeneous initiatives with a wide range of functions, and for indicating progress, even when target years may be significantly in the future.

The assessment of output performance is conducted in three steps. First, individual initiatives are classified by 12 inductively clustered function categories, including training, technical and on-the-ground implementation (e.g. local pilot projects, new installations and infrastructure), knowledge production, knowledge dissemination, campaigning, lobbying, and product development. Second, data on outputs and their years of production are collected for every initiative from publicly available sources, including annual reports, websites, and social media accounts, in addition to occasional email correspondence. Finally, output performance is calculated by matching data on functions of climate initiatives with data on tangible and attributable outputs (26 output data categories). The resulting values indicate the proportion of functions for which an initiative produces appropriate outputs. Methodological details of the FOF method can be found in Technical Annex II.

While taking an important step towards understanding ex-post effectiveness of ICIs, the current analysis exhibits important limitations. FOF values are a minimal indicator for effectiveness. High values do not guarantee desired impacts or behavioural change among target actors, rather they indicate a greater *likelihood* that desired outcomes and impacts may be achieved. By contrast, very low values certainly rule out attributable environmental or social impacts. Moreover, the method requires considerable interpretation of qualitative data. To ensure inter-coder reliability, initiatives were coded by multiple coders, who discussed and compared coding results throughout the data collection process.

2.2.2.2 Results

Using the FOF method, we find that, over time, the sample of 190 ICIs have generally improved output performance significantly since 2013 (Figure 7). A slightly lower share of high and medium-high performing initiatives in 2018 compared to 2017 may be related to the addition of a significant number of new initiatives, which need more time to produce fitting outputs.

Many outputs, such as infrastructure and trainings, are not only relevant in their particular year of production but also in subsequent years. Assuming the cumulative effects of outputs, we find that almost 70% of initiatives have delivered high or medium high output performance by July 2019 (Figure 8), producing relevant outputs that increase the likelihood that desired changes in

Figure 7. Output performance per year

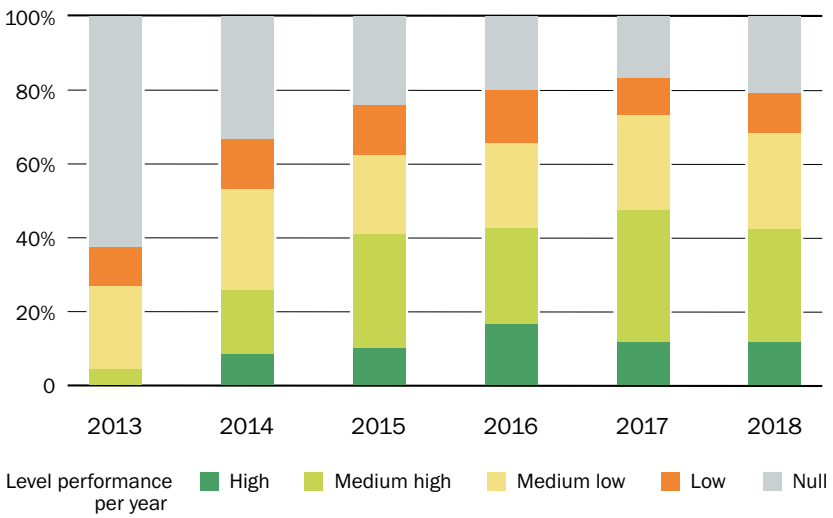
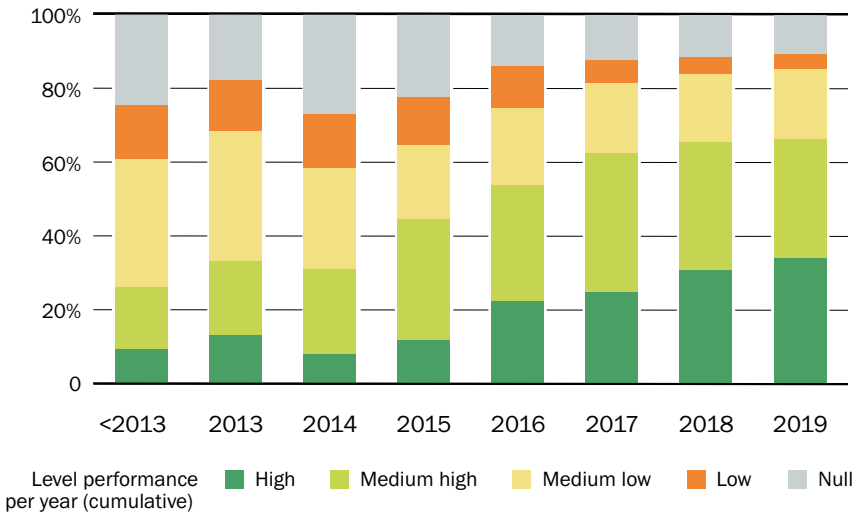


Figure 8. Level of performance per year (cumulative)



environmental and social indicators may be achieved. The development of cumulative output performance since 2013 compares particularly well with previous analysis of international cooperative initiatives in broader sustainable development; for instance, eight years after their launch, 43% of partnerships for sustainable development presented at the 2002 World Summit on Sustainable Development were still performing poorly, with many producing no outputs at all (Pattberg et al., 2012).

The addition of many new initiatives since 2017 may result in additional improvements in output performance. Indeed, we see that initiatives tend to perform better over time, especially during the first several years of their life spans (Figure 9). This performance pattern is consistent with our expectation that initiatives strengthen over time as they institutionalise, attract resources, and implement their plans. However, among older initiatives (approximately 3-4 years or older) we do not see a singular pattern; some initiatives tend to further improve over time, while others are beginning to deteriorate. Further analysis is needed to determine whether the "decay" of a subset of ICIs requires additional efforts to strengthen and support of existing initiatives.

Mitigation initiatives tend to perform better, on average, than adaptation initiatives (Figure 10). The share of high and medium-high performing initiatives is higher among those that mainly focus on mitigation compared to those that mainly focus on adaptation. Almost a quarter of initiatives that mainly focus on adaptation produce no outputs at all. The output performance of a subset of initiatives with high mitigation potential (also used for the analysis of mitigation potential in section 3.2 of this study) perform particularly well; more than 80% reached a high or medium high level of performance. The findings indicate the potentially strong contribution to global mitigation efforts by effective cooperative initiatives, while also suggesting the need to enhance initiatives' contributions to adaptation to climate change.

Figure 9. Output performance by initiatives' age

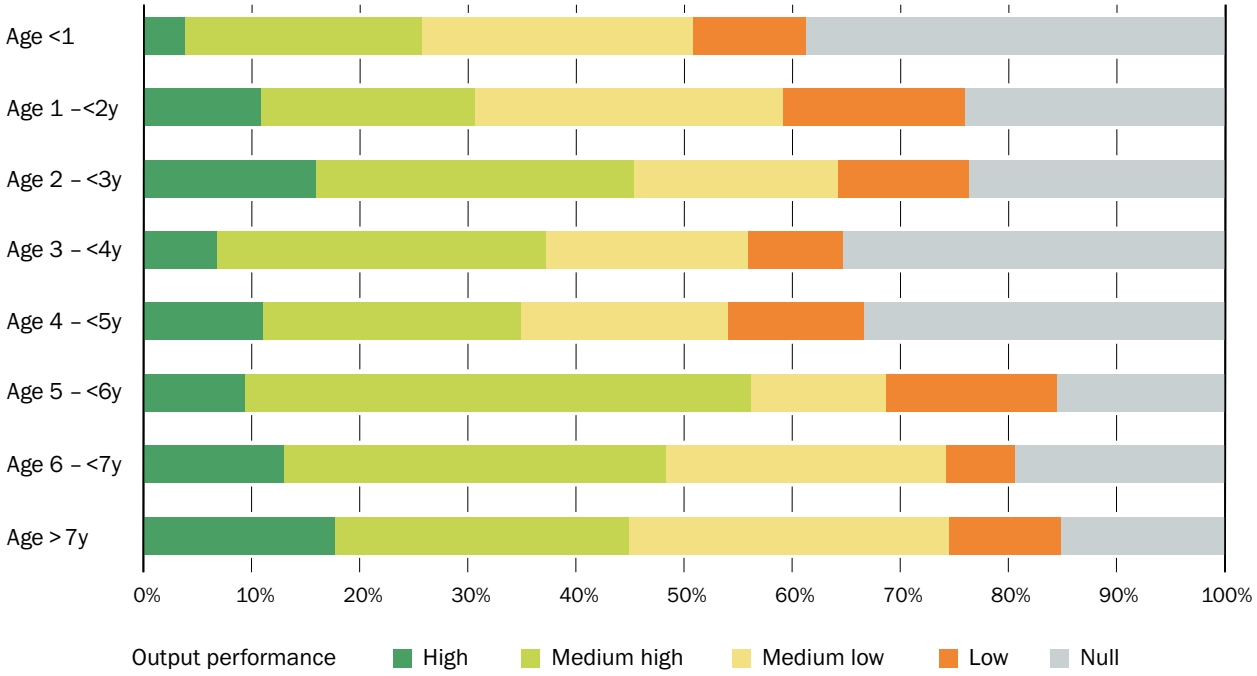
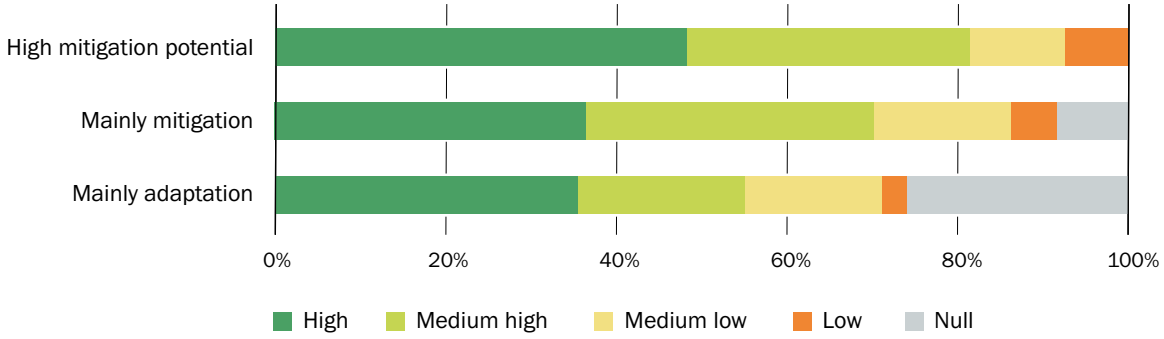


Figure 10. Output performance: adaptation, mitigation and high mitigation potential initiatives



2.2.2.3 Key insights

Since 2013, ICIs have improved output performance significantly; they are delivering relevant outputs, increasing their likelihood to achieve desired environmental and social impacts. In particular, initiatives that focus on mitigation, and the subset of high-mitigation potential initiatives quantified in this report, show strong output performance. These results provide additional confidence that the potential emissions reductions calculated below can be realised.

Despite positive trends in output performance, however, continued efforts are necessary to strengthen existing initiatives to ensure that their keep up performance over their lifespans. Moreover, given the rapid and worsening impacts of climate change, the relative underperformance of cooperative initiatives that mainly focus on adaptation is cause for concern.

03

GLOBAL GHG EMISSION REDUCTION POTENTIAL OF SUBNATIONAL AND NON-STATE CLIMATE ACTORS

We have updated GHG emissions reduction potential assessments for individual subnational and non-state actors (i.e. cities, regions and companies), as well as for ICIs and compared these actors' potential contributions with emissions projections under national government policies in ten major emitting economies (Brazil, Canada, China, EU, India, Indonesia, Japan, Mexico, South Africa, US) as well as to the global total.[7] All GHG emissions figures presented in this report were aggregated with 100-year global warming potential (GWP) values of the IPCC Fourth Assessment Report. Global and national GHG emissions totals include emissions from land use, land-use change and forestry (LULUCF), unless otherwise noted.

To make this comparison, we consider several scenarios or representations of what future emissions might look like, assuming all commitments are fully implemented without changing the pace of action elsewhere. These scenarios include:

1) The **"Current national policies" scenario** considers the likely path of emissions under current implemented national policies. This scenario assumes that no additional mitigation action is taken beyond climate policies implemented as of mid-2018. Whenever possible, current policy trajectories reflect all adopted and implemented policies, which are defined here as legislative decisions, executive orders, and their equivalent. This excludes announced plans and strategies, yet policy instruments to implement such plans or strategies would qualify. We do not assume that policy targets will be achieved even when they are codified in a law or a strategy document. These classifications of policy type are often subject to interpretation and sometimes require informed judgement calls. These current national policies scenario criteria are consistent with those applied in den Elzen et al. (2019). For our analysis we took two current national policies scenario projections developed by NewClimate Institute and PBL based on distinct modelling approaches and presented in Kuramochi et al. (2018).

2) The **"Current national policies plus individual actors' commitments" scenario** models the potential impact of both current implemented national and federal policies as well as recorded and quantifiable commitments by individual sub-national (cities and regions) and non-state actors (companies) in ten major emitting economies as described in Section 2. This approach accounts for overlap between actors, to avoid double-counting emission reductions. We did not quantify the coordination effects between national governments and other actors, nor the interaction between policy instruments at different scales. Instead, we assume additional reductions take place for each actor group (e.g., regions, cities, companies), if their aggregated reductions (relative to 2015) are higher than those that would result from (evenly distributed) implementation of national policies (example calculations presented in section 3.1.1). We also assume that both national governments and other actors do not change their existing climate policies and actions in response to these subnational and non-state actors' efforts.

3) The **"Current national policies plus initiatives' goals" scenario** models the potential impact of currently implemented national and federal policies as well as the quantifiable commitments made by ICIs (as described in Section 2). This scenario accounts for the number of members in each ICI and the total amount of GHG emissions reductions from additional prospective members in the target year. This scenario assumes that the ICIs' commitments will be fully implemented and do not change the pace of action elsewhere. We did not analyse specific actions or implementation barriers to meet these targets. The analysis was conducted for the ten major emitting economies as well as for the rest of the world (RoW).

7 For full description of the methodology please refer to the separate methodological notes on initiatives and on individual actors.

The latter two scenarios were developed using distinct datasets and calculation steps. The analytical steps taken for this analysis follows those described in an earlier 2018 report (Data-Driven Yale, NewClimate Institute and PBL, 2018) and adopts the methodological recommendations made in Hsu et al. (2018). Detailed descriptions of this can be found in the Technical Annexes I and II of the report (https://newclimate.org/publications/).

Comparing the latter two scenarios gives an indication of the relative impacts of current recorded and quantified commitments and those resulting from ICIs' intended goals. Many (but not all) of the individual actors whose commitments are considered in the "current national policies plus individual actors' commitments" scenario also participate in the analysed ICIs. However, compared to individual commitments by cities, regions and companies, the goals established by ICIs often have longer term vision, are often more ambitious in terms of the speed of emissions reductions (in some cases without detailed feasibility assessments) and aim to cover significantly larger geographical areas and sectors than these initiatives currently do. The "current national policies plus initiatives' goals" scenario assumes that all members of an ICI set quantifiable emissions reduction targets in line with the goal described in that ICIs' roadmap or planning documents, even if this is not the case for current members. In other words, the "Current national policies plus initiatives' goals" scenario represents a considerably higher ambition scenario, where ICIs expand their membership (including individual actors that are currently not taking any climate action at all), and these members ratchet up their individual efforts to align with ICIs' ambitious goals. Thus, individual actors' commitments and ICI goals were analysed separately. Both quantifications consisted of an analysis of the original targets, a distribution of effects to countries, and the consideration of overlaps (Figure 11).

Figure 11. Global aggregation of individual commitments and initiatives' goals

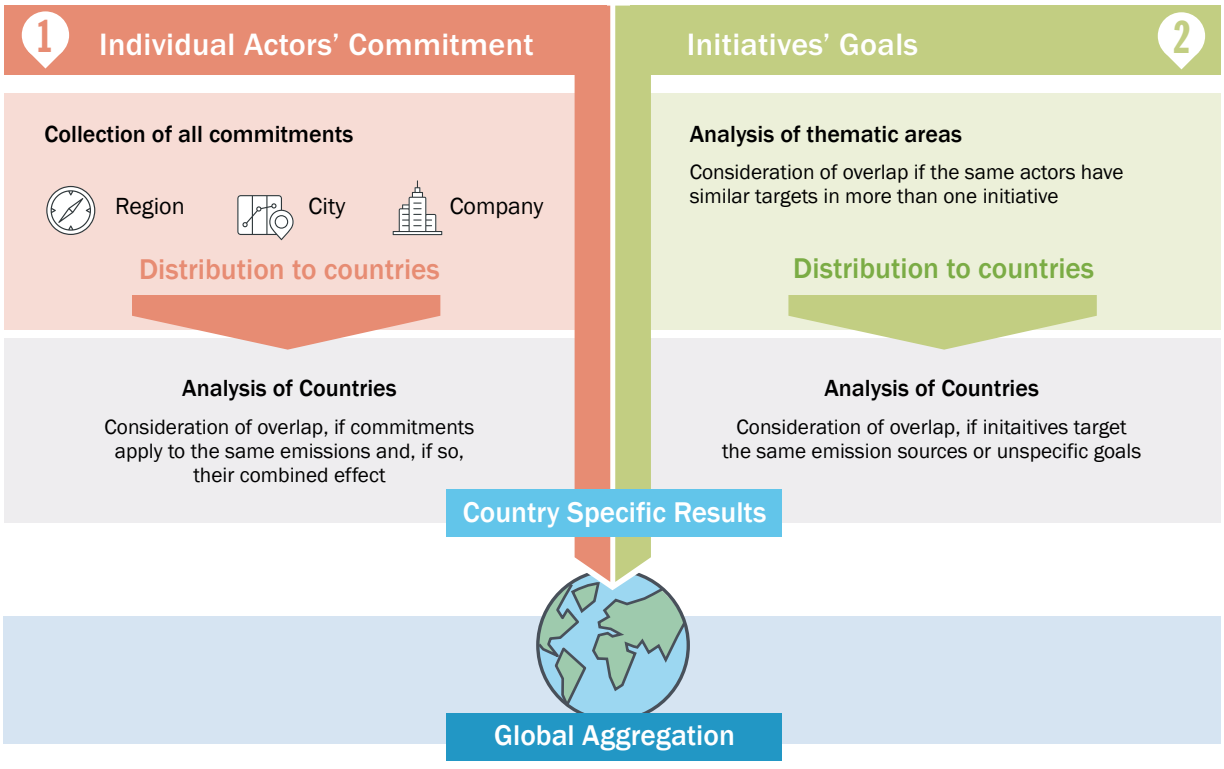
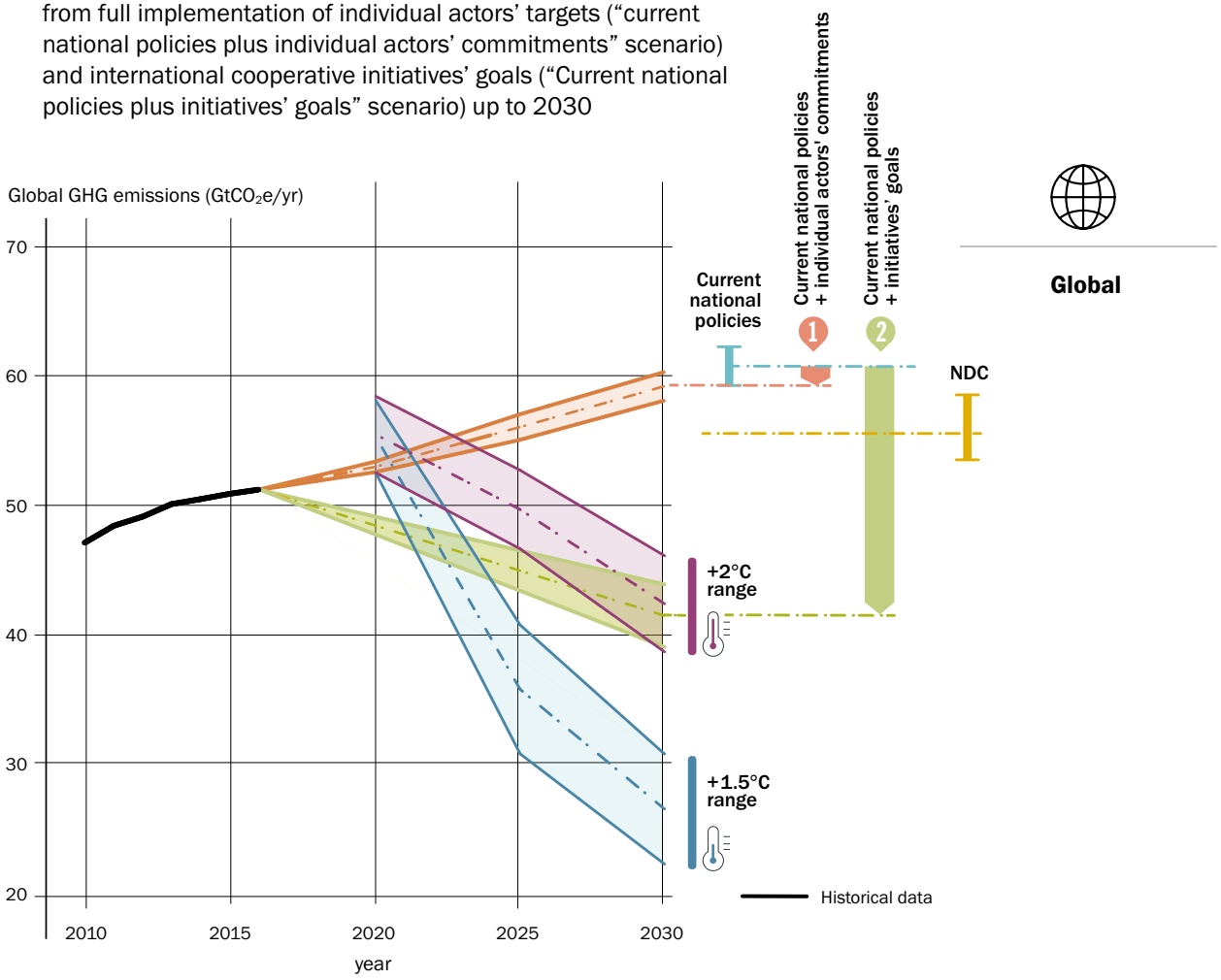


Figure 12. Potential global greenhouse gas (GHG) emissions reductions resulting from full implementation of individual actors' targets ("current national policies plus individual actors' commitments" scenario) and international cooperative initiatives' goals ("Current national policies plus initiatives' goals" scenario) up to 2030



Data sources: current national policies scenario (CPS) projections from Climate Action Tracker (2018b) supplemented with land use, land-use change and forestry (LULUCF) emissions projections adapted from Forsell et al. (2016), NDC (unconditional) scenario projections from Climate Action Tracker (Climate Action Tracker, 2018b), 2°C (in 2100, 66% chance) and 1.5°C (in 2100, 66% chance) pathways from UNEP (2018) adapted to global warming potentials (GWPs) from the IPCC Fourth Assessment Report based on the 2016 historical data from PRIMAP database (Gütschow, Jeffery and Gieseke, 2019), impact of individual actors and initiatives: this study. Our GHG emissions projections for 2020 are on the lower end of the range derived from the 2018 UNEP Emissions Gap Report, which can partially be explained by the possible underestimation of historical LULUCF emissions (see Technical Annex I for details).

We developed two additional scenarios: a **"Nationally determined contributions (NDCs) plus individual actors' commitments"** scenario and an **"NDCs plus initiatives' goals"** scenario. Both scenarios include the impact of currently implemented national policies and the proposals countries have made under the Paris Agreement (their unconditional NDCs), taken from the recent analysis published by NewClimate Institute, PBL and IIASA (Kuramochi et al., 2018). To these results, we added the impact of recorded and quantified commitments from individual subnational and non-state actors, assuming their full implementation.

The emissions reductions potential of subnational and non-state actor action compared to current national policies scenario projections are presented in Figure 12, alongside the 2 °C and 1.5 °C consistent pathways presented in the 2018 UNEP Emissions Gap Report (UNEP, 2018). The following sections summarise these analytical approaches and results.

3.1 INDIVIDUAL ACTORS' COMMITMENTS: POTENTIAL EMISSIONS REDUCTIONS

3.1.1 APPROACH

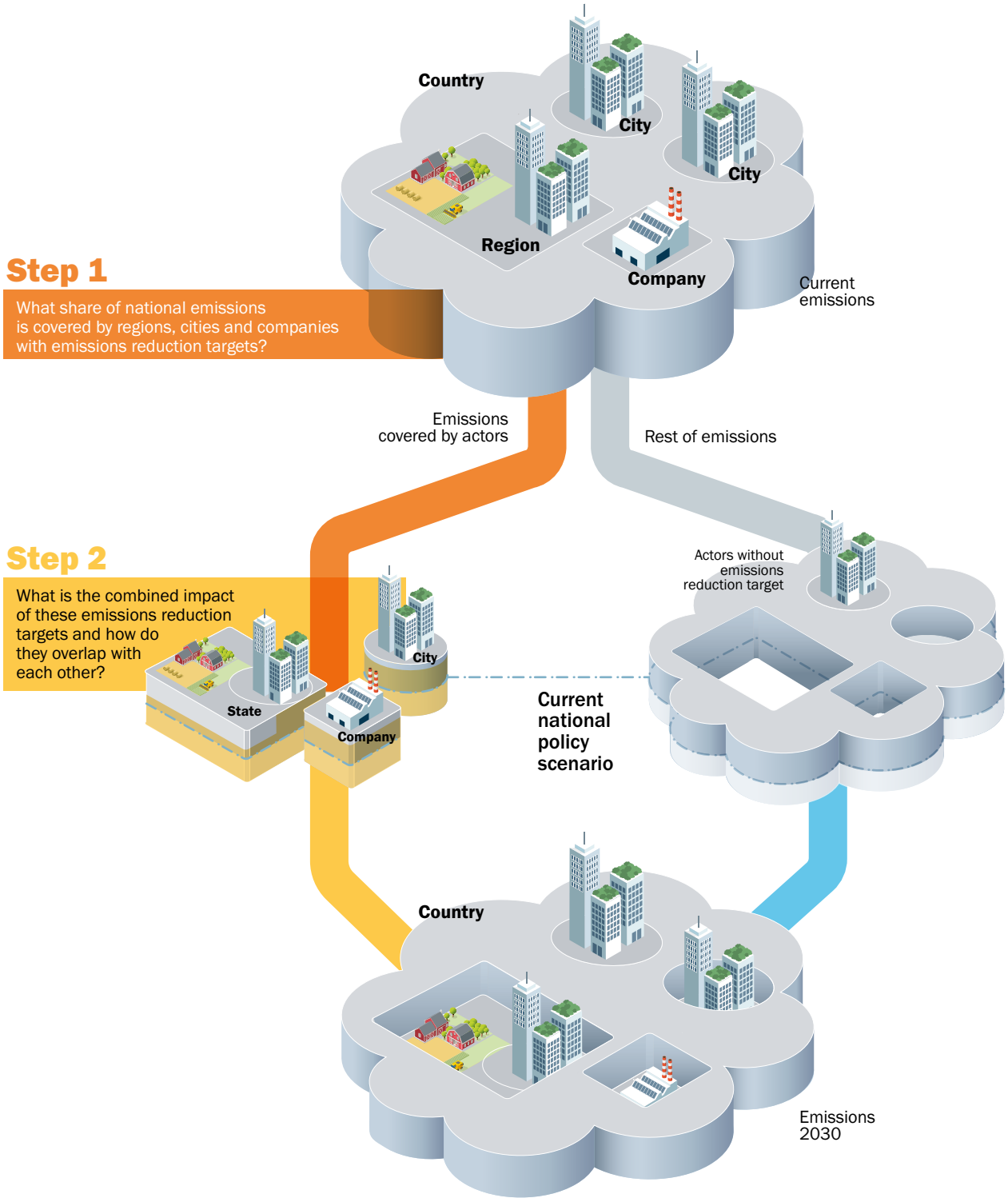
The information on city, region, and company commitments were gathered from various climate action networks and platforms, described in greater detail in section 2.1 and Technical Annex I. Given the substantial time needed to process, review, and clean and standardise the data, we focus our analysis on the ten major emitting economies introduced earlier. Altogether, individual commitments from the ten economies cover 7.2 $GtCO_2e$/year (after subtracting the overlaps), a total larger than the US' 2016 emissions. Our assessment included 79 regions accountable for at least 3.7 $GtCO_2e$/year in 2015, approximately 6,000 cities accountable for at least 4.2 $GtCO_2e$/year, and nearly 1,600 companies accountable for 2.8 $GtCO_2e$/year. The coverage of cities and regions in the aggregation analysis has expanded since the 2018 assessment, due to improved data availability and an increased number of commitments. The companies dataset is smaller than in the 2018 analysis, due to several factors, including some CDP participants not allowing public access to their survey responses and revised approaches to data cleaning and filtering.

The aggregation analysis covers Scope 1 emissions – GHG emissions emitted directly by the actors – and Scope 2 emissions, which result from the actors' electricity consumption. Other indirect GHG emissions (Scope 3 emissions) are excluded from the analysis. For companies, we analysed absolute targets and intensity targets reported to CDP. We did not include renewable energy targets in our analysis, due to inconsistencies in how these targets were reported.

Once the data was collected and processed, we calculated the potential for each actor type (cities; regions; and companies, which were further divided into utilities and energy end-use categories) to reduce emissions within the 10 major emitting economies. We calculated their impact by comparing the emissions levels that would result from these actors' emission reduction commitments to the emissions levels that would result from the (evenly distributed) implementation of current national (or EU) policies (Figure 13). For example, assume country A has a target to reduce GHG emissions by 30% below 1990 levels by 2030, and region B, which is located within country A, has a target to reduce GHG emissions 40% below 1990 emissions levels by 2030. If country B's 1990 emissions are 40 $MtCO_2e$/year, then it aims to achieve a16 $MtCO_2e$/year reduction compared to 1990. The additional reductions delivered by the region would be 40-30=10% of 1990 emissions, i.e. 4 $MtCO_2e$/year. At this point, the results are an estimate of cities, regions, and companies' additional reductions – emissions reductions that are additional to the results expected from national climate policies – before accounting for overlaps between subnational and non-state actor groups.

Next, we calculated the geographical overlap between the different actor groups in a specific order. For cities making commitments, located in regions making commitments, we took two distinctive approaches to account for overlaps between their efforts. The first approach only includes city reductions that result in emission levels in line with keeping temperature below 2°C; these emissions levels were calculated based on a range of effort sharing approaches (Höhne, den Elzen and Escalante, 2014). The second approach accounts for cities that do not have commitments and might partially offset emissions reductions from other cities. For utilities – companies that supply energy – and energy end-use companies – companies that use or consume energy – we estimate their geographical overlap with subnational actors in terms of percentage of GHG emissions and use this as correction factor. See the Technical Annex I for details. Our approach only takes pledged commitments of subnational- and non-state actors into account; it does not consider the interactions of policy instruments that may be implemented to achieve these commitments.

Figure 13. Steps taken to quantify the overall impact of emission reduction targets from regions, cities, and companies on national GHG emissions

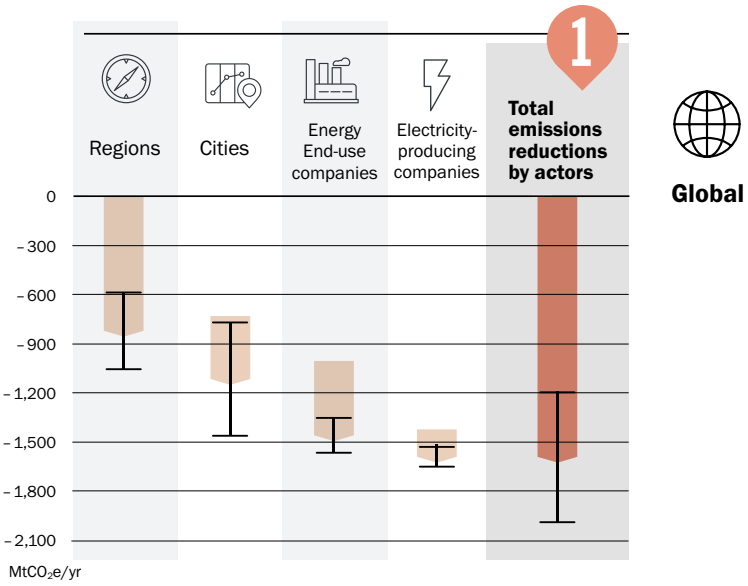


3.1.2 RESULTS AND KEY INSIGHTS

The analysis finds significant mitigation potential from commitments made by regions, cities and businesses, a result in keeping with the findings of the 2018 report. Global GHG emissions in 2030 would be 1.2 to 2.0 $GtCO_2e$/year lower than the current national policies scenario, if recorded and quantified commitments by individual cities, regions and companies are fully implemented (Figure 12). These results also assume that these efforts do not change the pace of action elsewhere; the analysis does not account for ways that these commitments could prompt national governments and other sub- and non-state actors to either slow or accelerate their own climate action efforts. Since this analysis focuses on a narrow subset of quantifiable emission reductions commitments recorded in climate action networks, it may underestimate the emissions reduction potential of all sub- and non-state actor efforts to reduce emissions. Conversely, it assumes that all commitments are fully implemented – actual emissions reductions in 2030 would naturally be smaller if regions, cities or companies do not fulfil their commitments.

Figure 14 illustrates different actor groups' (cities, regions, energy end-use companies, and electricity-producing companies) contributions to the overall GHG emissions reduction potential in the "Current national policies plus individual actors' commitments" scenario. Individual commitments from cities, regions and energy end-use companies could all potentially deliver considerable GHG emissions reductions in the ten major emitting economies we focus on. Electricity-producing companies have not made sizeable commitments. As described earlier, actors that participate in climate action networks like the Global Covenant of Mayors, but do not report their emissions reduction targets individually, are not reflected in this quantification; they are only considered in the initiatives' impacts presented in the next section.

Figure 14. Fully implemented, recorded and quantified region, city and business commitments' impact on global greenhouse gas (GHG) emissions by actor group



Source: this study

We find that aggregate commitments from cities, regions and companies could be more ambitious than the unconditional NDC targets for a number of key economies (see Section 5):

- In the EU, our most optimistic emissions projections show that the city, company, and regions' commitments, combined with current national policies (the "Current policies plus individual actors' commitments" scenario) could reduce emissions 48% below 1990 levels in 2030. Lowering emissions to this level are in line with the long-term EU strategy that aims for climate neutrality by 2050. However, it should be noted that while our calculations include LULUCF emissions, the EU's NDC target (40% below 1990 levels) does not specify the extent to which LULUCF sinks would be accounted for.
- In India, city, region, and company commitments would bring down emissions to about 3,800 to 4,200 $MtCO_2e$/year, 5.5% below the current national policies scenario projections (which are significantly lower than the NDC emission levels anyway) in 2030 and about 1,100 to 1,900 $MtCO_2e$/year lower compared to the NDC target emission levels.
- In Japan, city, region, and company commitments would bring down emissions to levels by up to 70 $MtCO_2e$/year compared to NDC target emission levels;

We also find that the commitments from cities, regions and companies could be a driving force for climate action in countries where national governments are rolling back climate policies:

- In the US, city, region, and company commitments could bring the country close to the upper bound (the least ambitious end) of its 2025 NDC target, to reduce emissions 26% to 28% below 2005 levels.
- In Brazil, city, region, and company commitments could reduce emissions in 2030 by an additional 50 to 100 $MtCO_2e$/year below current national policies scenario projections.

These results strongly indicate that these countries could raise their NDC ambition by incorporating city, region, and company commitments into their national climate policy formulation process. The full implementation of non-state and subnational actor commitments ("NDCs plus individual actors' commitments" scenario) would reduce emissions to between 0.4 to 0.7 $GtCO_2e$/year lower in 2030 than they would be with NDCs alone.

3.1.3 CHALLENGES TO TRACKING PROGRESS

Uncertainty around the likelihood of cities, regions, and companies to fulfil their commitments creates a large source of uncertainty around their ultimate mitigation impact. Scarce data tracks progress towards climate action goals (Chan et al., 2018; 2015), making it difficult to predict the likelihood these commitments will be fully implemented. While some climate action networks offer ways for their members to report on their progress, often only a fraction of participating actors share this information (Hsu et al, 2018).

A better understanding of how actors are progressing towards meeting their goals will be vital to accurately assessing the contributions they can make to national and global mitigation goals – and helping unlock and direct the support and resources needed to ensure their success. For instance, surveys of cities have flagged shortfalls in funding, technical know-how, or shifts in political priorities or leadership as potential obstacles to progress (C40 Cities, 2016). Studies focused on ICIs have revealed several factors likely to spur implementation, including: target clarity and ownership; monitoring and progress reporting mechanisms; actors' technical and financial capacity; and supportive political and regulatory frameworks (Pattberg and Widerberg, 2016; Graichen et al., 2017; Micahelowa and Michaelowa, 2017; Hsu, Widerberg, et al., 2018). One report used emissions inventories from 138 subnational governments in the US to identify trends in efforts to reduce emissions within the commercial, residential, and transportation sectors (ICLEI, 2018). More detailed implementation data could power similar and expanded analyses that explore drivers and obstacles to climate action in different contexts, insights that would enable the global community to better support these efforts.

Several initiatives to more closely track progress are underway. From 2019 onwards, the Corporate Climate Action Benchmark (CCAB), developed by CDP and the World Benchmarking Alliance, will measure the climate action performance of high emitting companies on a yearly basis, allowing stakeholders to monitor their progress (Hsu, Widerberg, et al., 2018). Efforts to streamline the reporting process could also make it easier to track progress, by lowering actors' reporting burden and consolidating existing data. In April 2019, ICLEI's carbonn® Climate Registry and CDP streamlined their data platforms – local and regional governments can report just once,

on CDP's platform, and their data will automatically be shared with ICLEI (van Staden and Appleby, 2019) . The common reporting framework of the Global Covenant of Mayors for Climate & Energy (GCoM), which took effect in January 2019, is designed to enable cities to report data in a standardised way, provide flexibility to meet specific local or regional circumstances, and unambiguously tracking progress (GCoM, no date). These changes in the reporting pipeline have the potential to make it easier to analysts, policymakers, and the reporting cities, regions and companies to track individual and collective progress towards climate action commitments.

3.2 INTERNATIONAL COOPERATIVE INITIATIVES

This section identifies the emissions reductions that a subset of international cooperation initiatives (ICIs) could deliver. The analysis builds upon our 2018 report (Data-Driven Yale, NewClimate Institute and PBL, 2018), which quantified the mitigation potential of 21 ICIs. The 2018 analysis found that these 21 ICIs could lower global emissions in 2030 by approximately a third (15 to 23 $GtCO_2e$/year) below the emissions current national policies would deliver. This calculation assumes all these initiatives meet their goals – including their goals to increase their membership – and that their efforts do not change the pace of action elsewhere.

3.2.1 APPROACH

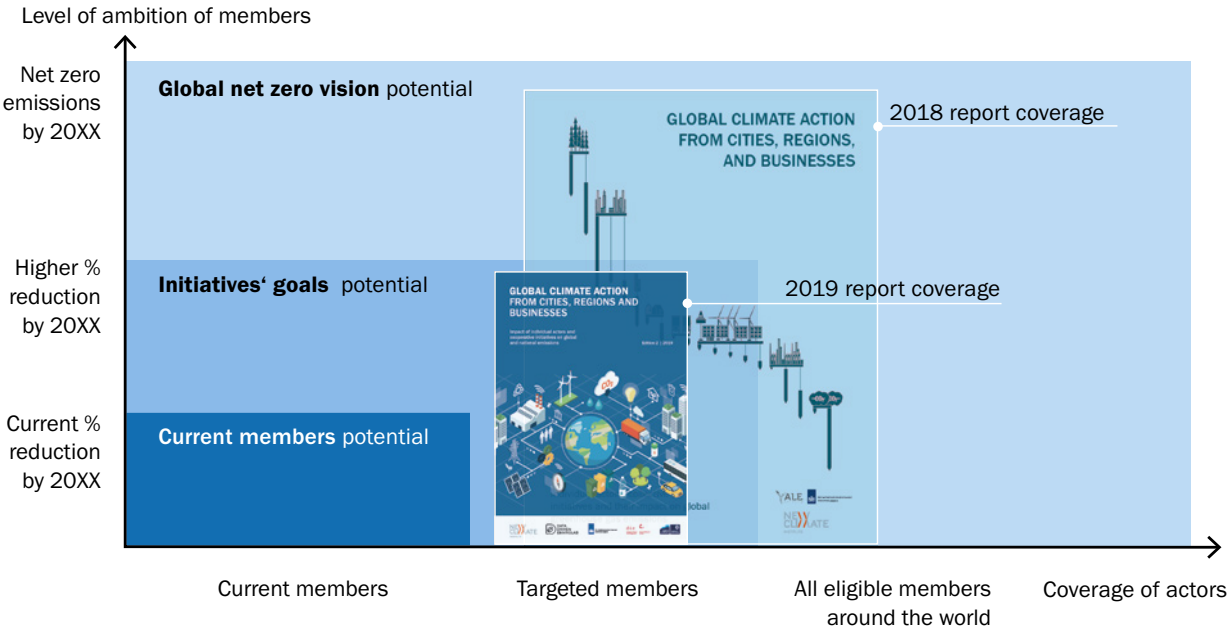
We refined the approach used in our 2018 report (Data-Driven Yale, NewClimate Institute and PBL, 2018) in three areas: 1) the selection of ICIs for quantification, 2) the definition of "initiatives' goals" quantified in the analysis, and 3) a refined methodology for calculating overlaps.

To determine the emissions reductions from ICIs in this year's report, the starting point was a list of over 300 initiatives (Climate Initiatives Platform, supplemented by own research). This is a larger sample than the initiatives included in a Function-Output-Fit (FOF) analysis presented in section 2.2. This list was narrowed down to 24 ICIs, according to the following criteria: (i) a quantifiable goal, (ii) a potentially significant impact on emissions, and (iii) an actionable mitigation plan focused on implementation. These 24 ICIs were then cross-checked with the FOF analysis results presented in section 2.2.2 to identify those that met a fourth criterion: (iv) a high likelihood of implementation. Our final selection of 17 ICIs differs from ICIs included in the 2018 report. A new initiative (Lean and Green) was added, while several previously included initiatives (Zero-Routine Flaring, US Wind Program, SunShot Initiative, European Wind Initiative) were dropped, due to this year's more stringent inclusion criteria. Solar Europe Industry Initiative is now quantified under its new name, European Technology & Innovation Platform Photovoltaic (ETIP-PV). The three forestry initiatives included in 2018 are now defined as two initiatives – Bonn Challenge and the Governors' Climate and Forest Task Force – which both also contain additional goals from the New York Declaration on Forests.

Figure 15 maps different ways of understanding ICIs' emissions reduction goals. The small dark blue box in the figure reflects the emissions reduction potential of ICIs' current members, if they implement the ICI's stated goal. The middle blue box, the "initiatives' goals potential", represents the emissions reduction potential that could result if ICIs' members achieve the ICI's goal, and the ICIs meet their stated goals to grow their membership or ambition. We quantify this possibility in our analysis, using expansion targets set for the "mid-term future:" the years up to and around 2030. This represents a different target selection approach than we took in our 2018 analysis. The 2018 analysis also incorporated the approach represented by the light-blue box in Figure 15, which represents ICIs' "global net zero emissions vision." In this approach, ICIs' references to their long-term maximum ambition goals (e.g., alignment with a 1.5°C emission trajectory) are included when they do not articulate a mid-term future target. The "global net zero emissions vision" approach represents an idealised systemic impact that we consider unlikely to be achieved with the current state of play.

By making this methodological shift, we aim to present more realistic, although still aspirational, emission reduction potentials, and to focus the discourse on the implementation of achievable targets. The change has altered the scale of some ICIs' emission reduction potential. The most notable example is the quantification of Architecture 2030, whose potential emissions reduction impact has decreased to about a tenth from last year's assessment, due to the new approach of defining ICI targets. In the 2018 analysis, Architecture 2030's mitigation potential was estimated based on its maximum ambition or "global net zero

Figure 15. Different approaches to defining and selecting ICI targets for emission reduction quantification



emissions vision" scenario, in which its energy consumption and fossil use targets were implemented in all new buildings around the world. This year we assumed a lower increase in membership coverage over time, to reflect the ICIs' growing presence in North America, early presence in the EU and China, and minimal penetration in other regions.

After calculating the potential emissions reductions of each ICI, we calculated overlaps across ICIs to avoid double counting their potential emissions reductions. ICI activities can target the same emission sources because they are in the same geographical area or operate in the same sector. For the overlap quantification, we first developed a matrix to identify possible overlaps between any two of the 17 initiatives analysed for each of the ten major economies. Then we quantified the overlap of the two ICIs' calculated emissions reduction potentials, using historical or projected indicators (e.g., electricity generation and (sub)sector final energy use and GHG emissions). Following this, the overlaps calculated for any two of the 17 initiatives were aggregated to calculate the total overlap for all ICIs (for a full description, see Technical Annex II for details).

3.2.2 RESULTS AND KEY INSIGHTS

The full list of selected initiatives and their quantified emissions reduction potential compared to the current policies scenario in 2030, without accounting for overlaps, can be found in Table 1. For a detailed description of each initiative, its targets, and the methodology used to quantify its emissions reduction potential, please refer to Technical Annex II.

Table 1. Initiatives selected for quantitative analysis with the estimated reductions in 2030 if their goals are fully implemented. The presented values do not yet account for overlaps.

Name of international cooperative initiative	Regions covered	Target(s)	Emissions reduction potential in 2030, compared to the current policies scenario
Energy Efficiency			
United for Efficiency (U4E)	Global (focus on developing countries)	Members to adopt policies for energy-efficient appliances and equipment	0.6 to 1.2 $GtCO_2e$/year
Super-efficient Equipment and Appliance Deployment (SEAD) Initiative	Global	Members to adopt current policy best practices for energy efficiency product standards	0.5 to 1.2 $GtCO_2e$/year
Buildings			
Architecture 2030	Global (focus on North America)	New buildings and major renovations shall be designed to meet an energy consumption performance standard of 70% below the regional (or country) average/median for that building type and to go carbon-neutral in 2030	0.2 $GtCO_2e$/year
Transport			
Collaborative Climate Action Across the Air Transport World (CAATW)[1]	Global	Two key objectives: 1) 2% annual fuel efficiency improvement through 2050 2) Stabilise net carbon emissions from 2020	0.6 $GtCO_2e$/year
Lean and Green	Europe	Member companies to reduce CO_2 emissions from logistics and freight activity by at least 25% over a five-year period	0.02 $GtCO_2e$/year
Global Fuel Economy Initiative (GFEI)	Global	Halve the fuel consumption of the LDV fleet in 2050 compared to 2005	0.5 $GtCO_2e$/year
Renewable Energy			
European Technology & Innovation Platform Photovoltaic (ETIP PV)	Europe	Supply 20% of electricity from solar PV technologies by 2030	0.2 to 0.5 $GtCO_2e$/year
Africa Renewable Energy Initiative (AREI)	Africa	Produce 300 GW of electricity for Africa by 2030 from clean, affordable and appropriate forms of energy	0.3 to 0.8 $GtCO_2e$/year
Global Geothermal Alliance (GGA)	Global	Achieve a five-fold growth in the installed capacity for geothermal power generation and a more than two-fold growth in geothermal heating by 2030	0.2 to 0.5 $GtCO_2e$/year

Table 1 (continued)

Name of international cooperative initiative	Regions covered	Target(s)	Emissions reduction potential in 2030, compared to the current policies scenario
Business & Industry[2]			
RE100 initiative	Global	2,000 companies commit to source 100% of their electricity from renewable sources by 2030	1.9 to 4.0 $GtCO_2e$/year
Science Based Targets initiative (SBTi)	Global	By 2030, 2,000 companies have adopted a science-based target in line with a 2°C temperature goal	2.7 $GtCO_2e$/year
Forestry			
[Deforestation] Bonn Challenge / New York Declaration on Forests (NYDF) **[Restoration] Governors' Climate and Forests Task Force (GCFTF) / New York Declaration on Forests (NYDF)**	Global	Two main quantifiable long-term targets: end forest loss by 2030 in member countries (NYDF/ GCFTF); Restore 150 million hectares of deforested and degraded lands by 2020 and an additional 200 million hectares by 2030 (NYDF/Bonn)	5.4 to 5.6 $GtCO_2e$/year
Non-CO_2 GHGs			
Climate & Clean Air Coalition (CCAC) (HFCs and methane)	Global	Members to implement policies that will deliver substantial short-lived climate pollutant (SLCP) reductions in the near- to medium-term (i.e. by 2030)	1.4 $GtCO_2e$/year
Cities & Regions			
Under2 Coalition	Global	Local governments aim to limit their GHG emissions by 80 to 95% below 1990 levels by 2050 (220 members)	4.6 to 5.0 $GtCO_2e$/year
Global Covenant of Mayors for Climate & Energy (GCoM)	Global	Member cities have a variety of targets (+9,000 members)	1.4 $GtCO_2e$/year
C40 Cities Climate Leadership Group (C40)[3]	Global	94 member cities have a variety of targets, aiming for 1.5°C compatibility by 2050.	1.5 $GtCO_2e$/year

1) CAATW concerns the international aviation sector and thus is not accounted for in country analyses.

2) Results for RE100 and SBTi are only available at the global level and are not accounted for in country analyses.

3) From this emissions reduction impact, about 0.67 $GtCO_2e$/year comes from the rest of the world (RoW), i.e. outside of our ten focus major emitting economies. For this reason, potential global C40 impact is comparable to our individual commitments aggregation results.

Our analysis shows that ICIs could reduce global GHG emissions in 2030 by 18 to 21 $GtCO_2e$/year below the emissions expected under the current national policies scenario. This calculation accounts for overlaps and assumes that all analysed initiatives meet their goals and that their efforts do not change the pace of action elsewhere (Figure 12). The range of ICIs' potential emissions reduction in 2030 is consistent with the results from the 2018 report – which found ICIs could reduce emissions in 2030 by 15 to 23 $GtCO_2e$/year, compared to the current national policies scenario – although the range has narrowed. The difference in results from last year's report can be attributed to a combination of factors:

1) Shortening the list of selected ICIs lowers their aggregate mitigation impact.

2) This year's approach defines ICI targets differently, quantifying the "initiatives' goals potential" and removing any consideration of their "global net zero emissions vision." This decreases the maximum impact of certain ICIs and thus the global aggregated impact.

3) Enhanced data quality and methodology transparency altered the calculations of some ICIs' mitigation impact. The reduction ranges of some high-impact ICIs, such as forestry-focused initiatives, have narrowed.

4) The revised methodology used to calculate overlaps this year also contributed to some degree to narrow the upper and lower bounds of ICI's aggregated global mitigation impact.

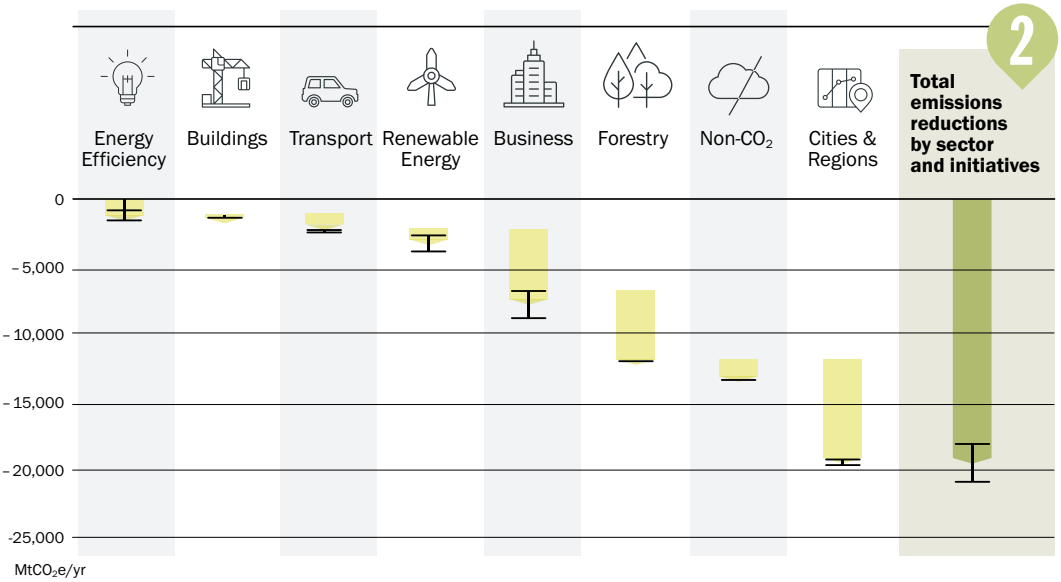
Starting from the current national policies scenario, the additional emissions reduction potential of ICIs could close the global emissions gap in 2030 to a range consistent with limiting temperature rise below 2°C. The pathway for limiting temperature rise below 2°C (in 2100, 66% chance) is taken from the 2018 UNEP Emissions Gap Report (UNEP, 2018), which is based on the findings from the IPCC SR1.5 (IPCC, 2018b). However, even ICIs' substantial emissions reduction potential would not be able to fully bridge the gap between the current policies or NDC scenarios and the pathway for limiting temperature rise below 1.5°C (in 2100, 66% chance) in 2030 (Figure 10). The emissions gap separating these trajectories from the 1.5°C trajectory has widened compared to our 2018 analysis. In large part, this reflects the downward revision of the 1.5°C-consistent pathways following the publication of the IPCC SR1.5. If countries also implement the unconditional NDCs submitted under the Paris Agreement ("NDCs plus initiatives' goals" scenario), the initiatives have a potential aggregated impact of 15 to 18 $GtCO_2e$/year globally.

The breakdown of the global potential impact by sector (Figure 16) shows that initiatives focused on businesses, forestry, non-CO_2 GHGs, and cities and regions could each potentially deliver GHG emissions reductions of more than 3 $GtCO_2e$/year by 2030.

In addition to the emission reduction potential of specific initiative, several trends across specific sectors also emerged in our ICI analysis:

- **Initiatives involving cities and regions** can deliver the most significant emissions reductions, as they enlist a high number of actors with high levels of ambition. Many actors have committed to targets in line with the Paris Agreement or consistent with 1.5°C emissions pathways. However, while a large number of actors make climate mitigation action pledges annually, 58% do not have concrete emission reduction targets with action plans on how to achieve them.
- **Forestry initiatives** have high emissions reduction potential due to high projected deforestation rates and the ambitious targets of many of these forestry initiatives. For instance, the New York Declaration on Forest aims to end deforestation by 2030. The potential of these initiatives is vital in light of recent increases in projected deforestation.
- **Initiatives by industry and businesses** have ambitious goals, such as adopting "science-based targets" in line with the Paris Agreement's goal or supplying 100% of their electricity from renewable sources. However, the rate of expansion to new members remains slow.
- There are **few active ICIs with potentially high mitigation impacts in emissions-intensive energy sub-sectors, such as buildings, industry and transport.** Given the importance of the energy sector to global climate mitigation, implementing ambitious mitigation action in these sub-sectors could have large economy-wide effects.

Figure 16. Potential GHG emissions reductions of international cooperative initiatives (ICIs) by sector.



The ambition demonstrated by cities, regions, companies, and other national, corporate, and civil society actors through ICIs demonstrate the potential for national governments to implement more ambitious national policies and increase their ambition in upcoming NDC updates under the Paris Agreement. Their efforts can also serve as guiding examples to spur greater economy-wide action in spillover sectors and non-state actor groups, particularly to provide examples on how NDCs could be enhanced. However, this assessment assumes full implementation of the ICIs' targets. While the level of aspirational ambition is evidently high in the global ICI landscape, the level of implementation varies widely. We included here only initiatives that have higher likelihoods of achieving their goals, but a high degree of uncertainty remains. To fully deliver these ICIs' "initiatives' goals potentials," a great diversity of institutions and stakeholders from different countries, levels of governance, sectors, and branches of civil society must collaborate and coordinate willingly and effectively.

04

LINKAGES BETWEEN NON-STATE CLIMATE ACTION AND SDGS

Climate action is inextricably linked to sustainable development. The failure to sufficiently mitigate greenhouse gases will undermine decades of progress in sustainable development. Conversely, accelerated mitigation can reduce the cost of achieving low-carbon and sustainable development. While the strong linkages between climate action and sustainable development are clear, the specific role of non-state and subnational climate action in leveraging synergies and avoiding trade-offs remains little understood. This chapter analyses explicit linkages and possible synergies and trade-offs between the 17 Sustainable Development Goals (SDGs) introduced in 2015 as part of the Agenda 2030 for Sustainable Development and selected international cooperative initiatives (ICIs) quantified in section 3.2.

The recent IPCC SR1.5 report (IPCC, 2018b) highlights the need for governance that fosters climate resilient development while also effectively addressing questions of equity and fairness and potential trade-offs between different priorities. Trade-offs exist, for instance, between mitigation, land use change, food security and food prices; (individual) climate adaptation and community-level risks; and, the use of certain forms of bioenergy and land-use and biodiversity (see Mead, 2018). The IPCC SR1.5 report also points out "robust synergies" between SDGs and 1.5°C pathways, particularly for SDGs 2 (health), 7 (energy), 12 (responsible consumption and production), and 14 (oceans). However, the specific role and influence of non-state and subnational actors in helping realise these benefits is much less understood.

In this section, we address two questions. First, what actual (explicit) linkages to the SDGs can be discerned from ICIs' climate action commitments? Second, what synergies and trade-offs with SDGs can be expected from ICIs with high mitigation potential?

International cooperative initiatives play an important role in realising synergies and avoiding or mitigating trade-offs by, for instance, engaging actors with different interests, expected benefits or damages, and enabling inclusive dialogues and integrative outcomes. Earlier assessments emphasised the potential for synergies and greater coherence between climate and sustainable development (see Chan, Iacobuta and Haegele, 2019, forthcoming; and Laine et al., 2019). Scholars have pointed out opportunities for policy integration (Nordhaus, 1977; Beg et al., 2002; Swart, Robinson and Cohen, 2003). Assessments have explored climate measures' effects on sustainable development broadly (Kok et al., 2008; IPCC, 2014, 2018a; von Stechow et al., 2015) and focused on narrower aspects of sustainable development, including energy security (e.g. Guivarch and Monjon, 2017), energy poverty (e.g. Solaymani et al., 2015), and air quality (e.g. Braspenning Radu et al., 2016). According to von Stechow et al. (2016), SDG 13, which calls for "urgent action to combat climate change and its impacts," implies large scale transformation that requires interaction with many SDGs, and – indirectly – even with all SDGs (also see IPCC, 2018a). In these assessments, climate measures have often been associated with positive impacts on sustainable development, particularly over long-term timelines. However, some trade-offs are likely to occur (IPCC, 2018a); for instance, biofuels could increase food insecurity and land competition (Hasegawa et al., 2018).

This study focuses on the 17 ICIs analysed in section 3.2 (see this section for a description of each ICI and details about how we selected these initiatives).[8] Since inaction on mitigation will surely undermine sustainable development, successful implementation of initiatives with high mitigation potential are likely to have an overall positive effect. However, individual initiatives may still have important (if perhaps unintended) negative effects

on other aspects of sustainable development. A lack of reflection on broader effects on sustainable development may result in missed opportunities to further leverage the synergies and co-benefits with climate action.

While there are many potential linkages between climate action and sustainable development, this analysis focuses on the synergies and trade-offs between international climate initiatives and SDGs. We define synergies – also referred to as "co-benefits" – as positive linkages between SDGs and ICIs: a synergy exists when the objectives of both agendas are mutually reinforcing. A potential "trade-off," or negative linkage, between an ICI and the SDGs refers to cases where the objective of one undermines the objective of the other. It is important to emphasise that whether synergies or potential trade-offs occur depends on how an initiative's actions are implemented. This twofold classification of interactions as synergistic or negative could be further refined. For instance, the OECD distinguishes five dimensions of coherence, particularly the (in)compatibility between international agendas and processes; between economic, social and environmental policies; between different sources of finance; and between multiple actors and stakeholders (OECD, 2014). However, we limit ourselves to policies and actions outlined by ICIs. First, we focus on analysing explicit mentions of linkages, the (mostly positive) linkages that ICIs make to other aspects of sustainable development. Subsequently, we examine possible synergies and trade-offs, based on the impacts ICIs' mitigation activities could have sustainable development objectives in their respective sectors.

To identify explicit mentions of linkages, the study used data from the ClimateSouth project.[9] Explicit mentions of linkages are found in ICIs' self-descriptions; for instance, on their websites, in brochures, and in other publications. Coders were asked to identify explicit mentions of linkages, which occur when there are direct references to an SDG or SDG target, including references to goal and target numbers, or when self-descriptions include keywords, which were defined for every SDG. In addition, we asked coders to identify explicit mentions to linkages when exact keywords do not appear, but close synonyms do. To ensure higher reliability, all ICIs were coded by at least two people.

To identify potential synergies and trade-offs we used Ambition to Action's SDG Climate Action Nexus Tool (SCAN-tool) (Gonzales-Zuñiga et al., 2018). This tool identifies a total of 982 linkages between sector-specific mitigation actions and the 17 SDGs. Our analysis focuses on the identification of links (both synergies and potential trade-offs) between climate initiatives and SDGs through an alignment of the scope of the selected ICIs with the SCAN-tool's mitigation actions. This alignment was done through a matrix of the selected ICIs and SCAN-tool's mitigation actions, that was filled using expert knowledge of each individual initiative.[10] While the SCAN-tool provides a specific number of synergies and a specific number of trade-offs between SDGs and mitigation actions classified in different sectors, our analysis does not indicate the magnitude for the identified links. In our analysis, we show three possible categories: 1) "no links"; 2) "existence of only synergies"; and 3) "existence of synergies and potential trade-offs" (both potential positive and negative links. The third category is assigned irrespective to the number of potential trade-offs identified; in other words, yellow is assigned when at least one potential trade-off is identified.

The following sections present the results of both analyses: the explicit linkages as well as the theoretical synergies and potential trade-offs between the selected ICIs and the SDGs.

8 Earlier studies indicate an enormous mitigation potential of cooperative initiatives that engage one or more subnational (e.g. city, regional actor) and/or non-state actors (e.g. businesses, investors, and NGOs); probably surpassing the potential of currently recorded individual non-state and subnational actions (Data-Driven Yale, NewClimate Institute and PBL, 2018).

9 A collaboration between the German Development Institute/Deutsches Institut für Entwicklungspolitik (DIE), Blavatnik School of Government at the University of Oxford, The Energy and Resources Institute, and the African Center for Technology Studies.

10 For further details on how SCAN-tool was utilised to identify synergies and trade-offs between ICIs and SDGs, see Technical Annex III.

4.1 EXPLICIT LINKAGES BETWEEN MITIGATION-FOCUSED COOPERATIVE INITIATIVES AND SDGS

Using a systematic keyword search for every SDG, we find many explicit (Figure 17) mentions of linkages to sustainable development goals among ICIs with high mitigation potential. However, these mentions are unequally distributed.

Unsurprisingly, all initiatives explicitly mention SDG 13. Disregarding SDG 13, the top 5 SDGs linked to these ICIs include: SDG 7 (affordable and clean energy); SDG 9 (industry, innovation and infrastructure); SDG 17 (partnership for the goals), SDG 11 (sustainable cities and communities), and SDG 12 (sustainable consumption and production). Explicit mentions of SDG 14 (life below water), SDG 16 (peace, justice and strong institutions), and SDG4 (quality education) are few or absent. It is important to note, however, that these results focus on the selected initiatives with high mitigation potential and may not be representative of all mitigation-related initiatives. Additionally, initiatives that do not directly aim at mitigation may carry sustainability co-benefits that are underrepresented in this sample.

International cooperative initiatives are more likely to highlight positive explicit linkages, resulting in a bias towards synergies and co-benefits. Moreover, they may not accurately indicate their potential to maximise sustainability co-benefits, or to minimise potential trade-offs. To gain a fuller understanding of climate action/SDG linkages, we further investigate theoretical synergies and trade-offs using the SCAN-tool. This following analysis helps to show the potential but also some limitations of this set of initiatives in delivering simultaneously on climate goals and the SDGs (Iacobuta and Höhne, 2017; Gonzales-Zuñiga et al., 2018).

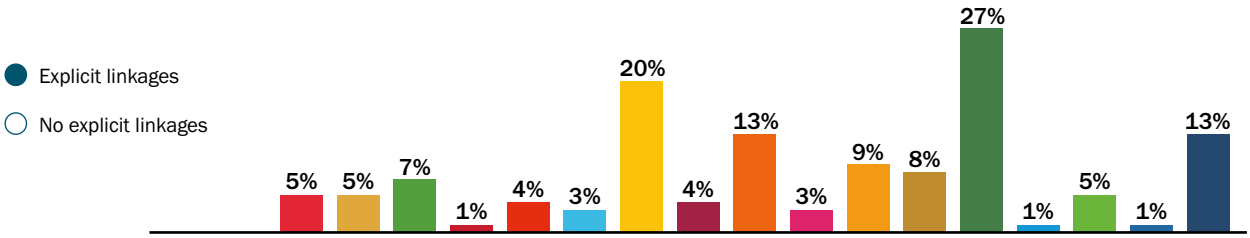
4.2 POTENTIAL SYNERGIES AND TRADE-OFFS

By matching ICIs to mitigation actions from the SCAN-tool, we identify 248 potential links between the selected initiatives and the SDGs (see Figure 18). Most of these links are synergies, suggesting a high potential for alignment and integrated implementation. We identify 146 synergies, shown in green (59% of all links) and 102 links that could potentially be synergies or trade-offs, shown in yellow (41% of all links). Grey dots indicate that we identified no synergies or trade-offs between a climate initiative and an SDG. It only notes the potential for synergies or trade-offs based on an initiative's focus and mitigations actions in SCAN-tool. Identified synergies may have one or more positive links to SCAN-tool's mitigation actions.

This analysis finds unequal distribution of synergies and potential trade-offs across different SDGs. By definition of our methodology (see Technical Annex III), only synergistic links are found between ICIs and SDG 13 (climate action) and SDG 17 (partnerships for the goals). SDGs with the largest amount of only synergies to ICIs' goals (marked by green dots in Figure 18) include: SDG 7 (affordable and clean energy), SDG 9 (industry, innovation and new infrastructure), SDG 12 (responsible consumption and production), and SDG 16 (peace, justice and strong institutions). SDG 11 (sustainable cities and communities), SDG 8 (decent work and economic growth), SDG 15 (life on land), SDG 2 (zero hunger), and SDG 1 (no poverty) have the most links to ICIs that could turn out to be either synergies or trade-offs.

From a sectoral perspective, we find that initiatives in the energy supply sectors have almost as many synergies (in green dots) as synergies and potential trade-offs (in yellow dots). Potential trade-offs stem from conflicts between mitigation actions and development targets. Examples include the installation of renewable energy in threatened terrestrial ecosystems (SDG 15), or in communities that depend on land resources for livelihood (SDGs 1, 6 and 8) or food security (SDG 2). Initiatives in energy demand sectors, such as transport, buildings, and business, more synergies than potential trade-offs exist. For initiatives focused on energy efficiency, more specifically energy efficiency appliances, we find only synergies. Some examples of possible synergies from increased energy

Figure 17. Explicit links to the SDGs for 17 international climate initiatives selected from ClimateSouth's analysis. The numbers presented above the table represent the shares of all explicit links found.



Sector	Selected Intiatives	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Energy efficiency	United for Efficiency (U4E)	○	○	○	○	○	○	●	○	●	○	○	○	●	○	○	○	●
	Super-efficient Equipment and Appliance Deployment (SEAD) Initiative	○	○	○	○	○	○	●	○	●	○	○	○	●	○	○	○	●
Buildings	Architecture 2030	○	○	○	○	○	○	●	○	○	○	●	○	●	○	○	○	○
Transport	Collaborative Climate Action Across the Air Transport World (CAATW)	○	○	○	○	○	○	●	○	●	○	●	○	●	○	○	○	●
	Lean and Green	○	○	○	○	○	○	○	○	○	○	○	○	●	○	○	○	○
	Global Fuel Economy Initiative (GFEI)	○	○	●	○	○	○	●	○	●	○	●	●	●	○	○	○	●
Renewable Energy	European Technology & Innovation Platform Photovoltaic (ETIP PV)	○	○	○	○	○	○	●	○	○	○	○	○	●	○	○	○	○
	Africa Renewable Energy Initiative	●	●	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Global Geothermal Alliance	○	○	○	○	●	○	●	●	●	●	○	●	●	○	○	○	●
Business	RE100 Initiative	○	○	○	○	○	○	●	○	○	○	○	○	●	○	○	○	○
	Science Based Targets Initiative (SBTI)	●	○	○	○	○	○	●	○	○	○	○	○	●	○	○	○	●
Forestry	NYDF/Bonn Challenge	○	○	○	○	○	○	○	○	○	○	○	○	●	○	●	○	●
	NYDF/Governors' Climate and Forest Task Force	○	○	○	○	○	○	○	○	○	○	○	○	●	○	●	○	○
Non-CO_2	Climate and Clean Air Coalition (CCAC)	●	●	●	○	●	●	●	●	●	○	●	●	●	○	○	○	●
Cities & Regions	Under 2 Coalition	●	○	○	○	○	○	●	○	○	○	○	○	●	○	○	○	○
	Global Covenant of Mayors for Climate & Energy (GCoM)	○	○	●	○	○	○	●	○	●	○	●	●	●	○	○	○	●
	C40 Cities Climate Leadership Group (C40)	○	●	●	○	●	●	●	○	●	○	●	●	●	○	○	○	●

efficiency include increased energy access and reduction of energy expenditure (SDGs 1 and 7), improvements in health (SDG 3) from reduced air and water pollution from reduced fuel consumption (SDGs 11, 12, 14 and 15), increased economic productivity through resource efficiency, and support to economic diversification and innovation through technological upgrade (SDGs 8 and 9) to name a few. For initiatives in the buildings sector we find potential trade-offs to reduced access to affordable housing (SDG 11), as housing equipped or retrofitted with energy efficiency measures (e.g. appliances, water saving systems, or rooftop PV installations) are often more expensive. Additional to potentially higher housing costs (SDG 11), initiatives in the buildings sector may also see trade-offs in land competition (SDG 15) for livelihood (SDG 1), food production (SDG 2), and living space (SDG 11) from an increased use of renewable electricity, which may also lead to lower economic growth (SDG 8). In the transport sector, increased use of biofuels, including in air transport (i.e. Collaborative Climate Action Across the Air Transport World), could potentially result in trade-offs for several SDGs that are related to resource competition (SDGs 1, 2, 6, 11, 14 and 15), pollution and health issues (SDG 3), and higher costs of living (SDGs 1, 8, and 11).

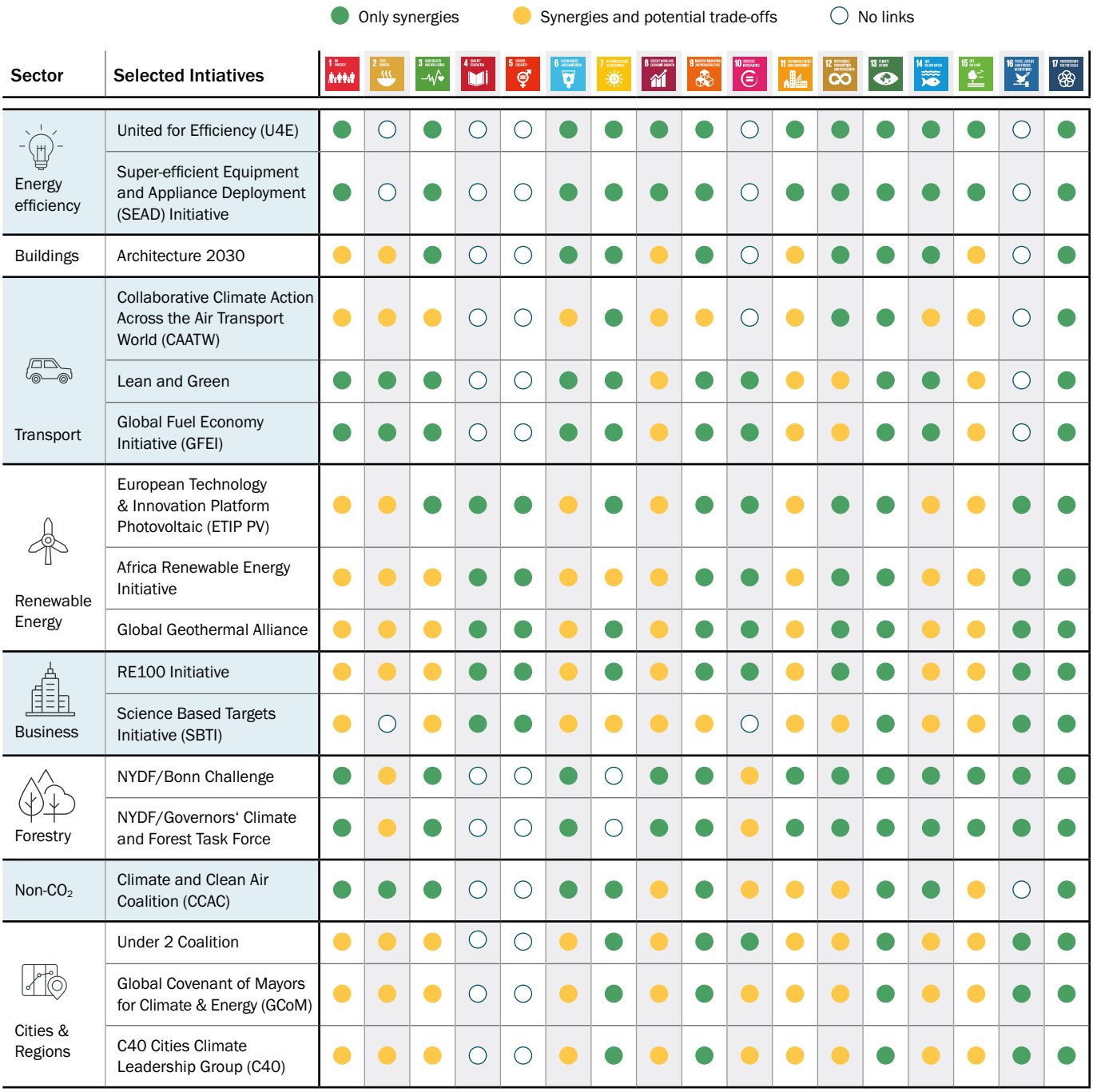
Initiatives with a focus on cities have the highest potential of trade-offs with SDGs. Potential trade-offs for city initiatives could occur, for instance, in measures to switch electricity generation to hydropower — which could lead to displacement of local communities to build hydropower plants, endangering their livelihood (SDGs 1, 2, 8, and 11), reducing their access to clean water (SDG 6), and cause environmental impacts in the ecosystem (SDG 15) — switch electricity generation to bio generation — which could lead to drinking water competition between local communities and irrigation of bio energy crops (SDG 6), water pollution from increased use of fertiliser used in growing bio energy crops (SDGs 14 and 15), and negative economic impact from potential job losses (SDG 8) — or switch electricity generation to geothermal power — which can reduce land and resource access for dependent communities (SDGs 1 and 8), lead to hydrogen sulphide and ammonia emissions to air (SDG 3), lead to thermal water pollution (SDGs 6 and 14), and cause environmental damage to surrounding terrestrial ecosystems (SDG 15). Other potential trade-offs stem from switching to low-carbon vehicles — which can lead to waste production from batteries (SDGs 8, 11 and 12) — and pollution from mining (SDG15). These trade-offs are not to suggest that the shift to mitigation activities is not worthwhile. Many trade-offs could still represent an overall improvement from the status quo. Rather, an awareness of these potential trade-offs can enable ICIs and their members to craft implementation processes that account for these potential trade-offs and minimise and negative interactions.

The frequent linkages to SDG7 (energy) confirm previous observations of strong linkages with climate action (e.g. Brandi et al., 2017; IPCC, 2018a). Indeed, ensuring access to affordable, reliable, sustainable and modern energy is a central issue in low-carbon and sustainable development. Current fossil fuel dependence presents one of the biggest climate-related challenges and is a major driver of climate change. Solutions under SDG 7, including expansion of renewable energy production, may carry climate mitigation benefits as well as opportunities to accelerate social progress and productivity. However, important trade-offs may exist in the role of biofuels as a source and carbon sink.

A number of initiatives explicitly refer to a high number of SDGs. For instance, the Climate & Clean Air Coalition (CCAC) points out that: “Actions to reduce short-lived climate pollutants (SLCPs) will produce important near-term benefits that support the success of the SDGs by improving human health and reducing vulnerability, driving economic growth and innovation such as catalysing improvements in energy efficiency, and combatting near-term climate change” (Climate and Clean Air Coalition, 2017). Other initiatives only state one or two explicit mentions to linkages, however, they can reasonably be expected to link to other SDGs. For instance, initiatives associated with the New York Declaration of Forests, the Bonn Challenge and the Governors’ Climate and Forest Task Force, are likely to impact on SDG 12 (responsible consumption and production). At the same time, it is important to note that many negative linkages and trade-offs may remain implicit; and cooperative initiatives may not want to “advertise” their possibly negative impacts on other aspects of sustainable development. For instance, carbon capture through large-scale (re)forestation could negatively impact food prices (Peña-Lévano, Taheripour and Tyner, 2019).

This analysis reveals considerable scope for alignment and

Figure 18. Theoretical positive and potentially negative links between selected international climate initiatives and SDGs based on the SCAN-tool (Gonzales-Zuñiga et al., 2018)



Sector	Selected Intiatives
Energy efficiency	United for Efficiency (U4E)
	Super-efficient Equipment and Appliance Deployment (SEAD) Initiative
Buildings	Architecture 2030
Transport	Collaborative Climate Action Across the Air Transport World (CAATW)
	Lean and Green
	Global Fuel Economy Initiative (GFEI)
Renewable Energy	European Technology & Innovation Platform Photovoltaic (ETIP PV)
	Africa Renewable Energy Initiative
	Global Geothermal Alliance
Business	RE100 Initiative
	Science Based Targets Initiative (SBTI)
Forestry	NYDF/Bonn Challenge
	NYDF/Governors' Climate and Forest Task Force
Non-CO_2	Climate and Clean Air Coalition (CCAC)
Cities & Regions	Under 2 Coalition
	Global Covenant of Mayors for Climate & Energy (GCoM)
	C40 Cities Climate Leadership Group (C40)

joint delivery on climate and sustainability goals. Some initiatives mention only few linkages to SDGs. However, our analysis finds that the potential for synergies for most initiatives is larger than explicitly mentioned. The findings are especially important for initiatives focused on the cities and energy demand sectors, as those are the ones with the most potential trade-offs.

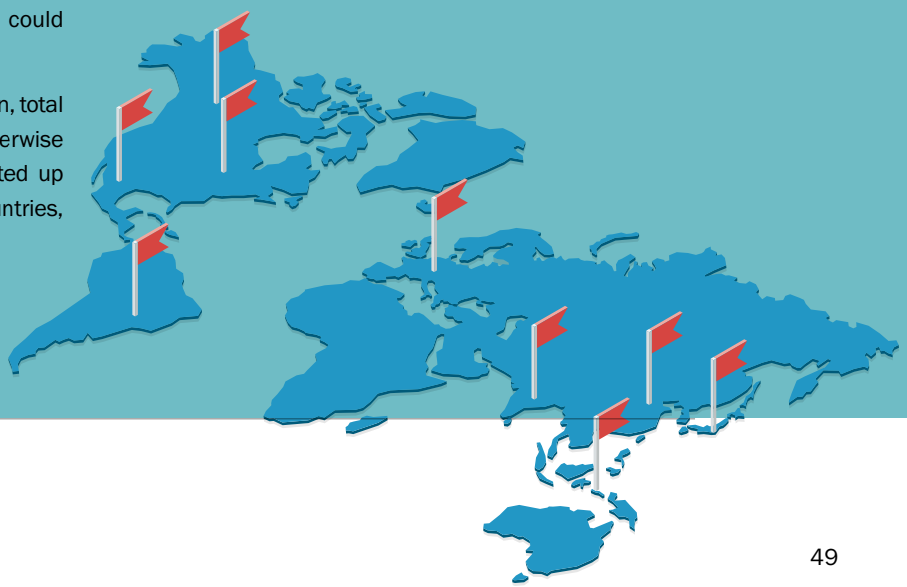
05

ASSESSMENT OF SUBNATIONAL AND NON-STATE CLIMATE ACTION FOR LARGE-EMITTING REGIONS

Following the assessment on the potential global impact of subnational and non-state climate change mitigation action, this section takes a closer look at the impact on a country level for ten high-emitting economies. In each profile below, we: (1) provide general information on the country's greenhouse (GHG) emissions and its energy and climate policies (the country context); (2) describe the interactions between the national government and subnational and non-state actors on climate action; (3) identify and map the type of GHG emissions reduction commitments made individually by cities, regions and companies within that country, as well as the actors making them; and (4) quantify the potential GHG emissions reduction impact that city, region and company commitments, as well as those of international cooperative initiatives (ICIs), could have on that country's emissions trajectory.

Regarding the emissions data presented in this section, total national GHG emissions include LULUCF, unless otherwise stated. The historical GHG emissions data are plotted up to 2016; for a number of UNFCCC non-Annex I countries, the values between the last inventory year and 2016 were estimated based on current policies scenario projections by NewClimate Institute, PBL and IIASA (Kuramochi et al., 2018). All GHG emissions figures presented are aggregated with 100-year global warming potential (GWP) values of the IPCC Fourth Assessment Report.

For the NDC target emission levels, we used LULUCF sector emission levels projected under the current policies scenario when a country's NDC: (i) excludes LULUCF emissions, (ii) is not clear about the LULUCF accounting or (iii) considers LULUCF credits. For these countries, the NDC target emission levels may not match the official values reported by the national governments.



5.1 Brazil

5.1.1 COUNTRY CONTEXT

Brazil's climate policy is at a critical juncture, due to changing political currents that leave its past success in reducing greenhouse gas (GHG) emissions in limbo. Brazil's emissions have fallen significantly since peaking in 2004, a trend driven primarily by a decline in deforestation between 2005 and 2012 (UNFCCC, 2019b). Deforestation, however, has been increasing since 2013, reflecting a lack of funding for environmental agencies and weakened environmental legislation, including the Forest Code, which mandates that farmers in the Amazon preserve forest cover on 80% of their land (William E. Magnusson et al., 2018; Watts, 2019). In 2018, Brazil lost 1.3 million hectares of Amazonian rainforest to deforestation (a 13% increase from 2017). This rise in deforestation coincides with the 35% surge of fires in the Amazon over the first eight months of 2019[11] (Escobar, 2019; Symonds, 2019). This trend could risk the forests' ability to support over 1 million indigenous people and an estimated 10% of the world's biomass and species, and to act as a key carbon sink (Climate Action Tracker, 2019a; Giacomo, 2019; Viscidi and Graham, 2019).

Brazil's contribution to global climate change threatens to increase following the 2018 election of President Jair Bolsonaro, who ran on an anti-environmental platform and received backing by the *bancada ruralista* (a pro-agribusiness congressional bloc which has traditionally opposed protective environmental legislation). Not only is deforestation likely to increase further, but Brazil's progress towards fulfilling its NDC target may also be jeopardised. Since taking office, Bolsonaro has reduced the Ministry of Environment's budget for climate change by 95%, attempted to transfer the ability to demarcate indigenous territory from the National Indian Foundation to the Ministry of Agriculture, and proposed legislation that would reduce the size of protected areas in the Amazon (Climate Action Tracker, 2018a; Rochedo et al., 2018; Viscidi and Graham, 2019).

In its nationally determined contribution (NDC) to the Paris Agreement, Brazil commits to limit its GHG emissions to 1.3 $GtCO_2e$/year in 2025 and also sets an indicative target of 1.2 $GtCO_2e$/year in 2030. The latest assessment by NewClimate Institute, PBL and IIASA as shown in Figure 19 (top panel) indicate that Brazil is not on track to meet its NDC with existing national policies (Kuramochi et al., 2018).

Despite these political setbacks, Brazil has progressed towards its NDC in the transportation and energy sectors, primarily via policies targeting increased usage of biofuels. The 2018 passage of RenovaBio, a national biofuels policy, is estimated to limit the increase in transport emissions to 4-6% by 2030, as compared to a predicted increase of 23% under "business-as-usual" conditions. The NDC target of achieving 45% renewables in Brazil's energy mix by 2030 is estimated to be achieved by 2027. However, without further measures, total energy emissions will continue to rise, driven by increased fossil fuel usage in response to soaring energy demands and water scarcity within Brazil's hydroelectric plants (Climate Action Tracker, 2019a). Within the Ten-Year Plan for Energy Expansion, the Brazilian government is planning to increase investments in both renewables and fossil fuels between 2018-2027, with investments in fossil fuels projected to rise to 76.1% (Climate Action Tracker, 2019a).

11 Fires have increased 35% above the average for the first eight months of each year since 2010.

5.1.2 INTERACTIONS BETWEEN THE NATIONAL GOVERNMENT AND SUBNATIONAL AND NON-STATE CLIMATE ACTORS

Brazil's national government has consulted city, state, and company actors to create their national-level climate policy (Hale et al., 2018). In recent years, many of these actors have also responded vocally to the shifts in the national government's stance on climate change. In response to earlier uncertainty as to whether Brazil would remain a party in the Paris Agreement, in April 2019 12 states – whose CO_2 emissions comprise approximately 50% of the national total – pledged to form a state-level council and continue working to achieve the emissions reductions outlined in Brazil's NDC (Spring, 2019).

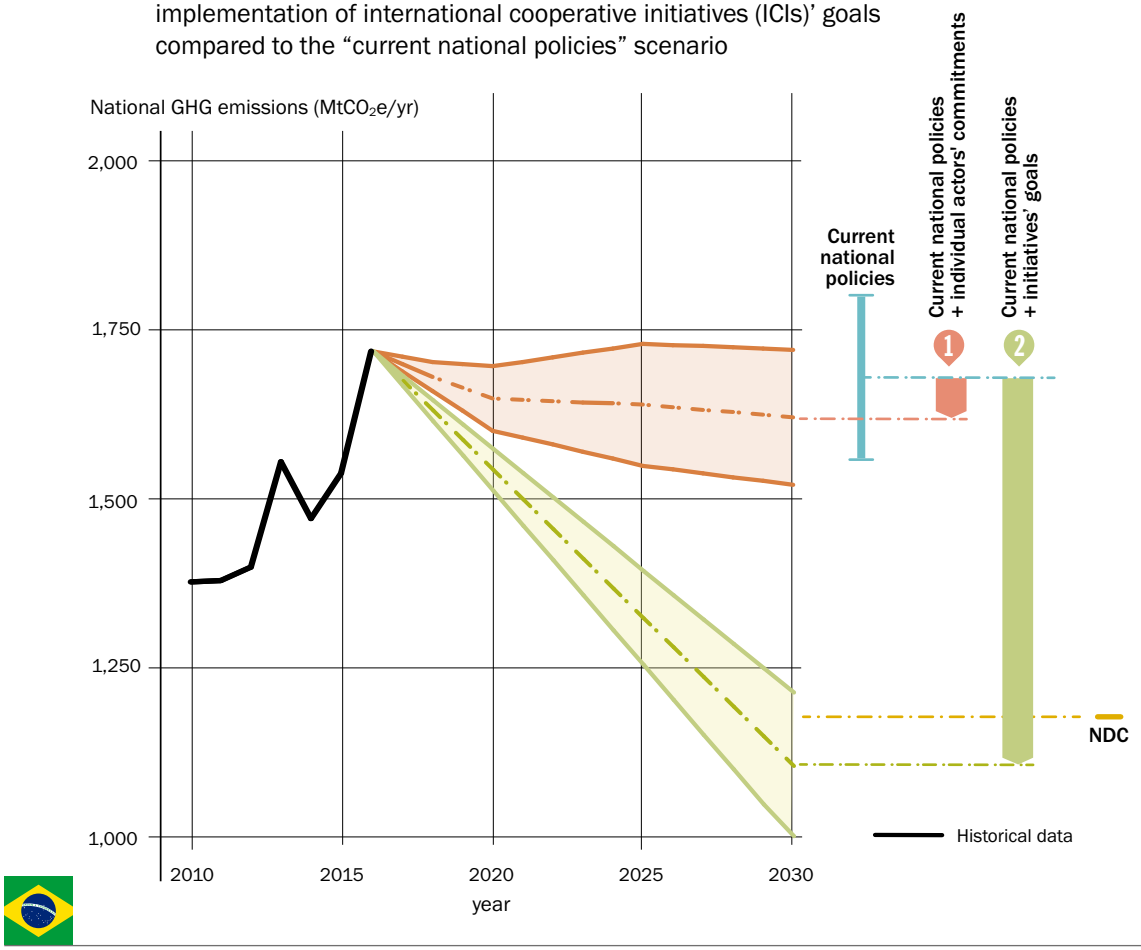
Brazil has one of the largest urban populations in the world – urban residents account for 87% of the country's total population – meaning that cities are also a crucial partner in achieving the country's climate goals (Kahn and Brandão, 2015; World Bank, 2019) and preparing for climate risks (Federative Republic of Brazil, 2015). For instance, Rio de Janeiro, Brazil's highest-emitting city, was one of the first cities in Latin America to adapt carbon neutrality as a municipal policy, and has set goals to meet 30% of the city's energy demand with renewable sources (C40 Cities, 2019b). Engaging nearly 40 city departments, private sector stakeholders, and over 4,000 citizens, the city also developed the Rio Resilience Strategy, which seeks to reduce the risks from natural disasters, improve the safety of urban spaces, promote a low-carbon economy, and provide basic services such as clean water to all citizens (C40 Cities, 2019b).

Efforts to reduce emissions in urban mobility, energy use in residential and commercial buildings, and waste management in cities could contribute significantly to lowering Brazil's emissions (Kahn and Brandão, 2015). The city of Salvador, for example, has reduced its GHG emissions by 31,500 tonnes annually through the Environmental Recovery program, which fertilises over 20,000 newly planted native trees with treated sewage, and is expected to capture 2.8 $MtCO_2$ by 2035 (C40 Cities, 2019b). Many Brazilian cities have taken especially ambitious action around transport. Brasilia has modernised its public bus fleet and implemented a Bus Rapid Transit system, significantly reducing both local pollutants and emissions (Zottis, 2015). The city of São Paulo's public bus agency reduced its GHG emissions 10% between 2010 and 2012 through an "Ecofleet" program incorporating biodiesel and ethanol fuel sources and, along with the municipality of Campinas, piloted a public electric bus program in 2018 (Viscidi and Graham, 2019).

Many Brazilian companies operating have also made climate commitments, perhaps driven by the risks climate change poses to industries, such as agriculture, manufacturing, and commodity-based exports, that the country's economy relies heavily on (Assad et al., 2013; Carlucci, 2015). One study of 38 companies operating in Brazil found that these actors had implemented 1,340 climate action projects from 2015-2017, with investments totaling more than $85.8 billion USD for emission reduction actions, focused on energy efficiency, process optimization, and low-carbon energy sources (CEBDS, 2018). A We Mean Business Coalition study of companies operating in Latin America and the Caribbean found that energy efficiency measures powered 90% of business' carbon emission reductions, producing a higher than average internal rate of return (of 16.7%) on these activities (We Mean Business, 2014).

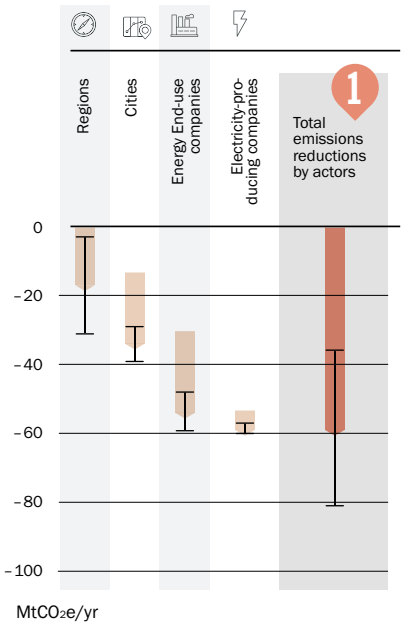
Several partnership programs between the private sector, states, and national ministries focus on targeting emissions around agriculture and land use. As part of the Forest Investment Program (FIP), the ABC Cerrado project – which is conducted jointly by the Ministry of Agriculture, Livestock, and Food, the Brazilian Agricultural Research Corporation and the National Service for Rural Apprenticeship – trains farmers across eight states in sustainable practices that both increase productivity and reduce GHG emissions (Kossoy, 2018). Between 2016 and 2018, the program restored over 84,000 hectares of degraded land ('Projeto ABC Cerrado recupera áreas degradadas', 2018) (Ministério da Agricultura, Pecuária e Abastecimento, 2018). In another example, major soy and beef companies, local and global non-governmental organizations, and the Government of the State of Mato Grosso – the largest agricultural commodity producing state in the Amazon – worked together to develop and implement the "Produce, Conserve, Include" strategy (Miller and Mendlewicz, 2016). This program aims to reduce deforestation in the Amazon by 90% by 2030, while also increasing agricultural production and fostering the socioeconomic inclusion of smallholders and traditional populations (Governo de Mato Grosso, no date).

Figure 19. Potential greenhouse gas (GHG) emissions reductions in Brazil resulting from the full implementation of individual subnational and non-state actor commitments and the full implementation of international cooperative initiatives (ICIs)' goals compared to the "current national policies" scenario

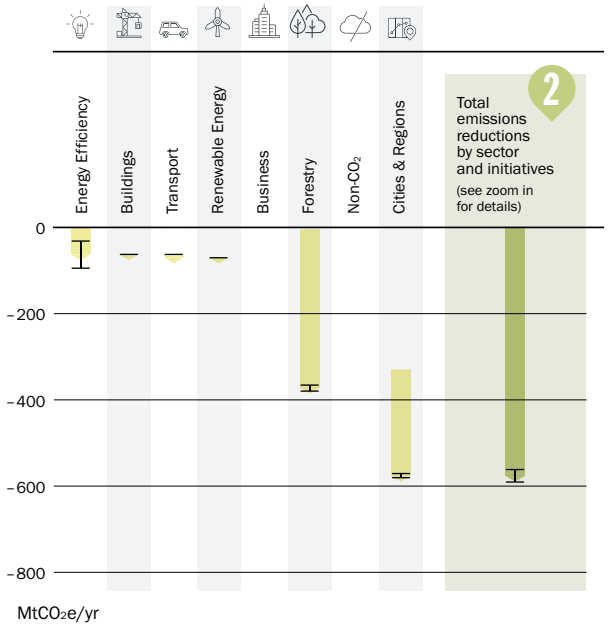


Brazil

Emissions reduction potential of individual actors beyond current national policies, **by actor group**



Emissions reduction potential of international cooperative initiatives beyond current national policies, **by sector**



The „current national policies" scenario (Kuramochi et al., 2018) includes land use, land-use change and forestry. Top panel: historical GHG emissions up to 2016 (with authors' own estimates for years between the last inventory data year and 2016) and scenario emissions pathways up to 2030, alongside the NDC target emissions range (indicative target level for 2030). Emissions reduction target trajectories from individual actors' commitments and initiatives' goals are assumed to be achieved linearly from the latest historical data year and are presented here for illustrative purposes. Bottom-left panel: the breakdown of potential GHG emissions reductions from individual subnational and non-state actor commitments in 2030 by actor group. Bottom-right panel: the breakdown of potential GHG emissions reductions from ICIs in 2030 by sector." The results for "Current national policies plus initiatives' goals" scenario do not include the potential emissions reductions from Science Based Targets, RE100 and Collaborative Climate Action Across the Air Transport World (CAATW); they are only quantified at a global level.

5.1.3 COMPARING SUBNATIONAL AND NON-STATE TRAJECTORY WITH NATIONAL TRAJECTORY

A relatively small but impactful cohort of Brazil's subnational actors have set climate goals. The assessment includes seven cities, representing more than 25 million people, and 1 region, representing over 45 million people, that have made quantifiable commitments to reduce GHG emissions.[12] It also includes more than 300 companies, controlling over $317 billion USD in revenue[13] – and including 8 of the world's largest companies[14] – that have made quantifiable climate commitments, most frequently in the electrical and electronic equipment, biotech and pharmaceuticals, and chemicals sectors.

Together, these cities, region, and companies represent 220 $MtCO_2e$/year in 2015, accounting for overlap between actors. Individual city, region, and company commitments' impact on Brazil's emissions is moderate. If fully implemented and if such efforts do not decrease efforts elsewhere, they would reduce emissions in 2030 by an additional 40 to 80 $MtCO_2e$/year or 2.3% to 4.5% below current national policies scenario projections (Figure 19, top panel).

ICIs – networks of cities, regions, companies, investors, civil society, and, in some cases, countries, pursuing common climate action – could have a more substantial impact. If they realise their goals, they could reduce emissions in 2030 by 560 to 590 $MtCO_2e$/year or 33% to 36% below the projected emissions under current national policies. Initiatives focused on forestry, non-CO_2 GHG emissions and cities and regions make the largest contributions to initiatives' total mitigation potential (Figure 19, bottom-right panel). The reduction potential in the forestry sector has increased significantly from the 2018 analysis, due to the upward revision of the current national policies scenario projections of LULUCF emissions (Kuramochi et al., 2018).

12 Quantifiable commitments to reduce GHG emissions typically include a specific emissions reduction goal, target year, baseline year, and baseline year emissions. See Technical Annex I for more details.

13 Companies' combined revenue reflects companies making quantifiable commitments to reduce GHG emissions, whose headquarters are in Brazil, and whose revenue data is publicly available. See Technical Annex I for more details.

14 The world's largest companies are defined in terms of their inclusion in the 2019 Forbes 2000 and Global Fortune 500 lists.

5.2 Canada

5.2.1 COUNTRY CONTEXT

Canada faces an internal tug-of-war as it tries to steer its climate policies. National efforts to implement a carbon price have faced push-back from four provinces, and the country's trajectory may hinge on upcoming federal elections this fall. Campaigning conservative politicians have pledged to remove the carbon price if elected, turning to tax incentives and spending to improve energy efficiency and reduce fuel's carbon content, while the Liberal Party aims to maintain existing greenhouse gas (GHG) emissions reduction goals.

This debate comes at a crucial moment for Canada's overall climate policy. In the country's pledge in support of the Paris Agreement (its Nationally Determined Contribution or NDC), it sets a target of reducing GHG emissions 30% by 2030 (Government of Canada, 2016a) compared to 2005 levels. The latest assessment by NewClimate Institute, PBL and IIASA as shown in Figure 20 (top panel) indicate that the country is not on track to meet this goal with existing national policies (Kuramochi et al., 2018).

Canada's GHG emissions (including LULUCF) have been increasing consistently since 2010 and grew by 2.4% from 2012 to 2017 (UNFCCC, 2019a). Fossil fuel combustion accounts for the majority of Canada's emissions, and in 2018, the largest driver in the increase in carbon dioxide emissions was the growth in crude oil and liquid natural gas production (ibid.) The five most populous provinces, including Alberta, Ontario, and Quebec, account for over 91% of the country's total GHG emissions (Environment and Climate Change Canada, 2013). As a member of the Powering Past Coal Alliance, Canada has implemented policies, with the support of key coal-firing provinces, such as Alberta, to phase out coal production entirely by 2030. Yet this may result in a switch to the reliance on liquified natural gas production, another carbon-intensive fuel (Nace, Plante and Browning, 2019).

5.2.2 INTERACTIONS BETWEEN THE NATIONAL GOVERNMENT AND SUBNATIONAL AND NON-STATE CLIMATE ACTORS

Canada's national climate policy formation has been marked by significant – and sometimes turbulent – back and forth between the federal government, local and tribal governments, and the private sector. In practice, local and regional governments have played a powerful role in both advancing and challenging Canada's national climate goals.

In 2018, the federal government implemented the Greenhouse Gas Pollution Pricing Act, which sets a fixed and gradually increasing carbon price per tonne of emissions. The government compels each province and territory to maintain a carbon pricing scheme and intends to impose a nationally-mandated backstop in provinces that fail to produce a scheme by the end of 2019 (Government of Canada, 2018). Several provinces have already established carbon pricing systems. British Columbia, for instance, introduced North America's first broad-based carbon tax in 2008, and its price per tonne currently exceeds the federally mandated rate – the province prices carbon at 30 Canadian Dollars per tCO_2, well above the federal threshold of 10 Canadian Dollars per tCO_2 in 2018 (Ye, no date; Government of British Columbia, 2018). However, the provinces of Alberta, Saskatchewan, Ontario and New Brunswick have mounted legal challenges against the constitutionality of this carbon "backstop system," in which federal carbon pricing is implemented in the absence of a provincial legislation (Climate Action Tracker, 2019b). In May 2019, the Saskatchewan provincial court ruled in favour of the act's constitutionality, and the case is now headed to Canada's Supreme Court.

Other actors, however, continue to push ambitious climate action forward. Under the 2016 Pan-Canadian Framework, many provincial, territorial, and municipal governments are working to implement climate action

commitments. In 2017, the City of Toronto unanimously approved "TransformTO," a climate action plan that pledges to reduce carbon emissions by 65% by 2030, thus surpassing Canada's national level targets. Vancouver, a member of the Carbon Neutral Cities Alliance, has set a goal to achieve zero greenhouse gas emissions for all new buildings in the city by 2030. Canada's 2016 Budget allocated 125 million Canadian Dollars to the Green Municipal Fund, which supports urban projects that deliver environmental benefits and improve quality of life (Government of Canada, 2019). These resources may help catalyse additional efforts from municipal governments, which have the ability to influence about half of Canada's GHG emissions (Government of Canada, 2019).

There is also a growing awareness of climate action within Canada's private sector, with more than 20 Canadian companies joining the Carbon Pricing Leadership Coalition, which advocates for international adoption of carbon pricing schemes (Government of Canada, 2019). Rural electrification and energy infrastructure schemes by the Government of Canada seek to increase private sector demand for carbon-neutral technologies (Government of Canada, 2018). In the past year, for instance, the federal government expanded key programs like the Electric Vehicle and Alternative Fuel Initiative, investing an additional 49.6 million Canadian Dollars into the development of a "coast-to-coast" electric transportation infrastructure and commercialization of electric vehicles (Infrastructure Canada, 2018).

5.2.3 COMPARING SUBNATIONAL AND NON-STATE TRAJECTORY WITH NATIONAL TRAJECTORY

The assessment includes 23 cities, representing over 11 million people, and 3 regions, representing a population of nearly 14 million, that have made quantifiable targets to reduce GHG emissions.[15] It also includes over 330 companies, controlling over $486 billion USD in revenue[16] – and including 20 of the world's largest companies[17] – that have made quantifiable climate commitments, most frequently in the financial services and electrical and electronic equipment sectors.

Together, these cities, regions, and companies represent 260 $MtCO_2e$/year in 2015, accounting for overlap between actors. Individual city, region, and company commitments could have a large impact on national GHG emissions. If fully implemented and if such efforts do not decrease efforts elsewhere, they would reduce emissions in 2030 by an additional 50 and 80 $MtCO_2e$/year or 8.5% to 11% below reductions from current national policies, with provinces, cities and companies all making substantial contributions (Figure 20, bottom-left panel).

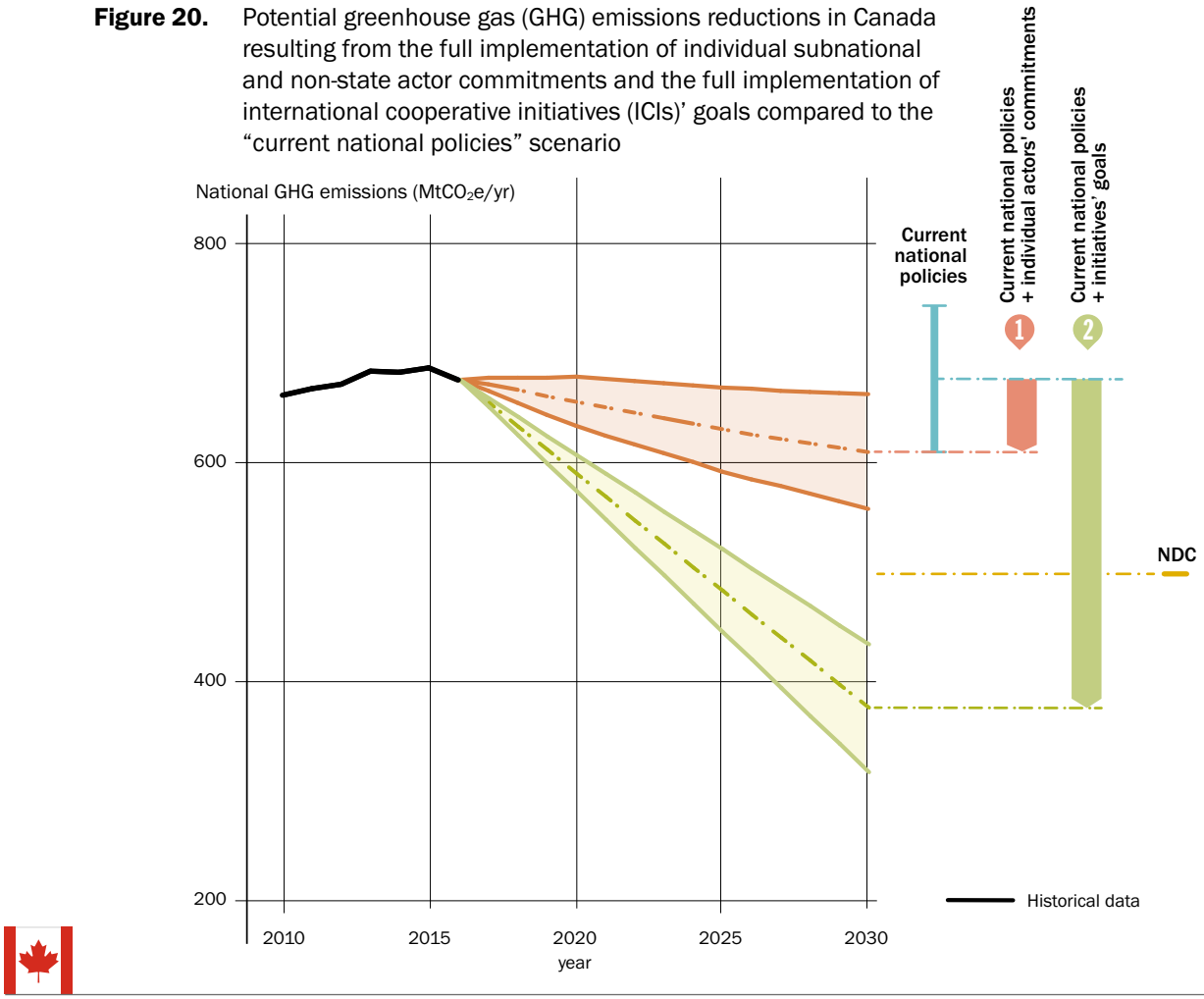
International cooperative initiatives (ICIs) – networks of cities, regions, companies, investors, civil society, and, in some cases, countries, pursuing common climate action – could have an even larger impact. If they realise their goals, they could reduce emissions in 2030 by 290 to 310 $MtCO_2e$/year or 42% to 48% below the projected emissions under current national policies. Initiatives focused on cities and regions account for large majority of this estimated mitigation potential, followed by those targeting non-CO_2 GHG reductions (Figure 20, bottom-right panel). These initiatives' success could enable Canada to remain on track to achieve net zero GHG emissions by early in the second half of the 21st century.

15 Quantifiable commitments to reduce GHG emissions typically include a specific emissions reduction goal, target year, baseline year, and baseline year emissions. See Technical Annex I for more details.

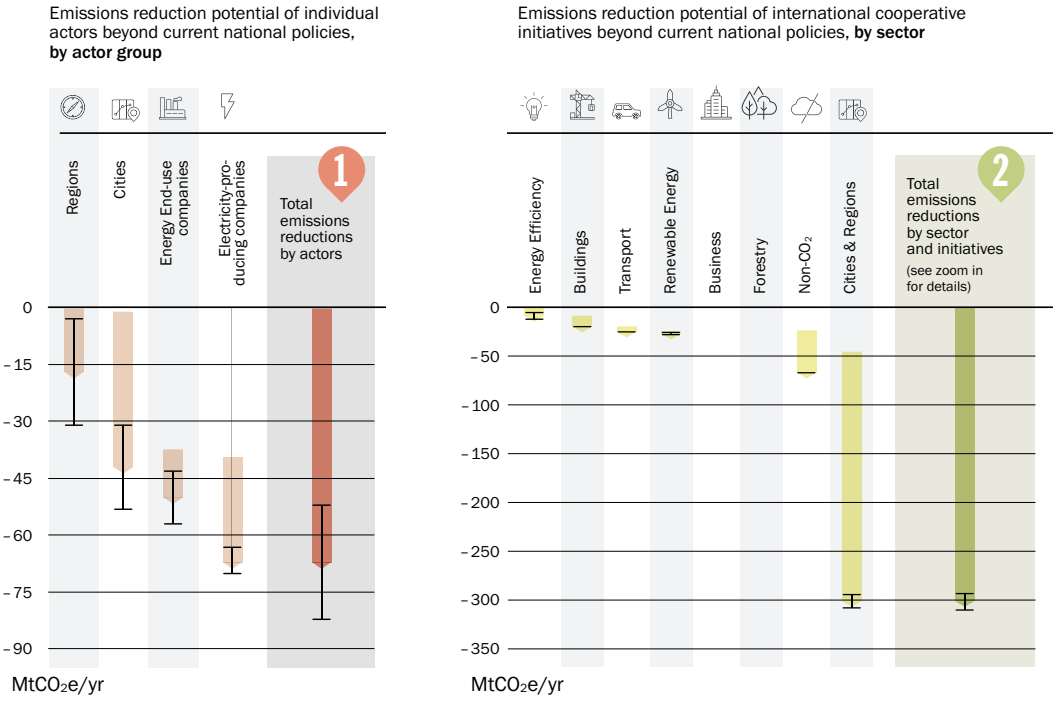
16 Companies' combined revenue reflects companies making quantifiable commitments to reduce GHG emissions, whose headquarters are in Canada, and whose revenue data is publicly available. See Technical Annex I for more details.

17 The world's largest companies are defined in terms of their inclusion in the 2019 Forbes 2000 and Global Fortune 500 lists.

Figure 20. Potential greenhouse gas (GHG) emissions reductions in Canada resulting from the full implementation of individual subnational and non-state actor commitments and the full implementation of international cooperative initiatives (ICIs)' goals compared to the "current national policies" scenario



Canada



The „current national policies" scenario (Kuramochi et al., 2018) includes land use, land-use change and forestry. Top panel: historical GHG emissions up to 2016 (with authors' own estimates for years between the last inventory data year and 2016) and scenario emissions pathways up to 2030, alongside the NDC target emissions range (indicative target level for 2030). Emissions reduction target trajectories from individual actors' commitments and initiatives' goals are assumed to be achieved linearly from the latest historical data year and are presented here for illustrative purposes. Bottom-left panel: the breakdown of potential GHG emissions reductions from individual subnational and non-state actor commitments in 2030 by actor group. Bottom-right panel: the breakdown of potential GHG emissions reductions from ICIs in 2030 by sector." The results for "Current national policies plus initiatives' goals" scenario do not include the potential emissions reductions from Science Based Targets, RE100 and Collaborative Climate Action Across the Air Transport World (CAATW); they are only quantified at a global level.

5.3 China

5.3.1 COUNTRY CONTEXT

China's climate change record is mixed. Although it leads the world in terms of renewable energy capacity, recent trends in carbon emissions tell a less optimistic story. China's 3.3% rise in energy consumption led to both an increase in national – and global – carbon dioxide (CO_2) emissions, after a levelling out period between 2014 and 2016 (Climate Action Tracker, 2019a; National Bureau of Statistics of China, 2019). The recent increase in greenhouse gas (GHG) emissions could be partially explained as a result of slowing economic growth, which prompted the country to stimulate production in emission-intensive industries, including new construction of 28 GW worth of coal-fired power plants in 2018. While China has lifted its ban on new coal-fired power plants, it still leads the world in clean energy investment, accounting for 32% of the global total (REN21, 2019) and contributing more than $100 billion USD in 2018 (BNEF, 2019). In 2017, China's carbon intensity declined by 46% relative to 2005 levels, surpassing the 40% to 45% intensity reduction target laid out in the National Climate Change Plan (2014–2020) (People's Republic of China, 2014).

In its nationally determined contribution (NDC), China has pledged to peak CO_2 emissions before 2030, to achieve a 20% share of non-fossil fuel energy sources in total primary energy consumption by 2030, and to reduce the carbon intensity of its GDP by 60% to 65% compared to 2005 levels. Overall, China is on track to meet its NDC as shown in Figure 21 (top panel), through existing policies, such as reducing the carbon intensity of economic production, improving energy efficiency, an up-and-running emissions trading system, as well as air pollution regulations (Kuramochi et al., 2018; den Elzen et al., 2019).

5.3.2 INTERACTIONS BETWEEN THE NATIONAL GOVERNMENT AND SUBNATIONAL AND NON-STATE CLIMATE ACTORS

China's comparatively "state-controlled, top-down" political system (Westman and Broto, 2018) has created a climate governance structure characterised by "central authority and decentralised policy implementation" (Hsu, 2019). In other words, the national government delegates the implementation of its wide-ranging energy and climate policies to local governments and businesses (Hale et al., 2018). Cities and regions also serve as important testing grounds as the national government sets targets and develops plans. For instance, seven cities and provinces piloted an emissions trading system before its national rollout in December 2017. Since 2010, China's National Development and Reform Commission (NDRC) has shortlisted 81 cities and six provinces as low-carbon pilots (Ministry of Ecology and Environment of China, 2018). In many cases, the pilot program serves as a new avenue for cities and the national governments to work together directly.

Financial benefits and technology transfer generated through the Clean Development Mechanism first motivated provincial and municipal governments to engage on climate change outside of central government mandates (Qi and Wu, 2013). Since then, local governments have been assigned greater responsibility to implement energy and climate policy. Sustainability-focused partnerships between state, market, and civil society actors also help facilitate local climate action by increasing access to information, technology, funding and other resources (Westman and Broto, 2018). A recent survey found approximately 150 of these partnerships operating within 15 Chinese cities (Westman and Broto, 2018).

Chinese cities and provinces' Five-Year Plans reflect national goals to reduce energy and carbon intensity and increase the share of renewable energy. Many also

introduce their own low-carbon development practices, establishing carbon peaking targets or setting caps on carbon dioxide emissions. According to China's Climate Policies and Actions 2018 Annual Report, GHG inventorying mechanisms have been established in cities like Hangzhou, Ningbo, Wenzhou and Jiaxing at both the city and the county level (Ministry of Ecology and the Environment, 2018). However, these sub-national actors do not necessarily participate actively in international networks or disclose inventory emissions.

Companies are also actively engaged in climate action. The private sector has taken on a growing role in developing sustainable infrastructure (Westman and Broto, 2018), in part to supply the housing, transportation, and energy needed to sustain China's rapid urban development (Thieriot and Dominguez, 2015). As the government works to step up enforcement of environmental regulations and encourage the spread of renewable energy, a growing proportion of Chinese companies are incorporating climate change into their strategy and operations, and taking steps to control emissions (CDP, 2019a). China currently leads the world in terms of the number of jobs – 4.1 million in 2018 – generated by the renewable energy industry (REN21, 2019). The China Business Climate Action Initiative, which encourages businesses and industries to incorporate climate change into their corporate social responsibility and overall strategies, launched during the 2018 Global Climate Action Summit and includes roughly 800,000 participating entities, from industry associations like the China Chain-Store & Franchise Association and China Textile Industry Federation (Xie, 2018; Xin, 2018).

5.3.3 COMPARING SUBNATIONAL AND NON-STATE TRAJECTORY WITH NATIONAL TRAJECTORY

The assessment includes 27 cities, representing more than 191 million people, and 2 regions, representing a population of over 90 million, that have made quantifiable commitments to reduce GHG emissions.[18] It also includes more than 550 companies, controlling over $410 billion USD in revenue[19] – and including 14 of the world's largest companies[20] – that have made quantifiable climate commitments, most frequently in the electrical and electronic equipment and powered machinery sectors.

Together, these cities, regions, and companies represent 1,400 $MtCO_2$/year in 2015, accounting for overlap between actors. Individual city, region, and company commitments could have a moderate impact on national GHG emissions. If fully implemented and if such efforts do not decrease efforts elsewhere, they would reduce emissions in 2030 by up to 50 $MtCO_2e$/year, beyond the projected emissions under current national policies – an amount roughly equivalent to less than 0.5% of China's current GHG emissions (Figure 21, top panel).

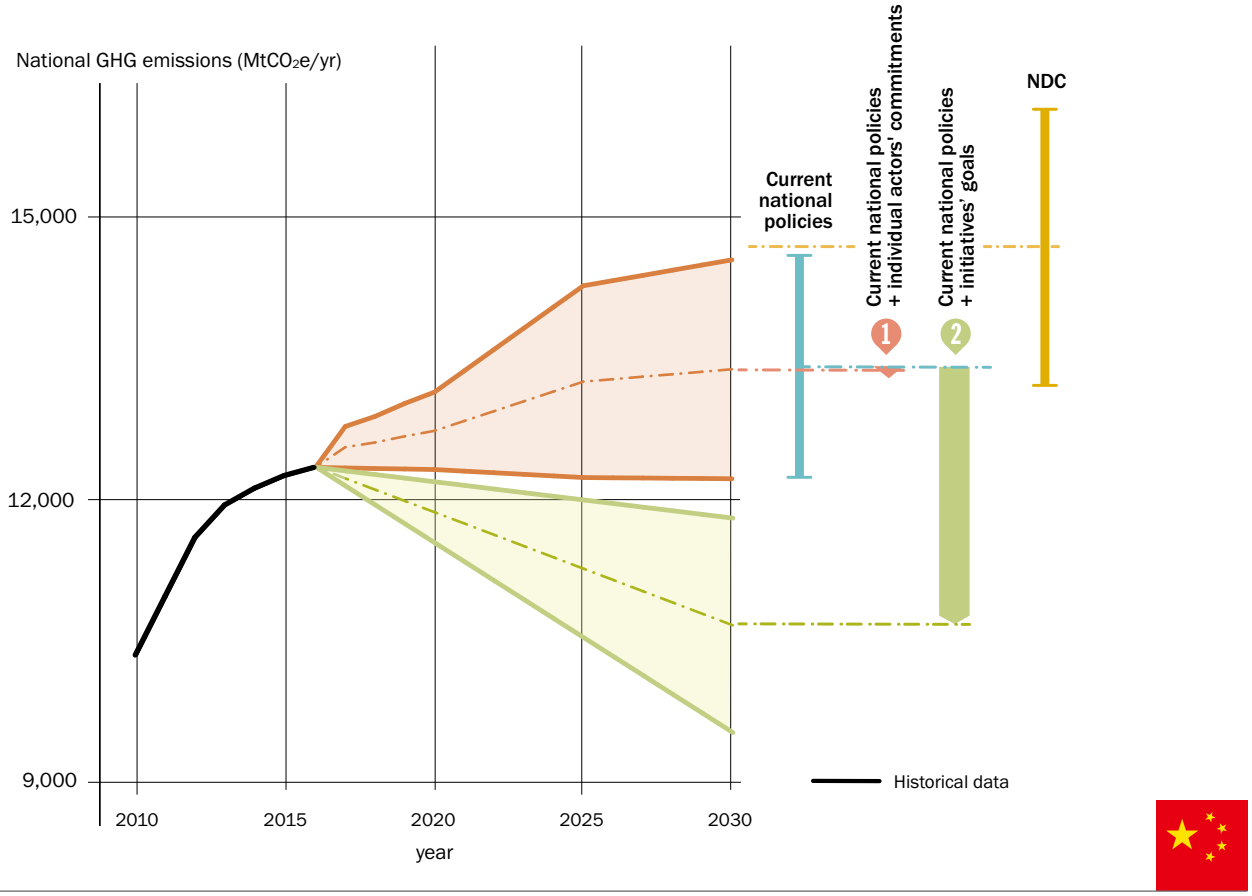
By contrast, international cooperative initiatives (ICIs) – networks of cities, regions, companies, investors, civil society, and, in some cases, countries, pursuing common climate action – could have a significantly larger impact. Assuming full realisation of the pledges, they could reduce emissions in 2030 by 2,700 to 2,800 $MtCO_2e$/year or 19% to 22% below the projected emissions under current national policies. Initiatives focused on cities and regions are by far the largest contributors to this estimated mitigation potential, followed by initiatives addressing non-CO_2 GHGs and energy efficiency (Figure 21, bottom-right panel). These initiatives' success could enable China to achieve more than what it has promised in its NDC.

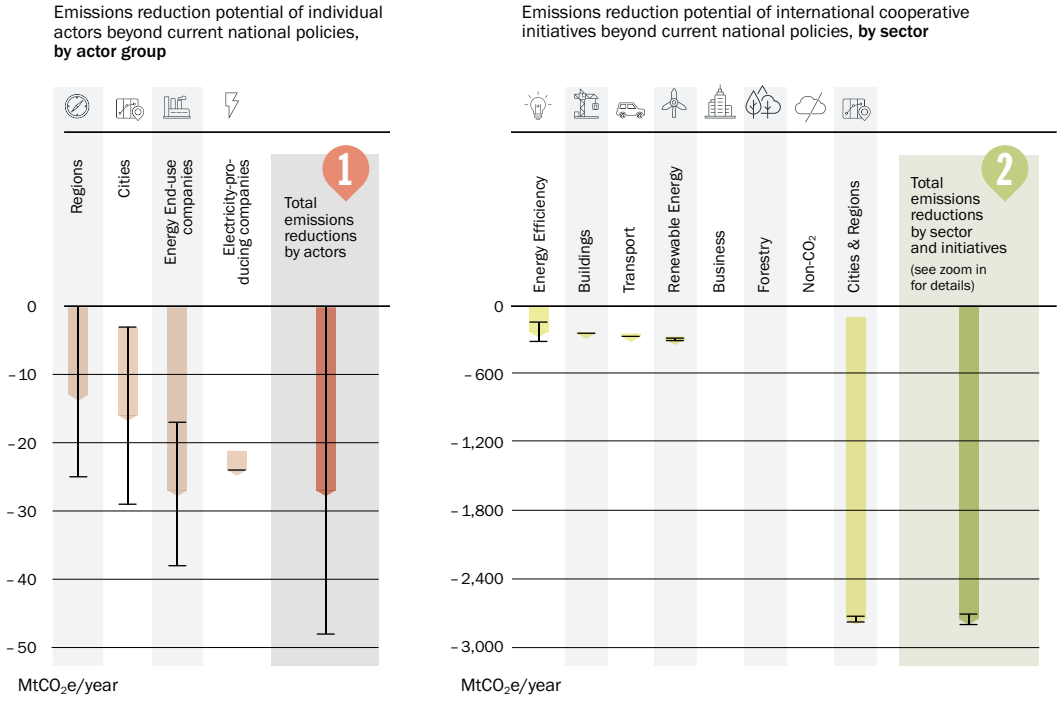
18 Quantifiable commitments to reduce GHG emissions typically include a specific emissions reduction goal, target year, baseline year, and baseline year emissions. See Technical Annex I for more details.

19 Companies' combined revenue reflects companies making quantifiable commitments to reduce GHG emissions, whose headquarters are in China, and whose revenue data is publicly available. See Technical Annex I for more details.

20 The world's largest companies are defined in terms of their inclusion in the 2019 Forbes 2000 and Global Fortune 500 lists.

Figure 21. Potential greenhouse gas (GHG) emissions reductions in China resulting from the full implementation of individual subnational and non-state actor commitments and the full implementation of international cooperative initiatives (ICIs)' goals compared to the "current national policies" scenario





The „current national policies" scenario (Kuramochi et al., 2018) includes land use, land-use change and forestry. Top panel: historical GHG emissions up to 2016 (with authors' own estimates for years between the last inventory data year and 2016) and scenario emissions pathways up to 2030, alongside the NDC target emissions range (indicative target level for 2030). Emissions reduction target trajectories from individual actors' commitments and initiatives' goals are assumed to be achieved linearly from the latest historical data year and are presented here for illustrative purposes. Bottom-left panel: the breakdown of potential GHG emissions reductions from individual subnational and non-state actor commitments in 2030 by actor group. Bottom-right panel: the breakdown of potential GHG emissions reductions from ICIs in 2030 by sector." The results for "Current national policies plus initiatives' goals" scenario do not include the potential emissions reductions from Science Based Targets, RE100 and Collaborative Climate Action Across the Air Transport World (CAATW); they are only quantified at a global level.

5.4 European Union

5.4.1 COUNTRY CONTEXT

The European Union (EU) has made considerable progress in decarbonizing its economy, lowering its greenhouse gas (GHG) emissions (by 2017) by 23% since 1990, while more than doubling its GDP during that same time span (European Commission, 2018a) (Gaventa et al., 2018). This shift is supported by the 2030 climate and energy framework that aims for at least 40% reductions in GHG emissions (compared to 1990 levels) also enshrined as the EU's nationally determined contribution (NDC). To achieve these goals, the EU aims to reach a 32% share of renewable energy and 32.5% improvement of energy efficiency in 2030. These targets are supported by economy-wide energy supply, buildings, and transport sector policies, of which the European Emission Trading System covers the largest amount of GHG emissions. European countries are required to develop National Energy and Climate Plans for the period 2020 to 2030. Based on the assessment of these plans, the European Commission calls on Member States to step up ambition. The stakes are high: "if no further action is taken and global temperature increases by 3.5°C, climate damages" by the end of this century in the EU "could total at least €190 billion, a net welfare loss of 1.8% of its current GDP" (European Commission, 2018a).

The latest assessments by NewClimate Institute, PBL and IIASA includes two GHG projections, of which one indicate that the EU would achieve its NDC, while the other is short of achievement if the aforementioned policy packages are fully implemented (Kuramochi et al., 2018; den Elzen et al., 2019). These findings are supported by den Elzen et al. (2019).

5.4.2 INTERACTIONS BETWEEN NATIONAL GOVERNMENT AND SUBNATIONAL AND NON-STATE CLIMATE ACTORS

The EU climate policy is for a large part established at the European level but needs to be implemented by the Member States. The majority of international cooperative initiatives (ICIs) registered on the Global Climate Action (NAZCA) platform are led by EU countries, and mainly countries in western Europe (Chan and Bencini, 2018). Small non-state actors, in particular, need more support, and in general local action must be better acknowledged (European Economic and Social Committee, 2018). For example, the EU does not make any reference to non-state actors in their NDC (Hsu et al., 2019). In addition, only five EU countries mention at least one city climate action in their National Energy and Climate Actions Plans, and only four refer to the EU Covenant of Mayors (Sailler, 2019). The Netherlands is one example where the national government includes different stakeholders, such as companies, the financial sector, and NGOs, in its efforts to establish reduction measures in each sector that result in achieving the country's economy-wide target.

Many local governments in the EU Covenant of Mayors have put forward pledges in line with EU's NDC, committing to reduce GHG emissions at least 40% below 1990 levels by 2030. The Under2 Coalition, which brings together regions and cities, includes 44 EU signatories, out of 220 total participating regions. Moreover, London, Paris, Stockholm, Barcelona, Copenhagen, Helsinki, Manchester, Nottingham and Heidelberg have pledged to be carbon neutral in or before 2050 (Unit Energy & Climate Intelligence, 2019). Climate change is a topic that is being discussed in European boardrooms, but the extent that it influences strategic decision making remains an open question (CDP, 2018). Transparency of climate action is slowly increasing due to the Task Force on Climate-related Financial Disclosure (TCFD) and the implementation of the EU Sustainable Finance Action Plan (CDP, 2018; European Commission, 2018b).

5.4.3 COMPARING SUBNATIONAL AND NON-STATE TRAJECTORY WITH NATIONAL TRAJECTORY

Almost 75% (380 million) of the EU's population resides in urban areas (UNDESA, 2018). This assessment includes roughly 5,700 cities, representing nearly 178 million people, and 31 regions with more than 98 million people, that have made quantifiable targets to reduce GHG emissions.[21] It also includes approximately 780 companies, controlling over $5.4 trillion USD in revenue[22] – and including 322 of the world's largest companies[23] – that have made quantifiable climate commitments, most frequently in the financial services, biotech and pharmaceuticals, and electrical and electronic equipment sectors.

Together, these cities, regions and companies represent 1,500 $MtCO_2e$/year in 2015, accounting for overlap between actors. These individual city, region, and company commitments could reduce emissions in 2030 by 110 and 320 $MtCO_2$/year or 3.8% to 9.2% below the projected emissions under current national policies, assuming all commitments are fully implemented and such efforts do not decrease efforts elsewhere (Figure 22, top panel). The lower bound of the projected emissions in this "Current national policies plus individual actors' commitments" scenario in 2030 would be about 300 $MtCO_2e$/year below the EU's NDC target emission levels. These results suggest that the EU could further raise its ambition level, to pursue a 48% reduction below 1990 levels by fully taking the existing commitments of regions, cities and companies into account; its current NDC aims to reduce emissions 40% below 1990 levels by 2030. A reference scenario in the in-depth analysis document underlying the EU's long-term vision document (European Commission, 2018) projects a 48% reduction including LULUCF in 2030 below 1990 levels; our results are consistent with this EU scenario projections. It should be noted, however, that while our calculations incorporate LULUCF emissions, the EU's NDC target does not specify the extent to which LULUCF sinks would be accounted for.

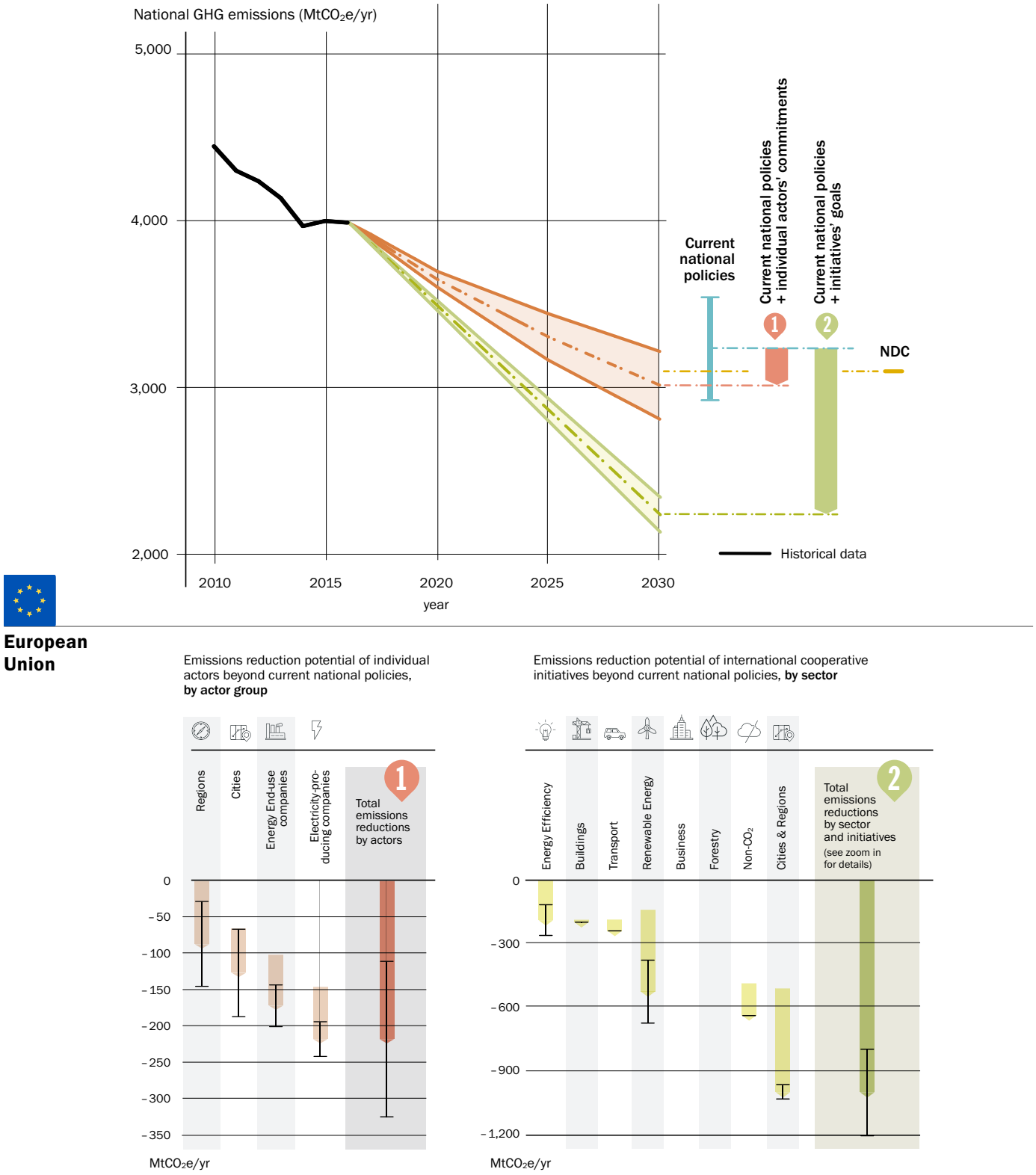
ICIs – networks of cities, regions, companies, investors, civil society, and, in some cases, countries, pursuing common climate action – could have a significantly larger impact. If they realise their goals and such efforts do not decrease efforts elsewhere they could reduce emissions in 2030 by 790 to 1,200 $MtCO_2e$/year or 27% to 34% below the projected emissions under current national policies. Initiatives focused on renewable energy, non-CO_2 GHGs and cities and regions account for the largest share of this estimated mitigation potential (Figure 22, bottom-right panel). The potential impact of ICIs is smaller compared to the results in the 2018 report, mainly due to the exclusion of a renewable energy initiative (EU Wind Initiative) that received low scores in the function-output-fit (FOF) analysis presented in section 2.2, and the revision of the target/roadmap for the Architecture 2030 initiative. The full implementation of the quantified mitigation potential from ICIs would put the EU on track to achieve carbon neutrality by around 2050.

21 Quantifiable commitments to reduce GHG emissions typically include a specific emissions reduction goal, target year, baseline year, and baseline year emissions. See Technical Annex I for more details.

22 Companies' combined revenue reflects companies making quantifiable commitments to reduce GHG emissions, whose headquarters are in the EU, and whose revenue data is publicly available. See Technical Annex I for more details.

23 The world's largest companies are defined in terms of their inclusion in the 2019 Forbes 2000 and Global Fortune 500 lists.

Figure 22. Potential greenhouse gas (GHG) emissions reductions in the European Union resulting from the full implementation of individual subnational and non-state actor commitments and the full implementation of international cooperative initiatives (ICIs)' goals compared to the "current national policies" scenario



The „current national policies" scenario (Kuramochi et al., 2018) includes land use, land-use change and forestry. Top panel: historical GHG emissions up to 2016 (with authors' own estimates for years between the last inventory data year and 2016) and scenario emissions pathways up to 2030, alongside the NDC target emissions range (indicative target level for 2030). Emissions reduction target trajectories from individual actors' commitments and initiatives' goals are assumed to be achieved linearly from the latest historical data year and are presented here for illustrative purposes. Bottom-left panel: the breakdown of potential GHG emissions reductions from individual subnational and non-state actor commitments in 2030 by actor group. Bottom-right panel: the breakdown of potential GHG emissions reductions from ICIs in 2030 by sector." The results for "Current national policies plus initiatives' goals" scenario do not include the potential emissions reductions from Science Based Targets, RE100 and Collaborative Climate Action Across the Air Transport World (CAATW); they are only quantified at a global level.

5.5 India

5.5.1 COUNTRY CONTEXT

India's population has grown rapidly, reaching 1.35 billion people in 2017 (UN DESA, 2019). Therefore, greenhouse gas (GHG) emissions will increase accordingly, unless action is taken in the next few years. It all depends on India's development transition (Dubash et al., 2018), which currently has two faces: coal consumption is increasing rapidly, but at the same time India is becoming a global leader in renewable energy (Carbon Brief, 2019; Climate Action Tracker, 2019a).

Currently, India has 221 GW of coal power, 36 GW is being built, and 58 GW is in the pipeline (Carbon Brief, 2019), but costs for solar power are falling, making this technology interesting for India. The National Solar Mission aims to grow solar power to 100 GW by 2022, and 75 GW from other renewable sources are also planned (Indian Ministry of New and Renewable Energy, 2015). The Secretary of New and Renewable Energy announced that India is planning to install 500 GW of renewable capacity by 2030 (Beetz, 2018; Varadhan, 2019).

In the transport sector, the complete ban on new fossil fuel-driven cars after 2030 has been scaled down to a target of 30% of sales for electric vehicles (Carbon Brief, 2019). In addition, India has implemented fuel efficiency standards for cars, which will be tightened by 2022, and a 20% blending biofuel target, which had not been met in 2018 (ibid).

In its nationally determined contribution (NDC), India commits to reducing its emissions intensity of GDP by 33% to 35% below 2005 levels by 2030, and also sets targets for non-fossil fuel energy and forest carbon stock. The latest assessments by NewClimate Institute, PBL and IIASA indicate that India is likely to meet its unconditional NDC emissions intensity target with its current policies (Kuramochi et al., 2018; den Elzen et al., 2019).

5.5.2 INTERACTIONS BETWEEN NATIONAL GOVERNMENT AND SUBNATIONAL AND NON-STATE CLIMATE ACTORS

Although India has a strong centralised federal system with a dominant role for national government regarding climate policy, states are essential for implementation. Since 1990, states increasingly conduct independent policy making by setting their own objectives and implementing policy instruments (Jörgensen, Mishra and Sarangi, 2015). Since the publication of the National Action Plan on Climate Change in 2008, states are required to submit and implement State Action Plans on Climate Change. Implementation of these plans is not evident, as many states feel lack of ownership, links to development are unclear, and alignment with the budget process is small (Gogoi, 2017). The GHG Program India is an initiative that supports setting up GHG emission inventories, if necessary, for the national government and local governments (Ghosh and Prasad, 2017).

In India, 25 companies have committed to Science Based Targets, while 52 have responded to the CDP questionnaire giving insight into their climate action (CDP, 2019b). The Mahindra Group was one of the first companies to articulate a climate commitment, pledging to reduce (scope 1, 2 and 3) emissions per tonne of steel by 35% in 2030 relative to 2016 (Mahindra, 2018).

5.5.3 COMPARING SUBNATIONAL AND NON-STATE TRAJECTORY WITH NATIONAL TRAJECTORY

The assessment includes 3 cities, representing just under 3.4 million people, and 1 region, representing a population of more than 60 million, that have made quantifiable commitments to reduce GHG emissions.[24] It also includes over 340 companies, controlling over $576 billion USD in revenue[25] that have made quantifiable climate commitments – including 17 of the world's largest companies[26] – most frequently in the financial services, specialised professional services, and electrical and electronic equipment sectors.

Together, these cities, regions, and companies represent 350 $MtCO_2e$/year in 2015, accounting for overlap between actors. If fully implemented and if such efforts do not decrease efforts elsewhere, individual city, region, and company commitments would reduce emissions in 2030 by 220 to 250 $MtCO_2e$/year, 5.5%% below the projected emissions under current national policies (Figure 23, top panel). Companies' commitments make up the largest share of these potential emissions mitigations, reducing by more than 200 $MtCO_2e$/year in 2030 (Figure 23, bottom-left panel). In the current national policies scenario, total GHG emission levels increase to a level between 4,050 and 4,450 $MtCO_2e$/year by 2030 (Kuramochi et al., 2018). The emissions in a "current national policies plus individual actors' commitments" scenario are about 3,800 to 4,200 $MtCO_2e$/year, which are 1,100 to 1,900 $MtCO_2e$/year lower than India's NDC target emission levels. These results suggest that India could further raise its NDC ambition level by fully taking the commitments of regions, cities and companies into account.

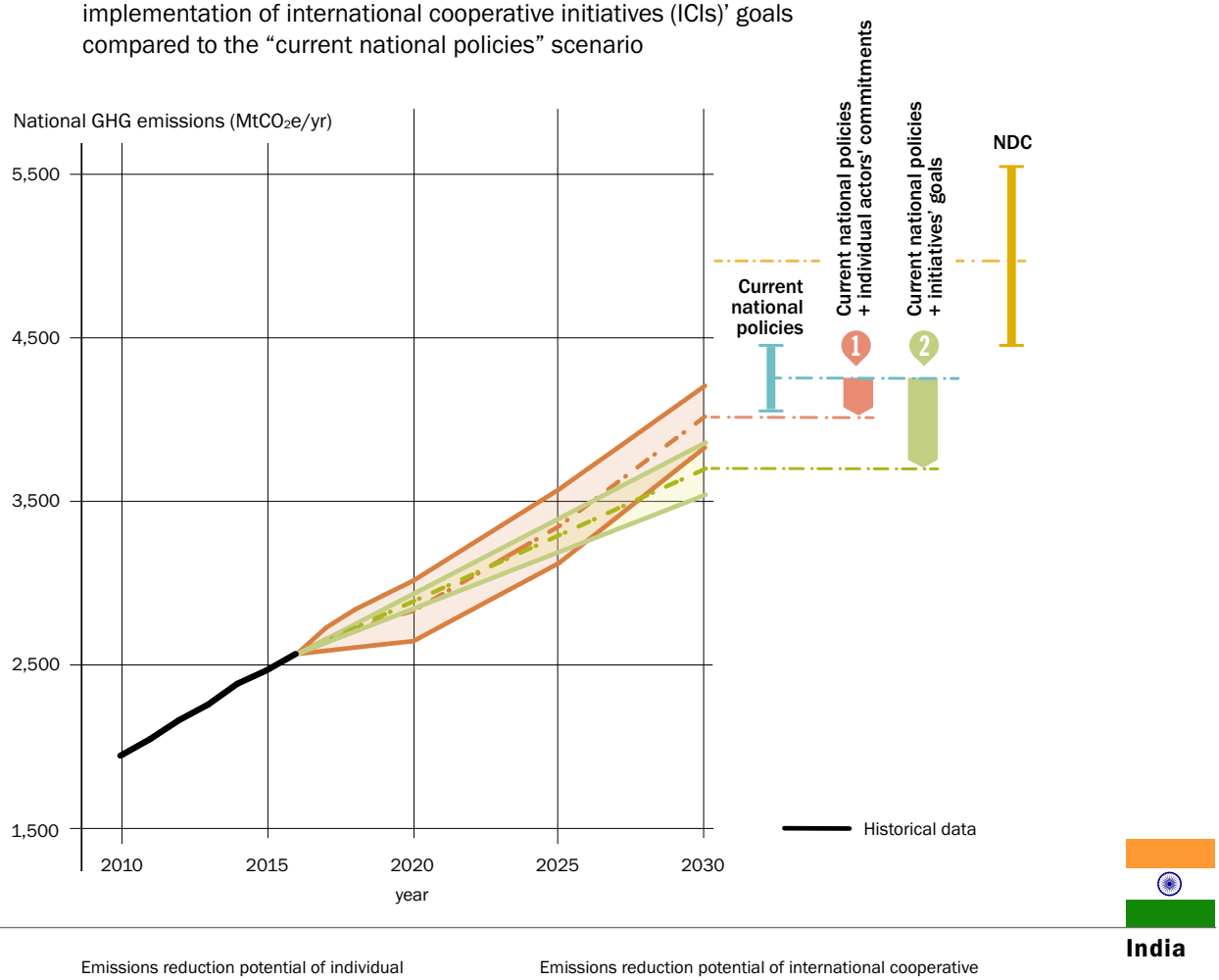
International cooperative initiatives (ICIs) – networks of cities, regions, companies, investors, civil society, and, in some cases, countries, pursuing common climate action – could have a significantly larger impact. If they realise their goals, they could reduce emissions in 2030 by 510 and 590 $MtCO_2e$/year or 13% below the projected emissions under current national policies (Figure 23, bottom-right panel). These reductions mostly come from initiatives on cities and regions, non-CO_2 GHGs and appliances energy efficiency. This would lead to total GHG emissions levels in the 'current national policies plus initiatives goals' scenario of 3,500 to 3,900 $MtCO_2e$/year, about 1,400 to 2,200 $MtCO_2e$/year lower than the emissions levels of India's NDC target.

24 Quantifiable commitments to reduce GHG emissions typically include a specific emissions reduction goal, target year, baseline year, and baseline year emissions. See Technical Annex I for more details.

25 Companies' combined revenue reflects companies making quantifiable commitments to reduce GHG emissions, whose headquarters are in India, and whose revenue data is publicly available. See Technical Annex I for more details.

26 The world's largest companies are defined in terms of their inclusion in the 2019 Forbes 2000 and Global Fortune 500 lists.

Figure 23. Potential greenhouse gas (GHG) emissions reductions in India resulting from the full implementation of individual subnational and non-state actor commitments and the full implementation of international cooperative initiatives (ICIs)' goals compared to the "current national policies" scenario



The „current national policies" scenario (Kuramochi et al., 2018) includes land use, land-use change and forestry. Top panel: historical GHG emissions up to 2016 (with authors' own estimates for years between the last inventory data year and 2016) and scenario emissions pathways up to 2030, alongside the NDC target emissions range (indicative target level for 2030). Emissions reduction target trajectories from individual actors' commitments and initiatives' goals are assumed to be achieved linearly from the latest historical data year and are presented here for illustrative purposes. Bottom-left panel: the breakdown of potential GHG emissions reductions from individual subnational and non-state actor commitments in 2030 by actor group. Bottom-right panel: the breakdown of potential GHG emissions reductions from ICIs in 2030 by sector." The results for "Current national policies plus initiatives' goals" scenario do not include the potential emissions reductions from Science Based Targets, RE100 and Collaborative Climate Action Across the Air Transport World (CAATW); they are only quantified at a global level.

5.6 Indonesia

5.6.1 COUNTRY CONTEXT

Indonesia is the fourth largest global emitter of greenhouse gas (GHG) emissions, primarily due to significant emissions from its forestry sector – which reached almost 1.5 $GtCO_2e$/year in 2015. Indonesia has developed a number of policies to curtail its LULUCF emissions, including the Forest Moratorium (Kuramochi et al., 2018), which suspends the issuing of new licenses to use forest and peatland (Reuters, 2017). They also put in place a three year moratorium on new licenses for palm oil plantations (Mongabay, 2018). Despite these efforts, the country still maintains the highest deforestation-related emissions among G20 countries (Climate Transparency, 2018). Indonesia's emissions in other sectors are also worrying; the increase is mostly driven by the rising energy-related emissions. Indonesia has made progress in phasing out fossil fuel subsidies, although they remain high, but the country's investment attractiveness for renewable energy and overall renewable energy capacity are still low (Climate Transparency, 2018).

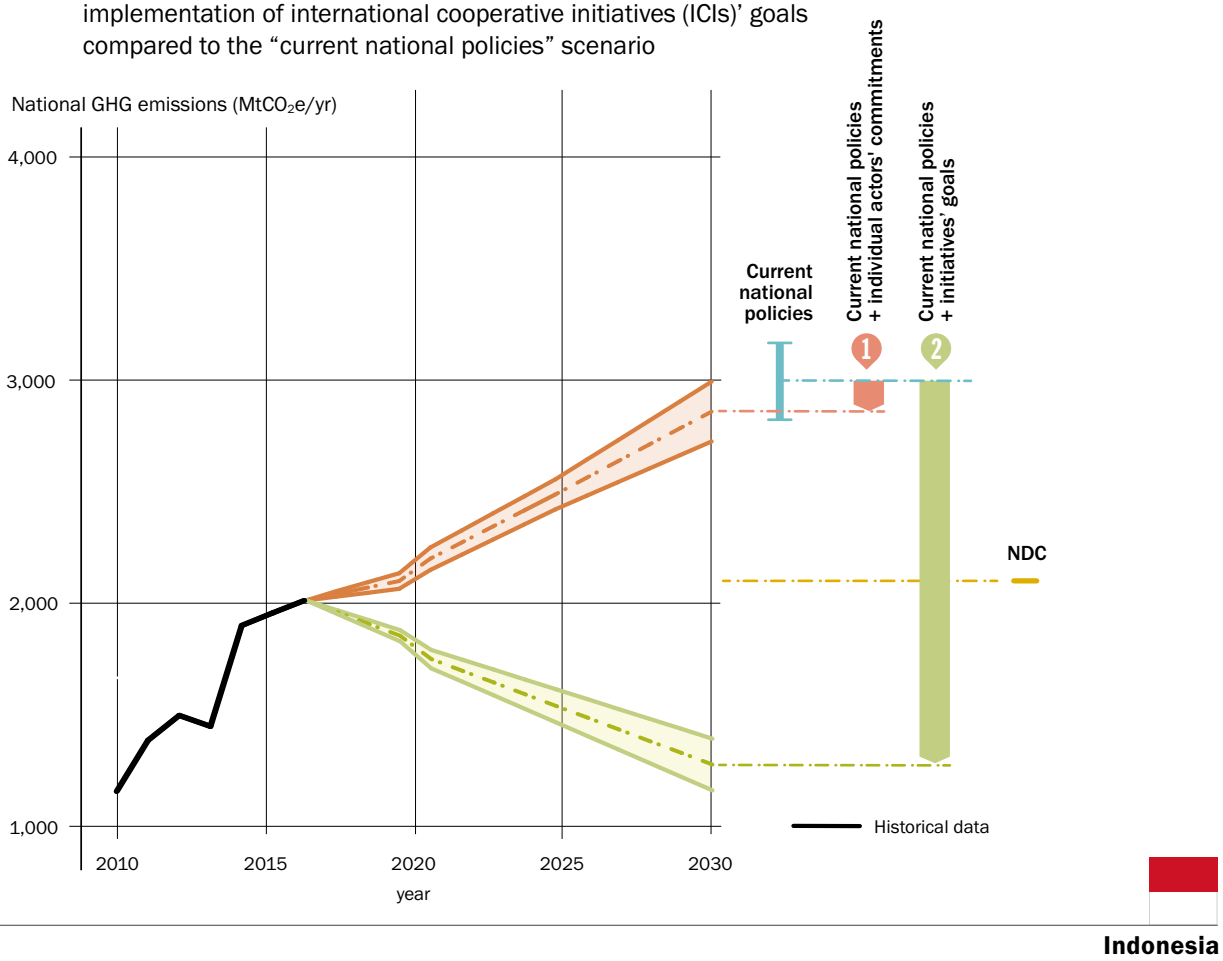
In its unconditional nationally determined contribution (NDC), Indonesia aims for a 29% GHG emissions reduction by 2030, relative to a baseline scenario. The latest assessment by NewClimate Institute, PBL and IIASA indicate (Figure 24, top panel) that the country would likely fall short of meeting its unconditional NDC target under current policies (Kuramochi et al., 2018).

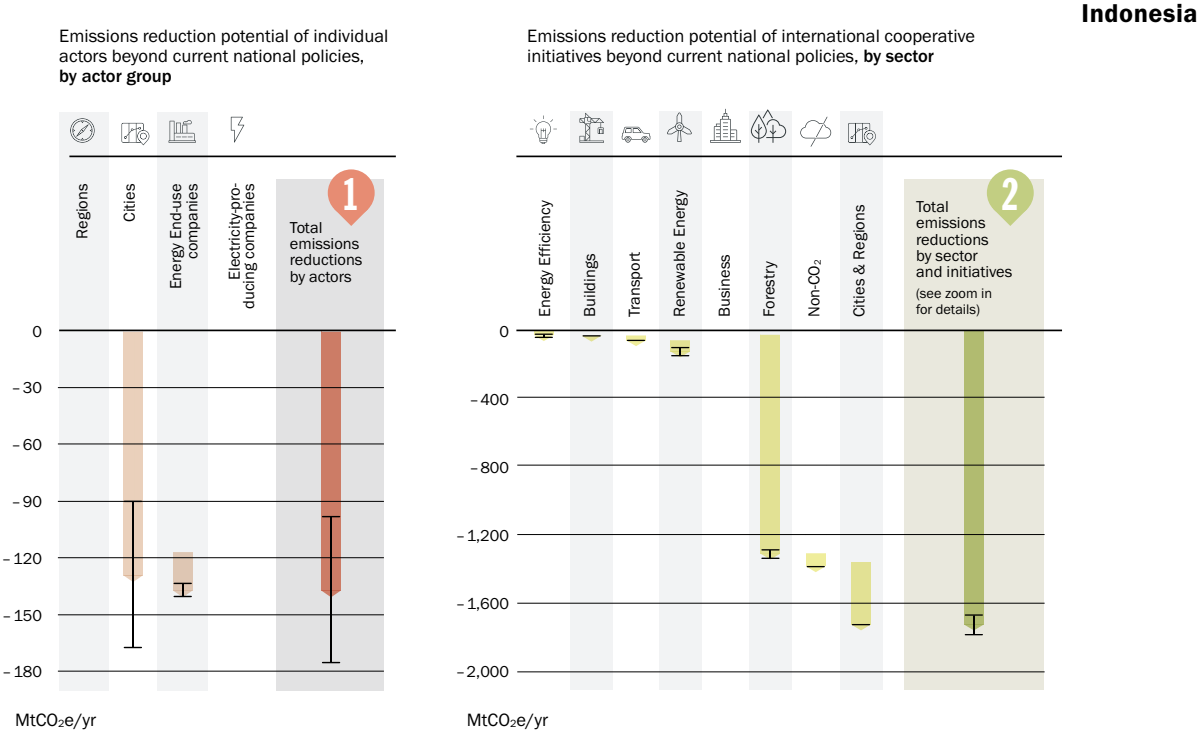
5.6.2 INTERACTIONS BETWEEN NATIONAL GOVERNMENT AND SUBNATIONAL AND NON-STATE CLIMATE ACTORS

The interactions between national government and subnational governments have been historically more state led. Indonesian climate policy is based on National Action Plan for Greenhouse Gas Reduction (RAN-GRK), which is the central government policy guideline to implementing activities aiming to reduce GHG emissions. Provincial governments must create their own Local Action Plan for Greenhouse Gas Reduction (RAD-GRK) in line with the national targets presented in the RAN-GRK. Since 2010, more than 12,000 mitigation actions have taken place in the provinces under RAD-GRK, leading to almost 3 $GtCO_2e$ in emissions reductions (PPN/Bappenas, 2019).

In recent years, city governments have become particularly active on climate action – an important development in Indonesia, due to the high number of cities with over 1 million inhabitants. Jakarta, the nation's capital and largest city (with over 10 million inhabitants) aims to reduce its GHG emissions by 30% from 2005 levels by 2030; Jakarta is also a member of the C40 Cities for Climate Leadership and ICLEI – Local Governments for Sustainability networks. Other Indonesian cities also have concrete emission reduction plans, supported by networks like ICLEI (13 Indonesian cities). Eighteen cities have committed to the Global Covenant of Mayors for Climate & Energy, which aims to support climate change action. Also, two model cities and six satellite cities participate in an Urban-LEDS project to create Low Emission Development Strategies, develop GHG inventories, make climate commitments, and implement a variety of climate solutions.

Figure 24. Potential greenhouse gas (GHG) emissions reductions in Indonesia resulting from the full implementation of individual subnational and non-state actor commitments and the full implementation of international cooperative initiatives (ICIs)' goals compared to the "current national policies" scenario





The „current national policies" scenario (Kuramochi et al., 2018) includes land use, land-use change and forestry. Top panel: historical GHG emissions up to 2016 (with authors' own estimates for years between the last inventory data year and 2016) and scenario emissions pathways up to 2030, alongside the NDC target emissions range (indicative target level for 2030). Emissions reduction target trajectories from individual actors' commitments and initiatives' goals are assumed to be achieved linearly from the latest historical data year and are presented here for illustrative purposes. Bottom-left panel: the breakdown of potential GHG emissions reductions from individual subnational and non-state actor commitments in 2030 by actor group. Bottom-right panel: the breakdown of potential GHG emissions reductions from ICIs in 2030 by sector." The results for "Current national policies plus initiatives' goals" scenario do not include the potential emissions reductions from Science Based Targets, RE100 and Collaborative Climate Action Across the Air Transport World (CAATW); they are only quantified at a global level.

Expanding subnational and non-state engagement could help catalyse deeper emissions reductions. Indonesia's 34 provinces will be largely responsible for delivering its proposed emissions reductions (Utami, Juliene and Ge, 2016). Many participate in forums such as the Governors' Climate and Forests Task Force, which discusses ways to promote low emission rural development and reduce emissions from deforestation and land-use (REDD+). Since Indonesia's deforestation stems largely from its role as the world's largest palm oil producer (BusinessWire, 2017), companies operating in this sector play a powerful role in addressing this source of emissions. In 2018, Wilmar International, one of the biggest palm oil traders in the world, released a statement pledging to establish a deforestation-free palm oil supply chain from 2020 onward (Wilmar International, 2018). Additionally, as Indonesia's population continues to grow and gather in urban areas, strategies that address climate change and promote sustainable urban development could help the country both mitigate and adapt to climate change on the national level.

5.6.3 COMPARING SUBNATIONAL AND NON-STATE TRAJECTORY WITH NATIONAL TRAJECTORY

The assessment includes 7 cities, representing nearly 17 million people, that have made quantifiable commitments to reduce GHG emissions.[27] It also includes over 160 companies, controlling over $9.7 billion USD in revenue[28] that have made quantifiable climate commitments, most frequently in the financial services and chemicals manufacturing sectors.

Together, these cities and companies represent 250 $MtCO_2e$/year in 2015, accounting for overlap between actors. If fully implemented and if such efforts do not decrease efforts elsewhere, they would reduce emissions in 2030 by an additional 100 to 180 $MtCO_2e$/year or 3.5% to 5.5% below the projected emissions under current national policies (Figure 24, bottom-left panel).

International cooperative initiatives (ICIs) – networks of cities, regions, companies, investors, civil society, and, in some cases, countries, pursuing common climate action – could take Indonesia even further. If they realise their goals, they could lower emissions in 2030 by 1,700 to 1,800 $MtCO_2e$/year below the projected emissions under current national policies (Figure 24, bottom-right panel). The largest potential reductions are observed in the forestry sector, since Indonesia is part of the Bonn Challenge, New York Declaration of Forests (NYDF) and the Governors' Climate and Forest Task Force (GCFTF). The potential impact of initiatives focused on cities and regions is also large, on the order of 370 $MtCO_2e$/year by 2030. A full implementation of global cooperative initiatives in Indonesia could decrease Indonesia's emissions by 56% to 59% below the current national policy scenario projections by 2030.

27 Quantifiable commitments to reduce GHG emissions typically include a specific emissions reduction goal, target year, baseline year, and baseline year emissions. See Technical Annex I for more details.

28 Companies' combined revenue reflects companies making quantifiable commitments to reduce GHG emissions, whose headquarters are in Indonesia, and whose revenue data is publicly available. See Technical Annex I for more details.

29 The world's largest companies are defined in terms of their inclusion in the 2019 Forbes 2000 and Global Fortune 500 lists.

5.7 Japan

5.7.1 COUNTRY CONTEXT

Japan is the fifth largest greenhouse gas (GHG) emitting country in the world, emitting around 1,200 $MtCO_2e$/year annually including land use, land-use change and forestry (LULUCF). Since the Fukushima nuclear accident of 2011, Japan has been going through a major power sector transformation, going from a balanced mix of coal, gas and nuclear towards a decarbonisation strategy that does not rely on nuclear power. Japan's emissions have fallen since 2013, mainly due to reduced electricity demand and the deployment of renewable electricity.

Though Japan has relied on nuclear energy as an alternative to fossil fuels, renewable energy has grown over recent years, and might help accelerate the country's decarbonisation. Policies like the Renewable Energy Act of 2011, which established a feed-in tariff and funding for distribution networks, have helped grow the share of renewable energy in the total electricity generation from 10% in 2010 to 16% in 2017 (IEA, 2018).

Under its nationally determined contribution (NDC), Japan aims to reduce its GHG emissions 26% below 2013 levels by 2030. As shown in Figure 25 (top panel), the latest assessment by NewClimate Institute, PBL and IIASA indicates that Japan would fall short of achieving its NDC by a small margin under current policies (Kuramochi et al., 2018).

5.7.2 INTERACTIONS BETWEEN NATIONAL GOVERNMENT AND SUBNATIONAL AND NON-STATE CLIMATE ACTORS

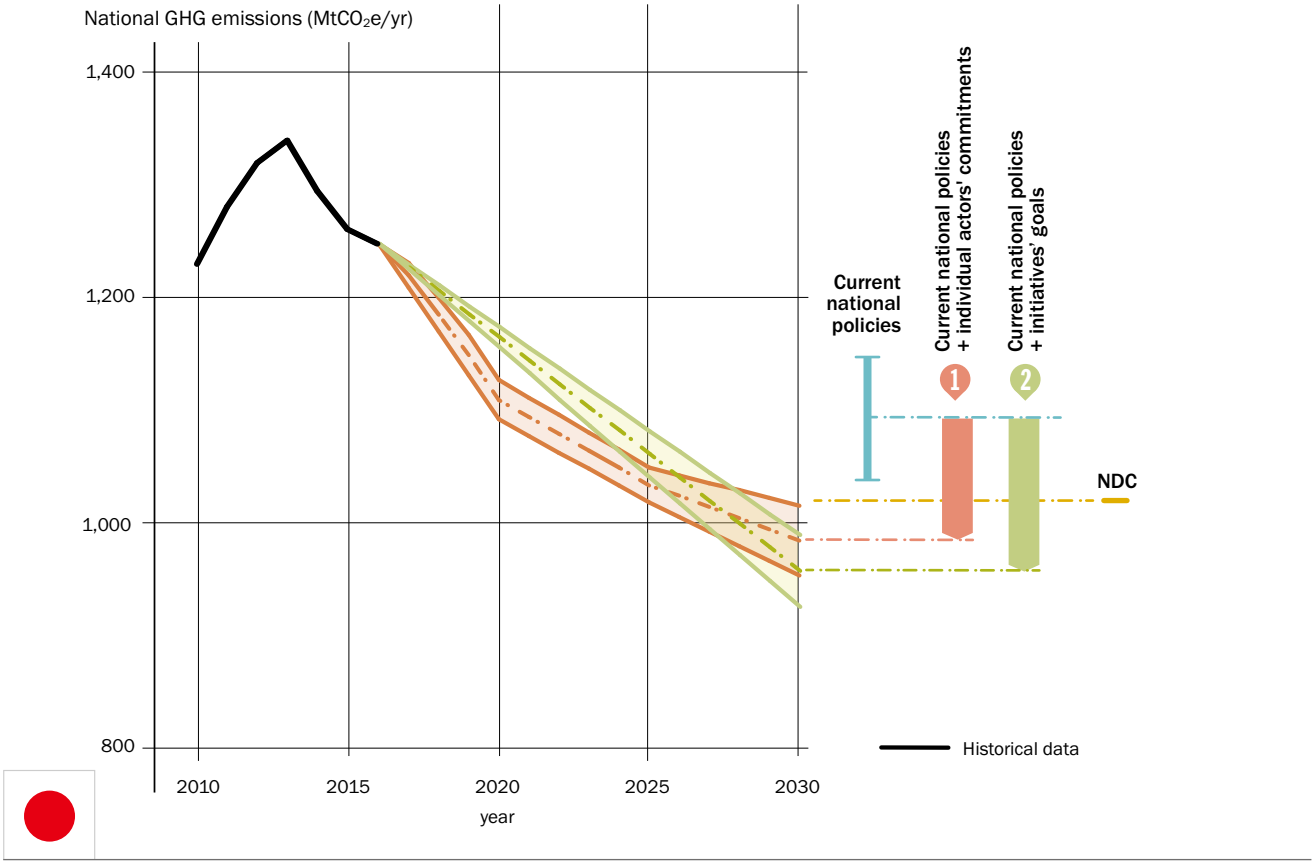
The interactions between the national government and subnational governments has historically been more led by the national government: the Global Warming Countermeasures Promotion Act, Japan's framework law on climate action, mandates prefectural governments as well as city and town governments to develop climate action plans consistent with national targets. As of October 2018, 18 of the 47 prefectures and 11 of the 20 ordinance-designated cities had set GHG emissions reduction targets for 2030 (Nomura Research Institute, 2019, supplemented by authors).

Climate action in the business sector has also historically been closely aligned with national climate action. The voluntary action plans of Keidanren, the most influential business association in Japan, have been monitored by the national government since the first commitment period of the Kyoto Protocol.

In recent years, city governments have become particularly active on climate action. Tokyo, the nation's capital and largest city, aims to reduce its GHG emissions by 30% from 2000 levels by 2030 (Tokyo Metropolitan Government, 2016) and has been implementing an emissions trading scheme since 2010 (ICAP, 2018). Furthermore Governor Yuriko Koike announced in May 2019 that Tokyo has committed to zero GHG emissions by 2050 (Urban 20 Group of Cities, 2019). Yokohama, the second largest city in the country and a member of both the ICLEI – Local Governments for Sustainability and C40 Cities Climate Leadership Group networks, also aims to realise carbon neutrality as early as possible during the second half of the 21st century, with 2050 in sight (Kobayashi, 2018). A large number of measures have already been implemented to materialise the necessary transitions (ibid.)

In addition, the Japan Climate Initiative (JCI) was launched in July 2018 as the country's first cross-sectoral coalition of subnational governments and businesses in support of ambitious domestic climate action (Japan Climate Initiative, 2019b). A member coalition of Alliances for Climate Action (ACA), JCI aims to expand and accelerate decarbonisation efforts in Japan through: (i) "creation of a momentum to move the whole nation toward the realization of a decarbonised society;" (ii) "support for implementation of members' activities;" (iii) "dialogue with the government to strengthen Japan's climate action;" and iv) "communication of Japanese non-state actors' efforts to the world and international collaboration" (Japan Climate Initiative, 2019b). As of July 2019 there are more than 370 member organisations from companies, local governments, research institutions and NGOs. The member companies account for 26% of electricity consumption in the industry, commercial and transport sectors and 8% of total national GHG emissions, while participating local governments account for 32% of the national population and 22% of national GHG emissions (Japan Climate Initiative, 2019a).

Figure 25. Potential greenhouse gas (GHG) emissions reductions in Japan resulting from the full implementation of individual subnational and non-state actor commitments and the full implementation of international cooperative initiatives (ICIs)' goals compared to the "current national policies" scenario



The „current national policies" scenario (Kuramochi et al., 2018) includes land use, land-use change and forestry. Top panel: historical GHG emissions up to 2016 (with authors' own estimates for years between the last inventory data year and 2016) and scenario emissions pathways up to 2030, alongside the NDC target emissions range (indicative target level for 2030). Emissions reduction target trajectories from individual actors' commitments and initiatives' goals are assumed to be achieved linearly from the latest historical data year and are presented here for illustrative purposes. Bottom-left panel: the breakdown of potential GHG emissions reductions from individual subnational and non-state actor commitments in 2030 by actor group. Bottom-right panel: the breakdown of potential GHG emissions reductions from ICIs in 2030 by sector." The results for "Current national policies plus initiatives' goals" scenario do not include the potential emissions reductions from Science Based Targets, RE100 and Collaborative Climate Action Across the Air Transport World (CAATW); they are only quantified at a global level.

5.7.3 COMPARING SUBNATIONAL AND NON-STATE TRAJECTORY WITH NATIONAL TRAJECTORY

As of August 2019, the commitments from individual non-state and subnational actors in Japan are not as prominent as in the US and the EU, both in terms of their target levels and emissions coverage. The assessment includes 55 cities, representing over 45 million people, and 14 regions, representing a population of over 45 million people, that have made quantifiable commitments to reduce GHG emissions. Many of the Japan Climate Initiative members are covered in this assessment. It also includes over 400 companies, controlling approximately $4 trillion USD in revenue – and including 61 of the world's largest companies – that have made quantitative climate commitments, most frequently in the electrical and electronic equipment, financial services, and biotech and pharmaceuticals sectors.

Together, these cities, regions and companies represent 630 $MtCO_2e$/year in 2015, accounting for overlap between actors. If fully implemented and if such efforts do not decrease efforts elsewhere, they would reduce emissions in 2030 by an additional 80 to 130 $MtCO_2e$/year, beyond the projected emissions under current national policies. The resulting emission levels for 2030 are 8.2% to 12% lower than the levels projected under the current national policies scenario for the same year, and lead to emission levels up to 70 $MtCO_2e$/year lower than the NDC target emission levels (Figure 25, top panel). These findings are consistent with another study conducted in 2016 (E-konzal and Kiko Network, 2016) and suggest that Japan could further raise its NDC ambition level by fully taking the commitments of regions, cities and companies into account.

International cooperative initiatives (ICIs) – networks of cities, regions, companies, investors, civil society, and, in some cases, countries, pursuing common climate action – are projected to reduce emissions by 110 to 160 $MtCO_2e$/year, or 11% to 14% , below the current national policies scenario projections in 2030 (Figure 25, top and bottom-right panels).

30 Quantifiable commitments to reduce GHG emissions typically include a specific emissions reduction goal, target year, baseline year, and baseline year emissions. See Technical Annex I for more details.

31 Companies' combined revenue reflects companies making quantifiable commitments to reduce GHG emissions, whose headquarters are in Japan, and whose revenue data is publicly available. See Technical Annex I for more details.

32 The world's largest companies are defined in terms of their inclusion in the 2019 Forbes 2000 and Global Fortune 500 lists.

5.8 Mexico

5.8.1 COUNTRY CONTEXT

Mexico's emissions have shifted from being driven primarily by agriculture and LULUCF to being tied to energy-related emissions (Climate Action Tracker, 2018a). The country has increased its renewable energy capacity significantly (IRENA, 2019), but further growth could accelerate its progress towards decarbonisation. Mexico has set clean energy targets of 30% by 2021 and 35% by 2024, both in terms of share in total electricity generation (Kuramochi et al., 2018), and could have the potential to generate up to 46% of its electricity, or 280 terawatt-hours (TWh), from renewable sources each year. Policies that facilitate expanded infrastructure, grid integration, and the uptake of renewable energy to heat and fuel buildings, industry, and transport could help accomplish this key shift in Mexico's highest emitting sector (IRENA, 2015).

In its nationally determined contribution (NDC), Mexico sets an unconditional target of reducing greenhouse gas (GHG) emissions by 22% below business-as-usual (BAU) in 2030 and a conditional target of 36% below BAU in 2030. The latest assessment by NewClimate Institute, PBL and IIASA show that the uncertainty on the emissions projections under current policies is large and therefore not possible to judge whether the country is on track to meet its unconditional NDC target (Kuramochi et al., 2018).

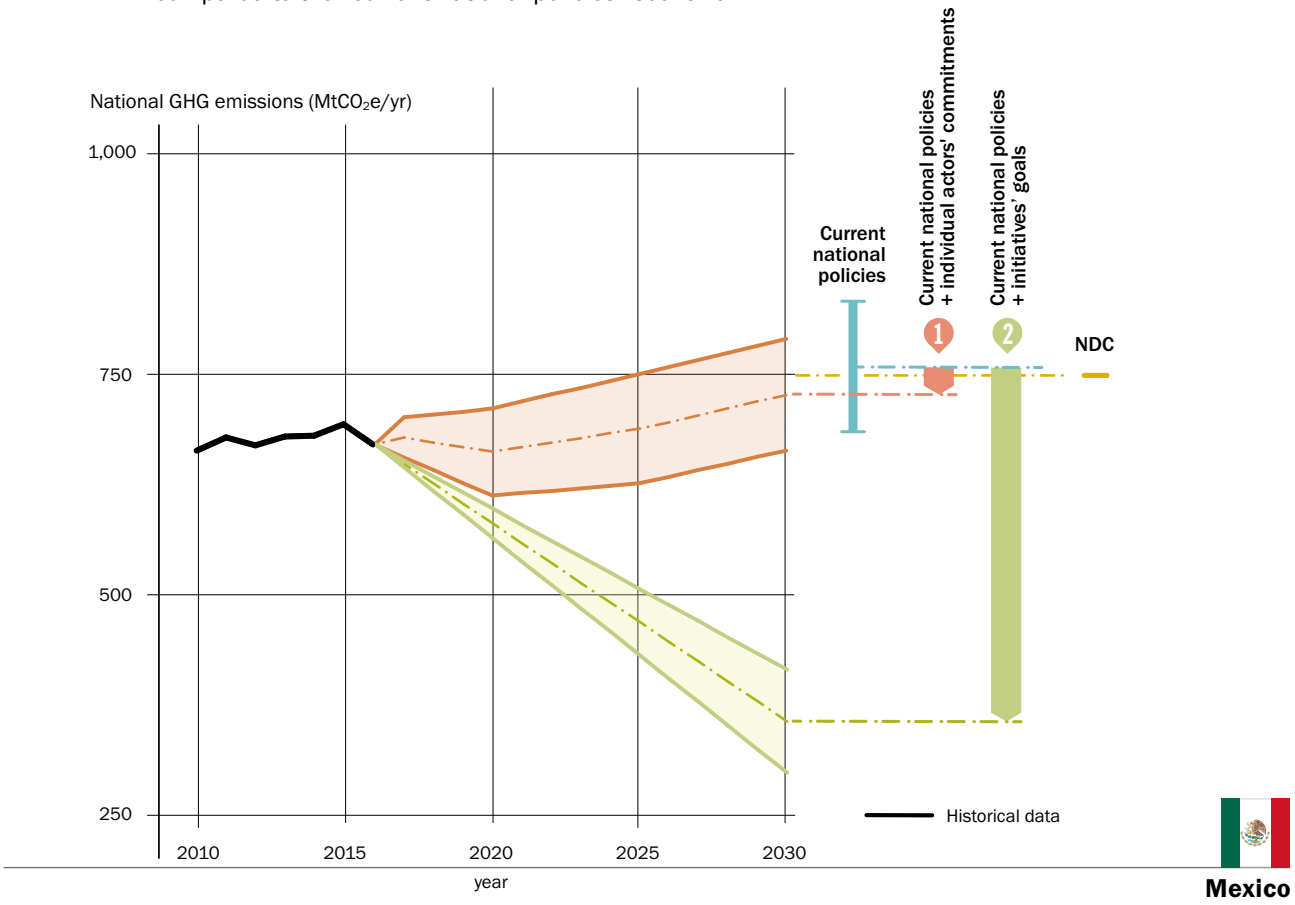
5.8.2 INTERACTIONS BETWEEN NATIONAL GOVERNMENT AND SUBNATIONAL AND NON-STATE CLIMATE ACTORS

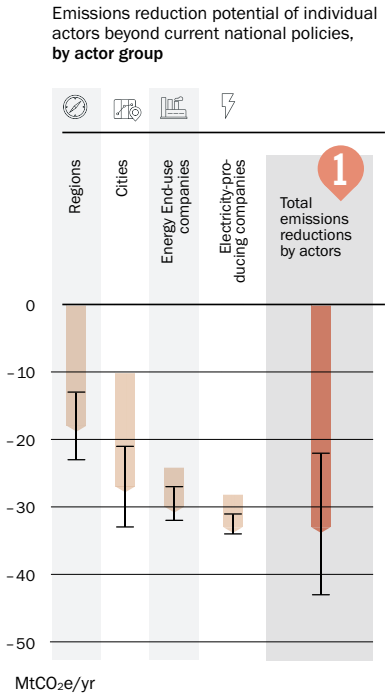
Interactions between the national government and subnational government and non-state climate actors in Mexico have been historically a mixture of subnational-led interactions, state-led interactions, and more recently also non-state led interactions.

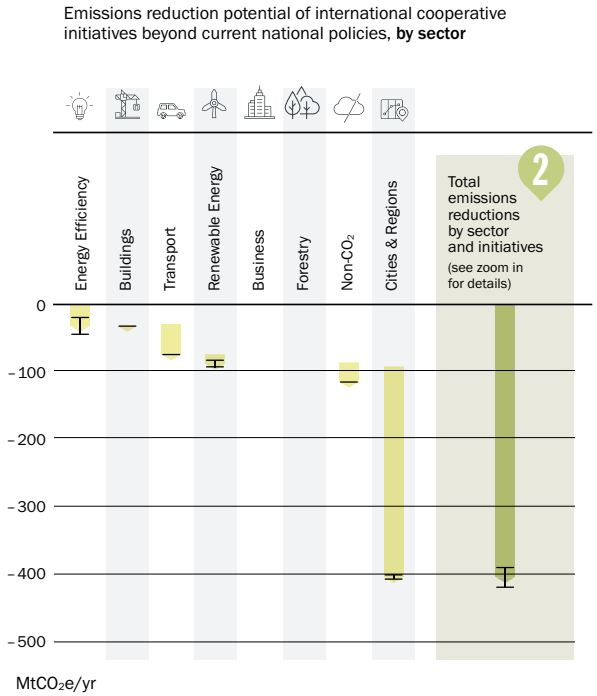
Examples of subnational-led interactions include the government of Mexico City, which in 2008, published its first plan for climate change mitigation through the implementation of actions in the energy, transport, water, and waste sectors: "Mexico City's climate action plan (PACCM) 2008-2012." It was estimated that 86% of the mitigation actions outlined in the plan were implemented, leading to the mitigation of 6 $MtCO_2e$ (Centro Mario Molina, 2012). This program was followed by the PACCM 2014-2020, which has an estimated emissions reduction potential of 10 $MtCO_2$ (Gobierno de la Ciudad de México and Centro Mario Molina, 2014). Also, as part of the C40 Initiative, Mexico City has since 2011 participated in 14 case studies—including C40 good practice guides and Cities100— to implement climate actions in the transport, energy, buildings, urban planning, food, waste, water, and financial sectors (C40 Cities, 2019a). Case studies examples include Mexico City's voluntary Sustainable Buildings Certification Program—which reduced 66 $ktCO_2e$ between 2009 and 2015; Mexico City's public shared bicycle system ECOBICI—with an estimated emissions reduction of 770 tCO_2e between 2010 and 2015; installation of energy efficiency measures and renewable energy in hospitals and other public buildings—which are estimated to reduce around 750 tCO_2e; establishment of a barter market for recyclables, and development of public green spaces.

An example of state-led interaction is the Climate Change Council (C3), established under Mexico's General Law on Climate Change from 2012. The C3 is a permanent consultation organ of the national Inter-secretarial Commission on Climate Change (CICC, in Spanish), formed by members of the private, academic and social spheres (Cámara de Diputados del H. Congreso de la Unión. Diario Oficial de la Federación, 2012). Its functions include: 1) providing advice and recommendations for the development of studies, policies, actions and targets to face the effects of climate change, and 2) promoting informed and responsible social participation through public consultations. The C3 has operated since 2013, has provided inputs to the National Program on Climate Change 2013-2018 (incl. inputs from the private sector), and was represented in the Mexican delegation for COP20 (Programa de las Naciones Unidas para el Desarrollo, 2018). Nevertheless, participation in the council is by personal invitation only, limiting its ability to represent and include all elements of Mexican society (ibid).

Figure 26. Potential greenhouse gas (GHG) emissions reductions in Mexico resulting from the full implementation of individual subnational and non-state actor commitments and the full implementation of international cooperative initiatives (ICIs)' goals compared to the "current national policies" scenario







The „current national policies" scenario (Kuramochi et al., 2018) includes land use, land-use change and forestry. Top panel: historical GHG emissions up to 2016 (with authors' own estimates for years between the last inventory data year and 2016) and scenario emissions pathways up to 2030, alongside the NDC target emissions range (indicative target level for 2030). Emissions reduction target trajectories from individual actors' commitments and initiatives' goals are assumed to be achieved linearly from the latest historical data year and are presented here for illustrative purposes. Bottom-left panel: the breakdown of potential GHG emissions reductions from individual subnational and non-state actor commitments in 2030 by actor group. Bottom-right panel: the breakdown of potential GHG emissions reductions from ICIs in 2030 by sector." The results for "Current national policies plus initiatives' goals" scenario do not include the potential emissions reductions from Science Based Targets, RE100 and Collaborative Climate Action Across the Air Transport World (CAATW); they are only quantified at a global level.

An example of non-state-led interaction can be found in the Alianza para la Acción Climática de Guadalajara, which includes over 35 actors that work together towards the achievement of Mexico's NDC pledge. A member coalition of Alliances for Climate Action (ACA), this alliance has been formed through a coalition of sub-national and non-state actors including the local and state governments, Mexican companies from the energy and waste sectors, the University of Guadalajara, and civil society organizations (Alliances for Climate Action, 2018). This bottom-led multi-stakeholder coalition has established three priority thematic areas: 1. energy (incl. renewable energy and energy efficiency), 2. waste and 3. urban resilience (Alianza para la Accion Climatica de Guadalajara, 2018).

5.8.3 COMPARING SUBNATIONAL AND NON-STATE TRAJECTORY WITH NATIONAL TRAJECTORY

While subnational and non-state action in Mexico is substantial, it has room to grow and strengthen further. The assessment includes ten cities, representing over 15 million people, and two regions, representing a population of more than 10 million people, that have made quantifiable commitments to reduce GHG emissions. It also includes over 280 companies, controlling over $37 billion USD in revenue – and including one of the world's largest companies – making quantifiable climate commitments, most frequently in the transportation equipment and electrical and electronic equipment sectors.

Though some of the country's largest cities – including Mexico City – have made ambitious commitments, they constitute under one-fourth of the total urban population in the country. While 17 of the world's largest companies are based in Mexico, just one of these has made a quantifiable commitment captured within the CDP database. This may be due to a lack of national imperative for businesses to make such commitments; unlike most G20 countries, Mexico has no energy efficiency standards in the industry sector. However, some national programs for business do exist. Mexico instituted a mandatory Emissions Trading Scheme that starts with a three-year pilot phase in 2019, after its regulations are finalised and published (ICAP, 2019). This national carbon market is expected to include between 400 to 700 companies.

Together, these cities, provinces and companies represent 100 $MtCO_2e$/year in 2015, accounting for overlap between actors. If fully implemented and if such efforts do not decrease efforts elsewhere, they would reduce emissions in 2030 by an additional 20 to 40 $MtCO_2e$/year beyond the projected emissions under current national policies (Figure 26, top panel).

International cooperative initiatives (ICIs) – networks of cities, regions, companies, investors, civil society, and, in some cases, countries, pursuing common climate action – could have a significantly larger impact. If they realise their goals, they could lower emissions in 2030 by an additional 390 and 420 $MtCO_2e$/year compared to, or 50% to 57% below, the emissions projections current national policies. The largest reductions, of about 540 $MtCO_2e$/year by 2030, are expected from initiatives focused on cities and regions (specifically, C40 Cities for Climate Leadership Group, Global Covenant of Mayors for Climate & Energy, and the Under2 Coalition) where the coverage is already very high in comparison with other countries. Substantial reductions could also be delivered through the Climate and Clean Air Coalition on non-CO_2 GHGs (around 70 $MtCO_2e$/year by 2030) (Figure 26, bottom-right panel).

33 Quantifiable commitments to reduce GHG emissions typically include a specific emissions reduction goal, target year, baseline year, and baseline year emissions. See Technical Annex I for more details.

34 Companies' combined revenue reflects companies making quantifiable commitments to reduce GHG emissions, whose headquarters are in Mexico, and whose revenue data is publicly available. See Technical Annex I for more details.

35 The world's largest companies are defined in terms of their inclusion in the 2019 Forbes 2000 and Global Fortune 500 lists.

5.9 South Africa

5.9.1 COUNTRY CONTEXT

South Africa's progress in reducing emissions will be closely tied to its economic and energy infrastructure. Mining and heavy industry form a significant part of the country's economy, and in 2016, 91% of its electricity was generated from coal (IEA, 2018). South Africa released the long-awaited draft of the Department of Energy's Integrated Resource Plan (IRP 2018) in August 2018, setting out a new direction in energy sector planning. The plan includes a shift away from coal, increased adoption of renewables and gas, and an end to the expansion of nuclear power (Department of Energy, 2018). The revised plan aims to decommission 35 GW of 42 GW currently operating coal generation capacity by 2050 and increase renewables-based power generation capacity from wind and solar by an additional 8.1 GW for wind and 5.7 GW for solar by 2030. Uncertainty remains on the plan's final adoption by the South African Government considering that the previous two proposed IRP updates in 2013 and 2016 were never adopted. The South African Parliament finally approved a carbon tax in February 2019 after two years of consultations, although its immediate impact is likely to be limited, given tax exemptions for up to 95% of emissions during the first phase until 2022 (KPMG, 2019).

South Africa's nationally determined contribution (NDC) commits to achieving a "peak, plateau and decline" (PPD) of greenhouse gas (GHG) emissions at a level between 398 and 614 $MtCO_2e$/year between 2025 and 2030. The latest assessments by NewClimate Institute, PBL and IIASA indicate that South Africa would fall short of its NDC target with its current policies (Kuramochi et al., 2018; den Elzen et al., 2019). South Africa experienced several rolling blackouts during the first quarter of 2019 caused by the mismanagement of the state-owned utility Eskom (Onishi, 2019), adding to the complications on transitioning the country's power sector to a low-carbon one.

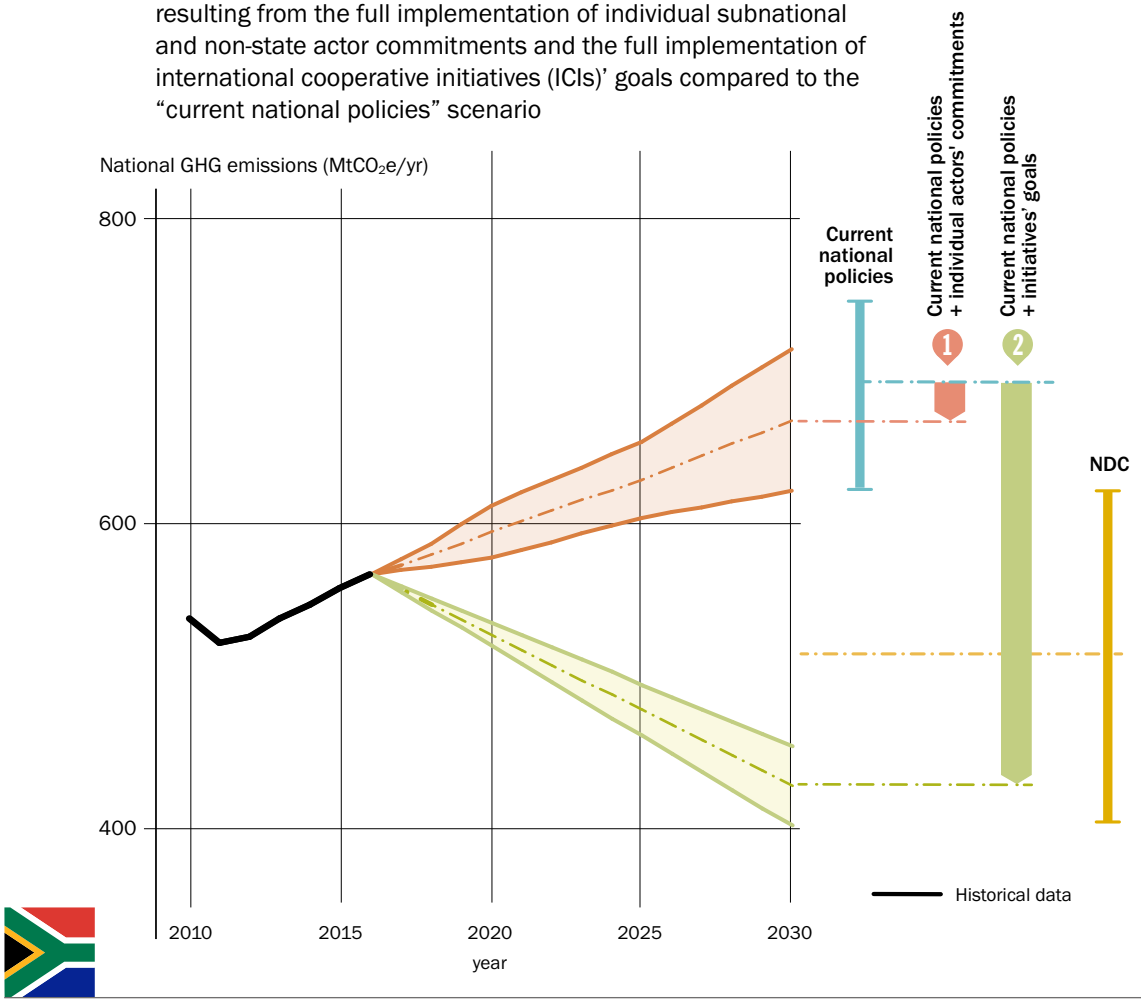
5.9.2 INTERACTIONS BETWEEN NATIONAL GOVERNMENT AND SUBNATIONAL AND NON-STATE CLIMATE ACTORS

Interactions between the national government and subnational and non-state actors in South Africa have historically been vertically integrated; the national government incorporates subnational and non-state actors in its design of national policies (Hale et al., 2018). This vertical integration may be further institutionalised once the South African Government passes a Climate Change Bill mandating the integration of provinces, municipalities, and economic sectors into the national climate policy.

South Africa released the draft Climate Change Bill in June 2018. It was open for public consultation until the beginning of August 2018, but has not been officially adopted as of July 2019 (Department of Environmental Affairs, 2018). The Climate Change Bill mandates the establishment of Provincial Committees on Climate Change for each province to coordinate climate change response actions, to recommend relevant climate change matters to the national Ministerial Committee on Climate Change, and to provide regular progress reports. All provinces and municipalities must also undertake climate change needs and response assessments and develop climate change response implementation plans covering all priority sectors and defining mechanisms for implementation. South Africa's 2015 NDC had also emphasised the need to integrate sub-national planning into national climate action (Government of South Africa, 2016), but little progress has been made since (Hale et al., 2018).

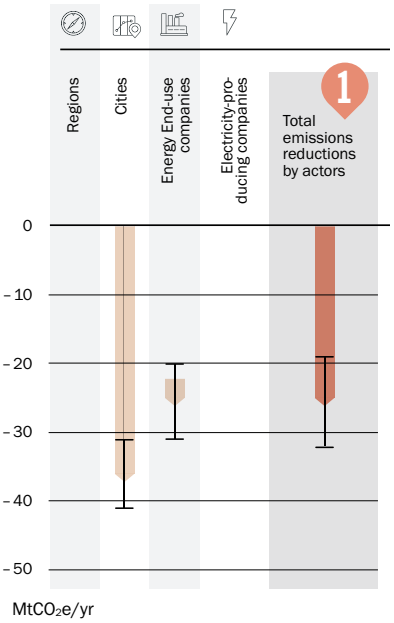
South Africa's Green Fund, established in 2011, constitutes a mechanism for subnational actors' integration into national climate action. The Green Fund provides an array of financial instruments for a variety of non-state actors such as project developers, municipalities, provinces, NGOs, and academic institutions to invest in low carbon and innovative development projects. The funding streams align with priorities identified in various national development and sustainability plans (Bhandari, 2014).

Figure 27. Potential greenhouse gas (GHG) emissions reductions in South Africa resulting from the full implementation of individual subnational and non-state actor commitments and the full implementation of international cooperative initiatives (ICIs)' goals compared to the "current national policies" scenario

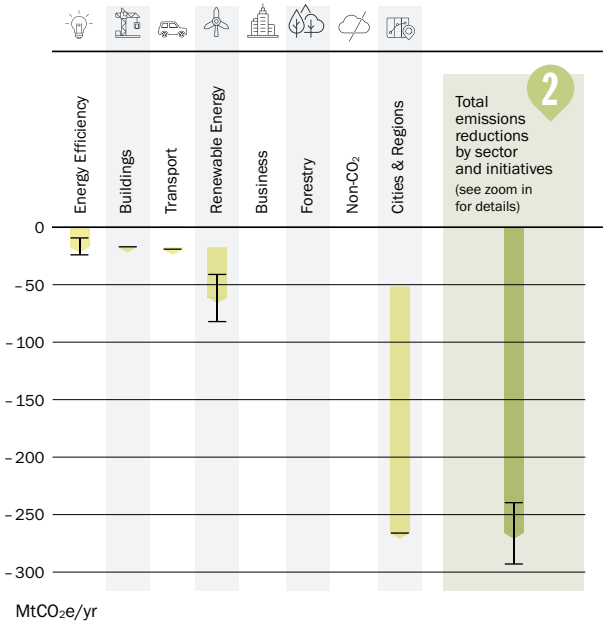


South Africa

Emissions reduction potential of individual actors beyond current national policies, **by actor group**



Emissions reduction potential of international cooperative initiatives beyond current national policies, **by sector**



The „current national policies" scenario (Kuramochi et al., 2018) includes land use, land-use change and forestry. Top panel: historical GHG emissions up to 2016 (with authors' own estimates for years between the last inventory data year and 2016) and scenario emissions pathways up to 2030, alongside the NDC target emissions range (indicative target level for 2030). Emissions reduction target trajectories from individual actors' commitments and initiatives' goals are assumed to be achieved linearly from the latest historical data year and are presented here for illustrative purposes. Bottom-left panel: the breakdown of potential GHG emissions reductions from individual subnational and non-state actor commitments in 2030 by actor group. Bottom-right panel: the breakdown of potential GHG emissions reductions from ICIs in 2030 by sector." The results for "Current national policies plus initiatives' goals" scenario do not include the potential emissions reductions from Science Based Targets, RE100 and Collaborative Climate Action Across the Air Transport World (CAATW); they are only quantified at a global level.

Subnational and non-state action has gained momentum over the past decade. Projects that reduce emissions while strengthening communities' resilience to climate change impacts have risen since 2011 and are often implemented through collaborations between local government and non-profit organizations, other government agencies, research institutes and the private sector (Local government programme 4 climate change., 2016). A 2015 analysis found that approximately half of all municipalities address climate change or sustainable energy in their development plans, and that municipalities including funding for climate change or sustainable energy projects in their budgets has nearly doubled between 2012 and 2015 (Ibid).

In recent years, city governments have become more active on climate action; the cities of Johannesburg, Tshwane, Cape Town and Durban, are all members of the C40 Cities Climate Leadership Group. All four cities aim to adopt and publish long-term climate action plans and their respective actions by 2020, as part of C40's Climate Action Planning (CAP) initiative for South African cities (C40 Cities, 2018). The city governments aim to align these processes with all relevant national and provincial policies and legislation. The city of Cape Town has already pledged to become carbon neutral by 2050, for example by aiming for carbon neutrality of new buildings from 2030 onward and exploring option to purchase electricity from independent electricity producers (Davis, 2019; IOL, 2019). The C40 Cities South Africa Buildings Programme aspires to make zero carbon buildings standard practice across South African cities.

Climate action in the business sector has mainly been streamlined by the South African National Business Initiative (NBI). The voluntary coalition of more than more than 80 South African and multinational companies works towards sustainable growth and development in South Africa. The NBI engages with the South African Government on key thematic focus areas such as the National Development Plan (NDP) implementation.

5.9.3 COMPARING SUBNATIONAL AND NON-STATE TRAJECTORY WITH NATIONAL TRAJECTORY

The assessment includes seven cities, representing just under 20 million people, that have made quantifiable commitments to reduce GHG emissions.[36] It also includes over 170 companies, controlling over 131 billion USD in revenue[37] – and including six of the world's largest companies[38] – that have made quantifiable climate commitments, most frequently in the metallic mineral mining, financial services, and web and marketing service sectors.

Together, these cities, provinces and companies represent 110 $MtCO_2e$/year in 2015, accounting for overlap between actors. If fully implemented and if such efforts do not decrease efforts elsewhere, they would reduce emissions by 20 to 30 $MtCO_2e$/year, or by 3% to 4%, below the emission levels projected under current national policies (Figure 27, top panel), with cities being the largest contributors (Figure 27, bottom-left panel).

International cooperative initiatives (ICIs) – networks of cities, regions, companies, investors, civil society, and, in some cases, countries, pursuing common climate action – could have a significantly larger impact. If they realise their goals, they could lower emissions in 2030 by an additional 240 to 290 $MtCO_2e$/year or 37% to 39% below the current national policies scenario projections in 2030 (Figure 27, top panel). This would decrease emissions to a level between 400 and 450 $MtCO_2e$/year, the lower end of the range of South Africa's NDC target. Initiatives focused on cities and regions, such as the C40 Cities for Climate Leadership Group, Global Covenant of Mayors for Climate & Energy, and Under2 Coalition, account for the largest share of this estimated mitigation potential (Figure 27, bottom-right panel).

36 Quantifiable commitments to reduce GHG emissions typically include a specific emissions reduction goal, target year, baseline year, and baseline year emissions. See Technical Annex I for more details.

37 Companies' combined revenue reflects companies making quantifiable commitments to reduce GHG emissions, whose headquarters are in South Africa, and whose revenue data is publicly available. See Technical Annex I for more details.

38 The world's largest companies are defined in terms of their inclusion in the 2019 Forbes 2000 and Global Fortune 500 lists.

5.10 United States

5.10.1 COUNTRY CONTEXT

In the United States (US), the second largest greenhouse gas (GHG) emitting country in the world, the Trump administration has pursued a sweeping, systematic rollback of critical climate policies. In June 2019, the Environmental Protection Agency replaced the Obama-era Clean Power Plan, which set strict limits on carbon emissions from coal- and gas-fired power plants, with a far weaker alternative. The Trump administration has abandoned the enforcement of rules prohibiting the use of hydrofluorocarbons, powerful GHGs, in refrigerators and air conditioners. In the wake of loosened rules governing how methane leaks from oil and gas production are reported and fixed (Popovich, Albeck-Ripka and Pierre-Louis, 2019), US gas flaring spiked by more than 50% in 2018 (Bazilian and Busby, 2019). The federal government also seeks to weaken Obama-era fuel-economy standards for cars and light trucks, and to remove California's ability to set its own tailpipe standards that other states can also adopt. If successfully implemented, these rollbacks could increase GHG emissions in 2030 by up to 400 $MtCO_2e$ – almost as much as California's 2016 emissions – compared to the trajectory expected when President Trump first took office (Climate Action Tracker, 2019a)c. The ultimate direction of US federal climate policy, however, will likely hinge on the results of a series of court cases challenging these policies, and on the 2020 presidential election.

With the Trump administration's resistance to climate action, the US's nationally determined contribution (NDC) to reduce its GHG emissions by 26% to 28% below 2005 levels by 2025 is unlikely to be reached with existing federal policies (Kuramochi et al., 2018; den Elzen et al., 2019). US emissions rose in 2018, after three years of decline, driven by the electricity, industry, and building sectors (US EPA, 2019). Transportation emissions, which have formed the largest source of US emissions for the past three years, also continued to grow, reflecting greater demand from industry, diesel trucks, and air travel (Houser and Marsters, 2018; Irfan, 2019).

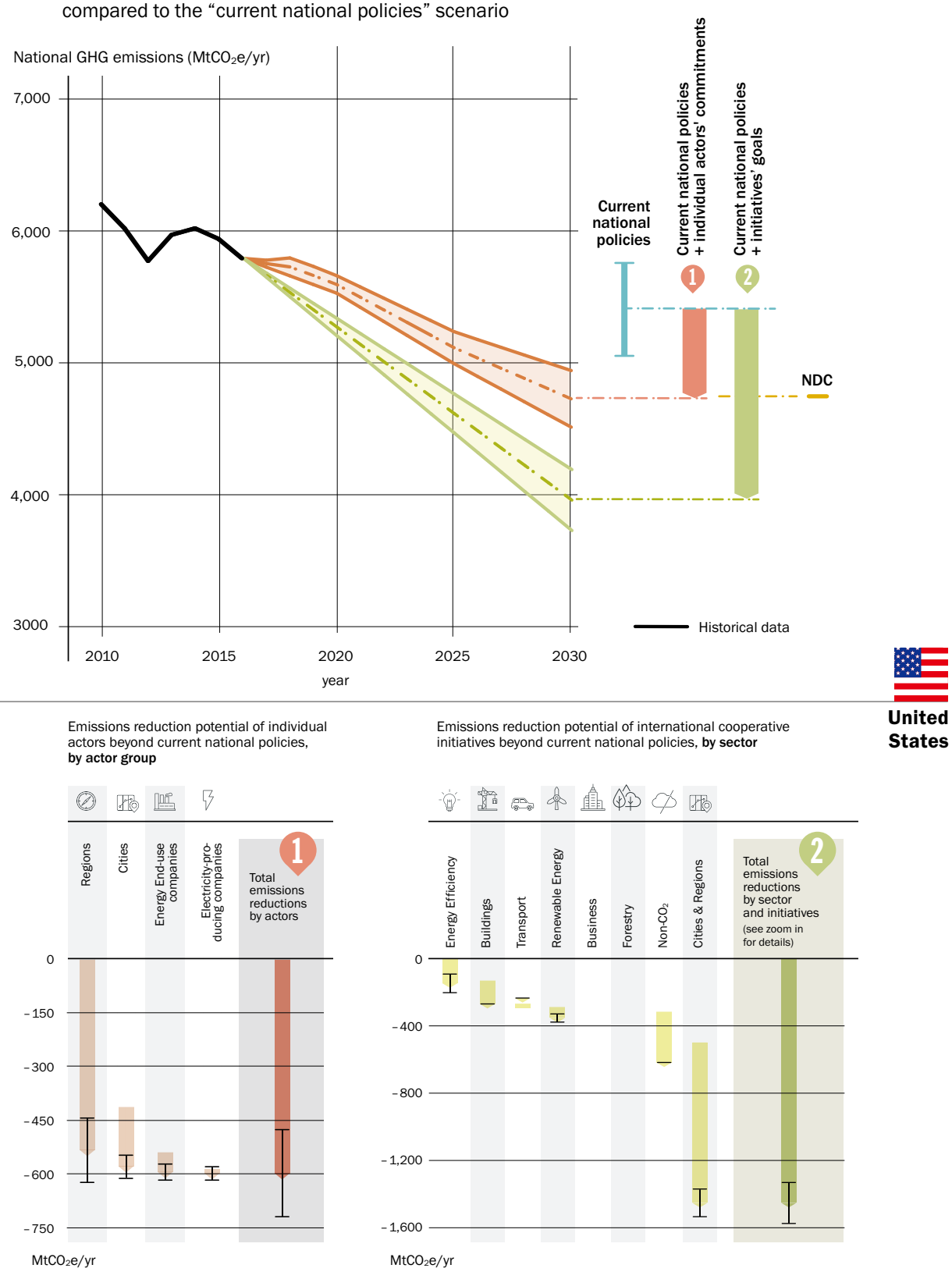
However, despite these setbacks, real momentum towards a decarbonised economy continues. Renewables are thriving, a result of falling costs, favourable state policies, and federal renewable energy production and investment tax credits (Jensen and Dowlatabadi, 2017). Renewable capacity doubled between 2008 and 2018, to account for 17.6% of the nation's electricity generation (EIA, 2019). A "Green New Deal" resolution, introduced to Congress in February, calls for more ambitious action mobilizing the nation to reach net-zero emissions through a "fair and just transition" (Ocasio-Cortez, 2019). While unlikely to pass, the resolution has catalysed discussions around climate change in the run-up to the 2020 presidential election and may help lay the groundwork for more ambitious climate action. Presidential candidates are releasing detailed and ambitious decarbonization plans, and current polls show climate change is a key voter issue in the primaries leading up the 2020 election (Detrow, 2019).

5.10.2 INTERACTIONS BETWEEN THE NATIONAL GOVERNMENT AND SUBNATIONAL AND NON-STATE CLIMATE ACTORS

In the face of lacklustre national action, local governments and the private sector are stepping up their efforts (Hale et al., 2018). A bipartisan group of governors ran – and won – on climate and clean energy platforms. The 2018 mid-term elections resulted in state-wide victories for climate action. Michigan, Maine, Colorado, Illinois, Nevada, New Mexico, and Wisconsin elected governors who endorsed renewable energy standards of 50% or higher (Nuccitelli, 2018; State of Wisconsin, 2019). Nine states, representing 16% of US electricity demand, have enacted 100% clean energy legislation.[39] They join more than 130 cities and 11 counties with 100% clean energy goals, including six that have already reached these targets (Sierra Club, 2019). In North Carolina, New Jersey, and Virginia, Democratic governors reversed past stances denying climate change or opposing policy responses to it (Irfan, 2018). Republican governors in Maryland, Massachusetts, and Vermont

39 California, Hawai'i, New Mexico, Nevada, Washington, Maine, New York, Puerto Rico, and Washington D.C.

Figure 28. Potential greenhouse gas (GHG) emissions reductions in the United States resulting from the full implementation of individual subnational and non-state actor commitments and the full implementation of international cooperative initiatives (ICIs)' goals compared to the "current national policies" scenario



The „current national policies" scenario (Kuramochi et al., 2018) includes land use, land-use change and forestry. Top panel: historical GHG emissions up to 2016 (with authors' own estimates for years between the last inventory data year and 2016) and scenario emissions pathways up to 2030, alongside the NDC target emissions range (indicative target level for 2030). Emissions reduction target trajectories from individual actors' commitments and initiatives' goals are assumed to be achieved linearly from the latest historical data year and are presented here for illustrative purposes. Bottom-left panel: the breakdown of potential GHG emissions reductions from individual subnational and non-state actor commitments in 2030 by actor group. Bottom-right panel: the breakdown of potential GHG emissions reductions from ICIs in 2030 by sector." The results for "Current national policies plus initiatives' goals" scenario do not include the potential emissions reductions from Science Based Targets, RE100 and Collaborative Climate Action Across the Air Transport World (CAATW); they are only quantified at a global level.

made progress on electric, buildings, and transportation emissions. The US Climate Alliance, a bipartisan coalition of governors committed to reducing GHG emissions consistent with the goals of the Paris Agreement, grew from 16 to 25 members (Data-Driven Yale, NewClimate Institute and PBL, 2018; U.S. Climate Alliance, 2019). "We Are Still In," an initiative committed to moving forward with the "country's commitments under the Paris Agreement — with or without Washington," has roughly doubled in size since 2017. A member coalition of Alliance for Climate Action (ACA), We Are Still In now includes over 3,800 signatories from the public and private sectors (We Are Still In, 2019).

Many of subnational and non-state actors are also directly challenging the federal administration's rollback of key climate policies. A coalition of 29 states and cities led by New York has sued the Environmental Protection Agency over the weakening of the Clean Power Plan (Friedman, 2019; General New York State Office of the Attorney, 2019). California, along with a coalition of 18 other states, plans to fight the administration's attempt to dilute its vehicle emissions standards (Shepardson, 2019). In July 2019, the state stuck a deal with four of the world's largest automakers that largely maintains its vehicle emissions standards, bypassing the Trump administration's efforts to weaken them (Davenport and Tabuchi, 2019). Colorado employed a similar approach, working directly with car companies to structure it's adoption of California's zero-emission vehicle (ZEV) requirements (Shepardson, 2019). In August, it became the eleventh state to adopt these zero-emissions standards, despite the Trump administration's attempt to roll this target back (Elliott, 2019).

5.10.3 COMPARING SUBNATIONAL AND NON-STATE TRAJECTORY WITH NATIONAL TRAJECTORY

The assessment includes more than 150 cities, representing nearly 72 million people, and 19 regions, representing a population of over 167 million, that have made quantifiable commitments to reduce GHG emissions.[40] It also includes roughly 740 companies, controlling over $8 trillion USD in revenue[41] – and including 166 of the world's largest companies[42] – that have made quantifiable climate commitments, most frequently in the financial services, biotech and pharma, and electrical & electronic equipment sectors.

Together, these cities, states, and companies represent nearly 2,600 $MtCO_2e$/year in 2015, accounting for overlap between actors. If fully implemented, they would reduce emissions in 2025 by an additional 390 to 540 $MtCO_2e$/year beyond the projected emissions under current national policies – leading to total emission levels of 21% to 24% below 2005 levels including LULUCF. This would fill much of the gap between the country's current national policies trajectory and its NDC target emission levels (Figure 28, top and bottom-left panels). For 2030, the impact would be even larger – a 540 to 820 $MtCO_2e$/year reduction compared to the current national policies scenario, which would lower US emissions 25% to 32% below 2005 levels. Our lower bound projections for 2030 (32% below 2005 levels) are similar to the "Enhanced Engagement" scenario projections in the America's Pledge report (America's Pledge, 2018).

International cooperative initiatives (ICIs) – networks of cities, regions, companies, investors, civil society, and, in some cases, countries, pursuing common climate action – could have a more substantial impact. If they realise their goals, they could reduce emissions by 1,300 to 1,500 $MtCO_2e$/year below the current national policies scenario projections or 36% to 43% below 2005 levels by 2030. Initiatives focused on cities and states account for the largest share of this estimated mitigation potential, followed by initiatives targeting non-CO_2 GHGs (Climate and Clean Air Coalition) (Figure 28, bottom-right panel). These initiatives' success could enable the US to go beyond its NDC target.

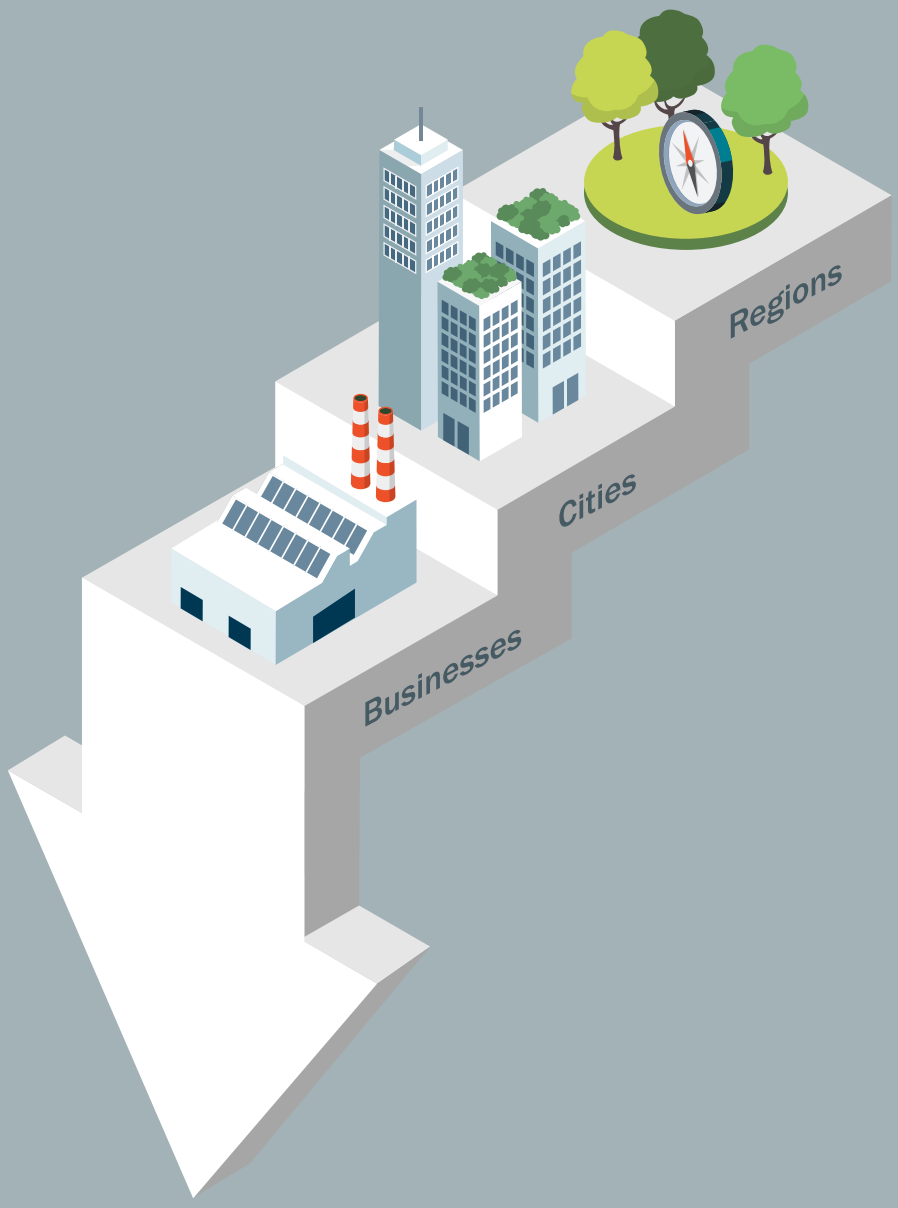
40 Quantifiable commitments to reduce GHG emissions typically include a specific emissions reduction goal, target year, baseline year, and baseline year emissions. See Technical Annex I for more details.

41 Companies' combined revenue reflects companies making quantifiable commitments to reduce GHG emissions, whose headquarters are in the United States, and whose revenue data is publicly available. See Technical Annex I for more details.

42 The world's largest companies are defined in terms of their inclusion in the 2019 Forbes 2000 and Global Fortune 500 lists.

06

CONCLUSION



6.1 SUMMARY OF THE KEY FINDINGS

Recorded subnational and non-state climate action represents a significant portion of the world economy and population:

- More than **6,000 cities and regions have made quantifiable commitments to reduce GHG emissions**, and share supporting information that makes it possible to quantify their potential impact. The local governments making these commitments represent populations that rival some of the world's largest countries: participating cities represent a collective population of 579 million – more than the combined population of the US and Brazil – while participating regions are home to approximately 514 million people, about four times the population of Japan.
- Roughly **1,500 companies report quantifiable climate action commitments to CDP**, representing a combined revenue of more than 20.5 trillion USD, the size of the US GDP.
- **ICIs (joint projects in which sub- and non-state actors work together across borders, sometimes with national governments and international organizations) have the potential to enable non-state and subnational actors to deliver deep emission cuts.** We assessed 190 ICIs and found that most have been taking appropriate steps to deliver their goals, and have achieved concrete outputs over the last 6 years. We also quantified the mitigation potential for the selected 17 initiatives that are considered to be large in scale and scored well in the output performance assessment. Seventeen selected initiatives can lead to emission reductions to put the world back on track to keep the Paris Agreement's goals within reach.

This report represents, to the authors' knowledge, the most comprehensive analysis to date of the mitigation potential of subnational and non-state climate action. We acknowledge, however, that this analysis represents only a portion of the total universe of climate action by regions, cities, firms, investors, and others, and therefore represents a conservative estimate of their commitments' mitigation potential. This analysis is also limited to city, region, and company mitigation commitments. In reality actors are contributing to a range of climate-related activities, including adaptation, financing, and sustainable development that are difficult to quantify and compare.

This 2019 report confirms non-state and subnational actors' potential to deliver significant emissions reductions in 2030. If recorded and quantified individual commitments by cities, regions and companies are fully implemented and if such efforts do not change the pace of action elsewhere, global GHG emissions in 2030 would be 1.2 to 2.0 $GtCO_2e$/year lower compared to a current national policies scenario. The roadmaps of select ICIs could potentially reduce global GHG emissions in 2030 by 18 to 21 $GtCO_2e$/year compared to a current national policies scenario, closing the global emissions gap in 2030 to a range consistent with a pathway limiting temperature rise below 2°C warming, although a significant gap between the 1.5°C scenario remains.

On a country level, subnational and non-state actors could help national governments deliver their NDCs by taking ambitious actions beyond national policies. In particular, we find that the aggregate of individual commitments by cities, regions and companies alone could deliver more emissions reductions than the current unconditional NDCs in the EU, India and Japan. Our results also show that individual city, region, and company commitments could be a driving force of climate action in countries where national governments are rolling back climate policies, such as the US and Brazil.

These results have two important implications. First, subnational and non-state climate action is helping many countries achieve or over-achieve their NDCs. Second, many countries could raise their NDC ambition by considering existing city, region, and company commitments in their national climate policy formulation process. Taking this report's country-specific results on ICIs' potential impact

could help countries develop or implement their long-term decarbonisation pathways. For a few major emitting economies including the EU and the US, the emissions trajectories for the "Current national policies plus initiatives' goals" scenario are roughly consistent with net zero CO_2 or GHG emissions around mid-21st century.

While many national governments do not seem to fully acknowledge non-state climate action in their climate policy formulation (Hsu et al., 2019), these results clearly show that national governments could leverage cooperative initiatives to put the world on track to reach long-term carbon neutrality consistent with the Paris Agreement's long-term temperature goal. It is therefore crucial that national governments enhance cooperation with these initiatives, especially those that cover the sectors that matter most to the country, to facilitate and harmonise efforts toward long-term carbon neutrality.

6.2 RECOMMENDATIONS

To realise the anticipated mitigation potential of subnational and non-state actors in 2030 and to further align these actors' commitments with their respective national governments, we provide several recommendations.

Data and monitoring

- **More investment in capturing the full range of non-state and subnational climate contributions is needed.** While existing data offers a valuable window into the potential impact of subnational and non-state climate action, several challenges limit the insights it can deliver. Data is often messy – requiring significant time and resources to compile and analyse. Much of the climate action underway in developing and emerging economies is not being captured through existing reporting platforms. Finding ways to better identify, understand and incorporate the impact of these actions into climate action assessments is crucial to understanding the full extent and potential of bottom-up climate action. A more comprehensive understanding of climate action could also help national governments identify and work with subnational and non-state actors to design and achieve country-wide targets.
- **Information tracking implementation progress is vital to ensure the credibility of non-state and subnational climate actions.** While some cities, companies, regions, and initiatives report progress towards their mitigation goals, the overall state of progress remains unclear. More data on progress, such as percentage completion or attainment of stated goals, could deliver insights into drivers that enable or inhibit implementation. Strategies to help address the current data gap could encompass:
  - Detailed reporting from subnational and non-state actors that includes: clear definitions of commitments, the status of commitments' implementation, and more frequent publication of GHG inventories;
  - Development of innovative analyses such as the Function-Output-Fit (FOF) approach, that identify proxies to fill data gaps;
  - Use of new technologies, such as real-time monitoring, to help overcome challenges in collecting and reporting data.

As many commitments set 2020 as a target year, next year represents an opportunity to capture lessons learned to inform subsequent rounds of commitments. Additionally, detailed data on progress would further enhance these efforts' credibility, providing another incentive for national governments and the global community to draw on these efforts to meet and scale up their targets.

- **More efforts are needed to bridge geographic and sectoral gaps in data coverage.** Most recorded subnational and non-state climate action primarily draw from developed countries like the EU and the US, as well as from China. Coverage of non-state and subnational climate actions from emerging economies and developing countries, including South Africa, Indonesia, and India, is far sparser. Additionally, most individual commitments target primarily CO_2 gases and economy-wide targets; opportunities abound for cities, regions, and companies to further target sectors with some of the greatest reduction potential, as demonstrated through our ICI analysis, including forestry and non- CO_2 gases. The ClimateSouth Initiative, which targets climate action in developing countries like Kenya and India, is one example of an effort striving to fill this knowledge gap.

Implementation

- **Achieving the Sustainable Development Goals will require close alignment with subnational and non-state climate action.** Climate mitigation action contributes to sustainable development and the potential for achieving sustainability co-benefits, such as green jobs, energy access, and pollution reduction, is even greater when potentially unintended negative effects and trade-offs are avoided. By contrast, when initiatives fail to consider these trade-offs and linkages in the broader sustainability context, critical opportunities may be missed.
- **Considerable scope exists for closer alignment and simultaneous delivery on climate and sustainability goals.** For example, ICIs with high mitigation potential highlight positive linkages between their efforts and sustainability outcomes. Besides SDG 13 (climate action), initiatives frequently refer to SDG 7 (affordable and clean energy); SDG 9 (industry, innovation and infrastructure); SDG 17 (partnership for the goals); SDG 11 (sustainable cities and communities); and SDG 12 (sustainable consumption and production). Initiatives' explicit references to the SDGs mainly concern synergies; they may be less likely to mention possible trade-offs between their climate goals and SDG targets. We find that SDG 11 (sustainable cities and communities), SDG 8 (decent work and economic growth), SDG 15 (life on land), SDG 2 (zero hunger), and SDG 1 (no poverty) represent areas in which trade-offs are most likely to occur. Initiatives often mention only a few linkages to the SDGs, and the potential for synergies for most initiatives is larger.

Ambition

- **Greater ambition could be achieved with closer alignment between national climate policies and city, region, and company actions.** While many national governments do not appear to fully acknowledge non-state climate action in their climate policy formulation (Hsu et al., 2019), this report's results clearly show that national governments could leverage international cooperative initiatives to put the world on track to reach long-term carbon neutrality, consistent with the Paris Agreement's long-term temperature goal. It is therefore crucial that national governments enhance cooperation with these initiatives and non-state and subnational actors more broadly, especially those that cover the sectors that matter most to the country, to facilitate and harmonise efforts toward long-term carbon neutrality.
- **With 2020 representing a critical year for review, there is an opportunity for non-state and subnational actors to further enhance ambition.** The quantification of city, region, and company climate actions in this report represent a baseline by which actors can consider ways to further ratchet up their own climate actions. Aligning goals with other sustainable development goals, ICIs, or other actors is one way this report demonstrates the possibility for non-state and subnational actors to further their own climate ambition. Implementing committed climate actions and reporting progress are other ways to enhance the credibility of non-state and subnational actions to both policymakers and the global community.

  In addition to short-term targets, focused on 2020, it is crucial that subnational and non-state actors also set a combination of short- to mid-term goals and long-term goals, ideally aligned to the Paris Agreement's long-term temperature target. Many efforts, like C40's Deadline 2020 program (C40 Cities, 2016) and the Science Based Targets' target setting guidance (SBTi, 2019), have begun working to support actors seeking to integrate these long-term temperature goals into their own target-setting processes.

This report has demonstrated the continued momentum of city, region, and company climate action to support and exceed climate efforts pledged by national governments. To realise this potential, however, will require support at all levels – from the international community, to national and local governments – to ensure a supportive policy environment that recognises the valuable contributions of all actors to global climate mitigation. The anticipated results in this report also depend on national governments following through on their Paris pledges and existing climate policies, which is an uncertain conclusion in several countries like the US and Brazil, where national governments are actively rolling back climate policies. In these contexts, non-state and subnational actors, as well as ICIs, could play a critical role in ensuring progress on climate mitigation is still made.

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GLOSSARY

Cities: Local governments that are administrative units of a specific geographical territory. For the purposes of this report, the term "cities" includes towns, urban communities, districts, and counties, as defined by the actors themselves and often also defined in the country's legal system.

Climate action by subnational and non-state actors: Any kind of activity that is directly or indirectly aimed at reducing GHG emissions or driving climate change adaptation and resilience that is led by these actors. Actions can be pursued individually (by one sub-national or non-state actor) or cooperatively in the form of initiatives (by a group of actors, including non-state and/or sub-national actors).

Commitments by subnational and non-state actors: Planned climate action as well as action currently under implementation, which has been publicly announced. Commitments can be put forward and pursued individually (by one sub-national or non-state actor) or cooperatively in the form of initiatives (by a group of actors, including non-state and/or sub-national actors).

International Cooperative Initiative (ICI): Multi-stakeholder arrangement through which subnational and non-state actors (e.g. cities, regions, businesses, NGOs, etc.) cooperate across border to mitigate or adapt to climate change, often in partnership with national governments or international organizations.

Non-state actor: Any actor other than a national government. This includes local and other sub-national governments, private actors, such as companies and investors, civil society and international organizations, among others.

Quantifiable commitments to reduce greenhouse gas emissions: For the purposes of this report, quantifiable commitments typically include a specific emissions reduction goal, target year, and baseline year (e.g., a goal to reduce emissions by 20% compared to 2000 levels by 2020). In addition, calculating these targets' mitigation impact requires baseline year emissions. (See Technical Annex I for more details on how emissions reductions commitments are selected and quantified).

Scope 1 emissions: Direct emissions resulting from owned or controlled sources. See www.ghgprotocol.org for further details.

Scope 2 emissions: Indirect emissions resulting from purchased electricity, heat or steam. See www.ghgprotocol.org for further details.

Scope 3 emissions: Other indirect emissions not included in Scope 2 that are in the value chain of a reporting actor, including both upstream and downstream sources. See www.ghgprotocol.org for further details.

Regions: Subnational administrative units that are generally broader in population and in scope than cities. They usually have separate governing bodies from national and city governments but encompass lower administrative levels of government; often, they are the first administrative level below the national government. "Regions" in this report includes US and Indian states, German Länder, and Chinese provinces. Regions can also include councils of subnational governments acting together.

Sub-national actor: Any form of government that is not a national government, such as cities, sub-national states, provinces and regions.

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