A Research Roadmap for Quantifying Non-State and Subnational Climate Mitigation Action
Supplementary Information

We reviewed all existing studies that evaluate and quantify non-state and subnational actors' contributions to global climate change mitigation from both published peer-reviewed academic papers to gray literature. In total these include 24 reports at the time this survey was conducted in September 2017 These reports were identified by the authors and co-authors, many of whom authored these studies, and Internet searches using keywords related to non-state and subnational climate mitigation aggregation analysis. For each study, we reviewed the following:

- How subnational and non-state climate action is defined;
- The status of climate actions being evaluated -- that is, whether reports assess commitments that have been pledged, commitment that are in progress, commitments that have been achieved, or the potential impact of expanded or scaled up climate action
- A study's coverage in terms of the number of actors or baseline emissions of actors included in its analysis;
- How the reports evaluate what efforts have been implemented and what they have achieved;
- Impacts on greenhouse gas emissions, whether individual reductions, initiative-wide reductions, or systemic (e.g., whole sector) reductions;
- What counterfactual scenarios are used for baselines to compare emissions impacts: Counterfactual "no policy" baselines, "Current national policies" scenario, "Nationally Determined Contributions (NDCs)" scenario, and/or "Current national policies plus subnational and non-state action" scenario;
- Which individual baselines for specific actors groups are used to determine individual actor and actor group reductions: baselines for each individual actor; baselines per actor group (e.g., industry sector projections, average growth rates of relevant subsectors, average growth rates for an economy or region); or constant emissions levels (e.g., base year emissions, constant per capita emissions and population projections);
- How overlaps between actors, initiatives, and national actors are taken into consideration; and
- The timeframe of an analysis, whether short-term (2020), mid-term (2030) or long-term (2050).

Supplementary Table 1 summarizes the range of choices adopted across the studies surveyed, across several of the metrics described above.

Report	**Number of actors**	**Baseline emissions covered by evaluated actors**	**GHG reductions of evaluated actors**	**Baseline used to quantify the mitigation impact for individual actors**	**Overlap determination**	**Global or regional scenarios used to quantify actors' impact**
Compact of Mayors. (2015). Climate Leadership at the Local Level: Global Impact of the Compact of Mayors.	360 cities	2.08 $GtCO_2e$	0.50 $GtCO_2e$/yr by 2020; 0.74 $GtCO_2e$/yr by 2030	Baseline per actor group	✓	Business as Usual (No Policy Baseline)

Arup & C40 Cities Climate Leadership Group. (2014). Working Together: Global Aggregation of City Climate Commitments.	228 cities	–	0.454 $GtCO_2e$/yr in 2020; 0.402 $GtCO_2e$/yr in 2030; 0.430 $GtCO_2e$/yr in 2050	Constant emissions levels	✓	Business as Usual (No Policy Baseline)
The Climate Group. (2015). Compact of States and Regions Disclosure Report 2015.	44 regions	2.81 $GtCO_2e$ in annual emissions	0.6 $GtCO_2e$/yr in 2020;1.2 $GtCO_2e$/yr in 2030; 2.2 $GtCO_2e$/yr in 2050	Constant emissions levels	–	Business as Usual (No Policy Baseline)
The Climate Group. (2016). Compact of States and Regions Disclosure Report 2016.	62 regions	3.1 $GtCO_2e$	0.4 $GtCO_2e$/yr in 2020; 0.6 $GtCO_2e$/yr in 2030; 1.2 $GtCO_2e$/yr in 2050	Constant emissions levels	–	International Energy Agency's (IEA) Energy Technologies Perspectives 2014 4 Degrees Scenario and 6 Degrees Scenario
CDP. (2016). Out of the starting blocks: Tracking progress on corporate climate action.	1089 companies	6.4$GtCO_2e$	1 $GtCO_2e$ by 2030	Constant emissions levels	–	Not specified - Variable according to individual company actor
CDP and WeMeanBusiness. (2016). The business end of climate change.	5 ICIs[1], including ~ 300 companies	–	3.2 to 4.2 $GtCO_2e$ by 2030 (5 ICIs); ~ 10 $GtCO_2e$ by 2030 (systematic sector transformation)	Baseline per actor group	✓	Current national policies scenario
Hsu, A., Moffat, A. S., Weinfurter, A. J., & Schwartz, J. D. (2015). Towards a new climate diplomacy. Nature Climate Change, 5(6), 501-503.	5 ICIs quantified (out of 29 ICIs considered)	–	2.54 $GtCO_2e$ in 2020	Baselines for each individual actor	✓; considers overlap with national actors as well	"Current national policies" scenario
Roelfsema, M., Harmsen, M., Olivier, J. & Hof, A., Van Vuuren, D.P. (2018). Integrated assessment of international	11 ICIs quantified (out of 17 considered)	14.5 $GtCO_2e$	2.5 $GtCO_2e$/yr by 2020; 5.5 $GtCO_2e$/yr by 2030	Baseline per actor group	✓; considers overlap with national actors as well	Counterfactual "no policy" baseline

[1] International Cooperative Initiatives (ICIs).

climate mitigation commitments outside the UNFCCC*; Global Environmental Change*, Vol. 48, p67-75.						
Roeslfsema, M. (2017). Assessment of US City Reduction Commitments, from a Country Perspective.	25 cities	0.345 $GtCO_2e$ in 2010	0.095 to 0.125 $GtCO_2e$ by 2030 (from cities' no-policy baseline); 0.005 to 0.03 $GtCO_2e$ by 2030 (from "Current national policies plus NSA action" scenario)	Baseline per actor group	✓; considers overlap with national actors	"NDCs" scenario, "Current national policies plus NSA action" scenario
United Nations Environment Programme. (2015). Climate commitments of subnational actors and business: A quantitative assessment of their emission reduction impact.	15 ICIs, including 25 cities, 30 companies, 150 CSOs quantified (out of 180 ICIs considered)	–	2.9 $GtCO_2e$ [2.5–3.3 GtCO2e] in 2020	Baseline per actor group	✓; considers overlap with national actors as well	Business as Usual Scenario
Graichen, J., Healy, S., Siemons, A., Höhne, N., Kuramochi, T., Gonzales-Zuñiga, S., ... & Wachsmuth, J. (2017). International Climate Initiatives–A way forward to close the emissions gap?.	19 ICIs quantified (out of 174 ICIs considered)	–	8 Gt CO_2e/year [5-11 $GtCO_2e$ /year] in 2030	Baseline per actor group	✓; considers overlap with national actors as well	Current national policies scenario plus NDCs
Jaquot, P. (2013). Contribution of four initiatives from the 'Wedging the Gap' approach to achieve Copenhagen climate-change mitigation target (MsC Thesis). Wageningen University, Netherlands.	3 ICIs, including over 477 cities	–	3.46 Gt CO_2e by 2020	Constant emissions levels	✓; considers overlap with national actors as well	Current national policies scenario according to 2015 World Energy Outlook

de Boer, T. (2014). Wedging the Gap: Possible Impact of a 'Top 1000 Companies' Emission Reduction Initiative for Greenhouse Gas Mitigation in 2020 (MsC Thesis). Wageningen University, Netherlands.	224 companies	–	0.5-1.07 $GtCO_2e$ in 2020	Baseline per actor group	–	Current national policies scenario according to 2012 World Energy Outlook
Kuramochi, T., Höhne, N., Sterl, S., Lütkehermöller, K., & Seghers, J.C. (2017). States, cities and businesses leading the way: a first look at decentralized climate commitments in the US. NewClimate Institute and the Climate Group.	54 cities, 22 regions, 250 companies	2.898 $GtCO_2e$ (44% of US GHG emissions in 2015)	0.360-0.560 $GtCO_2e$/yr (12-14% below 2005 level by 2025)	Baseline per actor group	✓	Current national policies scenario
U.S. Climate Alliance. (2017). 2017 Annual Report: Alliance States Take the Lead.	15 regions	–	24-29% reduction below 2005 levels by 2025	Baselines for each individual actor	–	Comparison to 2005 US emission levels
ICLEI. (2015). Measuring Up 2015: How US Cities Are Accelerating Progress Toward National Climate Goals.	116 cities	–	0.038 $GtCO_2$/yr by 2020 (cities with 2020 targets); 0.179 $GtCO_2$/yr by 2035 (cities with 2050 targets); 0.328 $GtCO_2$/yr by 2050 (cities with 2050 targets)	Constant emissions levels	–	Not specified - Variable according to individual city actor
Deng-Beck, C. & van Staden, M. (2015). carbon*n* Climate Registry 5 year overview report (2010-2015). ICLEI.	608 cities and regions	2.2 Gt CO2e	~ 1.0 Gt CO_2e by 2020	Constant emissions levels	✓	Not specified - Variable according to individual city actor
Kona, A., Melica, G., Koffi, B., Iancu, A., Zancanella, P.,	6,201 cities	0.951Gt CO_2e	0.254 $GtCO_2e$ by 2020	Constant emissions levels	–	Baseline Emissions Inventory (BEI) scenario from

Calvete, S. R., ... & Monforti-Ferrario, F. (2016). Covenant of Mayors: Greenhouse Gas Emissions Achievements and Projections.						reporting entities
C40 Cities & Arup. (2017). Deadline 2020: How U.S. cities will get the job done.	12 cities analyzed (analysis then extended to 758 additional US cities)	–	0.131 $GtCO_2e$ by 2020; 1.9 $GtCO_2e$ by 2030; 12.2 $GtCO_2e$ by 2050 (C40 cities). 4 $GtCO_2e$ by 2025; 13 $GtCO_2e$ by 2030; 454 $GtCO_2e$ by 2100 (US cities).	Constant emissions levels	–	Business as Usual for cities evaluated
C40 Cities & Arup. (2016). Deadline 2020: How cities will get the job done.	84 cities	2.4 $GtCO_2e$	500 $GtCO_2e$ by 2100	Constant emissions levels	–	Business as Usual for cities evaluated
Global Covenant of Mayors for Climate and Energy. (2017). Raising Global Climate Ambition: Aggregate Impact of the Global Covenant of Mayors for Climate and Energy.	7,494 cities	–	0.85 $GtCO_2e$/yr in 2020; 1.29 $GtCO_2e$/yr in 2030; 1.67 $GtCO_2e$/yr in 2050	Constant emissions levels	–	Business as Usual (No Policy Baseline)
Erickson, P. & Tempest, K. (2014). Advancing climate ambition: How city-scale actions can contribute to global climate goals.	600 + cities	–	3.7 $GtCO_2e$ in 2030; 8.0 $GtCO_2e$ in 2050	Baseline per actor group	–	Current Policy Scenario
Moorhead, J & Nixon, T. (2016).Global 3500 Greenhouse Gas Performance 2010-2015: Key Trends and Opportunities for Leadership.	3500 companies, including Global 50 companies [4]	11.64 $GtCO_2e$ (Scope 1, 2)	Global 50 company emissions increased 4% between 2011-2015	Constant emissions levels	–	Current Policy Scenario of the 3,500 companies evaluated
The Climate Group & CDP. . (2017). States and Regions Climate	110 states and regions	3.8 $GtCO_2e$	0.3 $GtCO_2e$ in 2020; 21.9 $GtCO_2e$ in 2050	Baselines per actor group	–	Compared to 'Reference Technology Scenario' that includes current

Tracker.						policies and the NDCs

Supplementary Table 1. Survey of the diversity of methodological approaches taken by 24 studies quantifying the mitigation impact of non-state and subnational climate action. This is a summary meant to capture the range of findings across reports, rather than a comprehensive summary of each report's content. In some cases, we have reported only a report's figures for annual GHG savings, for instance, when it also includes a cumulative mitigation estimate. This table also does not reflect methodological choices -- for instance, the application of likelihood assessments -- that may influence report findings.

[4] Global 50 companies include 50 firms that produce nearly half of the Global 3500 emissions and about 10% of total global emissions.