

States, cities and businesses leading the way: a first look at decentralized climate commitments in the US

Authors:

Takeshi Kuramochi, Niklas Höhne, Sebastian Sterl, Katharina Lütkehermöller (NewClimate Institute), Jean-Charles Seghers (The Climate Group)

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Authors

Takeshi Kuramochi, Niklas Höhne, Sebastian Sterl, Katharina Lütkehermöller (NewClimate Institute), Jean-Charles Seghers (The Climate Group)

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Summary and findings

This paper presents the results of a first analysis into US sub-national and non-state action and its impact on national greenhouse gas (GHG) emissions, based on currently reported targets when fully implemented. The analysis covers commitments from individual states, cities and companies, which set quantitative mitigation targets and for which historical emissions data is available. It considers 342 non-state actions, of which 22 are from states including 13 that joined the US Climate Alliance, 58 actions from 54 cities and 262 actions from 250 companies headquartered in the US. More action is constantly emerging which was not covered in this first analysis.

We show that the currently recorded and quantified individual commitments by sub-national and non-state actors would already take the US around halfway towards achieving the higher end of its Nationally Determined Contribution (NDC) by 2025. Under the “current reported sub-national and non-state commitments” scenario, GHG emissions are reduced to 12-14% below 2005 level by 2025. This is equal to a reduction of about 360-560 metric tons of carbon dioxide equivalent (MtCO_{2e}) per year from the “current administration policies” scenario (Figure S-1).

A significant portion of the estimated reductions come from US state-level commitments (190-390 MtCO_{2e} below 2015 levels) because of their size, with the three US Climate Alliance states (California, Colorado, and New York) committing to a 110 MtCO_{2e} reduction from 2015 levels, and an additional 110 MtCO_{2e} reduction commitment potentially coming from Florida and Illinois. Commitments by companies other than electric utilities are the most ambitious in terms of relative reduction between 2015 and 2025 (25%), mainly due to significant renewable energy targets. The proposed reduction rate across all cities is also generally more ambitious than across US states included in the analysis. Cities will also be crucial to implement actions. The proposed reduction rate of electric utilities was found to be the least ambitious, with an average reduction of only 7% over the same period.

We assume here that the recorded and quantified commitments will be fully implemented, which may not necessarily be the case, as they are mostly voluntary and could be overturned.

There are more reasons to believe that the calculated impact of states, cities and businesses in the report is currently underestimating rather than overestimating the full impact of these actor groups: an increasing number are making commitments (they may not all be included here), the impact of some commitments is difficult to quantify (e.g. financial sector commitments are not included here), global initiatives support individual actors to make commitments (their goals are not included here) and these actions could lead to systemic, transformative impacts (not considered here).

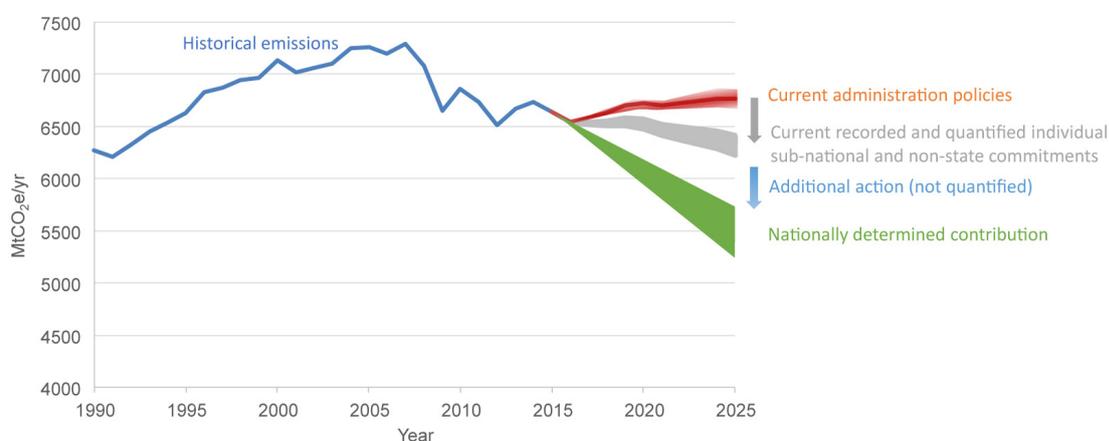


Figure S-1: Impact of recorded and quantified individual sub-national and non-state commitments on GHG emissions of the US (all GHGs excluding land-use, land-use change and forestry).

Introduction

With the adoption of the Paris Agreement in December 2015, nearly 200 countries agreed to keep the global average temperature to “well below 2°C”, while pursuing efforts to limit it to 1.5°C by the end of the century, and reach net-zero emissions in the second half of the century. However, the commitments made by countries in their Nationally Determined Contributions (NDCs) are currently insufficient to achieve these targets (Climate Action Tracker, 2016).

Climate action is, however, not only dependent on the actions of national governments. Potential emissions reductions through sub-national or non-state action (states or regions or states within a country, cities, companies) have received increasing attention lately, e.g. (Höhne, Sterl and Fekete, 2015; Roelfsema *et al.*, 2015; Graichen *et al.*, 2016a; Hsu *et al.*, 2016). The Emissions Gap Report 2016, published by the United Nations Environment (UNEP), dedicated an entire chapter to the potential impact of sub-national and non-state action (UNEP, 2016). Estimates of the potential for global reduction, if sub-national and non-state actors achieve their own targets, vary widely, but are generally in the region of around two gigatons of CO₂ per year beyond current national policy trajectories until 2030.

The Obama Administration submitted an NDC to the Paris Agreement intended to achieve an economy-wide target of reducing US GHG emissions by 26-28% below 2005 levels in 2025 and to make best efforts to reduce its emissions by 28%.

On June 1, 2017, US President Donald Trump announced his decision to formally withdraw the US from the Paris Agreement and to stop the implementation of the NDC, and these were later officially communicated to the United Nations (The Representative of the United States of America to the United Nations, 2017). Prior to this announcement, the new US Administration had already implemented several policy rollbacks that will have adverse consequences on the drive to reduce emissions, thus federal policies alone will not be sufficient to meet the 2025 NDC target (Climate Action Tracker, 2017a).

But the reality on-the-ground appears to be quite different. Several state governments in the US have stated their will to pursue the objectives of the Paris Agreement under the U.S. Climate Alliance (Ronayne, 2017; United States Climate Alliance, 2017), and the growth of renewable energy is continuing at unprecedented rates (Gibbens, 2017). California Governor Jerry Brown and Former Mayor of New York Michael Bloomberg have also launched “America’s Pledge”, an initiative that is moving forward with the “country’s commitments under the Paris Agreement — with or without Washington” (America’s Pledge, 2017).

So, while the US Administration’s policies are likely to limit emissions reductions, mitigation opportunities exist elsewhere through sub-national and non-state action. These opportunities include sub-national governments (US state-level or city-level) setting their own targets, companies increasing the drive for renewable energy and reducing their own emissions, innovation and the scaling-up of breakthrough transformative technologies, and cooperative initiatives aimed at sectoral transformation.

This paper presents the results of an initial analysis into US sub-national and non-state action and its impact on emissions based on a road test of draft guidance developed under the Initiative for Climate Action Transparency (ICAT). We show here that the currently recorded commitments by sub-national and non-state actors, if fully implemented, will take the US already around halfway towards achieving the higher end of its NDC by 2025.

There is an increasing need for further quantification of sub-national and non-state mitigation commitments. Within the Initiative for Climate Action Transparency (ICAT) we will continue this effort, as will America’s Pledge.

Data and methods

This section summarizes the analytical methods used in this report. Detailed description of data and methods can be found in Appendix 1.

As a starting point, we use a **“Current administration policies” scenario**, which considers only currently implemented federal policies and excludes the Clean Power Plan, which the Trump administration clearly expressed its intention to cancel (The White House, 2017). This scenario is taken from the Climate Action Tracker (2017b). It is already lower than a “no climate action scenario” used in some other studies as it includes actions like the fuel economy standard. Under this scenario, GHG emissions reach 6,770 MtCO_{2e} in 2025 excluding land use, land-use change and forestry (LULUCF). A detailed description of which policies are included and a comparison to other recent studies is presented in the Appendix (section A1.5).

The **“Current reported sub-national and non-state commitments” scenario**, the main scenario in this analysis, takes the quantifiable commitments by individual sub-national and non-state actors (regions, cities and companies including utilities) into account.

In the current analysis, the base year is 2015 and the future time horizon is 2025. The analysis covers commitments from individual actors, which set quantitative mitigation targets and for which historical emissions data is available. The quantification of the emissions trajectory for the “Current individual sub-national and non-state commitments” scenario is based on the dataset prepared by CDP in partnership with The Climate Group (CDP, 2017c; CDP and The Climate Group, 2017), supplemented by additional data collection (see Appendix section A1.1).

Our analysis covers 342 sub-national and non-state actions by individual actors, of which 22 are from states including 13 from the US Climate Alliance as of end-August 2017 (United States Climate Alliance, 2017), 58 from 54 cities, and 262 from 250 companies headquartered in the US. 10 of the 20 largest cities in terms of population are included in the analysis. For all actors, we used the targets as a basis and assume they will be fully implemented. We did not further analyze specific policies and actions to meet these targets.

With regard to state-wide targets, governing parties have changed in some states since the initial targets were established. It is uncertain in some cases whether the targets would actively be pursued. In the “Current individual sub-national and non-state commitments” scenario, the lower end of the projection range includes state-wide targets from all 22 states and the upper end of the projection range only includes those included in the US Climate Alliance (13 states).

The current analysis only covers a selected set of reported actions (covering 44% of GHG emissions of the US); the results of the analysis could change over time as more sub-national and non-state actors commit to quantifiable mitigation pledges and more relevant data is collected.

We first quantify the impact of the targets of the actor groups individually and then calculate a total net impact considering the overlaps in the following order:

- Regions: we start with the reduction targets from US states.
- Cities: the emissions reductions from cities are counted to contribute to the overall total, if cities are outside of the regions with action, or if the cities’ actions are undoubtedly more ambitious than those of the region in which the cities are located. As an estimate, we only counted the reductions of those cities to the overall total that go beyond an 80% reduction line from 2015 to 2050. The 80% reduction value is based on most region- and city-level targets being in line with a 60-80% reduction between 2015 and 2050.

- Companies other than electric utilities: reductions only count towards the overall total if they operate outside of regions and cities with action, or if these companies' action are undoubtedly more ambitious than those of the region or city in which the companies are located, as above.
- Electric utilities: reductions only count towards the overall total for the electricity generation not covered by other actor groups (regions, cities and other companies) or if the electric utilities' targets are undoubtedly more ambitious, see above.

Results and analysis

The current recorded and quantified commitments by sub-national and non-state actors takes the US already around halfway towards achieving the higher end of its the emissions range under the NDC excluding land use, land-use change and forestry (LULUCF) by 2025 (5,260-5,730 MtCO₂e, Figure 1). Under the "Current individual sub-national and non-state commitments" scenario, GHG emissions reduce to 12-14% below 2005 levels by 2025, depending on the inclusion of the nine state-wide targets that are not part of the US Climate Alliance. This is equal to about 340-540 MtCO₂e/yr reduction from the "Current administration policies" scenario. In its original NDC, the US intended to achieve an economy-wide target of reducing its GHG emissions by 26-28% below its 2005 level in 2025 and to make best efforts to reduce its emissions by 28%.

The sub-national and non-state commitments covered in this analysis (including states outside the US Climate Alliance) were estimated to comprise 44% of national GHG emissions in 2015 after subtracting overlaps.

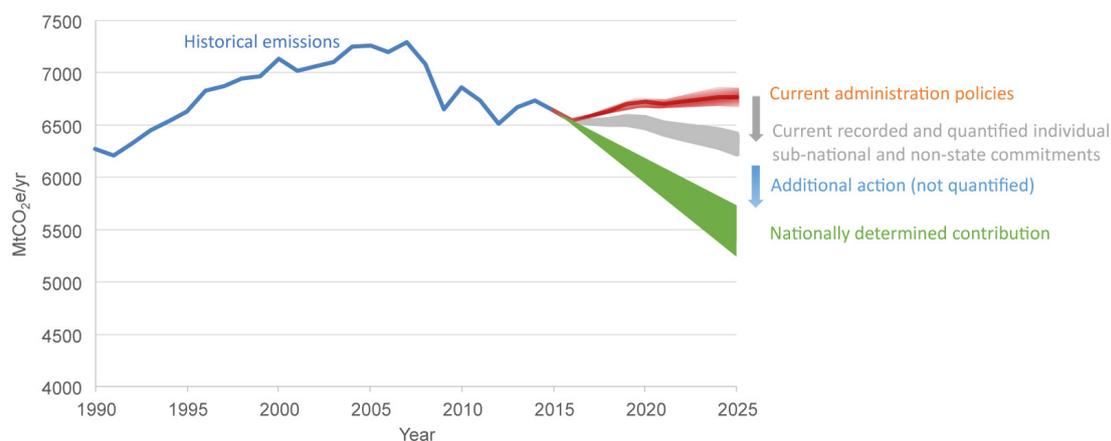


Figure 1: Impact of current recorded and quantified individual sub-national and non-state commitments on GHG emissions of the US (all GHGs, excluding land-use, land-use change and forestry). The NDC emissions range and current administration policies scenario projections are taken from the Climate Action Tracker (Climate Action Tracker, 2017b) with illustrative uncertainty added.

National, state-level, city and company level action are all interconnected and mutually influential. One actor setting a goal (e.g. a state) usually leads to another player taking significant actions (e.g. cities or utilities). Determining who is first or attributing a reduction only to one actor is impossible.

Here we analyzed, which of the goals set by the various actor groups deviate most in absolute terms from the reference development, i.e. the "Current administration policies" scenario.

Many of the goals set by 13 US Climate Alliance states are more ambitious than the "Current administration policies" scenario. If fully implemented they would lead to emissions 220 MtCO₂e lower in 2025 than the "Current administration policies" scenario (Figure 2) or 190 MtCO₂e below 2015 levels, which is 63% of the total reductions estimated here from sub-national and non-state actor commitments. A case with all 22 state-wide targets included is presented in the Appendix 2.

This high share for state-level commitments is because of their size and the coverage of actions in the dataset; it is not necessarily a reflection of ambition. The largest US Climate Alliance contributors are California, Colorado, and New York (110 MtCO₂e reduction from 2015 levels). Nine other states with GHG emissions reduction targets could potentially reduce an additional 190 MtCO₂e below 2015 levels by 2025; Florida and Illinois alone could potentially deliver a 110 MtCO₂e reduction from 2015 levels by 2025.

The targets by the 54 cities included here would lead to emissions over 70 MtCO₂e lower than the “Current administration policies” scenario, if implemented in isolation. But 62% of the emissions from cities with targets in 2015 are also covered by one of the 13 US Climate Alliance states. These cities will be crucial to implement the state level targets. When aggregating a total reduction, we counted those cities’ contribution only if they were undoubtedly more ambitious than the respective state commitments (i.e. if they prescribed a faster annual reduction rate than 80% from 2015 to 2050). States’ and cities’ targets fully implemented together lead to emissions around 240 Mt CO₂e lower than the “Current administration policies” scenario (states and cities together in Figure 2, see overlap of both).

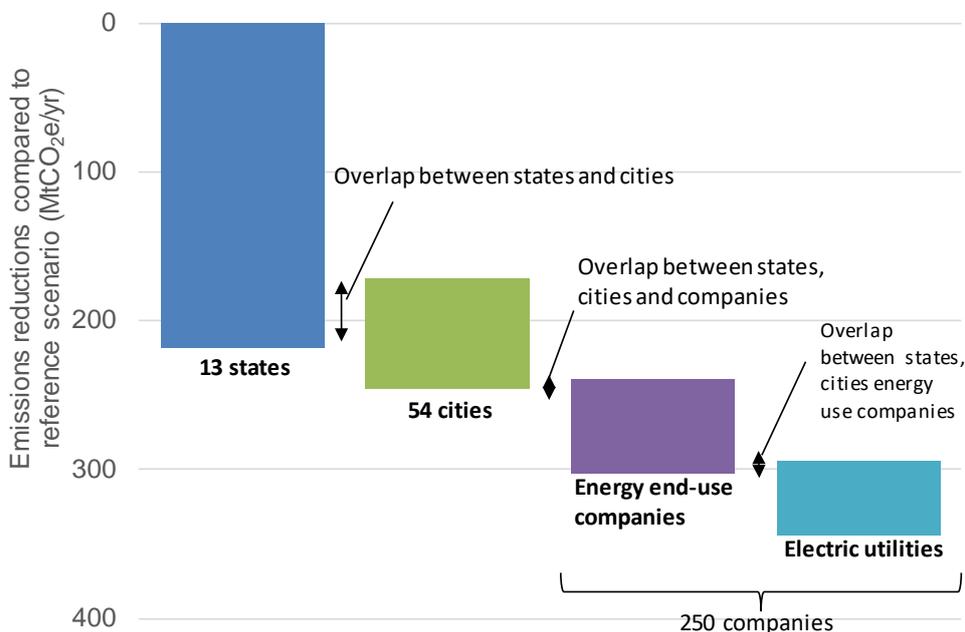


Figure 2: GHG emission reductions committed for 2025 (compared to the reference as defined in this analysis) by sub-national and non-state actors: individual contributions per actor category (total bars) and overlaps (overlaps between the bars), and the net aggregate impact expected from all commitments covered by the analysis. The breakdown is shown for the case with 13 US Climate Alliance states.

The targets by the 250 companies excluding utilities included here would lead to emissions around 60 MtCO₂e lower than the “Current administration policies” scenario, if implemented in isolation. Close to a quarter (21%) of the 2015 emissions from these energy end-use companies was estimated to also be covered by state- and city-level targets, based on shares of these states and cities in national total GHG emissions in 2015 (excluding LULUCF). Many of those energy end-use companies have commitments more ambitious than the targets in the 13 states for a 2025 time horizon, so a large part of the company emissions reductions in the 13 states are counted here as adding to the overall total. States’, cities’ and energy end-use companies’ targets fully implemented together lead to emissions around 300 Mt CO₂e lower than the “Current administration policies” scenario (Figure 2).

The targets of the seven electric utilities included here would lead to emissions around 50 MtCO₂e lower than the “Current administration policies” scenario, if implemented in isolation. 17% of their emissions were estimated to also be covered by the states, cities and energy end-use companies with targets, based on shares of these three actor groups in total CO₂ emissions from the power sector in 2015.

States', cities' and all companies' targets fully implemented together lead to emissions around 340 Mt CO₂e lower than the "Current administration policies" scenario (Figure 2),

As a measure of ambition, we used the annual percentage reduction rate of the targets of the various actors (Figure 3; a results table also available in Appendix 2). Aggregated targets by the energy end-use companies have the most ambitious reduction rate between 2015 and 2025 (25%) (Figure 3). They usually take on ambitious short-term renewable energy use targets or focus on short-term reduction options. Their time horizon is short, maximum 10 years. The reduction curve for energy end-use companies flattens over a period of less than 10 years.

Aggregated electric utilities' commitments show a 7% reduction from 2015 and 2025. Some of these companies have overachieved their short-term targets by 2015. The actual emissions by all electric utilities will likely need to be significantly lower than the observed commitment levels, if the commitments states, cities and energy end-use companies are to be met.

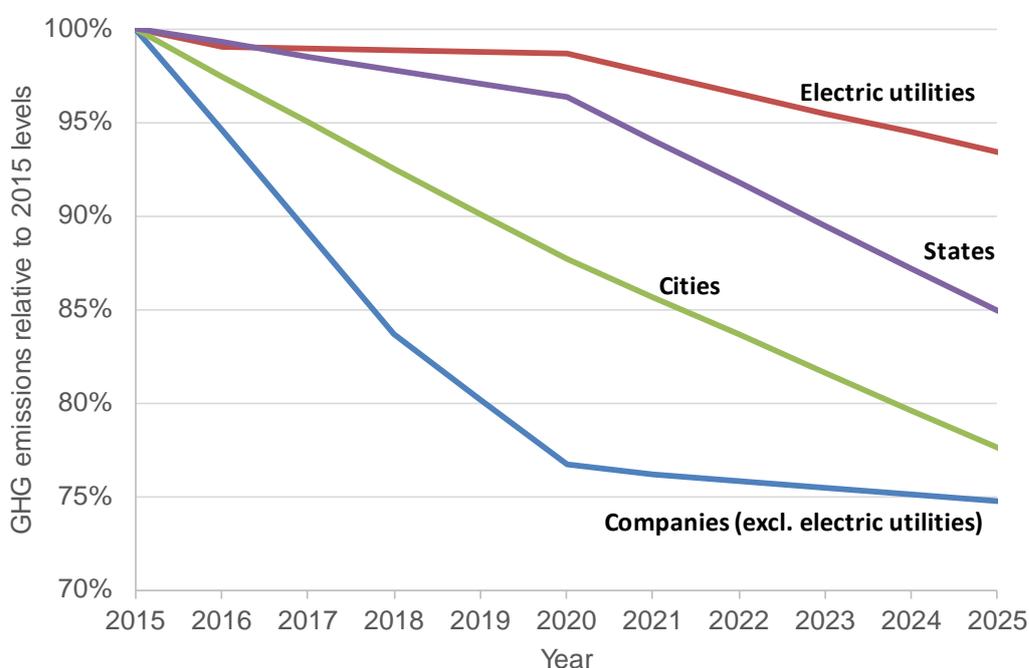


Figure 3: Average of committed GHG emission targets relative to 2015 levels for four sub-national and non-state actor categories. For state-level actions, only those from the US Climate Alliance states are considered. Overlaps across different actor categories are not taken into account here.

On one hand, the mitigation ambition of 340-540 MtCO₂e in 2025 from individual actors' commitments can be an underestimation because it is only part of a wider picture of sub-national and non-state actions (Table 1). The analysis only covers commitments with quantitative mitigation targets and historical emissions data available. The expected mitigation impact will likely become larger if the analysis is extended beyond the current dataset, which does not yet cover all US specific sub-national and non-state action, especially for cities and companies. The mitigation impact in the business sector could be much higher than projected in this paper if the companies headquartered outside the US but with domestic operations are also taken into account. For example, the We Mean Business coalition, which is identified as one of only two platforms that requires specific mitigation commitments, alone has more than 590 companies (We Mean Business, 2017).

Our analysis results also do not include goals of initiatives that bring individual actors together. A recent report (Graichen *et al.*, 2016) shows that the aggregation of mitigation ambition under major international

sub-national and non-state initiatives in the US could be as large as a 1.0-1.8 GtCO₂e/yr reduction compared to a current policy scenario, leading to emissions levels well below those of the US NDC. There are also certain types of commitments of which the impact cannot easily be quantified (e.g. investment-related actions by the financial sector).

Spill-over effect or transformational impact induced by the non-state actions covered in this report and various actions that have emerged in recent months are also not accounted for in this study. The mitigation impact for cities can also be much larger when, for example, the commitments from over 370 US cities to adopt, honor and uphold Paris Climate Agreement goals are taken into account (Climate Mayors, 2017). The We Are Still In declaration has 135 cities and more than 1,300 companies that support the Paris Agreement as signatories as of early-June (Rocky Mountain Institute, 2017).

On the other hand, there are also a number of factors that may have led to an overestimation of mitigation ambition. We assumed that all targets would be achieved. Long-term targets (e.g. for 2050), which in some cases determine the interpolated target level for 2025, are sometimes mere aspirational targets that may not reflect the true ambition of the actors today. Moreover, the assumption that the baseline emissions levels for the sub-national and non-state actors would increase proportionally to the “Current administration policies” scenario might be inflating the mitigation ambition.

In total, there are more reasons to believe that the calculated impact of states, cities and businesses in the report is currently underestimating rather than overestimating the full impact of these actor groups.

Table 1: Factors leading to underestimation or overestimation of mitigation ambition by sub-national and non-state actors

Factors leading to underestimation of mitigation ambition	Factors leading to overestimation of mitigation ambition
<ul style="list-style-type: none"> • Collection of individual commitments may be incomplete as: <ul style="list-style-type: none"> ○ This US dataset currently only covers companies headquartered in the US ○ More actors are likely to engage in action (We Are Still In campaign, US Climate Alliance, Under2 Coalition) • Collective impact and goals of initiatives that aggregate individual actors are not included • Commitments that cannot be quantified such as financial sector commitments are not included • Systemic impact not covered e.g. 100% renewable targets from large IT companies drives electricity production planning in whole states • Targets could be achieved early and ambition raised along the way 	<ul style="list-style-type: none"> • Assumes all targets will be achieved • Long-term targets are often aspirational • Baseline emissions levels for non-state actors

Conclusion

We show that the currently recorded commitments by sub-national and non-state actors could, if fully achieved, take the US already around halfway towards achieving the higher end of its NDC by 2025.

The analysis shows that sizable emissions reductions are possible from sub-national and non-state actors. There are more reasons to believe that the calculated impact of states, cities and businesses in the report is currently underestimating rather than overestimating the full impact of these actor groups: an increasing number of those actors are taking action and reporting (they may not all be included here), the impact of some commitments is difficult to quantify (e.g. financial sector commitments are not included here), global initiatives support individual actors to make commitments (their goals are not included here) and these actions could lead to systemic, transformative impacts (not considered here).

More sub-national and non-state actions are expected to emerge in the next months and years as illustrated by the momentum behind initiatives such as the US Climate Alliance and the Under2 Coalition, and it will be crucial to continually track their collective ambition as well as the mitigation progress. We plan to continually update our analysis as we develop a more comprehensive dataset including, e.g. more US states, companies signed up to the RE100 initiative and Climate Mayors cities.

Appendix 1: Details of the data and methods used in the analysis

A1.1 Dataset of non-state actions in the US

The dataset of non-state actions in the United States was provided by CDP as part of a scoping exercise for a global climate action dataset undertaken in parallel to the development of the ICAT non-state and sub-national guidance document. It is largely based on the 2016 responses to CDP's climate change, supply chain, and cities questionnaires (CDP, 2017c), as well as responses to the states and regions questionnaire run by CDP in partnership with TCG (CDP and The Climate Group, 2017), and some additional data collected through the Covenant of Mayors and Science-Based Targets initiative.

The CDP dataset on company-level action provides information necessary for the analysis, such as the amount of GHG emissions generated on the U.S. terrain by a company operating worldwide.

To enable the analysis, the dataset is supplemented by additional information on U.S. city- and state-level targets from publicly available sources:

- additional information on cities' targets was taken from the Global Covenant of Mayors for Climate and Energy website (Global Covenant of Mayors for Climate and Energy, 2017).
- For states, data on existing targets was collected from various sources presented in Table A-1. When a target is provided as a range, a midpoint value was used. Historical GHG emissions data between 1990 and 2011 were taken from WRI's U.S. States Greenhouse Gas Emissions database (WRI, 2014).
- city-level historical GHG emissions data (direct emissions) was taken from CDP's Citywide Emissions Map database (CDP, 2017a) and City of Chicago (2008).

In total, we considered 342 non-state actions, of which 22 are from states, 58 from 54 cities including all of the 20 largest cities (in terms of population) with GHG mitigation targets, and 262 from 250 companies headquartered in the U.S. The emissions inventory totals used for the calculations are mostly self-reported by entities. Some actors report multiple commitments for different emission sources, which this analysis treats as separate actions. Others may report overlapping or reinforcing targets for different types of action, e.g. absolute emission reduction targets, intensity targets and renewable energy targets. For the purpose of compilation of this sample U.S. dataset, a hierarchy and criteria were instated to support the presentation of a single action per actor, deemed to be the most encompassing/ambitious. In the preliminary analysis presented in this paper, sector-level targets for regions and states are excluded when community-wide emissions reduction targets exist. For U.S. states, we considered the shortest-term targets and the longest-term targets when targets exist for different future years and linearly interpolated or extrapolated the emission levels for 2025.

All GHG emission values are expressed using the global warming potential (GWP) values from the second assessment report (SAR) of the Intergovernmental Panel on Climate Change (IPCC) (IPCC, 1995). Among the data sources used, the companies' responses to the CDP questionnaire (CDP, 2017c) are encouraged to be reported using the GWP values from the IPCC's Fourth Assessment Report (AR4) (IPCC, 2007). Among the data sources used in this study, the CDP questionnaire for companies encourage the use of GWPs from the IPCC's fifth assessment report (AR5) (IPCC, 2014) for reporting emissions. However, we consider these data to be fully comparable with that reported in SAR GWP terms; Most companies are categorized to be emitting predominantly CO₂, and only around 60 MtCO_{2e} of nearly 2,700 MtCO_{2e} covered in this study is from the "Industrial processes" sector, from which a considerable amount of non-CO₂ emissions are expected.

Table A-1: Overview of U.S. state-level targets (Maryland Commission on Climate Change, 2016; C2ES, 2017; CDP and The Climate Group, 2017; State of Colorado, 2017; State of Hawaii, 2017)

State	Target (including reference levels, target year and assumption(s) if available)	US Climate Alliance
Arizona	50% below 2000 levels by 2040 2000 levels by 2020	No
California*	80% below 1990 levels by 2050 40% below 1990 levels by 2030	Yes
Colorado	26% below 2005 levels by 2025	Yes
Connecticut*	80% below 2001 levels by 2050 10% below 1990 levels by 2020	Yes
Delaware	No quantified state-wide target	Yes
District of Columbia *	80% below 2005 levels by 2050 20% below 2006 levels by 2020	No
Florida	80% below 1990 levels by 2050 2005 levels by 2020	No
Illinois	60% below 1990 levels by 2050 1990 levels by 2020	No
Hawaii*	Aligned with the Paris Agreement	Yes
Maine	75-80% below 2003 levels in the long-term 10% below 1990 levels by 2020	No
Maryland	25% below 2006 levels by 2020 80% below 2006 levels by 2050	No
Massachusetts	75-85% below 1990 levels in the long-term 10% below 1990 levels by 2020	Yes
Minnesota*	80% below 2005 levels by 2050 30% below 2005 levels by 2025	Yes
New Hampshire	75-85% below 2001 levels in the long-term 10% below 1990 levels by 2020	No
New Jersey	80% below 2006 levels by 2050 1990 levels by 2020	No
New Mexico	75% below 2000 levels by 2050 10% below 1990 levels by 2020	No
New York State*	80% below 1990 levels by 2050 40% below 1990 levels by 2030 10% below 1990 levels by 2020	Yes
Oregon *	75% below 1990 levels by 2050 10% below 1990 levels by 2020	Yes
Rhode Island	10% below 1990 levels by 2020	Yes
Vermont*	75% below 1990 levels by 2050 50% below 1990 levels by 2028 10% below 1990 levels by 2020	Yes
Virginia	No quantified state-wide target**	Yes
Washington State*	50% below 1990 levels by 2050 25% below 1990 levels by 2035 1990 levels by 2020	Yes

*: Data provided by CDP, in partnership with The Climate Group.

** : Assumed to be achieving reductions as prescribed in the NDC

A1.2 GHG emission projections

Total GHG emissions in the United States in year t under non-state actions ($E_{\text{tot}}(t)$) are given by:

$$E_{\text{tot}}(t) = E_{\text{totref}}(t) * \frac{E_{\text{totref}}(2015) - E_{\text{NSA}}(2015)}{E_{\text{totref}}(2015)} + E_{\text{NSA}}(t) \quad (1)$$

where

$E_{\text{totref}}(t)$: total GHG emissions under the reference scenario in year t ,

$E_{\text{totref}}(2015)$: total GHG emissions under the reference scenario in year 2015,

$E_{\text{NSA}}(2015)$: total GHG emissions from non-state actors in year 2015,

$E_{\text{NSA}}(t)$: total GHG emissions from non-state actors in year t .

The reference GHG emission trajectory excluding LULUCF ($E_{\text{totref}}(t)$) is based on the current policy projection excluding the Clean Power Plan of the Climate Action Tracker (Climate Action Tracker, 2017b), the details of which are described in Section A1.5.

A1.3 Quantification of overlaps between actions

The quantification of overlaps among actions was conducted in three steps. The below description is based on the upper end projection which assumed state-level commitments only from the US Climate Alliance states.

First, **the overlaps between states and cities** are quantified. We found 35 cities (39 actions) in the 13 US Climate Alliance states. We assumed that both Scope 1 and Scope 2 GHG emissions from these 39 cities occur in these states. When the annual reduction rate of the cities was more ambitious than a linear reduction of 80% from 2015 and 2050, the additional emissions reductions compared to the 80% reduction trajectory were taken into account also for the overlapping portion (Figure A-1).

This approach is a compromise between two extremes: In a conservative case, action by a city with a commitment could be compensated by a very inactive cities or other actors without commitments. The additional effect of the city's commitment would be zero even if it is reducing faster than the state. The ambitious case is that the city's action leads to truly lower emissions and the reduction effort is not compensated elsewhere. Our compromise approach only takes the part of the cities action that is undoubtedly ambitious, i.e. faster than an 80% reduction.

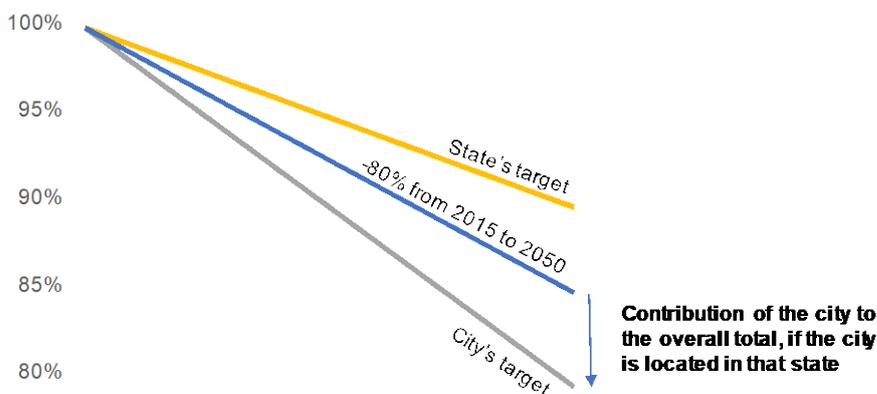


Figure A-1: Illustrative example of contribution to the overall total of a city located in a state with a target

Second, **the overlaps between companies excluding electric utilities** (hereinafter, “energy end-use companies”) **and sub-national governments** (states and cities) are quantified. States and cities cover about 21% of U.S. national GHG emissions in 2016 after subtracting the overlaps quantified in the first step. Based on this, we assumed that 21% of Scope 1 and Scope 2 GHG emissions from all energy end-use companies with targets are overlapping up to 2050. This overlap rate increased to 35% when all 22 states with climate commitments were included.

We took this simplified approach because there is no company-level information available on the amount of GHG emissions generated in individual states or cities. When the energy end-use companies’ actions are collectively more ambitious than a linear trajectory to an 80% reduction between 2015 and 2050, the additional emissions reductions compared to the 80% reduction trajectory were taken into account also for the overlapping portion. The 80% reduction value is based on most region- and city-level targets being in line with a 60-80% reduction between 2015 and 2050.

Third, **the overlaps between electric utilities and all other actors** (sub-national governments and energy end-use companies) are quantified. These overlaps concern Scope 1 emissions of electric utilities and Scope 2 emissions of all other sectors.

For states, we quantified from the state-level GHG emissions data for 2011 (WRI, 2014) that 215 MtCO_{2e} of GHG emissions in 2011 from the 13 US Climate Alliance states were electricity-related. For cities, we assumed that 29% of total GHG emissions covered by mitigation targets are electricity-related. This value was calculated as the share of power sector CO₂ emissions in national total GHG emissions (excluding LULUCF) in 2015 using data from the latest national GHG inventory report (U.S. EPA, 2017). Taking into account the overlaps as described above, we quantified that the 13 states and 54 cities accounted for about 250 MtCO_{2e} or 13% of national power sector CO₂ emissions in 2015.

For energy-end use companies, electricity-related (Scope 2) GHG emissions data from the CDP dataset was aggregated. Energy end-use companies with targets accounted for 77 MtCO_{2e}/yr Scope 2 emissions in 2015, which equals to about 4% of total power sector GHG emissions in the US in 2015.

Based on these numbers, we quantified that about 17% of total power sector GHG emissions are covered by “all other actors”.¹ Based on this, we assume that 20% of GHG emissions from electric utilities with targets are overlapping. Additional emissions reductions were to be taken into account for the overlapping portion when the electric utilities’ actions are more ambitious than a linear trajectory to an 80% reduction between 2015 and 2050, but there was no such instance in the current analysis.

The calculations steps described above can be summarized by the following equation:

$$E_{NSA}(t) = E_R(t) + (E_C(t) - E_{C,R}(t)) + (E_B(t) - E_{B,RC}(t)) + (E_P(t) - E_{P,RCB}(t)), \quad (2)$$

where

$E_R(t)$: Sum of GHG emissions from state actors;

$E_C(t)$: Sum of GHG emissions from city actors;

$E_{C,R}(t)$: GHG emissions from city actors overlapping with U.S. state-level actions;

$E_B(t)$: Sum of GHG emissions from company actors (excluding electric utilities);

$E_{B,RC}(t)$: GHG emissions from energy end-use company actors overlapping with state- and city-level actions;

¹ $1 - (1 - 13.0\%) * (1 - 4.0\%) = 16.5\%$

$E_P(t)$: Sum of GHG emissions from electric utilities actors;

$E_{P,RCB}(t)$: GHG emissions from electric utilities actors overlapping with state-, city-level, and energy end-use company-level actions.

A1.4 Assumptions used for impact quantification

A number of assumptions were made to quantify the net impact of actions, of which the first four are related to the emissions Scope:

1. Scope 3 emissions are excluded from the analysis. While Scope 3 emissions are significant for most companies, it is not possible to quantify the overlaps between Scope 1 and 2 emissions and Scope 3 emissions across actors nor to localize these emissions to specific geographies given current data availability.
2. We applied the emissions composition by Scope of the last reported year (2015 in the current dataset) when the base year and the target year emissions are not reported. Most targets that cover multiple emission Scopes do not specify the breakdown of emissions in the target year by Scope. Similarly, emissions are also often not reported by Scope for the base year of the actions.
3. For regions and cities, we assume that the reduction targets only cover direct emissions. Emissions scope for actions of cities and states are not entirely clear in the CDP dataset (often reported as “community-wide”). The composition of electricity generation-related emissions and other emissions in regions and cities were assumed to be equal to the national average in 2015.
4. The coverage of emissions Scopes for renewable energy targets are not reported in the CDP dataset; the target types are reported instead (“electricity consumption target”, “electricity production target”, and “all energy consumed”). For the analysis, the following assumptions are applied in consistency with the CDP dataset methodology:
 - a. Electricity Consumption targets: Scope 2 (location-based);
 - b. Electricity Production: Scope 1;
 - c. All Energy Consumed: Scope 1+2 (market-based).

Other assumptions are as follows:

5. For long-term U.S. state-level targets that do not specify the target year, we assumed the target year to be 2050.
6. With regard to historical GHG emissions, the U.S. state-level data from WRI CAIT database (WRI, 2014) for 2011 was used as proxy for 2015 emissions data. Similarly for cities, the emissions data for the latest measured year in CDP (CDP, 2017b) was as proxy for 2015 emissions data.
7. For the quantification of absolute emission reduction impact, the values calculated by CDP are used. Many renewable energy targets do not provide information on the future total electricity consumption and/or production levels and on the fossil fuel-fired electricity that the increased renewable electricity is replacing. It was therefore not possible to make our own impact quantification. In its current form, renewable electricity is put into emission terms by assuming future electricity consumption levels will be on par with 2015 and multiplying the associated MWh by the 2015 U.S. average grid emission factor.
8. We assume that the geographical share of GHG emissions per country do not change over time. The CDP dataset on companies provides the share of GHG emissions generated in individual countries in the last measured year (2015), but such data is not always available for the action base year and the target year.

9. We assume for city-level and company-level actions that the emission levels remain unchanged after the target year and a linear interpolation of target emission levels for years between 2015 and the target year.
10. We assume for U.S. state-level actions that the emission levels remain unchanged after the target year and a linear interpolation of emission levels between the short-term target year and the long-term target year.

A1.5 Details of the “Current administration policies” scenario

For the “Current administration policies” scenario, we referred to the current policies projections excluding the Clean Power Plan developed by the Climate Action Tracker (Climate Action Tracker, 2017b). An excerpt of the methodology description is presented below:

“Historical emissions are inventory submissions to the UNFCCC, reported in the Common Reporting Format (UNFCCC, 2016). The US reports their inventory global warming potentials (GWPs) based on the IPCC Fourth Assessment Report. To compare and sum up different gases on a common basis, the reported data were converted into terms of GWPs from the IPCC Second Assessment Report (SAR).

“The current policy projection was done in four steps:

- First, energy-related CO₂ emissions projections were taken from EIA’s Annual Energy Outlook 2017 (U.S. EIA, 2017). The Annual Energy Outlook contains two scenarios: the reference case and the reference case without the Clean Power Plan.
- Second, industrial process CO₂ emissions were projected by applying the future growth rates observed for industrial process GHG emissions in the 2nd Biennial Report to the latest inventory data (UNFCCC, 2016).
- Third, other GHG emission projections were taken from the 2nd Biennial Report (U.S. Department of State, 2016) after conversion to SAR GWP terms. For HFCs and PFCs, the values were converted to SAR GWP terms by applying a correction factor derived from 2010 data reported in the 2014 inventory report (using SAR GWPs) and 2nd Biennial Report (using AR4 GWPs).
- Fourth, all the aforementioned emissions were aggregated and then harmonized to historical data.”

Table A-2 presents main climate change mitigation policies considered under the “Current administration policies” scenario. Under this reference scenario, annual GHG emissions are projected to change from 7,250 MtCO_{2e} in 2005 and 6,640 MtCO_{2e} in 2015 to 6,770 tCO_{2e} in 2025 (-7% from 2005 level).

The Climate Action Tracker emissions projection for 2025 is on the high side of the emissions projections under the Trump administration policies reported in the literature. A recent analysis by the Resources For the Future project 6,760 MtCO_{2e}/year excluding LULUCF (Hafstead, 2017) and Rhodium Group projects 6,350 MtCO_{2e}/year excluding LULUCF under baseline economic growth assumptions (Larsen *et al*, 2017). The emissions projections reported in these two studies are expressed in AR4 GWPs, and the Climate Action Tracker data shows that for the U.S. the emissions values excluding LULUCF are consistently 2% higher for the 1990-2015 period when expressed in AR4 GWPs than when expressed in SAR GWPs. Therefore, these two projections would be about 6,620 MtCO_{2e}/year and 6,220 MtCO_{2e}/year when expressed in SAR GWPs, respectively, and are 150-550 MtCO_{2e}/year lower than the Climate Action Tracker estimate.

Table A-2: Main climate change mitigation policies considered under the Climate Action Tracker's current policies projections for the United States. Source: Climate Action Tracker (Climate Action Tracker, 2017b), based on: (Executive Office of the President, 2013; U.S. Department of State, 2014; United States of America, 2015; N.C. Clean Energy Technology Center, 2016)

Sector	Policy	Description
Economy-wide	Clean Air Act (1963)	Act governed by the EPA that is implemented through actions such as the Clean Power Plan (CPP)
Energy supply	Reduce CH ₄ emissions from oil and gas production	40 – 45% from 2012 levels by 2025 Specific standards for oil and gas production
Transport	Efficiency standards light commercial vehicles (CAFE)	34.1 mpg (14.9 km/l) by 2016, 55 mpg (23.2 km/l) by 2025
	Efficiency standards heavy-duty trucks	Differentiated standards per truck type
	Renewable fuel standard (2015)	Volume of renewable fuel required to be blended into transportation fuel from 9 billion gallons in 2008 to 36 billion gallons by 2022
Buildings	ENERGY STAR Tax credits for buildings	Tax credits for energy efficiency products and solar energy systems
	Building Energy Codes Program	Efficiency codes are adopted at a state level
	Federal Appliance standards	Appliance standards for a large number of appliances
Industry	Curbing emissions of hydrofluorocarbons (HFCs)	Mix of actions to reduce HFCs use and encouraging the use of alternatives

Appendix 2: Supplementary result tables and figures

Table A-3: GHG emissions reductions per sub-national and non-state actor category

Actor category	2015 emissions (MtCO ₂ e)	2025 emissions (MtCO ₂ e)	Change 2015-2025
States			
US Climate Alliance states (13)	1,290	1,090	-190 (-15%)
All 22 states	2,240	1,850	-390 (-17%)
Cities	310	240	-70 (-22%)
Energy end-use companies	230	170	-60 (-25%)
Electric Utilities & Independent Power Producers & Energy Traders	600	560	-40 (-7%)

* Values are rounded to the nearest ten.

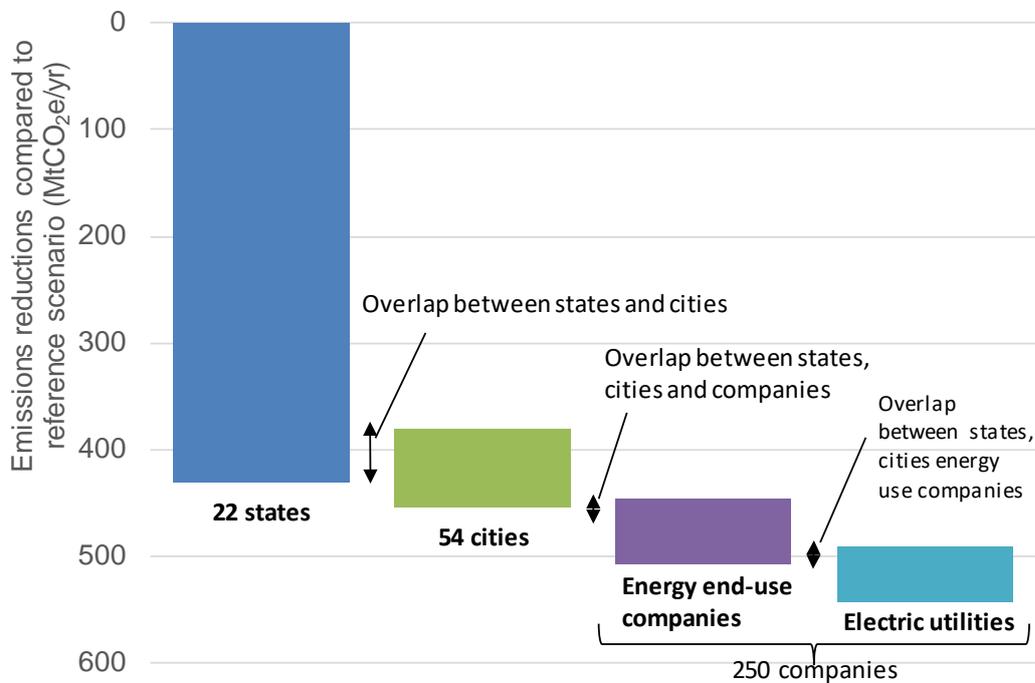


Figure A-2: GHG emission reductions committed for 2025 (compared to the reference as defined in this analysis) by sub-national and non-state actors: individual contributions per actor category (gross total, bars) and overlaps (overlaps of the bars), and the net aggregate impact expected from all commitments covered by the analysis. The breakdown is shown for the case with 22 states that committed to climate action.

Glossary

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

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

Non-state and sub-national action: Any kind of activity that is directly or indirectly aimed at reducing GHG emissions and that is led by non-state and sub-national actors. Actions 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).

Non-state and sub-national commitments: Planned non-state and sub-national action which have been publicly announced. However, in contrast to the non-state and sub-national actions, implementation of the action is not yet underway. In practice though, the difference between commitments and action is often not clear. For example, planning how to implement a target could be considered an action. This report therefore considers both existing actions underway and planned commitments.

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NewClimate – Institute for Climate Policy and Global Sustainability gGmbH

Cologne Office

Am Hof 20-26
50667 Cologne
Germany

T +49 (0) 221 999833-00

F +49 (0) 221 999833-19

Berlin Office

Brunnenstraße 195
10119 Berlin
Germany

E info@newclimate.org

www.newclimate.org

