



HOW U.S. CITIES WILL GET THE JOB DONE

C40
CITIES
CLIMATE LEADERSHIP GROUP

ARUP

An analysis of the contribution U.S. C40 cities can make to delivering the Paris Agreement objective of limiting global temperature rise to 1.5 degrees Celsius.

REPORT DONORS



This Special Report on U.S. cities has been delivered through a collaborative partnership between C40 and Arup, the global consultancy firm. It is based on a larger report and research programme called *Deadline 2020: How cities will get the job done*. Arup has worked with C40 since 2009 to develop strategic analysis and research that is central to progressing our understanding of how cities contribute to climate change mitigation and adaptation. In June 2015, Arup announced a major partnership with C40, committing \$1 million of professional support over three years to help cities take meaningful action against climate change.



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THE TIME FOR CITY ACTION IS NOW

EXECUTIVE SUMMARY

The United States' commitment was a major step forward for the Paris Agreement, representing 15% of global greenhouse gas emissions. It also provided a clear signal to states, cities, businesses and investors within the U.S. about the future trajectory towards low carbon growth and climate resilient development. Today – at the dawn of a new presidential term – there is confidence among cities and other 'non-state' actors about the urgency of climate action.

This report and its findings reinforce the positive influence and action seen from U.S. C40 cities to date, with plenty of reasons to be confident that this will continue.

Specifically, the leading findings from this work can be summarised as:

- **We have a 'Deadline 2020' for limiting temperature rise to 1.5°C.**
Action in the next four years will determine if it is possible for cities to get on the trajectory required to meet the ambitions of the Paris Agreement. If insufficient action is taken over this period, limiting temperature rise to below 1.5°C will be impossible.
- **U.S. C40 cities can and want to play a pivotal role in this.**
Between now and 2020, 1,666 actions are required in U.S. C40 cities, delivering 131 MtCO₂e tonnes of savings, or 7% of the total across all C40 cities. The intention to act is clear, with U.S. C40 cities reporting that they intend to expand 91% of their existing climate actions.
- **U.S. C40 cities are already leading the way.**
Preliminary estimates indicate U.S. C40 cities have already invested on average \$2.91bn per city on climate action, compared with non-U.S. cities' \$2.16bn per city. This has unlocked 2,382 individual climate actions since 2011.
- **C40 cities are some of the most collaborative in the world,** with 37% of their actions carried out via networking, compared with 19% for non-U.S. cities. Based on their excellent legacy of collaboration and action, we can have confidence that they can scale this up to deliver what's needed.
- **If all other U.S. cities follow suit, the impact will be tremendous.**
If all U.S. cities were to follow the lead of C40 cities, pursuing deep, rapid emissions reductions, cumulative savings would ramp up from **4GtCO₂e by 2025, to 13 GtCO₂e by 2030, reaching 454 GtCO₂e by 2100.** This represents 6% of the global cumulative savings necessary for a 1.5°C limit scenario.
- **This will deliver wide ranging benefits.**
Achieving the ambitions of the Paris Agreement will demand \$506 billion of investment in transport infrastructure, creating many jobs and improving urban infrastructure for millions of citizens.

THE NUMBERS

2,382

**ACTIONS TAKEN
BY U.S. C40
CITIES TO DATE**

1 IN 5

**U.S. CITY DWELLERS
LIVES IN A C40 CITY**

30%

**OF U.S. GDP
GENERATED IN
U.S. C40 METRO AREAS**

37% OF THESE
ACTIONS
INVOLVED

INTERNATIONAL COLLABORATION

1,666

**NEW ACTIONS
NEEDED BY 2020**

U.S. CITIES COLLECTIVELY CAN DELIVER

6% OF GLOBAL
CUMULATIVE
SAVINGS

**NECESSARY FOR A
1.5 DEGREE WORLD**

2 INTRODUCTION

2.1 A global climate agreement and now a routemap for cities to follow

This Special Report presents the U.S.-specific findings from a major new piece of research undertaken by C40 and Arup. *Deadline 2020: How Cities Will Get the Job Done*,¹ provides an important illustrative pathway for moving beyond the ambition of the Paris Agreement to deliver action on the ground. *Deadline 2020* shows what is needed of C40 cities, representing 650 million people and 25% of the world's GDP, to deliver emissions trajectories consistent with limiting global temperature rise to 1.5°C.²

Research and analysis for this report has identified C40 cities' share of the remaining global carbon budgets to 2100, both for 1.5°C and 2°C temperature rise scenarios. Target emissions trajectories that will enable cities to meet these budgets have been established for 84³ member cities. City-specific action pathways to meet the target trajectories have also been identified. These include the pace, scale and prioritisation of action needed between now and the end of the century. The analysis will be provided to C40 members and used in discussions on future C40 action.

2.2 This Special Report: A United States perspective

On September 3, 2016, the United States formally ratified the Paris Agreement adopted by 190 countries at CoP21. This Special Report considers what this means for the 12 C40 cities in the United States, drawing attention to the role they are currently playing and action they must continue to take in addressing global climate change. The report also demonstrates how U.S. C40 cities are contributing to the development of a thriving low-carbon economy for the United States, showing that urban regeneration and economic growth can be delivered in tandem with climate goals. Finally, the report considers the potential influence these U.S. C40 cities could have on the 758⁴ large cities across the United States.

1. http://www.c40.org/other/deadline_2020
2. This report uses "1.5 degrees" and "2 degrees" as shorthand for scenarios that limit global warming to less than 1.5°C and 2°C above pre-industrial levels respectively.
3. The number of C40 member cities at the time of analysis, which is lower than the number of members at the time of publication. See methodological report for full list of included cities http://www.c40.org/other/deadline_2020
4. 758 cities with populations greater than 50,000 people.

3 CITIES OF THE UNITED STATES

U.S. cities have an indisputably important role to play, not only in the C40 network but in the wider world.

3.1 A significant constituency

The U.S. is amongst the world's most urbanised nations, and cities play a pivotal role across the country.

- 86% of the United States' population is urban.⁵
- There are 758 U.S. cities with populations of over 50,000 people, the total metropolitan⁶ population of which is 124 million.⁷
- By 2050, it is expected that the city population in the U.S. will grow by 20%, from 124 million today to 149 million. Metropolitan populations will grow by 12%, from 275 million to 360 million people.⁸

Of those U.S. cities, some of the most significant are part of the C40 group of cities.

- 1 in 5 U.S. city dwellers lives in a C40 city.
- The 12 C40 mayors in the U.S. currently represent 7% of the U.S. population within their administrative boundaries. When metropolitan areas are taken into account, C40 cities include 25% of the U.S. population.

NEW YORK CITY
LOS ANGELES
CHICAGO
HOUSTON
PHILADELPHIA
AUSTIN

SAN FRANCISCO
PORTLAND
WASHINGTON D.C.
BOSTON
SEATTLE
NEW ORLEANS

Not only do cities represent a critical and growing share of the U.S. population, but the vast majority of the nation's GDP is generated in cities too.

- In 2015, 90.8% of U.S. GDP was generated in metro areas.⁹
- In 2015, the ten highest-producing metropolitan economies in the U.S. generated \$6.2 trillion in economic value, more than the total value output of 37 U.S. states.¹⁰

- The C40 cities in the U.S. currently contribute 9% of national GDP, or 30% within their metropolitan zones.¹¹

3.2 U.S. cities are powerful, independent and principled actors

The U.S. federal system endows cities with greater powers than many cities elsewhere in the world. The system allows state and city governments to set policy and targets, design laws and standards, implement financial mechanisms to develop and support markets (e.g. green bonds), and enforce regulatory compliance. These are key levers through which climate actions can be – and are already being – delivered, and through which a thriving low-carbon goods and services sector is being developed.

U.S. cities have high levels of power to take climate action due to their ownership of key assets; ability to set and control budgets for city functions; and ability to set their own vision and policy. C40/Arup research shows that C40 cities in the U.S. have stronger powers to set their own vision and enforce policy than non-U.S. cities (around 10% higher than the average).¹² Compared with other regions, mayoral powers are particularly strong in relation to Finance (33% higher than the average for C40 cities), Water (19% higher), Outdoor Lighting (16% higher), Buildings (9% higher), and Energy Supply (7% higher).

The 12 C40 cities are among the most important constituencies in the U.S. Their powers have enabled them to take transformative climate actions that stimulate systemic change.

- Washington D.C. has high powers over its power purchasing and entered into a 20-year Power Purchase Agreement (PPA) to supply 30% of the District government's electricity from a dedicated 46 megawatt wind farm. The PPA is projected to save District taxpayers \$45 million over the next 20 years through lower electricity rates. D.C. is further expanding energy investments including a 12.5 megawatt solar project and cutting edge energy efficiency programmes.
- San Francisco is in the special position of having full powers over a number of transport assets such as city roads and pavements and transport systems such as inter-city rail and freight systems, trams, buses and the municipal fleet. It is currently in the process of piloting procurement EV infrastructure and vehicles. Telematics are being installed in the municipal fleet to improve operational efficiency and achieve fuel reductions, and in 2015 the city switched the fleet to 100% renewable diesel.

5. Annual Estimates of the Resident Population for Incorporated Places of 50,000 or More, Ranked by July 1, 2015. <http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkml>

6. Metropolitan population includes the wider urban area surrounding the city's administrative boundary.

7. Annual Estimates of the Resident Population for Incorporated Places of 50,000 or More, Ranked by July 1, 2015. <http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkml>

8. Based on Arup analysis of UN data. UN Department of Economic and Social Affairs, World Urbanisation Prospects: The 2014 Revision.

9. U.S. Metro Economies. GMP and Employment Report: 2015-2017. <http://usmayors.org/metroeconomies/0616/keyfindings.pdf>

10. Based on data provided by C40 cities through the CDP Cities and GPC data collection platforms.

11. Based on data provided by C40 cities through the CDP Cities and GPC data collection platforms.

12. Arup-C40, 2015. Powering Climate Action: Cities as Global Changemakers. http://publications.arup.com/publications/p/powering_climate_action_cities_as_global_changemakers

- Austin Energy is a publicly owned utility providing energy supply throughout the city. Operations are funded entirely through energy sales and services, and profits are returned to the city's general fund to finance energy and other city services. Renewable energy including wind, solar and biomass facilities make up 23% of the utility's energy generation. Austin Energy's Green Building programme also rated homes and commercial buildings on their energy efficiency and sustainable building practices. In 2013 alone, it rated more than two million square feet of commercial space and 1,500 multifamily units. The city's ownership of the utility and related energy assets has enabled this concerted climate action.

3.3 U.S. C40 cities are already pioneers of climate action

U.S. C40 cities are amongst the most active in the world on climate change. C40 cities in the U.S. have already demonstrated climate leadership in terms of the significant number and scale of actions taken, and the magnitude of investment made. To date, the average number of city-wide climate actions taken per city in the U.S. is 63% more than that of cities in the rest of the world (199 in the U.S. vs 122 elsewhere). Of the 2,382 actions reported since 2011, U.S. cities are taking 22% of all actions in the C40, but only represent 5% of total C40 population.

Since 2011, U.S. C40 cities have increased their climate action almost seven-fold. In particular, they are together taking 500 actions in the Buildings sector, and 408 actions in the Adaptation sector. Across the Transport sector, over 450 actions are being taken, while Waste and Water Systems are seeing over 430 actions.

Of all new city-wide actions reported by C40 cities in 2016, 41% were implemented in U.S. cities. U.S. cities took 584 new actions at a city-wide scale in 2016 relative to 2015. Furthermore, 60% of actions reported in U.S. cities in 2016 were at a city-wide scale, versus 45% at city-wide scale in non-U.S. cities. These actions include some of the most innovative in the C40 network - from creating a market for stormwater control in Washington D.C. to building a landmark bridge for trains, bikes and pedestrians - but not cars - in Portland.

U.S. C40 cities are already investing substantially to create a growing and highly demand-driven market for climate action. On average they have invested 26% more than cities in the rest of the world; U.S. cities on average invested \$2.91bn per city compared with \$2.6bn for non-U.S. cities. U.S. cities represent 18% of total investment in climate action across all C40 cities thus far, whilst only accounting for 5% of the C40 population.

Figure 1. Break down of estimated total U.S. C40 city spending on climate action to date (U.S.\$ Billion)



3.4 U.S. C40 cities will continue to lead the way in international collaboration on climate change

The growth of climate action in U.S. cities has been built on international collaboration with other C40 and non-C40 cities. U.S. C40 cities are some of the most collaborative in the world with 37% of their actions carried out via networking, compared with 19% for non-U.S. cities. U.S. C40 cities are working with cities in a specific C40 network almost twice as often as non-U.S. cities, and with non-C40 cities four times as often as non-U.S. cities.

For example, informed by discussions with Washington D.C. through C40's Sustainable Urban Development Network, Johannesburg is exploring new strategies, such as the use of Tax Increment Financing (TIF) notes. Washington D.C.'s experience led Johannesburg to rethink the strategy not as a standalone financial mechanism, but as an integrated planning approach to neighbourhood improvement.¹³

Los Angeles has been an active member of the U.S.-China Climate Leaders Summit, which promotes exchange between mayors in both countries on how to reduce local emissions.

Research by Arup/C40 found that Houston is delivering the highest number of actions of any C40 city through networking and collaboration. That's 70% of the city's total actions. Houston has shown leadership in its ability to collaborate on a number of issues. In 2014, the city partnered with

13. Arup-C40, 2015. Climate Action in Mega-Cities 3.0. <http://cam3.c40.org/#/main/home>

private sector providers to convert 165,000 conventional light bulbs to LEDs. This is expected to reduce the city's street light electricity usage by around 50%, whilst reducing municipal emissions by 5%, and saving the city around \$1.4 million on its annual electricity bill. Long-term reductions in maintenance costs are also expected to offset the up-front cost of installation.¹⁴ There are many other examples of how U.S. C40 cities are collaborating to share best practices and accelerate action around the world.

Example: Following collaboration through the C40 Sustainable Infrastructure Finance Network, Portland adopted a resolution backing green bond issuance in the city in 2015. Green bonds can support cities with financing the infrastructure needed to reduce carbon emissions and become more resilient to the effects of climate change. Portland's action could support the wider development of the green bond market in cities, with a number of C40 cities actively interested in progressing their own green bond programmes.¹⁵



4 CLIMATE INACTION YIELDS INESTIMABLE COSTS FOR U.S. CITIES

In cities across the U.S., climate related events are already a significant burden on public spending and the private sector. Two of the costliest weather events of all time have occurred in C40 cities during the past decade: Superstorm Sandy in New York (2012, \$65 billion in damage) and Hurricane Katrina in New Orleans (2005).¹⁶ Hurricane Katrina caused \$81 billion in property damage, but it is estimated that the total economic impact may exceed \$150 billion. The 10-year average cost of fighting wildfires in California has increased by \$700 million since 1995.¹⁷ These costs are passed directly and indirectly to the taxpayer.

According to research from C40 and Arup, all 12 U.S. C40 cities, acknowledged future risks from flash and surface flooding and heat waves, with over two thirds rating the probability as medium-high to high.¹⁸ Eight cities expect high risks from extreme hot days, while five warn of the high probability of drought. 98% of these changes are expected to occur in the short to medium-term. No city expects climate hazards to decrease in frequency or intensity.

The cost of inaction on climate change will be extremely high. Major impacts for cities and communities will include business interruption, failure in supply chains, temporary or permanent loss of household incomes, as well as losses of life and property. If U.S. mayors do not act to protect their cities, they risk impacts today and a loss of competitiveness on the international stage in the eyes of investors.

But urban infrastructure can be planned and designed effectively for resilience to weather-related hazards. Research undertaken by Siemens and Arup found that investments in the resilience of New York City's energy supply systems could reap financial savings of up to \$4 billion based on improved efficiency and reliability, reduced greenhouse gas emissions, and decreased losses in transmission and distribution.¹⁹

14. Sustainia. <https://issuu.com/sustainia/docs/cities100/917e=4517615/31305566>
15. Arup-C40, 2015. Climate Action in Mega-Cities 3.0. <http://cam3.c40.org/#/main/home>

16. National Oceanic and Atmospheric Administration (NOAA) data.
17. California Today: The Steep Costs of Fighting Wildfires. New York Times, 5th October 2016.
18. Arup/C40, 2015. Climate Action in Megacities 3.0. <http://cam3.c40.org/#/main/home>
19. Toolkit for Resilient Cities, Siemens/Arup, 2013.

TOP THREE HAZARDS FOR EACH U.S. C40 CITY

SEATTLE

MOST COMMON HAZARDS AND RISK LEVEL

FLASH/SURFACE FLOOD	20
COASTAL FLOOD	20
HEAT WAVE	15

PORTLAND

MOST COMMON HAZARDS AND RISK LEVEL

HEAT WAVE	20
LANDSLIDE	20
FLASH/SURFACE FLOOD	20

SAN FRANCISCO

MOST COMMON HAZARDS AND RISK LEVEL

DROUGHT	25
COASTAL FLOOD	20
STORM SURGE	20

LOS ANGELES

MOST COMMON HAZARDS AND RISK LEVEL

DROUGHT	25
FOREST FIRE	25
COASTAL FLOOD	25

MOST COMMON CLIMATE HAZARDS FOR USA

MOST COMMON HAZARDS	AVERAGE RISK LEVEL
FLASH/SURFACE FLOOD	19
HEAT WAVE	17
EXTREME HOT DAYS	16
RAIN STORM	12
COASTAL FLOOD	19

CHICAGO

MOST COMMON HAZARDS AND RISK LEVEL

FLASH/SURFACE FLOOD	16
RAIN STORM	16
HEAVY SNOW	12

AUSTIN

MOST COMMON HAZARDS AND RISK LEVEL

DROUGHT	25
FLASH/SURFACE FLOOD	25
FOREST FIRE	25

HOUSTON

MOST COMMON HAZARDS AND RISK LEVEL

DROUGHT	25
TROPICAL STORM	25
STORM SURGE	25

HOUSTON

Extreme hot days increase energy use in buildings, contribute to higher ozone levels, can be potential causes for brownouts, which can lead to increased levels of PM 2.5 and PM 10, and can lead to heat-related illnesses/death. Increased energy usage also means increased water usage for the energy production at power plants.

NEW ORLEANS

MOST COMMON HAZARDS AND RISK LEVEL

CYCLONE (HURRICANE/TYPHOON)	25
TROPICAL STORM	25
COASTAL FLOOD	25

NEW ORLEANS

Floods have been and continue to be the most frequent, destructive, and costly natural hazard facing Orleans Parish. As of July 2015, Orleans Parish was ranked number one in the state of Louisiana, with \$7.2 million in total flood insurance payments since 1978. Louisiana has the largest number of repetitive loss properties of any state, and, since the inception of the National Flood Insurance Program in 1968, has the largest numbers of claims and total amounts of claims nationally.

BOSTON

Due to changes in ocean current and other dynamic factors, sea-level rise in Boston (and in the Northeast U.S. generally) is likely to be higher than the global average. A two-foot rise in sea level will turn the current 100-year flood into a 3-year flood. A six-foot rise in sea level will cause regular inundation of several areas of Boston.

Increased sea level rise will further exacerbate the impacts of storm surge on Boston's coastline, where significant commercial, residential, and transportation assets are located.

BOSTON

MOST COMMON HAZARDS AND RISK LEVEL

COASTAL FLOOD	20
HEAT WAVE	12
RAIN STORM	12

NEW YORK CITY

MOST COMMON HAZARDS AND RISK LEVEL

COASTAL FLOOD	25
HEAT WAVE	25
PERMANENT INUNDATION	12

PHILADELPHIA

MOST COMMON HAZARDS AND RISK LEVEL

FLASH/SURFACE FLOOD	20
RIVER FLOOD	16
HEAT WAVE	12

WASHINGTON D.C.

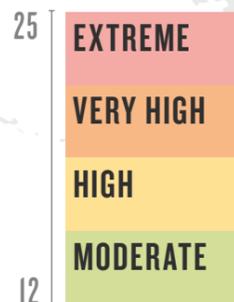
MOST COMMON HAZARDS AND RISK LEVEL

HEAT WAVE	25
EXTREME HOT DAYS	15
FLASH/SURFACE FLOOD	15

WASHINGTON D.C.

Heat waves are expected to be hotter and last longer. According to downscaled climate change projections developed by D.C., in the past, the average heatwave in D.C. lasted just under 5 days. In the future, the average length is expected to be around 6 days by the 2020s, 8 to 9.5 days by mid-century, and 9.5 days to 12 by the 2080s.

Vulnerable populations including the elderly, homeless residents, low income residents and those with medical conditions are most at risk for heat stroke and other heat related health conditions. Heat waves will also impact energy infrastructure, as peak demand for cooling could strain the distribution system, and transportation as existing roads and rail lines were not designed for temperature extremes expected by the 2080s.



Cities report the climate hazards they currently face using the Climate Hazard Taxonomy. They then rate the 'consequence' and 'likelihood' of these hazards on a five point scale. Risk from each hazard is calculated by multiplying the consequence and likelihood scores.

5 CLIMATE ACTION YIELDS MULTIPLE BENEFITS FOR U.S. CITIES

In the U.S., the growth of the renewable energy sector is having a positive impact on local job creation, economic development, air quality, and other social, environmental and economic factors.

Jobs

According to the Georgetown Climate Center, from 2011 to 2014 installed wind energy capacity grew by more than 40% nationally, while solar capacity grew by 577%.²⁰ In 2016, renewable energy jobs across the country – mostly in wind and solar – increased by 6%. The U.S. is now one of the world’s leading employers in renewable energy with 769,000 people working in the sector in 2016.²¹

In San Francisco between 2003 and 2010, clean tech jobs grew annually by 5-13%, far outpacing the 4.2% national job creation rate.²² In 2013, 4,758 green job listings were posted in clean technology, energy efficiency and energy storage in the city.²³

In 2014, Illinois’ clean energy industry employed more than 100,000 people, showing a 7.8% increase in 15 months. The growth of this market has created jobs directly related to clean energy including a mix of highly skilled and less technical positions. It has also provided a boost to other related industries including engineering, research, manufacturing, installation and maintenance services.²⁴ The City of Chicago is contributing to the ongoing development of this sector, with programmes such as the Retrofit Chicago Energy Challenge, which aims to improve energy performance across municipal, commercial, institutional and residential buildings throughout the city.²⁵

Growth

The renewable energy manufacturing industry is expanding, bringing further economic benefits to the U.S. There are now more than 500 U.S. factories manufacturing parts for wind turbines across 43 states, producing more than 8,000 components. Growth of this manufacturing sector is driving up demand for local manufacturers to supply turbine subcomponents, providing a boost to the supply chain and representing a major market opportunity for U.S. manufacturing companies in this area.²⁶

In a letter to the federal government, 365 companies and major investors – including Mars, Nike, Levi Strauss and Starbucks – emphasised their “deep commitment to addressing climate change”, stating that “failure to build a low-carbon economy puts American prosperity at risk” but “the right action now will create jobs and boost U.S. competitiveness.”

Environmental quality

Analysis of U.S. Renewable Portfolio Standards (RPS) in 2013 found economic benefits of an average of \$2.2 billion from reduced greenhouse gas emissions, and another \$5.2 billion in benefits from reductions in air pollutants.²⁷ Studies have shown enormous local air quality improvements associated with building energy retrofits; for example, while an oil fired boiler may emit 120mg/kWh of local NOx, electric heat pumps and solar thermal emit 0mg/kWh.²⁸

Energy independence

The National Renewable Energy Laboratory (NREL) has found that renewable energy sources have the technical potential to supply the U.S. with 118 times the nation’s current electricity demand.²⁹

Health and social benefits

Climate action can bring health and social benefits to U.S. cities. Shifting to cleaner fuels carries with it the potential to improve public health outcomes, reduce premature mortality and minimise lost workdays. Air and water pollution emitted by coal and natural gas plants is linked to breathing problems, neurological damage, heart attacks, and cancer. The national economic cost associated with these impacts is between \$362-887 billion, or 2.5-6% of GDP. Moving away from fossil fuels therefore has the potential to lower the nation’s overall healthcare costs.³⁰

20. <http://www.georgetownclimate.org/articles/new-report-shows-u-s-states-leading-a-shift-to-clean-energy.html>
21. http://www.se4all.org/sites/default/files/IRENA_RE_Jobs_Annual_Review_2016.pdf
22. <http://www.bayareacouncil.org/economy/green-jobs-actually-are-sprouting-in-bay-area/>
23. As defined by the Bureau of Labor Statistics: http://www.bls.gov/green/green_definition.html
24. <http://www.cleanjobsillinois.com/2015/#ch/soaring>
25. <http://www.retrofitchicago.net/about>
26. AWEA. <http://www.awea.org/Issues/Content.aspx?ItemNumber=5081&navItemNumber=704>

27. <https://emp.lbl.gov/publications/retrospective-analysis-benefits-and-reducing-air-pollution-from-your-building-a-series-of-manuals-for-operators-designers-developers>. Manual A - Minimising air pollution during building use (2013). Par Hill Research. <https://www.cleanerairforlondon.org.uk/sites/default/files/Factsheet%20A4%20-%20Select%20the%20right%20heating%20system.pdf>
28. <https://www.cleanerairforlondon.org.uk/sites/default/files/Factsheet%20A4%20-%20Select%20the%20right%20heating%20system.pdf>
29. Though the full extent of this potential may not be realised immediately due to conflicting requirements. NREL. 2012. U.S. Renewable Energy Technical Potentials: A GIS -Based Analysis. <http://www.nrel.gov/docs/fy12osti/51946.pdf>
30. Machol, Rizk. 2013. <https://www.ncbi.nlm.nih.gov/pubmed/23246069>

6 A BRIGHT FUTURE OF CONTINUED U.S. CITY LEADERSHIP ON CLIMATE CHANGE

6.1 Deadline 2020: four years to get on track

The next four years will determine whether or not the world's megacities can deliver their part of the ambition of the Paris Agreement.

Without action by cities, the Paris Agreement cannot realistically be delivered. The business-as-usual path of C40 cities' emissions needs to 'bend' from a projected increase of 35% by 2020 (based on business-as-usual scenarios), to peak at only 5% higher than today's emissions. This 'bending of the curve' is required now to ensure that in the coming decades the necessary reductions remain feasible, given that actions can take many years to mature and reach full scale.

6.2 U.S. cities in particular are critical to achieving this ambition

U.S. city emissions are amongst the highest of all C40 cities, and so need to drop most rapidly. C40 cities are pioneers within the U.S., setting the bar high for other cities – and business – to follow. But when compared with C40 cities in other regions, the story is different; the average per capita emissions of U.S. C40 cities is significantly higher than their peer cities in other regions. U.S. C40 cities are currently responsible for 10% of the annual C40 carbon budget. The U.S. cities need to achieve a substantial emissions reduction in a short space of time to remain within the target of 1.5°C global temperature rise.

- Average per capita emissions across all C40 cities need to reach 2.9 tonnes of CO₂e per capita by 2030.
- For high GDP and high-emitting cities like those in the U.S., that means an immediate and steep decline in emissions³¹ from the national average of 21 tonnes of CO₂e per capita.
- U.S. C40 cities require somewhat less of a reduction than U.S. cities as a whole, but they still must drop from the average 10 tonnes of CO₂e per capita.
- To stay within the 1.5°C trajectory, U.S. C40 cities will need to reduce their emissions from 10% of the annual C40 carbon budget in 2016, to 1% in 2036. The steepest part of this decline will need to occur in the first four years.

For a climate safe future, business as usual is not an option for U.S. cities.

In the absence of measures to decouple economic activity and emissions, anticipated economic and population growth is likely to drive up emissions significantly over the coming decades. In fact, if the 758 U.S. cities with populations over 50,000³² were to halt progress towards decarbonisation, their BAU trajectory would see them emit 475 GtCO₂e to 2100, single-handedly using up the global budget for a 1.5°C limit scenario.

6.3 How U.S. cities can continue to lead

C40 cities in the U.S. are committed to continuing large-scale emissions reductions through an ever-increasing number and scale of climate action. For example, the Retrofit Chicago Energy Challenge expanded this year to cover 62 buildings and 43 million square-feet – making it one of the largest voluntary energy efficiency programmes in the country.³³

Maintaining this momentum of accelerating and expanding climate action will be critical for U.S. cities to meet their commitments under the Paris Agreement. This will require continuing support from the federal, state and business levels.

U.S. C40 cities intend to continue expanding their action by building on established success. C40 U.S. cities report plans to expand 91% of their existing climate actions. But there is still much to be done and U.S. C40 cities will play a pivotal role in achieving what is required.

A tremendous increase in action is required in the next 4 years. By 2020, 1,666 new actions must be initiated by C40 cities (138 per city), with the majority of these being in the buildings sector (819) and energy sector (275). This is 12% of the action required by all C40 cities across this time period.

- Buildings Action: 819 actions are needed in U.S. C40 cities over the next four years, such as commercial building retrofit and energy performance ratings for new construction.
- Transport Action: 211 actions are needed over the next four years, such as bus rapid transit and electric vehicle system expansion.
- Energy Action: 275 actions are needed over the next four years, such as district scale energy and investment in renewable generation and storage.

This action will attract huge levels of investment. \$48 billion in new investment is expected to be committed to long-term climate actions across U.S. C40 cities by 2020. This represents 13% of the global investment needed by C40 cities to stay within the 1.5°C target. Of this, \$42 billion must be committed in the next year alone. In 2021 a further major injection of capital (\$32 billion) will be needed to catalyse a second wave of new and expanded climate action. Figure 2 shows the sectors likely to receive the greatest investment. U.S. cities' transportation infrastructure is set to receive a significant boost, with city waste and energy infrastructure also benefiting significantly.

31. Arup/C40. 2016. Deadline 2020. http://www.c40.org/other/deadline_2020

32. Annual Estimates of the Resident Population for Incorporated Places of 50,000 or More. US Census Bureau, Population Division. 2015.
33. https://www.cityofchicago.org/city/en/depts/mayor/press_room/press_releases/2016/july/Retrofit-Chicago-Energy-Challenge.html

Figure 2. Breakdown of U.S. city investment pipeline between 2016 and 2050 (U.S.\$ Billion)

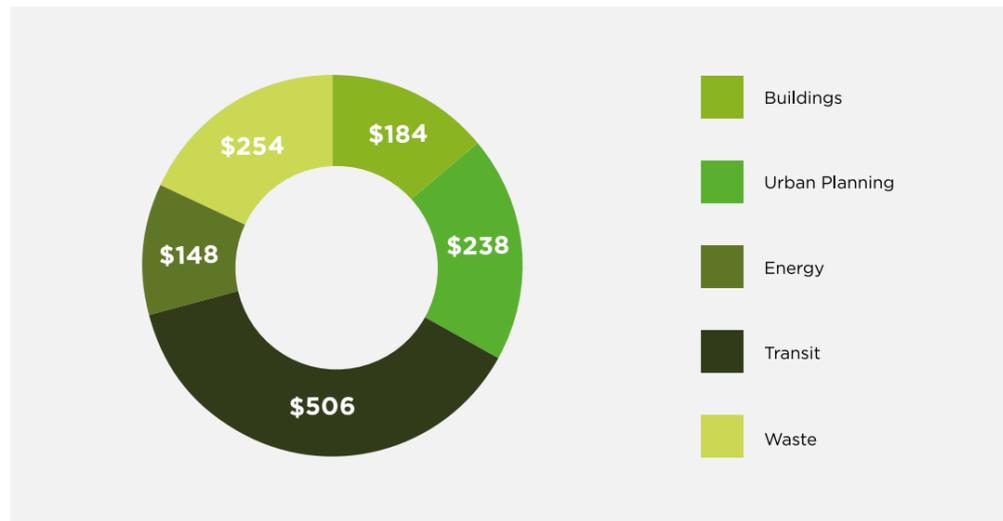
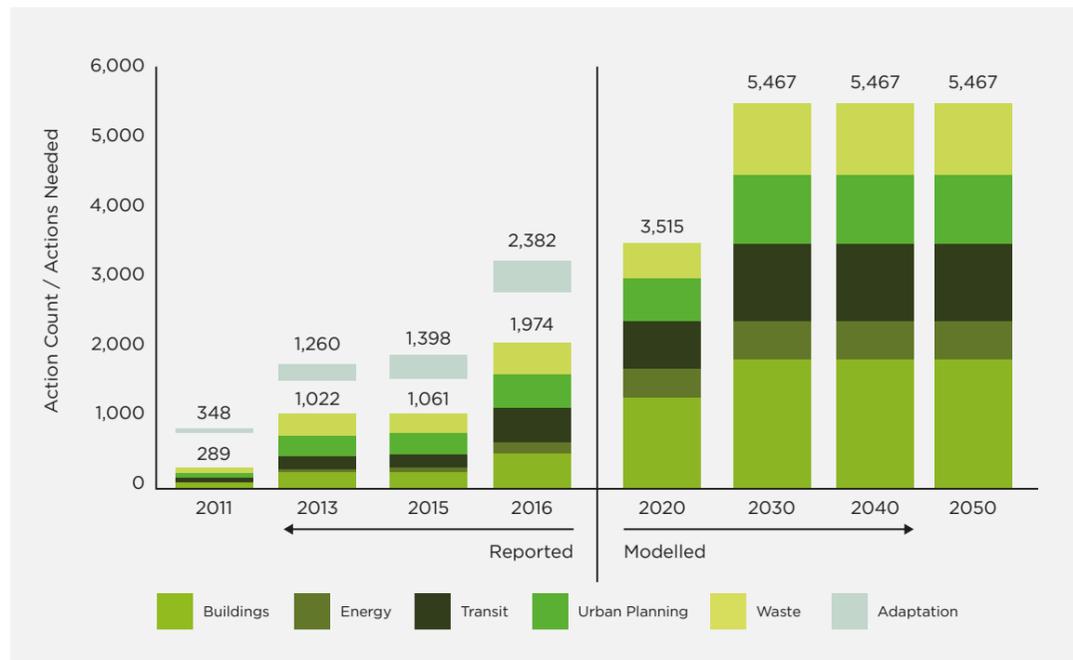


Figure 3. Historic reported action profile for U.S. cities, and the scale of action required over the next years.



U.S. C40 cities can move forward with much of this right away.

Just under half of the emissions savings identified in this routemap can be delivered directly by cities or through collaboration between C40 city governments, at a city-level.

The impact of this climate action by U.S. C40 cities will be 131 MtCO₂e saved by 2020, or 7% of the reduction needed across all C40 cities.

In 2030, the impact increases to 1,900 MtCO₂e and 8% of total reductions needed across all C40 cities. By 2050, U.S. C40 cities will achieve reductions of 12,200 MtCO₂e.

If all U.S. cities took actions similar to those being planned by C40 cities, they could deliver 36% of the emissions reductions needed to reach the U.S. Paris Agreement Pledge.

As its contribution to the Paris Agreement, the U.S. committed to reduce economy-wide GHG emissions by 19-21% below 2015 levels by 2025.³⁴ If all U.S. cities with populations over 50,000 followed the ambitions of C40 cities, however, they could collectively deliver emissions reductions equivalent to 28% of city emissions, representing 36% of the total necessary to hit the U.S. target by 2025.

By 2030, U.S. cities will be transformed. As many actions as possible need to be underway before 2030 - indeed by 2028 they should have all been commenced. This is due to the existing high emissions of U.S. cities, and their need for rapid reductions. They need to act earlier than the rest of the C40 cities, which as a group must have all required actions underway after 2030.

This leadership, if adopted by all U.S. cities, will make a huge contribution globally.

If all U.S. cities were to follow the action routemaps of C40 cities, pursuing deep, rapid emissions reductions via similar combinations of climate actions on buildings, transit and waste that are currently within their control, cumulative savings would ramp up from 4GtCO₂e by 2025, to 13 GtO₂e by 2030, reaching 454 GtCO₂e by 2100. This represents 6% of the global cumulative savings necessary for a 1.5°C limit scenario, and 10% of savings achievable in all global cities with populations over 100,000.³⁵

This leadership is already underway across the U.S. More than 100 U.S. cities have joined the Global Covenant of Mayors for Climate & Energy, a global coalition of city officials committed to lowering local emissions. 36 major U.S. cities, including New York, Chicago, Los Angeles and Atlanta, have set emissions reduction targets of 80% or higher by 2050. 62 cities are on track to meet or exceed federal climate targets.³⁶ Strong leadership, a supportive policy framework and a willingness to collaborate, learn and test innovative ideas have driven these successes. Mayors are confirming their on-going commitment to climate action.

Cities look forward to continuing to work with state government to bridge the remaining gap.

Acceleration of grid decarbonisation is also essential to keep U.S. C40 cities on a path to 1.5°C. By 2026, grid carbon intensity for these cities needs to be at 60% of 2015 levels. This will be achieved through continued growth in the renewables industry. The rest of the world's average requires only a 20% reduction by this time.

34. Note, the US INDC relates to a 2005 baseline, targeting national emissions reductions of 26-28% by 2025. This reduction has been re-baselined for this report based on the latest available EPA data (<https://www.epa.gov/climate-indicators/climate-change-indicators-us-greenhouse-gas-emissions>)
 35. This analysis is based on an 'aggregation' exercise, where every city in the USA with a population over 50,000 was paired with the US C40 city most closely related to it. City Business As Usual (BAU) estimates - where BAU refers to a worst-case, no further climate action scenario - were built up based on historical population trends, UN population projections, and assumptions around continued GDP growth and energy efficiency improvement. Emissions reduction trajectories were taken from Deadline 2020 analysis for C40 cities, and applied to the paired US cities.
 36. WWF- ICLEI, 2015. Measuring Up 2015. How US Cities Are Accelerating Progress Toward National Climate Goals. <http://www.worldwildlife.org/press-releases/biggest-us-cities-setting-unprecedented-emissions-reductions-goals-to-fight-climate-change>

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