City of Houston - Cities 2020

Introduction

(0.1) Please give a general description and introduction to your city including your city's reporting boundary in the table below.

	Administrative boundary	Description of city
Please complete	City / Municipality	Houston is the fourth largest city in the United States, with an estimated population of 2.3 million. The City of Houston worked with C40 Cities to conduct a community-wide baseline inventory using the standard reporting method, Global Protocol for Community-Scale Greenhouse Gas Emissions (GPC), to better understand the sources of Houston's GHG emissions and track progress over time. Based on the availability and quality of existing data, 2014 was selected as the baseline year using the City's general-purpose boundary and excluding the extraterritorial jurisdiction and limited-purpose boundary (such as the Houston Ship Channel). Houston's GHG baseline for 2014 states a land area of 1,553 km2. Houston is currently updating GHG emissions baseline inventory for 2019. Houston is one of the nation's fastest-growing and most diverse cities. Houston's economy includes a broad industrial base in the energy, aeronautics, and technology industries, and ranks third among areas in Fortune 500 headquarters. In 2016, the regional Gross Area Product was about 478 billion dollars, which is slightly larger than the Gross Domestic Product of Australia, Poland, Saudi Arabia and even many states. Houston is also home to NASA's Johnson Space Center, several educational research institutions and colleges, and the Texas Medical Center, the world's largest concentration of healthcare and educational research institutions and colleges in one area. map-2018CityLimit-Districts_pj20489.pdf

(0.2) If you have not previously submitted your Letter of Commitment to the Global Covenant of Mayors, either through the relevant regional covenant or through the Global Covenant secretariat, please attach the letter signed by an appropriately mandated official (e.g. Mayor, City Council) to this question.

City Details

(0.3) Please provide information about your city's Mayor or equivalent legal representative authority in the table below.

	Leader title	Leader name	Current term end year
Please complete	Mayor	Sylvester Turner	2024

(0.4) Please select the currency used for all financial information disclosed throughout your response.

USD US Dollar

(0.5) Please provide details of your city's current population. Report the population in the year of your reported inventory, if possible.

	Current population	Current population year	Projected population	Projected population year
Please complete	2343365	2019	3626591	2060

US Census Population Estimates (2018): https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk
Population Growth Projections: https://www.houstontx.gov/planning/Demographics/demograph_docs/PopProjections.htm
Population Demographics: https://www.houstontx.gov/planning/Demographics/

(0.6) Please provide further details about the geography of your city.

	Land area of the city boundary as defined in question 0.1 (in square km)
Please complete	1737.88

https://www.houstontx.gov/planning/Demographics/

Governance and Data Management

Governance

(1.0) Does your city incorporate sustainability goals and targets (e.g. GHG reductions) into the master planning for the city?

Yes

(1.0a) Please detail which goals and targets are incorporated in your city's master plan and describe how these goals are addressed in the table below.

Goal type	How are these goals/targets addressed in the city master plan?
Other, please specify (Sustainability and Environmental Goals)	Goals include creation of walkable and bikeable neighborhoods, increasing recycling citywide, efficient use, reuse, and conservation of resources, increased investment in public transit and creation of more parks and greenspace. http://planhouston.org/ http://www.greenhoustontx.gov/pressrelease20200806.html
Adaptation targets	Resilient Houston is a framework for collective action that links new and existing efforts to protect Houston against future disasters—from hurricanes and flooding to extreme heat waves—and chronic stresses such as aging infrastructure, poor air quality, and climate change. The strategy frames five key Visions for Houston's future along with 18 goals and 62 actions describing timeframes, partners, implementation opportunities, and corresponding U.N. Sustainable Development Goals. The master plan includes a goal to create resilient man-made and natural systems that protect citizens and assets from disasters and other risks. This goal measures and aims to reduce the number of structures at-risk in the floodplain, percent of residences inside floodplain, and percent of power distribution that is underground or fortified.
Emissions reduction targets	Houston Climate Action Plan, a science-based, community-driven strategy for the City of Houston to reduce greenhouse gas (ghg) emissions, meet the Paris Agreement goal of carbon neutrality by 2050, and lead a global energy transition.
Renewable energy targets	Grow Houston's investment in renewable and resilient energy, support and promote the use and development of renewable energy, support and promote retail renewable energy opportunities, advocate for renewable energy policies at the local, state, and federal levels, and target 5 million MWh local solar per year by 2050.
Energy efficiency targets	Update energy code and increase compliance, develop programs that improve building efficiency, reduce water and wastewater energy consumption by 10%, promote clean energy financing programs, expand utility energy financing and incentive programs, provide training in the operation, management, and maintenance of relevant building systems.
Water security targets	Houston has a water reduction target of 1.6% every five years. Houston plans to reduce water loss by 1% every year with the long-term target of 10% or less of water loss. This goal is reasonable given Houston's water loss trends in the last decade, and the target is consistent with the water loss target adopted by the Region H Water Planning Group in the 2016 Region H Water Conservation Plan.

http://www.houstontx.gov/mayor/press/marissa-aho-chief-resilience-officer.html

(1.6) How many city staff (FTE) work on topics related to climate change mitigation and adaptation?

	Mitigation	Adaptation	Comment
Please complete	9	9	All 9 employees work on topics related to climate change mitigation and adaptation

Climate Hazards and Vulnerability

Climate Risk and Vulnerability Assessment

(2.0) Has a climate change risk and vulnerability assessment been undertaken for your city?

Yes

https://www.houstontx.gov/mayor/press/climate-action-summit.html

(2.0a) Please select the primary process or methodology used to undertake the risk and vulnerability assessment of your city.

	Primary methodology	Description
Risk assessment methodology	Other, please specify (C40's Climate Risk Assessment Guidance)	https://cdn.locomotive.works/sites/5ab410c8a2f42204838f797e/content_entry5ab410fb74c4833febe6c81a/5b17dd2614ad660612c5dc54/files/C40_Cities_Climate_Change_Risk_Assessment_Guidance.pdf?1541689629

(2.0b) Please attach and provide details on your climate change risk and vulnerability assessment. Please provide details on the boundary of your assessment, and where this differs from your city's boundary, please provide an explanation.

Publication title and attach the document
Houston's Climate Future: Climate Impact Assessment

Web link
TBA

Year of publication or approval from local government
2020

Boundary of assessment relative to city boundary (reported in 0.1)
Larger – covers the whole city and adjoining areas

Explanation of boundary choice where the assessment boundary differs from the city boundary
The boundary was expanded beyond the city boundaries based on a partnership with a local research firm. The data is based on 11 individual weather stations across the Greater Houston area.

Primary author of assessment
Consultant

Does the assessment identify vulnerable populations?
No

Areas/sectors covered by the risk and vulnerability assessment
Energy
Water Supply & Sanitation
Education
Public health
Emergency Management

Please explain
The Climate Impact Assessment presents and analyzes historical and projected trends in 27 different climate indicators, from the temperature of the hottest day of the year to projected changes in heavy precipitation at all 11 weather station locations. Sectors selected are the most relevant for the 27 different indicators.

Climate Hazards

(2.1) Please list the most significant climate hazards faced by your city and indicate the probability and consequence of these hazards, as well as the expected future change in frequency and intensity. Please also select the most relevant assets or services that are affected by the climate hazard and provide a description of the impact.

Climate Hazards
Extreme hot temperature > Extreme hot days

Did this hazard significantly impact your city before 2020?
Yes

Current probability of hazard
High

Current magnitude of hazard
Medium

Social impact of hazard overall
Fluctuating socio-economic conditions
Increased risk to already vulnerable populations

Most relevant assets / services affected overall
Energy
Water supply & sanitation
Transport
Tourism
Public health
Emergency services

Please identify which vulnerable populations are affected
Children & youth
Elderly
Persons with disabilities
Persons with chronic diseases
Low-income households
Persons living in sub-standard housing

Future change in frequency
Increasing

Future change in intensity
Increasing

Future expected magnitude of hazard
High

When do you first expect to experience those changes in frequency and intensity?
Immediately

Please describe the impacts experienced so far, and how you expect the hazard to impact in the future
Extreme hot days increase energy use in buildings, contribute to higher ozone levels, cause brownouts which can lead to increased levels of PM 2.5 and PM 10, and lead to heat-related illnesses/death. Between 2003 to 2008, there were 31 heat-related deaths in Harris County. The National Center for Atmospheric Research estimates that by 2050 more than half of summer nights in Houston may qualify as high heat stress nights and the number of summer days that qualify for heat advisories may increase. Increased energy usage also means increased water usage for the energy production at power plants. Additionally, hot and sunny conditions paired with increased electricity usage can lead to greater ozone formation, and the greater Houston region is currently failing to meet its federal and state ozone standards.

Climate Hazards
Water Scarcity > Drought

Did this hazard significantly impact your city before 2020?
Yes

Current probability of hazard
High

Current magnitude of hazard
Medium

Social impact of hazard overall
Fluctuating socio-economic conditions

Most relevant assets / services affected overall
Water supply & sanitation
Transport
Food & agriculture

Please identify which vulnerable populations are affected
Children & youth
Elderly
Persons with disabilities
Persons with chronic diseases
Low-income households
Persons living in sub-standard housing

Future change in frequency
Increasing

Future change in intensity
Increasing

Future expected magnitude of hazard
High

When do you first expect to experience those changes in frequency and intensity?
Immediately

Please describe the impacts experienced so far, and how you expect the hazard to impact in the future
More frequent droughts deplete water resources for people and wildlife and cause infrastructure problems. It also leads to drought-stressed trees and vegetation which reduces the urban forest that would normally provide cooling and improve air quality.

Climate Hazards
Extreme hot temperature > Heat wave

Did this hazard significantly impact your city before 2020?
Yes

Current probability of hazard
High

Current magnitude of hazard
Medium

Social impact of hazard overall
Fluctuating socio-economic conditions
Increased risk to already vulnerable populations

Most relevant assets / services affected overall
Energy
Water supply & sanitation
Public health

Please identify which vulnerable populations are affected
Children & youth
Elderly
Persons with disabilities
Persons with chronic diseases
Low-income households
Persons living in sub-standard housing

Future change in frequency
Increasing

Future change in intensity
Increasing

Future expected magnitude of hazard
High

When do you first expect to experience those changes in frequency and intensity?
Immediately

Please describe the impacts experienced so far, and how you expect the hazard to impact in the future
Heat waves increase energy use in buildings, contribute to higher ozone levels, can be potential causes for brownouts which lead to increased levels of PM 2.5 and PM 10, and lead to heat-related illnesses/death. Between 2003 to 2008, there were 31 heat-related deaths in Harris County. Increased energy usage also means increased water usage for energy production at power plants.

Climate Hazards
Flood and sea level rise > Flash / surface flood

Did this hazard significantly impact your city before 2020?
Yes

Current probability of hazard
High

Current magnitude of hazard
High

Social impact of hazard overall
Fluctuating socio-economic conditions
Increased incidence and prevalence of disease and illness
Increased demand for public services
Increased demand for healthcare services
Increased risk to already vulnerable populations
Increased resource demand
Population displacement

Most relevant assets / services affected overall
Water supply & sanitation
Transport
Food & agriculture
Waste management
Public health
Emergency services

Please identify which vulnerable populations are affected
Women & girls
Children & youth
Elderly
Marginalized groups
Persons with disabilities
Persons with chronic diseases
Low-income households
Unemployed persons
Persons living in sub-standard housing

Future change in frequency
Increasing

Future change in intensity
Increasing

Future expected magnitude of hazard
High

When do you first expect to experience those changes in frequency and intensity?
Immediately

Please describe the impacts experienced so far, and how you expect the hazard to impact in the future
Houston has experienced 6 federally declared flooding disasters in 5 years, including Hurricane Harvey and Tropical Storm Imelda. Flooding can disrupt mobility, damage buildings and assets in the community assets, and increase risk of a water-borne illnesses. Flooding in the area also increases risk of environmental contamination. In the aftermath of Hurricane Harvey, Escherichia coli was found in flood waters at 4 times the level considered safe. Additionally, elevated levels of lead and arsenic were found in flood water. Flooded houses also face risk of mold growth which can irritate or damage the respiratory tract and exacerbate chronic conditions such as asthma and some pulmonary conditions.

Climate Hazards
Storm and wind > Cyclone (Hurricane / Typhoon)

Did this hazard significantly impact your city before 2020?
Yes

Current probability of hazard
High

Current magnitude of hazard
High

Social impact of hazard overall
Fluctuating socio-economic conditions
Increased incidence and prevalence of disease and illness
Increased demand for public services
Increased demand for healthcare services
Increased risk to already vulnerable populations
Increased resource demand

Most relevant assets / services affected overall
Energy
Transport
Waste management
Information & communications technology
Residential
Public health
Emergency services

Please identify which vulnerable populations are affected
Children & youth
Elderly
Persons with disabilities
Persons with chronic diseases
Low-income households
Persons living in sub-standard housing

Future change in frequency
Increasing

Future change in intensity
Increasing

Future expected magnitude of hazard
High

When do you first expect to experience those changes in frequency and intensity?
Immediately

Please describe the impacts experienced so far, and how you expect the hazard to impact in the future
Tropical storms can disrupt mobility, damage buildings and assets in the community assets, and disrupt the power supply to homes and buildings. It is estimated that a "Hurricane Katrina-like" storm would cause aggregate losses to the Texas economy of $73 billion in gross product, $61.3 billion in income and 863,000 jobs. Hurricane Ike in 2008 cost the region $30 billion in damages and Hurricane Harvey is estimated to have cost $125 billion. Additionally, hurricanes such as Hurricane Harvey can have dramatic impacts on public health and safety. Eighty-two people are believed to have died as a result of Hurricane Harvey. Flood waters and damaged buildings can also have lasting impacts on public health due to contamination and increased growth of mold which can trigger asthma attacks or allergic reactions. As some of the largest refineries in the nation are located in the greater Houston area, hurricanes and tropical storms have the ability to greatly impact the nation's gasoline prices and an extended shutdown of Houston-area refineries would likely cause shortages of fuel and pose a national security risk. About 13% of the nation's petroleum products are refined in the Houston area. Additionally, the high concentration of refineries and chemical manufacturing operations can cause toxic releases into the air and water. After Hurricane Harvey, more than 90 chemical releases were reported and estimated to have involved more than 700,000 gallons of pollutants being released into the water, and 38,000 pounds of pollutants being released into the air.

Climate Hazards
Storm and wind > Storm surge

Did this hazard significantly impact your city before 2020?
Yes

Current probability of hazard
High

Current magnitude of hazard
Medium High

Social impact of hazard overall
Fluctuating socio-economic conditions
Increased demand for public services
Increased risk to already vulnerable populations

Most relevant assets / services affected overall
Water supply & sanitation
Transport
Waste management
Commercial
Public health
Emergency services

Please identify which vulnerable populations are affected
Children & youth
Elderly
Persons with disabilities
Persons with chronic diseases
Low-income households
Persons living in sub-standard housing
Other, please specify (Residential, commercial and industry could be impacted in the event of a storm surge)

Future change in frequency
Increasing

Future change in intensity
Increasing

Future expected magnitude of hazard
High

When do you first expect to experience those changes in frequency and intensity?
Immediately

Please describe the impacts experienced so far, and how you expect the hazard to impact in the future
Storm surges can disrupt mobility, damage buildings and community assets, increase salt water intrusion, and affect water quality. It is estimated that a “Hurricane Katrina-like” storm would cause aggregate losses to the Texas economy of $73 billion in gross product, $61.3 billion in income and 863,000 jobs. Hurricane Ike in 2008 cost the region $30 billion in damages and Hurricane Harvey is estimated to have cost $125 billion. As some of the largest refineries in the nation are located within a short distance of Galveston Bay, storm surges have the ability to greatly impact the nation's gasoline prices and an extended shutdown of Houston-area refineries would likely cause shortages of fuel and pose a national security risk. About 13% of the nation's petroleum products are refined in the Houston area. Additionally, the high concentration of refineries and chemical manufacturing operations can cause toxic releases into the air and water. After Hurricane Harvey, more than 90 chemical releases were reported and estimated to have involved more than 700,000 gallons of pollutants being released into the water, and 38,000 pounds of pollutants being released into the air.

Climate Hazards
Mass movement > Subsidence

Did this hazard significantly impact your city before 2020?
Yes

Current probability of hazard
Medium Low

Current magnitude of hazard
Medium

Social impact of hazard overall
Increased demand for public services
Increased resource demand

Most relevant assets / services affected overall
Water supply & sanitation
Transport
Land use planning

Please identify which vulnerable populations are affected
Low-income households

Future change in frequency
Decreasing

Future change in intensity
Decreasing

Future expected magnitude of hazard
Medium Low

When do you first expect to experience those changes in frequency and intensity?
Immediately

Please describe the impacts experienced so far, and how you expect the hazard to impact in the future
Historically in Harris County, subsidence has been worse in areas where groundwater,oil, and gas are removed from the ground, causing the land to sink by fractions of an inch a year, and in some places by feet over many years. Groundwater withdrawals have caused about 3,200 square miles of the Houston-Galveston area to subside (or sink) more than a foot, with some areas subsiding as much as 12 to 13 feet. Over the last century, aquifers in this area have lost between 300 and 400 feet, leaving some of the land to collapse. Spring Branch, where Interstate 10 and Beltway 8 meet, has dropped four feet since 1975. Jersey Village, at US 290 and Beltway 8, is almost two feet lower than it was in 1996. And Greater Greenspoint, where Interstate 45 intersects with Beltway 8, has given up about two feet in the last decade, according to USGS data. Also according to the USGS, while some areas in Houston have significantly reduced their groundwater pumping (particularly with the creation of subsidence and groundwater districts, whose purpose is to regulate groundwater pumping), subsidence remains a threat for the region.

(2.2) Please identify and describe the factors that most greatly affect your city's ability to adapt to climate change and indicate how those factors either support or challenge this ability.

Factors that affect ability to adapt	Indicate if this factor either supports or challenges the ability to adapt	Level of degree to which factor challenges/supports the adaptive capacity of your city	Please describe how the factor supports or challenges the adaptive capacity of your city
Government capacity	Challenges	Significantly challenges	There is limited government capacity to fund projects, materials, and emergency personnel. City government budget cuts have led to many vacant positions being eliminated and forced some departments to continue to operate short-handed. Houston lacks regulatory authority to make changes in electricity market, emissions control, transportation system, and other sectors.
Political engagement / transparency	Challenges	Significantly challenges	Political engagement/ transparency becomes another conflict when the issue itself becomes politically polarized by party politics. Political involvement withdraws when monetary donations to politicians and government agencies are at risk. Political involvement withdraws often to promote business and political motives nullifying intervention or regulatory changes that can help the cities to mitigate causes. Transparency slows the city's ability to adapt when FEMA or other government agencies remove informative text and material from their websites that hinder education to citizens.
Budgetary capacity	Challenges	Significantly challenges	Budgetary capacity becomes problematic when the importance of adapting the city to climate change is not prioritized.. For three consecutive years the City of Houston has faced budget cuts, approximately $80 million each year, due to the revenue cap, hurricane recovery spending, and COVID-19-related impacts. The budget shortfall that the city has faced has made it difficult to undertake projects requiring capital, even if these projects would improve efficiency and save the city money in the long run. In some cases, lack of budgetary capacity directly prevents the city and region from undertaking necessary adaptation measures. Refineries around the Houston Ship Channel and Galveston Bay produce 40% of the nation's petroleum and half of the country's jet fuel. Storm surges and flooding in this region pose two grave risks: 1) Serious environmental contamination, and 2) huge shortages of petroleum products. As a result of Hurricane Ike in 2008, 500,000 gallons of crude oil were spilled causing $29 billion in damages. A group of universities and partners have led the planning for the "Ike Dike," a defensive barrier designed to protect this key area. The project would extend an existing sea wall, construct a 17 ft revetment near the beach and add flood gates. Gates and barriers would likely be modelled after those at use in the Netherlands' Delta Works project. The project is estimated to cost $15 billion and has been stalled due to lack of funding. This project is necessary to protect public health and national security as a hurricane wiping out oil production ability in the region could cause fuel shortages and greatly impair transportation in the United States.
Rapid urbanization	Challenges	Significantly challenges	Rapid urbanization over the years along with unsatisfactory infrastructure capacity, building code regulations, and inadequate land use planning has caused streets, channels, river, dikes, drainage ditches, levees, dams and reservoirs to flood or overflow andcause extreme flooding throughout the Houston area. Additionally, rapid development and urbanization has exacerbated the extreme heat and heat wave impacts
Environmental conditions	Challenges	Significantly challenges	Houston's topography and soil type contribute to it being a flood prone region. The area is low lying and has clay-based soil with low permeability. The area has historically relied on natural wetlands and bayous for drainage. However, when severe storms occur these natural protections are unable to handle the inundation of water.
Infrastructure capacity	Challenges	Significantly challenges	Storm water infrastructure in Houston poses major difficulties. As Houston is located in a low-lying region with a clay-like soil that naturally has low-permeability, the region's bayous have functioned as the main drainage system, but many neighborhoods must have engineered storm water management systems in place. Aging infrastructure can limit the effectiveness of storm water drains. Additionally, as the frequency and intensity of storms increase, it becomes clear that the engineered capacity of such systems may not have been high enough to face the increased intensity of storms. Limited storm water capacity can lead to flooded streets impairing residents' ability to evacuate in emergency situations. The American Society of Civil Engineers 2017 Report Card gave the State of Texas a C- for infrastructure noting that the state earned a D for flood control and roadways.
Land use planning	Challenges	Significantly challenges	The City of Houston is the largest city in the United States to not have zoning laws in an effort to encourage development. Largely unobstructed either by rules or by natural features such as mountains, the Houston area sprawled. Nearly 25,000 acres of natural wetlands were developed between 1992 and 2010, mostly in Harris County. Between 1992 and 2010 alone nearly 30% of wetlands in Harris County were destroyed due to development. The region is low lying and with soil that is mostly clay-based, causing the region to be naturally prone to flooding and drainage problems. The area's bayous have largely functioned as storm water management and drainage systems. However, development in the area and over wetlands threaten this natural drainage mechanism. As Houston is rapidly expanding-- the population in Houston and the surrounding cities is expected to grow by 66.7% by 2040-- land use planning poses a huge challenge to manage the cities development and drainage needs, and to adapt to changing flood plains.

(2.3) Is your city facing risks to public health or health systems associated with climate change?

Yes

(2.3a) Please report on how climate change impacts health outcomes and health services in your city.

Area affected by climate change
Health outcomes
Health systems (service provision, infrastructure and technologies)
Areas outside the health sector (e.g. agriculture, water and sanitation, transport, power generation, built environment)

Health-related risk and vulnerability assessment undertaken
No

Identify the climate hazards most significantly impacting the selected areas
Extreme Precipitation > Rain storm
Storm and wind > Cyclone (Hurricane / Typhoon)
Storm and wind > Tropical storm
Extreme hot temperature > Heat wave
Extreme hot temperature > Extreme hot days
Water Scarcity > Drought
Flood and sea level rise > Coastal flood
Chemical change > Atmospheric CO2 concentrations
Biological hazards > Water-borne disease
Biological hazards > Vector-borne disease
Biological hazards > Air-borne disease
Biological hazards > Insect infestation

Identify the climate-related health issues faced by your city
Heat-related illnesses
Vector-borne infectious diseases (e.g. malaria, dengue, Lyme disease, tick-borne encephalitis)
Air-pollution related illnesses
Exacerbation of Non-Communicable Disease Symptoms (e.g. respiratory disease, cardiovascular disease, renal disease)
Mental health impacts
Direct physical injuries and deaths due to extreme weather events
Food & Nutrition Security
Disruption to water, sanitation and wastewater services
Disruption to health service provision
Overwhelming of health service provision due to increased demand
Lack of climate-informed surveillance, preparedness, early warning and response
Damage/destruction to health infrastructure and technology
Disruption of health-related services (e.g. roads, electricity, communications, emergency/ambulatory response, laboratories, pharmacies)

Timescale of climate-related issues for the selected health area
Current

Please identify which vulnerable populations are affected by these climate-related impacts
Women
Children and youth
Elderly
Marginalized groups
Outdoor workers
Persons with disabilities
Persons with pre-existing medical conditions
Low-income households
Persons living in sub-standard housing

Please explain
Climate change is projected to harm human health by increasing ground-level ozone and/or particulate matter air pollution in some locations. Ground-level ozone (a key component of smog) is associated with many health problems, such as diminished lung function, increased hospital admissions, emergency room visits for asthma, and increases in premature deaths. According to the City of Houston's Climate Action Plan, Tailpipe emissions, which comprise 47% of Houston's total GHG emissions, worsen air quality and threaten the public's overall health. Extreme heat events have constantly threatened public health in Houston. Heat is even more concerning in underserved communities that are less likely to have central air conditioning. Deaths result from heat stroke and related conditions, but also from cardiovascular disease, respiratory disease, and cerebrovascular disease. Extreme summer heat is increasing in Houston, and climate projections indicate that extreme heat events will be more frequent and intense in coming decades. Houston will go from experiencing 10 days a year with a heat index of 105 or more during our hot summers today to 74 days a year by 2050. Flooding may be the most significant mass health issue Houston regularly faces. It is an ongoing threat and its consequences can be devastating. Sitting only 50 feet above sea level, streets tend to flood easily and often (Urban Flooding). Flooding poses a number of different public health risks, both during and after the event, including: Drowning incidents, injuries that can occur in areas covered by floodwater, such as falling into manholes or stepping on foreign objects; Infection or illness resulting from exposure to flood water containing bacteria, chemicals or human waste; Illness from drinking contaminated tap water or water from lakes and streams; Illness resulting from mold exposure due to growth on water-damaged surfaces in homes, schools, or businesses.

Adaptation

Adaptation Actions

(3.0) Please describe the main actions you are taking to reduce the risk to, and vulnerability of, your city's infrastructure, services, citizens, and businesses from climate change as identified in the Climate Hazards section.

Climate hazards
Extreme hot temperature > Extreme hot days

Action
Cooling centers, pools, water parks/plazas

Action title
Cooling Center

Status of action
Operation

Means of implementation
Awareness raising program or campaign

Co-benefit area
Enhanced resilience
Social community and labour improvements

Sectors/areas adaptation action applies to
Public Health and Safety

Action description and implementation progress
The City of Houston activates Heat the Emergency Plan and opens 98 cooling centers (e.g. city libraries, multi-service centers and park and recreation centers) to residents without access to air conditioning during heat waves. When the National Weather Service issues a Heat Advisory (Heat index of 108 F for two consecutive days), the City of Houston may open cooling centers in the interest of public health. The City also activates the Heat Emergency Management Group that publicizes the opening of the cooling centers. The cooling centers are City facilities open during normal business hours. On weekends, hours may be extended at a few locations. 311, the City's help and information hotline, takes calls for transportation and METRO provides free transportation to the cooling centers.

Finance status
Finance secured

Majority funding source
Local

Total cost of the project (currency)
60000

Total cost provided by the local government (currency)

Total cost provided by the majority funding source (currency)
60000

Web link
https://www.houstontx.gov/health/NewsReleases/heatplan.html. Cooling centers operate at City of Houston's facilities during normal operational hours. No additional costs are incurred. Additional costs may be incurred for staffing when cooling centers must be operated outside normal operational hours. Due to COVID-19, NRG's "Beat the Heat" program focuses on helping seniors and vulnerable populations with portable AC units instead of staffing City facilities.

Climate hazards
Storm and wind > Cyclone (Hurricane / Typhoon)

Action
Storm water capture systems

Action title
Climate Hazards

Status of action
Operation

Means of implementation
Infrastructure development

Co-benefit area
Enhanced resilience
Disaster preparedness

Sectors/areas adaptation action applies to
Transport (Mobility)
Water

Action description and implementation progress
Build Houston Forward is the City of Houston's initiative to improve the quality of life and mobility for residents by rebuilding its drainage and street infrastructure. To support the initiative, the City has established a dedicated, pay-as-you-go fund to maintain the infrastructure and to plan upgrades to meet future needs as the City grows. Since the start of Build Houston Forward, Houston Public Works (HPW) has reconstructed 349 miles and rehabilitated 573 lane miles. In all, Build Houston Forward is responsible for more than 900 miles or roadway improvements across the City. The Fiscal Year 2017-2021 Capital Improvement Plan allows funding of $63 million of the $100 million commitment between the City of Houston and the Houston Parks Board for the Bayou Greenways Initiative. Previous appropriations equal $37 million. The Houston Parks Board has committed $88 million of $120 million matching funds for the Bayou Greenways Initiative, which is being invested in linear parks land, design, and construction. HPW, with funding from ReBuild Houston, plans to: 1) Rehabilitate or reconstruct more than 483 miles of roadway; 2) Place more than 1.3 million feet (246 miles) of sidewalks throughout the City; 3) Add more than 20,288 feet of on-street bikeways and off-street trails; 5) Add 1,025 curb ramps as part of its safe sidewalks program; 4) Make 154 miles of storm water drainage improvements; 6) Build 4,663 storm water inlets; 7) Add 8 acre feet of in-pipe detention which will hold more than 2.6 million gallons of storm runoff water.

Finance status
Finance secured

Majority funding source
Local

Total cost of the project (currency)
188000000

Total cost provided by the local government (currency)
63000000

Total cost provided by the majority funding source (currency)
100000000

Web link
http://www.buildhoustonforward.org/

Climate hazards
Water Scarcity > Drought

Action
Maintenance/repair – leaking infrastructure

Action title
Maintenance

Status of action
Implementation

Means of implementation
Assessment and evaluation activities

Co-benefit area
Enhanced resilience
Improved resource efficiency (e.g. food, water, energy)

Sectors/areas adaptation action applies to
Water

Action description and implementation progress
The City of Houston Water Conservation Plan (effective 2019-2024), highlights water conservation goals and continuous progress that will preserve long-term water supplies for the City of Houston and the greater Houston region. Water supply planning is important to the City of Houston in order to meet long term growth in demand and to comply with 30 TAC Chapter 288 that requires the City to prepare and implement a water conservation plan that meets certain requirements. This plan includes information to fulfil these requirements in addition to information specific to the City of Houston's water supply and treatment systems. The current plan includes measures to be taken internally at the City of Houston as well as programs for water customers. These include current programs such as an in-house public education program, continued enforcement of water-wise building and plumbing codes, and the Consumption Awareness Program which communicates real-time meter data to household users. This document also summarizes plans to develop an internal Water Loss Program, pilot a Mainline Leak Detection Program and expand the Consumption Awareness Program.

Finance status
Seeking funding

Majority funding source
Other, please specify (City Capital Projects)

Total cost of the project (currency)
1047000000

Total cost provided by the local government (currency)
1047000000

Total cost provided by the majority funding source (currency)
1047000000

Web link
https://www.publicworks.houstontx.gov/sites/default/files/assets/2019_water_conservation_plan_01132020.pdf

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Climate hazards
Flood and sea level rise > Flash / surface flood

Action
Additional reservoirs and wells for water storage

Action title
Additional water storage

Status of action
Operation

Means of implementation
Infrastructure development

Co-benefit area
Disaster Risk Reduction
Enhanced resilience
Disaster preparedness
Resource conservation (e.g. soil, water)

Sectors/areas adaptation action applies to
Transport (Mobility)
Spatial Planning
Public Health and Safety

Action description and implementation progress
Bayou Greenways 2020 is a $220 million project that is a public-private partnership between Houston Parks Board, the Houston Parks and Recreation Department and the Harris County Flood Control District. When complete, Houston will have added more than 3,000 acres of new and equitably distributed green spaces that can also serve the function of flood control and storm water quality enhancement. We will have also completed 80 new miles of continuous all-weather hike and bike trails that will meander through those greenways — an amenity unparalleled in the nation – that will provide a total network of 150 miles of greenspace and trails crisscrossing the city. When the project is complete, approximately 60 percent of Houstonians will live within 1.5 miles of a Bayou Greenway. There are numerous other benefits associated with utilizing

our bayou corridors for green space and recreation: 1) Reduced doctor visits due to increased access to recreation opportunities; 2) Increase in use of alternative transportation for commuting along the hike and bike trails; 3) Increase in property values along the corridor resulting in increased revenue to the city; 4) Increased flood prevention due to the opportunity for wet-bottom detention areas in the newly created green spaces; 5) Increased water quality due to the simple plantings located strategically along the bayous, the wet-bottom detention ponds, and reduced runoff; 6) Increased air quality due to increased CO2 sequestration by newly planted trees and grasses, and use of trails for alternative transportation; and 7) Change in Houston's image to attract the best and brightest to our city.

Finance status
Finance secured

Majority funding source
Local

Total cost of the project (currency)
220000000

Total cost provided by the local government (currency)
100000000

Total cost provided by the majority funding source (currency)
100000000

Web link
http://houstonparksboard.org/bayou-greenways-2020/2020/

Climate hazards
Storm and wind > Storm surge

Action
Flood defences – development and operation & storage

Action title
Development of flood defenses

Status of action
Pre-implementation

Means of implementation
Infrastructure development

Co-benefit area
Disaster Risk Reduction
Enhanced resilience
Disaster preparedness

Sectors/areas adaptation action applies to
Building and Infrastructure
Industry
Water
Public Health and Safety

Action description and implementation progress
Refineries around the Houston Ship Channel and Galveston Bay produce 40% of the nation's petroleum and half of the country's jet fuel. Storm surges and flooding in this region poses two grave risks: 1) Serious environmental contamination, and 2) huge shortages of petroleum products. As a result of Hurricane Ike in 2008, 500,000 gallons of crude oil were spilled causing $29 billion in damages. A group of universities and partners have led the planning for the "Ike Dike," a defensive barrier designed to protect this key area. The project would extend an existing sea wall, construct a 17 ft revetment near the beach, and add flood gates. Gates and barriers would likely be modelled after those at use in the Netherlands' Delta Works project. The project is estimated to cost $15 billion and has been stalled due to lack of funding. On 05/16/2018, US Senator John Cornyn introduced legislation that would expedite feasibility studies for the project and a coastal spine that would protect Houston and the greater region.

Finance status
Seeking funding

Majority funding source
Local

Total cost of the project (currency)
15000000000

Total cost provided by the local government (currency)

Total cost provided by the majority funding source (currency)

Web link
http://www.tamug.edu/ikedike/

Climate hazards
Flood and sea level rise > Flash / surface flood

Action
Restrict development in at risk areas

Action title
Restricted development in risk areas

Status of action
Pre-implementation

Means of implementation
Infrastructure development

Co-benefit area
Disaster Risk Reduction
Enhanced resilience
Shift to more sustainable behaviours

Sectors/areas adaptation action applies to
Building and Infrastructure
Spatial Planning
Public Health and Safety

Action description and implementation progress
Harvey flooded an unprecedented number of homes across the city. Many of these homes were destroyed or remain uninhabitable. Prior to the disaster, many communities had vacant lots in need of infill development. The Single Family Home Development Program provides $200 million for recovery and reconstruction as well as opportunities for residents to move out of areas prone to repetitive flooding. Additionally, the Buyout Program authorizes $40 million to demolish homes that have flooded repeatedly and create open spaces or detention areas.

Finance status
Finance secured

Majority funding source
(Sub)national

Total cost of the project (currency)
240000000

Total cost provided by the local government (currency)

Total cost provided by the majority funding source (currency)
240000000

Web link
http://houstontx.gov/housing/chdo.html

Climate hazards
Flood and sea level rise > Flash / surface flood

Action
Resilience and resistance measures for buildings

Action title
Building regulations

Status of action
Operation

Means of implementation
Infrastructure development

Co-benefit area
Enhanced resilience
Enhanced climate change adaptation

Sectors/areas adaptation action applies to
Building and Infrastructure

Action description and implementation progress
After the devastating flood damage caused by Hurricane Harvey, the City of Houston has resolved to leverage every opportunity to make the City more resilient to future flooding disasters. The City's floodplain regulations are an important tool for reducing the flooding risk to lives and property in new development and redevelopment projects. With the goal of informing a review of those regulations, Houston Public Works (HPW) has prepared a report, based on extensive analysis of data collected both before and after the storm. Work on the report began in September 2017. The data clearly shows that current floodplain regulations – which require only structures in the 100-year floodplain be elevated one foot above the 100-year flood elevation – were inadequate to protect homes from flooding in Harvey. While 33 percent of all homes in the 500-year floodplain flooded during Harvey, an even higher percentage (38 percent) of all the currently compliant homes in the 100-year floodplain flooded. Chapter 19 regulations were changed to require all new structures in the 100- and 500-year floodplains to be elevated 2 feet above the 500-year flood elevation. Houston Public Works is coordinating with other groups within the City and local and regional stakeholders on a variety of flood risk reduction efforts.

Finance status
Finance secured

Majority funding source
Other, please specify (HCFDC and FEMA)

Total cost of the project (currency)
709012000

Total cost provided by the local government (currency)
64012000

Total cost provided by the majority funding source (currency)
645000000

Web link
Hurricane recovery progress report January 2019- https://www.houstontx.gov/postharvey/public/documents/11.28.2018_progress_report_updated.pdf and 2020 progress report - http://www.houstontx.gov/mayor/harvey-recovery-report-2020-q1.pdf

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Climate hazards
Flood and sea level rise > Flash / surface flood

Action

Flood defences – development and operation & storage

Action title
Develop flood defences

Status of action
Implementation

Means of implementation
Infrastructure development

Co-benefit area
Disaster Risk Reduction
Disaster preparedness
Enhanced climate change adaptation

Sectors/areas adaptation action applies to
Building and Infrastructure

Action description and implementation progress
Following Hurricane Harvey, the City of Houston submitted applications for flood risk reduction. These include channel improvements, detention basins, dam improvements, and home elevation. Three applications have been approved and funded for the design phase. These include 1) North Canal, a project creating a high-flow diversion channel in downtown Houston. The project will include utility relocation and bridge improvements. 2) Inwood, where the City of Houston purchased a 227 acre golf course for $9.3 million and spent $2.5 million building the first two detention basins, and plans to spend $34 million to design and develop additional basins to produce a total 1300-acre feet of storm water storage. 3) Lake Houston, where several flood detention projects and planned improvements to improve the Lake Houston Dam gates are in progress.

Finance status
Seeking funding

Majority funding source
Other, please specify (FEMA)

Total cost of the project (currency)
230000000

Total cost provided by the local government (currency)
105000000

Total cost provided by the majority funding source (currency)
125000000

Web link
https://www.houstontx.gov/mayor/cro-fema-grants/north-canal.pdf https://www.houstontx.gov/mayor/cro-fema-grants/lake-houston.pdf
https://www.houstontx.gov/mayor/cro-fema-grants/inwood.pdf

Climate hazards
Extreme hot temperature > Heat wave

Action
Heat mapping and thermal imaging

Action title
Resilient Houston Action 16.1: Launch an urban heat island mapping campaign

Status of action
Pre-implementation

Means of implementation
Awareness raising program or campaign

Co-benefit area
Enhanced resilience
Enhanced climate change adaptation
Improved public health
Ecosystem preservation and biodiversity improvement
Improved access to and quality of mobility services and infrastructure
Shift to more sustainable behaviours
Improved access to data for informed decision-making

Sectors/areas adaptation action applies to
Energy
Transport (Mobility)
Building and Infrastructure
Spatial Planning
Public Health and Safety

Action description and implementation progress
Houston was selected for the 2020 HeatWatch program to conduct an urban heat island mapping campaign to engage and educate the general public about Houston's urban heat islands and heat-health safety. Houstonians will be empowered as "citizen scientists," collecting data that will help us understand how the built environment affects perceived temperatures across different neighborhoods. This initiative can be modelled after similar efforts successfully executed in other cities.

Finance status
Seeking funding

Majority funding source
Other, please specify (NOAA, The Nature Conservancy)

Total cost of the project (currency)

35000

Total cost provided by the local government (currency)
10000

Total cost provided by the majority funding source (currency)
20000

Web link
www.h3at.org http://www.greenhoustontx.gov/pressrelease20200805.html

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Climate hazards
Flood and sea level rise > Flash / surface flood

Action
Resilience and resistance measures for buildings

Action title
Disaster Recovery Multi-Family Affordable Housing Resilience Matrix

Status of action
Implementation

Means of implementation
Capacity building and training activities
Infrastructure development
Development and implementation of action plan
Policy and regulation

Co-benefit area
Disaster preparedness
Enhanced climate change adaptation
Reduced GHG emissions
Shift to more sustainable behaviours
Improved access to data for informed decision-making

Sectors/areas adaptation action applies to
Building and Infrastructure

Action description and implementation progress
As part of the Houston Housing and Community Development Department's 2nd round Notice of Funding for Multi-family Housing as a part of Harvey Recovery efforts, a Resilience Matrix was developed to encourage multifamily developers to incorporate a minimum number (12) of resilience components to any project, including protection, adaptation, back up, community, green buildings, green infrastructure, solar, and EV, mostly aligned with the Strategies for Multifamily Building Resilience by Enterprise Green Communities.

Finance status
Finance secured

Majority funding source
(Sub)national

Total cost of the project (currency)
175000000

Total cost provided by the local government (currency)
0

Total cost provided by the majority funding source (currency)
175000000

Web link
https://recovery.houstontx.gov/multifamily-program/

Climate hazards
Flood and sea level rise > Flash / surface flood

Action
Nature based solutions for water

Action title
Houston Incentives for Green Development

Status of action
Implementation

Means of implementation
Awareness raising program or campaign
Infrastructure development
Policy and regulation
Financial mechanism

Co-benefit area
Disaster Risk Reduction
Enhanced resilience
Enhanced climate change adaptation
Social community and labour improvements
Greening the economy
Shift to more sustainable behaviours

Improved access to data for informed decision-making

Sectors/areas adaptation action applies to
Building and Infrastructure
Spatial Planning
Water
Public Health and Safety

Action description and implementation progress
Creating Houston's Green Development Incentives is the first step toward achieving a robust green infrastructure program, which includes municipal and private projects. Through funding from Houston Endowment, the City's Chief Recovery Office commissioned a one-year study to identify and recommend incentives to encourage the use of green stormwater infrastructure (GSI) in private land development, leading to economic, social, and environmental benefits as well as resilience. Green infrastructure strives to mimic how rain falls on undeveloped, green landscape. Typical design elements include green roofs, rain garden bio-retention systems, permeable pavements, rainwater harvesting, urban forests, constructed wetlands and other strategies to manage rainwater. It improves the performance of drainage systems and can make real estate projects safer and more attractive to buyers. After interviews with cities with GSI programs, external stakeholders, and city leadership, and analysis of costs and benefits, the following incentive programs are recommended: Integrated GSI Development Rules Property Tax Abatements Award and Recognition Program Increased Permitting Process Certainty and Speed

Finance status
Feasibility finalized, and finance partially secured

Majority funding source
Local

Total cost of the project (currency)
2000000

Total cost provided by the local government (currency)

Total cost provided by the majority funding source (currency)

Web link
http://www.houstontx.gov/igd/

Climate hazards
Extreme hot temperature > Extreme hot days

Action
Tree planting and/or creation of green space

Action title
Plant 4.6 million new native trees

Status of action
Pre-implementation

Means of implementation
Awareness raising program or campaign
Stakeholder engagement
Infrastructure development
Assessment and evaluation activities
Monitor activities
Development and implementation of action plan
Financial mechanism

Co-benefit area
Enhanced resilience
Enhanced climate change adaptation
Reduced GHG emissions
Social inclusion, social justice
Improved public health
Ecosystem preservation and biodiversity improvement
Improved access to data for informed decision-making

Sectors/areas adaptation action applies to
Building and Infrastructure
Industry
Spatial Planning
Agriculture and Forestry
Public Health and Safety

Action description and implementation progress
Houston's Resilient Houston and Climate Action Plan both include a new City tree planting target of 4.6 million new native trees by 2030. This target was established in 2020 to accelerate and increase tree planting in Houston to meet multiple resilience goals and actions. Public and private partners are working collaboratively to develop an action plan for being able to meet this 10-year goal. This work will include the evaluation of supply chain capacity for native trees, identification of potential locations for enhanced planting in coordination with climate/heat mapping.

Finance status
Pre-feasibility/impact assessment study status

Majority funding source
Other, please specify (Regular city operational budget)

Total cost of the project (currency)

Total cost provided by the local government (currency)

Total cost provided by the majority funding source (currency)

Web link
https://www.houstontx.gov/mayor/Resilient-Houston-20200518-single-page.pdf http://greenhoustontx.gov/climateactionplan/CAP-April2020.pdf

Climate hazards
Flood and sea level rise > Flash / surface flood

Action
Restrict development in at risk areas

Action title
Remove habitable structures from the floodway

Status of action
Implementation

Means of implementation
Development and implementation of action plan

Co-benefit area
Disaster Risk Reduction
Enhanced resilience
Poverty reduction / eradication
Improved public health
Improved access to data for informed decision-making

Sectors/areas adaptation action applies to
Building and Infrastructure
Spatial Planning
Public Health and Safety

Action description and implementation progress
Resilient Houston Action 25.1 Remove all habitable structures and prevent new development in the floodway. To accomplish this objective, some mapped floodways may be able to be made smaller through engineering solutions; in other areas, buyouts and property swaps will need to occur. Local ordinances have already been updated to prevent the development of habitable structures within the FEMA-defined floodway and other high-hazard areas.

Finance status
Feasibility finalized, and finance partially secured

Majority funding source
(Sub)national

Total cost of the project (currency)

Total cost provided by the local government (currency)

Total cost provided by the majority funding source (currency)

Web link
https://www.houstontx.gov/mayor/Resilient-Houston-20200518-single-page.pdf

Adaptation Planning

(3.2) Does your city council, or similar authority, have a published plan that addresses climate change adaptation?
Yes

(3.2a) Please provide more information on your plan that addresses climate change adaptation and attach the document. Please provide details on the boundary of your plan, and where this differs from your city's boundary, please provide an explanation.

Publication title and attach the document
Resilient Houston
Resilient-Houston-20200518-double-page.pdf

Web link
https://www.houstontx.gov/mayor/Resilient-Houston-20200518-single-page.pdf

Sectors/areas covered by plan that addresses climate change adaptation
Energy
Transport (Mobility)
Building and Infrastructure
Industry
Agriculture and Forestry
Water
Waste
Public Health and Safety
Business and Financial Service
Social Services

Climate hazards factored into plan that addresses climate change adaptation
Storm and wind > Cyclone (Hurricane / Typhoon)
Storm and wind > Storm surge
Extreme hot temperature > Extreme hot days
Water Scarcity > Drought
Flood and sea level rise > Flash / surface flood

Year of adoption from local government

2020

Boundary of plan relative to city boundary (reported in 0.1)
Larger – covers the whole city and adjoining areas

If the city boundary is different from the plan boundary, please explain why
The plan included a regional approach beyond the city's immediate boundaries to emphasize the partnership opportunities for resilience-building in the region and to address that the resilience challenges do not stop at the city boundaries.

Stage of implementation
Plan in implementation

Type of plan
Integrated mitigation / adaptation

Has your local government assessed the synergies, trade-offs, and co-benefits, if any, of the main mitigation and adaptation actions you identified?
Yes

Describe the synergies, trade-offs, and co-benefits of this interaction
In 2020, City of Houston released Resilient Houston, which addresses Climate Adaptation as one of 5 core themes. The release of Resilient Houston included a corresponding Executive Order on Resilient as an implementation tool that directed City Departments and Divisions to implement Resilient Houston. Leading up to the release of Resilient Houston, the City also released a Living with Water Houston report that informed many of the goals, targets, actions and sub-actions in Resilient Houston. In May 2020, the City released a COVID-19 addendum to Resilient Houston to show the applicability of 42 of the 62 actions in Resilient Houston to also advancing response, recovery, adaptation, and institutionalization of COVID-19. Resilient Houston is a framework for collective action and links existing efforts with new ones that will work collectively to protect Houston against future disasters—from hurricanes and flooding to extreme heat waves—and chronic stresses such as aging infrastructure, poor air quality, and climate change. The strategy frames five key Visions for Houston's future along with 18 goals and 62 actions describing the path forward, timeframe, partners, implementation opportunities, and corresponding U.N. Sustainable Development Goals.

Primary author of plan
Dedicated city team

Description of the stakeholder engagement processes
Resilient Houston was forged during an 18-month process in collaboration with local stakeholders and regional, national and global partners. Resilient Houston will help to mitigate flooding risk and improve climate readiness. The stakeholder engagement consisted of two major "Living with Water" workshops held in November 2018 and May 2019 to develop recommendations at the regional, city, and neighborhood scale. During the May 2019 workshop, there was a community open house to review and provide feedback on the visions that were being sketched for three specific neighborhoods. The recommendations from this process primarily informed the Bayou chapter of Resilient Houston. An additional "agenda setting" workshop was held in November of 2018 with 250 stakeholders, the project team held interviews with public, private, academic, and non-profit stakeholders. In 2019 five working groups were established, with nearly 100 stakeholders, many of whom represented other coalitions, and groups. These multi-disciplinary working groups focused on 1) equity and inclusion, 2) housing and mobility, 3) living with water, 4) economy and infrastructure, and 5) health and safety. The working group members developed over 100 potential actions to be included in Resilient Houston. In addition to the working groups many other stakeholders were engaged through one-on-one interviews, and through presentations to organizations for additional feedback. A draft outline was also available for public comment.

Update/revision process in place for the Adaptation Plan
<Not Applicable>

Publication title and attach the document
Living With Water Houston

Web link
https://www.houstontx.gov/mayor/Living-With-Water-Final-Report.pdf

Sectors/areas covered by plan that addresses climate change adaptation
Industry
Water
Public Health and Safety

Climate hazards factored into plan that addresses climate change adaptation
Extreme Precipitation > Rain storm
Storm and wind > Cyclone (Hurricane / Typhoon)
Storm and wind > Storm surge
Water Scarcity > Drought
Flood and sea level rise > Flash / surface flood

Year of adoption from local government
2020

Boundary of plan relative to city boundary (reported in 0.1)
Larger – covers the whole city and adjoining areas

If the city boundary is different from the plan boundary, please explain why
The plan included a regional approach beyond the city's immediate boundaries to emphasize the partnership opportunities for resilience-building in the region and to address that the resilience challenges do not stop at the city boundaries.

Stage of implementation
Plan in implementation

Type of plan
Integrated mitigation / adaptation

Has your local government assessed the synergies, trade-offs, and co-benefits, if any, of the main mitigation and adaptation actions you identified?
Yes

Describe the synergies, trade-offs, and co-benefits of this interaction
Living With Water Houston was undertaken as part of the Resilient Houston strategy development process. The Mayor's Office for Resilience teamed with The Water Institute of the Gulf, Waggonner & Ball, and the Kingdom of the Netherlands to hold two Living With Water workshops to develop place-specific strategies to reduce flood risk and equip Houstonians to prepare for the next storm. The outcomes of the Living With Water workshops are summarized in the following report and incorporated into the Resilient Houston strategy. Living with Water is an exploration of the regional systems, natural and built, that define Houston and an analysis of regional flood risk in the

context of climate projections and increasing urbanization. The key to Living With Water approach – and Resilient Houston strategy - is a recognition that actions to reduce risk and increase resilience can be taken at multiple interconnected scales—from the home, to the block, neighborhood, bayou, city, and region. The report goes on to highlight design proposals and recommendations developed for three focus areas – Kashmere Gardens, Independence Heights, and Greenspoint – as well as overall neighborhood-scale recommendations. The Living With Water workshops provided an opportunity for a deep dive into this critical component of Houston's resilience. Houston is the first city to integrate these two-well established frameworks for advancing city resilience, combining a comprehensive vision for a more resilient Houston with place-based strategies that reduce risk and deliver multiple community benefits. Living With Water Houston builds on the many local efforts underway to reduce flood risk and provides a framework and illustrative vision for aligning future actions. The strategies presented in this document should be embraced, localized, developed, and deployed to address the increasing riverine/bayou, urban drainage, and storm surge flooding that threatens Houston.
http://www.greenhoustontx.gov/pressrelease20200130.html

Primary author of plan
Dedicated city team

Description of the stakeholder engagement processes
Living With Water Houston was undertaken as part of the Resilient Houston strategy development process. In August 2018, the one-year anniversary of Hurricane Harvey, Mayor Sylvester Turner, 100 Resilient Cities—Pioneered by the Rockefeller Foundation, and Shell joined forces to name Houston as the 101st member of the 100 Resilient Cities Network, now known as the Global Resilient Cities Network. The stakeholder engagement consisted of two major "Living with Water" workshops held in November 2018 and May 2019 to develop recommendations at the regional, city, and neighborhood scale. During the May 2019 workshop, there was a community open house to review and provide feedback on the visions that were being sketched for three specific neighborhoods. The recommendations from this process primarily informed the Bayou chapter of Resilient Houston.

Update/revision process in place for the Adaptation Plan
<Not Applicable>

Publication title and attach the document
Houston Resilient Assessment

Web link
https://www.houstontx.gov/mayor/Resilient-Houston-Resilience-Assessment-2019may.pdf

Sectors/areas covered by plan that addresses climate change adaptation
Energy
Transport (Mobility)
Building and Infrastructure
Industry
Spatial Planning
Agriculture and Forestry
Water
Business and Financial Service
Social Services

Climate hazards factored into plan that addresses climate change adaptation
Extreme Precipitation > Rain storm
Storm and wind > Severe wind
Storm and wind > Tornado
Storm and wind > Cyclone (Hurricane / Typhoon)
Storm and wind > Tropical storm
Storm and wind > Storm surge
Storm and wind > Lightning / thunderstorm
Extreme cold temperature > Cold wave
Extreme hot temperature > Heat wave
Extreme hot temperature > Extreme hot days

Year of adoption from local government
2019

Boundary of plan relative to city boundary (reported in 0.1)
Larger – covers the whole city and adjoining areas

If the city boundary is different from the plan boundary, please explain why
The plan included a regional approach beyond the city's immediate boundaries to emphasize the partnership opportunities for resilience-building in the region and to address that the resilience challenges do not stop at the city boundaries.

Stage of implementation
Other, please specify (This report was a baseline analysis to inform Resilient Houston.)

Type of plan
Other, please specify (This report was a baseline analysis to inform Resilient Houston.)

Has your local government assessed the synergies, trade-offs, and co-benefits, if any, of the main mitigation and adaptation actions you identified?
Yes

Describe the synergies, trade-offs, and co-benefits of this interaction
The Resilient Assessment main focus was to establish a comprehensive list of shocks and stresses that Houston was susceptible to, based on quantitative and qualitative data. Through this assessment, the challenges and opportunities were grouped and ranked to establish priority areas and themes based on finding synergies, analyzing trade-offs and prioritizing opportunities for co-benefits.

Primary author of plan
Consultant

Description of the stakeholder engagement processes
The Resilience Assessment was developed after the Resilient Houston agenda-setting workshop with over 200 community members and additional interviews and review of existing programs and policies.

Update/revision process in place for the Adaptation Plan
<Not Applicable>

Adaptation Goals

(3.3) Please describe the main goals of your city's adaptation efforts and the metrics / KPIs for each goal.

Adaptation goal
Attract or incubate 50 Energy 2.0 companies in Greater Houston by 2025

Climate hazards that adaptation goal addresses
Storm and wind > Storm surge
Extreme hot temperature > Extreme hot days
Water Scarcity > Drought
Flood and sea level rise > Coastal flood
Biological hazards > Water-borne disease

Target year of goal
2025

Description of metric / indicator used to track goal
New companies

Does this goal align with a requirement from a higher level of government?
No

Select the initiatives related to this adaptation goal that your city has committed to
100 Resilient Cities

Comment
Global Resilient Cities Network should be included as a related initiative.

Adaptation goal
Remove all habitable structures from the floodway by 2030

Climate hazards that adaptation goal addresses
Extreme Precipitation > Rain storm
Flood and sea level rise > Flash / surface flood
Flood and sea level rise > River flood

Target year of goal
2030

Description of metric / indicator used to track goal
Habitable units in the floodway 1) buy outs 2) narrowing of the floodway

Does this goal align with a requirement from a higher level of government?
No

Select the initiatives related to this adaptation goal that your city has committed to
100 Resilient Cities

Comment
Global Resilient Cities Network should be included as a related initiative.

Adaptation goal
Plant 4.6 million new native trees by 2030

Climate hazards that adaptation goal addresses
Extreme hot temperature > Extreme hot days
Chemical change > Atmospheric CO2 concentrations

Target year of goal
2030

Description of metric / indicator used to track goal
Trees planted

Does this goal align with a requirement from a higher level of government?
No

Select the initiatives related to this adaptation goal that your city has committed to
100 Resilient Cities

Comment
Global Resilient Cities Network should be included as a related initiative.

Adaptation goal
Carbon neutral by 2050 in accordance with the Paris Agreement

Climate hazards that adaptation goal addresses
Extreme Precipitation > Rain storm
Storm and wind > Cyclone (Hurricane / Typhoon)
Extreme hot temperature > Extreme hot days
Water Scarcity > Drought

Target year of goal
2040

Description of metric / indicator used to track goal
Reduction in carbon.

Does this goal align with a requirement from a higher level of government?
No

Select the initiatives related to this adaptation goal that your city has committed to
Mayors National Climate Action Agenda

Comment
Global Resilient Cities Network should be included as a related initiative.

Adaptation goal
100 new green stormwater infrastructure projects by 2025

Climate hazards that adaptation goal addresses
Extreme Precipitation > Rain storm
Extreme hot temperature > Extreme hot days
Flood and sea level rise > Flash / surface flood

Target year of goal
2025

Description of metric / indicator used to track goal
Public/private new green stormwater projects - associated co-benefits.

Does this goal align with a requirement from a higher level of government?
No

Select the initiatives related to this adaptation goal that your city has committed to
100 Resilient Cities

Comment
Global Resilient Cities Network should be included as a related initiative.

Adaptation goal
Conserve 24% of undeveloped regional lands as natural spaces by 2040

Climate hazards that adaptation goal addresses
Extreme hot temperature > Extreme hot days
Flood and sea level rise > Flash / surface flood

Target year of goal
2040

Description of metric / indicator used to track goal
Acres conserved

Does this goal align with a requirement from a higher level of government?
No

Select the initiatives related to this adaptation goal that your city has committed to
100 Resilient Cities

Comment
Global Resilient Cities Network should be included as a related initiative.

Adaptation goal
Invest $50 billion in major recovery, mitigation, and modernization projects that increase resilience by 2040

Climate hazards that adaptation goal addresses
Extreme hot temperature > Extreme hot days
Flood and sea level rise > Flash / surface flood

Target year of goal
2040

Description of metric / indicator used to track goal
Dollars invested

Does this goal align with a requirement from a higher level of government?
No

Select the initiatives related to this adaptation goal that your city has committed to
100 Resilient Cities

Comment
Global Resilient Cities Network should be included as a related initiative.

Adaptation Planning Process

(3.4) Does your local/regional government apply a Monitoring and Evaluation (M&E) system for monitoring the implementation of adaptation goals and targets as part of the climate adaptation plan (or integrated climate action plan)?

Monitoring & Evaluation (M&E) system

Response

Yes

Description of Monitoring and Evaluation (M&E) system applied

The City of Houston is in the process of developing Action-level KPIs to track all resilient measures, including climate adaptation actions in addition to the 18 overarching targets, including many related to climate adaptation. The monitoring and evaluation of Resilient Houston is led by the Chief Resilience Officer in coordination with Departmental Resilience Officers in every city department as well as additional internal and external implementation partners. Internal reporting is occurring at a minimum of quarterly with additional reporting planned for the annual anniversary of the February 2020 release of Resilient Houston.

(3.5) Please explain how your city has addressed vulnerable groups through transformative action.

A holistic approach to resilience specifically focuses on our most vulnerable people, places and systems. The development of and implementation of resilient Houston is centered around 5 visions, a healthy place to live, and equitable, inclusive and affordable city, a leader in climate adaptation, a city that builds up, not out, and a transformative economy that builds forward. In this vision actions specifically addressing, engaging, and calling attention to the specific needs of vulnerable groups, from people with disabilities, to small businesses, young people, the elderly, the undocumented, immigrants and non-English speakers, Houstonians experiencing homelessness, Houstonians living in bayou floodways and historically under-invested communities through direct ties to Mayor Turner's Complete Community program.

(3.6) Please explain the level of inclusion of the planning process.

Thousands of Houstonians contributed to the Resilient Houston planning process, and large and small workshops, working group and sub working group meetings, presentations to diverse groups over an 18-month period, one-on-one conversations with the Chief Resilience Officer, and a public review of the draft strategy outline posted online in English and Spanish. The Kashmere Gardens Super Neighborhood hosted a flood resilience workshop as part of the resilience-strategy process and the Complete Communities Action Planning process.

City-wide Emissions

City-wide GHG Emissions Data

(4.0) Does your city have a city-wide emissions inventory to report?

Yes

(4.1) Please state the dates of the accounting year or 12-month period for which you are reporting your latest city-wide GHG emissions inventory.

	From	To
Accounting year dates	January 1 2019	December 31 2019

(4.2) Please indicate the category that best describes the boundary of your city-wide GHG emissions inventory.

	Boundary of inventory relative to city boundary (reported in 0.1)	Excluded sources / areas	Explanation of boundary choice where the inventory boundary differs from the city boundary (include inventory boundary, GDP and population)
Please explain	Same – covers entire city and nothing else		

(4.3) Please give the name of the primary protocol, standard, or methodology you have used to calculate your city's city-wide GHG emissions.

	Primary protocol	Comment
Emissions methodology	Global Protocol for Community Greenhouse Gas Emissions Inventories (GPC)	

(4.3a) The Global Covenant of Mayors requires committed cities to report their inventories in the format of the new Common Reporting Framework (CRF). Would you like to report your inventory in the CRF format or continue to report in the GPC format? This question triggers the display of the corresponding emissions table.

Yes – I will use the CRF format

(4.4) Which gases are included in your city-wide emissions inventory?

CO2
CH4
N20

(4.5) Please attach your city-wide inventory in Excel or other spreadsheet format and provide additional details on the inventory calculation methods in the table below.

Emissions inventory format
GPC format: City Inventory Reporting and Information System (CIRIS)

Document title and attachment
2019 Houston GHG Emissions Inventory
COH 2019 GHG Emissions UEF 082420 CDP Final.xlsx

Emissions factors used
IPCC

Global Warming Potential (select relevant IPCC Assessment Report)
IPCC 4th AR (2007)

Please select which additional sectors are included in the inventory
No additional sectors included

Population in inventory year
2320268

Overall level of confidence
High

Comment on level of confidence
The City recently completed its 2019 GHG Emissions Inventory and is exploring options for third party review and verification. The City followed a similar methodology as the 2014 GHG Emissions Inventory for which a high level of confidence was reported.

(4.6a) The Global Covenant of Mayors requires committed cities to report their inventories in the format of the new Common Reporting Framework, to encourage standard reporting of emissions data. Please provide a breakdown of your city-wide emissions by sector and sub-sector in the table below. Where emissions data is not available, please use the relevant notation keys to explain the reason why.

	Direct emissions (metric tonnes CO2e)	If you have no direct emissions to report, please select a notation key to explain why	Indirect emissions from the use of grid-supplied electricity, heat, steam and/or cooling (metric tonnes CO2e)	If you have no indirect emissions to report, please select a notation key to explain why	Emissions occurring outside the city boundary as a result of in-city activities (metric tonnes CO2e)	If you have no emissions occurring outside the city boundary to report as a result of in-city activities, please select a notation key to explain why	Please explain any excluded sources, identify any emissions covered under an ETS and provide any other comments
Stationary energy > Residential buildings	815970	Please select	4049204	Please select		Not Estimated	
Stationary energy > Commercial buildings & facilities	449325	Please select	8834817	Please select		Not Estimated	
Stationary energy > Institutional buildings & facilities		Integrated Elsewhere		Integrated Elsewhere		Not Estimated	
Stationary energy > Industrial buildings & facilities	1183160	Please select		Integrated Elsewhere		Not Estimated	
Stationary energy > Agriculture		Integrated Elsewhere		Integrated Elsewhere		Not Estimated	
Stationary energy > Fugitive emissions	35031	Please select		Please select		Not Estimated	
Total Stationary Energy	2483487	Please select	12884021	Please select		Not Estimated	
Transportation > On-road	16853981	Please select		Integrated Elsewhere		Not Estimated	
Transportation > Rail	217846	Please select		Integrated Elsewhere		Not Estimated	
Transportation > Waterborne navigation		Not Occurring		Not Occurring		Not Estimated	
Transportation > Aviation	575	Please select		Not Occurring		Not Estimated	
Transportation > Off-road		Not Occurring		Not Occurring		Not Estimated	
Total Transport	17072403	Please select		Please select		Not Estimated	
Waste > Solid waste disposal	30089	Please select		Please select	566598	Please select	
Waste > Biological treatment		Not Occurring		Please select	20414	Please select	
Waste > Incineration and open burning		Not Occurring		Please select		Not Occurring	
Waste > Wastewater	225177	Please select		Please select		Not Occurring	

	Direct emissions (metric tonnes CO2e)	If you have no direct emissions to report, please select a notation key to explain why	Indirect emissions from the use of grid-supplied electricity, heat, steam and/or cooling (metric tonnes CO2e)	If you have no indirect emissions to report, please select a notation key to explain why	Emissions occurring outside the city boundary as a result of in-city activities (metric tonnes CO2e)	If you have no emissions occurring outside the city boundary to report as a result of in-city activities, please select a notation key to explain why	Please explain any excluded sources, identify any emissions covered under an ETS and provide any other comments
Total Waste	255266	Please select		Please select	587012	Please select	
IPPU > Industrial process		Not Estimated		Please select		Not Estimated	
IPPU > Product use		Not Estimated		Please select		Not Estimated	
Total IPPU		Not Estimated		Please select		Not Estimated	
AFOLU > Livestock		Not Estimated		Please select		Not Estimated	
AFOLU > Land use		Not Estimated		Please select		Not Estimated	
AFOLU > Other AFOLU		Not Estimated		Please select		Not Estimated	
Total AFOLU		Not Estimated		Please select		Not Estimated	
Generation of grid-supplied energy > Electricity-only generation	245852	Please select		Please select		Not Estimated	
Generation of grid-supplied energy > CHP generation		Not Estimated		Please select		Not Estimated	
Generation of grid-supplied energy > Heat/cold generation		Not Estimated		Please select		Not Estimated	
Generation of grid-supplied energy > Local renewable generation		Not Occurring		Please select		Not Estimated	
Total Generation of grid-supplied energy	245852	Please select		Please select		Please select	
Total Emissions (excluding generation of grid-supplied energy)	19811156	Please select	12884021	Please select	587012	Please select	

(4.8) Please indicate if your city-wide emissions have increased, decreased, or stayed the same since your last emissions inventory, and describe why.

	Change in emissions	Primary reason for change	Please explain and quantify changes in emissions
Please explain	Decreased	Other, please specify (Decrease in stationary emissions)	Overall, the total emissions inventory (2019) decreased by 0.4% since the last reported inventory (2014). There was a nearly 7% decrease in stationary emissions and nearly 6% increase in transportation emissions. Waste Emissions increased by 2.91%. Although electricity demand increased in 2019 (observed by increased kWh usage and population growth), emissions from electricity decreased because of the improved composition of the electrical grid. The increase in transportation emissions in 2019 is largely driven by a 9% VMT per capita increase since 2014. VMT for Single Unit Trucks (short haul and long haul, refuse truck, and motor home) increased by 14%, similar to Passenger and Light Commercial Trucks. VMT for passenger cars rose by 13% while combination trucks (short and long haul) increased by 9%. Waste emissions increased by approximately 3%.

(4.9) Does your city have a consumption-based inventory to measure emissions from consumption of goods and services by your residents?

	Response	Provide an overview and attach your consumption-based inventory if relevant
Please complete	Intending to undertake in the next 2 years	

City-wide external verification

(4.11) Does your city have a strategy, or other policy document, in place for how to measure and reduce consumption-based GHG emissions in your city?

Food

Response
No

Please provide more details on and/or a link to the strategy

Construction

Response
No

Please provide more details on and/or a link to the strategy

Transportation

Response
No

Please provide more details on and/or a link to the strategy

Clothing and textiles

Response
No

Please provide more details on and/or a link to the strategy

Electronics

Response
No

Please provide more details on and/or a link to the strategy

Aviation

Response
No

Please provide more details on and/or a link to the strategy

(4.12) Has the city-wide GHG emissions data you are currently reporting been externally verified or audited in part or in whole?
Intending to undertake in the next 2 years

(4.12b) Please explain why your city-wide emissions inventory is not verified and describe any plans to verify your city-wide emissions in the future.

	Reason	Comments
Please explain	Other, please specify (The City recently completed its 2019 GHG Emissions Inventory and is exploring options for third party review and verification.)	

Historical emissions inventories

(4.13) Please provide details on any historical and base year city-wide emissions inventories your city has, in order to allow assessment of targets in the table below.

Inventory date from
January 1 2014

Inventory date to
December 31 2014

Scopes / boundary covered
Total emissions

Previous emissions (metric tonnes CO2e)
33414017

Is this inventory used as the base year inventory?
Yes

Methodology
Global Protocol for Community Greenhouse Gas Emissions Inventories (GPC)

File name and attach your inventory
2014 City of Houston Greenhouse Gas Emissions Inventory
Houston_2014_GPC_CIRIS_05.18.2018_COH_FINAL for CDP.xlsx

Comments

Re-stating previous emissions inventories

(4.14) Since your last submission, have you needed to recalculate any past city-wide GHG emission inventories previously reported to CDP?
Yes

(4.14a) Please provide your city's recalculated total city-wide emissions figures for any previous inventories along with Scope 1, 2 and 3 breakdowns where applicable.

Inventory date from
January 1 2014

Inventory date to
December 31 2014

Scope/boundary covered
Total emissions

Previous emissions (metric tonnes CO2e)
33414017

Updated emissions (metric tonnes CO2e)
33414134

Updated methodology
Global Protocol for Community Greenhouse Gas Emissions Inventories (GPC)

File name and attach your new inventory
2014 Houston GHG Emissions Inventory CAP
2014 Houston GHG Emissions Inventory CAP.xlsx

Reason for recalculation
The recalculation results from an update of the resident population used to determine the metric tonnes organic waste treated biologically to determine the emissions from the biological treatment of waste. Because of rounding issues the CIRIS spreadsheet and the total used as the baseline in the Houston Climate Action Plan differ slightly 33,414.135 verses 33,414,134 (CAP). The City, to be consist with the CAP reports the 33,414,134 as the base.

Inventory date from
January 1 2014

Inventory date to
December 31 2014

Scope/boundary covered
Scope 1 (direct)

Previous emissions (metric tonnes CO2e)
19263921

Updated emissions (metric tonnes CO2e)
19264019

Updated methodology
Global Protocol for Community Greenhouse Gas Emissions Inventories (GPC)

File name and attach your new inventory

Reason for recalculation
The recalculation results from an update of the resident population used to calculate municipal wastewater emissions.

Inventory date from
January 1 2014

Inventory date to
December 31 2014

Scope/boundary covered
Scope 3 (other indirect)

Previous emissions (metric tonnes CO2e)
571584

Updated emissions (metric tonnes CO2e)
571602

Updated methodology
Global Protocol for Community Greenhouse Gas Emissions Inventories (GPC)

File name and attach your new inventory

Reason for recalculation
The recalculation results from an update of the resident population used to determine the metric tonnes organic waste used to calculate emissions from the biological treatment of solid waste.

GCoM Emission Factor and Activity Data

(4.15) Please provide a summary of emissions factors and activity data used in your inventory.

Applicable sub-sector
CRF - Stationary energy > Residential buildings

Category
Direct emissions

Fuel type or activity
Natural gas

Emission factor source
National Emissions Factors Database, U.S. Environmental Protection Agency Emissions Factors Hub Emissions Factors for Greenhouse Gas Inventories

Gas
CO2e

Emission factor value
0.0000544956

Emission factor unit (numerator)
Tonne (t)

Emission factor unit (denominator)
scf

Activity level (per emission factor unit denominator)
14973158000

Comment
The emissions value for gas equals the tCO2e (CO2, Ch4 and N2O)

Applicable sub-sector
CRF - Stationary energy > Residential buildings

Category
Indirect emissions from the use of grid-supplied electricity, heat, steam and/or cooling

Fuel type or activity
Electricity

Emission factor source
National electricity emission factor database/ U.S Environmental Protection Agency/ Emission factor for grid-supplied electricity (eGRID2018 - ERCT). Released March 2020

Gas
CO2e

Emission factor value
0.4245813299

Emission factor unit (numerator)
Tonne (t)

Emission factor unit (denominator)
MWh

Activity level (per emission factor unit denominator)
9536934.31

Comment
Includes single family and multi-family use. The emissions value for gas equals the tCO2e (CO2, Ch4 and N2O).

Applicable sub-sector
CRF -Stationary energy > Commercial buildings & facilities

Category
Direct emissions

Fuel type or activity
Natural gas

Emission factor source
National Emissions Factors Database, U.S. Environmental Protection Agency Emissions Factors Hub Emissions Factors for Greenhouse Gas Inventories

Gas
CO2e

Emission factor value
0.0000544956

Emission factor unit (numerator)
Tonne (t)

Emission factor unit (denominator)
scf

Activity level (per emission factor unit denominator)
8245174100

Comment
The emissions value for gas equals the tCO2e (CO2, Ch4 and N2O).

Applicable sub-sector
CRF -Stationary energy > Commercial buildings & facilities

Category
Indirect emissions from the use of grid-supplied electricity, heat, steam and/or cooling

Fuel type or activity
Electricity

Emission factor source
National electricity emission factor database/ U.S Environmental Protection Agency/ Emission factor for grid-supplied electricity (eGRID2018 - ERCT). Released March 2020

Gas
CO2e

Emission factor value
0.4245813299

Emission factor unit (numerator)
Tonne (t)

Emission factor unit (denominator)
MWh

Activity level (per emission factor unit denominator)
20808302.79

Comment
The emissions value for gas equals the tCO2e (CO2, Ch4 and N2O).

Applicable sub-sector
CRF - Stationary energy > Industrial buildings & facilities

Category
Direct emissions

Fuel type or activity
Natural gas

Emission factor source
National Emissions Factors Database, U.S. Environmental Protection Agency Emissions Factors Hub Emissions Factors for Greenhouse Gas Inventories

Gas
CO2e

Emission factor value
0.000054496

Emission factor unit (numerator)
Tonne (t)

Emission factor unit (denominator)
scf

Activity level (per emission factor unit denominator)
21711133400

Comment
The emissions value for gas equals the tCO2e (CO2, Ch4 and N2O).

Applicable sub-sector
CRF - Stationary energy > Fugitive emissions

Category
Direct emissions

Fuel type or activity
Natural gas

Emission factor source
Default emissions factors CIRIS Fugitive Gas Calculator

Gas
CO2e

Emission factor value
0.000027551

Emission factor unit (numerator)
Tonne (t)

Emission factor unit (denominator)
m3

Activity level (per emission factor unit denominator)
1271503871

Comment
The emissions value for gas equals the tCO2e.

Applicable sub-sector
CRF - Transportation > On-road

Category

Direct emissions

Fuel type or activity
Motor gasoline (petrol)

Emission factor source
Houston-Galveston Area Council and Texas A&M Transportation Institute/ Distance-based emission factor calculated using EPA's MOVES Model

Gas
CO2e

Emission factor value

Emission factor unit (numerator)
Tonne (t)

Emission factor unit (denominator)
Mile

Activity level (per emission factor unit denominator)
35000696859

Comment
The emissions factors vary by vehicle type and can be found in the attached 2019 City of Houston GHG Emissions Inventory. The emissions value for gas equals the tCO2e (CO2, Ch4 and N2O).

Applicable sub-sector
CRF - Transportation > On-road

Category
Direct emissions

Fuel type or activity
Diesel oil

Emission factor source
Houston-Galveston Area Council and Texas A&M Transportation Institute/ Distance-based emission factor calculated using EPA's MOVES Model

Gas
CO2e

Emission factor value

Emission factor unit (numerator)
Tonne (t)

Emission factor unit (denominator)
Mile

Activity level (per emission factor unit denominator)
2389259778.1

Comment
The emissions factors vary by vehicle type and can be found in the attached 2019 City of Houston GHG Emissions Inventory. The emissions value for gas equals the tCO2e (CO2, Ch4 and N2O).

Applicable sub-sector
CRF - Transportation > Rail

Category
Direct emissions

Fuel type or activity
Diesel oil

Emission factor source
National Emissions Factors Database, U.S. Environmental Protection Agency Emissions Factors Hub/ Emissions Factors for Greenhouse Gas Inventories

Gas
CO2e

Emission factor value
0.01030748

Emission factor unit (numerator)
Tonne (t)

Emission factor unit (denominator)
Gallon (US)

Activity level (per emission factor unit denominator)
20350250

Comment
The emissions value for gas equals the tCO2e (CO2, Ch4 and N2O).

Applicable sub-sector
CRF - Transportation > Rail

Category

Direct emissions

Fuel type or activity
Diesel oil

Emission factor source
National Emissions Factors Database, U.S. Environmental Protection Agency Emissions Factors Hub/ Emissions Factors for Greenhouse Gas Inventories

Gas
CO2e

Emission factor value
0.0000151425

Emission factor unit (numerator)
Tonne (t)

Emission factor unit (denominator)
Miles

Activity level (per emission factor unit denominator)
564901

Comment
The emissions value for gas equals the tCO2e (CO2, Ch4 and N2O).

Applicable sub-sector
CRF - Transportation > Rail

Category
Direct emissions

Fuel type or activity
Electricity

Emission factor source
National Emissions Factors Database, U.S. Environmental Protection Agency Emissions Factors Hub/ Emissions Factors for Greenhouse Gas Inventories

Gas
CO2e

Emission factor value
0.0001492015

Emission factor unit (numerator)
Tonne (t)

Emission factor unit (denominator)
Miles

Activity level (per emission factor unit denominator)
53624968

Comment
The emissions value for gas equals the tCO2e (CO2, Ch4 and N2O).

Applicable sub-sector
CRF - Transportation > Aviation

Category
Direct emissions

Fuel type or activity
Jet kerosene

Emission factor source
National Emissions Factors Database, U.S. Environmental Protection Agency Emissions Factors Hub/ Emissions Factors for Greenhouse Gas Inventories

Gas
CO2e

Emission factor value
0.00978409

Emission factor unit (numerator)
Tonne (t)

Emission factor unit (denominator)
Gallon (US)

Activity level (per emission factor unit denominator)
58819

Comment
The emissions value for gas equals the tCO2e (CO2, Ch4 and N2O).

Applicable sub-sector
CRF - Waste > Solid waste disposal

Category

Direct emissions

Fuel type or activity
Landfill gas

Emission factor source
Default emissions factors CIRIS Solid Waste Disposal Calculator

Gas
CO2e

Emission factor value
0.279015208

Emission factor unit (numerator)
Tonne (t)

Emission factor unit (denominator)
Landfill waste metric tonnes

Activity level (per emission factor unit denominator)
107840

Comment
Direct release of landfill gas to the atmosphere plus combustion of landfill gas without energy recovery. The emissions value for gas equals the tCO2e.

Applicable sub-sector
CRF - Waste > Solid waste disposal

Category
Emissions occurring outside the city boundary as a result of in-city activities

Fuel type or activity
Landfill gas

Emission factor source
Default emissions factors CIRIS Solid Waste Disposal Calculator

Gas
CO2e

Emission factor value
0.279015691

Emission factor unit (numerator)
Tonne (t)

Emission factor unit (denominator)
Landfill waste metric tonnes

Activity level (per emission factor unit denominator)
2030703

Comment
Direct release of landfill gas to the atmosphere plus combustion of landfill gas without energy recovery. The emissions value for gas equals the tCO2e.

Applicable sub-sector
CRF - Waste > Biological treatment

Category
Emissions occurring outside the city boundary as a result of in-city activities

Fuel type or activity
Other, please specify (Composting of organic waste diverted from landfill)

Emission factor source
Default emissions factors CIRIS Biological Treatment Calculator

Gas
CO2e

Emission factor value
0.171518833

Emission factor unit (numerator)
Tonne (t)

Emission factor unit (denominator)
Organic waste treated biologically in metric tonnes.

Activity level (per emission factor unit denominator)
119019

Comment
The emissions value for gas equals the tCO2e.

Applicable sub-sector
CRF - Waste > Wastewater

Category

Direct emissions

Fuel type or activity
Other, please specify (Municipal wastewater for WWTPs)

Emission factor source
Default emissions factors CIRIS Wastewater Calculator

Gas
CO2e

Emission factor value
0.097047841

Emission factor unit (numerator)
Tonne (t)

Emission factor unit (denominator)
Population

Activity level (per emission factor unit denominator)
2320268

Comment
The emissions value for gas equals the tCO2e.

Applicable sub-sector
CRF - Generation of grid-supplied energy > Electricity-only generation

Category
Direct emissions

Fuel type or activity
Other, please specify (Electricity generation)

Emission factor source
U.S. EPA FLIGHT Tool, Data reported to U.S. EPA directly by facility

Gas
CO2e

Emission factor value

Emission factor unit (numerator)
Tonne (t)

Emission factor unit (denominator)
Data reported to U.S. EPA directly by facility

Activity level (per emission factor unit denominator)

Comment
Data reported to U.S. EPA directly by facility

Applicable sub-sector
CRF - Generation of grid-supplied energy > Electricity-only generation

Category
Direct emissions

Fuel type or activity
Other, please specify (Combustion of landfill gas with energy recovery)

Emission factor source
Default emissions factors CIRIS Solid Waste Disposal Calculator, EPA Flight tool

Gas
CO2e

Emission factor value
0.141124174

Emission factor unit (numerator)
Tonne (t)

Emission factor unit (denominator)
Landfill waste metric tonnes

Activity level (per emission factor unit denominator)
1742097

Comment
The emissions value for gas equals the tCO2e.

Emissions Reduction

Mitigation Target setting

(5.0) Do you have a GHG emissions reduction target(s) in place at the city-wide level?
Base year emissions (absolute) target

(5.0a) Please provide details of your total city-wide base year emissions reduction (absolute) target(s). In addition, you may add rows to provide details of your sector-specific targets, by providing the base year emissions specific to that target.

Sector
All emissions sources included in city inventory

Where sources differ from the inventory, identify and explain these additions / exclusions
http://greenhoustontx.gov/climateactionplan/index.html

Boundary of target relative to city boundary (reported in 0.1)
Same – covers entire city and nothing else

Base year
2014

Year of target introduction
2020

Base year emissions (metric tonnes CO2e)
33414134

Percentage reduction target
40

Target year
2030

Target year absolute emissions (metric tonnes CO2e) [Auto-calculated]
20048480.4

The CAP plan targets account for certain growth factors, which result in an estimated target emissions reduction of 18 million metric tonnes CO2e.

Percentage of target achieved so far
0

Does this target align with the global 1.5 - 2 °C pathway set out in the Paris Agreement?
Yes - 1.5 °C

Select the initiatives that this target contributes towards
Global Covenant of Mayors for Climate & Energy
100 Resilient Cities
STAR Communities
Mayors National Climate Action Agenda

Does this target align to a requirement from a higher level of sub-national government
No

Please describe your target. If your country has an NDC and your city's target is less ambitious than the NDC, please explain why.
http://greenhoustontx.gov/climateactionplan/index.html

Target meets initial GCoM validation criteria
Automatically validate target

Sector
All emissions sources included in city inventory

Where sources differ from the inventory, identify and explain these additions / exclusions
http://greenhoustontx.gov/climateactionplan/index.html

Boundary of target relative to city boundary (reported in 0.1)
Same – covers entire city and nothing else

Base year
2014

Year of target introduction
2020

Base year emissions (metric tonnes CO2e)
33414134

Percentage reduction target
75

Target year
2040

Target year absolute emissions (metric tonnes CO2e) [Auto-calculated]
8353533.5

The CAP plan targets account for certain growth factors, which result in an estimated target emissions reduction of 33 million metric tonnes CO2e.

Percentage of target achieved so far
0

Does this target align with the global 1.5 - 2 °C pathway set out in the Paris Agreement?
Yes - 1.5 °C

Select the initiatives that this target contributes towards
Global Covenant of Mayors for Climate & Energy
100 Resilient Cities
STAR Communities
Mayors National Climate Action Agenda

Does this target align to a requirement from a higher level of sub-national government
No

Please describe your target. If your country has an NDC and your city's target is less ambitious than the NDC, please explain why.
http://greenhoustontx.gov/climateactionplan/index.html

Target meets initial GCoM validation criteria
Automatically validate target

Sector
All emissions sources included in city inventory

Where sources differ from the inventory, identify and explain these additions / exclusions
http://greenhoustontx.gov/climateactionplan/index.html

Boundary of target relative to city boundary (reported in 0.1)
Same – covers entire city and nothing else

Base year
2014

Year of target introduction
2020

Base year emissions (metric tonnes CO2e)
33414134

Percentage reduction target
100

Target year
2050

Target year absolute emissions (metric tonnes CO2e) [Auto-calculated]
0

Percentage of target achieved so far
0

Does this target align with the global 1.5 - 2 °C pathway set out in the Paris Agreement?
Yes - 1.5 °C

Select the initiatives that this target contributes towards
Global Covenant of Mayors for Climate & Energy
100 Resilient Cities
STAR Communities
Mayors National Climate Action Agenda

Does this target align to a requirement from a higher level of sub-national government
No

Please describe your target. If your country has an NDC and your city's target is less ambitious than the NDC, please explain why.
http://greenhoustontx.gov/climateactionplan/index.html

Target meets initial GCoM validation criteria
Automatically validate target

(5.1) Please describe how the target(s) reported above align with the global 1.5 - 2 °C pathway set out in the Paris agreement.

In April 2020, the City of Houston launched its Climate Action Plan. As outlined in the CAP, to comply with the Paris Agreement, the Houston plan will follow science-based criteria that will cap the temperature increase associated with climate change to 1.5 degrees Celsius. Scientists believe that preventing global temperatures from rising more than 1.5 degrees Celsius will avert the worst consequences of climate change. To comply with the Paris Climate Agreement and achieve a long-term goal of carbon neutrality by 2050, ambitious, interim targets were established. Using these targets as a roadmap, the CAP aims to reduce Houston's base year emissions (33,414,134 tonnes CO2e in 2014; city-induced framework) by at least 40% by 2030 and at least 75% by 2040.) The plan promotes practical, cost-effective steps to develop global low-carbon energy, transportation, and waste solutions.

(5.2) Is your city-wide emissions reduction target(s) conditional on the success of an externality or component of policy outside of your control?
No

(5.3) Does your city-wide emissions reduction target(s) account for the use of transferable emissions units?
No

Mitigation Actions

(5.4) Describe the anticipated outcomes of the most impactful mitigation actions your city is currently undertaking; the total cost of the action and how much is being funded by the local government.

Mitigation action
Energy Supply > Low or zero carbon energy supply generation

Action title
Community Solar Projects on Municipal Land

Means of implementation
Awareness raising program or campaign
Stakeholder engagement
Infrastructure development

Implementation status
Pre-feasibility study

Estimated emissions reduction (metric tonnes CO2e)
80420

Energy savings (MWh)
127540

Renewable energy production (MWh)
127540

Timescale of reduction / savings / energy production
Per year

Co-benefit area
Enhanced resilience
Reduced GHG emissions
Improved resource efficiency (e.g. food, water, energy)
Job creation
Improved resource quality (e.g. air, water)
Improved resource security (e.g. food, water, energy)

Scope and impact of action
Through participation in the C40 Reinventing Cities program, the City is making plans to re-imagine how under-utilized public assets can be used in a sustainable way. Starting in Sunnyside, a neighborhood in the Complete Communities program, the City will will work with Sunnyside Energy to convert the 240-acre Holmes Road landfill into a 70 MW solar farm. The proposal by Sunnyside Energy (a partnership between EDF Renewables, MP2 Energy, and Wolfe Energy) was selected through a competitive process and includes other potential benefits such as jobs and training, energy discounts for lower-income residents in the neighborhood, and reduced flooding.

Finance status
Pre-feasibility study status

Total cost of the project
86325000

Total cost provided by the local government
0

Majority funding source
Public-private partnership

Total cost provided by the majority funding source (currency)
86325000

Web link to action website
http://greenhoustontx.gov/pressrelease20190829.html

Name of the stakeholder group
<Not Applicable>

Role in the GCC program
<Not Applicable>

Name of the engagement activities
<Not Applicable>

Aim of the engagement activities
<Not Applicable>

Attach reference document
<Not Applicable>

Mitigation action
Buildings > Building performance rating and reporting

Action title
Building Performance Rating

Means of implementation
Policy and regulation

Implementation status
Implementation

Estimated emissions reduction (metric tonnes CO2e)
13759

Energy savings (MWh)
19460

Renewable energy production (MWh)
0

Timescale of reduction / savings / energy production
Projected lifetime

Co-benefit area
Reduced GHG emissions
Improved resource efficiency (e.g. food, water, energy)
Shift to more sustainable behaviours

Scope and impact of action
The City of Houston has voluntary benchmarking programs, like the Department of Energy's Better Buildings Challenge, where commercial buildings opt into disclosing their energy ratings to the City. Municipal buildings account for 7 million out of 30 million square feet of the city's commitment.

Finance status
Finance secured

Total cost of the project

Total cost provided by the local government

Majority funding source
Please select

Total cost provided by the majority funding source (currency)

Web link to action website
https://betterbuildingssolutioncenter.energy.gov/partners/houston-tx

Name of the stakeholder group
<Not Applicable>

Role in the GCC program
<Not Applicable>

Name of the engagement activities
<Not Applicable>

Aim of the engagement activities
<Not Applicable>

Attach reference document
<Not Applicable>

Mitigation action
Buildings > Energy efficiency/ retrofit measures

Action title
Property Assessed Clean Energy Program/Energy

Means of implementation
Stakeholder engagement
Infrastructure development
Financial mechanism

Implementation status
Operation

Estimated emissions reduction (metric tonnes CO2e)
5888

Energy savings (MWh)
10888.89

Renewable energy production (MWh)
52.88

Timescale of reduction / savings / energy production
Per year

Co-benefit area
Reduced GHG emissions
Improved resource efficiency (e.g. food, water, energy)
Job creation
Resource conservation (e.g. soil, water)

Scope and impact of action
In 2016, Houston created the first municipal Property Assessed Clean Energy Program (PACE) to provide an additional tool for Houston property owners to finance energy efficiency, renewable energy, and water conservation projects. In 2017, Houston's first PACE project was announced, which, at just over $2 million, was the largest PACE project in Texas at that time. Thus far, 5 projects have been completed in Houston, resulting in more than $26.6 million in investment and saving 5,888 metric tonnes of CO2 emissions each year, 23.5 million gallons water/year, 10.9 million kWh/year of electricity, and 3.7 million BTU/year of natural gas. PACE projects also created 357 jobs.

Finance status
Finance secured

Total cost of the project
26652455

Total cost provided by the local government

0

Majority funding source
Public-private partnership

Total cost provided by the majority funding source (currency)
26652455

Web link to action website
https://www.texaspaceauthority.org/houston-pace/

Name of the stakeholder group
<Not Applicable>

Role in the GCC program
<Not Applicable>

Name of the engagement activities
<Not Applicable>

Aim of the engagement activities
<Not Applicable>

Attach reference document
<Not Applicable>

Mitigation action
Private Transport > Improve fuel economy and reduce CO2 from motorized vehicles

Action title
EVolve Houston Partnership and EVolve Electric Vehicle Roadmap 30 by 30

Means of implementation
Awareness raising program or campaign
Policy and regulation
Sustainable public procurement

Implementation status
Operation

Estimated emissions reduction (metric tonnes CO2e)

Energy savings (MWh)

Renewable energy production (MWh)

Timescale of reduction / savings / energy production
Please select

Co-benefit area
Reduced GHG emissions
Shift to more sustainable behaviours

Scope and impact of action
EVolve Houston is a public-private coalition founded by Mayor Turner, Shell, NRG Energy, CenterPoint Energy, the University of Houston, and LDR Advisory Partners that is dedicated to improving air quality and reducing GHG emissions by electrifying transportation in Houston. Launched in late 2019, EVolve Houston has set a “30 by 30” goal: for electric vehicles to reach a 30% share of annual new car sales in Houston by 2030. To achieve this goal, EVolve Houston developed an Electric Vehicle Roadmap, which focuses on strategically increasing the awareness, availability, and affordability of electric vehicles. EVolve Houston is already implementing these initiatives through pilot projects, demonstrations, and educational outreach to accelerate EV adoption.

Finance status
Please select

Total cost of the project

Total cost provided by the local government

Majority funding source
Public-private partnership

Total cost provided by the majority funding source (currency)

Web link to action website
https://www.evolvehouston.org/

Name of the stakeholder group
<Not Applicable>

Role in the GCC program
<Not Applicable>

Name of the engagement activities
<Not Applicable>

Aim of the engagement activities
<Not Applicable>

Attach reference document
<Not Applicable>

Mitigation action

Buildings > Energy efficiency/ retrofit measures

Action title
City of Houston General Services Department (GSD) Energy Efficiency Project

Means of implementation
Assessment and evaluation activities

Implementation status
Pre-implementation

Estimated emissions reduction (metric tonnes CO2e)
4654

Energy savings (MWh)
6583.05

Renewable energy production (MWh)

Timescale of reduction / savings / energy production
Per year

Co-benefit area
Reduced GHG emissions
Improved resource efficiency (e.g. food, water, energy)
Resource conservation (e.g. soil, water)
Shift to more sustainable behaviours

Scope and impact of action
GSD applied to the State Energy Conservation Office (SECO) for energy efficiency funding under its LoanStar (Saving Taxes and Resources) Revolving Loan Program to fund the energy cost reduction measures identified by Texas Engineering Experiment Station (TEES) Energy System Laboratory. The total estimated cost of energy cost reduction measures is $2,753,914 with a payback of 6.7 years. GSD will implement the energy cost reduction measures at Bob Lanier Public Works Buildings, City Hall, City Hall Annex, and the Houston Permitting Center. The City will repay the low-interest SECO loan from energy cost savings achieved through retrofits of the facilities. On May 6, 2020 City Council approved Ordinance No. 2020-0395 an Interlocal Agreement for Energy Services between the City of Houston and Texas A&M Engineering Equipment Station.

Finance status
Pre-feasibility study status

Total cost of the project
2753914

Total cost provided by the local government
2753914

Majority funding source
Other, please specify (SECO LoanStar Revolving Loan Program)

Total cost provided by the majority funding source (currency)
2753914

Web link to action website
https://houston.novusagenda.com/agendapublic/CoverSheet.aspx?ItemID=19643&MeetingID=429; https://comptroller.texas.gov/programs/seco/funding/loanstar/

Name of the stakeholder group
<Not Applicable>

Role in the GCC program
<Not Applicable>

Name of the engagement activities
<Not Applicable>

Aim of the engagement activities
<Not Applicable>

Attach reference document
<Not Applicable>

Mitigation action
Buildings > Building codes and standards

Action title
LEED Designed Buildings

Means of implementation
Policy and regulation

Implementation status
Operation

Estimated emissions reduction (metric tonnes CO2e)
15555

Energy savings (MWh)
22000

Renewable energy production (MWh)

Timescale of reduction / savings / energy production
Per year

Co-benefit area
Reduced GHG emissions
Improved resource efficiency (e.g. food, water, energy)
Resource conservation (e.g. soil, water)
Shift to more sustainable behaviours

Scope and impact of action
Since 2004, the City of Houston has required all new municipal buildings larger than 10,000 square feet to be LEED Certified. The City now has 37 LEED municipal buildings and is investing in energy efficiency upgrades to 6 million square feet of city facilities through energy performance contracting. This effort has reduced energy use by 30%, saving more than 22 million kWh of electricity every year. A retro-commissioning audit of the Houston Permitting Center in 2019 identified $9,000 of energy-efficiency updates that will result in more than 1.3 million kWh saved per year

Finance status
Finance secured

Total cost of the project

Total cost provided by the local government

Majority funding source
Please select

Total cost provided by the majority funding source (currency)

Web link to action website
http://www.greenhoustontx.gov/pdf/ordinance-greenbuilding.pdf; http://www.greenhoustontx.gov/energy.html; http://greenhoustontx.gov/climateactionplan/CAP-April2020.pdf (pg 25)

Name of the stakeholder group
<Not Applicable>

Role in the GCC program
<Not Applicable>

Name of the engagement activities
<Not Applicable>

Aim of the engagement activities
<Not Applicable>

Attach reference document
<Not Applicable>

Mitigation action
Finance and Economic Development > Developing the green economy

Action title
Greentown Houston

Means of implementation
Capacity building and training activities
Stakeholder engagement

Implementation status
Pre-implementation

Estimated emissions reduction (metric tonnes CO2e)

Energy savings (MWh)

Renewable energy production (MWh)

Timescale of reduction / savings / energy production
Please select

Co-benefit area
Reduced GHG emissions
Greening the economy
Economic growth
Job creation

Scope and impact of action
Greentown Labs will provide approximately 30,000 square feet of prototyping lab and office space for about 50 startups. Greentown labs will help reach the CAP target of attracting 50 Energy 2.0 companies to Houston by 2025.

Finance status
Please select

Total cost of the project

Total cost provided by the local government
0

Majority funding source
Public-private partnership

Total cost provided by the majority funding source (currency)

Web link to action website
https://greentownlabs.com/houston/; http://greenhoustontx.gov/climateactionplan/CAP-April2020.pdf

Name of the stakeholder group
<Not Applicable>

Role in the GCC program
<Not Applicable>

Name of the engagement activities
<Not Applicable>

Aim of the engagement activities
<Not Applicable>

Attach reference document
<Not Applicable>

Mitigation action
Private Transport > Improve fuel economy and reduce CO2 from motorized vehicles

Action title
City of Houston 100% EV Fleet Conversion (Non-emergency municipal fleet)

Means of implementation
Infrastructure development
Development and implementation of action plan
Sustainable public procurement

Implementation status
Scoping

Estimated emissions reduction (metric tonnes CO2e)
30750

Energy savings (MWh)

Renewable energy production (MWh)

Timescale of reduction / savings / energy production
Per year

Co-benefit area
Reduced GHG emissions

Scope and impact of action
The City of Houston committed to converting its non-emergency, light-duty fleet to electric or hybrid vehicles by 2030. The City was awarded a $75k grant from Rice University/Kinder Foundation for a green fleet study with the Houston Solutions Lab, to help the Fleet Department determine when to replace City fleet vehicles and what type of fuel would be most emissions and cost efficient. The study was presented at the Transportation, Technology and Infrastructure council committee.

Finance status
Pre-feasibility study status

Total cost of the project

Total cost provided by the local government

Majority funding source
Public-private partnership

Total cost provided by the majority funding source (currency)

Web link to action website
http://greenhoustontx.gov/climateactionplan/CAP-April2020.pdf; https://www.houstontx.gov/fleet/ev/; houstontx.gov/council/committees/tti/20200305/presentation-evs.pdf

Name of the stakeholder group
<Not Applicable>

Role in the GCC program
<Not Applicable>

Name of the engagement activities
<Not Applicable>

Aim of the engagement activities
<Not Applicable>

Attach reference document
<Not Applicable>

Mitigation action
Private Transport > Improve fuel economy and reduce CO2 from motorized vehicles

Action title
Green Fleet Program

Means of implementation
Infrastructure development
Development and implementation of action plan
Sustainable public procurement

Implementation status
Implementation

Estimated emissions reduction (metric tonnes CO2e)

Energy savings (MWh)

Renewable energy production (MWh)

Timescale of reduction / savings / energy production
Please select

Co-benefit area
Reduced GHG emissions

Scope and impact of action
The City of Houston has one of the largest green fleets in the nation, including 525 hybrid vehicles and 44 electric vehicles, and was one of the first municipalities to pilot electric fleet vehicles. Approximately 50% of the City's non-specialty, light-duty fleet has been replaced with hybrid vehicles. Overall, about 5.7% of the City's entire vehicle fleet is green. Unfortunately, due to the severe flooding in the parking garages under City Hall, nearly all of the City's EV fleet was destroyed in 2017. (The City is still lacking the Pre-Harvey EV infrastructure, and therefore recently issued an RFI. The next step will be to issue an RFP once the initial responses are received). The City Fleet Management Department (FMD)is also conducting pilot projects to evaluate opportunities to deploy alternative fuels such as ethanol and biodiesel. In partnership with Houston Public Works, FMD is piloting a 5,000-gallon ethanol (E-85) alternative fuel tank and dispenser to use with ethanol/gasoline-capable flexible fuel vehicles. Planned for 2020, FMD will test the integration of biodiesel (B-20) in heavy- and medium-duty diesel equipment.

Finance status
Pre-feasibility study status

Total cost of the project

Total cost provided by the local government

Majority funding source
Public-private partnership

Total cost provided by the majority funding source (currency)

Web link to action website
http://greenhoustontx.gov/climateactionplan/CAP-April2020.pdf; https://www.houstontx.gov/fleet/ev/

Name of the stakeholder group
<Not Applicable>

Role in the GCC program
<Not Applicable>

Name of the engagement activities
<Not Applicable>

Aim of the engagement activities
<Not Applicable>

Attach reference document
<Not Applicable>

Mitigation action
Community-Scale Development > Transit oriented development

Action title
Houston Bike Share Program / Expansion Project

Means of implementation
Infrastructure development
Monitor activities

Implementation status
Operation

Estimated emissions reduction (metric tonnes CO2e)
516.2

Energy savings (MWh)

Renewable energy production (MWh)

Timescale of reduction / savings / energy production
Other, please specify (2019 estimated reduction)

Co-benefit area
Reduced GHG emissions
Improved public health
Shift to more sustainable behaviours

Scope and impact of action
Houston BCycle is the city's bike share program and currently consists of over 110 stations and 800 bikes available to riders across central Houston neighborhoods. The system is operated by Houston Bike Share, a local 501(c)(3) nonprofit whose mission is to provide equitable access to bike share that fosters recreation, mobility and personal wellness. With oversight from the Houston Planning & Development Department and funding support from a federal grant and local partners, Houston Bike Share is leading a $4.7 million project to expand the Houston BCycle network. In 2019, Houston BCycle ridership is the highest it's ever been with a 50% increase in bike share trips compared to last year. This is the largest growth in ridership in the history of the bike share program, surpassing the 26% growth from 2017-2018. Expansion Project. Is expected to be completed in 2020. The Planning & Development Department sponsored an application in the 2015 Transportation Improvement Program Call for Projects to expand the Houston BCycle program and was awarded a grant from the Federal Highway Administration. The expansion project will almost quadruple the size of bike share in Houston over the next two years by adding 97 bike stations and 767 bicycles. Two transport vans will also be added to help distribute bikes across the Houston BCycle network. As new stations are added to the network, the bike share system becomes more useful by connecting more neighborhoods to job centers and recreational destinations. The grant will reimburse the City of Houston for 80% of the cost to expand the system, up to $3.7 million. Houston Bike Share, the City's project partner and

program operator, will provide the 20% local match requirement and oversee installation of the bike stations. City of Houston provides 100% of the funding upfront for the grant-funded expansion project. 80% of project expenses is reimbursable by TxDOT (Texas Department of Transportation). Houston Bike Share provides the 20% local match funds for the project. The $940,500 Local Government Participation is provided to the City by Houston Bike Share. The City works in partnership with Houston Bike Share, a local 501(c)(3) nonprofit whose mission is to provide equitable access to bike share that fosters recreation mobility and personal wellness. Houston Bike Share partners with local public and private stakeholders to obtain local match funding for the bike stations. The City does not provide funding for the operation of the Houston BCycle program. Bike station user fees provide 80% of operational needs for the program. Houston Bike Share obtains other grants and private donations to supplement operation needs. Funding information below is for the expansion project.

Finance status
Finance secured

Total cost of the project
4704745

Total cost provided by the local government
940500

Majority funding source
Public-private partnership

Total cost provided by the majority funding source (currency)
3762000

Web link to action website
https://www.houstontx.gov/planning/transportation/BCycle.html

Name of the stakeholder group
<Not Applicable>

Role in the GCC program
<Not Applicable>

Name of the engagement activities
<Not Applicable>

Aim of the engagement activities
<Not Applicable>

Attach reference document
<Not Applicable>

Mitigation action
Community-Scale Development > Transit oriented development

Action title
Bayou Greenways 2020

Means of implementation
Awareness raising program or campaign
Infrastructure development

Implementation status
Operation

Estimated emissions reduction (metric tonnes CO2e)

Energy savings (MWh)

Renewable energy production (MWh)

Timescale of reduction / savings / energy production
Please select

Co-benefit area
Enhanced resilience
Reduced GHG emissions
Job creation

Scope and impact of action
In 2020, the Houston Parks Board completed the $220 million Bayou Greenways initiative which created 150 miles of trails and bridges connecting Houston's major bayous across 3,000 acres of park space. It is anticipated that 1.5 million Houstonians will live within 1.5 miles of the Bayou Greenways. The City will encourage the integration of walking, biking, and transit corridors with the Bayou Greenways 2020 linear park system to provide more access to existing trails, and the Beyond the Bayous program will bring more parks and trails to the city so that everyone can enjoy equitable access to green spaces. Through these efforts, the City will enhance the environmental health of its communities and its economic landscape, creating new homes and job opportunities. Most of the Bayou Greenways is completed (85%), i.e designed, constructed and in operation. The Houston Parks Board is on target to complete the project by 12/31/2020 or shortly after. The City contributed $100 million in park bond funds toward the project. The remaining $120 million is through private donations as well as state and federal grants.

Finance status
Finance secured

Total cost of the project
220000000

Total cost provided by the local government
100000000

Majority funding source
Public-private partnership

Total cost provided by the majority funding source (currency)

120000000

Web link to action website
https://houstonparksboard.org/about/bayou-greenways-2020

Name of the stakeholder group
<Not Applicable>

Role in the GCC program
<Not Applicable>

Name of the engagement activities
<Not Applicable>

Aim of the engagement activities
<Not Applicable>

Attach reference document
<Not Applicable>

Mitigation action
Buildings > Energy efficiency/ retrofit measures

Action title
Houston Airport System Energy Efficiency Project

Means of implementation
Assessment and evaluation activities

Implementation status
Implementation

Estimated emissions reduction (metric tonnes CO2e)
17255

Energy savings (MWh)
24404

Renewable energy production (MWh)

Timescale of reduction / savings / energy production
Per year

Co-benefit area
Reduced GHG emissions
Improved resource efficiency (e.g. food, water, energy)
Resource conservation (e.g. soil, water)
Shift to more sustainable behaviours

Scope and impact of action
HAS-Airport Energy Efficiency: The Houston Airport System through a design and construction management agreement with the Texas A&M Engineering Experiment Station (TEES), a member of the Texas A&M University System, will upgrade and renovate outdated infrastructure and equipment at the William P. Hobby and George Bush Intercontinental Airports. The projects include installing four new chillers, improving building operations, and installing a solar array on new shading canopies. The implemented projects will reduce annual energy consumption by more than 24 million kWh and utility costs by more than $1.3 million. This will also help the Houston Airport System to reach its “net-zero” energy goal for George Bush Intercontinental Airport. The Texas A&M Engineering Experiment Station Energy Systems Laboratory will manage project design and construction. The majority of funding will come from the LoanSTAR Program, administered by the State Energy Conservation Office of the Texas Comptroller’s Office.

Finance status
Finance secured

Total cost of the project
28370167

Total cost provided by the local government
12847025

Majority funding source
Other, please specify (Project management services related to the actual implementation of equipment upgrade and energy efficiency measures funded by City and/or State agencies (i.e. State Energy Conservation Office (SECO))

Total cost provided by the majority funding source (currency)
15523142

Web link to action website
https://www.fly2houston.com/newsroom/releases/texas-m-system-partners-city-houston-implement-capital-improvement-and-energy-efficiency-upgrades-ho/

Name of the stakeholder group
<Not Applicable>

Role in the GCC program
<Not Applicable>

Name of the engagement activities
<Not Applicable>

Aim of the engagement activities
<Not Applicable>

Attach reference document

<Not Applicable>

Mitigation action
Community-Scale Development > Transit oriented development

Action title
Houston Bike Implementation Plan

Means of implementation
Awareness raising program or campaign
Infrastructure development

Implementation status
Implementation

Estimated emissions reduction (metric tonnes CO2e)

Energy savings (MWh)

Renewable energy production (MWh)

Timescale of reduction / savings / energy production
Please select

Co-benefit area
Reduced GHG emissions
Social inclusion, social justice
Improved resource quality (e.g. air, water)
Improved public health
Improved access to and quality of mobility services and infrastructure
Shift to more sustainable behaviours

Scope and impact of action
Starting in Fiscal Year 2018, the City of Houston allocated $1.1 million each year for five years for bicycle infrastructure through its Capital Improvement Project. The Houston Bike Plan was adopted by City Council and Mayor Sylvester Turner in 2017. Almost 1,800 miles of high-comfort bikeways are planned for the City of Houston. In 2019 the City reported the completion of 42 miles of high-comfort bike lanes plus partners completed 25 miles of off-street bike facilities, which means over 300 miles of the Bike Plan has been implemented with 1,500 more miles planned. The total costs to be provided by the City has not yet been determined, since partners and funding sources have not all been determined.

Finance status
Feasibility undertaken

Total cost of the project
525000000

Total cost provided by the local government

Majority funding source
Other, please specify (The City is working to secure financing and not all the funding sources have been identified.)

Total cost provided by the majority funding source (currency)

Web link to action website
houstonbikeplan.org; https://www.houstontx.gov/planning/transportation/CompleteStreets/Complete_Streets_Annual_Report_2018-2019.pdf

Name of the stakeholder group
<Not Applicable>

Role in the GCC program
<Not Applicable>

Name of the engagement activities
<Not Applicable>

Aim of the engagement activities
<Not Applicable>

Attach reference document
<Not Applicable>

Mitigation action
Finance and Economic Development > Instruments to fund low carbon projects

Action title
Municipal Fleet Air Quality Monitoring Pilot

Means of implementation
Assessment and evaluation activities

Implementation status
Pre-implementation

Estimated emissions reduction (metric tonnes CO2e)

Energy savings (MWh)

Renewable energy production (MWh)

Timescale of reduction / savings / energy production
Please select

Co-benefit area
Enhanced climate change adaptation
Reduced GHG emissions
Improved public health
Improved access to data for informed decision-making

Scope and impact of action
In 2019, in partnership with the Houston Health Department (HHD), the Environmental Defense Fund (EDF) implemented a “smart fleet” pilot to test a cost-effective, scalable model for mapping air pollution using municipal vehicles. Prior to this pilot, air pollution mapping using vehicle-mounted sensors required expensive equipment, special-purpose vehicles, time-consuming hands-on instrument management, and special-purpose routes. In contrast, the Houston Smart Fleet pilot used rugged, low-cost instruments mounted on municipal vehicles. HHD vehicles collected and transmitted data in real time, demonstrating a new model for cities to actively monitor air quality using existing assets. Based on the success of the project, HHD ordered 10 additional vehicle monitors to continue the program full time.

Finance status
Finance secured

Total cost of the project
570000

Total cost provided by the local government
570000

Majority funding source
Public-private partnership

Total cost provided by the majority funding source (currency)
570000

Web link to action website
houstontx.gov/smartcity/

Name of the stakeholder group
<Not Applicable>

Role in the GCC program
<Not Applicable>

Name of the engagement activities
<Not Applicable>

Aim of the engagement activities
<Not Applicable>

Attach reference document
<Not Applicable>

Mitigation action
Waste > Recycling or composting collections and/or facilities

Action title
City of Houston Long Range Solid Waste Management Plan

Means of implementation
Education
Awareness raising program or campaign
Stakeholder engagement
Assessment and evaluation activities
Development and implementation of action plan
Financial mechanism

Implementation status
Scoping

Estimated emissions reduction (metric tonnes CO2e)

Energy savings (MWh)

Renewable energy production (MWh)

Timescale of reduction / savings / energy production
Please select

Co-benefit area
Reduced GHG emissions
Promote circular economy
Shift to more sustainable behaviours

Scope and impact of action
The City's Solid Waste Department is in the process of developing a 20-year long range solid waste management plan. The Plan was presented to Council Committee in June and is expected to be finalized in 2020. The plan proposes to among other things, right-size collection's operations with necessary collections equipment and staffing, increase the number of inspectors needed to address illegal dumping enforcement in a more substantial way, and provide first class programs designed to reduce waste generation and improve quality of recycling programs. The cost of the plan was approximately $485,000.

Finance status
Pre-feasibility study status

Total cost of the project
485000

Total cost provided by the local government
485000

Majority funding source
Local

Total cost provided by the majority funding source (currency)
485000

Web link to action website
https://www.houstontx.gov/council/committees/rna/20200601/swd-long-range-plan.pdf

Name of the stakeholder group
<Not Applicable>

Role in the GCC program
<Not Applicable>

Name of the engagement activities
<Not Applicable>

Aim of the engagement activities
<Not Applicable>

Attach reference document
<Not Applicable>

Mitigation action
Private Transport > Improve fuel economy and reduce CO2 from motorized vehicles

Action title
Electric vehicle charging infrastructure

Means of implementation
Awareness raising program or campaign
Stakeholder engagement
Infrastructure development
Sustainable public procurement

Implementation status
Scoping

Estimated emissions reduction (metric tonnes CO2e)

Energy savings (MWh)

Renewable energy production (MWh)

Timescale of reduction / savings / energy production
Please select

Co-benefit area
Reduced GHG emissions
Improved access to and quality of mobility services and infrastructure
Shift to more sustainable behaviours

Scope and impact of action
The City's Climate Action Plan, identifies accelerating the transition to cleaner and more efficient vehicle technologies as a priority action to reduce greenhouse gas emissions. To further enable EV ownership and ensure its viability for all residents, sufficient infrastructure needs to be put in place. Currently, the City operates 63 publicly available Level 2 charging stations. The City also operates several level 2 charging stations for fleet vehicles. According to a 2019 study by the International Council on Clean Transportation, the Houston area has 31-40% of the charging infrastructure in place to meed the demand needed by 2025. The City is working with EVolve Houston to expand public and private charging options across the City. On July 10, 2020 the City issued a Request for Information to gather information about business models and potential partnerships opportunities with third-party electric vehicle support equipment (EVSE) providers for owning, operating, and managing publicly accessible EVSE on City-owned property, in addition to privately accessible EVSE on City-owned property.

Finance status
Pre-feasibility study status

Total cost of the project

Total cost provided by the local government

Majority funding source
Other, please specify (The RFI requests information regarding potential additional revenue generating avenues to offset expenditures by the City)

Total cost provided by the majority funding source (currency)

Web link to action website
https://purchasing.houstontx.gov/bids/I03320/I03320%20-%20RFI%20for%20Publicly%20Accessible%20EV%20Charging%20Stations.pdf

Name of the stakeholder group
<Not Applicable>

Role in the GCC program
<Not Applicable>

Name of the engagement activities
<Not Applicable>

Aim of the engagement activities
<Not Applicable>

Attach reference document
<Not Applicable>

Mitigation action
Community-Scale Development > Green space and/ or biodiversity preservation and expansion

Action title
Houston Parks and Recreation Department (HPARD) Legacy Tree Program

Means of implementation
Awareness raising program or campaign
Assessment and evaluation activities
Development and implementation of action plan

Implementation status
Pre-implementation

Estimated emissions reduction (metric tonnes CO2e)

Energy savings (MWh)

Renewable energy production (MWh)

Timescale of reduction / savings / energy production
Please select

Co-benefit area
Enhanced resilience
Reduced GHG emissions
Ecosystem preservation and biodiversity improvement

Scope and impact of action
The Houston Parks and Recreation Department (HPARD) is planning a Legacy Tree Program to propagate native seedlings for installation into restoration sites and other tree plantings around the city and is developing a tree nursery to hold 10,000 trees annually. Planned to launch in 2020, the Linear Forests Initiative will tie into the current adoption program to create a plan to reforest esplanades across the city. These programs will prioritize tree planting in underserved communities and increase the city's overall tree canopy. The total cost to be provided by the City has not yet been determined, since partners and funding sources have not all been determined.

Finance status
Feasibility finalized, and finance partially secured

Total cost of the project
4700000

Total cost provided by the local government

Majority funding source
Other, please specify (Tree Fund - special fund dedicated for tree planting (https://library.municode.com/tx/houston/codes/code_of_ordinances?nodeId=COOR_CH33PLDE_ARTVTRSHSCFE_DIV2BUSI_S33-123TRPLEQCR))

Total cost provided by the majority funding source (currency)
500000

Web link to action website
http://greenhoustontx.gov/climateactionplan/CAP-April2020.pdf (page 25)

Name of the stakeholder group
<Not Applicable>

Role in the GCC program
<Not Applicable>

Name of the engagement activities
<Not Applicable>

Aim of the engagement activities
<Not Applicable>

Attach reference document
<Not Applicable>

Mitigation action
Private Transport > Infrastructure for non-motorized transport

Action title
Vision Zero Action Plan

Means of implementation
Awareness raising program or campaign
Stakeholder engagement
Infrastructure development

Implementation status
Pre-implementation

Estimated emissions reduction (metric tonnes CO2e)

Energy savings (MWh)

Renewable energy production (MWh)

Timescale of reduction / savings / energy production
Please select

Co-benefit area
Reduced GHG emissions
Improved public health
Improved access to and quality of mobility services and infrastructure

Scope and impact of action
In 2019 Mayor Turner signed an Executive Order for Vision-Zero Houston and appointed an Executive Committee and a Task Force to guide development of a Vision Zero Action Plan. The purpose of the plan is to eliminate traffic-related fatalities and improve road safety by 2030, and to identify mechanisms to ensure accountability and funding to reach its goals. The Planning and Development Department is currently working with stakeholders to develop short-term safety actions. Improving roadway safety for all users, especially pedestrians and bicyclists, is an important first step to encourage greater use of active and multi-modal transportation. One project example includes narrowing Hillcroft Avenue located in Houston from 8 vehicular lanes to 6 with the addition of buffered bike lanes; enhancing the pedestrian realm, including 8' sidewalks, improved lighting, and more trees for shade; among other things.

Finance status
Pre-feasibility study status

Total cost of the project

Total cost provided by the local government

Majority funding source
Please select

Total cost provided by the majority funding source (currency)

Web link to action website
https://www.houstontx.gov/visionzero/index.html; https://www.houstontx.gov/visionzero/pdf/One%20Pager%20-%20Updated-compressed.pdf

Name of the stakeholder group
<Not Applicable>

Role in the GCC program
<Not Applicable>

Name of the engagement activities
<Not Applicable>

Aim of the engagement activities
<Not Applicable>

Attach reference document
<Not Applicable>

Mitigation action
Private Transport > Infrastructure for non-motorized transport

Action title
Walkable Places Program and Plan

Means of implementation
Awareness raising program or campaign
Stakeholder engagement
Infrastructure development
Policy and regulation

Implementation status
Pre-implementation

Estimated emissions reduction (metric tonnes CO2e)

Energy savings (MWh)

Renewable energy production (MWh)

Timescale of reduction / savings / energy production
Please select

Co-benefit area
Reduced GHG emissions
Improved resource efficiency (e.g. food, water, energy)
Improved public health
Improved access to and quality of mobility services and infrastructure
Shift to more sustainable behaviours

Scope and impact of action
Both the Walkable Places and Transit-Oriented Development Programs will be effective from October 1, 2020. Both programs create rules to guide development on private properties. These rules are related to the pedestrian realm, building design and site design. The City of Houston Proposed Walkable Places Program and Plan establishes a public process to create context sensitive, pedestrian friendly development rules along designated street segments with the city. These public street corridors are in areas where the goal is to attract higher density commercial, office, and multifamily residential developments and improve the pedestrian experience.

Finance status
Please select

Total cost of the project

Total cost provided by the local government

Majority funding source
Please select

Total cost provided by the majority funding source (currency)

Web link to action website
https://www.houstontx.gov/planning/Commissions/committee_walkable-places.html;
https://houstontx.gov/planning/docs_pdfs/walkable_places/Walkable%20Places%20and%20Transit-Oriented%20Development%20Ordinance.pdf

Name of the stakeholder group
<Not Applicable>

Role in the GCC program
<Not Applicable>

Name of the engagement activities
<Not Applicable>

Aim of the engagement activities
<Not Applicable>

Attach reference document
<Not Applicable>

Mitigation action
Private Transport > Infrastructure for non-motorized transport

Action title
Transit Oriented Development

Means of implementation
Awareness raising program or campaign
Stakeholder engagement
Infrastructure development
Policy and regulation

Implementation status
Pre-implementation

Estimated emissions reduction (metric tonnes CO2e)

Energy savings (MWh)

Renewable energy production (MWh)

Timescale of reduction / savings / energy production
Please select

Co-benefit area
Reduced GHG emissions
Improved resource efficiency (e.g. food, water, energy)
Improved public health
Improved access to and quality of mobility services and infrastructure
Shift to more sustainable behaviours

Scope and impact of action
Both the Walkable Places and Transit-Oriented Development Programs will be effective from October 1, 2020. Both programs create rules to guide development on private properties. These rules are related to the pedestrian realm, building design and site design. The City of Houston Transit-Oriented Development Amendment and Transit Corridor Ordinance are designed to encourage the use of different types of transportation, such as walking and cycling, that reduce car dependency. The program promotes pedestrian safety by creating wider, unobstructed sidewalks and landscaping, increasing the 'eyes on the street' and providing more separation between automobile and pedestrian areas.

Finance status
Feasibility undertaken

Total cost of the project

Total cost provided by the local government

Majority funding source
Please select

Total cost provided by the majority funding source (currency)

Web link to action website
https://www.houstontx.gov/planning/Commissions/committee_walkable-places.html;
https://houstontx.gov/planning/docs_pdfs/walkable_places/Walkable%20Places%20and%20Transit-Oriented%20Development%20Ordinance.pdf

Name of the stakeholder group
<Not Applicable>

Role in the GCC program
<Not Applicable>

Name of the engagement activities
<Not Applicable>

Aim of the engagement activities
<Not Applicable>

Attach reference document

<Not Applicable>

Mitigation action
Water > Water use efficiency projects

Action title
2019 Water Conservation Plan

Means of implementation
Development and implementation of action plan

Implementation status
Implementation

Estimated emissions reduction (metric tonnes CO2e)

Energy savings (MWh)

Renewable energy production (MWh)

Timescale of reduction / savings / energy production
Please select

Co-benefit area
Reduced GHG emissions
Improved resource efficiency (e.g. food, water, energy)
Resource conservation (e.g. soil, water)
Shift to more sustainable behaviours

Scope and impact of action
Houston Public Works recently updated the City's Water Conservation Plan to include a wide range of water conservation programs to educate and engage customers about the importance of water and what they can do to protect and preserve this essential resource.

Finance status
Finance secured

Total cost of the project
40000

Total cost provided by the local government
40000

Majority funding source
Local

Total cost provided by the majority funding source (currency)
40000

Web link to action website
https://www.publicworks.houstontx.gov/sites/default/files/assets/2019_water_conservation_plan_01132020.pdf

Name of the stakeholder group
<Not Applicable>

Role in the GCC program
<Not Applicable>

Name of the engagement activities
<Not Applicable>

Aim of the engagement activities
<Not Applicable>

Attach reference document
<Not Applicable>

Mitigation Planning

(5.5) Does your city have a climate change mitigation or energy access plan for reducing city-wide GHG emissions?
Yes

The City launched its Climate Action Plan April 2020. The CAP is pending approval by City Council. Separately the City launched its Resilient Houston Strategy February 2020. http://greenhoustontx.gov/climateactionplan/index.html houstontx.gov/mayor/chief-resilience-officer.html

(5.5a) Please attach your city's climate change mitigation plan below. If your city has both mitigation and energy access plans, please make sure to attach all relevant documents below.

Publication title and attach document
Houston Climate Action Plan
CAP-April2020.pdf

Web link
http://greenhoustontx.gov/climateactionplan/

Focus area of plan
Climate change mitigation plan

Year of adoption from local government
2020

Areas covered by action plan
Energy
Transport (Mobility)
Building and Infrastructure
Waste

Boundary of plan relative to city boundary (reported in 0.1)
Same – covers entire city and nothing else

If the city boundary is different from the plan boundary, please explain why and any areas/other cities excluded or included
N/A - The boundaries are not different.

Stage of implementation
Plan developed but not implemented

Has your local government assessed the synergies, trade-offs, and co-benefits, if any, of the main mitigation and adaptation actions you identified?
Yes

Describe the synergies, trade-offs, and co-benefits of this interaction
There are numerous synergies and co-benefits with other goals and actions, including those identified in the Resilience Plan, the Houston Public Works Water Conservation Plan, Houston Airport System Sustainable Management Plan, Houston Bike Plan, Bayou Greenways 2020 Project, and many other plans and initiatives. There are several co-benefits tied to each goal and target including, but not limited to, economic growth, cost-savings, improved environmental quality, better health and well-being, affordability, enhanced resilience, improved resource efficiency and resource conservation, improved community equity, job creation, and ecosystem preservation.

Description of the stakeholder engagement process
Development of the plan included a very extensive stakeholder process which is outlined in the plan. Stakeholder engagement included public participation, comment and input on the draft plan. Working groups, public meetings, an a 'host-a-meeting" toolbox to facilitate and share dialogue. Starting in January 2019, the City of Houston convened a multi-sector working group consisting of approximately 160 subject-matter experts and stakeholders to help draft the CAP. After this initial convening, smaller working groups dedicated to the four focus areas—transportation, building optimization, energy transition, and materials management—were formed. During this same time period, the City of Houston also hosted a series of public community meetings at neighborhood multi-service centers across the City to introduce community members to the CAP development process and obtain feedback on proposed strategies and actions. The Office of Sustainability also participated in City of Houston Capital Improvement Plan (CIP) public meetings to encourage residents to learn more about the CAP and how to get involved. City participation in community events and workshops throughout the year provided additional opportunities to engage students, residents, and businesses. The City also held numerous individual discussions and interviews with private sector stakeholders and subject matter experts that helped to socialize the CAP and garner additional feedback and input. During the implementation process the City will continue to utilize a robust stakeholder process.

Does your plan include policy goals that explicitly reflect one of the following principles?
<Not Applicable>

Primary author of plan
Consultant

Comment
Please note that the Houston Climate Action Plan was launched in April 2020. Approval by City Council was tabled.

Opportunities

Opportunities

(6.0) Please indicate the opportunities your city has identified as a result of addressing climate change and describe how the city is positioning itself to take advantage of these opportunities.

Opportunity	Describe how the city is maximizing this opportunity
Development of clean technology businesses	Houston is often regarded as a hub for the world's leading energy companies, but it is also gaining momentum on growing a clean energy job market. Mayor Turner announced a new initiative to make Houston a prime location for startups in tech, including Clean Tech. On April 18, 2018, Mayor Turner announced the creation of a 9.4-acre innovation district within Houston's Midtown district. The innovation district is anchored by a former Sears building and will bring academic, entrepreneurial, and corporate communities together. The innovation district will connect the city's other districts through an innovation corridor spanning over 9 miles and connected by light rail, bike lanes and sidewalks. The district is expected to attract technology startups, including those in clean tech. Additionally, more than 17.8 percent of the nation's total biodiesel production capacity resides in the Houston region. According the U.S. Energy Information Administration, Texas' annual biodiesel production capacity of 431.0 million gallons is the highest in the nation. With 14 biodiesel plants, Texas has more biodiesel plants than Iowa (10) or California (9). The Houston area represents more than 92.8 percent of all biodiesel production capacity in the state of Texas. From bioenergy companies to biotechnology firms, the city encourages and welcomes new economic development in the clean energy sector. In a Brookings Institution study, Houston ranked 9th in the nation for top local clean economies. It was reported that there were 39,986 green jobs in the region in 2011.
Improved efficiency of municipal operations	In the City's municipal energy efficiency program, 6 million square feet of municipally-owned buildings are achieving guaranteed energy use reductions approaching 30% with paybacks of, on average, less than ten years. 18 libraries used Qualified Energy Conservation Bonds to fund additional municipal energy efficiency work. The City has long offered an expedited permitting process for a fee- this was originally only available to projects where the total cost of construction was over $1 million. However, the City has begun to offer a LEED incentive program, where any building which has registered for LEED certification can take part in the quick start program and LEED projects can also receive a rebate on the Quick Start program fees- with the rebate tiered from 25% - 100% of fees depending on the level of LEED certification obtained. On June 23, 2004, City Council adopted the Green Building Resolution, which established LEED certification as a standard for new construction, replacement facilities and major renovations of city of Houston-owned buildings and facilities with more than 10,000 square feet of occupied space. The City also approved an energy efficiency policy for municipal operations in 2011.
Development of resource conservation and management	As more people notice extreme weather events occurring in Houston, there is more attention placed on how the community needs to be more resilient. For instance, after the major drought in 2011, residents were increasingly inquiring about installing rainwater harvesting and the City's annual half-price rain barrel sale.
Increased opportunities for investment in infrastructure projects	Natural disasters like Hurricane Harvey, have highlighted the need to invest in the City's infrastructure. In the aftermath of Harvey, over 663 million dollars have been committed to projects to increases storm water detention and channel conveyance. As the city continues to rebuild, it is committed to looking towards smart, resilient solutions.

(6.1) Has your city measured and demonstrated the wider social and economic impacts of delivering climate actions/projects/policies? If so, please provide more details and a link to more information.

https://www.houstontx.gov/mayor/Resilient-Houston-Resilience-Assessment-2019may.pdf

Collaboration

(6.2) Does your city collaborate in partnership with businesses in your city on sustainability projects?

Yes

(6.2a) Please provide some key examples of how your city collaborates with business in the table below.

Collaboration area	Type of collaboration	Description of collaboration
Energy	Collaborative initiative	In 2014, Houston's transmission and distribution utility, CenterPoint Energy, in partnership with the City of Houston, began converting 165,000 streetlights from to LED technology. This project increases public safety and reduces GHG emissions by 5%, energy use by 50%, and energy costs of $28 million. CenterPoint has recently recommitted to fund the City's Residential Energy Efficiency Program (REEP) which was first run between 2007-2009. CenterPoint also offers funds through the Hard to Reach Programs which aims to help low income households undertake energy efficiency projects.
Transport (Mobility)	Collaborative initiative	Cigna has supported the City's Cigna Sunday Streets events where streets are opened to bicyclists, pedestrians, and families and closed to car traffic.
Waste	Collaborative initiative	In 2017 Houston began its newest project in waste management: a new 36-million-dollar contract with FCC Environmental Services for curbside recycling. This new contract makes it just as cost effective to recycle as using older more primitive waste disposal techniques.
Transport (Mobility)	Collaborative initiative	An agreement has been reached that will allow hike and bike trails along CenterPoint's utility ROWs. CenterPoint committed $1.5 million to build the first leg of the trails.
Building and Infrastructure	Collaborative initiative	Houston is participating in C40's Reinventing Cities Challenge. The goal of reinventing cities is to take under-used city property and challenge the best and brightest minds to redesign, reimagine, and reinvent how they can be used in a sustainable way. This challenge pairs City owned land with private companies to redevelop the brownfield. Two sites in Houston were chosen – the 240-acre former Sunnyside landfill and the Velasco Street Incinerator along East Buffalo Bayou. Sunnyside would be the perfect place for a community solar farm and Velasco Street will soon be one of the hottest properties in town when the East Buffalo Bayou Park development expands. The final Phase 2 proposals were submitted on May 1, 2019.

(6.3) Describe how your local/regional government collaborates and coordinates horizontally on climate action.

	Entity with which your local/regional government collaborates and coordinates horizontally on climate action	Description
Horizontal collaboration and coordination	Neighboring jurisdictions	Houston Harris Heat Action Team Organizers (City of Houston and Harris County) measured Harris County's hottest and coolest places during a one-day heat mapping campaign this summer. Urban areas are especially prone to high temperatures due to a combination of hard surfaces (buildings, roads), limited vegetation (such as trees), and heat-producing factors like car use and industrial activity. This problem, known as the urban heat island effect, can create issues for human health, infrastructure, and quality of life. Understanding how temperatures vary based on qualities of the natural and built landscape can inform how we reduce the impacts of rising summer temperatures in our communities. This heat mapping project is part of a larger initiative, Heat Watch, lead by CAPA Strategies and supported by the National Oceanic and Atmospheric Administration (NOAA)'s Climate Program Office. The Houston/Harris County team is one of 13 communities selected to participate in 2020 summer campaigns. http://www.greenhoustontx.gov/pressrelease20200805.html

(6.4) Describe how your local/regional government collaborates and coordinates vertically (higher levels of government) on climate action.

City of Houston Legislative Principals for the 86th Session of the Texas Legislature: 1. Support legislative and administrative efforts to assist the Houston region in improving air quality and addressing flooding/drainage challenges. Support initiatives for additional green space, urban forestation and park enhancements. 2. Support legislation strengthening local governments' regulatory authority over energy industry participants to protect consumer interests and make delivery systems more reliable and resilient. 3. Support legislation expanding the meaningful input of local governments to state agencies with oversight of energy industries. 4. Support legislation that protects adequate compensation for the use of City of Houston property and public rights-of-way and grants municipalities greater control over the 1 placement of these nodes . 5. Support legislation to give local residents more influence in environmental permitting in their neighborhoods

Finance and Economic Opportunities

(6.5) List any mitigation, adaptation, water related or resilience projects you have planned within your city for which you hope to attract financing and provide details on the estimated costs and status of the project. If your city does not have any relevant projects, please select 'No relevant projects' under 'Project Area'.

Project area
Renewable energy

Project title
5-Star Program

Stage of project development
Project feasibility

Status of financing
Project not funded and seeking full funding

Financing model identified
No

Identified financing model description

Project description and attach project proposal
The City's 5-Star Program is a creative way to couple renewable energy systems and energy efficiency projects. The 5-Star Program "sustainably" reinvests in Houston's historic neighborhoods. Builders receive incentives to build energy efficient homes and add photovoltaics and solar thermal as upgrades to these newly completed homes.

Total cost of project
1000000

Total investment cost needed
1000000

Project area
Other, please specify (Houston Green Office Challenge)

Project title
Houston Green Office Challenge

Stage of project development
Project feasibility

Status of financing
Project not funded and seeking partial funding

Financing model identified
No

Identified financing model description

Project description and attach project proposal
The Houston Green Office Challenge invites commercial office owners/managers and tenants in Houston to increase their environmental and economic performance in cleaner transportation choices, energy conservation, property management/tenant engagement, water efficiency and waste reduction.

Total cost of project
40000

Total investment cost needed
40000

Project area
Energy efficiency / retrofit

Project title
Residential Energy Efficiency Program (REEP)

Stage of project development
Project feasibility

Status of financing
Project not funded and seeking full funding

Financing model identified
No

Identified financing model description

Project description and attach project proposal
The Department of Energy described the City of Houston as a leader in weatherization through the Residential Energy Efficiency Program (REEP). The City received $23

million from the DOE to help thousands of Houston residents. Centerpoint and the City of Houston partnered to continue the program in 2014.

Total cost of project
2000000

Total investment cost needed
2000000

Project area
Buildings

Project title
Building Benchmark

Stage of project development
Scoping

Status of financing
Project not funded and seeking full funding

Financing model identified
Please select

Identified financing model description

Project description and attach project proposal
After participating in the City Energy Project, the City of Houston is looking for a private-sector partner to build a platform or method to incentive private building owners to benchmark buildings, despite regulatory hurdles of accessing and publishing data.

Total cost of project
50000

Total investment cost needed
50000

Project area
Other, please specify (Climate Action Plan Net-zero Emissions Reduction)

Project title
The Houston Climate Action Plan

Stage of project development
Implementation

Status of financing
Other, please specify (The City received funding to develop the Climate Action Plan.)

Financing model identified
Please select

Identified financing model description

Project description and attach project proposal
On April 22, 2020 – the 50th anniversary of Earth Day – the City launched the science-based, community-driven Houston Climate Action Plan to reduce greenhouse gas (GHG) emissions, meet the Paris Agreement goal of carbon neutrality by 2050, and lead the global energy transition.
http://www.greenhoustontx.gov/climateactionplan/CAP-April2020.pdf

Total cost of project
350000

Total investment cost needed
350000

Project area
Renewable energy

Project title
100% Renewable Energy Purchasing

Stage of project development
Post-implementation

Status of financing
Other, please specify (Project is funded)

Financing model identified
No

Identified financing model description

Project description and attach project proposal
Starting July 1, 2020, 100% of the municipal electricity supply sourced from wind and solar, the City of Houston is the largest municipal purchaser of green power in the nation. The City of Houston has committed to purchasing 100% renewable energy through a renewed partnership with NRG Energy as the City's retail electric provider. As part of the contract renewal, the City will power all municipal operations with renewable energy and realize $65 million in savings over the seven-year contract. Through the NRG Renewable Select plan, the City will receive 1,034,399 MWh of renewable electricity annually from a new, third-party utility-scale solar facility in Texas that is dedicated to City operations. In 2017, the City added a power purchase agreement (PPA) for a 50-megawatt (MW) solar facility in Alpine, TX to the municipal power portfolio. In exchange for increasing the PPA from 30 to 50 MW, the overall contract price was reduced by 8%, resulting in an estimated $40 million savings over the 20-year term of the PPA. The City has also installed solar panels on multiple municipal buildings including the Houston Permitting Center, City Hall Annex, and George R. Brown Convention Center. http://www.greenhoustontx.gov/pressrelease20200430.html

Total cost of project

Total investment cost needed

Project area
Renewable energy

Project title
Sunnsyside Solar Farm

Stage of project development
Project feasibility

Status of financing
Project partially funded and seeking additional funding

Financing model identified
No

Identified financing model description

Project description and attach project proposal
Through participation in the C40 Reinventing Cities program, the City is making plans to re-imagine how under-utilized public assets can be used in a sustainable way. Starting in Sunnyside, a neighborhood in the Complete Communities program, the City will work with Sunnyside Energy to convert the 240-acre Holmes Road landfill into a 70 MW solar farm, which will be one of the largest urban solar farms in the US. The proposal by Sunnyside Energy (a partnership between EDF Renewables, MP2 Energy, and Wolfe Energy) was selected through a competitive process and includes other potential benefits such as jobs and training, energy discounts for lower-income residents in the neighborhood, and reduced flooding. http://www.greenhoustontx.gov/pressrelease20190829.html

Total cost of project
86325000

Total investment cost needed
86325000

Project area
Renewable energy

Project title
Fast-Track Solar Permitting

Stage of project development
Implementation

Status of financing
Other, please specify (Funded through regular operations)

Financing model identified
No

Identified financing model description
Regular city operational budget

Project description and attach project proposal
The Houston Permitting Center offers expedited solar panel permitting for residential properties. This incentive has helped encourage the increased adoption of solar panel installations over the past four years.

Total cost of project

Total investment cost needed

Project area
Buildings

Project title
LEED Designed Buildings

Stage of project development
Post-implementation

Status of financing
Other, please specify (Funded through operations)

Financing model identified
No

Identified financing model description

Project description and attach project proposal
Since 2004, the City of Houston has required all new municipal buildings larger than 10,000 square feet to be LEED Certified.11 The City now has 37 LEED municipal buildings and is investing in energy efficiency upgrades to 6 million square feet of city facilities through energy performance contracting. This effort has reduced energy use by 30%, saving more than 22 million kWh of electricity every year. A retro-commissioning audit of the Houston Permitting Center in 2019 identified $9,000 of energy-efficiency updates that will result in more than 1.3 million kWh saved per year.

Total cost of project

Total investment cost needed

Project area
Energy efficiency / retrofit

Project title
Airport Energy Efficiency

Stage of project development
Implementation

Status of financing
Other, please specify (Funded)

Financing model identified
No

Identified financing model description

Project description and attach project proposal
The Houston Airport System (HAS) is currently implementing a 2018 sustainability management plan made possible through a multi-year planning grant from the Federal Aviation Administration. HAS is also working with Texas A&M University to implement capital-improvement and energy-efficiency upgrades at William P. Hobby Airport and George Bush Intercontinental Airport. Projects include installing four new chillers, improving building operations, and installing solar arrays to reduce the annual energy consumption by more than 24 million kWh.

Total cost of project
28370167

Total investment cost needed
28370167

Project area
Energy efficiency / retrofit

Project title
Fire Station Energy Challenge

Stage of project development
Post-implementation

Status of financing
Other, please specify (Sponsored by IKEA)

Financing model identified
No

Identified financing model description

Project description and attach project proposal
Sponsored by IKEA, this friendly competition between partic- ipating Houston Fire Stations resulted in reduced energy consumption by motivating simple behavior changes around lighting and electronics use.

Total cost of project

Total investment cost needed

Project area
Energy efficiency / retrofit

Project title
Green Building Resources Center

Stage of project development
Implementation

Status of financing
Other, please specify (Funded through regular city operations)

Financing model identified
No

Identified financing model description

Project description and attach project proposal
Located within the Houston Permitting Center, this program promotes economical, sustainable building solutions for the public including solar panel installation, low-impact development techniques, energy-efficient windows and lighting, heating and cooling technologies, and water conservation methods (including discounted rain and compost barrel sales). http://www.greenhoustontx.gov/greenbuilding.html

Total cost of project

Total investment cost needed

Project area
Other, please specify (Education)

Project title
Cities Connecting Children to Nature

Stage of project development
Implementation

Status of financing
Other, please specify (Funded through regular city operations)

Financing model identified

No

Identified financing model description

Project description and attach project proposal
Launched in 2018, the Mayor's Office of Education leads the Houston Cities Connecting Children to Nature Program, a collaboration of organizations and individuals championing the health, happiness, education, and success of all our area children through equitable access to nature.

Total cost of project

Total investment cost needed

Project area
Other, please specify (Urban Forestry)

Project title
Legacy Tree Program

Stage of project development
Implementation

Status of financing
Other, please specify (Funded through regular city operations)

Financing model identified
No

Identified financing model description

Project description and attach project proposal
The Houston Parks and Recreation Department (HPARD) is planning a Legacy Tree Program to propagate native seedlings for installation into restoration sites and other tree plantings around the city and is developing a tree nursery to hold 10,000 trees annually. Planned to launch in 2020, the Linear Forests Initiative will tie into the current adoption program to create a plan to reforest esplanades across the city. These programs will prioritize tree planting in underserved communities and increase the city's overall tree canopy.

Total cost of project
4700000

Total investment cost needed
4700000

Project area
Energy efficiency / retrofit

Project title
Property Assessed Clean Energy (PACE) Program

Stage of project development
Implementation

Status of financing
Project not funded and seeking partial funding

Financing model identified
No

Identified financing model description

Project description and attach project proposal
The City has an active commercial PACE program that has resulted in more than $25 million invested in the past five years to finance energy-efficiency, renewable-energy, and water-conservation projects.

Total cost of project

Total investment cost needed

Project area
Water management

Project title
Water Conservation Plan

Stage of project development
Implementation

Status of financing
Project partially funded and seeking additional funding

Financing model identified
No

Identified financing model description

Project description and attach project proposal
Houston Public Works recently updated the City's Water Conservation Plan to include a wide range of water conservation programs to educate and engage customers about the importance of water and what they can do to protect and preserve this essential resource.
https://www.publicworks.houstontx.gov/sites/default/files/assets/2019_water_conservation_plan_01132020.pdf

Total cost of project
1047000000

Total investment cost needed
1047000000

Project area
Water management

Project title
Wastewater Operations

Stage of project development
Project structuring

Status of financing
Project partially funded and seeking additional funding

Financing model identified
No

Identified financing model description

Project description and attach project proposal
Houston Public Works plans to consolidate 39 wastewater treatment facilities into 30 and to include energy efficiency upgrades and resource recovery at all remaining sites.

Total cost of project

Total investment cost needed

Project area
Waste management

Project title
Long-Range Solid Waste Plan

Stage of project development
Project structuring

Status of financing
Project not funded and seeking partial funding

Financing model identified
No

Identified financing model description

Project description and attach project proposal
The Solid Waste Management Department (SWMD) is developing a 20-year, long-range plan for the sustainable management of solid waste and recycling within city limits. The plan includes a gap analysis of current operations and provides recommendations for increased landfill diversion as well as environmentally sound and financially stable future actions.

Total cost of project
485000

Total investment cost needed
485000

Project area
Transport

Project title
Municipal Fleet

Stage of project development
Project feasibility

Status of financing
Project not funded and seeking partial funding

Financing model identified
No

Identified financing model description

Project description and attach project proposal
The municipal fleet currently includes 23 electric and plug-in-hybrid vehicles and 505 hybrid vehicles. Fleet Management Department (FMD) is working with Rice University to evaluate how to electrify the City's non- emergency passenger fleet. FMD is also conducting pilot projects to evaluate opportunities to deploy alternative fuels such as ethanol and biodiesel. In partnership with HPW, FMD is piloting a 5,000-gallon ethanol (E-85) alternative fuel tank and dispenser to use with ethanol/gasoline-capable flexible fuel vehicles. Planned for 2020, FMD will test the integration of biodiesel (B-20) in heavy- and medium-duty diesel equipment.

Total cost of project

Total investment cost needed

Project area
Transport

Project title
Electric Vehicle Charging

Stage of project development

Scoping

Status of financing
Project not funded and seeking partial funding

Financing model identified
No

Identified financing model description

Project description and attach project proposal
Since 2010, the City worked to help Houston “drive electric”, creating a network of 65 public electric vehicle charging stations at parks, libraries, theaters, and city buildings throughout the community. The City is working with EVolve Houston to expand public and private charging options across the city.
http://www.greenhoustontx.gov/pressrelease20200713.html

Total cost of project

Total investment cost needed

Project area
Transport

Project title
Smart Cities

Stage of project development
Implementation

Status of financing
Project partially funded and seeking additional funding

Financing model identified
No

Identified financing model description

Project description and attach project proposal
The City’s Office of Innovation is supporting numerous “Smart Cities” initiatives that pilot new technologies to reduce local vehicle emissions while increasing mobility. Examples of initiatives include working with METRO to streamline rider apps, bus tracking, and route optimization; reduce traffic downtown through parking guidance systems; and use smart trash bins in parks to optimize trash collection.

Total cost of project

Total investment cost needed

Project area
Other, please specify (Air Quality)

Project title
Mobile Air Quality Programs

Stage of project development
Implementation

Status of financing
Project partially funded and seeking additional funding

Financing model identified
No

Identified financing model description

Project description and attach project proposal
The City’s Health Department (HHD) educates Houstonians about the public health impacts of transportation emissions and promotes outreach efforts with the non-profit organization Air Alliance Houston. This includes placing bumper stickers on school buses to remind drivers of Houston’s five-minute idling limit12 and the health impacts of air pollution. HHD developed and uses the Rapid Alert Benzene Information: Time Sensitive, or RABITS, system to inform where and when elevated benzene concentrations are detected so HHD can respond more quickly with more specific monitoring or enforcement. The City also supports legislation to limit placement of concrete batch plants and is conducting research on the source of hot spots of formaldehyde toxic air pollution in Houston.

Total cost of project
570000

Total investment cost needed
570000

Project area
Other, please specify (Bayou Parks)

Project title
Bayou Greenways 2020 Project

Stage of project development
Project structuring

Status of financing
Please select

Financing model identified
No

Identified financing model description

Project description and attach project proposal
This public-private partnership between the Houston Parks Board and the City of Houston is converting 3,000 acres of land along bayous into linear parks, including 150 miles of hike and bike trails that connect communities.

Total cost of project
220000000

Total investment cost needed
220000000

Project area
Other, please specify (Biking Areas)

Project title
Houston Bike Plan Implementation

Stage of project development
Implementation

Status of financing
Other, please specify (Funding secured)

Financing model identified
Do not know

Identified financing model description

Project description and attach project proposal
Starting in Fiscal Year 2018, the City of Houston allocated $1.1 million each year for five years for bicycle infrastructure through its Capital Improvement Project. The Houston Bike Plan was adopted by City Council and Mayor Sylvester Turner in 2017. Almost 1,800 miles of high-comfort bikeways are planned for the City of Houston. In 2019 the City reported the completion of 42 miles of high-comfort bike lanes plus partners completed 25 miles of off-street bike facilities, which means over 300 miles of the Bike Plan has been implemented with 1,500 more miles planned. The total costs to be provided by the City has not yet been determined, since partners and funding sources have not all been determined.

Total cost of project
525000000

Total investment cost needed
525000000

Project area
Transport

Project title
Bike Share

Stage of project development
Implementation

Status of financing
Project partially funded and seeking additional funding

Financing model identified
Do not know

Identified financing model description

Project description and attach project proposal
Houston B-Cycle is a bike share program that initially began as a pilot project funded by an EPA grant to the City of Houston in 2012 to encourage biking in Houston. Now a 501(c)(3), Houston B-Cycle continues to partner with the Planning and Development Department to secure additional funding to expand bike stations across the city.

Total cost of project
3700000

Total investment cost needed
3700000

Project area
Transport

Project title
Reducing Parking Requirements

Stage of project development
Implementation

Status of financing
Project partially funded and seeking additional funding

Financing model identified
Do not know

Identified financing model description

Project description and attach project proposal
Minimum parking requirements result in the creation of excessive parking facilities and encourage car dependence. In July 2019, City Council approved Planning and Development's proposal to expand exemptions for minimum parking requirements to two additional neighborhoods in Houston— East Downtown and Midtown. This will

allow for higher-density development and fewer impervious surfaces in the city.

Total cost of project

Total investment cost needed

Project area
Transport

Project title
Vision Zero Action Plan

Stage of project development
Project structuring

Status of financing
Project partially funded and seeking additional funding

Financing model identified
Do not know

Identified financing model description

Project description and attach project proposal
Improving roadway safety for all users, especially pedestrians and bicyclists, is an important first step to encourage greater use of active and multi-modal transpor- tation. To eliminate traffic-related fatalities and improve road safety by 2030, this plan will identify mechanisms to ensure accountability and funding to reach its goals. The Planning and Development Department is currently working with stakeholders to develop short-term safety actions. https://cityofhouston.news/mayor-sylvester-turner-signs-vision-zero-executive-order-to-eliminate-traffic-fatalities-and-injuries/

Total cost of project

Total investment cost needed

Project area
Other, please specify (Walkable Places)

Project title
Walkable Places & Transit Oriented Development

Stage of project development
Implementation

Status of financing
Project partially funded and seeking additional funding

Financing model identified
Do not know

Identified financing model description

Project description and attach project proposal
The City of Houston Proposed Walkable Places and Transit-Oriented Development Amendment and Transit Corridor Ordinance are designed to encourage higher- density and mixed uses, reduce sidewalk interruptions and obstructions, promote multi- modal transportation, and encourage walkability. http://www.greenhoustontx.gov/pressrelease20200806.html

Total cost of project

Total investment cost needed

Project area
Water management

Project title
Living With Water Houston

Stage of project development
Implementation

Status of financing
Project partially funded and seeking additional funding

Financing model identified
Do not know

Identified financing model description

Project description and attach project proposal
Living With Water Houston was undertaken as part of the Resilient Houston strategy development process. The Mayor's Office for Resilience teamed with The Water Institute of the Gulf, Waggonner & Ball, and the Kingdom of the Netherlands to hold two Living With Water workshops to develop place-specific strategies to reduce flood risk and equip Houstonians to prepare for the next storm. The outcomes of the Living With Water workshops are summarized in the following report and incorporated into the Resilient Houston strategy. Living with Water is an exploration of the regional systems, natural and built, that define Houston and an analysis of regional flood risk in the context of climate projections and increasing urbanization. The key to Living With Water approach – and Resilient Houston strategy - is a recognition that actions to reduce risk and increase resilience can be taken at multiple interconnected scales—from the home, to the block, neighborhood, bayou, city, and region. The report goes on to highlight design proposals and recommendations developed for three focus areas – Kashmere Gardens, Independence Heights, and Greenspoint – as well as overall neighborhood-scale recommendations. The Living With Water workshops provided an opportunity for a deep dive into this critical component of Houston's resilience. Houston is the first city to integrate these two-well established frameworks for advancing city resilience, combining a comprehensive vision for a more resilient Houston with place-based strategies that reduce risk and deliver multiple community benefits. Living With Water Houston builds on the many local efforts underway to reduce flood risk and provides a framework and illustrative vision for aligning future actions. The strategies presented in this document should be embraced, localized, developed, and deployed to address the increasing riverine/bayou, urban drainage, and storm surge flooding that threatens Houston. https://www.houstontx.gov/mayor/Living-With-Water-

Final-Report.pdf http://www.greenhoustontx.gov/pressrelease20200130.html

Total cost of project

Total investment cost needed

(6.6) Has your city tested their climate actions through pilot/demonstration projects?

	Pilot/demonstration projects	Description of project and weblink
Tested by city government	Yes	EVolve Houston is a coalition of sustainability-minded civic, business, and academic leaders who seek to accelerate clean transportation through electrification. Collaborating with government, academic, private industry, and community leaders, our goal is to improve regional air quality and reduce greenhouse gas emissions in the Greater Houston area. https://www.evolvehouston.org

(6.7) Has your city received/secured funding for any low carbon projects (e.g. energy efficiency, renewable energy, low emission vehicles, bus rapid transit, waste management) or climate adaptation projects from a development bank (e.g. World Bank, Asian Development Bank, etc.)?

	Funding received/secured for low carbon projects or climate adaptation	Comment
Funding received/secured	No	

(6.8) Has your city established a fund to invest in energy efficiency, renewable energy or carbon reduction projects?

	Funds to invest in energy efficiency, renewable energy or carbon reduction projects	Comment
Funds	Yes	https://www.houstontx.gov/mayor/press/2020/100-percent-renewable-energy.html

(6.9) Has your city taken steps to decarbonize the investments held by the city retirement funds and/or municipal investments, e.g. by making a commitment to divest from fossil fuels and/or increase sustainable investments?

	Response	Please provide more details about how your city is taking steps to decarbonize the investments
Municipal investments, e.g. by divesting from fossil fuels	Yes	https://www.houstontx.gov/mayor/press/2020/100-percent-renewable-energy.html
Investments held by the city retirement funds, e.g. by making a commitment to divest from fossil fuels and/or increase sustainable investments?	No	

(6.11) If city staff pensions are managed at the city level, who has responsibility for making investments decisions for the city retirement funds?

	Does the department/institution have responsibility for oversight and/or implementation of investment of the city retirement funds?	Comment
City council/elected representatives	Yes	
Treasury or city finance staff	No	
City pension fund board	Do not know	
Other staff	Yes	

State legislators also play a role in overseeing investment of city retirement funds

(6.12) Does your city have its own credit rating?

	Does your city have a credit rating?	Rating agency	Rating	If you do not have a credit rating, please provide more details on why and what steps you are taking to get one
International	No			The City of Houston does not have an international credit rating because the City does not conduct business in the international market. Consequently, the City is not taking steps to obtain an international credit rating because there is no need for one.
Domestic	Yes	Moody's, Fitch, Standard and Poor's	Moody's Aa3 stable; S&P's rating AA; Fitch's rating AA (Source: http://www.houstontx.gov/controller/treasury/about.html)	<Not Applicable>

Climate Action Planning

(6.14) How do the city's environment/sustainability and economic development departments work together, for instance, in planning climate actions?

Working togehter

Have ad-hoc-meetings/workshops together (e.g. on climate action planning)
Yes

Joint strategy development/long-term planning (e.g. on the green economy, supporting green jobs and social equity)
Yes

Joint research
Yes

Joint target setting and/or monitoring (e.g. environmental targets impacting business)
Yes

Jointly engaging businesses (e.g. encouraging businesses to go green, strategy consultations)
Yes

Other, please specify

If they do not work together, please explain why

(6.15) How many people within your city are employed in green jobs/industries?

	Number of people in your city employed in green jobs and/or industries	If you measure green jobs in your city, please also indicate if you analyze demographic variables	If you analyse demographic variables, please indicate which variables from the list below	Comment
Green jobs/industries	39986	No	Working status	Elimination of the Green Goods and Services Occupations program On March 1, 2013, President Obama ordered into effect the across-the-board spending cuts (commonly referred to as sequestration) required by the Balanced Budget and Emergency Deficit Control Act, as amended. Under the order, the Bureau of Labor Statistics (BLS) must cut its current budget by more than $30 million, about 5 percent of the current 2013 appropriation, by September 30, 2013. In order to achieve these savings and protect core programs, the BLS will eliminate two programs and all "measuring green jobs" products. These products include: data on employment by industry and occupation for businesses that produce green goods and services; data on the occupations and wages of jobs related to green technologies and practices; and green career information publications. Please see https://www.bls.gov/bls/sequester_info.htm for more information regarding the sequestration at BLS.

Energy

(8.0) Does your city have a renewable energy or electricity target?
Yes

The City of Houston recently committed to purchasing 100% renewable energy effective July 1, 2020. In April 2020, the City of Houston launched its Climate Action Plan, which has a goal of 100% renewable energy by 2025 for municipal operations.

(8.0a) Please provide details of your renewable energy or electricity target(s) and how the city plans to meet those targets.

Scale
Local government operations

Type
Electricity

Energy / electricity types covered by target
Other, please specify (Purchased)

Base year
2020

Total renewable energy / electricity covered by target in base year (in unit specified in column 3: energy/electricity types covered by target)
1248958

Percentage renewable energy / electricity of total energy or electricity in base year
100

Target year
2025

Total renewable energy / electricity covered by target in target year (in unit specified in column 3: energy/electricity types covered by target)
1248958

Percentage renewable energy / electricity of total energy or electricity in target year
100

Percentage of target achieved
100

Please specify plans to meet the target(s) and in which sector this target will be implemented (i.e. All energy sectors, electricity, heating and cooling and/or transport)
As of July 1, 2020 the City of Houston has achieved this target. The City entered into a five-year contract (with two one-year renewal options) with NRG, the City's retail electric provider. As of July 1, 2020, Houston began purchasing 100% renewable energy through this contract with NRG.

Scale
City-wide

Type
Electricity

Energy / electricity types covered by target
All electricity produced (in MWh)

Base year
2014

Total renewable energy / electricity covered by target in base year (in unit specified in column 3: energy/electricity types covered by target)
7550

Percentage renewable energy / electricity of total energy or electricity in base year
0.03

Target year
2050

Total renewable energy / electricity covered by target in target year (in unit specified in column 3: energy/electricity types covered by target)
5000000

Percentage renewable energy / electricity of total energy or electricity in target year
10

Percentage of target achieved
21

Please specify plans to meet the target(s) and in which sector this target will be implemented (i.e. All energy sectors, electricity, heating and cooling and/or transport)
The City launched its Climate Action Plan April 2020 which has an overall goal to achieve carbon neutrality by 2050. A community goal of generating 5 million MWh from local rooftop and community solar per year by 2050 is part of this broader goal. The City is in the process of developing more 'specific' targets. Houston will grow Houston's investment in renewable and resilient energy by supporting and promoting the use and development of renewable energy; supporting and promoting retail renewable energy opportunities: and advocating for renewable energy policies at the local, state and federal levels.

(8.1) Please indicate the source mix of electricity consumed in your city.

Electricity source

Coal
22.62

Gas
48.55

Oil
0.03

Nuclear
10

Hydro
0.22

Biomass
0.24

Wind
17.02

Geothermal
0

Solar
0.77

Other sources
0.55

Total - please ensure this equals 100%
100

Year data applies to
2018

(8.2) What scale is the electricity mix data reported above?
Other, please specify (eGRID2018v2 SRL18 eGRID subregion year 2018 data)

(8.3) What percentage of your city's electricity grid mix is zero carbon? "Zero carbon" includes solar, wind, hydro, biomass and geothermal as the source to produce electricity.
18.25

(8.4) How much (in MW capacity) renewable energy is installed within the city boundary in the following categories?

	MW capacity	Comment
Renewable district heat/cooling		
Solar PV	42.53	Installed solar PV Capacity increased to 42.53 in 2019 from 20.9 (2018). https://environmentamerica.org/feature/ame/shining-cities-2020
Solar thermal		
Hydro power		
Wind		
Other, please specify		

(8.5) Does your city have a target to increase energy efficiency?
Yes

April 2020, the City launched its Climate Action Plan which has an overall goal to achieve carbon neutrality by 2050. Increasing energy efficiency is part of this broader carbon reduction goal. As a result, the City is in the process of defining and establishing 'specific' targets.

(8.5a) Please provide details on your city's energy efficiency targets.

Scale
City-wide

Energy efficiency type covered by target
Reduce total energy consumed (in MWh)

Base year
2014

Total energy consumed/produced covered by target in base year (in unit specified in column 2)
26095683

Target year
2030

Total energy consumed/produced covered by target in target year (in unit specified in column 2)
31223971

Percentage of energy efficiency improvement in target year compared to base year levels
6

Percentage of target achieved
0

Plans to meet target (include details on types of energy in thermal /electricity)
The City launched its Climate Action Plan April 2020, which has an overall goal to achieve carbon neutrality by 2050. Interim goals include 40% by 2030 and 75% by 2040. Increasing energy efficiency is part of this broader carbon reduction goal. As a result, the City is in the process of establishing 'specific' targets in the following areas: CAP Target 7. Adopt the 2021 International Code Council (ICC) model codes by 2025 with a minimum 5-year update. The City will also establish a plan to achieve 85% energy code compliance by 2030. (B1.1 Update energy code and increase compliance; B1.2 Develop programs that improve building energy efficiency to include municipal benchmarking and disclosure policy for municipal buildings by 2021 and developing benchmarking and audit programs for commercial, industrial and residential buildings; and B1.3 reduce water and wastewater energy consumption by 10% through optimization of facility operations and water conservation. CAP Target 8. Double the current number of PACE projects by 2025 (B2.1 Promote clean energy financing programs; B2.2 Expand utility energy financing and incentive programs this includes promoting weatherization programs to reduce residential energy consumption and focus on reducing energy burden on low-income populations and supporting and participating in CenterPoint's portfolio of energy efficiency programs. CAP Target 9. 70% of non-residential buildings operated by trained building operators by 2030 (B3.1 Provide training in the operation, management, and maintenance of relevant building systems. This includes promoting existing building owner/operator trainings and certification and identifying programs that need to be developed; educating, engaging and connecting the community about career pathway opportunities; providing training and education resources for single and multi-family residences and educating owners/operators on the Federal Rules governing refrigerant management.)

Please indicate to which energy sector(s) the target applies (Multiple choice)
Commercial buildings
Residential buildings
Public facility

Buildings

(9.0) What is the total tCO2e emissions per capita from existing commercial, institutional and residential buildings in your city?

	Total tonnes of CO2e emissions per capita
Commercial	4
Municipal	0.11
Residential	2.1
New buildings	
All building types	

Information pulled from 2019 City-Wide GHG inventory and 2019 Municipal Inventory. Categories include Commercial, Municipal and Residential Buildings.

(9.1) Does your city have emissions reduction targets or energy efficiency targets for the following building types?

	Emissions reduction target	Please provide more details and/or link to more information about the emission reduction target.	Energy efficiency target	Please provide more details and/or link to more information about the energy efficiency target.

	Emissions reduction target	Please provide more details and/or link to more information about the emission reduction target.	Energy efficiency target	Please provide more details and/or link to more information about the energy efficiency target.
Commercial	Yes	The City launched its Climate Action Plan April 2020 which has an overall goal to achieve carbon neutrality by 2050. The City is in the process of establishing 'specific' targets' related to the following areas: CAP Target 7. Adopt the 2021 International Code Council (ICC) model codes by 2025 with a minimum 5-year update. The City will also establish a plan to achieve 85% energy code compliance by 2030. (B1.1 Update energy code and increase compliance; B1.2 Develop programs that improve building energy efficiency to include developing benchmarking and audit programs for commercial, industrial and residential buildings; and B1.3 reduce water and wastewater energy consumption by 10% through optimization of facility operations and water conservation.) CAP Target 8. Double the current number of PACE projects by 2025 (B2.1 Promote clean energy financing programs; B2.2 Expand utility energy financing and incentive programs). CAP Target 9. 70% of non-residential buildings operated by trained building operators by 2030 (B3.1 Provide training in the operation, management, and maintenance of relevant building systems. This includes promoting existing building owner/operator trainings and certification and identifying programs that need to be developed; educating, engaging and connecting the community about career pathway opportunities; providing training and education resources for single and multi-family residences and educating owners/operators on the Federal Rules governing refrigerant management.) http://www.greenhoustontx.gov/climateactionplan/CAP-April2020.pdf Houston adopted the 2015 IECC for commercial buildings with amendments, effective December 2016. The City also adopted ASHRAE 90.1-2013 with amendments, effective December 2016. https://www.houstonpermittingcenter.org/help/codes	Yes	Increasing energy efficiency is part of the City's broader carbon reduction goal. As a result, the City is in the process of defining and establishing 'specific' targets related to the following areas: CAP Target 7. Adopt the 2021 International Code Council (ICC) model codes by 2025 with a minimum 5-year update. The City will also establish a plan to achieve 85% energy code compliance by 2030. (B1.1 Update energy code and increase compliance; B1.2 Develop programs that improve building energy efficiency to include developing benchmarking and audit programs for commercial, industrial and residential buildings; and B1.3 reduce water and wastewater energy consumption by 10% through optimization of facility operations and water conservation. CAP Target 8. Double the current number of PACE projects by 2025 (B2.1 Promote clean energy financing programs; B2.2 Expand utility energy financing and incentive programs). CAP Target 9. 70% of non-residential buildings operated by trained building operators by 2030 (B3.1 Provide training in the operation, management, and maintenance of relevant building systems. This includes promoting existing building owner/operator trainings and certification and identifying programs that need to be developed; educating, engaging and connecting the community about career pathway opportunities; providing training and education resources for single and multi-family residences and educating owners/operators on the Federal Rules governing refrigerant management.) http://www.greenhoustontx.gov/climateactionplan/CAP-April2020.pdf Houston adopted the 2015 IECC for commercial buildings with amendments, effective December 2016. The City also adopted ASHRAE 90.1-2013 with amendments, effective December 2016. https://www.houstonpermittingcenter.org/help/codes
Municipal	Yes	The City launched its Climate Action Plan April 2020 which has an overall goal to achieve carbon neutrality by 2050. The City is in the process of establishing 'specific' targets' to include: CAP Target 7. Adopt the 2021 International Code Council (ICC) model codes by 2025 with a minimum 5-year update. The City will also establish a plan to achieve 85% energy code compliance by 2030. (B1.1 Update energy code and increase compliance; B1.2 Develop programs that improve building energy efficiency to include adopting a municipal benchmarking and disclosure policy for municipal buildings by 2021 and developing benchmarking and audit programs for commercial, industrial and residential buildings; and B1.3 reduce water and wastewater energy consumption by 10% through optimization of facility operations and water conservation. http://www.greenhoustontx.gov/climateactionplan/CAP-April2020.pdf Houston adopted the 2015 IECC for commercial buildings with amendments, effective December 2016. The city also adopted ASHRAE 90.1-2013 with amendments, effective December 2016. https://www.houstonpermittingcenter.org/help/codes	Yes	Increasing energy efficiency is part of the City's broader carbon reduction goal. As a result, the City is in the process of defining and establishing 'specific' targets related to the following areas: CAP Target 7. Adopt the 2021 International Code Council (ICC) model codes by 2025 with a minimum 5-year update. The City will also establish a plan to achieve 85% energy code compliance by 2030. (B1.1 Update energy code and increase compliance; B1.2 Develop programs that improve building energy efficiency to include adopting a municipal benchmarking and disclosure policy for municipal buildings by 2021 and developing benchmarking and audit programs for commercial, industrial and residential buildings; and B1.3 reduce water and wastewater energy consumption by 10% through optimization of facility operations and water conservation. http://www.greenhoustontx.gov/climateactionplan/CAP-April2020.pdf Houston adopted the 2015 IECC for commercial buildings with amendments, effective December 2016. The city also adopted ASHRAE 90.1-2013 with amendments, effective December 2016. https://www.houstonpermittingcenter.org/help/codes Better Buildings Challenge: the City established a goal to achieve 20% energy reduction below 2008 levels by 2020. Municipal buildings account for 7 million out of 30 million square feet of the city's commitment. On June 23, 2004, City Council adopted the Green Building Resolution, which established LEED certification as a standard for new construction, replacement facilities and major renovations of City of Houston-owned buildings and facilities with more than 10,000 sq. feet of occupied space.
Residential	Yes	The City launched its Climate Action Plan April 2020 which has an overall goal to achieve carbon neutrality by 2050. The City is in the process of establishing 'specific' targets' to include: CAP Target 7. Adopt the 2021 International Code Council (ICC) model codes by 2025 with a minimum 5-year update. The City will also establish a plan to achieve 85% energy code compliance by 2030. (B1.1 Update energy code and increase compliance; B1.2 Develop programs that improve building energy efficiency to include developing benchmarking and audit programs for commercial, industrial and residential buildings; and B1.3 reduce water and wastewater energy consumption by 10% through optimization of facility operations and water conservation.) CAP Target 8 includes a complimentary initiative B2.2 to expand utility energy financing and incentive programs. This includes promoting weatherization programs to reduce residential energy consumption and focus on reducing energy burden of low-income populations and supporting and participating in CenterPoint's portfolio of energy efficiency programs. http://www.greenhoustontx.gov/climateactionplan/CAP-April2020.pdf	Yes	Increasing energy efficiency is part of the City's broader carbon reduction goal. As a result, the City is in the process of defining and establishing 'specific' targets related to the following areas: CAP Target 7. Adopt the 2021 International Code Council (ICC) model codes by 2025 with a minimum 5-year update. The City will also establish a plan to achieve 85% energy code compliance by 2030. (B1.1 Update energy code and increase compliance; B1.2 Develop programs that improve building energy efficiency to include developing benchmarking and audit programs for commercial, industrial and residential buildings; and B1.3 reduce water and wastewater energy consumption by 10% through optimization of facility operations and water conservation.) CAP Target 8 includes a complimentary initiative B2.2 to expand utility energy financing and incentive programs. This includes promoting weatherization programs to reduce residential energy consumption and focus on reducing energy burden of low-income populations and supporting and participating in CenterPoint's portfolio of energy efficiency programs. http://www.greenhoustontx.gov/climateactionplan/CAP-April2020.pdf
New buildings	No		No	
All building types	Yes	The City launched its Climate Action Plan April 2020 which has an overall goal to achieve carbon neutrality by 2050. The City is in the process of establishing 'specific' targets' to include: CAP Target 7. Adopt the 2021 International Code Council (ICC) model codes by 2025 with a minimum 5-year update. The City will also establish a plan to achieve 85% energy code compliance by 2030. (B1.1 Update energy code and increase compliance; B1.2 Develop programs that improve building energy efficiency to include adopting a municipal benchmarking and disclosure policy for municipal buildings in 2021 and developing benchmarking and audit programs for commercial, industrial and residential buildings; and B1.3 reduce water and wastewater energy consumption by 10% through optimization of facility operations and water conservation. http://www.greenhoustontx.gov/climateactionplan/CAP-April2020.pdf	Yes	The City launched its Climate Action Plan April 2020 which has an overall goal to achieve carbon neutrality by 2050. The City is in the process of establishing 'specific' targets' to include: CAP Target 7. Adopt the 2021 International Code Council (ICC) model codes by 2025 with a minimum 5-year update. The City will also establish a plan to achieve 85% energy code compliance by 2030. (B1.1 Update energy code and increase compliance; B1.2 Develop programs that improve building energy efficiency to include adopting a municipal benchmarking and disclosure policy for municipal buildings in 2021 and developing benchmarking and audit programs for commercial, industrial and residential buildings; and B1.3 reduce water and wastewater energy consumption by 10% through optimization of facility operations and water conservation. http://www.greenhoustontx.gov/climateactionplan/CAP-April2020.pdf

The City launched its Climate Action Plan April 2020 with a focus area on building optimization.

(9.2) Is your city implementing a strategy/pathway/roadmap to ensure that all new buildings are net zero carbon operational by 2030?

	Response	Building types that the policy applies to	Please provide more detail and/or link to more information about the requirements
Please complete	No	<Not Applicable>	

(9.3) Is your city implementing any requirements to achieve net zero carbon existing buildings? For example, regulations, codes or planning policies requiring Passive House or other ultra-high efficiency standards for existing buildings being implemented.

	Response	Please provide more detail and/or link to more information about the requirements
Net zero carbon existing buildings	No	

(9.4) What is the total final annual energy use for buildings within your city boundary (aggregated across all fuel types)? (*in USA 'total final energy use' is known as 'site energy use')?

	Total final energy use (kWh/annum)
Commercial	20808302787
Institutional	
Municipal	620443465
Residential	9536934306
New buildings	
All building types	30345237093

Estimates based off of 2019 Emissions inventory and 2019 municipal energy usage.

(9.5) Is your city implementing any retrofit programs addressing existing commercial, residential and/or municipal buildings?

	Response	Buildings that the program applies to	Please provide more detail and/or link to more information about the programs
Retrofit programs	Yes	Residential Commercial Municipal	Houston Property Assessed Clean Energy (PACE) Program. The City of Houston's commercial Property Assessed Clean Energy or PACE program provides an additional tool for Houston property owners to finance energy efficiency, renewable energy, and water conservation projects. Additional details and related ordinances can be found at: https://www.texaspaceauthority.org/houston-pace/ City of Houston General Services Department (GSD) Energy Efficiency Project. GSD applied to the State Energy Conservation Office (SECO) for energy efficiency funding under its LoanStar (Saving Taxes and Resources) Revolving Loan Program to fund the energy cost reduction measures identified by the Texas Engineering Experiment Station (TEES) Energy System Laboratory. https://houston.novusagenda.com/agendapublic/CoverSheet.aspx?ItemID=19643&MeetingID=429; https://comptroller.texas.gov/programs/seco/funding/loanstar/ Voluntary benchmarking programs, like the DOE's Better Buildings Challenge: https://betterbuildingssolutioncenter.energy.gov/partners/houston-tx Program to implement capital improvement and energy efficiency upgrades at Hobby and Bush Airports. A Partnership between Texas A&M System and the City. https://www.fly2houston.com/newsroom/releases/texas-m-system-partners-city-houston-implement-capital-improvement-and-energy-efficiency-upgrades-ho/ The City's electric utility offers retro-fit programs through its Energy Efficiency Plan which apply to municipal, commercial, residential buildings and municipal buildings. The City does not own its own municipal electric utility. While the City is not directly involved, the City has worked with the company regarding the plans, participates in the programs to benefit city buildings, and reviews the cost recovery for program implementation. http://interchange.puc.texas.gov/Documents/50666_16_1068617.PDF https://www.centerpointenergy.com/en-us/SaveEnergyandMoney/Pages/centerpoint-efficiency.aspx?sa=ho&au=bus LEED Certification and Building Retrofit Program: Since 2004, the City has required all new municipal buildings to be LEED certified. The City currently has 37 LEED buildings plans to add more through 2020. http://www.greenhoustontx.gov/pdf/ordinance-greenbuilding.pdf The City adopted a property tax incentive program for new construction green buildings in 2009. This program establishes a partial tax abatement for U.S. Green Building Council (USGBC) LEED certified commercial buildings. https://library.municode.com/tx/houston/ordinances/code_of_ordinances?nodeId=1026461

Transport

(10.0) Do you have mode share information available to report for the following transport types?

Passenger transport

(10.1) What is the mode share of each transport mode in your city for passenger transport?

Information from the US Census American Community Survey: ACS 1018 1-Year Estimates data Profiles. The survey categories include car, truck, or van - alone and carpool, public transport, walked, other means and worked from home. Included public transport in bus category, and combined worked from home with other. https://data.census.gov/cedsci/table?g=0400000US48_1600000US4835000&d=ACS%201-Year%20Estimates%20Selected%20Population%20Profiles&tid=ACSSPP1Y2018.S0201&hidePreview=false

Please complete

Private motorized transport

78.1

Rail/Metro/Tram

Buses (including BRT)

3.8

Ferries/ River boats

Walking

1.5

Cycling

Taxis or For Hire Vehicles

Micro-Mobility

Other

6.6

(10.3) What are the total number of journeys made in your city each year by each mode below?

	Number of journeys made each year
Private cars	33362811122
Rail / Metro / Tram	53624968
Buses (including BRT)	96992069
Ferries / River boats	
Walking	
Cycling	
Taxis or For Hire Vehicles	
Other	

Response data pulled from 2019 GHG Emissions inventory and from the Metropolitan Transit Authority 2018 Annual Agency Profile. Rail is given in annual passenger miles. The number of miles of walking and cycling in the city is not available.

(10.4) Please provide the total fleet size and number of vehicle types for the following modes of transport.

	Number of private cars	Number of buses	Number of municipal fleet (excluding buses)	Number of freight vehicles	Number of taxis	Transport Network Companies (e.g. Uber, Lyft) fleet size	Customer-drive carshares (e.g. Car2Go, Drivenow) fleet size	Comment
Total fleet size	1372489	1236	9978		1807			Number or private cars includes renter and owner occupied. Does not provide a break down of type of vehicle
Electric	1616		44					
Hybrid	12504		525					
Plug in hybrid	1118		0					
Hydrogen			0					

Reporting for municipal fleet represents FY2019 numbers. Reporting for the number of private vehicles and fuel type is an estimate based on the number of sales of vehicles by fuel type from 2011 (Jan) - 2019 (Jun) (https://autoalliance.org/energy-environment/advanced-technology-vehicle-sales-dashboard/). This number was divided by the aggregate number of vehicles state wide for each fuel category. The resultant % was multiple by the reported aggregate number for vehicles for Houston. Reporting for 'Number of Buses' obtained from the Metropolitan Transit Authority Website https://www.ridemetro.org/Pages/AboutMetro.aspx. Reporting for 'Number of Private Cars' https://censusreporter.org/data/table/?table=B25046&geo_ids=04000US48,16000US4835000,01000US&primary_geo_id=04000US48

(10.5) Provide information on GHG emissions from the transport sector.

Passenger Transport: Private cars

GHG emissions (CO2e)
12259626

Inventory year (numerical year)
2019

Passenger Transport: Public Transport (bus)

GHG emissions (CO2e)
114684

Inventory year (numerical year)
2019

Passenger Transport: Public Transport (LRT/MRT/Railway)

GHG emissions (CO2e)
8086

Inventory year (numerical year)
2019

Passenger Transport: Powered two/three wheelers (e.g. motorcycles)

GHG emissions (CO2e)
10257

Inventory year (numerical year)
2019

Passenger Transport: Taxi/TNC

GHG emissions (CO2e)

Inventory year (numerical year)

Freight transport

GHG emissions (CO2e)
4602957

Inventory year (numerical year)
2019

(10.6) How many buses has your city procured in the last year?

	Number of buses	Comment
Total number of buses	64	Bus procurement represents the number of buses procured by Metro in 2018. Information was not provided pertaining to the fuel type of the buses. (https://www.transit.dot.gov/ntd/transit-agency-profiles)
Electric buses		
Electric trolley buses		
Hybrid		
Plug-in hybrid		
Hydrogen		
Diesel		
CNG		

(10.7) Do you have a low or zero-emission zone in your city? (i.e. an area that disincentivises fossil fuel vehicles through a charge, a ban or access restriction)
No

(10.9) How many public access EV charging points do you have in your city and/or metropolitan area for the following types.

	Number of charging points	Number of charging points in your metropolitan area	Comment
Rapid 43 kw and above	47	91	
Fast 7-22kw	367	577	
Slow 3kw or below	74	78	
All types	488	746	

Information provided by HGAC, and City of Houston Charging Stations.

(10.11) Does your city collect air quality data?
Yes

(10.12) What is the most recent calendar year for which you have air quality data?
2019

(10.14) Please provide city-wide average air pollution metrics from the monitoring sites within your city for the most recent three years.

PM2.5 (1 year (annual) mean)

Most recent years available (select year)
2019

Average concentration for most recent year available (ug/m3)
9.83

Average concentration for second most recent year available (ug/m3)
9.91

Average concentration for third most recent year available (ug/m3)
9.33

Number of monitoring stations
4

Frequency of measurements (e.g. hourly, daily)
Varies by site and pollutant: hourly in most cases. Not all pollutants are monitored at each station and some report hourly automatically, some are daily and need to be lab processed

Where can the data be accessed?
https://www17.tceq.texas.gov/tamis/index.cfm

Who owns the data?
Varies: Texas Commission on Environmental Quality, City of Houston, Houston Regional Monitoring

Publicly available?
Yes

Completeness of data (%)
100

PM2.5 (Maximum 24-hour average)

Most recent years available (select year)
2019

Average concentration for most recent year available (ug/m3)
84.84

Average concentration for second most recent year available (ug/m3)
33.93

Average concentration for third most recent year available (ug/m3)
30.45

Number of monitoring stations
4

Frequency of measurements (e.g. hourly, daily)
Varies by site and pollutant: hourly in most cases. Not all pollutants are monitored at each station and some report hourly automatically, some are daily and need to be lab processed

Where can the data be accessed?
https://www17.tceq.texas.gov/tamis/index.cfm

Who owns the data?
Varies: Texas Commission on Environmental Quality, City of Houston, Houston Regional Monitoring

Publicly available?
Yes

Completeness of data (%)
100

PM10 (1 year (annual) mean)

Most recent years available (select year)
2019

Average concentration for most recent year available (ug/m3)
21.1

Average concentration for second most recent year available (ug/m3)
18.5

Average concentration for third most recent year available (ug/m3)

Number of monitoring stations
1

Frequency of measurements (e.g. hourly, daily)
Varies by site and pollutant: hourly in most cases. Not all pollutants are monitored at each station and some report hourly automatically, some are daily and need to be lab processed

Where can the data be accessed?
https://www17.tceq.texas.gov/tamis/index.cfm

Who owns the data?
Varies: Texas Commission on Environmental Quality, City of Houston, Houston Regional Monitoring

Publicly available?
Yes

Completeness of data (%)
79.6

PM10 (Maximum 24-hour average)

Most recent years available (select year)
2019

Average concentration for most recent year available (ug/m3)
64.3

Average concentration for second most recent year available (ug/m3)
105.8

Average concentration for third most recent year available (ug/m3)

Number of monitoring stations
1

Frequency of measurements (e.g. hourly, daily)
Hourly

Where can the data be accessed?

Who owns the data?

Publicly available?
Yes

Completeness of data (%)
84.9

NO2 (1 year (annual) mean)

Most recent years available (select year)
2019

Average concentration for most recent year available (ug/m3)
20.4

Average concentration for second most recent year available (ug/m3)
19.3

Average concentration for third most recent year available (ug/m3)
19.7

Number of monitoring stations
9

Frequency of measurements (e.g. hourly, daily)
Most data downloaded from TCEQ is in hourly increments. Some pollutants have 5-minute data; however, that data requires a public records request for access.

Where can the data be accessed?
https://www17.tceq.texas.gov/tamis/index.cfm?fuseaction=report.main

Who owns the data?
The data displayed on the Texas Commission on Environmental Quality website may not all be measured directly by the TCEQ. Other entities may supply TCEQ with data.

Publicly available?
Yes

Completeness of data (%)
94

O3 (Daily maximum 8 hour mean)

Most recent years available (select year)
2019

Average concentration for most recent year available (ug/m3)
81

Average concentration for second most recent year available (ug/m3)
88

Average concentration for third most recent year available (ug/m3)
74

Number of monitoring stations
16

Frequency of measurements (e.g. hourly, daily)
Varies by site and pollutant: hourly in most cases. Not all pollutants are monitored at each station and some report hourly automatically, some are daily and need to be lab processed

Where can the data be accessed?
https://www.tceq.texas.gov/cgi-bin/compliance/monops/8hr_attainment.pl

Who owns the data?
Varies: Texas Commission on Environmental Quality, City of Houston, Houston Regional Monitoring

Publicly available?
Yes

Completeness of data (%)
97

SO2 (Maximum 24-hour average)

Most recent years available (select year)
2019

Average concentration for most recent year available (ug/m3)
7.87

Average concentration for second most recent year available (ug/m3)
7.54

Average concentration for third most recent year available (ug/m3)
7.11

Number of monitoring stations
3

Frequency of measurements (e.g. hourly, daily)
Most data downloaded from TCEQ is in hourly increments. Some pollutants have 5-minute data; however, that data requires a public records request for access.

Where can the data be accessed?
https://www17.tceq.texas.gov/tamis/index.cfm?fuseaction=report.main

Who owns the data?
The data displayed on the Texas Commission on Environmental Quality website may not all be measured directly by the TCEQ. Other entities may supply TCEQ with data.

Publicly available?
Yes

Completeness of data (%)
97.3

Urban Planning

(11.0) What is the size of your city's park space in square km?
144.5

Our total park space is now 144.5 km2 (provided by City of Houston Parks and Recreation Department)

(11.1) Report the total population living within 500m of a mass transit station, with mass transit defined as any Bus Rapid Transit (BRT), light rail, other rail-based transit modes or frequent bus services (average of five times an hour from 7 a.m. to 9 p.m. on a weekday).

Total population living within 500m of a mass transit station

Population
83

Comment
83% of residents live within half a mile (0.8 km).

Food

(12.0) Report the total number of meals and tonnes that are served and/or sold through programs managed by your city (this includes schools, canteens, hospitals etc.).

Total meals and tonnes that are served or sold through programs managed by your city

Number of meals
44000000

Tonnes served and/or sold

Comment
Houston Independent School District serves 20 million breakfast meals and 24 million lunches. https://www.houstonisd.org/Page/125847 In 2018, the Houston Health Department managed the distribution of 1,412,394 , to adults 60 years or older, throughout Houston and Harris County. https://www.houstontx.gov/health/Aging/nutrition_services.html# / Check if program still in place... maybe average number per year Further research needed.

(12.0a) Report the tonnes per food group that are served and/or sold through programs managed by your city (this includes schools, canteens, hospitals etc.).

Vegetables

Tonnes served and/or sold

Comment

Fruit

Tonnes served and/or sold

Comment

Dairy foods

Tonnes served and/or sold

Comment

Whole grains

Tonnes served and/or sold

Comment

Tubers or starchy

Tonnes served and/or sold

Comment

Protein sources

Tonnes served and/or sold

Comment

Added fats

Tonnes served and/or sold

Comment

Foods with added sugar

Tonnes served and/or sold

Comment

(12.1) What is the per capita meat and dairy consumption (kg/yr) in your city?

Meat consumption per capita (kg/year)

Amount
101.7

Year data applies to
2019

Comment
According to the US Department of Agriculture (USDA), consumers are projected to eat 224.3 pounds of red meat and poultry. https://www.nationalchickencouncil.org/about-the-industry/statistics/per-capita-consumption-of-poultry-and-livestock-1965-to-estimated-2012-in-pounds/

Dairy consumption per capita (kg/year)

Amount
293

Year data applies to
2018

Comment
In 2018, the US Department of Agriculture (USDA) estimated the per capita consumption of dairy products to 646 pounds. https://www.ers.usda.gov/data-products/dairy-data.aspx

(12.3) Does your city have any policies relating to food consumption within your city? If so, please describe the expected outcome of the policy.

	Response	Please describe the expected outcome of the policy
Please complete	No	

	Response	Please describe the expected outcome of the policy

(12.4) How does your city increase access to sustainable foods?

Do you subsidise fresh fruits and vegetables?

Action implemented
No

Please provide details and/or links to more information about the actions your city is taking to increase access to sustainable foods
Check with Health Department

Do you tax/ban higher carbon foods (meat, dairy, ultra-processed)?

Action implemented
No

Please provide details and/or links to more information about the actions your city is taking to increase access to sustainable foods

Do you use regulatory mechanisms that limit advertising of higher carbon foods (meat, dairy, ultra-processed)?

Action implemented
No

Please provide details and/or links to more information about the actions your city is taking to increase access to sustainable foods

Do you incentivise fresh fruit/vegetables vendor locations?

Action implemented
Please select

Please provide details and/or links to more information about the actions your city is taking to increase access to sustainable foods

(12.5) Please report the total annual volume of food waste in tonnes.

Total annual volume of food waste

Total annual volume of food waste in tonnes

Comment

(12.6) What percentage of your population is food insecure?

Population that is food insecure

Percentage of population that is food insecure
14.8

Comment
In 2018, 14.8% of people in Houston/Harris County reported being food insecure. http://www.houstonstateofhealth.com/indicators/index/view?indicatorId=2107&localeId=2675

Waste

(13.0) What is the annual solid waste generation in your city?

	Amount of waste generated (tonnes/year)	Year data applies to	Please describe the methodology used to calculate the annual solid waste generation in your city
Please complete	650420	2019	Total Solid Waste Generation: tonnes (landfill, recycle, compost and reuse.)

(13.1) How much of the solid waste generated in your city is disposed to landfill or incineration (tonnes/year)?
550350

(13.2) What percentage of the solid waste generated in your city is diverted away from landfill or incineration?
15.4

(13.3) What is the amount of your city's total solid waste collected for each of the following sectors (tonnes/year)?

	Amount of solid waste generated (tonnes/year)
Total	650420
Residential	650420
Commercial	
Industrial	
Construction and demolition waste	
Other	

(13.4) What is the amount of solid waste being treated (tonnes/year) through the methods listed.

	Tonnes/year
Re-use	519
Recycling	51191
Composting	48360
Anaerobic digestion	
Incineration or other form of thermal treatment	
Open burning	
Sanitary landfill	550350
Non-sanitary landfill	
Other	

(13.5) Please provide a waste composition analysis

Please see attached City of Houston Waste Characterization Study 2014 Final Report
FINAL_HoustonWasteCharacterizationStudyv2.pdf

(13.6) Does your city have any of the following initiatives, policies and/or regulations.

Bans or restrictions on single use or non-recyclable materials

Response
No

Please provide more details and/or a link to more information about any of the proposed initiatives/policies/regulations

Volume based waste collection fees/incentives

Response
No

Please provide more details and/or a link to more information about any of the proposed initiatives/policies/regulations

Mandatory waste segregation

Response
No

Please provide more details and/or a link to more information about any of the proposed initiatives/policies/regulations

Target(s) on reducing food waste to disposal (landfill and incineration)

Response
No

Please provide more details and/or a link to more information about any of the proposed initiatives/policies/regulations

Sanitary landfill with leachate capture and landfill gas management system

Response
Yes

Please provide more details and/or a link to more information about any of the proposed initiatives/policies/regulations
The federal government regulates the minimum requirements for municipal solid waste landfills, and they are required to meet location requirements to ensure they are built in suitable areas away from faults, wetlands, flood plains and other restricted areas; that they have composite liners, leachate collection and removal systems; groundwater monitoring; follow closure and post closure monitoring and financial assurance. See: https://www.epa.gov/landfills/municipal-solid-waste-landfills

Water Security

Water Supply

(14.0) What are the sources of your city's water supply?
Surface water, from sources located fully or partially within city boundary
Surface water, from sources outside the city boundary (by water transfer schemes)
Ground water
Other source (Recycled/reclaimed water)

(14.1) What percentage of your city's population has access to potable water supply service?
100

(14.2) Are you aware of any substantive current or future risks to your city's water security?
Yes

(14.2a) Please identify the risks to your city's water security as well as the timescale and level of risk.

Water security risk drivers	Anticipated timescale	Estimated magnitude of potential impact	Estimated probability of impact	Risk description
Increased water stress	Medium-term (by 2050)	Extremely serious	High	H.B. 2846 Mandating Houston's Sale of Allens Creek Reservoir water rights to Brazos River Authority.

Water Supply Management

(14.3) Please select the actions you are taking to reduce the risks to your city's water security.

Risks
Increased water stress

Adaptation action
Other, please specify (Increasing our water portfolio by implementing other water supply strategies, including reuse and conservation)

Status of action
Pre-feasibility study/impact assessment

Action description and implementation progress
Houston is in litigation to retain its Allens Creek Reservoir water rights. The Travis County District Court ruled that HB 2846 is unconstitutional and Houston's water rights are currently intact. Brazos River Authority (BRA) has appealed the District Court's ruling, but Houston anticipates the Austin Court of Appeals will affirm the District Court's ruling. Houston has no knowledge whether BRA will appeal to the Texas Supreme Court. Houston continues to implement conservation awareness and education and is studying conservation incentives and water use restrictions. Houston is also developing its recycled/reclaimed water to expand the use of this resource.

(14.4) Does your city have a publicly available Water Resource Management strategy?
Yes

City of Houston has a Water Conservation Plan and Drought Contingency Plan in place. Currently, the City is in the process of obtaining approval for the 2019 Water Conservation Plan by the City Council (expected date: 6/19/2019).
https://edocs.publicworks.houstontx.gov/documents/divisions/utilities/coh_water_conservation_plan_2015.pdf

(14.4a) Please provide more information on your city's public Water Resource Management strategy.

Web Link not available at this time, currently going through approval process. Stage of Implementation: plan in implementation, measurement in progress, plan update in progress

Publication title and attach document
2019 City of Houston Water Conservation Plan

Year of adoption from local government
2019

Web link
https://www.publicworks.houstontx.gov/sites/default/files/assets/2019_water_conservation_plan_01132020.pdf

Does this strategy include sanitation services?
No

Stage of implementation
Other, please specify (Plan has been developed and implemented. Progress is measured annually.)

Publication title and attach document
2019 City of Houston Drought Contingency Plan (Appendix A in the 2019 City of Houston Water Conservation Plan)

Year of adoption from local government
2019

Web link
https://www.publicworks.houstontx.gov/sites/default/files/assets/2019_water_conservation_plan_01132020.pdf

Does this strategy include sanitation services?
No

Stage of implementation
Other, please specify (Plan has been developed and implemented. Progress is measured annually.)

Submit your response

What language are you submitting your response in?
English

Please read and accept our Terms and Conditions
I have read and accept the Terms and Conditions

Please confirm how your response should be handled by CDP.

	Public or non-public submission
I am submitting my response	Publicly (recommended)