Clean Air Action Plan

FOR THE HOUSTON-GALVESTON REGION

PREPARED BY

Houston-Galveston Area Council

3555 Timmons Lane
Houston, TX 77027
(713) 627-3200

Clean Air, Healthy Communities

Disclaimer

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Table of Contents

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As we move forward, let us continue to build upon the strong foundation laid by our affiliation. We look forward to our continued partnership and success.

Abbreviations and Acronyms

ACRONYM	EXPANSION
AVERT	Avoided Emissions and Generation Tool
AFOLU	Agriculture, Forestry, and Other Land Use
BAU	Business-as-Usual
CAP	Criteria Air Pollutants
CARE	Clean Air Regional Engagement Workgroup
CCAP	Comprehensive Climate Action Plan
CH_4	Methane
CO_2	Carbon Dioxide
CPRG	Climate Pollution Reduction Grant
DOE	Department of Energy
EIA	Energy Information Administration
EPA	Environmental Protection Agency
EV	Electric Vehicle
FLIGHT	Facility Level Information on Greenhouse Gases Tool
GHG	Greenhouse Gas
GHGRP	Greenhouse Gas Reporting Program
GWP	Global Warming Potential
HAP	Hazardous Air Pollutants
HARC	Houston Advanced Research Center
H-GAC	Houston-Galveston Area Council
IRA	Inflation Reduction Act
ICLEI	International Council for Local Environmental Initiatives
LEARN	Land Emissions and Removals Navigator Tool
$MTCO_2e$	Metric Tons (or Tonnes) of Carbon Dioxide Equivalents
MSA	Metropolitan Statistical Area
MSW	Municipal Solid Waste
NAAQS	National Ambient Air Quality Standards
NE	Not Estimated
NEI	National Emissions Inventory
NO_x	Nitrogen Oxides
PACE	Property Assessed Clean Energy
PCAP	Priority Climate Action Plan
PM ($PM_{2.5}$)	Particulate Matter (Fine Particulate Matter)
SEDS	State Energy Data System
SIT	State Inventory Tool
SLOPE	State and Local Planning for Energy
TCEQ	Texas Commission on Environmental Quality
TRI	Toxic Release Inventory
TxDOT	Texas Department of Transportation
VMT	Vehicle Miles Traveled
ZEV	Zero Emission Vehicles

Definitions

- **Award Gap:** The difference between the number of awards (which are post-secondary certificates or degrees) conferred in the region and the occupation demand in that same region. Negative values represent a shortage of degrees earned to the demand for the occupations. Positive values represent a surplus of awards to the demand for the occupations.
- **Base Year:** The reference point used to measure and compare changes in GHG emissions over time. It serves as the benchmark year against which future emission reductions or increases are calculated. The Base Year in this document is 2021.
- **Benchmark:** A way of measuring the performance of a resource, service, or process against a comparison standard to identify internal opportunities for improvement (e.g., building energy use per square foot).
- **Business-As-Usual Scenario:** The reference or baseline scenario to evaluate the impact of proposed actions or policies to reduce emissions. BAU reflects projected trends in population growth as well as the energy demand and supply mix.
- **Carbon Dioxide Equivalent (CO_2e):** Standard unit for reporting GHG concentrations.
- **Comprehensive Climate Action Plan (CCAP):** Title of second deliverable for CPRG planning grant that provides an overview of all GHG sources/sinks and sectors following industry standard protocols. The CCAP establishes near-term and long-term GHG emission reduction targets and identify GHG reduction measures to achieve those goals.
- **Climate:** The average weather pattern for a region over a timescale of 30 years or more.
- **Criteria Air Pollutants:** Group of six common pollutants identified and regulated under the Clean Air Act. The U.S. Environmental Protection Agency (EPA) sets National Ambient Air Quality Standards (NAAQS) for these pollutants to protect public health and the environment. They include carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), particulate matter (PM_{10} and $PM_{2.5}$), and sulfur dioxide (SO_2). **(SOURCE: EPA)**
- **Emissions:** Gases or particles released into the air by various sources like vehicles, factories, and power plants.
- **Fossil Fuel:** Non-renewable energy sources derived from ancient organic matter, such as coal, oil, and natural gas, used primarily for energy production and industrial processes.
- **Greenhouse Gas Inventory:** A summary of all GHG emission sources and sinks by sector and the associated emissions quantified using commonly accepted protocols. The CCAP must include a comprehensive inventory of GHG emissions and sinks for the following sectors: industry, electricity generation/use, transportation, commercial and residential buildings, agriculture, natural and working lands, and waste and materials management.
- **Grid Electricity:** Grid electricity is power generated from centralized plants and distributed through a network of transmission lines for use in homes, businesses, and industries.

- **Hazardous Air Pollutants:** Pollutants known to cause serious health impacts like cancer or asthma. The Clean Air Act requires the EPA to regulate hazardous air pollutants from industrial sources. (SOURCE: EPA)
- **Multimodal:** The integration of multiple modes of transportation such as walking, bicycling, public transportation systems, and driving into public infrastructure.
- **Non-Attainment:** Any area that does not meet (or that contributes to ambient air quality in a nearby area that does not meet) the national primary or secondary ambient air quality standard for a NAAQS. (SOURCE: EPA)
- **Occupation Gap:** A metric used to compare occupation demand growth to the local population growth and the projected educational attainment of residents. Negative values represent shortfalls while positive values represent surpluses of talent.
- **Ozone (Ground Level):** A highly reactive gas composed of three oxygen atoms. Emissions of ozone precursors—oxides of nitrogen (NO_x) and volatile organic compounds (VOCs)— result in formation of ground-level ozone, which can have negative impacts to humans, plants, and animals. (SOURCE: EPA)
- **Priority Climate Action Plan (PCAP):** A narrative climate planning report that includes a focused list of near-term, high-priority, and implementation-ready measures to reduce GHG pollution and an analysis of GHG emission reductions.
- **Sinks:** A carbon sink is anything that absorbs more carbon from the atmosphere than it releases, like trees, the ocean and soil.
- **Social Vulnerability:** The potential negative effects on communities caused by external stresses on human health. Such stresses include natural or human-caused disasters, or disease outbreaks. (SOURCE: CDC)
- **Solid Waste:** Any material discarded in a landfill, encompassing various items from household garbage to industrial waste.
- **Stationary (Fossil) Fuel:** Energy sources such as coal, oil, natural gas, refinery gas, municipal waste, and biomass that are burned and utilized for stationary activities like electricity generation, heating, and industrial processes, including power plants and industrial boilers.
- **Sub-Awardee:** An entity receiving a portion of grant funds.
- **Transportation:** Various modes of moving people and goods from one place to another.
- **Vehicle Miles Traveled:** The total number of miles traveled by vehicles across a certain geographic region or area during a specific time-period.
- **Weatherization:** Relatively inexpensive alterations/ retrofits made to a building that result in increased energy efficiency and savings as well as thermal comfort.

List of Figures

List of Tables

EXECUTIVE SUMMARY

Clean Air Action Plan for the Houston–Galveston Region

What the Clean Air Action Plan Is

The Houston–Galveston Clean Air Action Plan (CAAP) is a regional roadmap for improving air quality, protecting public health, and reducing climate pollution across one of the nation's largest and most diverse metropolitan regions. Developed through the U.S. Environmental Protection Agency's Climate Pollution Reduction Grants (CPRG) program, the plan builds on years of air quality planning and community engagement to move the region from analysis to action.

More than a due-diligence deliverable for the CPRG grant program, the CAAP is a shared vision and implementation framework designed to help local governments, businesses, institutions, and communities work together toward cleaner air and healthier outcomes. It identifies practical, flexible strategies that can be tailored to local needs while contributing to shared regional goals.

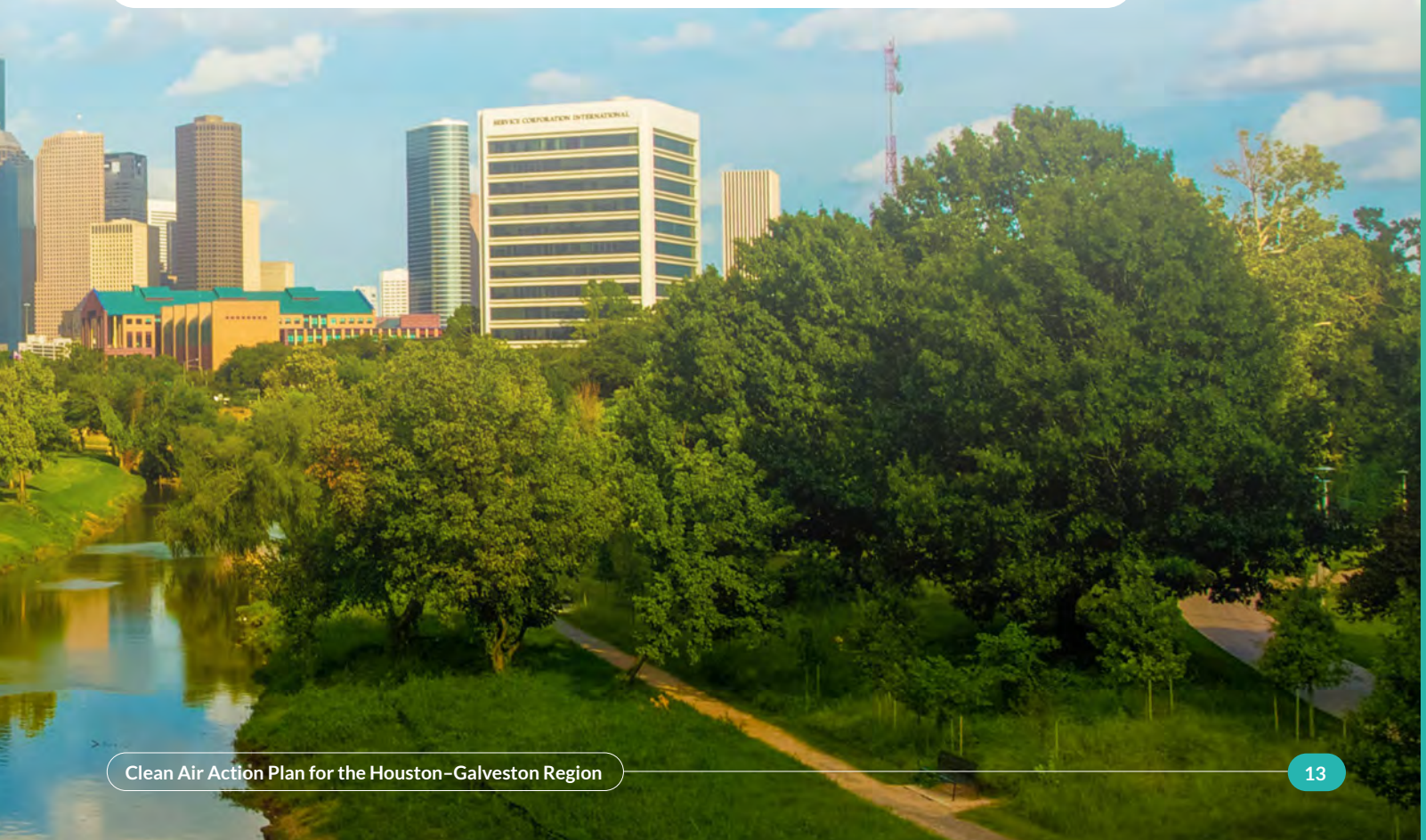
At its core, the CAAP recognizes a simple truth: clean air is essential to healthy communities, economic vitality, and long-term resilience.

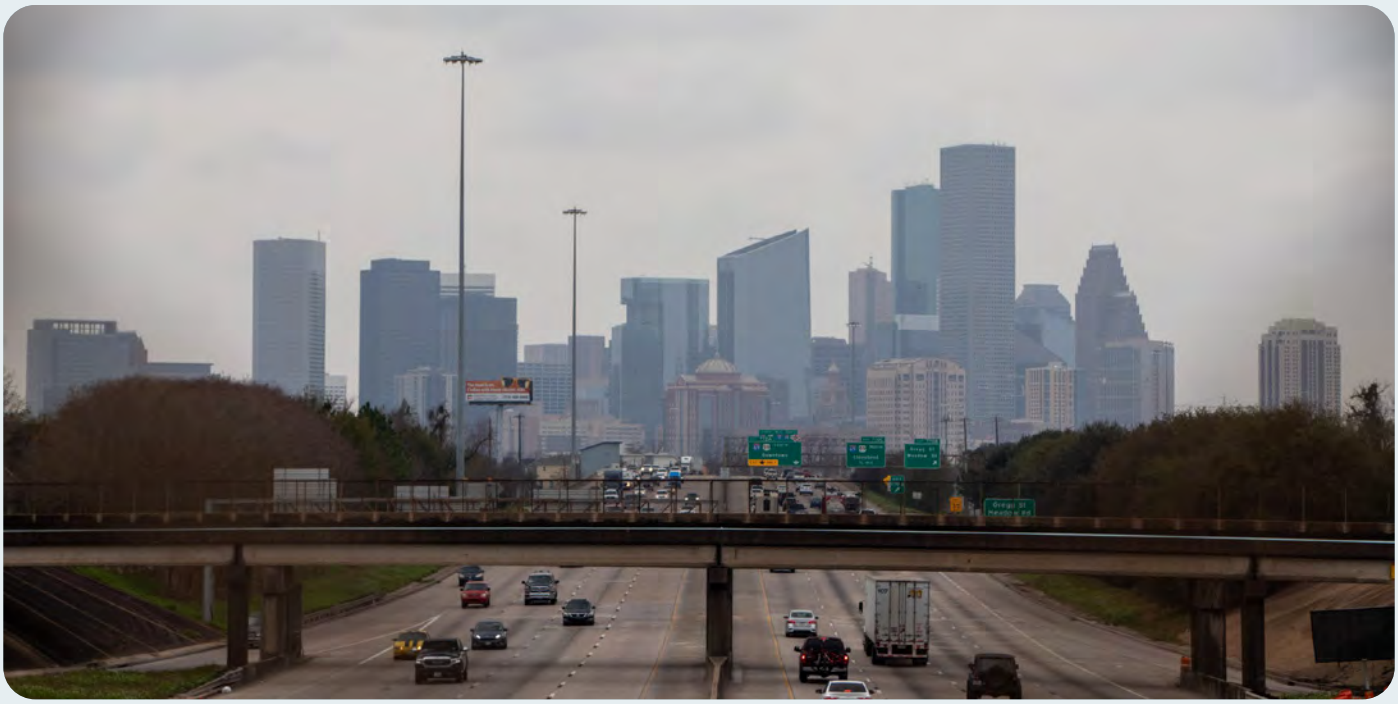
Why Clean Air Matters

Air pollution affects people every day where they live, work, learn, and play. In the Houston–Galveston region, millions of residents are exposed to pollutants that increase the risk and incidence of asthma, heart disease, respiratory illness, missed school and workdays, and premature death. These impacts are not evenly distributed. Communities that are low-income, overburdened by industrial activity, or located near major transportation corridors often face higher exposure and fewer resources to cope with its effects.

Fine particulate matter ($PM_{2.5}$), ground-level ozone, and toxic air pollutants are linked to emergency room visits, hospitalizations, cardiovascular disease, and adverse birth outcomes. Children, older adults, outdoor workers, and people with pre-existing health conditions are particularly vulnerable. Improving air quality is one of the most effective ways to protect public health, reduce healthcare costs, and improve quality of life—especially in communities that have lived with disproportionally higher air pollution for generations.

The CAAP places health at the center of climate and air quality planning, recognizing that actions to reduce pollution today deliver immediate and lasting benefits for people across the region.

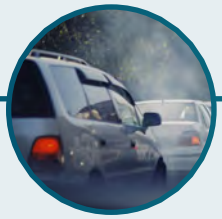




Major Sources of Air Pollution in the Houston-Galveston Region

The Houston–Galveston region's air quality challenges are shaped by its size, geography, and economy. The region spans 13 counties, covers approximately 12,500 square miles, and is home to more than 7 million people. It includes one of the nation's largest petrochemical and refining hubs, along with major ports and freight corridors, expansive highway networks, growing urban and suburban development, and diverse industrial and energy infrastructure.

Key sources of air pollution include:



Transportation emissions from cars, trucks, freight, and port operations

Industrial emissions from petrochemical facilities, refineries, and manufacturing

Power generation and energy use in buildings

Construction, land use change, and materials management

Weather patterns, regional transport of pollution, and rapid growth further complicate air quality, particularly for ozone and particulate matter. At the same time, these challenges create opportunities for coordinated, high-impact solutions.

Key Strategies and Priority Actions

The CAAP organizes solutions into five Opportunity Menus, offering flexible pathways for action across major sectors. Rather than prescribing a single approach, the plan empowers implementers to select strategies that align with their capacity, local emissions sources, and community priorities.

Key strategy areas include:

- **Buildings and Energy:** Accelerating clean energy adoption, energy efficiency, and electrification
- **Transportation:** Expanding clean and electric transportation, reducing vehicle miles traveled, and modernizing freight systems
- **Industry:** Improving energy efficiency, reducing process emissions, and advancing circular economy practices
- **Materials Management**: Reducing methane emissions, expanding composting and waste diversion
- **Agriculture and Land Use**: Protecting carbon sinks and expanding nature-based solutions

Together, these strategies have the potential to deliver substantial greenhouse gas reductions while also cutting harmful co-pollutants that affect daily air quality and individual health outcomes.

EXPECTED BENEFITS

Implementing the CAAP delivers wide-ranging benefits that extend beyond emissions reductions.

- **Health Benefits:** Cleaner air means fewer asthma attacks, fewer hospital visits, and healthier hearts and lungs. Modeled health benefits show significant reductions in premature mortality and illness, with the greatest gains in communities facing the highest pollution burdens.
- **Economic Benefits:** Clean energy and clean transportation investments create jobs, lower energy costs, and strengthen regional competitiveness. Avoided healthcare costs and increased productivity translate into real economic savings for families and communities.
- **Environmental and Climate Benefits:** Reducing greenhouse gases and co-pollutants helps mitigate climate change, improve ecosystem health, and enhance resilience to extreme heat and flooding.

FOCUSED ON COLLABORATION AND A SHARED VISION

Community voices shaped every stage of the CAAP development. Engagement included outreach across all 13 counties in the Houston-Galveston Area Council's region, collaboration with local governments and regional partners, and targeted engagement with low-income and disadvantaged communities. Feedback from residents, stakeholders, and implementers helped prioritize strategies, refine metrics, and ensure the plan reflects lived experience— not just technical modeling.

This plan reflects what communities told us they value: cleaner air, healthier neighborhoods, transparency, and meaningful participation in shaping regional solutions.

ALIGNMENT WITH REGIONAL, STATE, AND FEDERAL PRIORITIES

The CAAP aligns with local climate and air quality initiatives, including county and municipal plans such as the Harris County Climate Justice Plan, Houston Climate Action Plan, and H-GAC Great Region 2040 Plan. It moves the region towards meeting regulatory requirements for air quality, protects public health, supports economic transition, and positions the region to pursue future funding and partnerships.

By connecting local action to regional, state, and national priorities, the CAAP strengthens the Houston–Galveston region's ability to be a leader on clean air and climate solutions.

A LIVING PLAN FOR A HEALTHIER FUTURE

The CAAP is designed to be a living document. Through transparent tracking, public reporting, and ongoing community accountability, the plan will evolve as new data, technologies, and partnerships emerge. Implementation will be supported by tools like ICLEI ClearPath 2.0, allowing the region to measure progress, adjust strategies, and celebrate successes.

Clean air does not happen by accident—it happens through collective action. The CAAP invites everyone in the Houston–Galveston region to take part in that effort, working together to build cleaner air, healthier communities, and a more resilient future for generations to come.

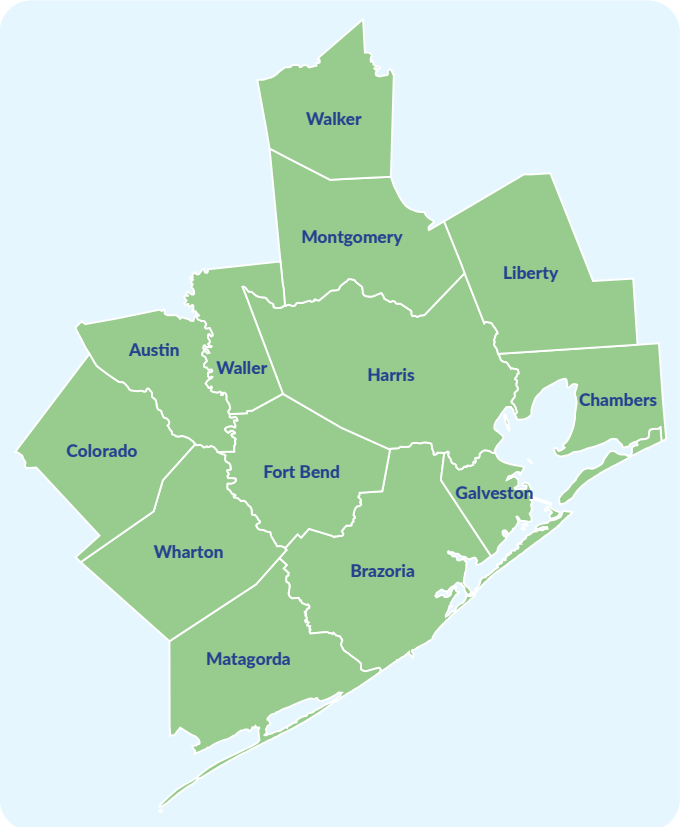
Community meetings were held across the region.

1. INTRODUCTION

1.1 Regional Context and Clean Air Challenges

The Houston-Galveston region is one of the largest, fastest-growing, and most economically diverse metropolitan areas in the United States. Encompassing thirteen counties and approximately 12,500 square miles, the region is home to more than seven million residents and includes a wide range of urban, suburban, rural, coastal, and industrial landscapes. This diversity shapes both the region's economic strength and its air quality challenges, requiring solutions that are locally responsive while coordinated at a regional scale.

The region's population growth has been among the highest in the nation, with continued in-migration driving increased demand for housing, transportation, energy, goods, and services. This growth places additional pressure on infrastructure systems and contributes to rising emissions from buildings, vehicles, freight movement, and industrial activity. At the same time, demographic diversity is a defining characteristic of the region, with communities representing a wide range of incomes, languages, cultures, and lived experiences. Many residents live in communities that face longstanding social and economic challenges, which is correlated to increased exposure to air pollution and limits the ability to adapt to climate-related impacts.



Map of Houston-Galveston Area Council's 13-county region.

The Houston-Galveston economy is anchored by globally significant industries, including energy production and refining, petrochemicals, manufacturing, shipping and logistics, aviation, and agriculture. The region is home to one of the nation's largest concentrations of industrial facilities and the busiest port in the United States by tonnage. These industries are central to regional and national economic vitality but are also major sources of greenhouse gas (GHG) emissions and co-pollutants such as nitrogen oxides (NO_X), particulate matter ($PM_{2.5}$), and volatile organic compounds (VOCs). Freight transportation, port operations, and extensive roadway networks further contribute to emissions and congestion, particularly in communities located near industrial corridors and major transportation routes.

The region has a long history of air quality challenges, including persistent ozone nonattainment and elevated levels of other harmful air pollutants. Weather patterns, including high temperatures,

humidity, and prevailing wind conditions, can exacerbate ozone formation and air pollution episodes. Climate change is expected to intensify these conditions, increasing the frequency of extreme heat events and the severity of health risks, particularly for children, older adults, outdoor workers, and individuals with pre-existing health conditions.

Not all communities experience these impacts equally. Many neighborhoods—especially those located near industrial facilities, highways, ports, and freight hubs—face disproportionate exposure to air pollution while also experiencing higher rates of poverty, limited access to healthcare, housing instability, and other social stressors. These cumulative burdens underscore the importance of integrating equal environmental opportunities into regional clean air planning.

Developed in response to the scale and complexity of the region's air-quality challenges, the Clean Air Action Plan (CAAP) focuses on practical solutions that protect public health and support a strong Houston–Galveston economy. The plan addresses pollution from all major sectors and supports the protection of communities that are most affected presently and historically. Rooted in local realities and community experience, it outlines practical, coordinated actions to improve air quality and quality of life for everyone who lives and works in the region.

WHERE DO GREENHOUSE GASES COME FROM?

Greenhouse gases that trap heat in the atmosphere, resulting in the warming on the surface

Carbon dioxide (CO_2): Burning fossil fuels (coal, natural gas, and oil), solid waste, trees and other biological materials, and also as a result of certain chemical reactions.

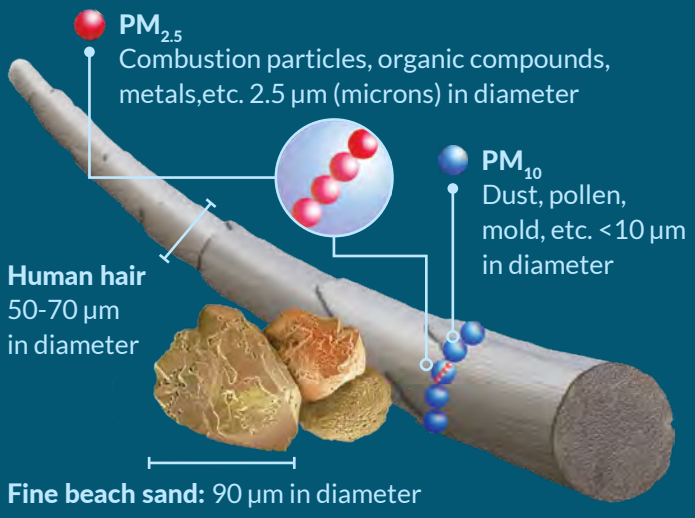
Methane (CH_4): Production and transport of coal, natural gas, and oil. Methane emissions also result from livestock and other agricultural practices.

Nitrous oxide (N_2O): Agricultural, land use, and industrial activities; combustion of fossil fuels.

Fluorinated gases: Emitted from a variety of household, commercial, and industrial applications and processes.

WHAT IS PARTICULATE MATTER ($PM_{2.5}$)?

$PM_{2.5}$ pollution is small enough to pass deep into the lungs, making it especially dangerous for children, older adults, and people with respiratory conditions.



1.2 CPRG Grant & CAAP Purpose

The Clean Air Action Plan (CAAP) was developed under the U.S. Environmental Protection Agency's Climate Pollution Reduction Grant (CPRG) Program, which was created to help state, local, and regional governments reduce GHG emissions, improve air quality, lower energy costs, and support economic growth. Through the CPRG Phase 1 planning grant, the Houston-Galveston Area Council (H-GAC), in partnership with the City of Houston, Harris County, and Fort Bend County, is leading a coordinated, multi-jurisdictional effort to advance climate and clean air solutions across the 13-county Houston-Galveston region. This regional approach reflects the scale of the region's emissions challenges and the need for collaboration across jurisdictional boundaries to achieve meaningful and lasting reductions.

While the CPRG program requires submission of a Comprehensive Climate Action Plan (CCAP) to EPA, the Clean Air Action Plan serves as the region's expanded, community-facing version of that deliverable. The CAAP builds upon the technical foundation established through the CCAP and the earlier Priority Climate Action Plan by providing additional regional context, clearer explanations of data and modeling, and a stronger emphasis on public health, equal environmental opportunities, and implementation readiness. It is intentionally designed to be accessible and useful to a broad audience—including local governments, community organizations, businesses, and residents—while remaining grounded in CPRG grant requirements.

The CAAP provides a shared roadmap for cleaner air and healthier communities across the Houston–Galveston region, while supporting long-term economic resilience. It includes both short and long term goals and identifies practical actions across key sectors that shape daily life, from transportation and buildings to industry, waste, and land use. The plan organizes these actions into five Opportunity Menus, giving communities flexible options to act based on their priorities and readiness. This approach allows communities at different stages to participate and make progress together.

Community engagement and lived experience are central to the development and purpose of the CAAP. Through a robust public participation process, the plan incorporates input from residents and stakeholders across the region, with particular attention to communities that experience disproportionate air pollution and climate-related impacts. By centering fairness, transparency, and community-informed solutions, the CAAP seeks to ensure that emission reduction strategies deliver tangible health, environmental, and economic benefits where they are needed most.

The CAAP is intended to complement and strengthen existing county and municipal climate, sustainability, and resilience plans rather than replace them. It aligns with local efforts such as the Harris County Climate Justice Plan and the City of Houston's Climate Action Plan, providing a regional framework that supports coordination, consistency, and shared learning across jurisdictions. By aligning data, modeling tools, and policy approaches, the CAAP helps local governments leverage shared resources, reduce duplication, and amplify the impact of locally driven actions. Together, these coordinated efforts position the Houston-Galveston region to advance practical, community-centered clean air solutions through a unified regional strategy.

How the Plan Was Developed

The Clean Air Action Plan (CAAP) was developed through a deliberate, inclusive, and data-driven process designed to reflect the needs, priorities, and capacities of the Houston-Galveston region. From the outset, H-GAC and its partners sought to balance technical rigor with meaningful community engagement, ensuring that the plan is both methodically sound and grounded in lived experience. This approach recognizes that achieving cleaner air and healthier communities requires collaboration across jurisdictions, sectors, and communities.

The development of the CAAP was guided by a set of core principles that shape both the content of the plan and the process used to create it. Central to this effort is the Clean Air, Healthy Communities vision, which emphasizes that reducing greenhouse gas (GHG) emissions and other air pollutants translates to tangible improvements to individuals' quality of life, and the community's public health. Protecting human health is a primary consideration throughout the plan, with particular attention to reducing exposure to harmful air pollutants and mitigating climate-related risks such as extreme heat.

The plan acknowledges that many communities in the region experience disproportionate air pollution burdens alongside social and economic challenges that limit their ability to respond to climate impacts. By integrating community-centered considerations into data analysis, strategy development, and prioritization, the CAAP seeks to ensure that emission reduction efforts deliver meaningful benefits.

Transparency and science-based decision-making are also core guiding principles. The CAAP relies on publicly available data, clearly documented methodologies, and established analytical tools to inform its findings and recommendations. Assumptions, limitations, and uncertainties are communicated openly to build trust and support informed decision-making among stakeholders and the public. A regional GHG inventory, business-as-usual emission projections, and emission reduction scenarios were modeled using ICLEI's ClearPath 2.0 platform. These analyses were led by the Houston Advanced Research Center (HARC) in collaboration with H-GAC and technical partners, ensuring consistency with national best practices and the latest climate science.

A key element of the Clean Air Action Plan CAAP is the development of five Opportunity Menus, which translate technical analysis and community input into practical, actionable options for implementation. These menus are designed to support local governments, businesses, and community partners by providing a flexible set of strategies that can be adapted to different local contexts, capacities, and priorities. Rather than prescribing a single pathway, the Opportunity Menus offer tiered actions across major sectors—buildings and energy, transportation, industry, waste, and agriculture and land use—allowing implementers to select measures that align with their emissions profiles, readiness, and available resources. This approach recognizes that communities across the region are at different stages of climate action and enables progress at multiple scales while contributing to shared regional goals. By linking modeled emission reductions with community-supported actions, the

Opportunity Menus serve as a bridge between planning and implementation and help position the region to pursue funding, partnerships, and near-term projects that deliver clean air and public health benefits.

Community engagement was a central component of the planning process. Building on relationships established during the Priority Climate Action Plan (PCAP) phase, H-GAC and its partners implemented a comprehensive Public Participation Plan that included in-person and hybrid community meetings, digital outreach, and targeted engagement with community-based organizations. These efforts focused on understanding lived experiences with air pollution, identifying barriers to implementation, and gathering input on feasible and locally relevant solutions. Community feedback directly informed the prioritization and refinement of strategies included in the CAAP.

Stakeholder collaboration extended beyond community engagement to include coordination with local governments, utilities, industry representatives, workforce organizations, academic institutions, and advocacy groups. Subawardee partners—the City of Houston, Harris County, and Fort Bend County—played key roles in shaping plan elements. Additional coordination with agencies such as the Texas Commission on Environmental Quality (TCEQ) and Port Houston helped align the CAAP with broader air quality, transportation, and energy initiatives.

Interagency coordination was supported through regular meetings, shared document platforms, and iterative review processes to ensure consistency and integration across plan components. This collaborative framework strengthens the CAAP's role as a regional roadmap that complements existing county and municipal plans while providing a unified structure for future implementation.

Together, these guiding principles and development approaches ensure that the Clean Air Action Plan is technically credible, community-informed, and regionally coordinated—positioning the Houston-Galveston region to make measurable progress toward cleaner air, healthier communities, and a more resilient future.

2. HEALTH RISK ASSESSMENT

2.1 Why Clean Air Matters

Clean air is not an abstract environmental goal—it is a daily public health necessity that directly affects how people in the Houston-Galveston region live, work, learn, and breathe. For many residents, air quality is experienced not through charts or monitors, but through asthma inhalers kept in backpacks. Poor air quality also leads to emergency room visits during high ozone days, missed school and workdays, and other chronic health impacts associated with living near pollution sources. These lived experiences are central to why the Clean Air Action Plan exists and why clean air is foundational to healthy communities.

Air pollution exposure in the region is shaped by a combination of industrial activity, transportation corridors, port operations, energy production, and meteorological conditions that can trap pollutants near the ground. Fine particulate matter ($PM_{2.5}$), ground-level ozone (O_3), and air toxics are among the pollutants of greatest concern. These pollutants are linked to a range of adverse health outcomes, including asthma exacerbations, chronic respiratory disease, cardiovascular disease, adverse birth outcomes, and premature death. High ozone days are associated with increased emergency department visits and hospital admissions, particularly among children, older adults, outdoor workers, and individuals with pre-existing conditions. $PM_{2.5}$ exposure has been shown to penetrate deep into the lungs and bloodstream, contributing to heart attacks, strokes, and long-term declines in lung function.

The health impacts of air pollution are not felt evenly across the region. Communities located near highways, freight hubs, ports, and industrial corridors often experience higher cumulative exposure to harmful pollutants while also facing barriers such as limited access to healthcare, lower incomes, housing instability, and language or mobility challenges. These overlapping factors can amplify health risks and limit the ability of individuals and families to avoid or recover from pollution-related illness. For families in these communities, poor air quality can mean recurring asthma attacks, higher medical costs, and difficult choices between health care, housing, and other basic needs.

Data reinforces these realities. Hospitalization records, asthma prevalence rates, and cardiovascular health indicators consistently show higher burdens of disease in areas with elevated pollution exposure. During periods of poor air quality, regional health systems see measurable increases in respiratory and cardiac-related admissions. These patterns underscore that air quality is not only an environmental issue, but also a healthcare and economic issue where some segments of our region carry heavier burdens.

The CAAP responds to this reality by placing health at the center of climate and air quality planning. Reducing GHG emissions often produces immediate co-benefits by lowering emissions of harmful co-pollutants, resulting in cleaner air and healthier communities. Investments in cleaner energy, transportation, and industrial practices can reduce hospital visits, improve quality of life, and ease the strain on families and healthcare systems alike.

By pairing community stories with health data and visualizations, the CAAP makes the case that clean air policies are fundamentally about people. The plan elevates the voices of residents who experience the impacts of air pollution firsthand while grounding solutions in evidence-based public health research. In doing so, it affirms H-GAC's commitment to promoting Clean Air, Healthy Communities—not only as a policy goal, but as a shared regional responsibility to protect health, especially in overburdened communities, and improve quality of life across the region for current and future generations.

2.2 Vulnerable Populations and Disproportionate Impacts

Understanding who is most affected helps us design a CAAP that serves everyone in the Houston-Galveston region.

Vulnerability, or social vulnerability, refers to the conditions that influence how well a person or community can prepare for, cope with, and recover from a hazard.[1] Vulnerability can be broken down into three factors:

- **Exposure** is about how much a person or community experiences different hazards.[2] Examples include hotter temperatures, high levels of particulate matter, ozone pollution, proximity to industrial sites, etc.
- **Sensitivity** refers to the physical or socio-economic conditions that make people or communities more likely to be harmed by a hazard, and affect how serious the impacts may be.[3] Examples include age, illnesses, income, language barriers, etc.
- **Adaptive Capacity** reflects how well a community can take action to prevent, adapt, or recover from hazards. It's another way of thinking about resilience.[4] Examples include transportation access, health care, tree canopy, EV chargers, etc.

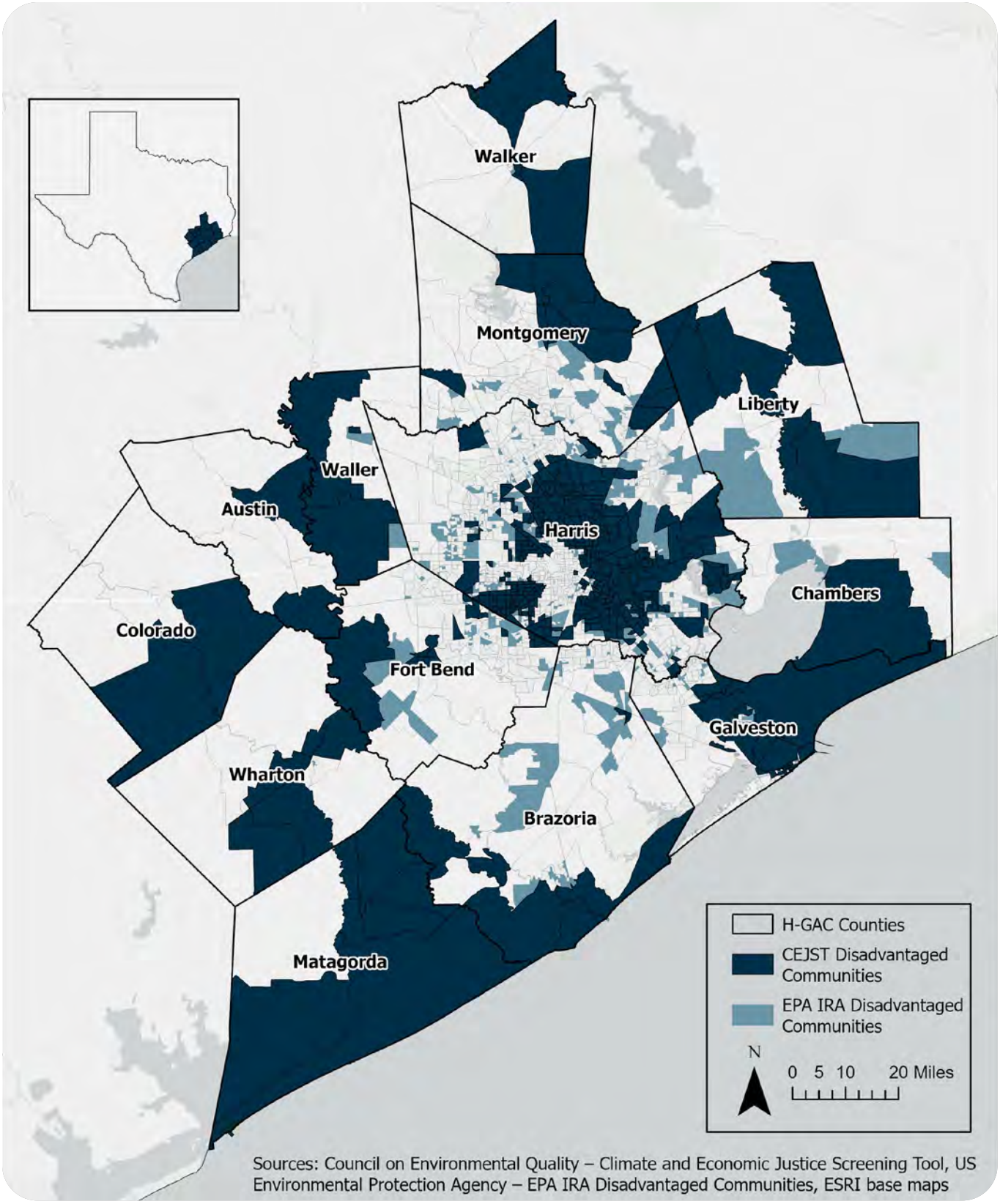


Figure 1: Map of Vulnerable Communities in the Region

Communities become vulnerable when exposure, sensitivity, and limited adaptive capacity reduce their resilience. Some factors that increase vulnerability include age, lack of health insurance, low income, being a person of color, and having respiratory or heart conditions - all of which are associated with higher risks and fewer resources to cope.[5] These factors often overlap and stack risks for certain neighborhoods.

Vulnerability mapping helps identify where negatively impacted groups are concentrated and helps see where improvements in air quality and health will have the greatest impact.

Figure 1 highlights all 13 counties in the Houston–Galveston region and shows which areas have the highest numbers of disadvantaged communities. In our region, more than 5.6 million community members - about 77% of the population - live in areas identified as disadvantaged.[6]

Almost half (49%) of the census tracts across the region are designated as disadvantaged (Figure 1). Census tracts qualify when they meet both a "burden" indicator (such as pollution) and a socio-economic indicator (such as income, age, or disability status). Some of the most significant burdens of this region include linguistic isolation (26%), diabetes rates (15%), proximity to industrial facilities (12%), fine particulate matter ($PM_{2.5}$) exposure (11%), and long-term flood risk (9.6%). By incorporating these indicators into the CAAP, we aim to ensure that our strategies reflect the diverse needs across our region.

Many communities in our region have varying access to safe or affordable housing, fewer transportation options, lower incomes and job opportunities, reduced access to health care, higher exposure to industrial pollution or flood-prone areas, and less capability to influence policy affecting these negative influences on health, safety, and quality of life.[7] Recognizing how this shapes daily life underscores the importance of ensuring that new projects and programs actively work to close, rather than widen, these gaps.

Considerations for Implementation:

- Is this project or program accessible to everyone?
- Does this project or program lower costs or increase services for everyone?
- Does this project or program reduce air pollution in vulnerable communities?
- Does this project or program provide workforce development opportunities for low-income individuals?
- Does this project or program place an undue burden on a particular neighborhood?
- Is the project or program designed with culturally appropriate outreach?

The CAAP reflects our shared goal of achieving clean air for all communities across the 13-county H-GAC region. Projects and programs can reduce exposure to harmful air pollution, increase resilience, and deliver community benefits.

As the plan moves forward with implementation, we will promote activities with partners that directly address vulnerabilities of those most affected by air quality challenges while supporting long term prosperity.

Examples of Existing Initiatives

- **METRO's all-electric Community Connector Shuttle:** a free on-demand shuttle service for people within their dedicated service area (Second Ward, Third Ward, Downtown, Heights, & Near Northside)
- **Evolve Houston's eMobility Grants:** Community leaders, nonprofits, and organizations can request up to $15,000 in funding to support innovative, community-driven solutions that improve mobility and local opportunity in underserved neighborhoods.

2.3 Industrial Hazards and Proximity-Based Risks

Our region is home to the largest petrochemical complex in the country and three of the largest oil refineries in the nation. These facilities supply gasoline, diesel, jet fuel, and petrochemical products to global markets and are linked to a vast and intricate network of pipelines, railways, and shipping terminals. Their economic importance to not only the region, but the nation, is undoubtedly significant. However, explosions, fires, and toxic releases are not uncommon in refining environments, posing serious risks to workers and nearby communities. The Houston-The Woodlands-Sugarland MSA has the highest disposal or release of chemicals per square mile of the 10 most populous MSAs in the country (Figure 2). A "release" of a chemical means that it is emitted to the air or water, placed in some type of land disposal, or transferred off-site for disposal or release. In 2023, 522 facilities in the Houston-The Woodlands-Sugarland MSA reported releasing a combined 17.3 million pounds of toxic chemicals into the air alone (Figure 3).[8]

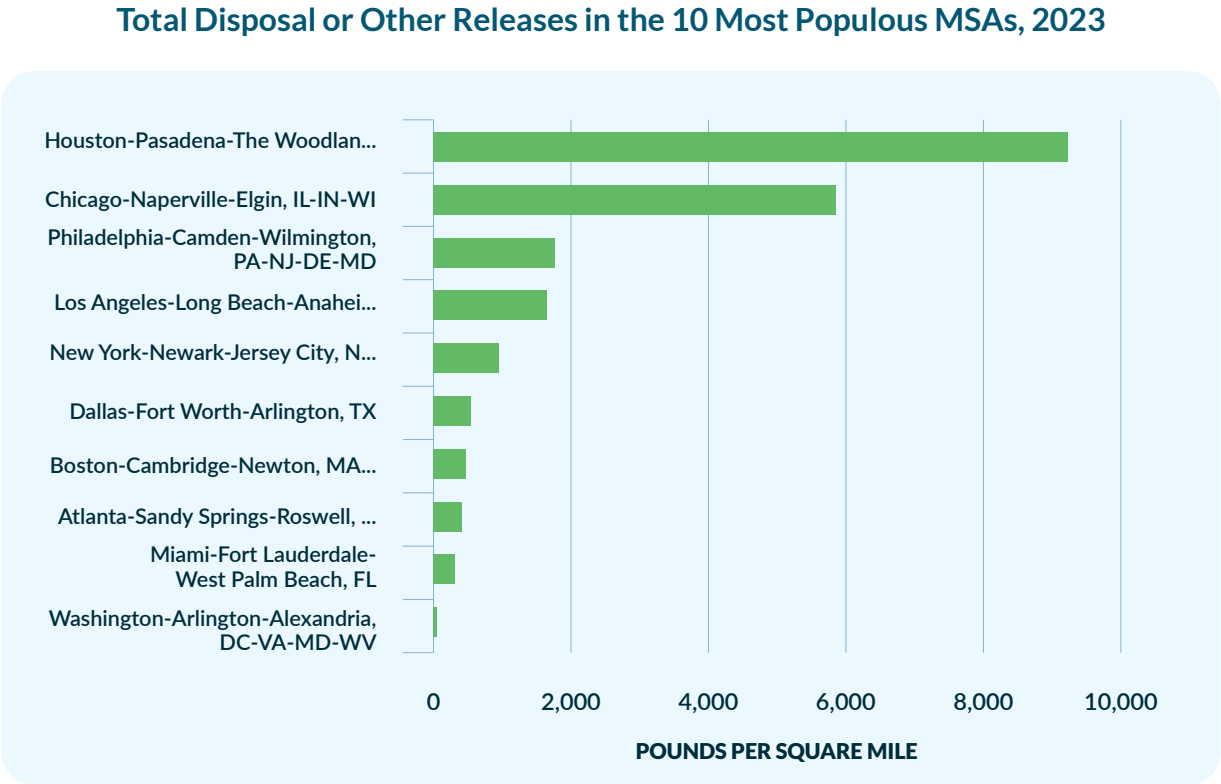


Figure 2: Total TRI Chemical Releases per Square Mile for 2023 for the 10 Most Populous MSAs. Source: States and Metropolitan Areas | US EPA

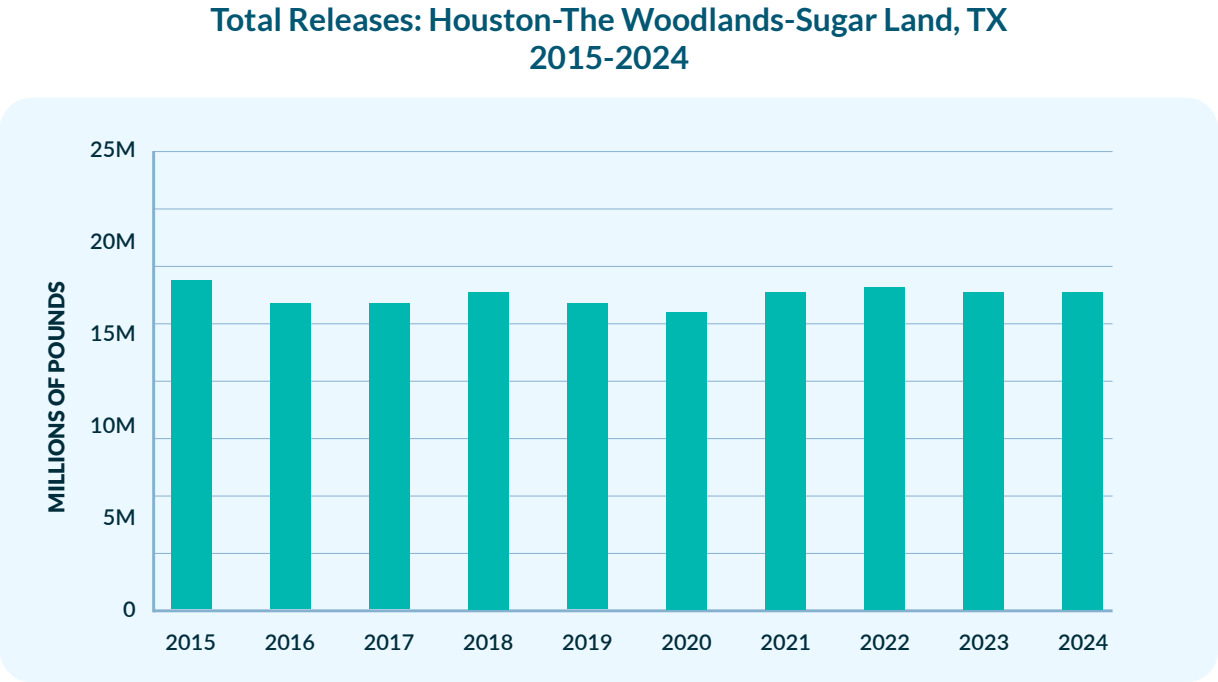


Figure 3: Annual Releases of TRI-Covered Chemicals to the Air in the MSA of Houston-The Woodlands-Sugar Land, TX From 2015-2024

The US EPA defines air toxics, or hazardous air pollutants, as "those pollutants that cause or may cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental and ecological effects." Air toxics tend to pose greater risks in urban areas because these areas tend to be located near major roadways, have a higher concentration of pollution sources, and a larger population exposed. Although ambient levels of many air toxics have improved over the past few decades, communities in the region may be exposed to concentrations that may cause adverse health effects, including elevated cancer risk (Figure 4).

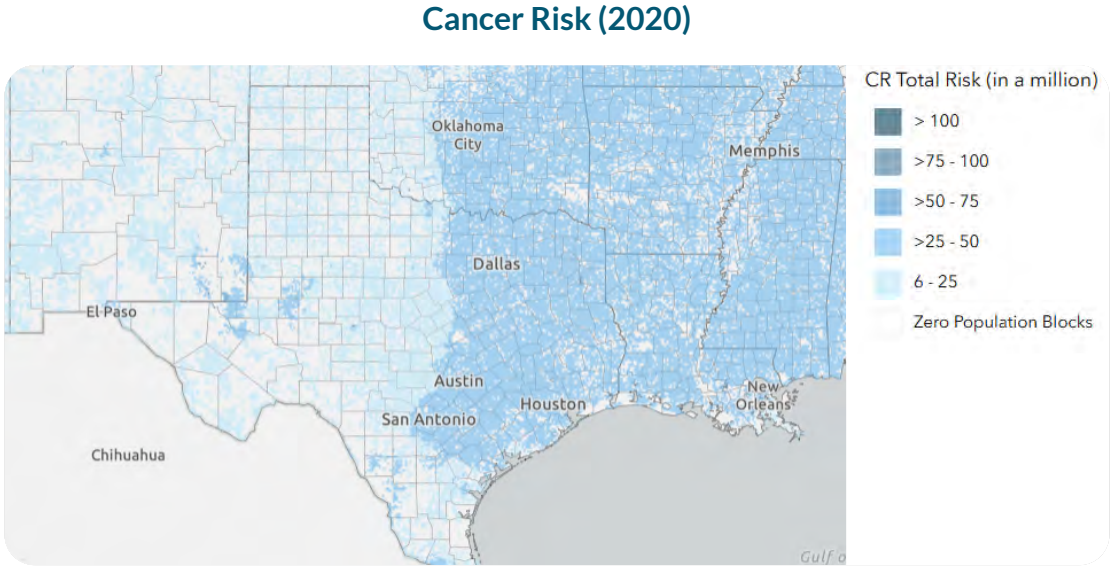


Figure 4: Screenshot of EPA's AirToxScreen Mapping Tool Showing Cancer Risk Results in Texas

Over the last few years, there have been several large, industrial air toxic release events in the region, most notably Harris County's ITC fire of 2019 which had an emergency activation for 27 days. Chemical fires usually result in the release of large amounts of particulate matter and carbon monoxide, as well as varying amounts of volatile organic compounds (VOCs, such as benzene), polycyclic aromatic hydrocarbons (PAHs), metals, and other chemicals.

2.4 Air Quality Monitoring

Air monitoring is key to estimating the potential for community exposure to air pollution. Monitoring is the process of collecting actual measurements of air pollution to describe air quality at specific locations and times. Community air monitoring conducted by industrial facilities, nonprofit organizations, and higher education institutions is complementing the existing network of monitors maintained by local, state, and federal agencies to:

- Enhance local air quality data availability and access.
- Identify sources of pollution.
- Determine if measured pollution levels affect public health.
- Advance education and awareness campaigns.
- Advocate policies that improve air quality.
- Identify any patterns and trends that may support regulatory activities.

By calling for a reduction in industrial pollution, the CAAP does more than clean the air, it helps our region breathe easier, stay healthier, and build communities that are better prepared to weather future challenges. Grounded in a clear inventory of emissions sources, the plan also allows progress and impacts to be tracked over time, ensuring accountability and continuous improvement.

3.

AIR QUALITY CHALLENGES IN THE REGION

Overview of Key Pollutants:

The Houston-Galveston region is burdened by air pollution, of numerous types and sources. There are air toxics, or compounds such as formaldehyde, 1,3-butadiene, benzene, and ethylene oxide which form and are emitted by industrial processes and transportation. There are also criteria pollutants, or those regulated by the U.S. EPA. Several counties in the region exceed established air quality standards.

The Clean Air Act (CAA) of 1970, and a later amendment in 1990, require the EPA to establish National Ambient Air Quality Standards (NAAQS) for several criteria air pollutants. The primary standards protect public health, including sensitive populations such as asthmatics, children, and the elderly. Secondary standards protect public welfare, including protection against damage to crops, animals, buildings, etc. Because H-GAC serves as the Houston-Galveston-Brazoria MPO, we fulfill regulatory responsibilities for ozone and $PM_{2.5}$.

Ozone (O_3)

As of December 2025, all eight counties in the metropolitan planning area are designated as being in severe nonattainment for the 2008 ozone primary NAAQS, which set the standard at 0.075 parts per million (ppm). In 2015, the EPA strengthened this standard to 0.070 ppm, to further protect public health. Currently, six counties — Brazoria, Chambers, Fort Bend, Galveston, Harris, and Montgomery —in the metropolitan planning area are in serious nonattainment for the 2015 ozone standard. Transportation, particularly on-road mobile sources, contributes to emissions of ozone precursors, including volatile organic compounds (VOCs) and nitrogen oxides (NO_x). These pollutants react in the presence of heat and sunlight to form ground-level ozone, a key contributor to poor air quality in the region. According to 2023 emission inventories published by the TCEQ, on-road mobile sources are responsible for approximately 23% of NO_x emissions and 7% of VOC emissions in the metropolitan planning area.

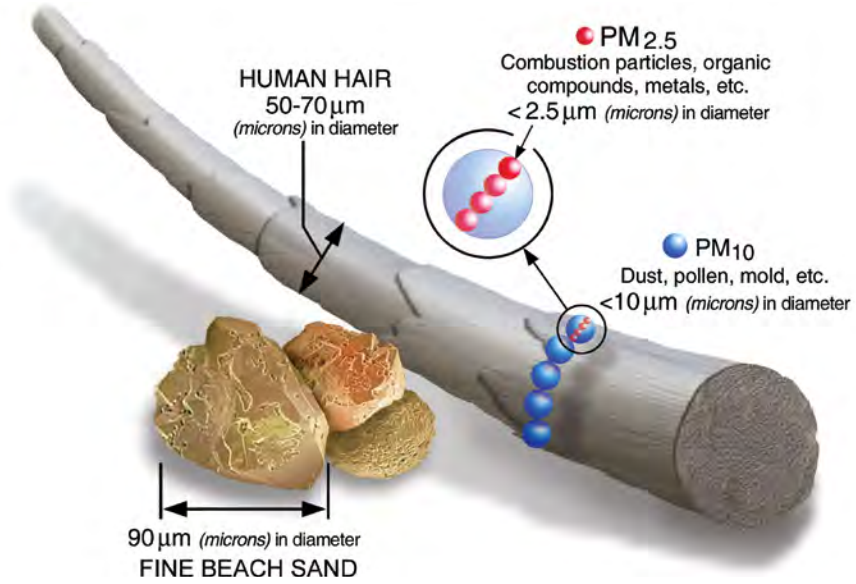
Particulate Matter ($PM_{2.5}$ and PM_{10})

In addition to ozone, fine particulate matter ($PM_{2.5}$) is an emerging concern. $PM_{2.5}$ refers to a complex mixture of microscopic particles measuring 2.5 microns or less in diameter or about 30 times smaller than the width of a human hair. The extremely small particles originate from both natural and man-made sources. Due to their size, these particles can bypass the body's natural defenses and penetrate deep into the respiratory system, posing significant health risks. Public health officials, scientists, and health researchers are increasingly interested in the health consequences of $PM_{2.5}$.

As of December 2025, all eight counties in the metropolitan planning area meet the 2012 $PM_{2.5}$ primary NAAQS, which set the standard at 12.0 micrograms per cubic liter. Several monitors in the region regularly read above this standard, and recent monitoring data show concentrations in the metropolitan planning area have been rising. The non-attainment designation process is lengthy. Based on criteria set by the Texas Legislature, the region qualified for funds from TCEQ to study and better understand $PM_{2.5}$ in the region, ahead of a potential non-attainment determination.

In 2024, the EPA strengthened this standard to 9.0 micrograms per cubic liter. Full implementation of strengthened standards is a lengthy process. Before the completion of this process the EPA announced that in conjunction with President Trump's Day One executive orders and the EPA's Power the Great American Comeback initiative, the 2024 $PM_{2.5}$ NAAQs was being reconsidered. In addition to vehicle exhaust and brake and tire wear, industrial sources, woodburning, and other combustion contribute to $PM_{2.5}$ formation.

PM_{10} refers to particulate matter with a diameter of 10 microns or less, to include $PM_{2.5}$. It is also referred to as coarse particulate matter because of its larger size. Though regionally, the levels of PM_{10} are lower and less concerning than $PM_{2.5}$, areas with robust construction, concrete batch plants, agricultural dust, and open land tend to experience higher levels of PM_{10}. The long-range transport of wildfire smoke or Saharan dust (which generally peaks in late June to mid-August) into our region can also contribute to higher levels of PM_{10}.

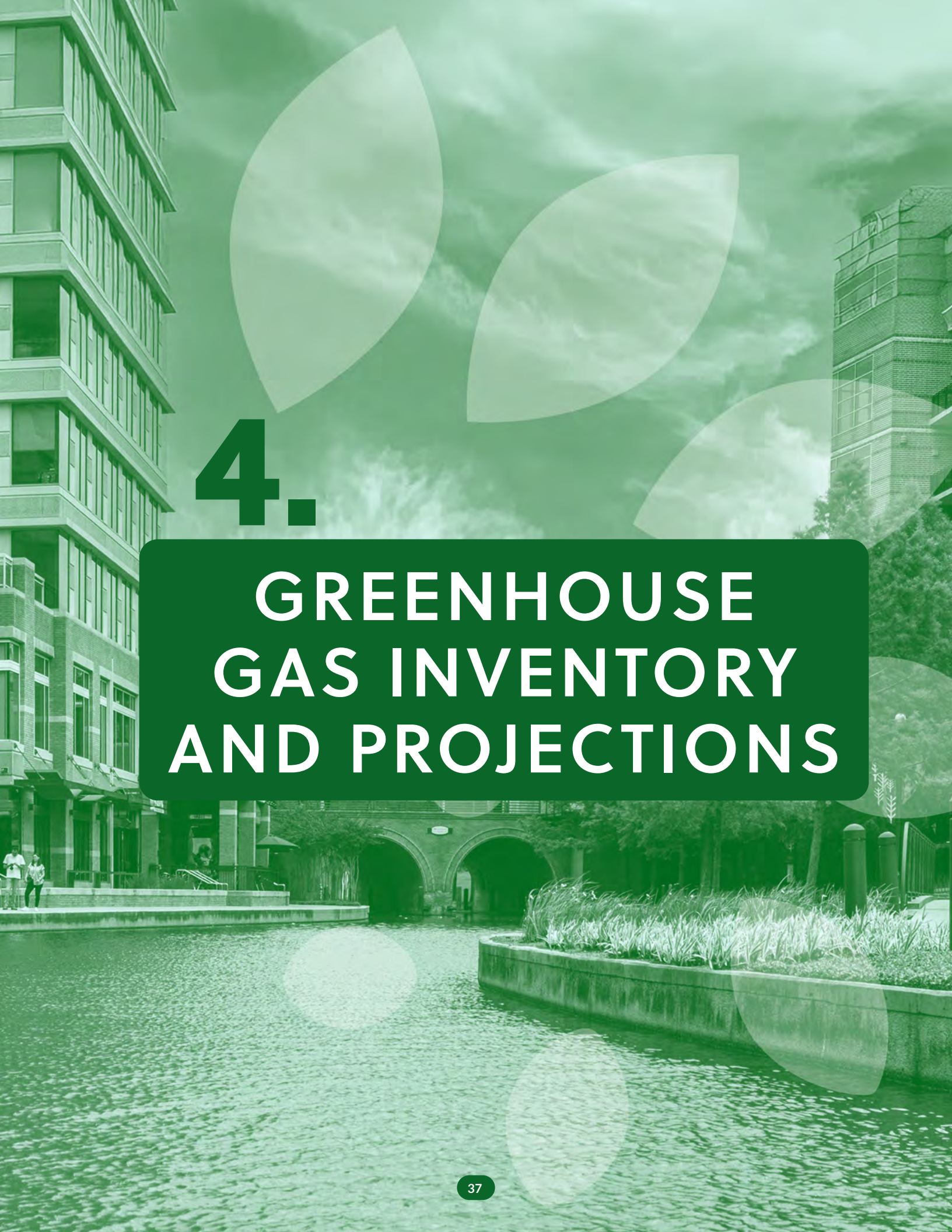


Greenhouse Gases (GHGs):

The CAAP targets three major air polluting gases that contribute to rising temperatures and unhealthy air: carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). When these gases build up in the atmosphere, they trap heat, increasing extreme weather and creating risks for people's health, local infrastructure, and the economy.

1. **Carbon dioxide (CO_2)** is the most prevalent GHG and is primarily released through the combustion of fossil fuels for electricity generation, transportation, and industrial processes. Because CO_2 remains in the atmosphere for long periods, cumulative emissions are a key driver of long-term climate change.
2. **Methane (CH_4)** is a highly potent GHG with a much stronger warming effect than CO_2 over shorter timeframes. Major sources include oil and gas operations, landfills, wastewater treatment, and agricultural activities. Reducing methane emissions can deliver rapid climate and air quality benefits.
3. **Nitrous oxide (N_2O)** is emitted from agricultural soil management, fertilizer use, fuel combustion, and certain industrial processes. While emitted in smaller quantities, N_2O has a very high global warming potential and persists in the atmosphere for over a century. Nitrous oxide also contributes indirectly to smog formation by participating in atmospheric chemical processes that influence nitrogen oxides (NO_x) levels, which are key precursors to ground-level ozone.

Throughout the CAAP, air polluting gases are measured using a common unit called metric tons of carbon dioxide equivalent, or $MTCO_2e$. This is simply a way to compare different gases using the same scale. Some gases, like methane and nitrous oxide, trap much more heat than carbon dioxide, even in smaller amounts. To make comparisons easier, their impact is translated into the amount of carbon dioxide that would create the same warming effect over time, usually measured over a 100 year period.



4.

GREENHOUSE GAS INVENTORY AND PROJECTIONS

4.0 Inventory & Projections

A pollutant inventory is a comprehensive accounting of the emissions of pollutants produced within a particular jurisdiction. This inventory is an essential tool for understanding the region's sources of air pollution and for developing strategies to reduce emissions. Additionally, the inventory serves as a baseline for setting emission reduction targets, will aid in tracking progress over time, and help inform policy decisions related to air quality and sustainability.

Emission projections are scenarios that anticipate what a future pollutant inventory could look like. Business-as-usual (BAU) is the reference or baseline scenario to evaluate the impact of proposed actions or policies to reduce emissions. BAU reflects projected trends in population growth as well as the energy demand and supply mix. With more people moving into the region, there will be greater demand for energy, food, housing, transportation, and goods, all of which require energy and result in emissions. Comparing the emissions expected under BAU scenario with established emission reduction targets can demonstrate the scale of change required to meet the region's emissions goals.

4.1 Inventory Methodology

A local baseline inventory of the major sources of GHG and co-pollutant emissions was developed for each of the 13 counties. Data for the county-level inventories was then compiled to create one complete inventory for the region. The regional GHG inventory was prepared using ICLEI's ClearPath 2.0 GHG reporting tool. The regional co-pollutant inventory was developed using data from the National Emissions Inventory (NEI), cross-referenced with county-level data published in TCEQ's CCAP for the State of Texas. The sectors and gases used in the GHG inventory are outlined in the table below and data sources are referenced in the appendix. The GHG baseline year selected was 2021 to maximize data availability. The co-pollutant baseline year is 2020.

Emission Source Categories	Subsector Categories	Greenhouse Gases (across all sectors)	N_2O (MT)
Grid Electricity	Residential and commercial buildings, and industrial facilities	• carbon dioxide (CO_2) • methane (CH_4) • nitrous oxide (N_2O)	• VOC • O_3 • CO • PM_{10} • $PM_{2.5}$ • NO_x • SO_x • Hazardous Air Pollutants (HAPs)
Stationary Fuel			
Transportation	On road vehicles, aviation, railway, and waterborne navigation		
Waste	Solid waste disposal, biological treatment of waste, incineration and open burning		
Agriculture, Forestry, and Other Land Use (AFOLU)	Livestock, forestry (trees)		

Table 1. Sectors, Subsectors, and Gases Included in the GHG and Co-Pollutant Inventories

4.2 Inventory Results

In 2021, the region generated a net balance of 234,248,538 $MTCO_2e$ (Figure 5). Net emissions are calculated by subtracting 7,601,627 $MTCO_2e$ of emissions sinks —anything like trees that absorb more carbon from the atmosphere than it releases— from 241,850,165 $MTCO_2e$ produced by emissions sources. Additional summary tables are included in the Technical Appendices.

The three largest sources of GHG emissions in the 13-county region, shown in figure 6, were stationary fuel combustion (e.g., natural gas consumed on site; 66%), electric power consumption (grid electricity; 17%), and transportation sources (15%).

Figure 5. Net GHG Emissions by County, shown in $MTCO_2e$ (2021; ClearPath 2.0 Estimates)

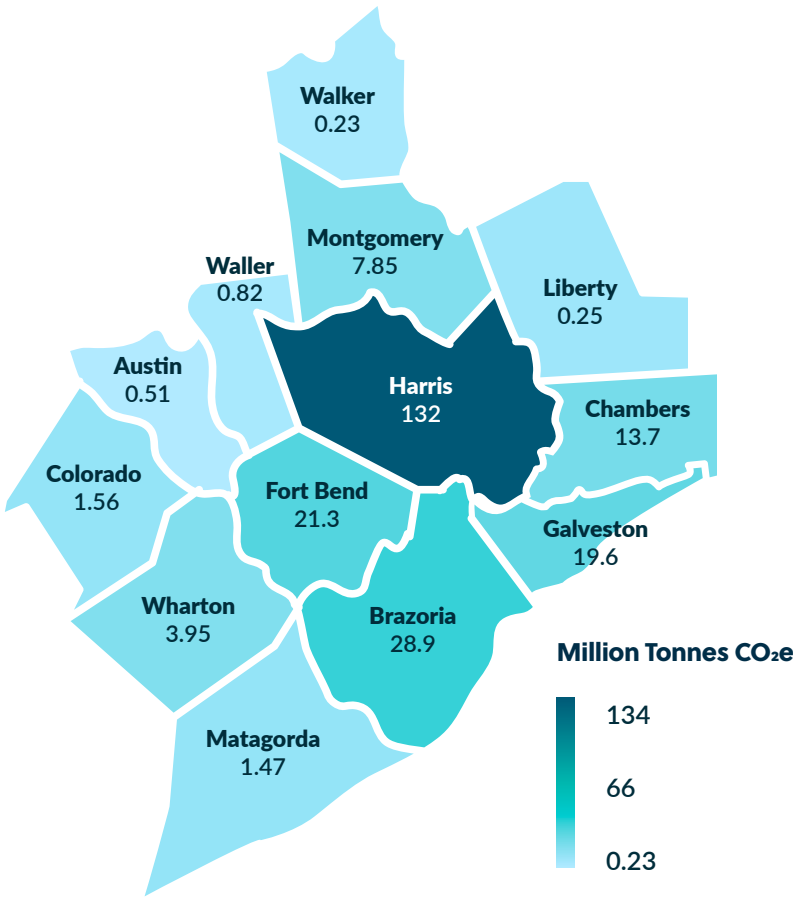
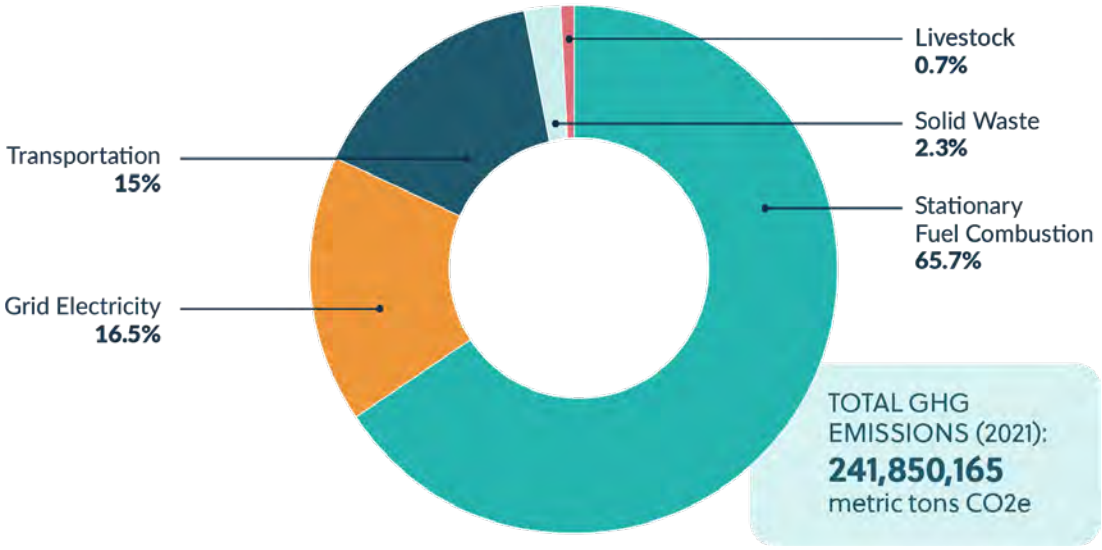


Table 2. Regional GHG Inventory Summary (2021)

Sector	GHG Emissions ($MTCO_2e$)
Stationary Fuel Combustion	158,843,173
Grid Electricity	39,923,624
Transportation	35,729,882
Waste	5,643,497
Agriculture (Livestock)	1,709,989
Subtotal (Emissions Sources)	241,850,165
Natural and Working Lands (Emissions Sinks)	(7,601,627)
Total (net)	**234,248,538**

Figure 6. Percentage of Regional Greenhouse Gas Emissions by Sector



A regional co-pollutant baseline inventory was also developed (Table 3). The co-pollutant inventory shows that air pollution in the region comes from a mix of everyday activities: how buildings use energy, how goods are produced, how people and freight move, how land is managed, and how waste is handled. Each sector contributes differently across pollutants, underscoring the need for a multi-sector approach to improving air quality.

Table 3. Baseline Regional Co-Pollutant Inventories

SHORT TONS EMITTED PER YEAR							
Sector	**VOC**	**CO**	**PM_{10}**	**NO_x**	**$PM_{2.5}$**	**SO_x**	**HAP**
Buildings and Energy	45,509	13,076	3,961	13,367	3,815	252	5,487*
Industry	52,689	2,8705	9,384	3,3623	6,038	9,6645	2,391
Transportation	27,751	463,721	58,241	77,484	10,629	1,216	7,785
AFOLU	296,192	152,197	34,591	10,452	20,123	1,257	30,584
Waste	3,880	26,056	3,886	949	3,496	482	531
Total	**432,448**	**700,231**	**159,727**	**136,127**	**50,879**	**13,002**	**47,368**

**Data Source: NEI, cross-referenced with county-level data published in TCEQ's CCAP for the State of Texas. TCEQ's inventory assigned emissions to Energy and Industry sectors differently, so HAP emissions from Buildings and Energy appear higher and Industry emissions appear lower in this plan compared to TCEQ's inventory. Base year for VOC, CO, PM_{10}, $PM_{2.5}$, NO_x, SO_x in 2022, while HAP base year is 2020.*

4.3 Trends and Key Insights

REGIONAL STATIONARY ENERGY EMISSIONS

The stationary energy sector covers emissions from fuel combustion in fixed facilities, including electricity generation, industrial processes, and residential and commercial energy use. Industrial fuel combustion represents 63.3% of total regional GHG emissions, with the majority originating in Harris, Brazoria, and Galveston counties, home to some of the nation's largest refining and petrochemical facilities. By comparison, commercial fuel combustion contributes 1.3% of total emissions and residential fuel combustion 1.0%, with emissions generally proportional to population.

Industry contributes heavily to PM and SO_x. Industrial sources also emit notable amounts of VOCs and HAPs, which can have localized air quality and health impacts, particularly for nearby communities. These emissions often reflect fuel combustion, material handling, and process-related activities. Buildings and energy use contribute meaningful levels of VOCs, NO_x, and PM, largely from fuel combustion for heating, power generation, and other energy needs. These emissions are closely tied to population centers and can directly affect neighborhood-scale air quality.

Table 4. Activity Data for Stationary Energy Use by Sector

Sector	Electricity (kWh)	Natural Gas (MMBTU)
Residential	32,956,741,852	44,641,911
Commercial	43,059,042,752	56,455,399
Industrial	31,684,869,068	723,665,940

GHG emissions from grid electricity are somewhat evenly distributed across the subsectors (commercial, residential, industrial). Commercial electricity represents the largest share at 6.6%, followed by residential (5.1%) and industrial (4.9%). Harris County represents the largest share of grid emissions due to its population size and dense commercial and industrial base, while Brazoria and Galveston counties also contribute significantly through their large industrial loads and growing residential demand. The highlighted patterns show the importance of both grid decarbonization and demand side strategies that can deliver emissions reductions across households, businesses, and industrial facilities.

Figure 7 illustrates the distribution of GHG emissions by industrial source category. Petrochemical manufacturing is the largest contributor, making up 34.6% of emissions from industrial stationary fuel combustion. This is followed by electric power generation, which accounts for 28.2%, and petroleum refineries, contributing 17.3%. Together, these three sectors make up nearly 80% of industrial stationary fuel combustion emissions.

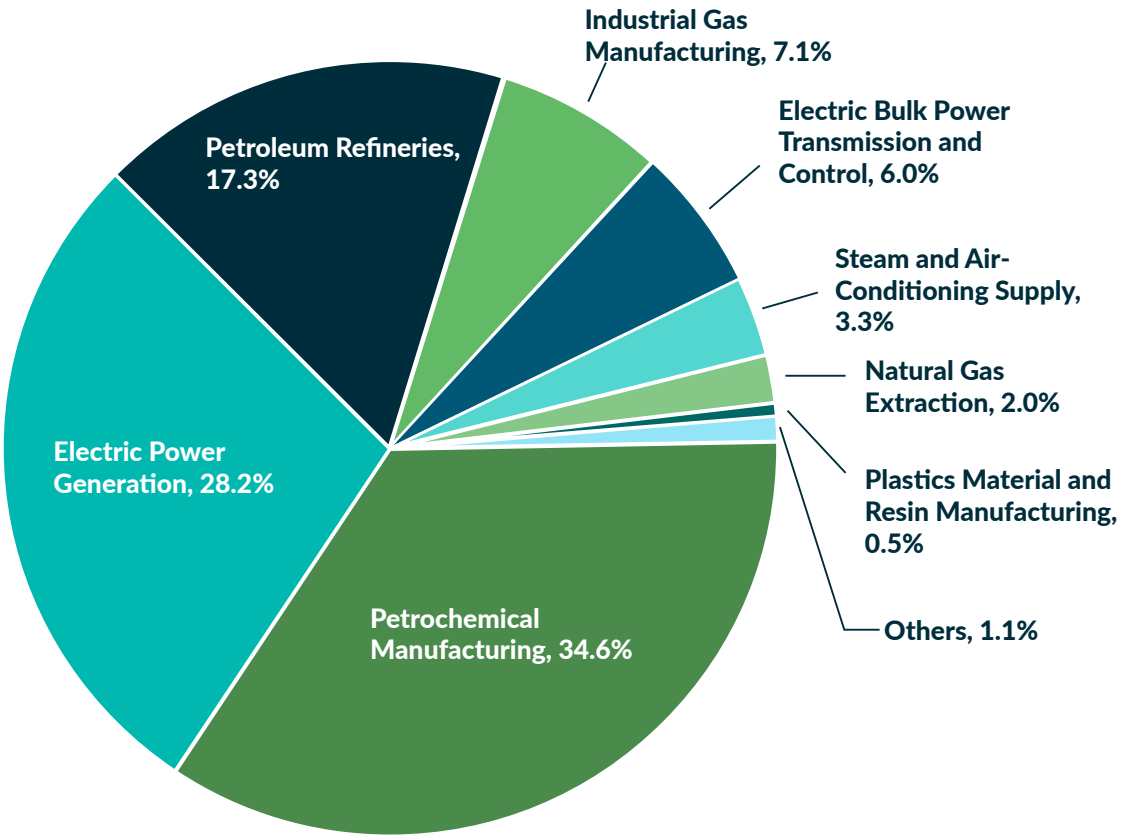


Figure 7. Breakdown of Point Sources of Stationary Emissions from Industry Fuel Combustion in the Region

REGIONAL TRANSPORTATION EMISSIONS

Transportation is the next largest source of emissions, shaped by a mix of passenger travel and freight activity. This sector accounts for 15% of total regional GHG emissions with the highest contributions from Harris, Montgomery, and Fort Bend counties. Most transportation-related emissions come from on-road vehicles (12.1% of total emissions), which drove more than 63 billion vehicle miles in 2021. There are over 27,000 miles of local and arterial roads and freeways in the region that support the movement of goods as first and last mile connectors for distribution and industrial sites, ports, airports, and rail yards.[9] Commuter travel is likely to dominate in Montgomery and Fort Bend due to rapid suburban growth. Heavy-duty freight movement is most concentrated in Harris County's extensive highway corridors and areas near ports in Freeport and Galveston.[10]

Table 5. Vehicle Miles Traveled (VMT) by Vehicle Type

Vehicle Type	VMT (million miles)	% of total VMT
Cars	53,136.14	80.9%
Heavy Duty Vehicles	6,017.21	9.2%
Light Duty Vehicles	3,251.17	5.0%
Motorcycles	389.23	0.6%
Buses	328.07	0.5%
Total	**63,121.81**	**100%**

Table 6. VMT by Various Fuel and Vehicle Types (Shown as Million Miles)

Fuel / Vehicle Type	Cars	Heavy Duty Vehicles	Light Duty Vehicles	Motor-cycles	Buses	Total
Gasoline	51,796.33	749.21	3,038.67	389.23	58.27	56,031.72
Diesel	964.39	5,233.13	197.79	-	242.82	6,638.14
CNG	-	34.23	-	-	24.33	58.57
Electric	302.48	0.63	4.12	-	2.64	309.86
E-85	72.94	-	10.58	-	-	83.52
Total	**53,136.14**	**6,017.21**	**3,251.17**	**389.23**	**328.07**	**63,121.81**

The transportation sector is the dominant source of CO and NO_x, producing the majority of total CO emissions and more than half of all NO_x emissions. Twenty-five percent of all ozone-forming NO_x pollution is associated with the on-road transportation sector.[11] Heavy duty trucks produce 54% of NO_x emissions from on-road transportation sources.[12] Transportation is also the largest contributor to PM_{10}. These pollutants play a central role in ozone and fine particulate formation, particularly in urban areas and along major roadways, where exposure levels are highest.

Although GHG emissions from railways and waterborne navigation account for just 0.7% and 0.1% of total emissions, respectively, they make up 6.1% of emissions from the transportation sector. Rail and waterborne navigation in the region support one of the most prolific freight gateways in the nation.

The Houston Ship Channel complex is the nation's largest port for waterborne tonnage and has more than 200 private and eight public terminals. In 2024, trade through Port Houston contributed $171.1 billion to the Texas economy.[13] Port Houston's Sustainability Action Plan established a goal of achieving a net-zero GHG emissions by 2050 through renewable electricity, infrastructure upgrades, smart lighting, vehicle and equipment electrification, and operational efficiencies.

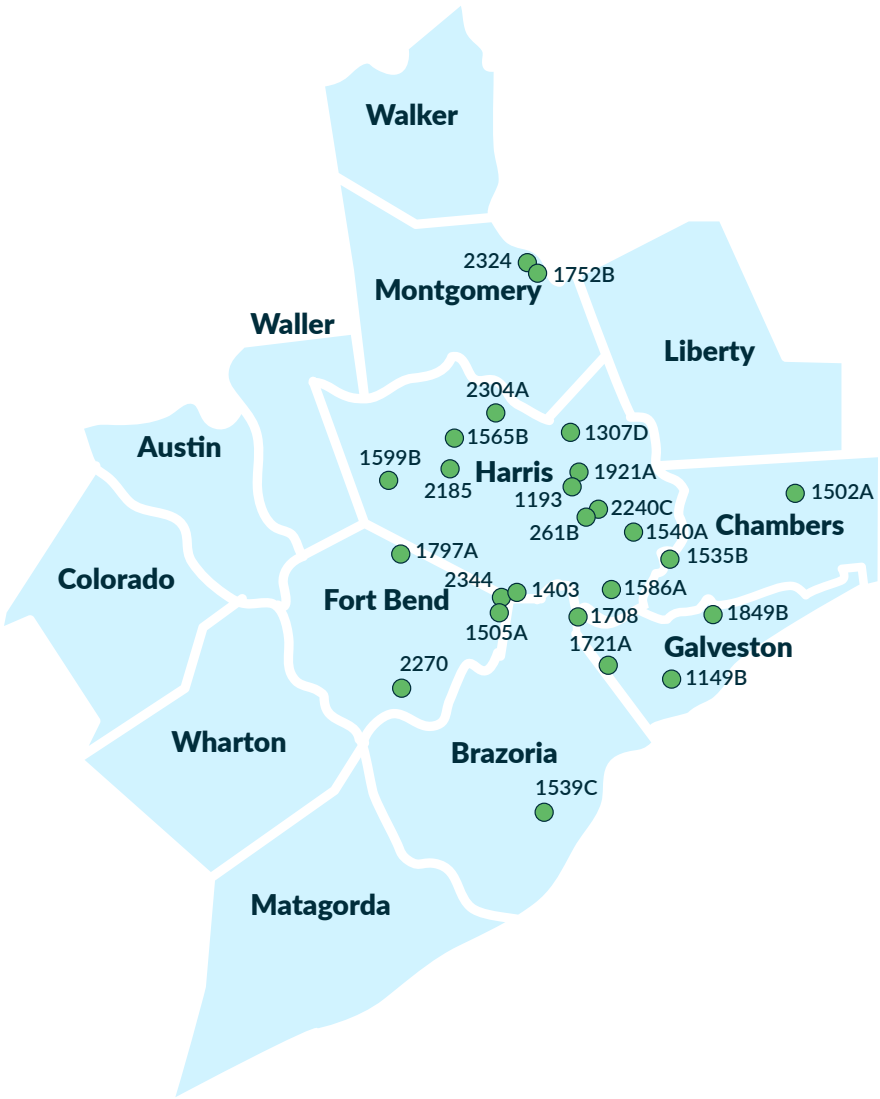
Railways are a key component of the region's manufacturing, shipping, and logistics supply chains, with approximately 2,200 trains operating within the Houston region per week.[14] Across the region, trains often block traffic for extended periods of time, increasing congestion and impacting emergency services.

WASTE

Waste GHG emissions are broken into solid waste disposal, biological treatment of waste, and its incineration and open burning. Waste accounts for 2.4% of total regional GHG emissions, though reporting gaps make this sector less uniformly represented across the 13 counties. Five counties (Austin, Colorado, Liberty, Matagorda, and Walker) did not have data available for this category, limiting a complete regional picture which could suggest that emissions from this sector may be underestimated. Among the counties with reported data, the highest GHG emissions come from Harris, Fort Bend, and Brazoria counties. This reflects their larger populations, landfill locations, and capacities, and industrial waste streams.

Waste-related activities make up a smaller share of total co-pollutant emissions overall but still contribute across all pollutant categories, including VOCs, PM, and HAPs. These emissions can be important at the local level, particularly near landfills or waste processing facilities.

Figure 8. Landfill Locations in the 13-County Region



Source: TCEQ AS-187/22, Municipal Solid Waste in Texas: A Year in Review, p. 56 (2022).

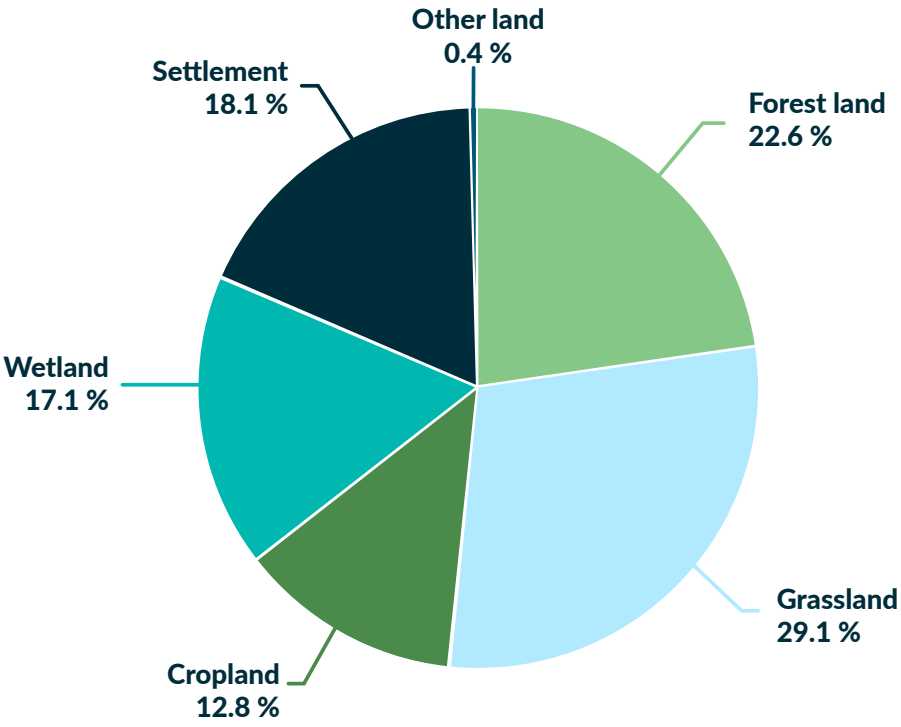
AGRICULTURE, FORESTRY, AND OTHER LAND USE (AFOLU)

AFOLU is both a source and sink of emissions. GHG emissions from livestock (1,709,989 $MTCO_2e$) represented less than 1% of regional GHG emissions, with the highest sources in Walker, Matagorda, and Wharton counties, where cattle ranching and other livestock operations are most prevalent in the region. AFOLU is also the largest source of VOCs, accounting for nearly 70% of emissions. The sector also contributes substantially to HAPs, PM, and CO. These emissions are often tied to equipment use, livestock operations, and land management practices, and while they may be more dispersed geographically, they can still influence regional ozone formation and fine particle levels.

Forests and trees play a critical role in regulating the planet's climate, capturing carbon and improving environmental quality by mitigating extreme heat, flooding, and poor air quality. The presence of urban trees and green spaces in neighborhoods can improve the overall quality of life by bolstering physical health and wellbeing.

Forests and trees remove a significant amount of CO_2 from the atmosphere through photosynthesis. Each year, trees are lost to forest disturbances (such as harvests, fires, and insects) or converted to settlements, grassland, and other non-forest lands. The net balance of emissions from forests and trees was an estimated -7,601,627 $MTCO_2e$ per year, or 3.1% of gross emissions in 2021 (carbon removals are represented by negative values). According to the LEARN tool, roughly 22% of the 13-county region's total land base is forest (Figure 9) in addition to an average of nearly 5.2% tree canopy on lands outside of forest.

Figure 9. Percentage of Land Cover Types in the 13-County Region



Our region has many different land cover types (individual county results and maps from LEARN are included in the Technical Appendices). The center of the region is highly developed with forest land more prevalent to the north, wetlands along the coast, cultivated crops to the southwest, and grasslands making up the remainder.

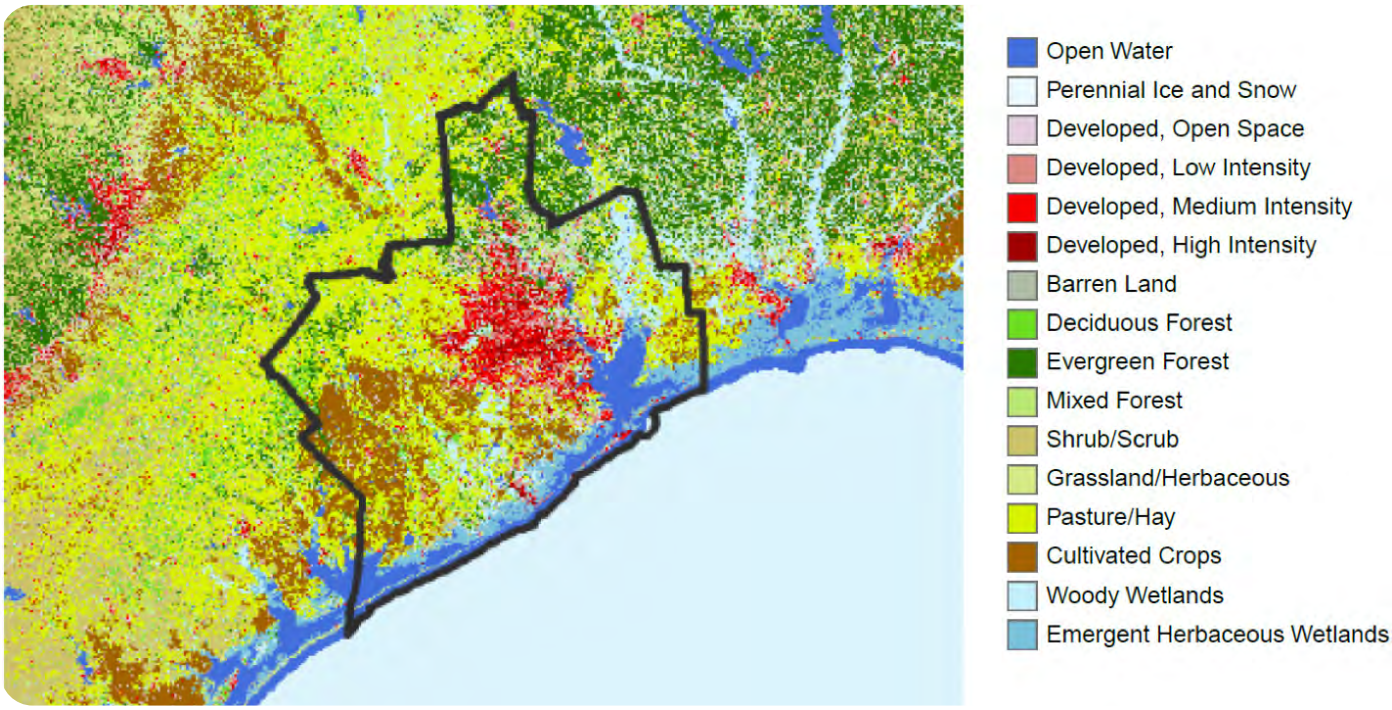


Figure 10. Map of Land Cover Types in the 13-County Region. Source: National Land Cover Database, 2019 via LEARN

Montgomery, Liberty, Walker, and Brazoria counties represent the largest net sinks. However, suburban development has been on the rise since 2019 when the National Land Cover Database used in the LEARN tool was last updated, which will likely result in additional tree losses in future inventory updates.

4.4 Business-As-Usual (BAU) GHG Emissions Projections

The region has been a hotspot for people moving in, with multiple counties in the region listed as the fastest growing by percentage according to the Census Bureau for 2023-2024.[15] Liberty County experienced a 5.4% growth in population, ranking 6th out of counties with populations of 20,000 or more in 2023 and 2024. Montgomery County was ranked 7th in percent growth and 9th in numeric growth with a 4.8% (or 34,268 persons) increase. Harris County topped the chart ranking 1st of counties by numeric growth with 105,852 additional people. With more people moving into the region, there will be greater demand for energy, food, housing, transportation, and goods, all of which require energy and result in emissions.

BAU GHG projections were developed in ClearPath 2.0 based on a 0.98% expected annual population growth for the 13-county region from 2021 to 2050. County-level population projections were obtained from the Texas Demographic Center's Projections of the Total Population of Texas and Counties in Texas, 2020-2060 and summed to estimate the regional population each year and calculate the annual population growth. The latest U.S. Census data was used to validate the reliability and accuracy of this data.

BAU GHG projection scenarios were delineated into three timeframes: near-term, medium-term, and long-term. The near-term (2025 to 2030) focuses on the immediate impacts of current policies, economic conditions, and social trends, providing stakeholders with actionable insights for short-range planning and response strategies. The medium-term (2030 to 2040) serves as a critical bridge, offering a deeper understanding of the maturation of short-term trends and the beginning effects of long-term strategies, thereby ensuring that mid-range infrastructure and policy developments are on track to meet longer-range goals. Lastly, the long-term (2040 to 2050) enables a forward-looking approach, assessing the sustained impacts of demographic shifts and policy implementations over several decades.

Table 7. BAU GHG Emission Projections by Sector

Sector	Base Year Emissions (MT CO_2e)	Near-Term BAU 2030 (MT CO_2e)	Medium-Term BAU 2040 (MT CO_2e)	Long-Term BAU 2050 (MT CO_2e)
Grid Electricity	39,923,624	38,162,233	35,810,084	33,028,390
Stationary Fuel	158,843,173	163,604,938	169,614,731	176,428,746
Transportation	35,729,882	38,967,656	42,914,707	47,266,079
Waste	5,643,497	6,159,967	6,789,578	7,483,683
AFOLU	(5,891,638)	(5,891,638)	(5,891,638)	(5,891,638)
Total	**234,248,538**	**241,003,157**	**249,237,461**	**258,315,260**

5.

EMISSION REDUCTION TARGETS

5. Emission Reduction Targets

Our region is taking bold steps to cut pollution and build a healthier, more sustainable future. The Clean Air Action Plan (CAAP) sets clear goals: reduce net GHG emissions 8% by 2030, 24% by 2040, and 40% by 2050 compared to 2021 levels. These milestones and key checkpoints provide a roadmap for steady progress over the coming decades.

The CAAP takes a flexible approach so it can work across the entire economy and meet communities where they are. The initial goals are intentionally modest, reflecting the voluntary nature of the plan and current realities, including available technology, local economic growth, and funding opportunities. Because participation is voluntary, progress relies on the shared commitment of local governments, businesses, and residents. Focusing on realistic short term goals helps build momentum, show what is possible, and support stronger action over time.

Communities are also at different stages of readiness to implement key strategies such as energy transition, transportation electrification, and building efficiency upgrades. Establishing foundational actions now will enable deeper reductions in later phases as technological and financial conditions evolve. This approach gives communities, businesses, and local leaders the tools needed to act in ways that make sense for them, while keeping the region on track toward shared goals.

This strategy is designed to meet communities where they are, while encouraging ambition. By combining realistic steps with long-term vision, the goals aim to be both practical and inspiring.

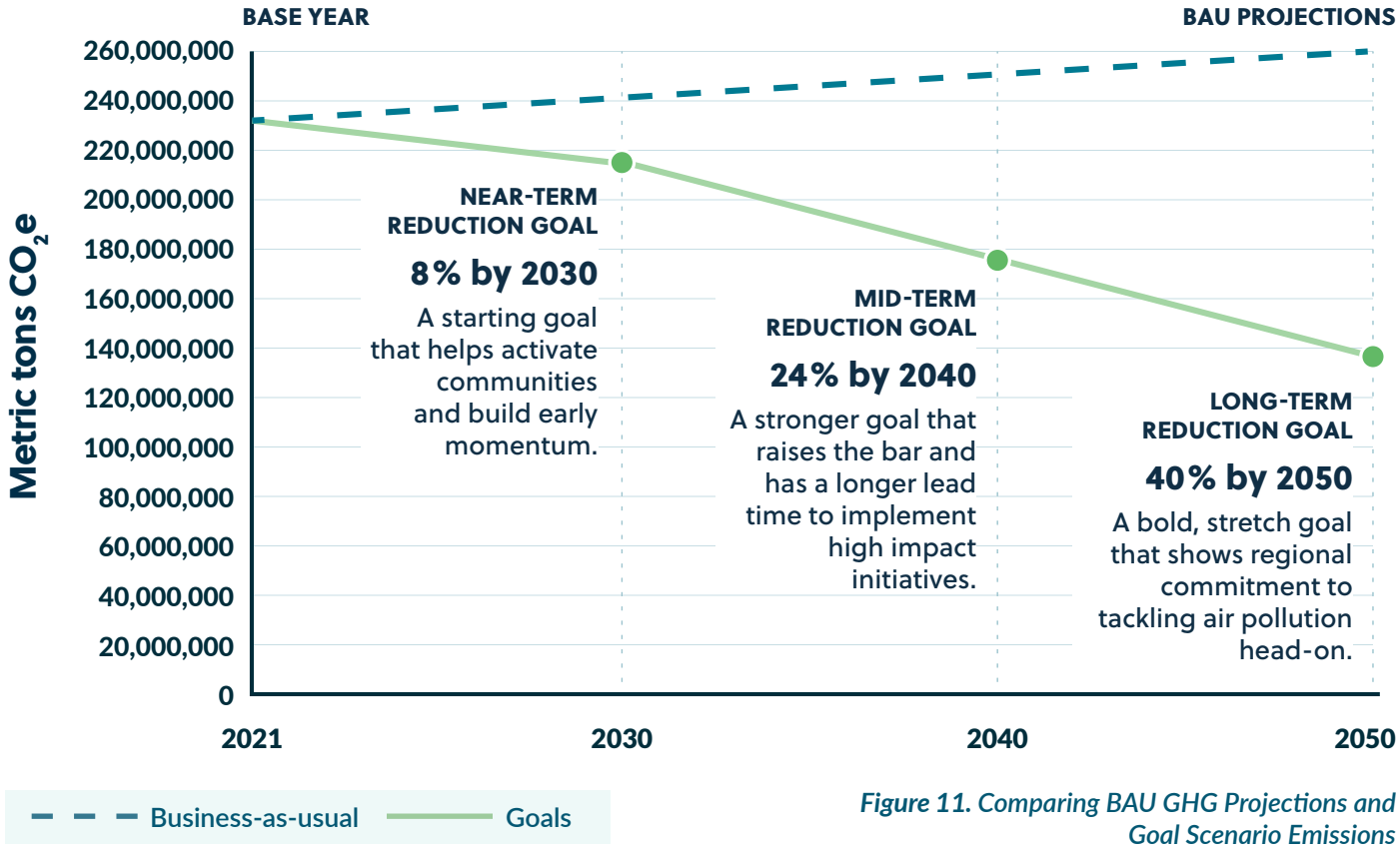


Figure 11. Comparing BAU GHG Projections and Goal Scenario Emissions

6. ENGAGEMENT EFFORTS

H-GAC took a multi-pronged, proactive approach to spreading the word about the Clean Air Action Plan (CAAP) and associated planning process. We aimed to meet participants where they were; not only in terms of awareness of emissions and pollution threats but also hosting meetings and sharing information where participants live, work, and play. Public meetings, social media, local journalism, online tools, and partnerships were important methods that led to successful engagement on this plan. Our approach is detailed below.

In our CAAP, we hope that community members, local officials, and other decision-makers and stakeholders see the results of their engagement with Clean Air, Healthy Communities.

Community Engagement Meetings

The bulk of our formal and structured engagement sessions were conducted through a public meeting format. H-GAC conducted eight meetings in total: six in-person, one hybrid (in-person and online), and one completely online meeting. With slight variations, the meetings were intentionally structured to provide background information (grant details, climate change basics, and GHG inventory results), offer best-practice emission reduction strategies, and solicit feedback on the strategies or any other relevant contributions. The six in-person meetings had tailored presentations to reflect local GHG inventory results for the host counties.

Our in-person and hybrid events were held in:

City	County	Date
→ Missouri City	Fort Bend	August 27, 2025
→ League City	Brazoria and Galveston	August 28, 2025
→ Baytown	Liberty and Chambers	September 2, 2025
→ Conroe	Walker and Montgomery	September 3, 2025
→ Hempstead	Colorado, Waller, and Austin	September 8, 2025
→ Wharton	Wharton and Matagorda	September 9, 2025
→ Houston	Full 13-county focus	September 16, 2025

Additional outreach events:

City	Event	Date
→ Rice University	3rd Annual Campus Sustainability Day	October 16, 2025
→ University of Houston	2025 Greater Houston Environmental Summit	October 17, 2025

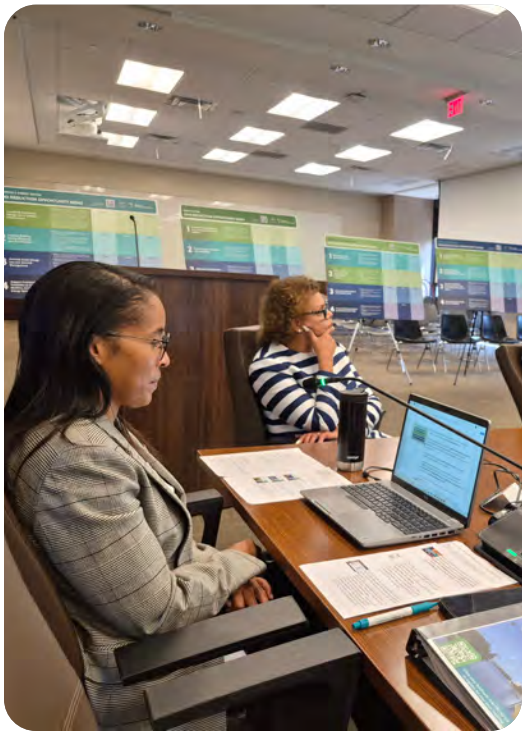
We sought locations that were familiar and accessible to local participants, including libraries, community buildings, and expo centers. Each in-person meeting had in-person Spanish interpretation services, and the hybrid meeting at the H-GAC office had in-person Vietnamese interpretation services. Additionally, the hybrid meeting and the completely online meeting had American Sign Language interpretation.

Over 230 comments (between sticky notes, comment cards, and verbal comments) were collected, analyzed, and considered from these meetings. They ranged from questions about the effectiveness of plastics recycling to questions about GHG inventory methodology. In addition to real-time feedback, we were excited to capture more formal feedback from all our meeting participants in the form of an online survey described below.

Webpage and Survey

H-GAC used an outreach platform, Engage from Granicus, to solicit feedback on draft strategies for inclusion in the CAAP. The digital survey pages were split by the five sectors covered by the CAAP: Buildings & Energy, Transportation, Industry, Waste, and Agriculture Forestry and Other Land Use (AFLOU).

Participants were able to select which pages they were most interested in completing. Each page collected between 15-25 responses from participants. The responses solicited feedback (Unsure/Undecided/Support) on proposed GHG reduction actions.



Buildings & Energy

The sector with the highest number of responses was Buildings & Energy with at least 263 responses for each proposed action. Taken together, the actions garnered 77% support. The most supported actions were:

- Offer rebates or incentive programs for certified energy-efficient appliances, lighting, HVAC, and insulation in homes and businesses. (87% support)
- Incentivize/support green roofs and/or permeable cool pavement applications to reduce heat islands and minimize flooding. (83% support)
- Streamline permitting processes for renewable energy projects and support behind-the-meter technologies that reduce power losses and enable distributed generation. (83% support)

The support for these actions resulted in their representation in the plan (see Measures 1, 2, and 3).

Transportation

Transportation had the 2nd highest number of responses with at least 202 responses to each question. Taken together, the measures garnered 71% support. The most supported measures were:

- Conduct assessments and update local building and zoning codes to support transit-oriented, walkable communities. (83% support)
- Invest in "complete streets" projects that support biking, walking, and micro-mobility options with a focus on safe, high-comfort, connected networks. (81% support)
- Convert all traffic lights and streetlights to LEDs to reduce municipal energy use and long-term operating costs and prioritize safety. (81% support)

The support for these actions resulted in their representation in the plan (see Measures 7 and 8).

Waste, Industry and Agriculture for Forestry and Other Land Use (AFLOU)

Waste, Industry, and AFLOU had similar numbers of respondents, with at least 141 responses for each measure. Between the three, the most supported measures were:

- Launch tree planting and green space initiatives in urban areas to raise awareness and improve local air quality. (91% support)
- Support local education and outreach campaigns to reduce food and yard waste at the source. (91% support)
- Promote consumer and business education on waste prevention, reuse, repair, and recycling best practices. (90% support)
- Identify and assess degraded or underutilized lands suitable for restoration projects. (90% support)
- Establish baseline material flows and waste profiles for key operations. Begin diverting waste from landfills through recycling or reuse. (87% support)
- Conduct comprehensive energy audits to identify opportunities for equipment upgrades and process optimization. (87% support)

The support for these actions resulted in their representation in the plan (see Measures 4, 5, 10, 11, and 14).

Additional Survey Feedback

To determine whether the respondents were aware of any action by their municipalities, the survey asked them to share if they were aware of work in the sector or knew of strategies or activities their local governments had planned for the near future. Additionally, respondents were asked to share additional thoughts. These responses are summarized by sector:

AFLOU

- 80% of respondents were not aware of any climate planning in this sector.
- 20% of respondents were aware of some sector initiatives by their municipalities including land restoration, tree planting, and urban forestry.
- The top themes identified from the free-form responses were 1) the need to protect trees/land from development or urban sprawl, 2) implement native landscaping to reduce flooding, and 3) opposition to excessive wetland loss.

HEAR FROM YOUR NEIGHBORS!

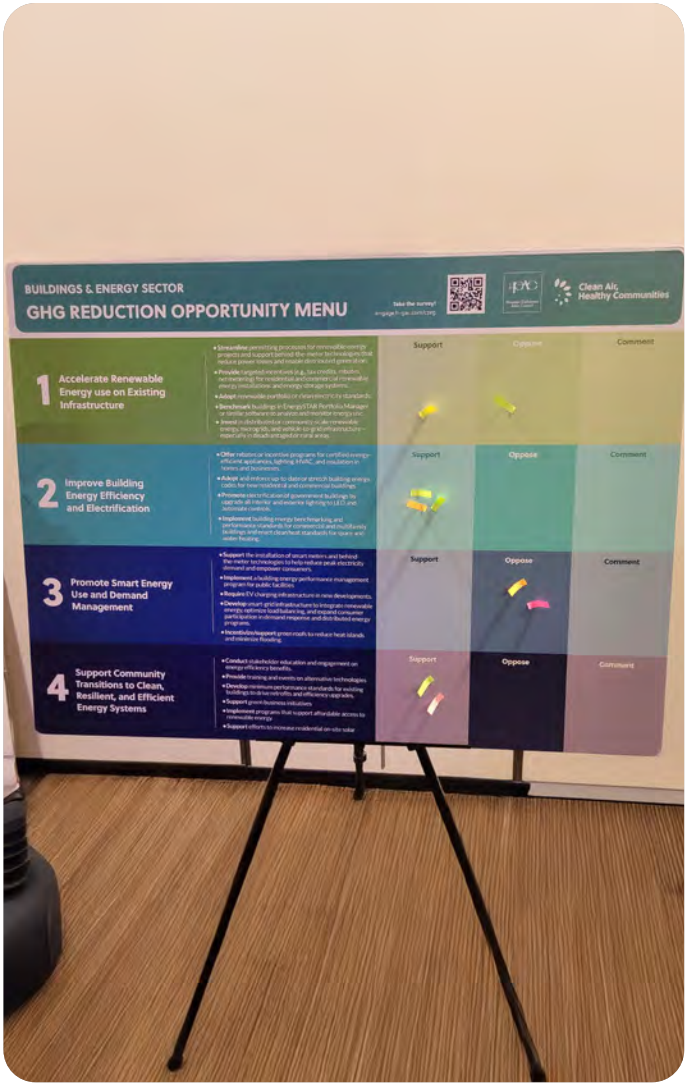
"Recently, we have lost many trees surrounding our neighborhood only to build another warehouse that may or may not be utilized for a few years. With many unused buildings nearby, there should be more efforts to preserve the natural land when there is unused developed land already"

"Have more neighborhood pocket parks designed to flood in torrential rain. demonstrate to community how much cooler it is with trees, shrubs, wildflowers, prairie grasses compared to mowed lawn and pavement. Native trees, shrubs, etc."

"Plant natives. Know the growth habit of what you plant and if it will fit there when fully grown. Don't let mowing crews mow over natural areas. And for God's sake, don't plant trees near and especially under powerline"

Buildings & Energy

- 89% of respondents were not aware of any climate planning in this sector.
- 11% of respondents were aware of some sector initiatives by their municipalities, including projects relating to LED lighting, energy efficiency and solar energy. Harris County respondents indicated they are aware of the county's Climate Justice Plan and Climate Plan for Internal Operations.
- The top themes identified from the free-form responses were 1) desire for tangible and visible improvements made to infrastructure, 2) grid reliability concerns, 3) equitable approaches to energy strategies, and 4) the need for public awareness and education.



HEAR FROM YOUR NEIGHBORS!

"Most of these efforts need to be relevant to residential/individuals as well as commercial. Too many residents and non-commercial entities are too far removed from these topics."

"Focus on green initiatives should be balanced with increased reliance on natural gas."

"Use sustainable energy and connect more communities with renewable connectivity."

"Solar and green roof energy should be supported and upfront costs to install should be given. Not just a rebate. Most people do not have the money for the upfront costs. Also people need to make aware that the cost of solar panels isn't just the panels, but that they need to have a battery installed to operate when power is out"

"Education to building management about AC use (people usually think large buildings are kept too cold for comfort)"

"Encourage stronger public-private partnerships to expand clean energy access and improve air quality monitoring in underserved communities"

Industry

- 85% of respondents were not aware of any climate planning in this sector.
- 15% of respondents were aware of some sector initiatives, naming Port Houston Sustainability Plans and Waste Management trucks using fuels other than diesel.
- The top themes identified from the free-form responses were 1) skepticism and lack of understanding on carbon capture technology, 2) support for recycling and closed loop systems, energy efficiency, and energy capture, 3) interest in nuclear, and other emerging energy sources, and 4) desire for clear and trustworthy public facing documentation of efforts.

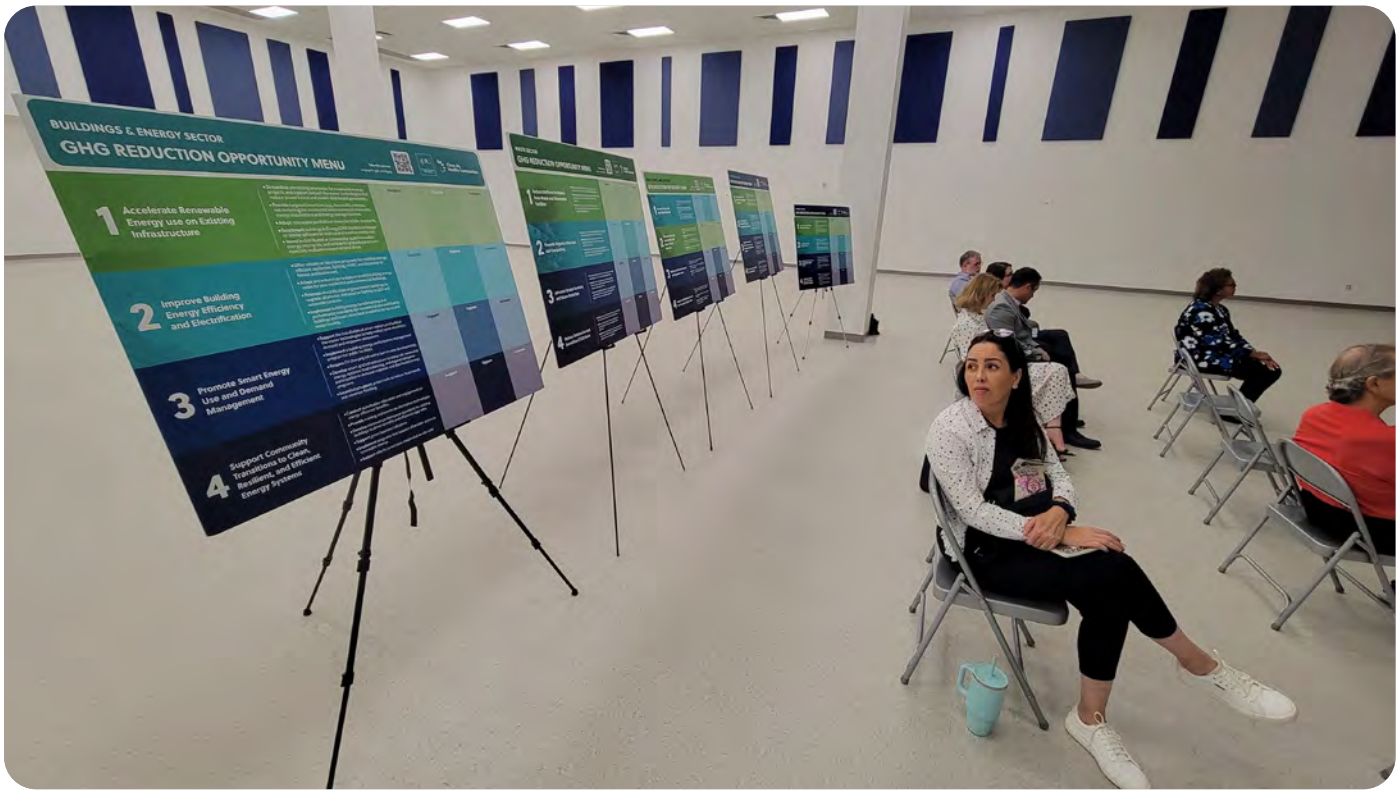
HEAR FROM YOUR NEIGHBORS!

"Minimizing waste, reducing emissions, recycling and energy recapture, all the things!"

"The focus should be on wise use of natural resources not just a switch to some alternative that causes different challenges."

"Pilot programs for reducing raw material input and closed loop and Zero-waste-to-landfill operations might be better initially."

"There is a balance between efficient operations and emission controls and finding that balance is the critical part of the equation for each manufacturer."



Transportation

- 80% of respondents were not aware of any climate planning in this sector.
- 20% of respondents were aware of some sector initiatives by their municipalities, including LED traffic light conversion, public transit and fleet electrification, and other planning efforts like livable cities, roadway changes, and municipal policies.
- The top themes identified from the free-form responses were 1) desire for expansion of public transit and increased reliability, 2) concerns about urban sprawl and highway expansion, 3) interest in complete street projects and walkability improvements, 4) lack public charging for EVs and cost concerns about EVs, and 5) traffic engineering initiatives to reduce idling.

HEAR FROM YOUR NEIGHBORS!

"I think one of the largest barriers to greater EV adoption is the lack of public charging locations - increasing those will have a great impact of EV adoption."

"Too many cars idling at traffic lights due to poor timing of lights. Use AI to optimize traffic light timing. Eliminate unnecessary lights where traffic patterns have changed"

"Additionally, complete streets with sidewalks and bike lanes would be fabulous (especially bike lanes that are protected from cars in busier areas). It's insane to be walking down a sidewalk and have it just end in the middle of a field."

"No more freeway expansions and road expansions. More public transportation"

"Not in favor of any policy restricting vehicle choice or mode of transportation by the public. Nor any policy reducing or restricting traditional individual transportation over public transportation."

Waste

- 91% of respondents were not aware of any climate planning in this sector.
- 9% of respondents were aware of some sector initiatives by their municipalities, including curbside recycling and food and waste diversion.
- The top themes identified from the free-form responses were 1) interest in methane capture and recovery, 2) composting and food waste diversion, 3) reuse and circular economy, and 4) need for education and clarity of recycling criteria.

HEAR FROM YOUR NEIGHBORS!

"Educate people about what can and cannot be recycled and NOT to put recycling in plastic bags"

"West U had a successful food waste dropoff pilot"

"Methane capture and reuse at landfills should be standard. That's free energy!"

"Education is great, permitting modification good, mandates bad."

Partner Outreach Inputs

While we did host one meeting in Harris County, in large part, H-GAC deferred to the feedback and results shared by our partner, the Harris County Office of Sustainability, whose recent Climate Justice Plan was released in 2025. Throughout 2024, Harris County held five in-person meetings across Harris County, mobilizing hundreds of participants and gathering valuable insight into Harris County residents' priorities for climate action.

To avoid planning fatigue, or duplicative results, H-GAC prioritized the siting of our public meetings in counties which had not yet engaged in climate planning.

Direct Outreach

Several emails were sent by H-GAC to our several thousand members guiding them to our webpage and survey. Before public meetings in specific counties, county email lists were contacted with meeting specifics and a call to action to take the survey. To ensure that decision makers were aware of our process and their ability to participate, a targeted email was sent to all county commissioners, judges, and city managers.

Simple, engaging social media ads directed online viewers to take our survey or attend a meeting in their area. With over 2.8 million total impressions over all platforms, the digital media campaign resulted in over 21,000 clicks to our program page. Six sub-campaigns

targeted counties which had a public meeting scheduled within two weeks to drive attendance at our in-person events. Three additional sub-campaigns targeted the entire region to drive attendance to the hybrid or virtual event. To ensure that meetings and survey feedback included perspectives from our region's most vulnerable and most impacted communities, low income and disadvantaged zip codes were targeted.

At our request, several local environmental groups created or shared social posts, which boosted the program's reach to their audiences, participation, and ultimately survey responses. These environmental groups include: the Buffalo Bayou Partnership, Keep Houston Beautiful, Greens Bayou Coalition, Citizens' Environmental Coalition, Houston Audubon Society, etc. We are very grateful to those who shared posts driving more people to our webpage, meetings, and survey!

During the final month of the survey, staff made several phone calls and wrote emails to over 600 organizations involved with or interested in regional climate planning. They included county Texas A&M AgriLife Extension Service offices, chambers of commerce, restaurant associations, local colleges and universities, school districts, professional unions, and environmental organizations and nonprofit organizations. As a result, a number of organizations took action to amplify our efforts. Some shared information in newsletters, group chats, email lists, posted flyers in offices, etc.

Clean Air Regional Engagement

As the CAAP team began reviewing feedback from our engagement, we began recruiting members for our Clean Air Regional Engagement working group. The team reviewed brief applications from environmental or planning professionals within the region, ultimately selecting five individuals. These individuals work in a variety of roles, from non-profit to academia and local government. We provided our CCAP draft to the members and requested detailed feedback. By identifying and activating a group of motivated, knowledgeable reviewers, we were able to gather feedback on readability, technical assumptions, engagement, etc. ahead of submitting the deliverable to EPA. Going forward, these individuals will be important in disseminating our final plan, identifying implementors, and carrying this work forward to future stages.

7.

CLEAN AIR STRATEGIES & MEASURES

7. Opportunity Menus

Measures are grouped by sector and include different tiers of potential actions that can be selected from a suite of Opportunity Menus. Measures were chosen based on a review of best practices, feedback from community and stakeholder surveys and workshops, compatibility with existing sustainability plans in the region, and sector-based contribution levels to the baseline emissions inventory.

Table 8. Summary of Cumulative GHG Emissions Reductions (2022-2050) and Percent of Community Survey Responses in Favor of Measure.

Measure by Sector		Cumulative Emissions Reductions 2022-2050 (MT CO_2e)	Percentage of Community Survey In Support of Measure
BUILDINGS & ENERGY OPPORTUNITY MENU			
Measure 1	Accelerate Clean and Renewable Energy Use in Buildings	43,631,569	78%
Measure 2	Improve Building Energy Efficiency and Electrification	78,145,330	80%
Measure 3	Promote Smart Energy Use and Grid-Responsive Management	3,501,750	73%
INDUSTRY OPPORTUNITY MENU			
Measure 4	Enhance Industrial Energy Efficiency and Clean Energy Adoption	220,801,880	76%
Measure 5	Reduce Process Emissions and Advance Carbon Capture	890,129,120	74%
Measure 6	Advance Circular Economy and Waste Reduction in Industrial Processes	310,747,840	83%
TRANSPORTATION OPPORTUNITY MENU			
Measure 7	Accelerate Clean and Electric Transportation Systems	95,683,880	68%
Measure 8	Reduce Vehicle Miles Traveled through Sustainable and Equitable Mobility Options	61,202,420	74%
Measure 9	Modernize Freight, Port, and Industrial Transportation Operations	25,657,970	74%
AGRICULTURE AND LAND USE OPPORTUNITY MENU			
Measure 10	Promote Sustainable Agricultural and Land Management Practices	NE	80%
Measure 11	Enhance Urban and Community Nature-Based Climate Solutions	4,227,820	88%
Measure 12	Protect and Enhance Coastal, Forest, and Other Carbon Sinks	81,620	87%
WASTE AND MATERIALS MANAGEMENT OPPORTUNITY MENU			
Measure 13	Reduce Methane Emissions from Waste and Wastewater Systems	53,890	85%
Measure 14	Promote Waste Reduction, Organics Diversion, Composting, and Construction Waste Reduction	46,168,890	85%

7.1 Implementation Scenarios

The implementation scenarios represent the maximum achievable emissions reductions that could occur if the actions in each measure are fully implemented. GHG emission reductions were modeled in ClearPath 2.0. using IPCC Mitigation Options. More detail on quantification methods and assumptions for each measure is included in the Appendix.

Based on current modeling results, 89% of the goal established for 2050 emissions reductions can be achieved, leaving an 11% gap that could be filled as better data, improved technology, and more tools become available to model additional impacts. In these scenarios, the Buildings and Energy sector includes emissions from grid-supplied energy and stationary fuel combustion (commercial and residential). Industry emissions include Industrial Processes and Stationary Fuel Combustion.

Table 9. Summary of Modeled GHG Emissions per Year by Opportunity Menu

Opportunity Menu	Base Year Emissions (MT CO_2e)	2030 Implementation Scenario (MT CO_2e)	2050 Implementation Scenario (MT CO_2e)
Buildings and Energy	33,876,362	31,629,619	25,948,518
Industry	164,890,435	140,095,507	109,490,377
Transportation	35,729,882	32,143,647	18,675,110
Agriculture & Land Use	(5,891,638)	(6,062,439)	6,066,192)
Waste & Materials Management	5,643,498	5,367,730	3,893,810
Total	**234,248,539**	**203,174,064**	**151,941,623**
Change from Base Year		**-13%**	**-35%**

The graph illustrates GHG emissions reductions within each Sector-based Opportunity Menu. The Pathway gap (light grey) represents the additional emissions reduction needed to achieve the goal of 40% reduction from 2021 levels by 2050.

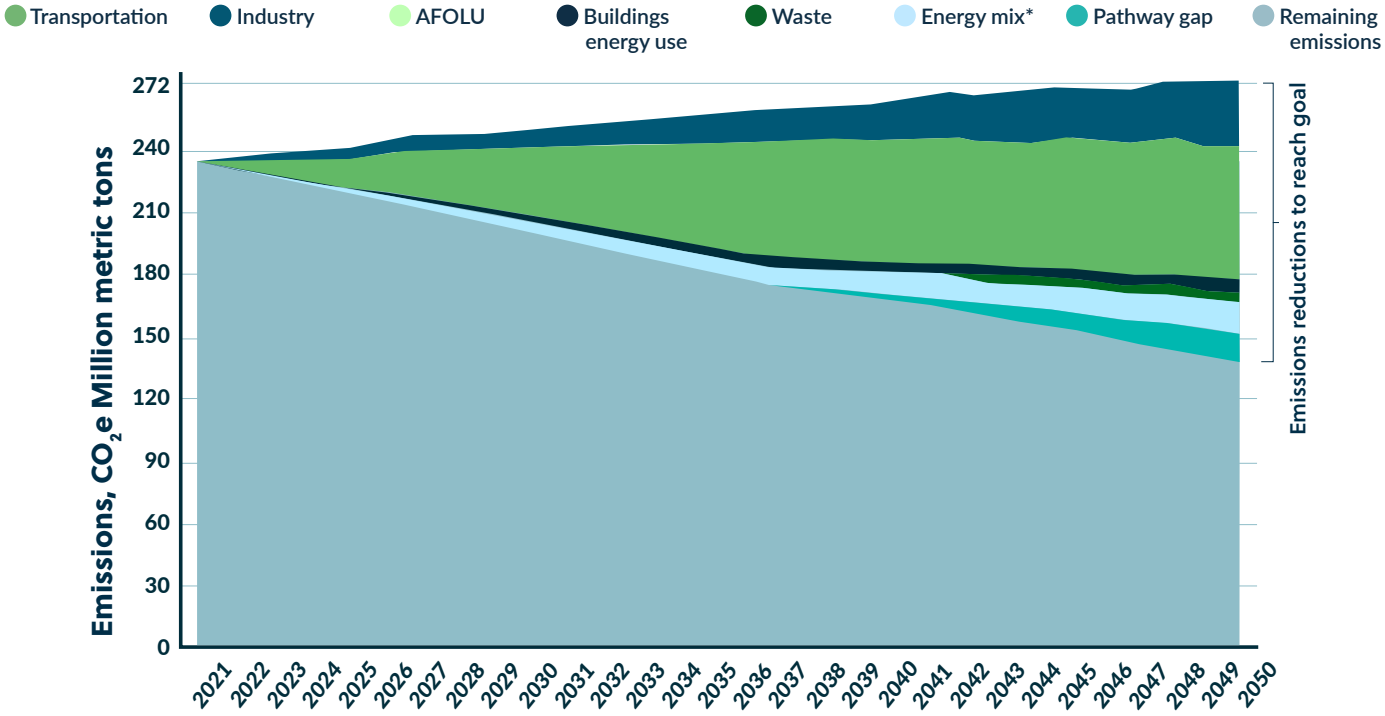


Figure 12. *Emission Reduction Potential of Selected Measures Modeled through 2050 in Relation to BAU.*

With a clear picture of baseline co-pollutant emissions, it is possible to assess how the energy and transportation measures identified in this plan could deliver co-benefits for air quality. The table below estimates the 2030 and 2050 changes in co-pollutant emissions that are achievable through implementation of Measures 1-4 and 7 using the EPA's Avoided Emissions and Generation Tool (AVERT). AVERT is designed to analyze emission impacts of energy policies and programs such as energy efficiency, renewable energy, electric vehicles, and energy storage.

Table 10. Estimated Air Pollutant Emissions Reductions from Selected Measures

CAP	Estimated emissions reduced in 2030 (tons)	Estimated emissions reduced in 2050 (tons)
VOC	1,339.76	5,771.25
CO	NE	NE
PM_{10}	NE	NE
NO_x	8,798.38	39,299.41
$PM_{2.5}$	851.07	3,814.52
SO_x	7,936.20	35,737.87
Total CAP	**18,925.40**	**84,623.03**

7.2 Introduction to Opportunity Menus

To support communities at different stages of climate action readiness, we developed 5 "Opportunity Menus" to guide implementation in each sector of the Clean Air Action Plan:

1. Buildings & Energy Opportunity Menu

2. Industry Opportunity Menu

3. Transportation Opportunity Menu

4. Agriculture and Land Use Opportunity Menu

5. Waste and Materials Management Opportunity Menu

Each menu outlines **foundational (F)**, **moderate (M)**, and **high-impact (HI)** actions for each measure. The Opportunity Menus are designed to be flexible, recognising that communities across the region have different resources, staffing, and readiness to take action. This approach allows each community to start where it makes sense for them today, while providing clear options to build toward more ambitious actions over time.

- **Foundational (F)** actions focus on building the enabling conditions for future progress, such as establishing policies, improving data and planning tools, and increasing awareness or staff capacity.
- **Moderate (M)** actions advance implementation through programs and investments that achieve measurable emission reductions or resilience benefits.
- **High-impact (HI)** actions represent transformative efforts, such as large-scale infrastructure investments, aggressive policy shifts, or cross-sector collaborations, that significantly accelerate progress toward long-term goals.

Opportunity Menu Actions are further categorized by type of opportunity (F, M, or HI), relative costs (shown as Low (<$), Medium ($$), or High ($$$), and proposed timeline to implement (shown as Short-term (by 2030), Medium-term (2030-2040), or Long-term (by 2050).

The following information is provided at the measure-level: a short qualitative description, quantified GHG emission reductions, implementation authority, metrics for tracking progress, intersection with other funding availability, key co-benefits, and a description of the quantification methods and assumptions. The anticipated community impacts and qualitative benefits associated with each measure are listed as broad categories of benefits, such as improved air quality, economic growth, health and well-being, cost-savings, workforce development, and improved reliability.

7.3 Buildings & Energy Opportunity Menu

Measure 1 *Accelerate Clean and Renewable Energy Use in Buildings*

ANNUAL GHG EMISSIONS REDUCED IN **2030**
1,037,079 $MTCO_2e$

ANNUAL GHG EMISSIONS REDUCED IN **2050**
2,530,000 $MTCO_2e$

DESCRIPTION

Expand the use of renewable energy and clean power systems across existing and new building infrastructure.

OPPORTUNITY MENU

1. Streamline permitting for renewable projects (F)(<$)(by 2030).
2. Support behind-the-meter and community-scale generation (F)(<$)(by 2030).
3. Provide targeted incentives (rebates, net metering, tax credits) for renewable and storage installations (M)($$$)(2030-2040).
4. Adopt clean electricity standards. (HI)($$)(by 2030).
5. Invest in distributed and community-scale renewables, microgrids, and vehicle-to-grid infrastructure in disadvantaged or rural areas (HI)($$$)(2030-2040).

AUTHORITY TO IMPLEMENT

City/County, State, Facility owners

METRICS FOR TRACKING PROGRESS

1. Number of municipalities that have adopted Solar APP+
2. kWh renewable energy permitted per year
3. kWh renewable and storage installed from incentives
4. Number of entities disclosing clean electricity standards adopted
5. Number of related projects developed in vulnerable or rural areas

KEY CO-BENEFITS

Improved air quality, economic growth, health and well-being, cost-savings, workforce development, and improved reliability

INTERSECTION WITH OTHER FUNDING AVAILABILITY

- SolarAPP+
- Texas Property Assessed Clean Energy (TX-PACE)
- Federal Solar Investment Tax Credit (ITC)
- Solar and Wind Energy Business Franchise Tax Exemption
- Property Tax Exemption for Renewable Energy Systems
- Building Technologies Office Technical Assistance for Building Performance Standards (BPS)
- State of Texas Renewable Energy Credit (REC) Trading Program

Measure 2 *Improve Building Energy Efficiency and Electrification*

ANNUAL GHG EMISSIONS REDUCED IN **2030**
1,429,910 $MTCO_2e$

ANNUAL GHG EMISSIONS REDUCED IN **2050**
5,785,930 $MTCO_2e$

DESCRIPTION

Upgrade building systems and appliances to improve energy performance and transition away from fossil fuels.

OPPORTUNITY MENU

1. Benchmark buildings in ENERGY STAR Portfolio Manager (F)(<$)(by 2030).
2. Offer rebates for certified energy-efficient appliances, lighting, HVAC, insulation, and weatherization (M)($$$) (by 2030).
3. Adopt and enforce up-to-date or stretch energy codes (M)($$)(2030-2040).
4. Upgrade public facilities to LEDs and smart controls (M)($$) (by 2030).
5. Implement building performance standards and clean heat standards for space and water heating (HI)($$$) (2030-2040).

AUTHORITY TO IMPLEMENT

City/County, State, Facility Owners and Operators, TIRZ/Management Districts

METRICS FOR TRACKING PROGRESS

1. Number of entities disclosing use of ENERGY STAR Portfolio Manager or similar software
2. Estimated energy savings from rebate programs implemented
3. Number of municipalities that have updated energy codes
4. Percent of public facilities converted to LED and smart controls
5. Number of entities disclosing adoption of building performance standards

KEY CO-BENEFITS

Improved air quality, economic growth, health and well-being, cost-savings, workforce development, and improved reliability

INTERSECTION WITH OTHER FUNDING AVAILABILITY

- Better Buildings Challenge
- HOMES and HEAR programs
- Building Technologies Office Technical Assistance for BPS
- LoanSTAR Revolving Loan Program

Measure 3 *Promote Smart Energy Use and Grid-Responsive Management*

ANNUAL GHG EMISSIONS REDUCED IN **2030**	ANNUAL GHG EMISSIONS REDUCED IN **2050**
116,810 $MTCO_2e$	**0 $MTCO_2e$**

DESCRIPTION

Encourage energy-saving behaviors and technologies that optimize grid interaction and reduce peak demand.

OPPORTUNITY MENU

1. Support installation of smart meters and behind-the-meter demand response technologies (F)(<$)(by 2030).
2. Implement performance management programs for public facilities and expand consumer participation in demand programs (F)(<$)(by 2030).
3. Develop smart-grid infrastructure to integrate renewables, optimize load balancing, and expand distributed energy participation (HI) ($$$)(by 2040).
4. Incentivize green roofs and cool pavements to reduce heat islands (HI) ($$)(by 2040).

AUTHORITY TO IMPLEMENT

City/County, Utilities, Business Sector, TIRZ/Management Districts

METRICS FOR TRACKING PROGRESS

1. Electric savings and demand reduction achieved for Utility Demand Side Management Programs
2. Electric savings and demand reduction achieved for Utility Demand Side Management Programs
3. Number of grid modernization projects completed or underway
4. Number of building permits incorporating green roof/cool pavement features

KEY CO-BENEFITS

Improved air quality, economic growth, health and well-being, cost-savings, workforce development, and improved reliability

INTERSECTION WITH OTHER FUNDING AVAILABILITY

- Utility Incentives (such as CenterPoint's Demand Side Management)
- Public Private Partnerships
- PACE for green roofs
- DOT Competitive Grants Dashboard

7.4 Industry Opportunity Menu

Measure 4 *Enhance Industrial Energy Efficiency and Clean Energy Adoption*

ANNUAL GHG EMISSIONS REDUCED IN **2030**
-6,811,370 $MTCO_2e$

ANNUAL GHG EMISSIONS REDUCED IN **2050**
-7,602,720 $MTCO_2e$

DESCRIPTION

Increase efficiency in industrial operations and shift energy use toward low- and zero-carbon sources.

OPPORTUNITY MENU

1. Conduct industrial energy audits and retrofit facilities with efficient motors, drives, HVAC systems, and lighting (F)(<$)(by 2030).
2. Install on-site renewable systems and implement waste heat recovery technologies (M)($$$)(by 2030).
3. Electrify major processes and adopt advanced manufacturing technologies that reduce energy intensity and emissions (HI)($$)(by 2030).

AUTHORITY TO IMPLEMENT

Business Sector

METRICS FOR TRACKING PROGRESS

1. Number of facilities disclosing completion of energy audits
2. Number of facilities disclosing installation of renewable energy systems or waste heat recovery technologies
3. Number of facilities disclosing investment in advanced manufacturing technologies promoting energy efficiency

KEY CO-BENEFITS

Improved air quality, economic growth, health and well-being, cost-savings, workforce development, and improved reliability

INTERSECTION WITH OTHER FUNDING AVAILABILITY

- Industrial Training and Assessment Centers (ITAC)
- Texas Industrial Energy Efficiency Network (TIEEN)
- Onsite Energy Technical Assistance Partnerships (OETAP)
- Better Plants

Measure 5 *Reduce Process Emissions and Advance Carbon Capture*

ANNUAL GHG EMISSIONS REDUCED IN **2030**
18,416,460 $MTCO_2e$

ANNUAL GHG EMISSIONS REDUCED IN **2050**
59,341,940 $MTCO_2e$

DESCRIPTION

Deploy cleaner production technologies and carbon capture solutions to lower industrial emissions.

OPPORTUNITY MENU

1. Identify process-related GHG emissions and adopt leak detection and repair best practices (F)(<$)(by 2030).
2. Deploy process modifications and chemical alternatives to reduce or eliminate high-GWP gases (M)($$)(by 2040).
3. Invest in carbon capture, utilization, and storage (CCUS) for large industrial point sources (HI)($$$)(by 2040).

AUTHORITY TO IMPLEMENT

Business Sector

METRICS FOR TRACKING PROGRESS

1. Number of industrial facilities disclosing implementation of leak detection and repair best practices
2. Number of facilities disclosing the deployment of process modifications and chemical alternatives
3. Number of permits issued for large industrial point source capture

KEY CO-BENEFITS

Improved air quality, economic growth, health and well-being, cost-savings, workforce development, and improved reliability

INTERSECTION WITH OTHER FUNDING AVAILABILITY

- Texas Industrial Energy Efficiency Program (TIEEP)
- NTIG
- Better Plants

Measure 6 *Advance Circular Economy and Waste Reduction in Industrial Processes*

ANNUAL GHG EMISSIONS REDUCED IN **2030**	ANNUAL GHG EMISSIONS REDUCED IN **2050**
11,952,710 $MTCO_2e$	**108,280 $MTCO_2e$**

DESCRIPTION

Promote material reuse, recycling, and design innovation to minimize waste resource intensity.

OPPORTUNITY MENU

1. Establish baseline material flows and begin diverting waste from landfills through recycling or reuse (F)($$)(by 2040).
2. Redesign production to minimize raw material input and increase use of recycled or bio-based feedstocks (M)($$) (by 2040).
3. Implement closed-loop manufacturing and zero-waste-to-landfill policies across all operational sites (HI)($$$)(by 2040).

AUTHORITY TO IMPLEMENT

Business Sector

METRICS FOR TRACKING PROGRESS

1. Tons of municipal and publicly disclosed industrial waste diverted from landfill annually
2. Number of industrial facilities disclosing implementation of production redesign to increase recycled or bio-based material use
3. Tons of waste diverted from landfills

KEY CO-BENEFITS

Improved air quality, health and well-being, cost-savings, and improved reliability

INTERSECTION WITH OTHER FUNDING AVAILABILITY

- Better Plants

7.5 Transportation Opportunity Menu

Measure 7 *Accelerate Clean and Electric Transportation Systems*

ANNUAL GHG EMISSIONS REDUCED IN **2030**	ANNUAL GHG EMISSIONS REDUCED IN **2050**
1,563,410 $MTCO_2e$	**7,661,560 $MTCO_2e$**

DESCRIPTION

Expand EV adoption and supporting infrastructure across passenger and fleet sectors.

OPPORTUNITY MENU

1. Launch EV incentive programs and public awareness campaigns (F)($$$)(by 2030).
2. Expand public charging infrastructure, prioritizing underserved areas and major corridors (M)($$$)(by 2040).
3. Electrification of municipal, transit, and fleet vehicles, including freight and drayage vehicles (HI)($$$)(by 2040).

AUTHORITY TO IMPLEMENT

City/County, METRO, Business Sector, Nonprofit Community & Faith Based Organizations

METRICS FOR TRACKING PROGRESS

1. Number of EVs registered
2. Number of EV charging stations (total and in priority areas)
3. Percent of fleet vehicles electrified

KEY CO-BENEFITS

Improved air quality, economic growth, health and well-being, cost-savings, and improved reliability

INTERSECTION WITH OTHER FUNDING AVAILABILITY

- Light Duty Motor Vehicle Purchase or Lease Incentive Program (LDPLIP)
- Alternative Fueling Facilities Program (AFFP)
- Texas Clean School Bus Program (TCSB)
- Texas Emissions Reduction Plan (TERP) Rebates and Grants
- Governmental Alternative Fuel Fleet Grant Program (GAFF)
- Texas Clean Fleet Program
- Electric Vehicle (EV) and Fuel Cell Electric Vehicle (FCEV) Tax Credit

Measure 8 *Reduce Vehicle Miles Traveled through Sustainable and Accessible Mobility Options*

ANNUAL GHG EMISSIONS REDUCED IN **2030**	ANNUAL GHG EMISSIONS REDUCED IN **2050**
3,014,270 $MTCO_2e$	11,728,840 $MTCO_2e$

DESCRIPTION

Support transit, active transportation, and land use strategies that reduce car dependence.

OPPORTUNITY MENU

1. Pilot flexible work and commuter benefit programs for local governments and employers (F)(<$)(by 2030).
2. Develop alternative workplace and telework policies for city and county staff (M)(<$)(by 2030).
3. Implement pedestrian and multimodal infrastructure and other innovative mobility options, leveraging prioritization plans such as Complete Streets and Vision Zero programs (HI)($$$)(by 2040).

AUTHORITY TO IMPLEMENT

City/County, METRO, TIRZ/Management Districts, Business Sector

METRICS FOR TRACKING PROGRESS

1. Number of local government departments implementing commuter benefit programs
2. Number of local governments with telework policies
3. Number of sidewalk and bike path renovation or improvement projects completed

KEY CO-BENEFITS

Improved air quality, economic growth, health and well-being, cost-savings, and improved reliability

INTERSECTION WITH OTHER FUNDING AVAILABILITY

- Commute Solutions
- Active transportation funding sources maintained on H-GAC's website

Measure 9 *Modernize Freight, Port, and Industrial Transportation Operations*

ANNUAL GHG EMISSIONS REDUCED IN **2030**	ANNUAL GHG EMISSIONS REDUCED IN **2050**
2,300,760 $MTCO_2e$	**9,220,920 $MTCO_2e$**

DESCRIPTION

Implement cleaner technologies and logistics efficiencies in goods movement and port activities.

OPPORTUNITY MENU

1. Promote idle reduction policies and voluntary adoption of cleaner practices (F)(<$)(by 2030).
2. Implement incentive programs for zero-emission heavy-duty vehicle and equipment replacement (M)($$)(by 2040).
3. Invest in full port electrification, shore power infrastructure, and zero-emission drayage fleets (HI)($$$)(by 2040).

AUTHORITY TO IMPLEMENT

City/County, State, Business Sector

METRICS FOR TRACKING PROGRESS

4. Number of port facilities adopting idle reduction policies
5. Number of zero-emission heavy-duty vehicles and equipment replaced through incentive programs
6. Number of zero-emission drayage fleets deployed

KEY CO-BENEFITS

Improved air quality, economic growth, health and well-being, workforce development, and improved reliability

INTERSECTION WITH OTHER FUNDING AVAILABILITY

- Port Authority Studies and Pilot Projects Grant Program
- Emissions Reduction Incentive Grants Program (ERIG)
- Seaport and Rail Yard Areas Emission Reduction Program

7.6 Agriculture and Land Use Opportunity Menu

Measure 10 *Promote Sustainable Agricultural and Land Management Practices*

GHG EMISSIONS PROJECTIONS NOT ESTIMATED FOR THIS MEASURE

DESCRIPTION

Encourage regenerative farming and land stewardship to enhance productivity and resilience.

OPPORTUNITY MENU

1. Offer educational programs and technical assistance on low-emission farming and efficient fertilizer use (F)(<$)(by 2030).
2. Provide incentives for technologies that reduce nitrous oxide emissions from fertilizer application (M)($$)(by 2030).
3. Fund adoption of electric agricultural equipment and methane-reducing digesters to capture emissions and generate renewable energy (HI)($$$)(by 2040).

AUTHORITY TO IMPLEMENT

City/County, H-GAC, State, Research/University

METRICS FOR TRACKING PROGRESS

1. Number of technical assistance sessions taken by farmers
2. Number of farms participating in nitrous oxide reduction incentive programs
3. Number of farms disclosing the use of electric agricultural equipment and methane reducing digesters

KEY CO-BENEFITS

Improved air quality, economic growth, health and well-being, cost-savings, workforce development, and improved reliability

INTERSECTION WITH OTHER FUNDING AVAILABILITY

- Sustainable Agriculture Research and Education Grants
- Rural Energy for America Program Renewable Energy Systems & Energy Efficiency Improvement Loans

Measure 11 *Enhance Urban and Community Nature-Based Climate Solutions*

ANNUAL GHG EMISSIONS REDUCED IN **2030**
169,110 $MTCO_2e$

ANNUAL GHG EMISSIONS REDUCED IN **2050**
169,110 $MTCO_2e$

DESCRIPTION

Integrate green infrastructure and natural systems into community planning to reduce urban heat island effects, manage stormwater, and improve air quality.

OPPORTUNITY MENU

1. Launch tree planting and green space initiatives to raise awareness and improve air quality (F)($$$)(by 2030).
2. Develop and fund urban afforestation and green infrastructure projects (green roofs, rain gardens, community gardens, urban forests) (M)($$)(by 2030).
3. Implement citywide policies that integrate urban forestry and nature-based solutions into development plans (HI)($$)(by 2030).

AUTHORITY TO IMPLEMENT

City/County, H-GAC, Nonprofit Community & Faith Based Organizations

METRICS FOR TRACKING PROGRESS

1. Number of trees planted
2. Number of green-infrastructure/ afforestation projects implemented
3. Number of municipalities with urban forestry plans or design standards incorporating nature-based solutions

KEY CO-BENEFITS

Improved air quality, health and well-being, cost-savings, and improved reliability

INTERSECTION WITH OTHER FUNDING AVAILABILITY

- Texas A&M Forest Service Community Forestry Grant Program
- National Fish and Wildlife Foundation Funding Opportunities
- NFWF Nature-based Solutions Funding Database
- Green Infrastructure Funding and Technical Assistance Opportunities | US EPA

Measure 12 *Protect and Enhance Coastal, Forest, and Other Carbon Sinks*

ANNUAL GHG EMISSIONS REDUCED IN **2030**	ANNUAL GHG EMISSIONS REDUCED IN **2050**
1,690 $MTCO_2e$	**5,440 $MTCO_2e$**

DESCRIPTION

Conserve and restore natural areas that capture and store carbon while protecting ecosystems.

OPPORTUNITY MENU

1. Partner with local environmental groups to promote wetland and forest conservation awareness (F)(<$)(by 2030).
2. Develop sustainable forest management policies (M) (<$)(by 2030).
3. Enact regional strategies to protect and restore wetlands and coastal estuaries with high carbon sequestration potential (HI) (<$)(by 2040).

AUTHORITY TO IMPLEMENT

City/County, H-GAC, State

METRICS FOR TRACKING PROGRESS

1. Number of outreach collaborations with local environmental groups
2. Number of sustainable forest management policies adopted
3. Acreage of wetlands and coastal estuaries conserved or restored

KEY CO-BENEFITS

Improved air quality, health and well-being, and cost-savings

INTERSECTION WITH OTHER FUNDING AVAILABILITY

- National Fish and Wildlife Foundation Funding Opportunities
- Texas A&M Forest & Land Management Technical Assistance
- Texas A&M Watershed Protection Plan Implementation Grant

7.7 Waste and Materials Management Opportunity Menu

Measure 13 *Reduce Methane Emissions from Waste and Wastewater Systems*

ANNUAL GHG EMISSIONS REDUCED IN **2030**
1,110 $MTCO_2e$

ANNUAL GHG EMISSIONS REDUCED IN **2050**
3,590 $MTCO_2e$

DESCRIPTION
Upgrade waste and wastewater management to capture or prevent methane emissions.

OPPORTUNITY MENU
1. Install energy efficiency measures at wastewater treatment plants to reduce operational emissions (F)($$$)(by 2040).
2. Introduce incentives for methane capture, flaring, or energy recovery at landfills and wastewater facilities (M)($$$)(by 2040).
3. Enforce methane collection, destruction, and utilization standards at major landfill and wastewater operations (HI)($$)(by 2030).

AUTHORITY TO IMPLEMENT
City/County, State

METRICS FOR TRACKING PROGRESS

1. Publicly disclosed number of wastewater treatment plants implementing energy efficiency measures
2. Number of total incentive programs for methane capture, flaring, or energy recovery
3. Tons of methane captured, destroyed, or utilized by major landfills and wastewater facilities

KEY CO-BENEFITS

Improved air quality, health and well-being, cost-savings, and improved reliability

INTERSECTION WITH OTHER FUNDING AVAILABILITY

- Better Plants
- Resources for Funding Landfill Gas Energy Projects

Measure 14 *Promote Waste Reduction, Organics Diversion, Composting, and Construction Waste Reduction*

ANNUAL GHG EMISSIONS REDUCED IN **2030**
791,120 $MTCO_2e$

ANNUAL GHG EMISSIONS REDUCED IN **2050**
3,586,280 $MTCO_2e$

DESCRIPTION

Expand recycling, composting, and circular material practices to reduce landfill waste.

OPPORTUNITY MENU

1. Conduct education and outreach campaigns to reduce food, yard, and construction waste at the source. (F)($$)(by 2030).
2. Provide grants or incentives for community composting programs and reuse of salvaged building materials. (M)($$)(by 2030).
3. Invest in large-scale composting and anaerobic digestion infrastructure; mandate diversion rates for major construction and demolition projects. (HI)($$$)(by 2040).

AUTHORITY TO IMPLEMENT

City/County, H-GAC

METRICS FOR TRACKING PROGRESS

1. Number of household/residential waste reduction outreach events conducted - Number of contractors/developers reached through construction and demolition outreach efforts
2. Number of community grants or incentives awarded for composting programs
3. Number and total capacity (tons/year) of composting and anaerobic digestion facilities

KEY CO-BENEFITS

Improved air quality, health and well-being, cost-savings, and improved reliability

INTERSECTION WITH OTHER FUNDING AVAILABILITY

- Keep Texas Beautiful Grants
- H-GAC Solid Waste Management Grants
- Resources for Funding Landfill Gas Energy Projects

8.
BENEFITS OF CAAP

The Clean Air Action Plan is designed to deliver measurable benefits that span public health, economic, social, and environmental dimensions while supporting job creation in numerous sectors (outlined in Section 9). Proposed actions can also lower operating costs and improve reliability of transportation and energy systems. Overall, expected reductions in emissions resulting from this plan support regional progress toward meeting federal air quality standards, protecting economic development, and strengthening resilience without slowing growth.

Figure 13. Co-Benefits of Reducing Emissions

8.1 Health and Economic Benefits

Many of the actions in this plan deliver real benefits beyond reducing emissions by improving the air people breathe every day. Cleaner air can mean fewer doctor visits, lower health care costs, and fewer missed days of work and school. By reducing pollution from cars, trucks, industry, and energy use, the plan helps lower rates of asthma and heart disease particularly in fast growing areas and neighborhoods near highways, ports, and industrial activity. This section outlines these health and economic benefits, along with added benefits such as healthier indoor air, more opportunities to be active, and increased tree cover in urban communities.

Benefits from Improved Air Quality

One approach to estimating health and economic benefits associated with air quality improvements is to use health impact models that translate emissions reductions into avoided health outcomes and economic value. EPA's CO-Benefits Risk Assessment Health Impacts Screening and Mapping Tool (COBRA) estimates benefits by combining emissions reductions, changes in pollution, and well-established health risk relationships. According to COBRA, actions in the plan could provide between $541 and $932 million dollars in regional health benefits in 2030 and between $2.4 and $5.2 billion dollars in 2050 due to improved outdoor air quality.

Table 11: Regional Public Health Benefits of Clean Air Action Plan in 2030 and 2050, 2% Discount Rate

Health Outcome Avoided	Projected year	Estimated Outcomes Avoided (count, annual)	Monetary Value ($2023, annual)
Mortality*	2030	33 - 59	$476,081,243 - $2,159,109,111
	2050	148-273	$867,278,405 - $3,981,214,063
Asthma Symptoms	2030	43,023	$9,836,376
	2050	190,536	$42,121,548
Asthma Incidence	2030	269	$20,526,408
	2050	1,181	$90,073,256
School Loss Days	2030	15,625	$26,536,476
	2050	66,794	$113,436,741
Minor Restricted Activity Days	2030	25,299	$3,180,584
	2050	117,313	$14,748,552
Hay Fever/Rhinitis	2030	1,679	$1,870,412
	2050	7,399	$8,243,503
Work Loss Days	2030	4,324	$1,367,620
	2050	20,057	$6,344,572
PM Nonfatal Heart Attacks	2030	14	$1,171,595
	2050	64	$3,180,409
Other**	2030	N/A	$698,004
	2050	N/A	$3,180,409
Total Health Benefits	2030	N/A	$541,268,718 – $932,425,880
	2050	N/A	$2,442,680,493 – $4,264,785,445

**Presented as a range to represent important uncertainties in the estimates of the health impacts of changing air quality*
***Other includes total ER visits (respiratory, asthma, all PM cardiac outcomes), HA Alzheimer's Disease (PM), total hospital admits (respiratory), stroke (PM), HA Cardio Cerebro and Peripheral Vascular Disease (PM), lung cancer (PM), HA Parkinson's Disease (PM), and out of hospital cardiac arrest (PM).*

Figure 14 summarizes annual avoided health outcomes and associated economic value for each target year. Larger estimated benefits in 2050 reflect more fully implemented plan actions and greater reductions in air pollution over time.

COBRA estimates both avoided premature mortality and avoided morbidity outcomes, including hospital visits, asthma exacerbations, and lost work or school days. Avoided mortality represents the reduction in premature deaths that is expected when air pollution levels decrease. In 2050, the vast majority (88% - 93%) of the monetary value of avoided health outcomes is associated with avoided mortality. This reflects EPA's use of a value of a statistical life, which assigns a standardized monetary value to small reductions in mortality risk, resulting in relatively large, monetized benefits for avoiding premature deaths.

Avoided morbidity costs estimate the dollar value of fewer illnesses and health-related disruptions that result from cleaner air, including reduced medical visits and fewer lost work or school days. In 2050, COBRA estimated the top morbidity-related economic benefits would be associated with avoided asthma incidence and symptoms as well as avoided school loss days, followed by reductions in minor restricted activity days, hay fever/rhinitis, work loss days, nonfatal heart attacks, and other health endpoints (Figure 14).

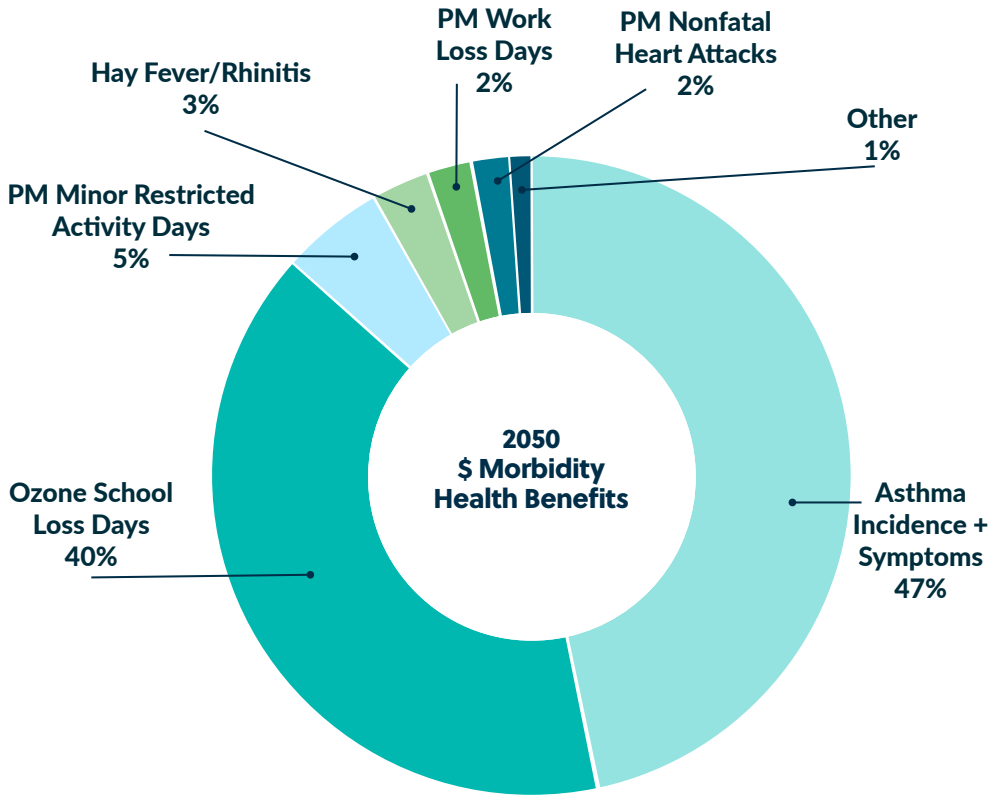


Figure 14: Distribution of Avoided Morbidity Health Benefits in 2050 (2023 dollars)

Additional Benefits of Plan Actions

The health benefits analysis was calculated based on the previously reported reduction in co-pollutant emissions from implementation of Measures 1-4 and 7 using the EPA's AVERT tool. Additional strategies were not analyzed in COBRA due to modeling limitations or data availability. These measures remain important components of a comprehensive clean air approach and are discussed qualitatively below.

This analysis also does not take into consideration the increase in grid electricity or fuel switching associated with electrification of appliances and implementation of heat pumps. However, transitioning from combustion-based appliances (natural gas, propane, fuel oil) to electric alternatives such as induction stoves and heat pumps can deliver significant improvements in indoor air quality, occupant health, and building safety. These benefits stem from the elimination of direct on-site combustion, which is a major source of indoor air pollutants (NO_2, CO, $PM_{2.5}$, and formaldehyde).

Active transportation infrastructure and services promote physical activity such as walking and cycling and can reduce the prevalence of chronic diseases such as obesity, diabetes, and cardiovascular disease by making routine movement easier and more accessible. Encouraging businesses to implement and incentivize sustainable transportation options, such as carpooling, public transit, biking, walking, telecommuting, and alternative work schedules, can also reduce traffic congestion, improve air quality, alleviate parking demand, and enhance employee well-being.

Tree planting programs are included in the plan for their climate benefits, such as storing carbon, but they also provide substantial health and economic co-benefits, especially in urban areas. These include heat risk reduction, wildlife habitat, property value increases, building energy savings, and air quality improvements. Table 13 summarizes estimated annual dollar values per tree associated with these and other benefits.

Table 12: Economic Benefits of Trees (FEMA 2022)[16]

Urban Tree Benefits	Annual Dollars per Tree (2021 USD)
Heat Risk Reduction	$ 910.28
Habitat	$ 53.15
Property Value Increase	$ 40.18
Stormwater Volume and Quality	$ 20.17
Building Energy Savings	$ 17.05
Carbon Sequestration and Avoided Emissions	$ 6.33
Drought Risk Reduction	$ 5.53
Air Quality Improvement	$ 2.50

8.2 Cost Savings and Improved Reliability

Many of the strategies in the Clean Air Action Plan promote cost savings and improve reliability of critical power, transportation, and waste management infrastructure. Here are some specific examples of how measures in the plan can generate savings for municipalities, businesses, and households:

- Energy efficiency measures, such as upgrading appliances, energy-efficient lighting, or improving insulation, reduce overall energy consumption (Measure 2).
- Demand-side management programs reduce energy consumption during peak demand periods or shift it to times when energy is cheaper (Measure 3).
- Solar installations help offset reliance on grid-supplied electricity and lower utility expenses. Adding energy storage systems provides backup power during grid outages or emergencies (Measure 1).
- EVs have lower lifetime fuel and maintenance costs and lower cost of ownership over time, although higher upfront purchase prices (Measures 7 and 9).
- Commute reduction programs and other actions that reduce VMT reduce transportation-related costs, such as parking fees, fuel expenses, vehicle maintenance, and employee travel reimbursements (Measure 8).
- Waste diversion can reduce VMT by heavy-duty collection and transfer trucks when collection routes are optimized or waste generation is reduced, also saving money on tipping fees, transportation, and long-term landfill maintenance (Measure 14).
- Waste diversion strategies also help extend the limited capacity of current landfills, of which new facilities take 5-10 years from concept to operationalize.

8.3 Environmental and Climate Co-Benefits

Over the past two decades, communities across the Texas Gulf region have experienced a wide range of extreme weather, including severe droughts, intense rainstorms, flooding, multiple hurricanes, and prolonged summer heat. These conditions have affected daily life, infrastructure, and public health throughout the region.

Looking ahead, studies of local conditions indicate that the Houston region is likely to see longer and hotter heatwaves, along with more frequent periods of both drought and heavy rainfall. Inland counties such as Waller, Montgomery, Liberty, Harris, and Fort Bend are expected to experience longer summers than coastal areas, with some areas facing a growing number of days each year with temperatures above 100°F.

These trends highlight the importance of actions that not only improve air quality but also help communities better prepare for hotter temperatures, heavier rainfall, and more extreme weather in the years ahead.

Length of Summer

This climate indicator is expressed as the length – or duration – of the summer season in number of days. Summers are growing longer - starting earlier and ending later compared to historical seasons. Under both the Moderate (4.5) and High (8.5) scenarios, summer in the coastal counties of Brazoria, Galveston, Chambers, and Jefferson will likely be shorter than the inland counties but range from 26 to 28 (Moderate 4.5) and 66 to 69 (High 8.5) days longer by the 2090s. In Waller, Montgomery, Liberty, Harris, and Fort Bend Counties, the projected length of summer will be 30 to 31 (Moderate 4.5) and 72 to 73 (High 8.5) days longer by the 2090s.

Left Pane: RCP4.5 | Right Pane: RCP8.5

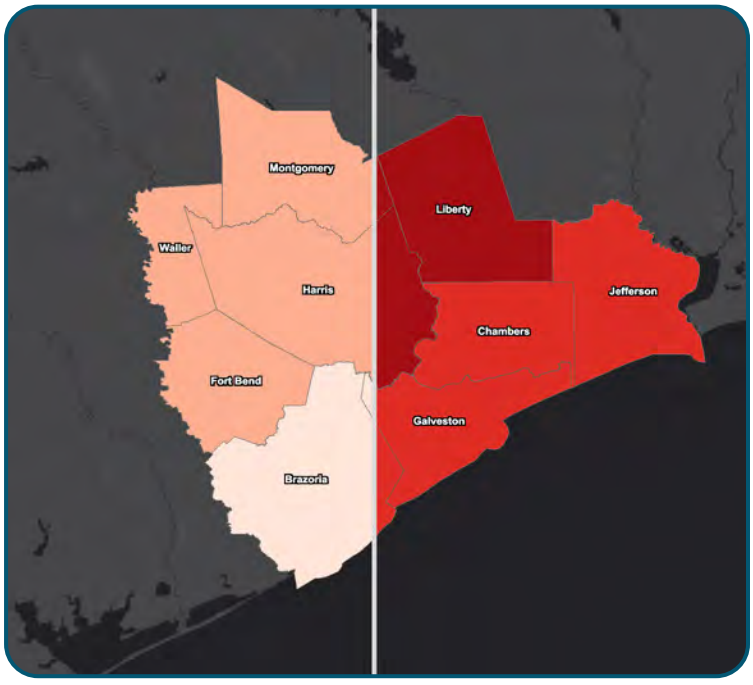


Figure 15: Screenshot of RESIN Portal Factsheet on climate indicator 'Length of Summer'

The Clean Air Action Plan can deliver co-benefits that help reduce the cascading impacts of drought and heat on communities and ecosystems.

Reducing waste heat from energy and fuel use also helps to reduce the urban heat island effect, which are areas in cities that are hotter than nearby rural or less-developed areas. Higher temperatures increase the risk of heat exhaustion, heat stroke, and worsen respiratory and cardiovascular conditions. Higher temperatures also increase air-conditioning use, leading to higher energy bills and added strain on the power grid, especially during heat waves. These impacts are not felt equally: communities with fewer trees, more pavement, and older housing tend to experience the highest temperatures and face the greatest risks, making urban heat islands a major public health concern. In addition to reducing emissions, urban trees and green spaces help cool neighborhoods through shade and evapotranspiration.

Actions that promote water-efficient practices and resilient infrastructure can also ease pressure on aquifers and reservoirs as irrigation demand rises. In addition, protecting air quality and reducing heat stress supports healthier freshwater ecosystems, helping sustain plant and animal diversity even as water availability declines and waterways rely more heavily on treated effluent during prolonged dry periods.

Native plants and trees are naturally adapted to local climate conditions, including temperature fluctuations, drought, and occasional extreme weather events such as hurricanes or heatwaves. Their resilience can help landscapes withstand environmental stresses and recover more quickly after disturbances. Native plants offer a unique aesthetic that reflects the natural beauty and character of the Gulf Coast region.

8.4 Distribution of Benefits Across Communities

The Clean Air Action Plan is designed to benefit the entire region, while placing added focus on neighborhoods that face the greatest challenges. By prioritizing programs for low income households and communities located near major roads, ports, and industrial areas, the plan helps ensure that those most affected by air pollution can experience cleaner air, better health, and an improved quality of life. Cleaner air can reduce asthma and other breathing related illnesses, lower missed work and school days, and help ease long term health costs for families already under financial strain.

Many actions in the plan also help lower household energy costs by improving energy efficiency, weatherizing homes, and expanding access to cleaner technologies. These improvements can make homes more comfortable during extreme heat and cold while improving indoor air quality. Workforce training and job programs connected to clean energy, building upgrades, and environmental monitoring can create local job opportunities and help residents build valuable skills.

Investments in heat and flood protection, along with improvements to housing and neighborhood infrastructure, can help communities better withstand extreme temperatures and severe weather. Expanded transportation options, safer walking and biking routes, and more affordable ways to get around can reduce transportation costs, improve access to jobs and essential services, and lower exposure to traffic related air pollution.

9.

WORKFORCE OPPORTUNITIES

Workforce Analysis

A strong and modern workforce is needed to carry out many of the strategies included in this plan. This analysis looks at how prepared the current workforce is or is not, to fill the jobs expected to result from the actions outlined in the CAAP. As additional clean air and workforce plans are developed, it will be important to expand and formalize job training programs, career pathways, and support for residents seeking work in these fields. Preparing people who are just entering the workforce, as well as retraining workers who want to move into higher demand sectors, will be important to the success of this plan and to the region's overall economic competitiveness.

To support implementation of the CAAP, H-GAC identified 64 occupations using the U.S. Bureau of Labor Statistics' Standard Occupational Classification (SOC) system. These occupations directly or indirectly support efforts to reduce emissions. The occupations are grouped by sector to measure the current number of jobs and to examine trends in employment, training needs, and wages. While many of these occupations exist across dozens or even hundreds of industries, most jobs within each occupation are typically concentrated in just one to three industries. Because of this, reviewing the top three industries for each occupation provides a useful way to understand workforce readiness and job outlook from an industry perspective.

This analysis also includes two measures, the award gap and the occupation gap, which are used to estimate whether there may be shortages or surpluses in trained workers for these occupations.

Across all identified occupations in the region, employment is expected to increase by an average of 5.7 percent by 2030. The median wage across these occupations in the Gulf Coast region is $50,100.

Table 13: Workforce Analysis Summary by Sector

Sector	Median Annual Wages	Number of jobs (2025)	Number of related occupations	Percent Growth by 2030 occupations	Number of Jobs Created by 2030
Buildings and Energy	$57,187	211,885	27	7.2%	15,344
Industrial	$62,246	52,210	8	7.8%	4,073
Transportation	$52,927[13]	38,825	15	5.2%	2,018
Waste	$42,119	9,911	7	5.7%	565
Agriculture and Forestry	$35,985	3,282	6	4.1%	136
Total	**n/a**	**316,113**	**63**	**7.0%**	**22,136**

An occupation is classified as "High-skill, High-growth" when it is mainly found within one or more of the Gulf Coast Workforce Board's targeted industries. Linking occupations to these industries helps ensure that job training and education investments align with employers' actual needs, supporting both workforce supply and employer demand. Income eligibility requirements for Gulf Coast Workforce Board scholarships further ensure that low income communities are prioritized as part of the region's broader workforce development strategy.

An individual who qualifies based on income and other requirements may be eligible to receive tuition assistance from the Board and Workforce Solutions to pursue training leading to one of these occupations. Therefore, inclusion of these occupations substantially increases the likelihood that low-income workers will be beneficiaries of investments in these occupations while also playing key role in mitigating their respective workforce shortages.

Buildings and Energy Sector

NUMBER OF RELATED OCCUPATIONS

27, primarily composed of skilled trades such as carpenters, electricians, and plumbers along with various other installation, maintenance, and repair roles.

TRENDS

The region possesses 28% more buildings and energy jobs than the nation as whole. In the past five years at the local level, these occupations have experienced relatively modest growth at 2.3%, equal to 4,724 new jobs, likely due to the COVID-19 global pandemic. However, growth is expected to accelerate reaching 7.2%, or 15,344 jobs, by 2030 thereby outpacing the region's projected 5.8% growth. Over the 2025 to 2030 timeframe, these occupations will see a total of 109,332 job openings with 34,916 job openings resulting from exits, 59,073 resulting from transfers and the remainder resulting from the creation of the 15,344 jobs new jobs noted above.

TRAINING AND EDUCATION REQUIREMENTS

Most occupations in this sector require a high school diploma with several also requiring formal apprenticeships as is typical of the skilled trades. As a result of larger-than-average employment, projected growth, education requirements, and wages, 11 of the 27 occupations in this sector have been designated "High-skill High-growth" thereby making them eligible for tuition assistance to individuals who qualify.

AWARD AND OCCUPATION GAPS

Consistent with known shortages in this area, the award gap for buildings and energy occupations stood at -835 while the occupation gap was comparable at -690. Both metrics reinforce that continued investments by the region's workforce board are essential for alleviating shortfalls of qualified workers in these areas.

INDUSTRY ANALYSIS

The buildings and energy sector occupations span 25 distinct industries with roughly half related to the construction sector and the remainder spread across various other production-related industries. Employment across these industries collectively stood at 823,811 in 2025 up from 786,706 in 2020, or 4.7%. Growth by 2030 is projected to be faster than average with an increase of 6.2% translating to new 51,252 jobs across the 13-county region. Given that roughly one-third of the occupations in this sector are High-skill High-growth as noted above, this collection of industries also contains several members that are "Targeted" by the Gulf Coast Workforce Board as part of its strategic investments in the region's workforce. A designation of "Targeted" signifies that an industry is larger than average in terms of employment and typically pays above average wages to its workers. These two measures are used to establish a threshold of relative importance to the regional economy.

Industrial Sector

NUMBER OF RELATED OCCUPATIONS

8; Various types of maintenance and repair of engines and machinery dominated this category along with welding.

TRENDS

Total employment rose 9.7%or 4,626 jobs since 2020 and is projected to see above average growth with a gain of 7.8%, or 4,073 jobs by 2030. Total job openings at 28,115 over the next five years will be composed of 8,737 exits, 15,307 transfers, and 4,073 new jobs mirroring the scale of the sector in terms of employment. In addition, Gulf Coast employment in the industrial sector exceeded the national average by 85%, a testament to the importance of production to the local economy.

TRAINING AND EDUCATION REQUIREMENTS

A high school diploma is sufficient for nearly all industrial sector occupations however all require moderate to long-term on-the-job training reflecting their adjacency to the apprenticeship model common to skilled trades. The Gulf Coast Workforce Board recognizes five of the eight occupations in this sector as High-skill High-growth thereby making them eligible for tuition assistance to individuals who qualify. (See Exhibit 1.)

AWARD AND OCCUPATION GAPS

This sector also faces proportionate worker shortages based on annual projected award and occupation gaps of -110 and -385, respectively.

INDUSTRY ANALYSIS

The industrial sector of occupations are primarily found within 16 distinct industries spanning manufacturing, construction, and utilities. Employment across these industries collectively stood at 345,578 in 2025 up from 342,583 in 2020, or 0.9%reflecting weakness in Gulf Coast Region's oil and gas sector throughout the COVID-19 pandemic. However, growth by 2030 is expected to accelerate surpassing the regionwide average with an increase of 7.0%translating to new 24,264 jobs across the 13-county region. Given the ties to oil and gas, average annual wages amongst this collection of industries is the highest among the five sectors at $108,070 per year compared to $79,169 across all industries. Lastly, 10 of the 16 industries in the Industrial sector are targeted by the Gulf Coast Workforce Board in recognition of their longstanding importance to the regional economy. (See Exhibit 2.)

Transportation Sector

NUMBER OF RELATED OCCUPATIONS

15, composed of primarily vehicle and engine mechanics along with operators of various modes of transportation.

TRENDS

The number of occupations in 2025 was virtually unchanged from its level of 38,679 in 2020, yielding a mere 0.4% growth rate. Despite rapid growth in warehousing and logistics in recent years, employment in the transportation sector was only 11%higher than the national average. While 8 of the 15 occupations saw employment declines over the past five years, Automotive Service Technicians had the largest impact given that this sole occupation accounted for 50%of the sector's employment and simultaneously lost 867 jobs over the five-year period for a 4.3% decline. Once again, the COVID-19 pandemic likely explains a portion of this outcome however the next five years show more promise with Automotive Service Technicians expected to increase by 4.9%, or 955 jobs, helping contribute to the overall sector's projected gains of 5.2% or 2,018 jobs by 2030. Furthermore only one of the 15 occupations in the sector, Electronic Equipment Installers and Repairers, Motor Vehicles, is expected to see losses over the next five years with a projected decline of 6.1%.

TRAINING AND EDUCATION REQUIREMENTS

The overwhelming majority of occupations in the transportation sector require a high school diploma accompanied by mostly moderate to long-term on-the-job training.

AWARD AND OCCUPATION GAP

Perhaps owing to the relative underperformance of the sector in recent years, talent shortages are less pronounced than might otherwise be expected with an award gap of -34 and an occupation gap of -73 individuals each year. Furthermore, owing to relatively low employment levels, projected growth, and in some cases below average wages, only two of the 15 occupations in the sector are recognized as High-skill High-growth by the Gulf Coast Workforce Board.

INDUSTRY ANALYSIS

In terms of unique industries related to occupations in the transportation sector, 23 were identified after limiting each occupation to the top three industries in which they are found. Sub-varieties of transportation, wholesale trade, repair, and maintenance were among the most common types with combined employment of 362,091 as of 2025. Growth at 6.9%since 2020 matched the average rate across all industries over the same timeframe while projected growth by 2030 at 4.6% indicates moderation over the next five years. Average compensation across the industries comprising the transportation sector stood at $73,294, or roughly 7% below the regionwide average of $79,169 per year. In keeping with the relatively few occupations in the transportation sector deemed High-skill High-growth by the Gulf Coast Workforce Board, just 5 of the 23 industries in the sector were designated as Targeted.

Waste and Materials Management Sector

NUMBER OF RELATED OCCUPATIONS

7; Beyond the areas included in the sector's title, occupations related to apparel and textile manufacturing were also included.

TRENDS

While these roles remain important to reduction of greenhouse gases, continued offshoring and automation of production processes resulted in the sector seeing a 2.3% decline in employment since 2020 for a loss of 229 jobs. Accordingly, employment among these occupations was 29% below the national average. However, by 2030 all but one occupation is expected to be flat, if not growing, with roles related to packaging, recycling, and material moving contributing most heavily to the sector's overall projected increase of 5.7%.

TRAINING AND EDUCATION REQUIREMENTS

In reflection of the long-term decline noted above, education requirements across occupations in this sector were the lowest of the five sectors with four of seven occupations requiring no formal education of any kind. On-the-job training requirements were also lower on average, skewing towards short-term to moderate at most.

AWARD AND OCCUPATION GAPS

Similar to the agriculture and forestry sector, the waste, recycling, and remediation sector faces an award gap of -5 each year but an occupation surplus of 16 individuals. None of the seven occupations in the sector met the requirements to be classified as High-skill High-growth by the Gulf Coast Workforce Board. It should be noted that occupations not deemed High-skill High-growth may still provide viable employment opportunities as evidenced by the fact that exits, transfers, and new jobs created are projected to provide a combined 6,324 job openings between 2025 and 2030.

INDUSTRY ANALYSIS

In contrast to the sector's occupations in and of themselves, industries where Waste, Recycling, and Remediation occupations are predominantly found experienced significant growth in the past five years posting an increase from 284,451 in 2020 to 309,726 as of 2025. This translates to a gain of 8.9%, making this collection of industries the fastest-growing of the five sectors. Mid-to-high double, and in some cases triple-digit percent gains were responsible with Apparel Accessories and Other Apparel Manufacturing growing by 154%, Warehousing and Storage growing 73%, and Commercial Machinery Repair growing nearly 34% over the past five years. In the case of Apparel, the decline in line-staff production roles contrasted with the industry's growth suggests that the employment gains are occurring among other roles likely requiring more formal education and training. Lastly, in another surprising set of indicators, wages across the waste, recycling, and remediation sector from an industry standpoint stood at $80,121 per year largely due to the presence of Basic Chemical Manufacturing, Commercial Machinery Repair, and Waste Treatment and Disposal with salaries ranging from $107,455 to $172,365. Accordingly, this sector contained four Gulf Coast Workforce Board Targeted Industries.

Agriculture and Forestry Sector

NUMBER OF RELATED OCCUPATIONS

6

TRENDS

In the past five years, these occupations experienced a 6.0% increase in employment, equivalent to 186 new jobs, and are expected to see an increase of 4.1%, or 136 jobs, by 2030. Over the 2025 to 2030, these six occupations are expected to see 976 job openings due to "exits," i.e., current workers permanently leaving these professions due to retirement or other reasons. The majority of openings will result from 1,458 transfers, i.e. workers switching to new careers. The remaining openings will result from the creation of the 136 new jobs noted above.

TRAINING AND EDUCATION REQUIREMENTS

Five of the six occupations require no more than a high school diploma. On-the-job training ranging from short-term (less than a month) to moderate (greater than a month but less than 1 year) to long-term (greater than a year) is necessary for an individual to reach proficiency in any or all of these professions.

AWARD AND OCCUPATION GAPS

Occupations are expected to face an award gap shortfall of five individuals on average each year as a result of fewer completions in postsecondary programs leading to these careers relative to open jobs. While this figure is not particularly large, and some occupations will see balanced supply and demand as denoted by an award gap of zero, it still suggests that this area could benefit from an appropriate level of workforce investment. Conversely, the occupation gap is positive at +38 indicating a surplus of workers however much of this is driven by one occupation alone: Farmworkers and Laborers, Crop, Nursery, and Greenhouse. This dichotomy between the award gap and occupation gap may provide an opportunity to upskill a few incumbent workers each year to compensate for the award gap.

INDUSTRY ANALYSIS

Fifteen unique industries were identified. Total employment across these industries, which includes occupations beyond the agriculture and forestry sector, stood at 389,626 as of 2025. Growth since 2020 stood at 8.3% versus 6.9% across all industries while projected growth by 2030 is expected to be 4.9% versus a regionwide average of 5.8%.

Workforce Resiliency Collaborative Findings

HARC conducted a research project with J.P. Morgan Chase in 2025 in support of the Resiliency Workforce Collaborative (https://www.hccs.edu/rwc/), leveraging survey data and focus groups from industry partners and service providers in Harris County and across Texas to identify key strengths and barriers in the energy and water workforce. These insights can also guide the implementation of the CAAP by highlighting strategies to strengthen workforce development and community access to clean energy and water careers.

BARRIER #1

Low public familiarity with the energy and water workforce sectors.

→ OPPORTUNITY

Workforce development programs can conduct targeted outreach and career awareness campaigns, particularly in low-income communities, to connect residents with opportunities in key sectors of the CAAP.

BARRIER #2

Difficulty accessing transportation and childcare due to limited availability of services or financial hardship.

→ OPPORTUNITY

Workforce programs can include wraparound supports and partnerships with local organizations to support equitable participation.

BARRIER #3

Misalignment among workforce programs and between program providers and employer needs and expectations.

→ OPPORTUNITY

Partnering with employers and apprenticeship programs to build communication channels among program providers can create workers who are better able to meet the needs of employers and successfully fill important roles in the industry.

Expanding training programs that are closely aligned with employer and community needs will also help create more direct pathways to stable, well-paying jobs. Leveraging existing partnerships with trusted local institutions and nonprofits (such as Goodwill, United Way, and higher education institutions) provides a strong foundation for scaling these efforts. Finally, focusing on in-demand careers such as HVAC, plumbing, solar installation, mechanical engineering, and energy analysis will align workforce priorities with CAAP sector goals and advance both climate and economic resilience objectives.

10.

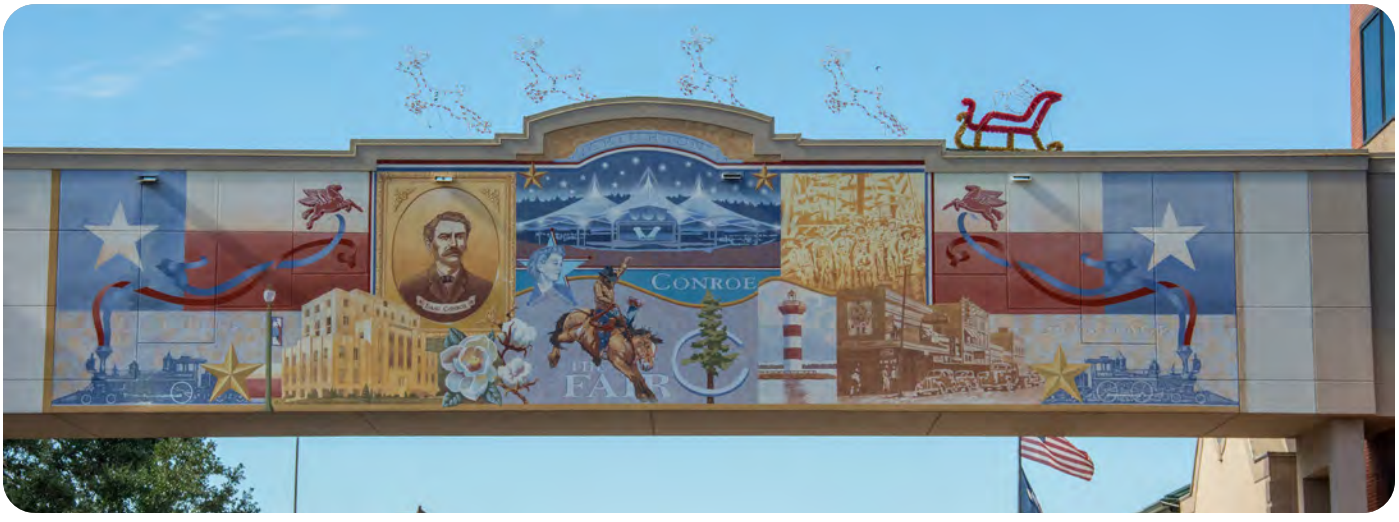
IMPLEMENTATION, MONITORING, AND CONTINUOUS IMPROVEMENT

The CAAP is designed not as a static document, but as a living roadmap that evolves as actions are implemented, data improves, and community priorities continue to shape regional climate efforts. Effective implementation, ongoing monitoring, and continuous improvement are essential to translating the strategies outlined in this plan into measurable reductions in GHG emissions, improved air quality, and tangible public health benefits. H-GAC will lead this effort through a coordinated governance structure, transparent reporting, and adaptive planning tools that support long-term accountability and learning.

10.1 Governance and Roles

H-GAC serves as the regional convener and coordinator for implementing the Clean Air Action Plan. In this role, H-GAC is responsible for maintaining the plan's overall framework, integrating data and reporting, and supporting collaboration among local governments, community partners, and other stakeholders. Subawardee partners also play important roles by advancing sector specific actions, community-centered strategies, workforce development efforts, and local implementation activities. Additional partners, including local governments, utilities, workforce organisations, community based organisations, and regional agencies, are expected to participate on a voluntary basis by advancing actions that align with the Opportunity Menus.

This shared governance approach reflects the fact that plan implementation will take place across multiple jurisdictions and sectors. Within this structure, H-GAC provides regional coordination, technical assistance, and performance tracking to help ensure that actions remain aligned with regional goals.



10.2 Measuring and Tracking Progress

ICLEI's ClearPath 2.0 platform will serve as the primary tool for tracking progress, monitoring performance, and reporting outcomes associated with the CAAP. ClearPath 2.0 provides a dynamic, data-driven system that connects greenhouse gas inventories, emission reduction targets, modeled scenarios, and real-world implementation activities into a single, integrated platform.

Through ClearPath 2.0, H-GAC will:

- Maintain and update the regional GHG inventory, including sector-specific emissions data.
- Track progress toward near-term, mid-term, and long-term emission reduction targets using business-as-usual and implementation scenarios.
- Monitor implementation of specific actions, linking projects and policies—such as building retrofits, fleet electrification, transit investments, or waste diversion programs—to quantified emission reductions.
- Compare planned outcomes with actual results to assess performance and identify opportunities for course correction.

Key indicators will include, but are not limited to, GHG emissions by sector, progress toward regional targets, number and type of actions implemented, participation by local governments and partners, and selected co-benefit indicators such as energy savings, air quality improvements, and workforce impacts where data are available.

10.3 Community Accountability and Transparency

Transparency and public accountability are central to the CAAP's implementation approach. H-GAC will provide regular public updates on progress through a dedicated Clean Air, Healthy Communities website, which will serve as the primary hub for plan information, data visualizations, and implementation updates. Public-facing dashboards generated through ClearPath 2.0 will allow residents, decision-makers, and stakeholders to view progress over time, explore sector-specific trends, and understand how individual actions contribute to regional goals.

H-GAC anticipates providing quarterly progress updates that summarize key metrics, highlight new or completed actions, and share lessons learned. These updates will help maintain momentum, support informed decision-making, and reinforce trust by clearly communicating both successes and challenges. Continued community engagement, through mechanisms such as the CARE group, will ensure that implementation remains responsive to local needs and priorities.

10.4 Future Updates to the Clean Air Action Plan

The Opportunity Menu framework is intentionally designed to support continuous improvement and expansion over time. As local governments, businesses, and community partners commit to implementing actions, those commitments can be added to ClearPath 2.0 and incorporated into updated emissions trajectories. This approach allows the region to track collective progress while accommodating new participants, emerging technologies, and evolving funding opportunities.

H-GAC plans to further build out and refine the implementation, monitoring, and reporting framework in 2026. This future phase will include enhancements to performance metrics, expanded dashboards, refined co-benefits tracking, and improved integration of local commitments. Through this iterative process, the Clean Air Action Plan CAAP will remain adaptive and relevant—supporting data-informed decision-making and sustained progress toward cleaner air and healthier communities across the Houston-Galveston region.

Clean Air,
Healthy Communities