



For Public Review - February 2026



Alamo Area
**CLIMATE
PLAN**

**A Roadmap for a Healthy,
Resilient, and Competitive
Region**



Acknowledgements

Alamo Area Council of Governments (AACOG)

City of San Antonio Department of Resilience and Sustainability

ICLEI USA

WSP USA

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The contents of this document do not necessarily reflect the views and policies of the EPA, nor does the EPA endorse trade names or recommend the use of commercial products mentioned in this document. Unless otherwise noted, the measures outlined in the CCAP are intended to be broadly accessible to any eligible entity within the plan's geographic scope, including those seeking support through the Climate Pollution Reduction Grants (CPRG) Implementation Grant General Competition or other relevant funding opportunities.

Acronyms

AACOG	Alamo Area Council of Governments
AAMPO	Alamo Area Metropolitan Planning Organization
AFOLU	Agriculture, Forestry, and Other Land Use
ART	Alamo Regional Transit
BAU	Business-as-Usual
BLS	Bureau of Labor Statistics
CAAP	Climate Action and Adaptation Plan (SA Climate Ready Plan)
CCAP	Comprehensive Climate Action Plan
CCS	Carbon Capture and Storage
CCUS	Carbon Capture, Utilization, and Storage
CH₄	Methane
CHP	Combined Heat and Power
CMAQ	Congestion Mitigation and Quality
CO₂	Carbon Dioxide
CO₂e	Carbon Dioxide Equivalent
COSA	City of San Antonio
CPS	City Public Service
CPRG	Climate Pollution Reduction Grant
DOE	Department of Energy
EIA	Energy Information Administration
eGRID	Emissions and Generation Resource Integrated Database
EECBG	Energy Efficiency and Conservation Block Grant
EPA	Environmental Protection Agency
EPD	Environmental Product Declaration
EPPP	Environmentally Preferred Purchasing Policy
EVs	Electric Vehicles
FLIGHT	Facility Level Information on Greenhouse gases Tool
FY	Fiscal Year
GHG	Greenhouse Gas
GHGI	Greenhouse Gas Inventory
GSI	Green Stormwater Infrastructure
HVAC	Heating, Ventilation, and Air Conditioning
IECC	International Energy Conservation Code
IIJA	Infrastructure Investment and Jobs Act of 2021
IRA	Inflation Reduction Act of 2022
kW/kWh	Kilowatts/kilowatt hours
LDAR	Leak Detection and Repair
LCRA	Lower Colorado River Authority
LID	Low Impact Development
LIHEAP	Low-Income Energy Assistance Program
LFG	Landfill Gas
LEARN	Land Emissions And Removals Navigator

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MTCO₂e	Metric Tons of Carbon Dioxide Equivalent
MSA	Metropolitan Statistical Area
MW	Megawatts
NAAQS	National Ambient Air Quality Standards
NEI	National Emissions Inventory
NREL	National Renewable Energy Laboratory
N₂O / NO_x	Nitrous Oxide
O₃	Ozone
PACE	Property Assessed Clean Energy
PCAP	Priority Climate Action Plan
PM	Particulate Matter
PV	Photovoltaic
REP	Retail Electric Provider
RNG	Renewable Natural Gas
RSWMP	Regional Storm Water Management Program
RTW	San Antonio Ready to Work
SARA	San Antonio River Authority
SAWS	San Antonio Water System
SIT	State Inventory Tool
SECO	State Energy Conservation Office
SCM	Supplementary Cementitious Materials
STEC	South Texas Electric Cooperative
STEP	Sustainable Tomorrow Energy Plan
TCEQ	Texas Commission on Environmental Quality
TDM	Travel Demand Management
TERP	Texas Emissions Reduction Plan
TOD	Transit-Oriented Development
TTI	Texas A&M Transportation Institute
TxDOT	Texas Department of Transportation
USDA	U.S. Department of Agriculture
VMT	Vehicle Miles Traveled
VOC	Volatile Organic Compounds
VPP	Virtual Power Plant
WSA	Workforce Solutions Alamo



Definitions

Alamo Area: The 13-county region of the Alamo Area Council of Governments, which includes the following counties in Central and South Texas: Atascosa, Bandera, Bexar, Comal, Frio, Gillespie, Guadalupe, Karnes, Kendall, Kerr, McMullen, Medina, and Wilson.

Attainment: When monitored air quality meets the National Ambient Air Quality Standards (NAAQS) for a specific pollutant (such as ozone or fine particulate matter).

Baseline: A measurement, calculation, or time used as a basis for comparison. Baseline estimates are needed to determine the effectiveness of emission reduction measures (also called mitigation strategies).

Biomass: Organic material coming from living or recently living organisms, such as plants and animals.

Business-as-Usual (BAU) Scenario: A projection of future emissions based on current trends and without additional policy interventions.

Carbon Dioxide (CO₂): A naturally occurring greenhouse gas in Earth's carbon cycle that absorbs and re-emits heat in the atmosphere, released by processes such as respiration, decomposition, wildfires, and volcanic activity, and absorbed by forests, soils, and oceans. Burning fossil fuels for energy and transportation and other human activities have increased atmospheric concentrations, trapping more heat and driving long-term climate change.

Carbon Dioxide Equivalent (CO₂e): A measure used to compare the emissions of GHGs based on their global warming potential.

Co-benefits: Additional positive outcomes that result from actions taken to reduce GHG emissions, such as improved air quality or economic savings.

Comprehensive Climate Action Plan (CCAP): A narrative climate planning report 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.

Electric Vehicles (EVs): Vehicles that are powered by electricity instead of fossil fuels (e.g. gasoline or diesel).

Electrification: The process of replacing equipment that uses natural gas, propane, or other fossil fuels with electric alternatives.

Energy Efficiency: Using less energy to perform the same task, thereby eliminating energy waste.

GHG - Greenhouse Gas: Gases that trap heat in the atmosphere, contributing to global climate change. Common GHGs include carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O).

Greenhouse Gas Inventory (GHGI): A summary of all GHG emission sources and sinks by sector and the associated emissions quantified using commonly accepted protocols.

Methane (CH₄): A colorless, odorless, and highly flammable GHG composed of carbon and hydrogen, emitted from various sources like energy, industry, agriculture, land use, and waste management activities. Although

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methane stays in the atmosphere for a shorter time than carbon dioxide, it traps much more heat per unit, making it a key driver of near-term climate change.

Microgrid: A local energy system consisting of interconnected loads and distributed energy resources that can operate independently from the power grid. Microgrids can connect/disconnect from the larger grid as needed.

Million British Thermal Units (MMBtu): Unit of measurement for energy consumption.

National Ambient Air Quality Standards (NAAQS): Federally mandated regulations that set limits for six primary air pollutants to protect public health and wellbeing from the harmful effects of air pollution.

Nitrogen Oxides (NO_x): A group of air pollutants, primarily nitric oxide (NO) and nitrogen dioxide (NO₂), formed during combustion in vehicles, power plants, and industrial equipment. Nitrogen oxides contribute to the formation of ground-level ozone (smog) and fine particulate matter, affecting air quality and human health.

Nitrous Oxide (N₂O): A potent greenhouse gas emitted from various activities like agriculture, industry, and fuel combustion, with a global warming potential significantly higher than carbon dioxide.

Non-attainment: When monitored air quality exceeds the NAAQS for a specific pollutant. Nonattainment areas must develop and implement a State Implementation Plan outlining enforceable strategies to reduce pollution and return the area to attainment within a required period.

Ozone (O₃): A highly reactive gas composed of three oxygen atoms. In the lower atmosphere, ozone is formed primarily from photochemical reactions between two major classes of air pollutants: volatile organic compounds (VOC) and nitrogen oxides (NO_x). Ground-level ozone is a major contributor to smog, harms respiratory health, and damages crops.

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.

Solar and Storage Microgrid: A localized energy system powered primarily by solar panels, with battery storage, able to operate independently from the main electrical grid.

Sulfur Hexafluoride (SF₆): A synthetic, powerful, and long-lived greenhouse gas, with a global warming of 22,800, meaning it traps 22,800 times more heat than carbon dioxide. It is the most potent greenhouse gas.

Urban Heat Island Effect: The tendency for cities and developed areas to be hotter than nearby rural areas because buildings, roads, and other paved surfaces absorb and retain heat, while limited trees and green space reduce natural cooling. Waste heat from vehicles, air conditioning, and industry can further raise temperatures, especially during the day and at night.

Vehicle Miles Traveled (VMT): A measure of the total miles driven by all vehicles in a specified area over time.

Virtual Power Plant (VPP): A network of distributed energy resources such as rooftop solar, home batteries, smart thermostats, electric vehicles, and commercial building controls that are digitally connected and coordinated to function like a single power plant.

Volatile Organic Compounds (VOCs): A group of gases released from fuels, solvents, industrial processes, consumer products, and vehicle exhaust, as well as from some natural sources such as vegetation, wildfires, soil microbes, wetlands, and oceans. VOCs react in the atmosphere to form ground-level ozone (smog), which harms respiratory health and damages crops. Some VOCs are directly toxic.

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Executive Summary

Overview

The Alamo Area Council of Governments (AACOG), in conjunction with the City of San Antonio (COSA), prepared the Comprehensive Climate Action Plan (CCAP), referred to as the **Alamo Area Climate Plan**, for its 13-county service area. This plan is not a mandate or regulatory requirement. Rather, it is a set of practical, flexible strategies that Alamo Area communities can use to identify pathways toward improved health, greater resilience, and long-term economic competitiveness.

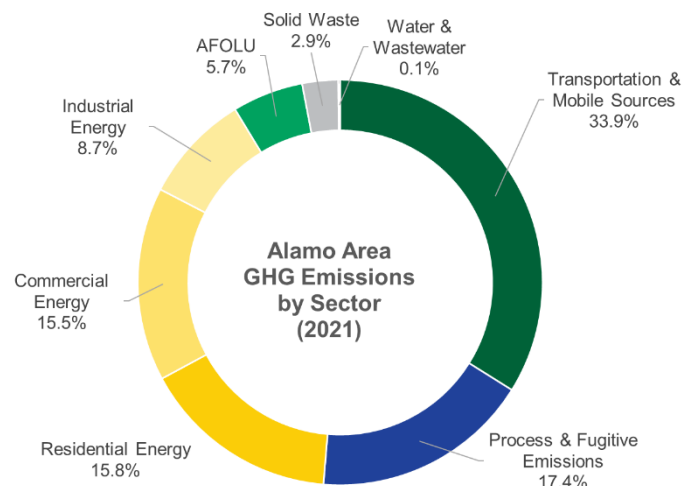
The plan is designed to support informed decision-making by offering options that reflect local priorities, capacities, and conditions. By advancing cleaner energy, healthier air, and climate-smart investments, these strategies help communities reduce risks, strengthen resilience to future challenges, and position themselves to compete for funding, jobs, and innovation in a changing economy.

The Alamo Area Climate Plan is the culmination of an approximately 18-month process that involved working across multiple levels of government, gathering meaningful community input, and conducting additional stakeholder outreach. Key features of the plan include:

- A regional analysis of Greenhouse Gases (GHG) sources/sinks,
- Proposed near-term and long-term GHG emission reduction targets,
- A broad range of strategies to reduce GHG emissions across all economic sectors,
- An assessment of co-benefits, and
- A breakdown of implementation authority, funding strategies, and workforce needs.

GHG Inventory

The Alamo Area's baseline GHG inventory provides a clear picture of the region's emissions sources and highlights where targeted climate action can deliver the greatest impact. In the baseline year (2021), the region generated an estimated 42 million metric tons of carbon dioxide equivalent (MTCO₂e), with emissions distributed across major economic and community sectors.



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GHG Reduction Targets:

GOAL	2030	2050
Moderate but Achievable	10% reduction from 2021 levels	50% reduction from 2021 levels
Stretch	30% reduction from 2021 levels	80% reduction from 2021 levels

Proposed Strategies:

SECTOR	OPPORTUNITIES FOR THE ALAMO AREA
Transportation and Mobile Sources	Expand transportation options while reducing commuting times, make neighborhood businesses more accessible by bringing back traditional Main Streets, and reducing resident out-of-pocket costs spent on transportation.
Process and Fugitive Emissions	Reduce waste through leaks, comply with regulations, and meet growing business demands for low-carbon products.
Residential Energy	Save money on utility bills while increasing home comfort, increase resilience and energy independence, and improve local air quality through energy efficiency, modernization through electrification, weatherization, and on-site solar.
Commercial Energy	Save money on utility bills, modernize equipment, and increase resilience and energy independence for Alamo Area businesses through energy efficiency, electrification, and on-site solar.
Industrial Energy	Save money on utility bills, modernize equipment, increase resilience and energy independence, and meet growing demand for low-carbon products. Some industries currently require fuel consumption, so mitigation measures also include carbon capture, utilization and storage (CCUS), and low-carbon alternative fuels.
Agriculture, Forestry, and Other Land Use (AFOLU)	Preserve and expand urban forests and green spaces, improve the health and maintenance of the existing tree canopy, and adopt best practices in agriculture to reduce methane and nitrous oxide emissions. These strategies also support improved soil health, urban cooling, flood mitigation, and quality of life.
Solid Waste	Avoid sending waste to landfills through improved recycling, composting, and food waste reduction. Measures also focus on expanding and improving landfill methane gas collection, such as early-stage landfill gas (LFG) to reduce emissions and generate energy.
Wastewater	Expand the use of anaerobic digestion to capture biogas, compost biosolids to create nutrient-rich compost, and utilize biogas to generate electricity. Other measures include implementing best practices for nitrification and denitrification to optimize nutrient removal and expanding water recycling to reduce demand on freshwater resources.

1.0 Introduction

Home to over 2.6 million community members, the 13 counties in the Alamo Area are part of a rapidly growing megaregion between San Antonio and Austin. The region grew at a faster rate than the state of Texas between 2010 and 2020, led by Comal, Kendall, and Guadalupe counties.

Alamo Area Council of Governments (AACOG) is a voluntary association of local governments established in 1967 under Chapter 391 of the Texas Local Government Code. Shown in Figure 1, AACOG serves 13 counties in Central and South Texas (Atascosa, Bandera, Bexar, Comal, Frio, Gillespie, Guadalupe, Karnes, Kendall, Kerr, McMullen, Medina, and Wilson). AACOG supports members through planning, information sharing, and coordinated activities; and serves as the air quality planning organization for State Planning Region 18. AACOG focuses on suburban and rural areas within the San Antonio–New Braunfels Metropolitan Statistical Area (MSA) outside the City of San Antonio.

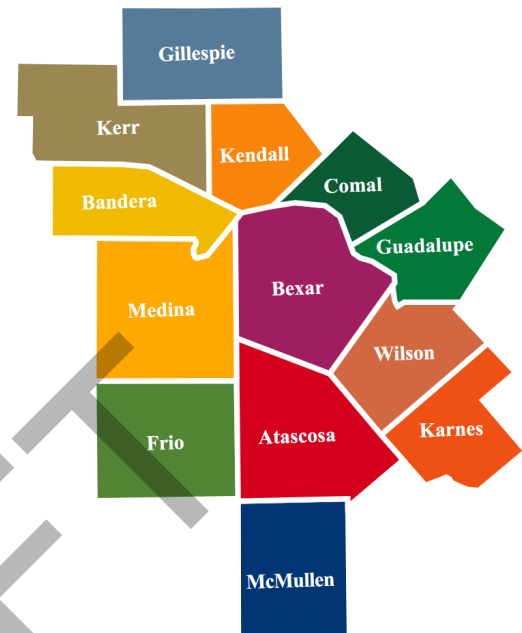


Figure 1: Map of 13 Counties in AACOG Service Territory

AACOG's Natural Resources Department leads regional collaboration on air quality between government, industry, and community stakeholders. Bexar County, the most populous county in the region, is the only county in nonattainment of the National Ambient Air Quality Standards (NAAQS). On June 20, 2024, the EPA reclassified the status from moderate to serious nonattainment for ozone (O_3), prompting stricter regulatory requirements. Other counties in the AACOG service area remain in attainment.

San Antonio is the largest city in the Alamo Area, the seventh largest city in the United States, and one of the strongest fiscally managed cities in the country, nurturing entrepreneurship, encouraging investment, and funding infrastructure. San Antonio is a vibrant city with a thriving economy, deep cultural heritage, and communities that are compassionate, inclusive, and proudly diverse. San Antonio's famed Riverwalk and Alamo are the top tourist attractions in Texas, and its historic missions are a designated World Heritage Site – the first and only in Texas. Proudly called Military City, USA®, San Antonio is home to one of the largest populations of active-duty military and veterans, as well as mission-critical commands, including military medicine, cybersecurity, pilot training, and basic training.

The City of San Antonio (COSA) is also a proven leader in climate action and adaptation, implementing the largest municipal on-site solar program in Texas. The \$30 million initiative involves the installation of rooftop solar photovoltaic (PV) and solar canopy shade structures at various City-owned facilities, moving San Antonio closer to its 2040 goal of achieving zero net energy for all

municipal buildings. In 2021, San Antonio became the first City in Texas to use cool pavement and created a Cool Neighborhoods Program that is implementing projects like cool roofs, cool pavement, more shade and trees to help adapt communities to extreme heat. As the region grows, environmental and public health challenges, including extreme heat and air quality, are becoming more critical. Addressing these challenges is important for protecting the community and supporting equitable regional planning.

The Alamo Area is experiencing increasing climate impacts from greenhouse gas emissions and extreme heat, which pose growing risks to communities. Temperatures across the region are projected to rise by 6°F to 10°F by the end of the century, increasing both the frequency and intensity of heatwaves. Areas with high urban heat island effects and limited tree canopy coverage experience higher temperatures, amplifying heat stress, and related health risks. Extreme heat and poor air quality increase the potential for respiratory and cardiovascular health impacts. Heat-related illnesses and deaths have risen across the region in recent years, with the San Antonio Metropolitan Health District reporting hundreds of cases annually in Bexar County alone.¹

Communities with fewer resources are even more sensitive to climate impacts. The region has one of the highest poverty rates among large metropolitan areas in the United States, with more than 14% of individuals in the San Antonio-Braunfels MSA living below the poverty line.² Community members experiencing poverty often lack access to home cooling, shaded outdoor spaces, or the ability to relocate during emergencies. Areas with higher social vulnerability often overlap with places experiencing stronger urban heat island effects and lower tree canopy coverage, which further increases exposure and health risks.^{3,4}

1.1 CLIMATE POLLUTION REDUCTION GRANT OVERVIEW

As part of the Inflation Reduction Act (IRA), the Climate Pollution Reduction Grants (CPRG) program provides significant financial resources to state, territory, local, and tribal governments to develop ambitious climate action and air pollution reduction plans and to implement measures from those plans. Administered by the United States Environmental Protection Agency (EPA), the CPRG is a two-phase program with \$250 million in non-competitive planning grants, followed by \$4.6 billion of competitive implementation grants. Entities must have completed and submitted a Priority Climate Action Plan (PCAP) to be eligible for implementation grants.

¹ City of San Antonio Metropolitan Health District. Heat-Related Illnesses and Deaths. Available at: Heat-Related Illnesses & Deaths - City of San Antonio.

² Craig Benson, U.S. Census Bureau, American Community Survey Briefs, ACSBR-016, Poverty in States and Metropolitan Areas: 2022. Available at: Poverty in States and Metropolitan Areas: 2022 (census.gov)

³ COSA DRS and Navigant. (2019). SA Climate Ready: Vulnerability & Risk Assessment.

<https://www.sanantonio.gov/Portals/0/Files/Sustainability/SAClimateReady/Vulnerability-Risk-Assessment.pdf>

⁴ COSA DRS (n.d.). Climate Equity Dashboard. <https://www.sasustainability.com/category/climate-equity>

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On April 27, 2023, the City of San Antonio (COSA) submitted a Notice of Intent to Participate for the CPRG with letters of support from AACOG, CPS Energy, Alamo Area Metropolitan Planning Organization (AAMPO), San Antonio Water System (SAWS), San Antonio River Authority (SARA), and VIA Metropolitan Transit. In April of 2023, the AACOG Board of Directors approved acceptance of subaward funding, if awarded, to carry out these duties.

The full CPRG application package was submitted on May 25, 2023. On August 31, 2023, COSA Department of Resilience and Sustainability (DRS) was awarded a grant in the amount of \$1 million to collaborate with AACOG in leading the development of the regional PCAP. The PCAP was submitted to EPA Region 6 on February 16, 2024, and was the first major deliverable of participation in the CPRG program. The CCAP is the second major deliverable in the CPRG program.

1.2 CCAP PURPOSE AND SCOPE

The CCAP outlines emission reduction strategies that will support investment in policies, practices, partnerships, and technologies that center the community; and enhance the quality of life for all community members within the Alamo Area. Thirteen counties are included in the Alamo Area Climate Plan: Atascosa, Bandera, Bexar, Comal, Frio, Gillespie, Guadalupe, Karnes, Kendall, Kerr, McMullen, Medina, and Wilson. This plan fulfills requirements under EPA's CPRG Planning Grant program.

This regional plan is complementary to the SA Climate Ready Plan, COSA's Climate Action and Adaptation Plan (CAAP). Adopted in 2019, SA Climate Ready committed COSA to reaching carbon neutrality by 2050 and to adapting to current and future climate impacts. Similarly, the CCAP establishes a vision for 2050 with 2030 as an interim target.

A 2021 baseline GHG inventory was prepared to project emissions for 2030 and 2050. The CCAP builds on the Alamo Area PCAP, submitted to the EPA, which included nine strategies and 40 measures focusing on the transportation and energy sectors. The CCAP provides a comprehensive list of emissions reduction actions across specific focus areas:

- Transportation and Mobile Sources
- Process and Fugitive Emissions
- Residential Energy
- Commercial Energy
- Industrial Energy
- Agriculture, Forestry, and Other Land Use
- Solid Waste
- Wastewater

1.3 APPROACH TO DEVELOPING THE CCAP

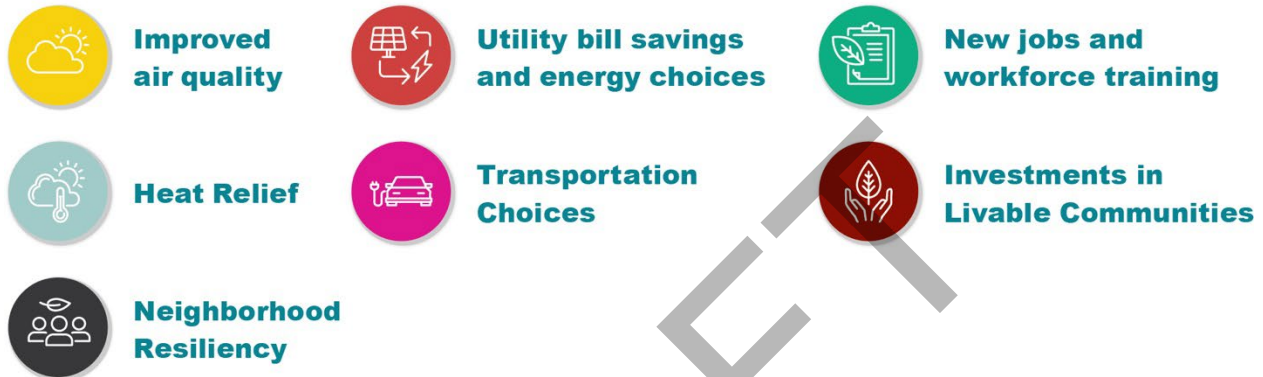
Community and stakeholder engagement played an integral part in developing the CCAP. The Alamo Area covers rural and suburban communities, representing a range of knowledge and interest in climate action and pollution reduction. At the beginning of the project, a strategic approach to engagement was developed that prioritized a diverse representation of stakeholders and community members. The approach included strategies for reaching members of the community through a website (<https://www.saspeakup.com/alamoareaclimateplan>), social

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media, branding, and presentations. Surveys were developed and directed towards both the community and stakeholders to obtain input on what their concerns are, what measures they support and what activities stakeholders are engaging in.

Building on the engagement done for the PCAP, the community engagement process was designed to highlight the community benefits to the plan, to encourage feedback on proposed strategies, and to gather strategies directly from the community on ways to reduce emissions.

ALAMO AREA COMMUNITY BENEFITS



Over 18,596 people have been engaged throughout the planning process. Engagement activities included community education events, which also promoted bilingual printed materials, and workshops with agency and partner organizations. Community handouts were created to describe the CCAP program and plan being developed, and the plan's impact on public health and economic growth (Figure 2).

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Figure 2: Program Handouts

Across all efforts, surveys generated 912 total responses over the three fiscal years, and were collected in a variety of methods, including through online survey forms and in person at community events and workshops. Participants ranked their top concerns for the area, which included:

- Clean Drinking Water
- Air Quality
- Energy costs and reliability
- Climate change and extreme weather events
- Food Security
- Employment and job growth
- Public Transportation
- Solid Waste and recycling

Many survey participants strongly agreed that they are concerned about drought and future water supply, stressing the need for more access to clean water. Traffic congestion is also a major concern, highlighting the need for improved sidewalks/bicycle routes, and encouraging remote work. The electric grid is another area of concern, with recommendations to reduce energy consumption and implement alternative energy solutions.

Most community members were unsure about which implementation strategies their local government is pursuing, with “I don’t know” being the most common response. Among those who did identify specific strategies, the top actions mentioned were installing electric vehicle charging stations and offering weatherization and energy efficiency programs.

When asked about priorities for reducing emissions in the Alamo Area, community members pointed to protecting, enhancing, and expanding urban ecosystems, trees, and greenspaces as a leading strategy, followed by a four-way tie: monitoring and reducing stormwater runoff impacts, implementing electricity and natural gas upgrades, optimizing industrial energy and fuel use, and improving solid waste recycling and composting programs.

Over 1,100 comments were received, and many stressed more engagement, developing strategies that also help economic development and provide more incentives for greener

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choices. Some comments expressed skepticism about the purpose of the program, and others supported the efforts.

AACOG and COSA staff attended 68 community education events to provide information about the CCAP process and solicit feedback. The following includes some of the events attended:

- DreamWeek Resilience (Jan. 25, 2024)
- Meeting with the City of Boerne (Feb. 23, 2024)
- Survey to AACOG listserv (Feb. 2, 2024)
- Presentation to AACOG Board of Directors (June 26, 2024)
- CCAP draft presented at separate Interagency Meetings held August through October 2025 in Karnes County, Wilson County, Bandera County, and Frio County
- Community Education Events August through October 2025 in Karnes County, Bexar County, and Gillespie County
- AACOG Air Quality Board brief on CCAP draft in September 2025
- Community events, including Monarch Butterfly Fest, Arbor Day, Earth Day, and others.

AACOG and COSA staff also conducted ad hoc air quality outreach and education programs to educate community members about air pollution and encourage regional stakeholder collaboration to implement air quality improvement measures. These measures addressed a wide range of topics, including alternative fuels and vehicles, energy efficiency, ride sharing, financial incentives, climate resiliency, and Ozone Action Day Alerts.

A series of sector specific stakeholder workshops were held to provide background on key reduction strategies that may apply to the region. Sector specific workshops included:

- | | |
|--|--|
| ■ Agriculture and Natural Lands | ■ Transportation Fleets |
| ■ Residential and Commercial Buildings | ■ Transportation Pedestrian and Bicycles |
| ■ Residential Energy | ■ Waste Management |

Each of these workshops included interactive polling to encourage stakeholder engagement. A total of 17 workshops were attended in-person or virtually. In addition to the workshops, COSA and AACOG conducted a survey to collect agency-specific regional strategies and measures that can reduce climate polluting emissions. These strategies, as applicable, were considered in the modeling efforts undertaken to predict future emission projections.

2.0 Greenhouse Gas Inventory

The GHG inventory covers the 13-county AACOG service area shown in Figure 1. The base year for the CCAP and GHG inventory is 2021 due to federal, state, and local data availability. The primary GHG included in the inventory are:

- Carbon dioxide (CO₂)
- Methane (CH₄)
- Nitrous oxide (N₂O)
- Sulfur hexafluoride (SF₆)
- Nitrogen trifluoride (NF₃)

2.1 GHG INVENTORY METHODOLOGY

The inventory is based on version 1.2 of the U.S. Community Protocol for Accounting and Reporting GHG Emissions, and additional activities/sources are considered in accordance with the Global Protocol for Community-Scale GHG Emissions Inventories (GPC). Most emissions sources in this inventory are quantified using activity data and emission factors. Activity data refers to the relevant measurement of GHG-generating processes such as fuel consumption by fuel type, metered annual electricity consumption, and annual vehicle miles traveled (VMT). Emission factors are used to convert activity data into associated quantities of emissions. For this inventory, calculations were made using ICLEI's ClearPath Climate Planner tool.

The CCAP GHG emissions inventory refined the GHG inventory prepared for the PCAP with information provided by the Texas A&M Transportation Institute (TTI) and local electricity and natural gas utilities. The TTI data was available for each of the 13 counties, while assumptions had to be developed for multiple counties in the PCAP due to lack of data.

Emissions from the residential, commercial, and industrial energy sectors were also updated since the PCAP was developed. PCAP emissions from the energy sectors were developed by downscaling state-level data obtained from the Energy Information Administration (EIA) using the population for each county. Emissions from electricity use were estimated using default regional factors from EPA's Emissions and Generation Resource Integrated Database (eGRID). After the PCAP was prepared, localized data was obtained from multiple utilities in the analysis area. Many of these utilities provided electricity emission rates that were lower than the EPA defaults. The CCAP emissions from electricity use were estimated by using the utility-specific data, when available, and the eGRID emission factors for the remaining electricity consumption.

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Table 1 provides an overview of data sources by sector. Further details on methodologies and data gaps/assumptions can be found in Appendix A.

Table 1: GHG Inventory Data Sources

TRANSPORTATION & MOBILE SOURCES	
On-Road	TTI
On-Road Transit	National Transit Database Fuel and Energy Report
Rail	TTI
Aviation	TTI
Waterborne	EPA's 2020 National Emissions Inventory (NEI)
Off-Road/Mobile	EPA's 2020 NEI
Emissions Factors	EIA's Annual Energy Review, Bureau of Transportation Statistics Average Fuel Efficiencies, and EPA's Emission Factors for GHG Inventories
GRID ELECTRICITY	
Residential, Commercial and Industrial Electricity	EIA State Energy Summaries, Electricity Utility Responses to Data Request
Electricity Generation	EPA Facility Level Information on Greenhouse gases Tool (FLIGHT)
Emissions Factors	EPA's eGRID 2021, Electricity Utility Responses to Data Request
STATIONARY FUEL	
Residential and Commercial Stationary Fuel	EIA State Energy Summaries, Natural Gas Utility Responses to Data Request
Industrial Stationary Fuel	EPA FLIGHT
Stationary Fuel Emissions Factors	EPA's GHG Emission Factors Hub
FUGITIVE EMISSIONS	
Fugitive Emissions from Natural Gas Distribution	EIA State Energy Summaries, EPA FLIGHT, Environmental Defense Fund's User Guide for Natural Gas Leakage Rate Modeling Tool.
Fugitive Emissions from Oil and Natural Gas Systems	EPA FLIGHT
INDUSTRIAL PROCESS & PRODUCT USE	
Industrial Process & Product Use	EPA FLIGHT

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SOLID WASTE

Waste Generation	Texas Commission on Environmental Quality's (TCEQ) Municipal Solid Waste in Texas: A Year in Review, 2021 Data Summary and Analysis
Closed Landfills	EPA FLIGHT data
Emissions Factors	EPA's Documentation for GHG Emission and Energy Factors used in the Waste Reduction Model
Waste Characterization	TCEQ's Study on the Economic Impacts of Recycling, Final Report 2017

AGRICULTURE, FORESTRY, AND OTHER LAND USE (AFOLU)

Agriculture: Livestock and Crops	U.S. Department of Agriculture's (USDA) 2017 Census of Agriculture, County Data
Forestry and Land Use	Land Emissions And Removals Navigator (LEARN) Tool
Agriculture Emissions Factors	EPA's State Inventory Tool (SIT) Agriculture Module
Forestry and Land Use	U.S. Forest Service's Forest Inventory and Analysis

2.2 GHG INVENTORY RESULTS

Table 2 summarizes the emission inventory by sector. A detailed breakdown of the inventory by sector and activity can be found in Appendix A (Table A-6).

The Alamo Area total emissions for all sectors totaled approximately 42 million metric tons of carbon dioxide equivalent (MTCO₂e) in 2021. To put it in more tangible terms, this is equivalent to emissions from:

- 9.8 million gasoline-powered passenger vehicles driven for one year,
- 554,000 tanker trucks' worth of gasoline,
- 5.6 million homes' energy use for one year,
- 11 coal-fired power plants in one year,
- 110 natural gas-fired power plants in one year, or
- 3.4 trillion smartphones charged.⁵

Combined, GHG emissions from electricity and fuel use in buildings across the residential, commercial, and industrial sectors is the Alamo Area's largest source of emissions (40%) – greater than transportation (Figure 3; Table 2). The transportation sector was the second largest contributor of GHG emissions in the baseline inventory, with approximately 34% of the total GHG emissions and on-road cars and trucks making up 30% of the total. The process and fugitive emissions sector was the

⁵EPA Greenhouse Gas Equivalencies Calculator: <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator#results>

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next largest contributor of GHG emissions (17%) due to multiple manufacturing facilities located in the region. Approximately 6% of the emissions were from agricultural sources, and approximately 3% were from solid waste management. The remaining emissions were from wastewater treatment, representing less than 1% of the inventoried emissions.

Table 2: Baseline GHG Inventory Results by Sector

SECTOR	METRIC TONS CO ₂ e
Transportation & Mobile Sources	14,191,349
Process & Fugitive Emissions	7,298,764
Residential Energy	6,622,535
Commercial Energy	6,474,139
Industrial Energy	3,647,006
AFOLU	2,374,986
Solid Waste	1,203,866
Water & Wastewater	60,152
Total	41,872,797

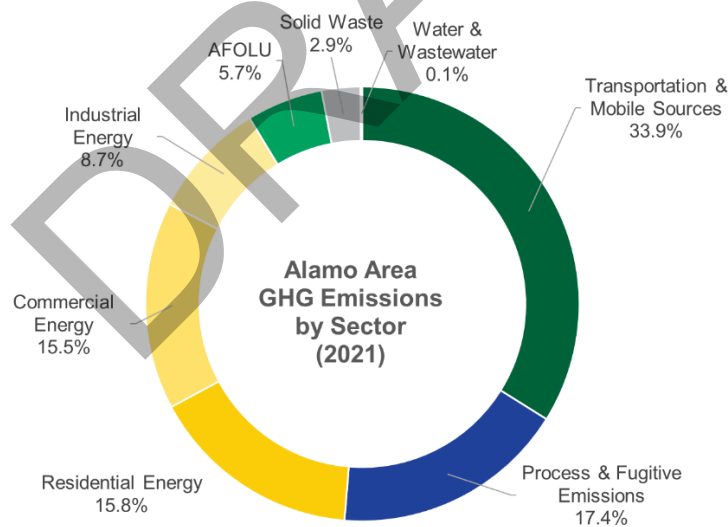


Figure 3: Baseline Inventory Results by Sector

2.3 INVENTORY TRENDS AND ANALYSIS

This 2021 baseline inventory is the first year for which an inventory was produced for the Alamo Area, and there are no previous inventories to evaluate for trends.

A Look at Other GHG Inventories in the Alamo Area

The City of San Antonio is the only municipality within the Alamo Area that has already established its own GHG inventory. The baseline inventory for the SA Climate Ready Plan was 2016 and the annual inventory was last updated for 2023 (publication pending). The results from San Antonio's annual inventory for 2021 can provide additional context for the Alamo Area baseline inventory. Despite the population increasing, emissions in San Antonio have decreased by 12.9% from 2014 to 2021 and 3.4% from 2019 to 2021 (Figure 4)⁶.

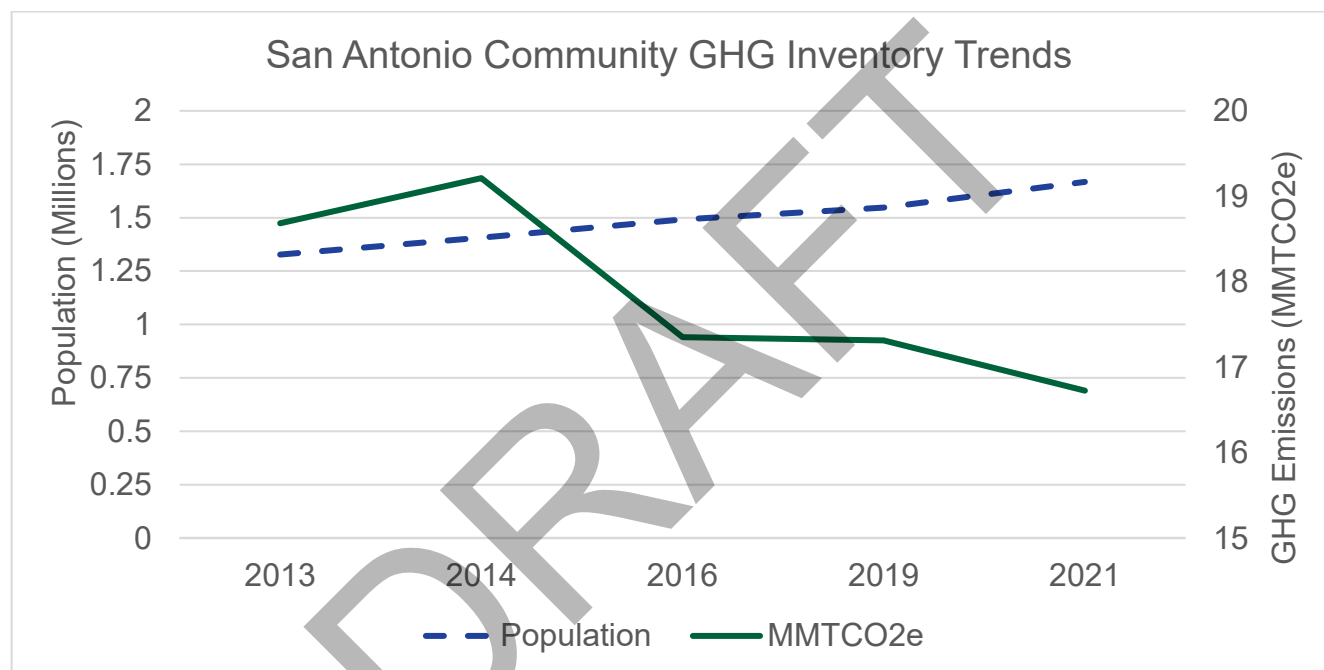


Figure 4: Trends in GHG Emissions for the City of San Antonio Community Inventory

In 2021, San Antonio reported a total of 16,726,428 MTCO₂e emitted, reflecting approximately 40% of the 2021 Alamo Area GHG inventory. The population of San Antonio represents 61% of the Alamo Area region. Like the Alamo Area, San Antonio's emissions were dominated by energy and transportation sectors. San Antonio reported nearly 6 million MTCO₂e from transportation, compared to approximately 14 MTCO₂e for the Alamo Area.

As a municipality, the City of San Antonio emitted 297,749 MTCO₂e in 2021 through operating city-owned landfills, buildings, facilities, vehicles, streetlights and traffic signals.

⁶ City of San Antonio 2021 GHG Inventory Report (2023).

<https://www.sanantonio.gov/Portals/0/Files/Sustainability/SAClimateReady/Greenhouse-Gas-Inventory-Community-Wide-2021.pdf>

Transportation and Mobile Sources

The transportation and mobile sources sector was the largest source of GHG emissions in the Alamo Area in 2021, with the largest contribution from on-road VMT of cars and trucks. The majority of the on-road transportation emissions in the Alamo Area are from Bexar County (65%) with neighboring Comal (9%), Guadalupe (7%), and Atascosa (4%) contributing the next most. This trend largely follows population density in the region (Figure 5).

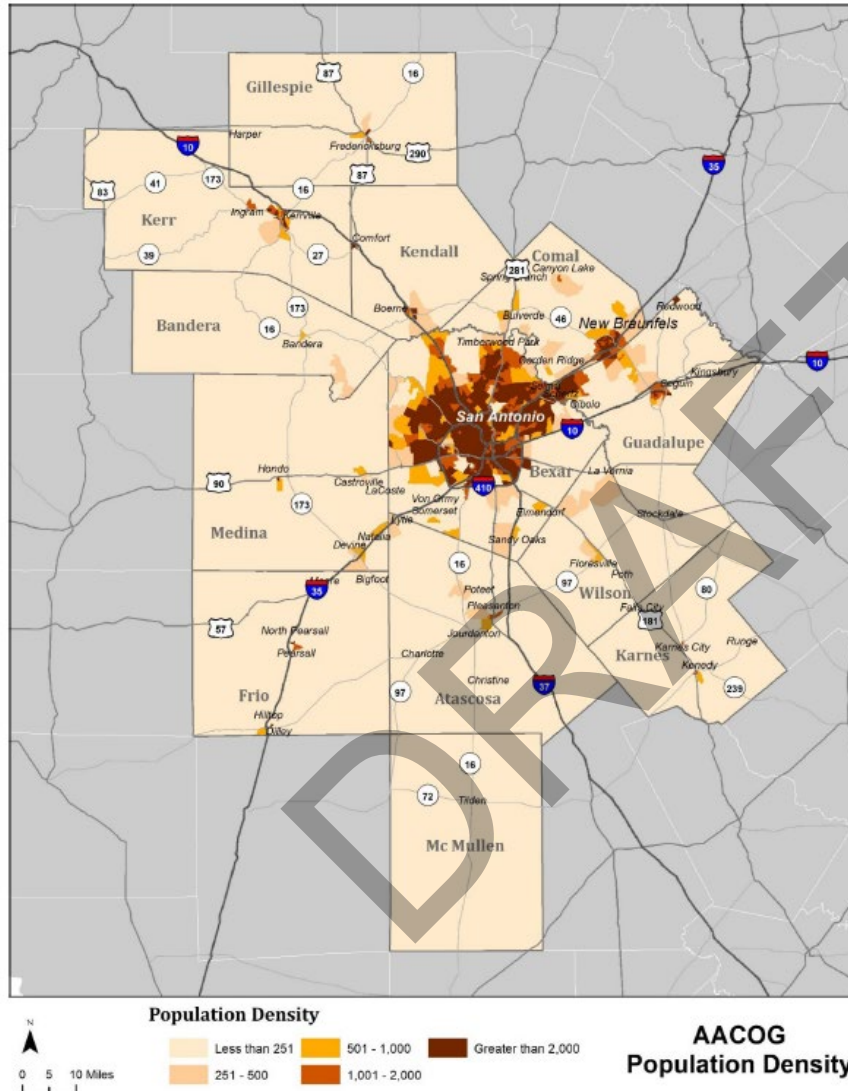


Figure 5: Alamo Area Population Density

Source: AACOG Regionally Coordinated Transportation Plan (2022)

Alamo Regional Transit (ART), a service of AACOG, along with the VIA, provides public transportation for the non-urbanized areas of Atascosa, Bandera, Comal, Frio, Gillespie, Guadalupe, Karnes, Kendall, Medina, and Wilson. In 2022, AACOG published its Regionally Coordinated Transportation Plan to enhance mobility programs for seniors and people with disabilities. ART partners with local

communities to implement local transit programs, such as the Atascosa Cowboy Connect and Connect Seguin.

Process and Fugitive Emissions

Process-related GHG emissions result from chemical or physical processes other than fuel combustion that are used by Alamo Area industries, such as production of cement, lime, iron and steel, electronics and oil and gas. Fugitive GHG emissions are unintentional releases of gases that escape directly into the atmosphere, which can happen from natural gas distribution pipelines, oil and gas extraction, and other industries. This sector represents a significant portion (17.4%) of the GHG inventory.

Energy

Combined, GHG emissions from electricity and fuel use in buildings across the residential, commercial, and industrial sectors is the Alamo Area's largest source of emissions – greater than transportation. For the purposes of this CCAP, these emissions are broken out by sectors: residential energy, commercial energy, and industrial energy.

In the Alamo Area, electricity is generated from a mix of sources and provided to consumers by CPS Energy, Lower Colorado River Authority (LCRA), and other purchased wholesale power. Community members in the Alamo Area receive power from their city,⁷ a cooperative,⁸ or a retail electric provider (REP). Most of these entities purchase wholesale power that they sell or distribute to community members, but they do not generate power themselves. Some of this electricity comes from CPS Energy or from power plants outside of AACOG, particularly from LCRA. LCRA's power supply is primarily natural gas, coal, and hydroelectric power.⁹

Over 8,000 MW of power capacity is sited within the AACOG counties (Figure 6; Table 3) including power plants supplying electricity to Alamo Area residents and those supplying wholesale power to electric utilities across Texas. Within the Alamo Area, CPS Energy operates multiple gas units, a coal plant, two landfill gas plants, solar farms, and battery storage, accounting for nearly 5,300 MW of power generated in the area.

In addition to CPS Energy, South Texas Electric Cooperative (STEC), and San Miguel power plants, approximately 28 operators run about a combined 2070 MW of additional power supply within the Alamo Area. STEC distributes power to nine electric cooperatives including four in the Alamo Area: Karnes, Medina, Nueces, and San Patricio. STEC operates three natural gas power plants, including a 200 MW natural gas plant in the Alamo Area, and purchases power from San Miguel Electric

⁷ Municipal utilities include CPS Energy, Seguin, San Marcos, Boerne, Luling, New Braunfels, Kerrville, and Fredericksburg.

⁸ Electric Cooperatives include Bandera, Guadalupe Valley, Central Texas, Pedernales, Bluebonnet, San Patricio, Medina, Karnes, and Nueces.

⁹ <https://www.lcra.org/energy/electric-power/#:~:text=Powering%20Central%20Texas%20%2D%20LCRA%20%2D%20Energy,as%20LCRA%20WSC%20Energy%20II.>

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Cooperative's 391 MW coal-fired power plant.¹⁰ San Miguel has plans to update the power plant to a solar and battery facility.¹¹

Outside of the Alamo Area, CPS Energy also owns a 40% stake in South Texas Project (nuclear), operates multiple solar farms,¹² and purchases power from wind farms in South and West Texas and other sources (Table 5).

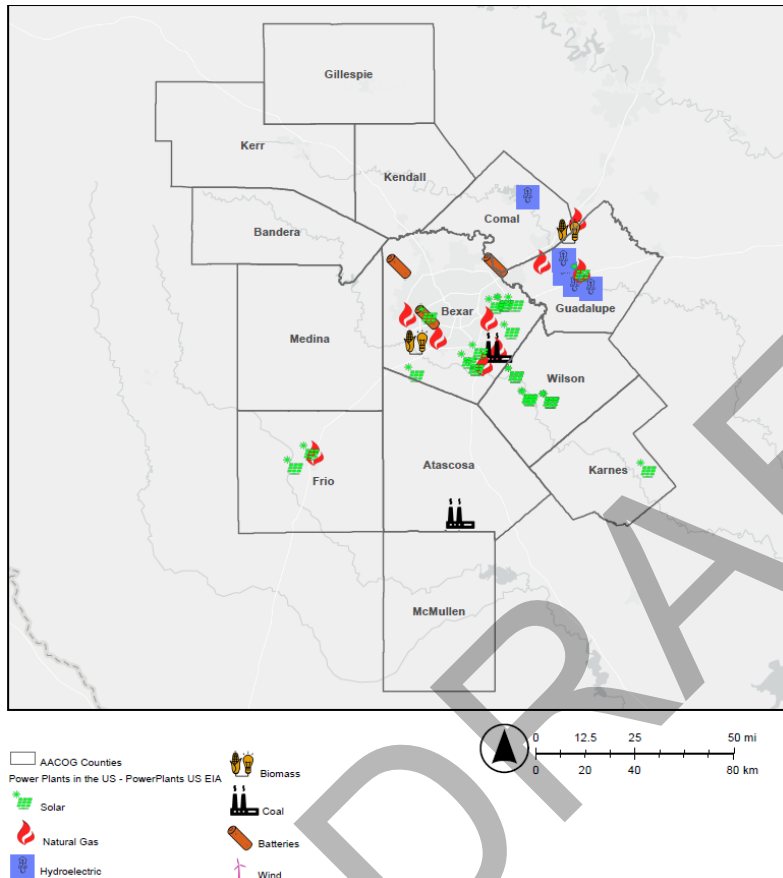


Table 3: Capacity Supplied by Each Energy Source for Power Plants Located in the Alamo Area.

Power Plant Primary Energy Source	Capacity (MW)
Batteries	227.8
Biomass	7.6
Coal	1,898.5
Hydroelectric	17.2
Natural Gas	5,072.6
Petroleum	5.8
Solar	587.5
Wind	235
TOTAL	8,052

Figure 6: Map of Power Plants in the Alamo Area

¹⁰ <http://www.smeci.net/about-us/our-operations>

¹¹ <https://www.texastribune.org/2024/12/20/texas-coal-fired-power-plant-conversion-clean-energy/>

¹² <https://www.cpsenergy.com/content/corporate/en/about-us/programs-services/energy-generation/solar-power.html>

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Table 4: Power Suppliers for Utilities and Cooperatives Across the Alamo Area

WHOLESALE SUPPLIER	UTILITY
LCRA	Luling, San Marcos, Fredericksburg, Bandera, Bluebonnet, Pedernales
ERCOT/wholesale	New Braunfels, Kerrville, Pedernales, Central Texas, Guadalupe Valley
BP Energy	Boerne
CPS Energy	Seguin
<i>San Marcos and Guadalupe Valley own part or all of their power plants in addition to purchasing power.</i>	

Table 5: CPS Energy Power Plant Capacity¹³

Power Plant Primary Energy Source	Capacity (MW)
Coal	1,345
Natural Gas	4,778
Solar (Owned)	6
Battery Storage (Owned)	10
Landfill Gas	4
Nuclear	1,029
Other Purchased Power	200
Wind (Purchased)	1,067
Solar (Purchased)	1,035
TOTAL	9,474

¹³ CPS Energy, Summary of Operational Power Generation as of 04/01/2025;
https://www.cpsenergy.com/content/dam/corporate/en/Documents/Trustees/PowerGenSlides_BoardPublicInformationSessionRequest_ada_081125.pdf

Agriculture, Forestry, and Other Land Use (AFOLU)

AFOLU is both a positive and negative source of emissions. GHG emissions from agriculture and land use arise from land management practices and natural systems, including methane emissions from livestock and nitrous oxide from fertilizer use. This sector contributes fewer overall emissions in the Alamo Area than the energy sectors, but it offers important opportunities for long-term carbon sequestration, emissions reduction, and resilience. Trees remove a significant amount of CO₂ through photosynthesis.

In urban areas, tree canopy loss and degraded green spaces reduce the landscape's ability to naturally store carbon. A little more than 10% of the Alamo Area is considered "Settlement" or developed areas of varying intensity (Figure 7). Approximately 15% of the Alamo Area's total land base is forest (Figure 7) and around 7.5% tree canopy on lands outside of forest.

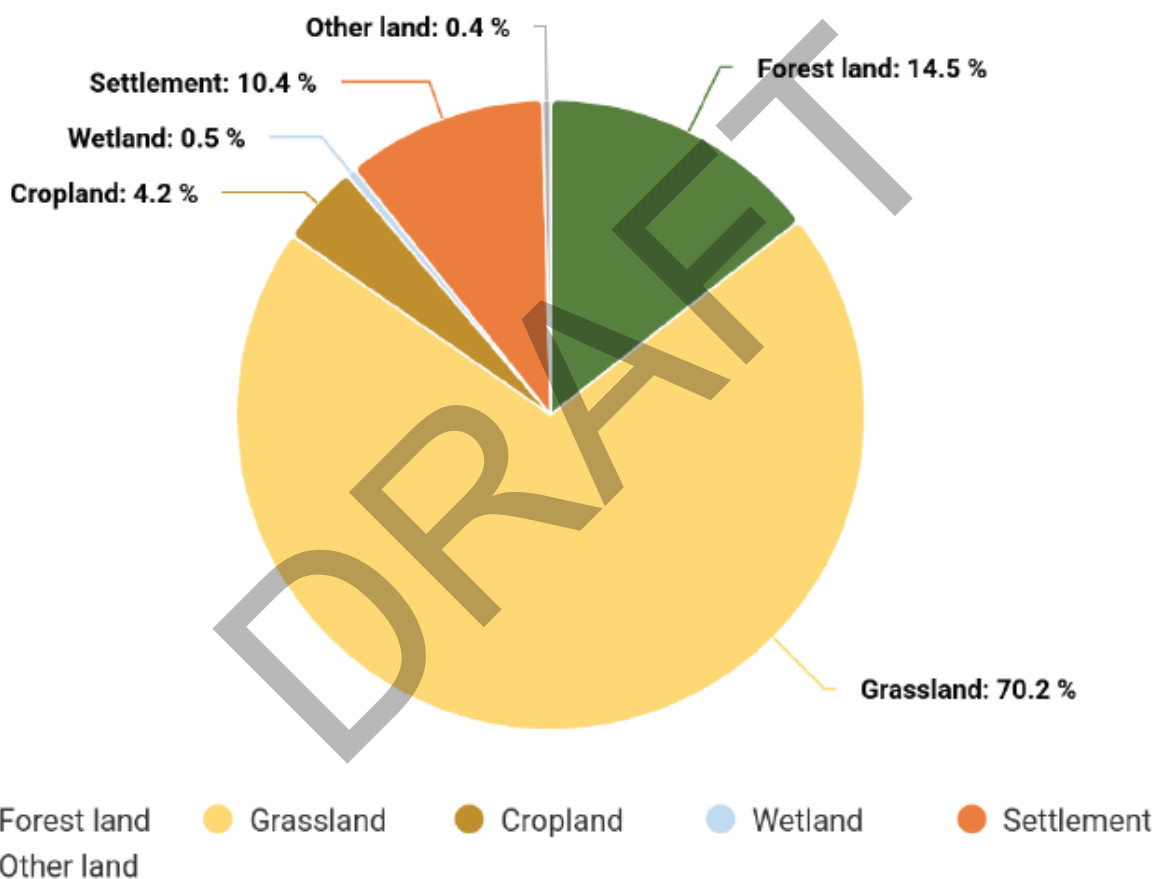


Figure 7: Percentage of Land Cover Types in the 13-County Region

Source: LEARN Tool (ICLEI)

Solid Waste

Solid waste contributes a modest 2.9% of the region's GHG emissions through landfill decomposition, food waste, and improper disposal of materials such as electronics. There are 8 operational landfills currently permitted in the Alamo Area (Table 6 and Figure 8).¹⁴ The majority of municipal solid waste processing facilities are commercially owned, with the City of Kerrville and COSA operating the only municipal transfer stations. The City of Kerrville also operates a compost facility. AACOG is the state designated planning agency for solid waste management issues in the region.

Table 6: List of Landfills and Remaining Years (Capacity)

Permit – Landfill Site	Remaining Years (as of 2024)
1410C – Tessman Road	32
2093B – Covell Gardens	64.5
66C – Mesquite Creek	7.1
1995 – City of Fredericksburg	8
1848A – Beck	3
2378 – Post Oak Municipal Solid Waste	227
1506B – City of Kerrville	417
571A – McMullen County	69

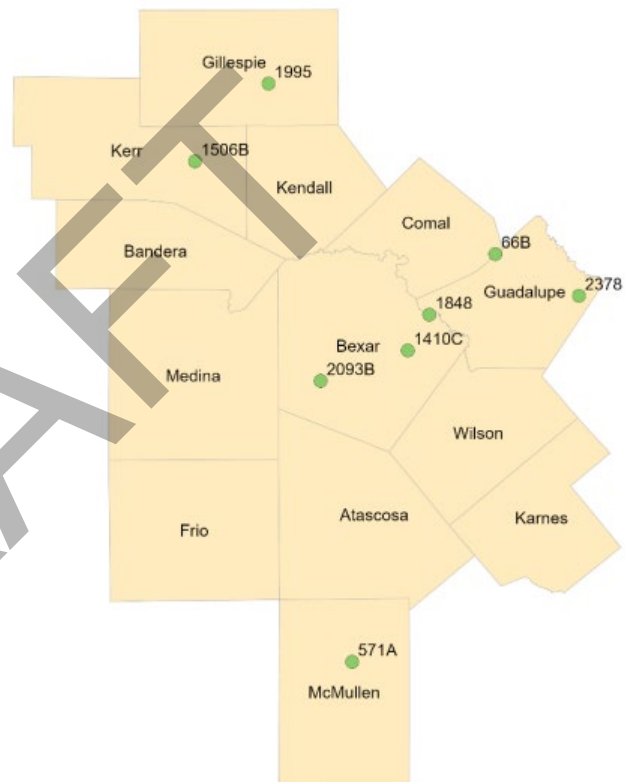


Figure 8: Landfill Locations in the Alamo Area

Based on 2024 disposal rates and the remaining capacity (tons), the reserve capacity (expressed in years) can be estimated for each landfill. Reserve capacity for landfills in the Alamo Area ranges from 3 to 417 years. While regional landfill capacity has not yet been exhausted, capacity will decline over time as waste volumes increase. Waste diversion through recycling, reuse, and reduction programs is a key strategy to preserve landfill space. The actions outlined under these measures aim not only to reduce landfill waste, but also to reduce overall waste generation, keeping materials in use for longer and supporting a circular economy. This approach focuses on waste reduction activities such as encouraging restaurants to reduce single-use plastics and supporting residents, schools, and

¹⁴ TCEQ Municipal Solid Waste in Texas: A Year in Review (2021)

institutions in minimizing waste at the source. Recycling services vary in the region, from COSA's curbside recycling and composting to county drop-off recycling centers available in Atascosa, Bexar, Comal, Gillespie, Medina, and Wilson.

Wastewater

Wastewater treatment systems contribute to GHG emissions through energy-intensive treatment processes and the decomposition of organic matter. Anaerobic treatment produces methane (CH_4), while both anaerobic and aerobic treatment processes can emit nitrous oxide (N_2O) because of microbial nitrification and denitrification of compounds in sewage. Additionally, unmanaged stormwater runoff can contribute to water pollution and strain infrastructure. A map of the region's wastewater treatment facilities is shown in Figure 9. Note: Emissions associated with the energy use involved with water and wastewater treatment, storage, and delivery are included in stationary energy. Emissions reported under Wastewater are primarily associated with N_2O emissions.

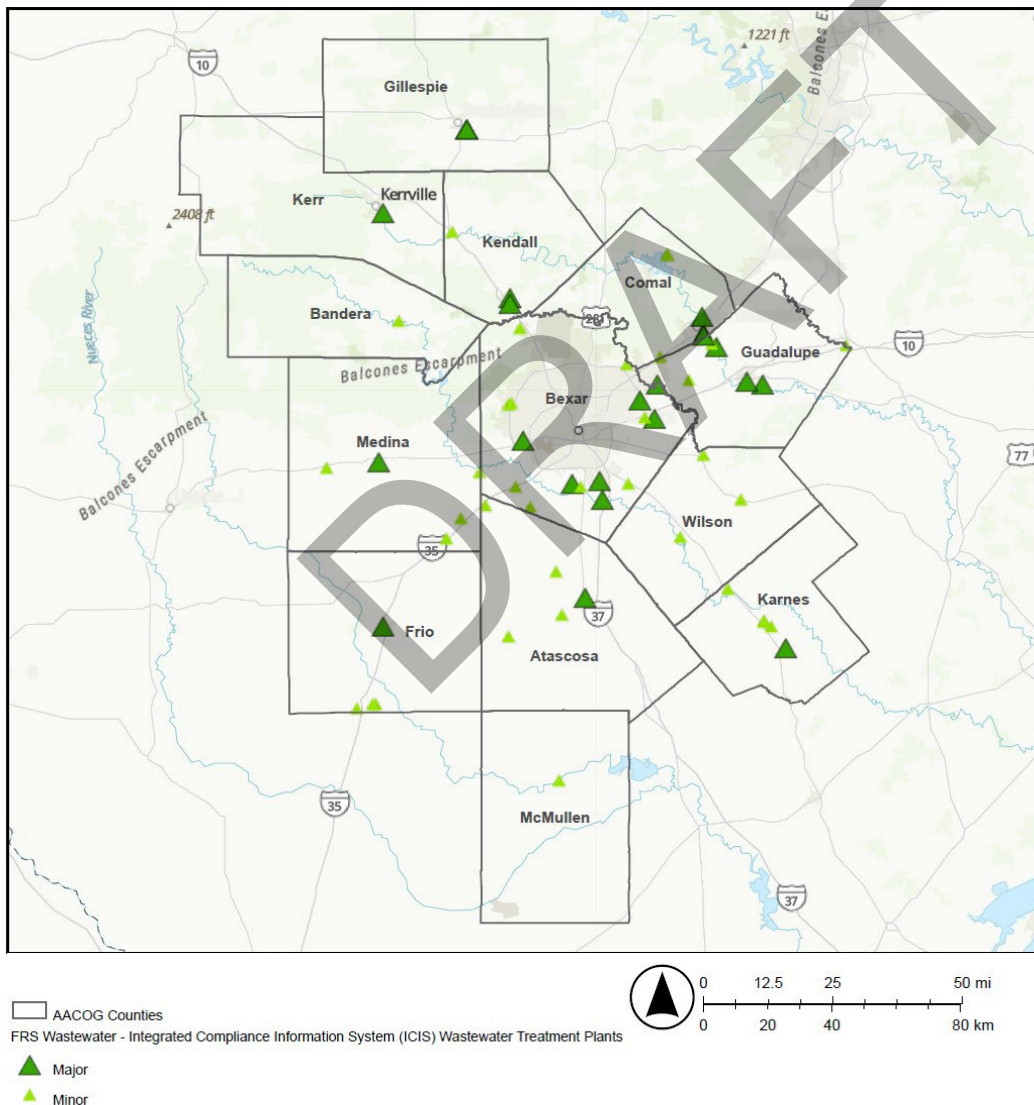


Figure 9: Map of Wastewater Treatment Plants in the Alamo Area

3.0 GHG Reduction Targets

As the Alamo Area continues to grow, AACOG recognizes that implementing sustainability and resiliency practices within its thirteen counties will be of the utmost importance to securing a sustainable future. The Alamo Area Climate Plan includes two sets of targets to guide this vision: A moderate but achievable goal and a stretch goal.

The stretch goal is designed to align more with the net-zero goal established by the City of San Antonio in SA Climate Ready, while acknowledging technology, policy, and market factors that make some sectors difficult to fully decarbonize.

The moderate but achievable goal is designed to align with existing market trends, utility and industrial plans already underway, and feasible electrification and efficiency improvements in buildings and transportation systems. This primary goal considers a realistic pathway for emissions reductions that supports the Alamo Area's economic momentum and quality of life through voluntary or market-based approaches.

Table 7: Goal Definitions and Target Years

GOAL	2030	2050
Moderate but Achievable	10% reduction from 2021 levels	50% reduction from 2021 levels
Stretch	30% reduction from 2021 levels	80% reduction from 2021 levels

4.0 BAU Emission Projections

4.1 BAU PROJECTION METHODOLOGY

The CCAP uses a Business-as-Usual (BAU) projection from the 2021 baseline GHG Inventory to 2030 and 2050. Projections were developed for each emissions source based on expected changes in activity levels and emissions intensity over time. Table 7 describes data sources, methodology, and assumptions for various growth rates used in the BAU projection.

Activity for most sectors was assumed to grow at a rate consistent with population growth and commercial growth. Growth assumptions for the transportation sector were provided by the TTI. No growth was assumed for the AFOLU and Process and Fugitive Emissions sectors.

BAU projections for energy use and transportation considered the effects of improved emission factors in the form of negative growth rates. Transportation emissions factors include the phasing in of on-road vehicle emissions and fuel economy regulations, as provided by TTI. Emission factors for electricity usage were based on the National Laboratory of the Rockies, previously National Renewable Energy Laboratory's (NREL), Mid Case Scenario¹⁵, which estimates an 87.33% reduction in Texas electricity grid emissions intensity from 2024-2050. This is an average annual change of 3.36%. This scenario does not account for any changes in federal law or funding priorities that occurred since 2024.

Table 8: Data Sources for BAU Projections

TYPE	DATA SOURCE	METHODOLOGY AND ASSUMPTIONS
Texas State Grid Projections to 2050: Electricity Carbon Intensity Rate	2021 baseline data from eGRID2021 and projection data from NREL's Cambium Scenario Viewer	n/a
Population Growth: Growth Rate (for various activities)	Texas Water Development Board	n/a
Commercial and Industrial Sq Ft Projections: Growth Rate	Greater:SATX	Combined county level total office & retail / Industrial Sq Ft, then projected from 2029-2050. Data was unavailable for some counties. Sq Ft projections went to 2028, so a log-linear model was used to project growth from 2029 to 2050.

¹⁵ [NREL Mid Case](#)

TYPE	DATA SOURCE	METHODOLOGY AND ASSUMPTIONS
On Road Transportation Projections: VMT Growth Rate and Emissions	TTI	Projected VMT and emissions by county, vehicle, and fuel type were provided for 2035 and 2050. Emissions were calculated using EPA's MOVES3. Emission factor model, which assumes emission standards and fuel economy regulations in place as of November 2020. Additional standards adopted since 2020 are not reflected in these projections.
Aviation Projections: Activity Growth Rate and Emissions	TTI	Projected aircraft fuel and emissions by county for 2023, 2035, and 2050.
Rail Activity Growth: Activity Growth Rate and Emissions	TTI	Projected fuel consumption and emissions by county and activity type for 2035 and 2050.

4.2 BAU PROJECTIONS RESULTS

BAU emissions were projected for each sector through 2050 as shown in and highlighted in Figure 10 and Table 8. Although emissions in the energy and transportation sector decline over time due to grid decarbonization and fuel efficiency standards, other sectors remain consistent or continue to rise alongside population growth.

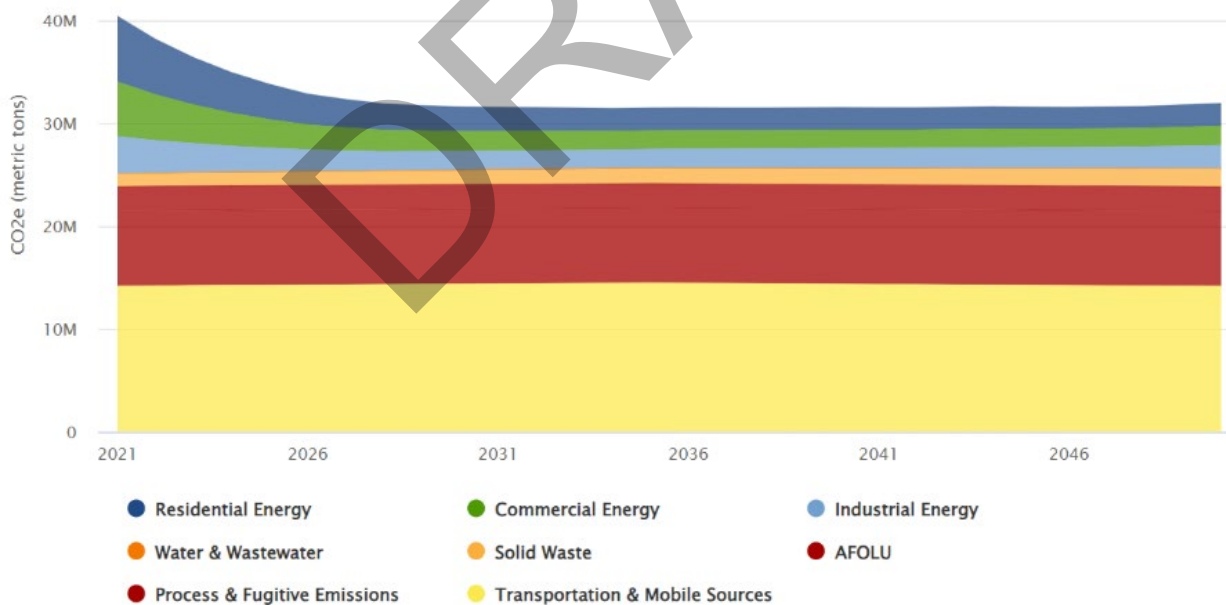


Figure 10: BAU Emission Projections by Sector

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Table 9: BAU Emission Projections by Sector

SECTOR	2021 BASE YEAR INVENTORY (MTCO ₂ e)	2030 BAU PROJECTION (MTCO ₂ e)	2050 BAU PROJECTION (MTCO ₂ e)
Transportation & Mobile Sources	14,191,349	14,391,238	14,187,814
Process & Fugitive Emissions	7,298,764	7,298,764	7,298,764
Residential Energy	6,622,535	1,189,530	2,194,317
Commercial Energy	6,474,139	1,936,335	1,875,902
Industrial Energy	3,647,006	1,822,026	2,265,716
AFOLU	2,374,986	2,374,986	2,374,986
Solid Waste	1,203,866	1,350,995	1,666,007
Water & Wastewater	60,152	67,501	83,240
Total	41,872,797	30,431,375	31,946,744

5.0 GHG Emission Reduction Measures and Implementation Scenario Projections

Emission reduction strategies were prioritized based on various criteria, including largest emitting activities/sources, significant impacts, implementation readiness, socioeconomic impacts on communities, general data availability, as well as other factors.

5.1 GHG EMISSION REDUCTION MEASURES SUMMARY

The Alamo Area has modeled GHG reduction impacts for the suite of reduction strategies outlined in the CCAP if implemented at full capacity. The emissions reductions associated with each strategy are summarized for years 2030 and 2050 in Table 11 below. The measures included are modeled with lofty goals, estimating near maximum levels of adoption of each strategy by the target population. Uptake will depend on market forces and interventions by local governments and other stakeholders in the Alamo Area. Section 5.3 focuses on how to reach these goals.

Table 10: Summary of Measures by Sector and Net GHG Reductions

	NET GHG REDUCTION (MTCO ₂ e)	
	2030	2050
<u>Transportation and Mobile Sources</u>		
<u>Measure 1:</u> Expand Travel Choice and Quality	174,020	524,387
<u>Measure 2:</u> Enable Consumer Access and Choice of Electric Vehicles (EVs)	2,499,554	9,981,514
<u>Measure 3:</u> Allow Freedom to Build and Bring Back Traditional Main Streets	120,654	419,509
<u>Process and Fugitive Emissions</u>		
<u>Measure 1:</u> Purchase Low-carbon Concrete from Local Producers	735,694	1,471,387
<u>Measure 2:</u> Methane Leak Detection and Repair Program (LDAR)	43,026	129,079
<u>Residential Energy</u>		
<u>Measure 1:</u> Energy Independence, Resilience, and Utility Bill Savings Through Increased Access to Zero-Emissions Energy Sources	241,040	486,015
<u>Measure 2:</u> Enable Residential Energy Savings Through Efficiency	140,050	444,315
<u>Measure 3:</u> Modernize Homes Through Electrification for Comfort and Savings	261,258	1,165,698



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	NET GHG REDUCTION (MTCO ₂ e)	
	2030	2050
Commercial Energy		
Measure 1: Create Business Value Through Solar Solutions for Commercial Properties	118,125	238,178
Measure 2: Eliminate Energy Waste for More Efficient Businesses	108,011	345,058
Measure 3: Modernize Commercial Buildings Through Electrification	177,389	786,801
Industrial Energy		
Measure 1: Optimize Industrial Energy Use	16,041	375,656
Measure 2: Unlock Rooftop and Ground-Mounted Potential for Industrial Solar	519	1,208
Measure 3: Modernize Industrial Facilities and Processes Through Electrification	241,712	955,786
Measure 4: Carbon Capture, Utilization, and Storage (CCUS)	0	168,578
Measure 5: Support Industrial Fuel Switching	178,870	115,170
AFOLU		
Measure 1: Protect, Enhance, and Expand Urban Ecosystems, Trees, and Green Spaces	265,918	3,133,386
Measure 2: Implement Agriculture Best Practices for Methane and Nitrous Oxide Emission Reduction	148,437	878,744
Measure 3: Support Urban-Rural Agricultural Connections	N/A	N/A
Solid Waste		
Measure 1: Improve Solid Waste, Recycling, and Compost Programs	121,588	488,974
Measure 2: Reduce Food Waste	228,504	394,498
Measure 3: Early-stage Landfill Gas (LFG) Collection Systems	540,488	633,853
Wastewater		
Measure 1: Monitor and Reduce Impacts of Stormwater	N/A	N/A
Measure 2: Energy and Compost from Wastewater	5,063	74,916
TOTAL	6,365,961	23,212,710

5.2 IMPLEMENTATION SCENARIO PROJECTIONS

The measures in this plan, if fully implemented under the BAU scenario and paired with significant electricity grid decarbonization and fuel efficiency, will achieve significant emissions reductions.

Table 11: Emissions Results of Implementation + BAU compared to Goals

Year	Full Implementation Scenario (MTCO ₂ e emissions)	Moderate, Achievable Goal (MTCO ₂ e emissions)	Stretch Goal (MTCO ₂ e emissions)
2030	24,065,416 (43% reduction from 2021)	✓ 37,685,517 (10% reduction)	✓ 29,310,958 (30% reduction)
2050	8,734,034 (79% from 2021)	✓ 20,936,399 (50% reduction)	8,374,559 (80% reduction)

These emissions reduction projections represent significant progress toward decarbonization while achieving numerous co-benefits including reducing utility costs, increasing resilience, and improving quality of life. The full implementation scenario for 2030 surpasses both emissions goals (Moderate, but Achievable and Stretch), resulting in a 43% reduction in GHG emissions from the 2021 baseline inventory. In 2050, the full implementation scenario depicts a 79% reduction from 2021, which surpasses the Moderate, but Achievable goal (50% reduction from 2021) and nearly meets the Stretch Goal (80% reduction from 2021).

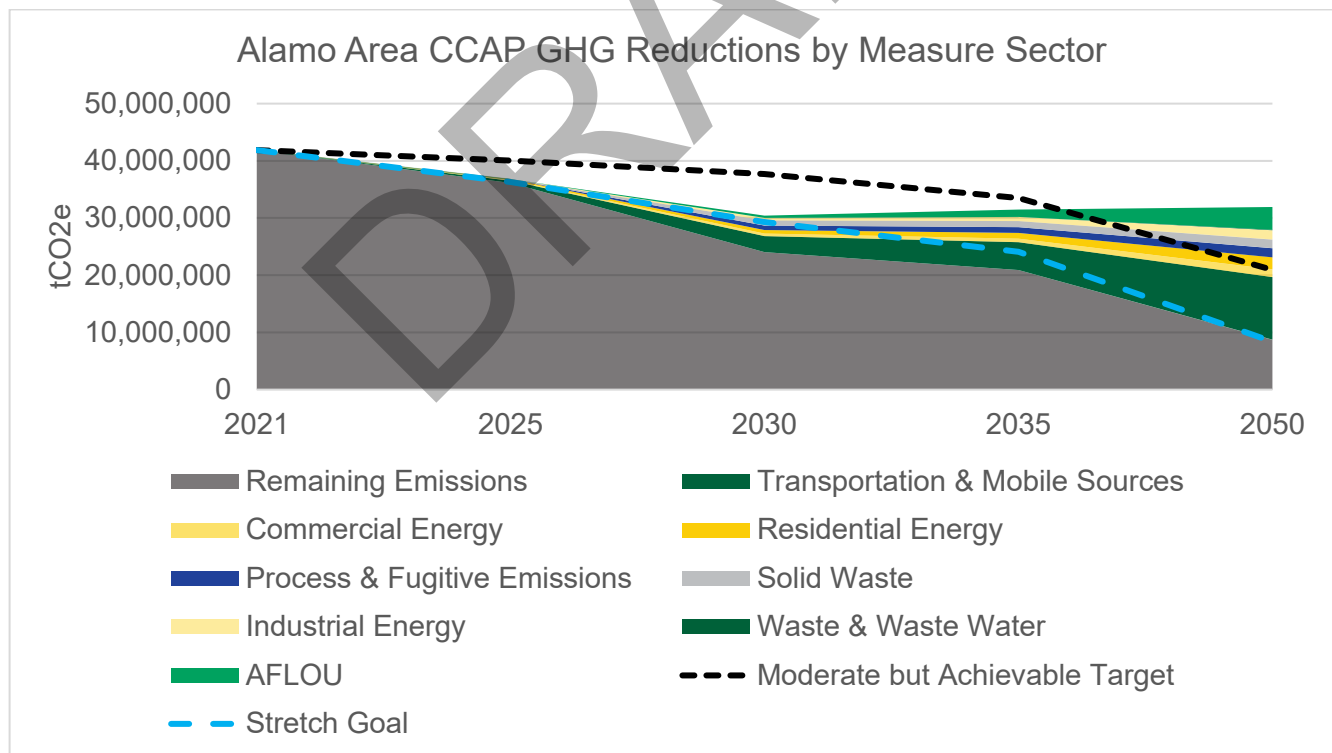


Figure 11: GHG Reductions by Measure Sector

5.3 GHG EMISSION REDUCTION MEASURES

Measures in this plan are voluntary and broadly applicable across municipalities and counties in the Alamo Area. Local governments can determine who is responsible for implementing each measure in coordination with the AACOG. This plan is presented as a guide for local communities and can be further refined by implementing partners. Where appropriate, communities can work independently or coordinate regionally to develop more detailed implementation plans at both the sector and measure levels.

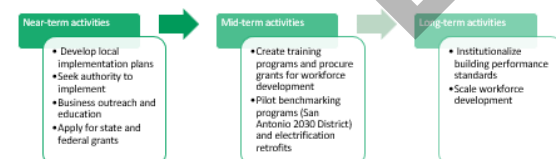
How to read:

In the following subsections, measures are described and grouped by sector.

- Tables in **green** introduce each sector and include summaries of implementation considerations, potential funding, co-benefits, and milestones.
- Tables in **blue** characterize each measure and include potential implementation partners, examples of related initiatives already underway, potential metrics for tracking, and quantified GHG emissions reduction under the full implementation scenario.

Commercial Energy Measures

<p>Implementation Considerations:</p> <ul style="list-style-type: none"> Leverage Commercial PACE (C-PACE) Financing: Implement C-PACE programs, standardize assessment agreements, and educate building owners on benefits. Integrate building electrification with modernization: Address permitting, workforce training, and utility infrastructure upgrades for widespread adoption of electric building systems and modernization. Adopt benchmarking and performance standards: Participate in DOE programs that support benchmarking of HVAC and energy use. <p>Existing Initiatives:</p> <ul style="list-style-type: none"> Commercial PACE: Administered by Texas PACE authority to offer low-cost financing for solar, HVAC, lighting, and resilience upgrades. Texas Energy Efficiency and Conservation Block Grant (EECBG): Administered by SECO to fund insulation, weather sealing, energy audits, and efficiency retrofits for municipally owned buildings as public meeting areas that serve as emergency shelters during disasters. Texas LoanSTAR (Saving Taxes and Resources) Revolving Loan: Administered by SECO to finance energy-related, cost-reduced retrofits of facilities supported by the state, including public school districts and colleges, as well as units of local government. Borrowers receive low-interest loans to help pay for these efforts and repay the loans from the energy cost savings realized by the projects. Utility Commercial Programs. <p>Co-benefits Summary:</p> <ul style="list-style-type: none"> Operational Cost Savings: Solar energy and energy efficiency lowers utility expenses and improves asset valuation and operational life. Grid resilience and demand management: Reduction in peak demand and improved energy security. Economic Development: Create demand for skilled trades.
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<p>Commercial Energy Measure 2: Eliminate Energy Waste for More Efficient Businesses</p> <p>Description: Partner with CPS Energy and other utilities to promote awareness of rebates for efficiency upgrades, support PACE financing to ease upfront costs, streamline permitting and zoning for retrofits, and adopt the latest IECC building codes to ensure high-efficiency standards in commercial buildings. Energy savings means a better bottom line for Alamo Area businesses.</p> <p>Supporting actions:</p> <ul style="list-style-type: none"> Host targeted outreach events for business owners to explain available rebates. Expand CPS Energy's STEP to include deeper retrofits or bundled upgrades. Improve technical assistance for businesses exploring PACE to identify eligible measures. Encourage and enable retro-commissioning to ensure energy assets are operating optimally. Eliminate outdated zoning restrictions on energy equipment (e.g., rooftop units or solar canopies). Offer builder training and compliance toolkits for the latest IECC standards. Explore the potential for district energy systems for heating and cooling. Support implementation of BSAG Programs. 		
<p>Geographic scope: All municipalities</p> <p>Implementing agencies and partners:</p> <ul style="list-style-type: none"> Electric utilities and providers AACOG Texas PACE Authority City / County planning departments Local builders, contractors, and code enforcement teams 	<p>Existing initiatives:</p> <ul style="list-style-type: none"> CPS Energy's STEP Program: Offers rebates for energy-efficient lighting, HVAC systems, insulation, etc. PACE Financing: Allows commercial property owners within participating cities and counties to finance energy efficiency projects. COSA and SAWS Downtown Chiller System. BSAG's Commercial Certification: Certified commercial projects are designed and built to perform above code. 	
<p>Potential metrics for tracking</p> <ul style="list-style-type: none"> Number of commercial projects receiving rebates. Number of projects completed. Annual MWh saved from upgrades. 		
<p>Quantified GHG emissions reduction impact (MTCO₂e)</p>	<p>2030</p> <p>108,011</p>	<p>2050</p> <p>345,058</p>
<p>GHG quantification method: Calculated in an Excel model based on the BAU projections developed in ClearPath.</p>	<p>Key assumptions include:</p> <ul style="list-style-type: none"> 3.85% of existing commercial building units receive efficiency retrofit per year. 20% Savings from efficiency retrofit of existing buildings. 25% Energy savings in new buildings. <p>For more details, see Appendix B.</p>	

Figure 12: Examples of Sector (Green) and Measure (Blue) Description Pages

Transportation and Mobile Sources Measures

Implementation Considerations

- **Land use & zoning reforms:** Encourage mixed-use, compact development to shorten trip distances and make walking, biking, and transit more accessible and enjoyable.
- **Stakeholder coordination:** Engage local governments, community members, and private developers to align incentives and policies.
- **Public outreach & education:** Raise awareness in communities of EV benefits, cost savings, and environmental impacts.

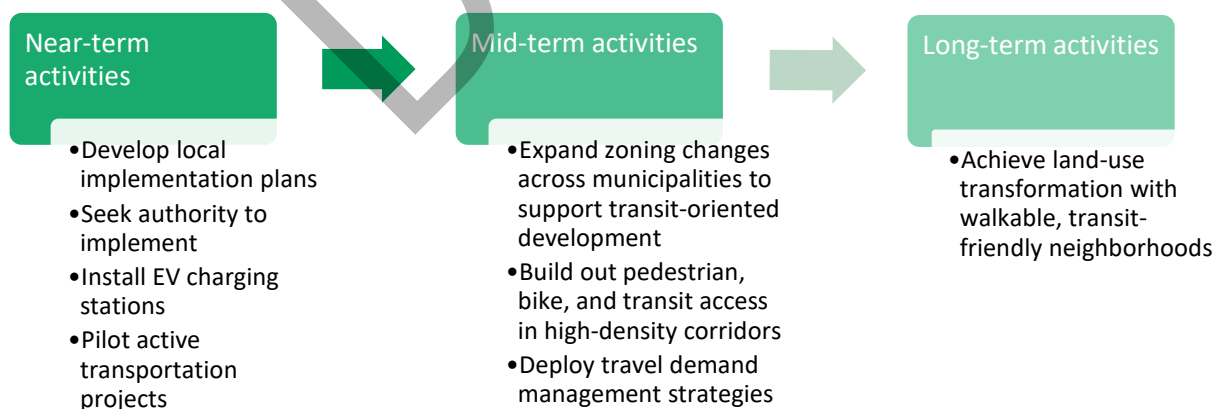
Funding Available

- **Congestion Mitigation and Quality (CMAQ) funds:** Administered locally by AAMPO, this program supports travel demand management, biking / pedestrian infrastructure, electric fleet vehicles, and diesel retrofits.
- **TERP & State incentives:** Texas Emissions Reduction Plan (TERP) supports alternative fuel vehicle adoption and charging infrastructure.
- **IJA Reconnecting Communities grants:** Provides funding for improving urban connectivity and low-carbon transportation access.

Co-benefits Summary

- **Public health improvement:** Cleaner air, more active lifestyles, fewer traffic crashes, and less noise pollution.
- **Economic resilience:** Cost savings (fuel, healthcare, maintenance), increased foot traffic, and local economic growth.
- **Social equity:** Inclusive access to transportation and mobility tools for underserved groups.
- **Climate impact:** Cumulative reductions in GHGs from lower VMT and higher EV adoption.

Timeline



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Transportation and Mobile Sources Measure 1: Expand Travel Choice and Quality		
<p>Description: Expand transportation options beyond single occupancy vehicles, reducing overall VMT. Coordinated regional planning and investments in new public transit, efficiency and service quality improvements in existing systems, walking and sidewalk infrastructure, micromobility, and Transit-Oriented Development (TOD) can improve connectivity between rapidly growing communities and support shorter, efficient trips.</p>		
<p>Supporting actions:</p> <ul style="list-style-type: none"> • Expand transit coverage, accessibility, and frequency. • Support and expand carpooling, vanpooling, and micro transit programs. • Promote active transportation and micromobility, including walking, biking, e-bikes, and e-scooters. Improve routes for walkability and bike-ability to enable increased use. Collaborate with San Antonio Mobility Coalition, hospitals, and health-focused nonprofits to increase uptake. • Implement planning and zoning strategies that encourage complete streets, connectivity, and access to amenities. 		
<p>Geographic scope: All municipalities</p>	<p>Existing initiatives:</p> <ul style="list-style-type: none"> • Alamo Commutes: A regional travel demand management (TDM) program encouraging alternatives to solo driving. • Public Transit: Advanced Rapid Transit (ART) and VIA, including VIA's Green and Silver Lines that support higher-frequency, higher-capacity regional travel. • Commute Solutions (Rideshare & Outreach Programs). • Small scale mobility solutions for the most vulnerable (i.e. senior or medically vulnerable transit services). • Active Transportation & Infrastructure Expansion: includes trails, bike lanes, and pedestrian safety upgrades. • Complete Streets for San Antonio policy and Equitable Transit-Oriented Development (ETOD) policy. • San Antonio B-Cycle Bike Share Program. • EECBG Low-Income E-Bike Rebate Program. • Howard W. Peak Greenway Expansion. • Great Springs Project. • AAMPO's Metro Area Resilience Plan. 	
<p>Implementing agencies and partners:</p> <ul style="list-style-type: none"> • Regional transit agencies • TCEQ • Public works and municipal sustainability offices • AACOG • AAMPO • Local governments, local employers, school districts, nonprofits • San Antonio Mobility Coalition, Activate SA, and other Alamo Area community partners • TXDOT 		
<p>Potential metrics for tracking</p>	<ul style="list-style-type: none"> • Ridership - rates of ridership, number of new riders • Rider cost savings, boarding and transit times, reliability and variability improvements. • Increase in coverage / area served. • Percentage of population with access. 	
<p>Quantified GHG emissions reduction impact (MTCO_{2e})</p>	<p>2030</p>	<p>2050</p>
	<p>174,020</p>	<p>524,387</p>
<p>GHG quantification method: Calculated in an Excel model based on the BAU projections developed in ClearPath.</p>	<p>Key assumptions include:</p> <ul style="list-style-type: none"> • 10% VMT reduction of gas vehicles by 2050. <p>For more details, see Appendix B.</p>	

Transportation and Mobile Sources Measure 2: Enable Consumer Access and Choice of EVs	
<p>Description: Support policies and programs that make EVs more accessible and attractive to consumers and fleet managers as alternatives to gasoline-powered cars. This includes expanding EV incentives, increasing charging infrastructure, and raising public awareness about the benefits of EV adoption, which include lower long-term operating costs, cleaner air, and improved performance. Modernize municipal fleets with high-performance EVs to reduce operating costs, improve performance, and promote cleaner air. This strategy should be paired with increasing use of zero-emissions energy sources and batteries.</p>	
<p>Supporting actions:</p> <ul style="list-style-type: none"> • Invest in public charging stations (free or paid). • Encourage fast chargers on highways and corridors. • Make charging more accessible using zoning (i.e., EV-ready/capable parking or curbside and public right-of-way charging). • Reward bidirectional charging and other grid services. • Group purchasing programs to reduce costs. • Replace light, medium, and heavy-duty municipal vehicles. • Replace school buses with electric options. • Work with electric utilities to offer off-peak charging incentives. • Provide local incentives for electric vehicles and fleet replacement. • Offer “cash for clunkers” programs. • Use building codes to ensure new homes are capable of charging EVs. • Targeted outreach to overcome barriers. • Collaborate with local new and used car dealers and mechanics, ensuring they have education and training to sell and repair EVs. 	
<p>Geographic scope: All municipalities</p>	<p>Existing initiatives:</p> <ul style="list-style-type: none"> • Alamo Area Clean Cities Coalition: Provides technical assistance, education, and resources for public and private fleets to adopt EVs. • Electric Vehicle San Antonio (EVSA): The City of San Antonio’s central EV initiative. • Texas EV Education Project: Collaboration with AAMPO to develop smart, community-informed EV infrastructure planning. • CPS Energy EV Charging Programs and Incentives: Supports charging infrastructure through Flex EV public charging programs. • AAMPO EV Infrastructure Planning: Manages federal planning funds for implementing EV charging stations. • COSA Municipal Fleet Electrification: Replacing light- and medium-duty internal combustion vehicles with EVs. • San Antonio ISD Electric Bus Deployment. • SAWS Fleet Electrification Program. • COSA Multi-family EV Charging Incentive Program.
<p>Implementing agencies and partners:</p> <ul style="list-style-type: none"> • AACOG, U.S. Department of Energy (DOE), TxDOT, Federal Highway Administration, municipalities, transit agencies • Vehicle dealers, manufacturers, and suppliers of EVs and plug-in-hybrids, fuel providers, garages, local utilities (water and energy), nonprofits • Local governments, fleet services, mobility stakeholders • Local public and private fleet operators, local businesses, commercial property owners, fleet stakeholders 	

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	<ul style="list-style-type: none"> • Drive EV Home: Educational tool from Build San Antonio Green to help consumers prepare their homes and buildings for EVs 	
Potential metrics for tracking	<ul style="list-style-type: none"> • Number of EVs purchased or leased by low-to-moderate-income households, businesses, and residents of multifamily buildings. • Average cost of EV after incentives / subsidies. • Number of public, business, or municipality owned/leased charging stations. • Charging station usage (number of sessions). • Percent of municipal fleet electrified. • Number of EVs deployed. • Number of staff trained on EV operations and maintenance. 	
Quantified GHG emissions reduction impact (MTCO₂e)	2030	2050
	2,499,554	9,981,514
GHG quantification method: Calculated in an Excel model based on the BAU projections developed in ClearPath.	<p>Key assumptions include:</p> <ul style="list-style-type: none"> • 95.63% of Gasoline VMT and 99.63% of Diesel VMT will switch to EVs by 2050 <p>For more details, see Appendix B.</p>	

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Transportation and Mobile Sources Measure 3: Allow Freedom to Build and Bring Back Traditional Main Streets		
Description: Create more livable neighborhoods with nearby amenities, increased green space access, and multiple transport options. Update the building and zoning codes to remove restrictive mandates while expanding as-of-right allowances to shorten trips, supporting walking, biking, and public transit use.		
Supporting actions: <ul style="list-style-type: none"> • Allow for mixed-use development. • Allow for more housing choices, including multifamily development. • Eliminate parking minimum mandates/requirements. • Streamline permitting. • Avoid restrictions that would limit EV charging. 		
Geographic scope: All municipalities	Existing initiatives: <ul style="list-style-type: none"> • TOD Zoning Update: Revises zoning along VIA's Green Line corridors to allow denser, mixed-use development. • River Improvement Overlay Districts: Permits high-density, mixed-use development along river corridors. • Complete Streets & Main Street Rehabilitation: Requires multimodal enhancements on any street project. • City of San Antonio Regional Center Planning 	
Implementing agencies and partners: <ul style="list-style-type: none"> • Local planning, transportation, and public works departments • Regional transit agencies • City Council, neighborhood associations, housing advocacy groups 		
Potential metrics for tracking	<ul style="list-style-type: none"> • Acres rezoned to TOD. • Housing affordability metrics (e.g., affordable units added). • Miles of sidewalks, bike lanes, and trails installed and/or improved. • Number of affordable housing units near amenities. 	
Quantified GHG emissions reduction impact (MTCO ₂ e)	2030	2050
	120,654	419,509
GHG quantification method: Calculated in an Excel model based on the BAU projections developed in ClearPath.	Key assumptions include: <ul style="list-style-type: none"> • 8% reduction in gasoline VMT by 2050 For more details, see Appendix B.	

Process and Fugitive Emissions Measures

Implementation Considerations

- **Procurement shifts:** Update public-sector specifications to include local and low-GHG criteria for cement and other building materials: target supply-chain CO₂ intensity, local sourcing zones, and blended cement usage rates.
- **Robust Leak detection and repair (LDAR) programs:** Ensure on-site fugitive emissions are minimized.
- **Data driven approaches:** Use instrument-based monitoring, and maintain a centralized LDAR database to identify leaks.

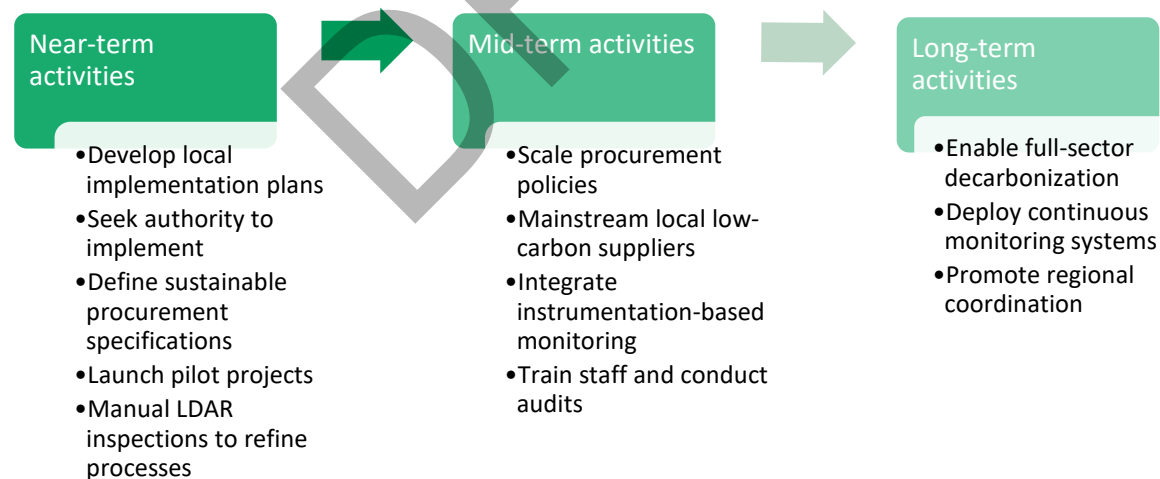
Resources Available

- **Carbon Leadership Forum Resource Library:** Hosts a variety of resources aimed at supporting designers, policy-makers, consultants, businesses, and building owners reduce embodied carbon

Co-benefits Summary

- **Public health:** Using low-carbon concrete can benefit public health by reducing air pollution, as it generates less dust and toxic emissions from clinker production. A robust LDAR program minimizes worker exposure to hazardous gas leaks and enhances emergency response in the event of a leak.
- **Operational & Financial:** By detecting fugitive emissions, counties and facilities avoid losing product and minimize waste. Faster leak detection means quicker repairs and less downtime. While initial costs may be higher, low-carbon concrete often offers superior durability and maintenance, reducing life-cycle costs.

Timeline



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Process and Fugitive Emissions Measure 1: Purchase Low-carbon Concrete from Local Producers		
<p>Description: Encourage the use of lower-impact concrete by adopting construction regulations that incentivize or require the use of locally produced cement—provided it has lower GHG intensity. Reduce process and fugitive emissions by sourcing lower-carbon cement made locally and by incorporating supplementary cementitious materials (SCMs). This measure will increase demand for low-carbon options that local manufacturers are already exploring.</p>		
<p>Supporting actions:</p> <ul style="list-style-type: none"> • Adopt and enforce low-carbon procurement policies by requiring EPDs, setting GHG intensity thresholds, and incentivizing the use of locally produced, SCM-blended cement in public construction projects. • Support local market development through partnerships with cement producers, creation of regional green materials registry, and funding for EPD development and pilot projects using low-carbon concrete. • Build institutional capacity and track progress by training staff, engaging contractors, incorporating embodied carbon into GHG inventories, and regularly evaluating policy effectiveness. • Support local carbon capture and storage (CCS) infrastructure development for the cement industry. Cement facilities release carbon from limestone; electrification alone will not decarbonize them. Carbon capture can be used to reduce emissions but requires capture, transport, and storage infrastructure as well as proper public engagement and monitoring to achieve emissions reduction results. 		
<p>Geographic scope: All municipalities</p>	<p>Existing initiatives:</p> <ul style="list-style-type: none"> • Alamo Cement Company Sustainability Commitment: Efforts to scale up clean power in the cement industry. • City of San Antonio Environmentally Preferred Purchasing Policy (EPPP): Enables the City's Procurement Division to favor eco-friendly products. 	
<p>Implementing agencies and partners:</p> <ul style="list-style-type: none"> • Regional industrial and manufacturing companies (e.g., Alamo Cement Company) • Municipal finance, procurement, and public works departments 		
<p>Potential metrics for tracking</p>	<ul style="list-style-type: none"> • Percent of public concrete procurements using low-carbon mix. • Tons/year of SCMs used. • Number of EPPP contracts requiring eco-criteria. 	
<p>GHG emissions reduction impact (MTCO_{2e})</p>	2030	2050
	735,694	1,471,387
<p>GHG quantification method: Calculated in an Excel model based on the BAU projections developed in ClearPath.</p>	<p>Key assumptions include:</p> <ul style="list-style-type: none"> • 20% reduction in cement production emissions by 2030. • 40% reduction in cement production emissions by 2050. <p>For more details, see Appendix B.</p>	

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Process and Fugitive Emissions Measure 2: Methane Leak Detection and Repair Program		
<p>Description: Implement a leak detection and repair (LDAR) program to reduce fugitive methane emissions, with a 60% annual reduction target for fugitive methane emissions with the purpose of reducing emissions from leaking equipment in industrial settings. Typical LDAR programs include elements such as regular monitoring of equipment for leaks using various inspection and detection methods, repair of any identified leaks, and conduct audits to ensure that the program is operating effectively.</p>		
<p>Supporting actions:</p> <ul style="list-style-type: none"> • Establish a comprehensive inventory of methane sources. • Develop leak detection protocols. • Set clear leak thresholds and repair deadlines. • Recordkeeping and reporting requirements. • Staff training and certification. • Establish a funding and incentive framework. • Integration with broader climate plans. • Community engagement and education. 		
Geographic scope: All municipalities	<p>Existing initiatives:</p> <ul style="list-style-type: none"> • Federal & State Regulatory Framework for LDAR: Standards require LDAR programs at refineries, processing plants, and gas facilities. 	
<p>Implementing agencies and partners:</p> <ul style="list-style-type: none"> • TCEQ • Railroad Commission of Texas • Natural gas refineries, private and municipal gas companies, petroleum and chemical industry associations • Nonprofits, universities/research institutions, environmental consultants 		
Potential metrics for tracking	<ul style="list-style-type: none"> • Percent of facilities enrolled in LDAR programs. • Leak repair time. • Annual methane reduction (%). • Methane leak volume captured (kg/year). • Number of compliance audits passed. 	
Quantified GHG emissions reduction impact (MT CO₂e)	2030	2050
	43,026	129,079
<p>GHG quantification method: Calculated in an Excel model based on the BAU projections developed in ClearPath.</p>	<p>Key assumptions include:</p> <ul style="list-style-type: none"> • 20% reduction in fugitive methane emissions by 2030. • 60% reduction in fugitive methane emissions by 2050. <p>For more details, see Appendix B.</p>	

Residential Energy Measures

Implementation Considerations

- **Streamline permitting for solar installations:** Update the permitting and contracting process to be faster, cheaper, and standardized. Develop solar-ready ordinances that require new homes to include appropriate roof structures, electrical panels, and wiring.
- **Upgrade building codes and construction standards:** Adopt the latest residential codes (including the International Energy Conservation Code, IECC) with strong thermal insulation requirements and solar-ready criteria.
- **Leverage financial incentives:** Educate and encourage the community to take part in federal and local incentives.

Funding Available

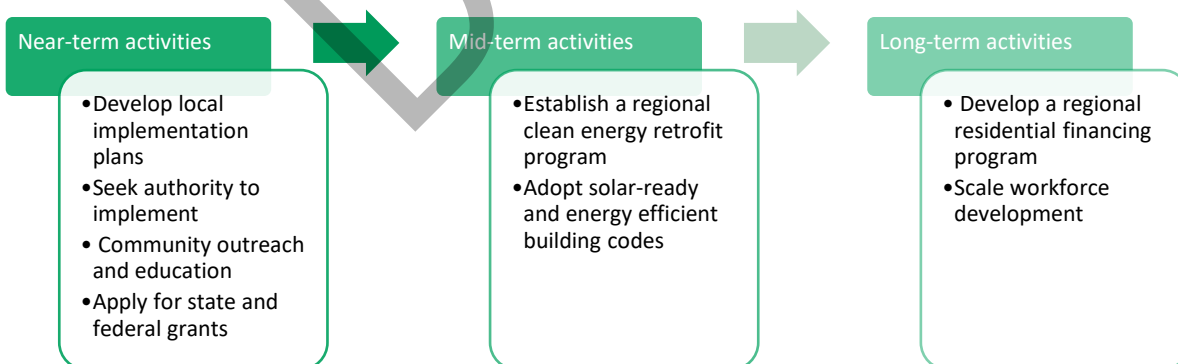
Home Efficiency Rebate (HOMES) and the Home Electrification and Appliances Rebate (HEAR) Programs: To be administered by SECO, the programs will give money back, through rebates, on household upgrade purchases that can lower monthly utility bills.

- **Weatherization Assistance Program:** Provides free or low-cost home retrofits for low income households.
- **Utility Incentives**

Co-benefits Summary

- **Long-term cost savings for residents:** Lower utility bills will improve economic resilience and community stability.
- **Public health improvements:** Improved air quality both indoors and outdoors will reduce negative health impacts and improve quality of life.
- **Local economic development:** Increased solar installation and energy efficiency upgrades will drive job creation for local skilled trades.

Timeline



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Residential Energy Measure 1: Energy Independence, Resilience, and Utility Bill Savings Through Increased Access to Zero-Emissions Energy Sources	
<p>Description: Pursue a multi-pronged strategy to increase use of renewable energy, including updating contracts for wholesale power purchase and enabling access to residential solar. Overcome barriers to access through options such as group purchasing programs to lower the cost of solar installations for homeowners, streamlining permitting processes to accelerate project timelines and reduce administrative barriers, and promoting the construction of solar-ready homes.</p>	
<p>Supporting actions:</p> <ul style="list-style-type: none"> • Launch a community solar co-op or campaign with nonprofit and installer partnerships. • Conduct outreach and education to increase resident awareness and participation. • Secure local incentives or rebates to stack with group discount pricing. • Integrate solar readiness into building codes and inspection checklists. • Encourage integration with batteries to provide resilience and grid services. • Mirror strategies of other utilities to increase access to distributed solar, e.g., working with third parties or utilities for solar leasing opportunities to allow more homes to use solar without putting in capital cost. • Leverage LIHEAP and utility incentives to install solar. • Work with utilities on Virtual Power Plant (VPP) programs to promote solar and storage microgrids. • Collaborate with electric utilities and cooperatives that own power plants to phase out coal power stations. With those that do not own power, encourage switching wholesale purchase contracts to utility-scale solar, wind, storage, geothermal, hydroelectric, or nuclear options. 	
<p>Geographic scope: All municipalities</p>	<p>Existing initiatives:</p> <ul style="list-style-type: none"> • “Bring Solar Home” Program by Build San Antonio Green (BSAG): City-backed program enabling homeowners to participate in group-buy solar campaigns. • AACOG SolSmart program: Technical assistance. • SolarApp+: Residential solar permitting. • Solar United Neighbors (SUN) Switch Together Program: A national program helping communities save money on solar through group purchases. • Bandera Electric Cooperative and Guadalupe Valley Electric Cooperative VPP programs through the Aggregated Distributed Energy Resource program. • San Miguel Electric Cooperative plans to switch coal power plant to solar and battery storage. • CPS Energy plans to phase out J.K. Spruce coal power plant and replace one unit with natural gas. • CPS Big Sun Solar Community Solar program. • Solar-Ready Homes Initiative: Promotion of the development of solar-ready homes.
<p>Implementing agencies and partners:</p> <ul style="list-style-type: none"> • Technical outreach provider (Bring Solar Home) • Electric utilities, coops, and REPs • Solar installers and registered contractors • Local Governments • AACOG 	
<p>Potential metrics for tracking</p>	<ul style="list-style-type: none"> • Number of homeowners enrolled. • Total residential solar capacity installed (kW). • Average permit approval time (days). • Number of energy burdened households receiving benefits.

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	<ul style="list-style-type: none"> Number of solar-ready homes constructed. 	
GHG emissions reduction impact (MTCO₂e)	2030	2050
	241,040	486,015
GHG quantification method: <i>Calculated in an Excel model based on the BAU projections developed in ClearPath.</i>	Key assumptions include: <ul style="list-style-type: none"> 446,745.14 kW installed capacity/year. 1,298.31 kWh/kW Generation Potential. For more details, see Appendix B.	

Residential Energy Measure 2: Enable Residential Energy Savings Through Efficiency	
Description: <i>Improve energy efficiency through comprehensive weatherization and insulation programs, which help seal homes and reduce heating and cooling needs, as well as through the promotion of efficient appliance programs that replace outdated or high-energy-use equipment with modern, energy-saving models. These efforts not only lower greenhouse gas emissions but also help residents reduce utility bills and improve indoor comfort.</i>	
Supporting actions: <ul style="list-style-type: none"> Expand eligibility and funding for low- and moderate-income households. Conduct community energy audits to identify homes with the greatest energy improvement potential. Offer targeted rebates or direct-install programs for energy efficient appliances. Bundle programs with solar or electrification incentives to reduce total home emissions. Offer additional home repairs to get homes “weatherization ready.” Provide more consumer education on energy efficiency and conservation. Increase training opportunities for weatherization professionals. 	
Geographic scope: <i>All municipalities</i>	Existing initiatives: <ul style="list-style-type: none"> AACOG Weatherization Assistance Program: Offers free weatherization services for eligible low-income homeowners and renters. CPS Energy Casa Verde Weatherization Program: Provides free efficiency upgrades to income-qualified homeowners and renters. CPS Energy’s Sustainable Tomorrow Energy Plan (STEP): Energy conservation program aimed at reducing community demand and promoting a low carbon future.

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<p>Implementing agencies and partners:</p> <ul style="list-style-type: none"> • AACOG • U.S. DOE & SECO • Electric utilities, cooperatives, and providers • Approved local contractors • Local Governments • Sustainability nonprofits (e.g., BSAG) 	<ul style="list-style-type: none"> • COSA Home Rehabilitation Programs: Aim to address health, safety, code, and/or accessibility issues that homeowners may be experiencing. • COSA Under 1 Roof Program: Assists homeowners in heat-vulnerable areas with replacing worn shingles with energy-efficient roofs and solar underlayment to reduce heat absorption and improve home energy performance. • COSA Green and Healthy Homes: Helps homeowners and landlords of residential properties in creating healthy, safe, energy-efficient and sustainable homes for families and children. • COSA Neighborhood and Housing Services: Minor and Major Repairs. • BSAG's Single Family Certification: Certified homes are designed and built to perform above code. 				
<p>Potential metrics for tracking</p>	<ul style="list-style-type: none"> • Number of homes weatherized annually. • Insulation measures installed (sqft. or linear ft.). • Estimated annual energy savings per home (kWh, USD). • Reduction in household energy burden (% income). 				
<p>GHG emissions reduction impact (MT CO₂e)</p>	<table> <tr> <th>2030</th><th>2050</th></tr> <tr> <td>140,050</td><td>444,315</td></tr> </table>	2030	2050	140,050	444,315
2030	2050				
140,050	444,315				
<p>GHG quantification method: calculated in an Excel model based on the BAU projections developed in ClearPath.</p>	<p>Key assumptions include:</p> <ul style="list-style-type: none"> • 3.85% of existing housing units receive efficiency retrofit per year. • 20% savings from efficiency retrofit of existing buildings. • 25% energy savings in new buildings. 				

Residential Energy Measure 3: Modernize Homes Through Electrification for Comfort and Savings

Description: Enhance the comfort and efficiency of homes by optimizing building codes to support all-electric homes and appliances, ensuring that new construction and major renovations are modernized for the 21st century through use of heat pumps and induction cook stoves. In parallel, collaborate with state agencies and local utilities to offer incentives that encourage homeowners to adopt energy-efficient, electric technologies.

Supporting actions:

- Adopt energy codes that support all-electric homes and appliances.
- Incentivize installation of high-efficiency electric appliances in new construction through zoning updates or energy code amendments.
- Offer pilot programs for retrofit projects to install high-efficiency electric appliances and upgrade circuit breakers in existing homes to test feasibility and gather cost-benefit data.
- Work with electric utilities to ensure homeowners can opt into having electrified appliances to support the grid through virtual/distributed power plant programs.

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- Target low- and moderate-income households with enhanced incentives to ensure equitable access to clean energy upgrades. Offer installer rebates, so the household isn't carrying the capital cost. Prioritize Heating, Ventilation, and Air Conditioning (HVAC), water heating, and cooking retrofits for incentives.
- Encourage participation in the SECO HOMES/HEAR program throughout the Alamo Area.
- Offer pay-as-you-save options for increased energy efficiency.
- Provide home repair/weatherization readiness (as well as education, outreach, engagement) to increase uptake of high-efficiency electric appliances. Ensure homes receive upgraded circuit breakers that can handle higher electric loads from increased appliances.
- Provide education and training resources to HVAC contractors on all-electric equipment.
- Collaborate with local colleges and unions to provide more training opportunities and wraparound services to increase the number of electricians and contractors.
- Work with utilities and cooperatives to support increased transmission and distribution system reliability throughout the Alamo Area.
- Provide education on electricity reliability.

Geographic scope: All municipalities	Existing initiatives: <ul style="list-style-type: none"> • New Home Construction Rebates: Offered by CPS Energy for new homes that exceed energy efficiency standards (15% more efficient than 2021 IEC Code). • SECO HOMES/HEAR program. 	
Implementing agencies and partners: <ul style="list-style-type: none"> • Electric utilities and providers • Sustainability nonprofits (e.g., BSAG) • AACOG • Local builders and contractors • Local sustainability departments 		
Potential metrics for tracking	<ul style="list-style-type: none"> • Number of homes built to electric-ready or all-electric code. • Percent of new construction that is all-electric. • Number of rebates issued for electric appliances. • Utility energy savings (kWh). • Participation by income level and neighborhood. 	
GHG emissions reduction impact (MT CO₂e)	2030	2050
	261,258	1,165,698
GHG quantification method: Calculated in an Excel model based on the BAU projections developed in ClearPath.	Key assumptions include: <ul style="list-style-type: none"> • 3.85% of existing housing units with natural gas electrified per year. • 85% (to 2030) and 100% (to 2050) of new construction electrified. • 3.58 Heat Pump Coefficient of Performance • 80% Furnace Efficiency. For more details, see Appendix B.	

Commercial Energy Measures

Implementation Considerations

- **Leverage Commercial PACE (C-PACE) Financing:** Implement C-PACE programs, standardize assessment agreements, and educate building owners on benefits.
- **Integrate building electrification with modernization:** Address permitting, workforce training, and utility infrastructure upgrades for widespread adoption of electric building systems and modernization.
- **Adopt benchmarking and performance standards:** Participate in DOE programs that support benchmarking of HVAC and energy use.

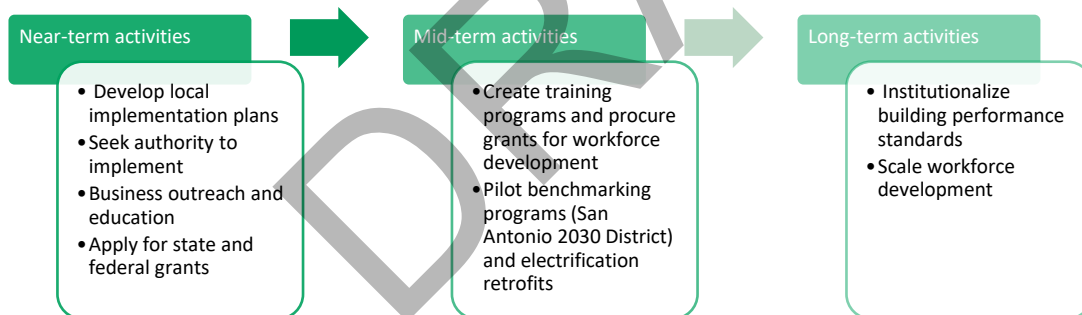
Funding Available

- **Commercial PACE:** Administered by Texas PACE authority to offer low-cost financing for solar, HVAC, lighting, and resilience upgrades.
- **Texas Energy Efficiency and Conservation Block Grant (EECBG):** Administered by SECO to fund insulation, weather sealing, energy audits, and efficiency retrofits for municipally owned buildings as public meeting areas that serve as emergency shelters during disasters.
- **Texas LoanSTAR (Saving Taxes and Resources) Revolving Loan:** Administered by SECO to finance energy-related, cost-reduced retrofits of facilities supported by the state, including public school districts and colleges, as well as units of local government. Borrowers receive low-interest loans to help pay for these efforts and repay the loans from the energy cost savings realized by the projects.
- **Utility Commercial Programs.**

Co-benefits Summary

- **Operational Cost Savings:** Solar energy and energy efficiency lowers utility expenses and improves asset valuation and operational life.
- **Grid resilience and demand management:** Reduction in peak demand and improved energy security.
- **Economic Development:** Create demand for skilled trades.

Timeline



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Commercial Energy Measure 1: Create Business Value Through Solar Solutions for Commercial Properties		
<p>Description: Advance a multifaceted approach to accelerate on-site solar adoption by commercial businesses enabling them to save on utility bills, hedge against utility rate increases, and increase brand value. Support pairing solar with battery storage to increase resilience, reduce demand charges, and increasingly get paid to be a grid asset. Promote awareness of commercial solar rebate programs and Property Assessed Clean Energy (PACE) financing. Streamline permitting and zoning to facilitate solar and energy storage adoption and adopt the latest IECC building standards to ensure that new and renovated commercial buildings are solar-ready and energy efficient.</p>		
<p>Supporting actions:</p> <ul style="list-style-type: none"> Expand and publicize utility rebate programs for commercial solar and energy storage, along with HVAC upgrades, lighting retrofits, and building envelope improvements. Collaborate with utilities to prioritize outreach to small and minority-owned businesses. Promote availability of PACE through local chambers of commerce and real estate networks. Provide technical assistance to help businesses develop project scopes and navigate approval. Remove permitting and zoning barriers to on-site solar, battery storage, and rooftop HVAC upgrades. Encourage integration with batteries to provide resilience and grid services. 		
<p>Geographic scope: All municipalities</p>	<p>Existing initiatives:</p> <ul style="list-style-type: none"> Commercial Solar & Community Solar Offerings: Allows commercial customers to own rooftop solar systems or subscribe to community solar. SolSmart Regional Certification and Technical Assistance (AACOG): Streamlining solar permitting, zoning, and inspection processes for commercial-scale projects. CPS Commercial Programs. COSA Municipal On-site Solar Program. PACE financing: Allows commercial and multifamily property owners within participating cities and counties to finance energy efficiency and solar projects. 	
<p>Implementing agencies and partners:</p> <ul style="list-style-type: none"> AACOG Local sustainability departments Electric utilities and providers Registered solar contractors, third-party developers 		
<p>Potential metrics for tracking</p>	<ul style="list-style-type: none"> Commercial solar capacity installed (kW or MW). Number of commercial customers participating in rooftop or community solar. PACE-funded solar projects (count, \$ invested, energy generated). 	
<p>GHG emissions reduction impact (MT CO₂e)</p>	2030	2050
	118,125	238,178
<p>GHG quantification method: Calculated in an Excel model based on the BAU projections developed in ClearPath.</p>	<p>Key assumptions include:</p> <ul style="list-style-type: none"> 1298.31 kWh/kW Generation Potential. 218,933.51kW installed capacity/year. <p>For more details, see Appendix B.</p>	

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Commercial Energy Measure 2: Eliminate Energy Waste for More Efficient Businesses		
Description: Partner with CPS Energy and other utilities to promote awareness of rebates for efficiency upgrades, support PACE financing to ease upfront costs, streamline permitting and zoning for retrofits, and adopt the latest IECC building codes to ensure high-efficiency standards in commercial buildings. Energy savings means a better bottom line for Alamo Area businesses.		
Supporting actions: <ul style="list-style-type: none"> • Host targeted outreach events for business owners to explain available rebates. • Expand CPS Energy's STEP to include deeper retrofits or bundled upgrades. • Improve technical assistance for businesses exploring PACE to identify eligible measures. • Encourage and enable retro-commissioning to ensure energy assets are operating optimally. • Eliminate outdated zoning restrictions on energy equipment (e.g., rooftop units or solar canopies). • Offer builder training and compliance toolkits for the latest IECC standards. • Explore the potential for district energy systems for heating and cooling. • Support implementation of BSAG Programs. 		
Geographic scope: All municipalities	Existing initiatives: <ul style="list-style-type: none"> • CPS Energy's STEP Program: Offers rebates for energy-efficient lighting, HVAC systems, insulation, etc. • PACE Financing: Allows commercial property owners within participating cities and counties to finance energy efficiency projects. • COSA and SAWS Downtown Chiller System. • BSAG's Commercial Certification: Certified commercial projects are designed and built to perform above code. 	
Implementing agencies and partners: <ul style="list-style-type: none"> • Electric utilities and providers • AACOG • Texas PACE Authority • City / County planning departments • Local builders, contractors, and code enforcement teams 		
Potential metrics for tracking	<ul style="list-style-type: none"> • Number of commercial projects receiving rebates. • Number of projects completed. • Annual MWh saved from upgrades. 	
Quantified GHG emissions reduction impact (MTCO_{2e})	2030	2050
	108,011	345,058
GHG quantification method: Calculated in an Excel model based on the BAU projections developed in ClearPath.	Key assumptions include: <ul style="list-style-type: none"> • 3.85% of existing commercial building units receive efficiency retrofit per year. • 20% Savings from efficiency retrofit of existing buildings. • 25% Energy savings in new buildings. For more details, see Appendix B.	

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Commercial Energy Measure 3: Modernize Commercial Buildings Through Electrification		
<p>Description: Update commercial buildings for the 21st century through electrification in combination with energy efficiency retrofits and integration of smart building technologies. The goal is to improve building performance by upgrading aging equipment such as HVAC systems, lighting, and insulation; transitioning from fuel-based systems to high-efficiency electric alternatives; and utilizing advanced energy management systems to optimize energy use. These improvements will reduce energy waste, improve local air quality, and enhance indoor comfort, while also helping businesses reduce utility costs and comply with updated energy codes and consumer expectations.</p>		
<p>Supporting actions:</p> <ul style="list-style-type: none"> • Conduct energy audits for medium and large commercial buildings to identify upgrade opportunities. • Develop a retrofit accelerator program for small and minority-owned businesses. • Incentivize replacement of gas-fired equipment with electric alternatives. • Promote use of building energy management systems (BEMS) to monitor and reduce energy use. • Combine electrification initiatives with targeted retrofit grant or rebate programs for lighting, HVAC, insulation, and windows upgrades. • Work with electric utilities to ensure businesses can opt into having electric assets to support the grid through virtual/distributed power plant programs. 		
<p>Geographic scope: All municipalities</p>	<p>Existing initiatives:</p> <ul style="list-style-type: none"> • PACE: Allows commercial property owners within participating cities and counties to finance energy efficiency projects. • CPS Energy Commercial & Industrial Programs: Rebates and incentives for energy efficiency upgrades in lighting, HVAC, and other systems. • COSA Energy Efficiency Fund: Finances energy conservation projects in municipal facilities. 	
<p>Implementing agencies and partners:</p> <ul style="list-style-type: none"> • Electric utilities and providers • Local governments • AACOG 		
<p>Potential metrics for tracking</p>	<ul style="list-style-type: none"> • Total energy savings (kWh). • Number of PACE-funded projects. • Number of buildings achieving Energy Star certification. • Annual avoided utility costs. 	
<p>GHG emissions reduction impact (MTCO₂e)</p>	2030	2050
	177,389	786,801
<p>GHG quantification method: Calculated in an Excel model based on the BAU projections developed in ClearPath.</p>	<p>Key assumptions include:</p> <ul style="list-style-type: none"> • 3.85% of existing commercial units with natural gas electrified per year. • 85% (to 2030) and 100% (to 2050) of new construction electrified. • 3.58 Heat Pump Coefficient of Performance (COP) • 80% Furnace Efficiency. <p>For more details, see Appendix B.</p>	

Industrial Energy Measures

Implementation Considerations

- **Industrial Energy Efficiency and Electrification Upgrades:** Conduct energy audits and install efficient motors, heat recovery, and electric boilers across heavy industry.
- **Scale On-Site Solar & Combined Heat & Power (CHP) Systems:** Incorporate rooftop or canopy solar plus CHP systems (electric + thermal).
- **Develop a Carbon Capture Utilization and Storage (CCUS) and Fuel-Switching Strategy:** evaluate suitability for CCUS or hydrogen blending, beginning with feasibility and transport/storage infrastructure planning.

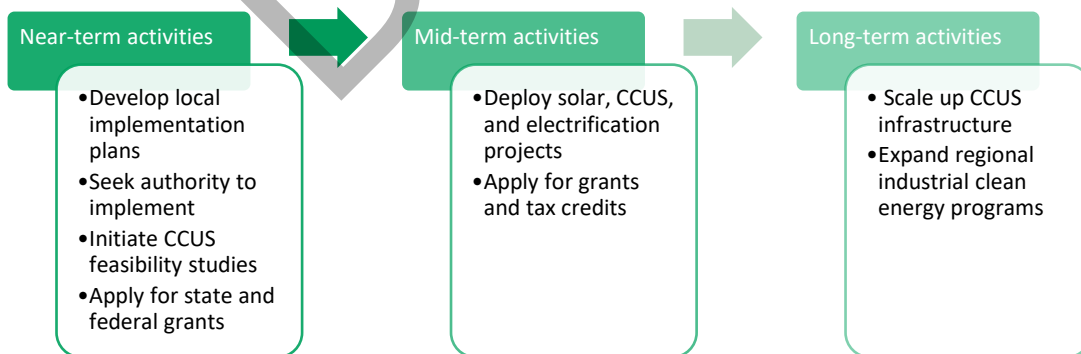
Funding Available

- **DOE Industrial Demonstration & Efficiency Grants:** Supports industrial decarbonization through grants to factories and materials processing facilities.
- **45Q Federal CCUS Tax Credits:** Tax credits for companies that capture and sequester or utilize carbon dioxide.

Co-benefits Summary

- Expands the local market for electric equipment installation, maintenance, and grid services.
- Enables integration with onsite renewables, battery storage, and demand response, enhancing resilience to power outages and price shocks.
- Improves air quality in overburdened communities.
- Supports clean technology innovation.
- Diversifies the energy supply and reduces dependency on natural gas and diesel.
- Spurs advanced manufacturing, job creation in electrolyzer and fuel technologies.

Timeline



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Industrial Energy Measure 1: Optimize Industrial Energy Use		
Description: Promote energy-efficient equipment upgrades, optimized process controls, and improved monitoring and maintenance practices to reduce industrial energy waste. Through energy audits and retro-commissioning, facilities identify inefficiencies and implement targeted improvements, lowering energy use, emissions, and operational costs while boosting sustainability and competitiveness.		
Supporting actions: <ul style="list-style-type: none"> • Conduct regular energy audits to identify inefficiencies and prioritize upgrades. • Provide incentives and rebates for installing high-efficiency motors, compressors, lighting, and HVAC systems. • Promote retro-commissioning programs to optimize existing equipment performance. • Encourage implementation of real-time energy monitoring and advanced process controls. • Encourage use of Onsite Energy Technical Assistance Program free screenings for energy efficiency and reliability options. 		
Geographic scope: All municipalities	Existing initiatives: <ul style="list-style-type: none"> • CPS Energy Commercial & Industrial Programs: Rebates and incentives for energy efficiency upgrades in lighting, HVAC, and other systems. • PACE: Allows industrial property owners within participating cities and counties to finance energy efficiency projects. • Texas A&M University Assessment Center: Provides free energy assessments for mid-sized industries focused on reducing utility costs, increasing energy efficiency, and enhancing productivity. 	
Implementing agencies and partners: <ul style="list-style-type: none"> • Electric utilities and providers • AACOG • Texas A&M University 		
Potential metrics for tracking	<ul style="list-style-type: none"> • Energy savings (kWh). • Number of assessments conducted. • Number of PACE-funded projects. • Value of rebates and incentives distributed. 	
GHG emissions reduction impact (MTCO_{2e})	2030	2050
	16,041	375,656
GHG quantification method: Calculated in an Excel model based on the BAU projections developed in ClearPath.	Key assumptions include: <ul style="list-style-type: none"> • 3% of facilities are engaged per year to implement energy efficiency. • 2% savings of total energy annually. For more details, see Appendix B.	

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Industrial Energy Measure 2: Unlock Rooftop and Ground-Mounted Potential for Industrial Solar		
<p>Description: Expand solar energy generation within the industrial sector by encouraging rooftop and ground-mounted solar systems and battery storage. These investments provide operations with long-term energy cost savings and reliability, hedges against utility rate increases, increase brand value, and create revenue as a grid asset. Partnerships with utilities to provide financial incentives, streamline zoning regulations and permitting processes to reduce project barriers, and promote innovative financing options such as PACE.</p>		
<p>Supporting actions:</p> <ul style="list-style-type: none"> • Develop and promote financial incentives for industrial solar. • Streamline permitting and zoning to reduce delays and administrative burdens for solar projects. • Facilitate access to finances by expanding programs like PACE financing to make upfront capital more accessible for industrial solar investments. • Update local energy policies to explicitly support industrial solar development and set targets for renewable energy adoption. • Provide education and resources to support industrial businesses in exploring the solar potential of their facilities. 		
<p>Geographic scope: All municipalities</p>	<p>Existing initiatives:</p> <ul style="list-style-type: none"> • CPS Energy's Simply Solar programs: Offers options for rooftop PV ownership, community solar subscriptions, and SolarHostSA model. • SolSmart Regional Certification and Technical Assistance (AACOG): Streamlining solar permitting, zoning, and inspection processes for industrial-scale projects. 	
<p>Implementing agencies and partners:</p> <ul style="list-style-type: none"> • Electric utilities and providers • AACOG • City governments 		
<p>Potential metrics for tracking</p>	<ul style="list-style-type: none"> • Solar capacity installed at industrial sites. • Number of industrial customers subscribing, hosting, or owning solar sites. • Permitting timelines (average approval time, number of permits). • Billing savings (kWh/year or \$ savings per facility) • Solar generation share in CPS Energy's portfolio (% and MWh/year). 	
<p>GHG emissions reduction impact (MTCO_{2e})</p>	2030	2050
	519	1,208
<p>GHG quantification method: Calculated in an Excel model based on the BAU projections developed in ClearPath.</p>	<p>Key assumptions include:</p> <ul style="list-style-type: none"> • 25MW of new industrial solar electricity generation capacity by 2050. • 1,499 kWh/kW per year generation. <p>For more details, see Appendix B.</p>	

Industrial Energy Measure 3: Modernize Industrial Facilities and Processes Through Electrification		
<p>Description: Support businesses as they modernize industrial facilities through electrification of equipment and processes to improve energy efficiency and performance. Replace outdated systems with high-efficiency electrified HVAC and industrial equipment combined with smart energy management systems that optimize electricity and thermal use. Where electrification is not feasible, facilities can pursue carbon capture or low-carbon fuels, as described in measures 4 and 5. Electrification will become more financially and technically feasible over time, so businesses should re-evaluate regularly.</p>		
<p>Supporting actions:</p> <ul style="list-style-type: none"> • Conduct energy audits to identify upgrade opportunities and prioritize improvements. • Provide incentives or rebates for electrified equipment and controls. • Expand access to financing tools like PACE or low-interest energy efficiency loans. • Streamline permitting and inspections for energy retrofit projects, including electrification. • Offer technical assistance and training in energy management and modernization strategies. • Develop benchmarking and reporting requirements to track and encourage performance improvements. • Create educational resources to support businesses with electrification. • Engage industry groups and local chambers to share best practices and lessons learned. 		
<p>Geographic scope: All municipalities</p>	<p>Existing initiatives:</p> <ul style="list-style-type: none"> • CPS Energy Commercial Solutions & CitySmart Programs: Offers technical assistance to industrial facilities for energy-efficient upgrades. • PACE Financing: Allows industrial property owners within participating cities and counties to finance energy efficiency projects. • Texas A&M University Assessment Center: Provides free energy assessments for mid-sized industries focused on reducing utility costs, increasing energy efficiency, and enhancing productivity. 	
<p>Implementing Agencies and Partners:</p> <ul style="list-style-type: none"> • Electric utilities and providers • AACOG • Texas A&M University 		
<p>Potential metrics for tracking</p>	<ul style="list-style-type: none"> • Number of industrial efficiency projects supported by rebates and PACE. • Annual energy saved (kWh/year). • Total value of PACE financing issued (USD). • Number of energy assessments completed. 	
<p>Quantified GHG emissions reduction impact (MTCO₂e)</p>	2030	2050
	241,712	955,786
<p>GHG quantification method: Calculated in an Excel model based on the BAU projections developed in ClearPath.</p>	<p>Key assumptions include:</p> <ul style="list-style-type: none"> • 25% of natural gas consumption electrified by 2030. • 70% of natural gas consumption electrified by 2030. • Average 2x efficiency gain with electrification. <p>For more details, see Appendix B.</p>	

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Industrial Energy Measure 4: Carbon Capture, Utilization, and Storage (CCUS)		
Description: Deploy CCUS technologies at industrial facilities to reduce direct GHG emissions. This involves capturing CO ₂ from high-emitting industrial processes, transporting it, and either storing it underground in secure geological formations or repurposing it for use in products like fuels or construction materials. CCUS can significantly reduce emissions from hard-to-abate sectors while supporting innovation and job creation in clean technology.		
Supporting actions: <ul style="list-style-type: none"> Identify suitable industrial sources for CCUS deployment, such as cement plants, refineries, or chemical facilities. Conduct feasibility studies to assess technical, economic, and environmental potential for CCUS at regional facilities. Develop regional CO₂ transport and storage infrastructure, including pipelines and geological storage sites. Create workforce training programs to build local expertise in CCUS installation, operation, and monitoring. 		
Geographic scope: All municipalities	Existing initiatives: <ul style="list-style-type: none"> Skymine: Industrial-scale carbon mineralization facility capturing CO₂ from cement flue gas, transforming it into carbon-negative baking soda. 	
Implementing agencies and partners: <ul style="list-style-type: none"> TCEQ Railroad Commission of Texas AACOG Industrial and manufacturing companies 		
Potential metrics for tracking	<ul style="list-style-type: none"> Number of industrial emitters enrolled. CO₂ capture rate (MT / year). CO₂ transported & stored (miles, MT / year). 	
Quantified GHG emissions reduction impact (MT CO₂e)	2030	2050
	0	168,578
GHG quantification method: Calculated in an Excel model based on the BAU projections developed in ClearPath.	Key assumptions include: <ul style="list-style-type: none"> 20% CCUS for remaining natural gas by 2030. 50% CCUS for remaining natural gas by 2050. For more details, see Appendix B.	

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Industrial Energy Measure 5: Support Industrial Fuel Switching		
<p>Description: Switch from high-emission fossil fuels to lower-carbon alternative fuels like green hydrogen, sustainably produced biogas, or renewable fuels such as renewable diesel or synthetic fuels. Fuel switching can significantly reduce industrial GHG emissions, improve local air quality, and enhance energy security by leveraging locally sourced low-GHG fuels. Costs and regional availability vary, so fuels should be evaluated alongside other decarbonization strategies and supply chains for careful assessment.</p>		
<p>Supporting actions:</p> <ul style="list-style-type: none"> • Conduct fuel use assessments across industrial facilities to identify key opportunities for switching to cleaner alternatives. • Expand grid capacity and reliability to support electrification of industrial processes. • Support green hydrogen and renewable fuel infrastructure (e.g., fueling stations, supply chains, blending facilities). • Facilitate pilot projects to demonstrate successful fuel-switching applications in high-impact sectors like cement or food processing. 		
Geographic scope: All municipalities	<p>Existing initiatives:</p> <ul style="list-style-type: none"> • Tessman Road RNG Project: Converts methane from Republic Services' Tessman Road Landfill into RNG. 	
<p>Implementing agencies and partners:</p> <ul style="list-style-type: none"> • Companies such as Republic Services (waste management and methane capture) and EDL North America (RNG processing) • CPS Energy and other utilities (utility injection and distribution) 		
Potential metrics for tracking	<ul style="list-style-type: none"> • Number of facilities implementing fuel switching. • Quantity of alternative fuels consumed. • Capital investment in fuel-switching infrastructure. • Air pollutant reductions. 	
GHG emissions reduction impact (MT CO₂e)	2030	2050
	178,870	115,170
<p>GHG quantification method: Calculated in an Excel model based on the BAU projections developed in ClearPath.</p>	<p>Key assumptions include:</p> <ul style="list-style-type: none"> • 30% of industrial fossil fuel use switched to low carbon fuels by 2050. <p>For more details, see Appendix B.</p>	

Agriculture, Forestry, and Other Land Use (AFOLU) Measures

Implementation Considerations

- **Land availability & zoning policies:** Counties can identify underutilized land (e.g., rights-of-way, park buffers) and adjust zoning to prioritize urban ecosystem expansion.
- **Species diversity & climate resilience:** Counties can consider native, drought-resistant species that thrive in South Texas and can sequester more carbon as recommended by regional ecological design principles.
- **Equity in access:** Ensure green space distribution addresses underserved neighborhoods, aligning with urban heat island relief and social equity goals.
- **Educational & cooperative programs:** Use AACOG and Alamo RCD workshops to build shared understanding and support among urban and rural stakeholders.

Funding Available

- **Urban & Community Forestry Grants (Texas A&M Forest Service):** Supports planting, equity, maintenance, and monitoring.
- **IRA Urban Forestry Funding via USDA Forest Service:** Supports planting, equity, maintenance, and monitoring.
- **USDA NRCS Conservation Programs (EQIP, CSP, ACEP, RCPP):** Supports climate-smart farming incentives, nutrient management, methane reduction, and small-scale forestry / agriculture eligible products.

Co-benefits Summary

- **Heat island reduction:** Greening urban areas lowers temperatures, improving comfort, and reducing energy use.
- **Public health benefits:** Access to parks and green views supports mental and physical wellbeing, and improves air quality.
- **Extended ecosystem services:** Grazing, rotational practices, and mature trees offer critical benefits like stormwater absorption, erosion control, shading, and improving biodiversity and water quality.
- **Local food resilience:** Shorter urban-rural supply chains decrease transportation emissions and improve food access.
- **Economic impact:** Create jobs in agriculture and forestry while supporting local producers and expanding regional food and land management infrastructure.

Timeline

Near-term activities

- Develop local implementation plans
- Seek authority to implement
- Launch pilot programs (planting, maintenance, farms, compost hubs)

Mid-term activities

- Scale planting
- Implement stewardship
- Expand agriculture practices
- Establish urban-rural linkages

Long-term activities

- Mature programs such as canopy maintenance, advanced carbon farming, and robust urban-rural cycles

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AFOLU Measure 1: Protect, Enhance, and Expand Urban Ecosystems, Trees, and Green Spaces		
<p>Description: Expand tree canopy coverage, preserving and maintaining existing mature trees, restoring native vegetation and soils, and increasing access to improved parks and natural areas. Support tree planting and restoration to enhance air quality, lower urban temperatures, support biodiversity, and promote community well-being while naturally capturing and storing carbon. Integrating green infrastructure into urban planning also builds resilience against extreme heat and flooding.</p>		
<p>Supporting actions:</p> <ul style="list-style-type: none"> Expand community-driven tree planting, reforestation, and municipality-led planting events with education on urban forestry. Offer incentives for native and drought-tolerant landscaping and support carbon crediting/offset programs for tree planting, maintenance, and land conservation. Prioritize communities vulnerable to urban heat and flooding and improve walkability and access to parks and green spaces. Develop green corridors linking parks, trails, and natural habitats to support biodiversity. Maintain and expand parks, urban natural areas, and equitable greenspace access. Strengthen tree preservation ordinances and protect mature and heritage trees. Conduct regular tree health/risk assessments; map protected trees and canopy zones. Allocate dedicated municipal funding for long-term tree maintenance. 		
<p>Geographic scope: All municipalities</p>	<p>Existing initiatives:</p> <ul style="list-style-type: none"> Green Shade Rebate programs: CPS Energy customers receive a rebate per tree planted in shade-critical zones. Tree Buds Citizen Forester Program: Trains volunteers to prune and care for young public trees. Urban Tree Care & Preservation Ordinance: Enforces tree preservation in development projects. COSA Parks and Rec's Communitree program targeting residential tree plantings based on UHI data. San Antonio Arboretum Expansion. Nonprofit Programs: Greenspaces Alliance, Bexar Branches Alliance 	
<p>Implementing Agencies and Partners:</p> <ul style="list-style-type: none"> USDA Forest Service Alamo Forest Partnership Local Arborists Associations Municipal parks & recreation departments 		
<p>Potential metrics for tracking</p>	<ul style="list-style-type: none"> Number of trees planted & maintained. Canopy cover percentage and expansion. Healthy tree survival rates and maintenance compliance. Funding per capita and program participation numbers. Percent of urban trees rated in good / excellent condition. Acres of green space receiving tree care or restoration. 	
<p>Quantified GHG emissions reduction impact (MTCO₂e)</p>	2030	2050
	265,918	3,133,386
<p>GHG quantification method: Calculated in an Excel model based on the BAU projections developed in ClearPath.</p>	<p>Key assumptions include:</p> <ul style="list-style-type: none"> Carbon sequestration from common trees used for urban forestry in the region. Targets to plant 200,000 new trees by 2030 and 500,000 new trees by 2050. <p>For more details, see Appendix B.</p>	

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AFOLU Measure 2: Implement Agriculture Best Practices for Methane and Nitrous Oxide Emission Reduction		
<p>Description: Reduce methane and nitrous oxide emissions from agricultural activities by promoting best management practices across crop and livestock operations. Strategies include optimizing fertilizer applications to reduce nitrous oxide emissions, adopting conservation tillage, planting cover crops, improving manure management systems, and enhancing feed efficiency for livestock to cut methane output. These practices not only lower greenhouse gas emissions but also improve soil health, water quality, and farm productivity.</p>		
<p>Supporting actions:</p> <ul style="list-style-type: none"> Promote the adoption of precision agriculture technology to optimize nitrogen use, minimizing N₂O emissions. Establish regional composting hubs for livestock manure and crop waste to convert organic matter into soil amendments. Launch a cost-share or grant program for farmers to adopt methane- and nitrous-reducing practices (no-till, cover crops, nitrification inhibitors) with technical support. 		
<p>Geographic scope: All municipalities</p>	<p>Existing initiatives:</p> <ul style="list-style-type: none"> Texas A&M AgriLife Extension & Practices Support: Supports best practices in pasture and crop management, soil testing, invasive species control, and nutrient management. Beef Cattle Course & Workshops: Trainings on livestock nutrition, health, pasture management, and drought resilience. 	
<p>Implementing Agencies and Partners:</p> <ul style="list-style-type: none"> Texas A&M AgriLife Extension Texas Master Naturalists AACOG Environmental Conservation 		
<p>Potential metrics for tracking</p>	<ul style="list-style-type: none"> Acres under nutrient management plans. Acres planted with cover crops or under conservation tillage. Number / percentage of livestock operations using improved manure management. Tons of manure composted or treated annually. Number of producers enrolled in conservation programs. 	
Quantified GHG emissions reduction impact (MT CO ₂ e)	2030	2050
	148,437	878,744
<p>GHG quantification method: Calculated in an Excel model based on the BAU projections developed in ClearPath.</p>	<p>Key assumptions include:</p> <ul style="list-style-type: none"> 5% of agriculture operations engaged annually to adopt best practices. 25% reduction in CH₄ and N₂O via adoption of best practices through 2030. 37% reduction in CH₄ and N₂O via adoption of best practices 2031-2050. <p>For more details, see Appendix B.</p>	

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AFOLU Measure 3: Support Urban-Rural Agricultural Connections		
Description: Strengthen urban–rural agricultural connections to promote climate-smart food systems and reduce emissions across the supply chain. By supporting local food production, processing, and distribution networks, the region can lower transportation-related emissions, increase access to fresh, regionally grown food, and enhance the resilience of both urban and rural communities. Key strategies include expanding farmers' markets, farm-to-school programs, community-supported agriculture, and local food hubs.		
Supporting actions: <ul style="list-style-type: none"> Invest in or partner with regional food hubs to aggregate, process and distribute local farm products. Launch a county level initiative encouraging schools, hospitals and public agencies to buy a percentage of food from local producers. Encourage cold storage, processing, and packaging facilities to increase the viability of local supply chains. Develop purchasing policies that prioritize local, sustainable producers for public institutions. 		
Geographic scope: All municipalities	Existing initiatives: <ul style="list-style-type: none"> Garcia Street Urban Farm: 4-acre urban farm that distributes produce directly to surrounding food-insecure neighborhoods. Alamo RC&D “Farm to Fork” & Food Councils: Regional initiative connecting rural growers with communities, food pantries, and institutional buyers. SAMHD and Food Policy Council’s urban agriculture grant pilot program. Food Bank Mission San Juan farm is an example of sustainable urban agriculture practices. Nonprofit Programs: Gardopia Gardens and Greenspaces Alliance. 	
Implementing Agencies and Partners: <ul style="list-style-type: none"> Local farmers and producers County food councils, schools, churches Local food banks Agriculture educators Local governments and institutions 		
Potential metrics for tracking	<ul style="list-style-type: none"> Acres farmed and diversity of produce (lbs). Number of food councils & markets. Volume / value of local food procured. 	
Quantified GHG emissions reduction impact (MT CO₂e)	2030	2050
	N/A	N/A
GHG quantification method	GHG emissions have not been quantified for this measure because the reductions are captured in multiple other measures in this plan.	

Solid Waste Emissions Measures

Implementation Considerations

- **Ensure broad access and equity:** Multifamily housing often lags in recycling participation due to fewer bins and less outreach. Alamo Area counties can provide standardized bin service and scale public education to reduce contamination rates.
- **Address commercial and residential streams:** Addressing household, restaurant, and grocery store food waste can dramatically reduce landfill input.
- **Overcome cost barriers:** Low landfill fees reduce incentive for e-waste programs. Counties may need to subsidize convenient drop-off sites, especially in smaller jurisdictions.

Funding Available

- **Congestion Mitigation and Air Quality (CMAQ) funds:** Primarily transportation-focused, targeting waste-hauling efficiency improvements (e.g., routing optimization, vehicle upgrades), and integrating compost and recycling collection into curbside routes.
- **Texas Property-Assessed Clean Energy (TX-PACE) program:** Finance eligible solid-waste facility upgrades (e.g., LFG capture, composting equipment).
- **Federal Recycling & Composting Infrastructure Grants:** Including Solid Waste Infrastructure for Recycling and Recycling Education & Outreach program.

Co-benefits Summary

- **Energy savings & pollution prevention:** Recycling reduces upstream extraction, production, and transport emissions, saving fossil energy and cutting air pollution.
- **Economic development & jobs:** Recycling and composting facilities generate more local employment per ton than landfills or incinerators.
- **Nutrient recovery & soil enhancement:** Compost replenishes soils, enhancing moisture retention, fertility, and reducing reliance on synthetic fertilizers.
- **Prevents toxins & recovers materials:** Proper e-waste handling keeps heavy metals and pollutants from leaching, while recapturing valuable materials (e.g., rare earths).

Timeline

Near-term activities

- Develop local implementation plans
- Seek authority to implement
- Acquiring funding
- Launching pilot and outreach programs
- Preliminary monitoring

Mid-term activities

- Scaling successful pilots and outreach programs
- Deploying infrastructure
- Optimizing operations

Long-term activities

- Continually monitoring emissions
- Ensuring funding cycles
- Continual improvement cycles using community benchmarking

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Solid Waste Measure 1: Improve Solid Waste, Recycling, and Compost Programs		
<p>Description: Expand access to curbside recycling, organics collection, and electronic waste recycling by improving public education, increasing convenient drop-off and collection options, and partnering with certified recyclers. Enhancing material recovery facilities and diverting food waste, yard waste, recyclables, and e-waste from landfills reduces methane emissions, prevents environmental contamination, preserves landfill capacity, and supports the creation of valuable products like compost, recycled materials, and recovered components.</p>		
<p>Supporting actions:</p> <ul style="list-style-type: none"> Expand infrastructure and access to curbside recycling, composting, material recovery facilities, and e-waste collection through permanent drop-off sites, mobile/community events, and partnerships with certified recyclers. Increase public education and outreach to reduce hazards and contamination, boost participation, and encourage waste reduction behaviors among residents, businesses, schools, and institutions. Adopt supportive policies and incentives, including mandatory diversion ordinances, pay-as-you-throw pricing, and permitting reforms. Enhance regional coordination and tracking by aligning standards, collaborating with stakeholders, and monitoring diversion and emissions data. Develop educational programs that encourage restaurants to not provide single-use plastic utensils or napkins unless requested by the customer. 		
Geographic scope: All municipalities	Existing initiatives:	
<p>Implementing Agencies and Partners:</p> <ul style="list-style-type: none"> AACOG Municipal solid waste management departments Certified e-waste recyclers 	<ul style="list-style-type: none"> COSA's Green Cart Program offers curbside collection for yard or food waste. AACOG Solid Waste Grant to support local projects that reduce landfill waste. COSA's E-Waste Recycling Program provides residents with multiple permanent drop-off locations for electronics. Tech Dump San Antonio: Local organization that promotes e-waste recycling and refurbish electronics for reuse. 	
Potential metrics for tracking	<ul style="list-style-type: none"> Tons or pounds of e-waste collected. Number of participating households, businesses, and institutions in e-waste programs. Number and geographic distribution of permanent e-waste drop-off locations. Quantity of materials recovered and recycled. 	
GHG emissions reduction impact (MT CO₂e)	2030	2050
	121,588	488,974
<p>GHG quantification method: Calculated in an Excel model based on the BAU projections developed in ClearPath.</p>	<p>Key assumptions include:</p> <ul style="list-style-type: none"> 40% solid waste diversion rate from landfills by 2030 50% solid waste diversion rate from landfills by 2050 0.8% of landfilled waste is e-waste. 20% recycling of currently landfilled e-waste by 2030 30% recycling of currently landfilled e-waste by 2050 <p>For more details, see Appendix B.</p>	

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Solid Waste Measure 2: Reduce Food Waste		
Description: Reduce food waste by diverting it from landfills through zero-waste programs and supportive policies. Implement collection systems for food waste from grocery stores, restaurants, and institutional kitchens. Prioritize donation of edible food to shelters and food banks, redirect inedible food to animal feed when appropriate, and compost remaining waste to minimize methane emissions and support soil health.		
Supporting actions: <ul style="list-style-type: none"> Establish food donation programs by partnering with food banks and shelters and incentivize donations from grocery stores and restaurants. Implement commercial food waste collection systems for businesses, schools, and institutions to separate and divert food scraps. Support food repurposing and composting infrastructure by connecting with farms for animal feed and expanding composting facilities. Launch public education campaigns to prevent food waste and promote responsible food purchasing, storage, and disposal. 		
Geographic scope: All municipalities	Existing initiatives: <ul style="list-style-type: none"> Too Good To Go: App that lets restaurants and bakeries sell surplus food as “surprise bags”. San Antonio Composting Project: Community compost program offering curbside pickups and school vermicomposting. 	
Implementing Agencies and Partners: <ul style="list-style-type: none"> Local restaurants and grocery stores Local food banks and shelters School districts and universities 		
Potential metrics for tracking	<ul style="list-style-type: none"> Tons or pounds of food waste diverted from landfills. Percentage of total municipal solid waste made up of food waste. Number of participating households, businesses, and institutions in food waste programs. 	
GHG emissions reduction impact (MT CO₂e)	2030	2050
	121,588	488,974
GHG quantification method: Calculated in an Excel model based on the BAU projections developed in ClearPath.	Key assumptions include: <ul style="list-style-type: none"> 50% reduction in food waste by 2030 70% reduction in food waste by 2030 For more details, see Appendix B.	

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Solid Waste Measure 3: Implement Early-stage Landfill Gas (LFG) Collection Systems		
<p>Description: Implement early-stage and ongoing LFG management at active and closed landfills to capture methane and other GHGs, which includes installing gas collection systems, monitoring emissions with advanced detection technologies, conducting regular site inspections, and applying corrective measures such as capping or flaring. These actions reduce potent methane emissions and allow captured methane to be used as an energy source. Use cleaned LFG for power generation when feasible.</p>		
<p>Supporting actions:</p> <ul style="list-style-type: none"> Require early-stage LFG collection systems in all new or expanding cells and collaborate with operators to pilot and implement these systems. Enhance gas capture during active operation through interim soil or synthetic covers, regular methane monitoring using ground-based sensors, drones, or infrared cameras, and prompt corrective actions such as system expansion, capping, or flaring. Offer financial incentives, like low-interest loans, grants, or tax credits, to help landfill operators offset upfront installation costs. Ensure regulatory compliance with TCEQ and EPA requirements through reporting, inspections, and methane threshold tracking. Invest in staff training and technology upgrades. Repurpose closed landfill sites into solar farms, or "brightfields," creating renewable energy while reclaiming land unsuitable for other developments. 		
<p>Geographic scope: All municipalities</p>	<p>Existing initiatives:</p> <ul style="list-style-type: none"> COSA's Southside Landfill LFG Recovery System. Bexar County Regional Landfill Monitoring programs to measure and optimize methane capture efficiency. Methane-to-RNG at Tessman Road Landfill: Capture methane from gas wells at this landfill and convert it to RNG. Texas landfills are implementing required methane monitoring, gas capture, and reporting systems. 	
<p>Implementing Agencies and Partners:</p> <ul style="list-style-type: none"> Municipal solid waste management and public works departments TCEQ AACOG Electric utilities and providers Landfill operators 		
<p>Potential metrics for tracking</p>	<ul style="list-style-type: none"> MWh of electricity generated from LFG. Number of facilities using LFG for thermal or power applications. Volume of LFG captured. Number of landfills with operational or early-stage LFG collection systems. 	
<p>Quantified GHG emissions reduction impact (MTCO₂e)</p>	2030	2050
	540,488	633,853
<p>GHG quantification method: Calculated in an Excel model based on the BAU projections developed in ClearPath.</p>	<p>Key assumptions include:</p> <ul style="list-style-type: none"> 60% methane collection efficiency by 2030 90% methane collection efficiency by 2050 90% reduction in CO₂e through flaring and/or electricity generation <p>For more details, see Appendix B.</p>	

Wastewater Emissions Measures

Implementation Considerations

- **Policy & Permitting:** Counties will need to adopt MS4 compliance, and coordinate regionally to align policies with the City of San Antonio's Regional Storm Water Management Program (RSWMP).
- **Maintenance & Monitoring:** Conduct water quality testing and evaluate green infrastructure installations over time to optimize design and maintenance.
- **Engagement:** Educate public and stakeholders, collaborate regionally by sharing data, pooling resources (as done via RSWMP), and coordinating regional capital improvements.

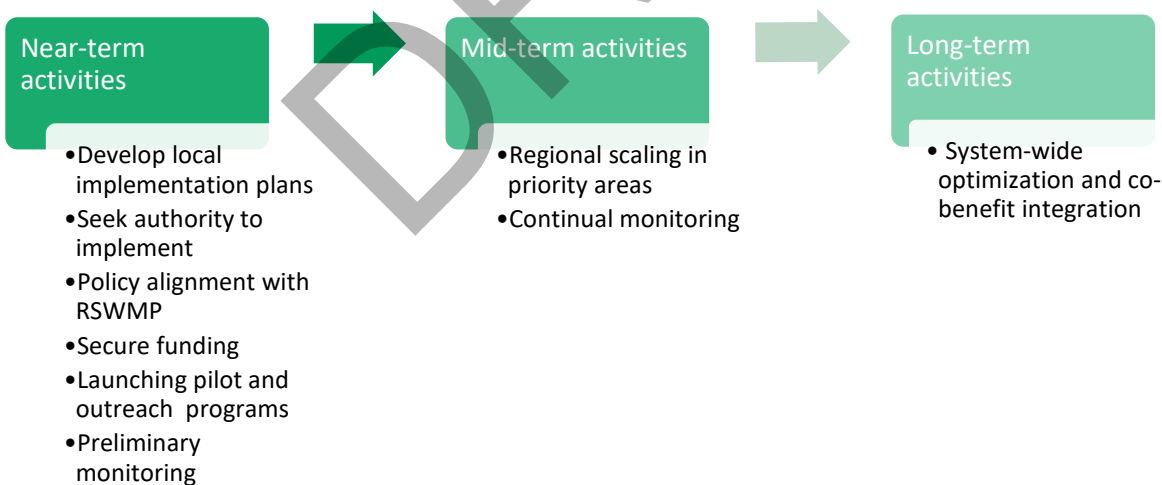
Funding Available

- **Texas Section 319(h) Nonpoint Source (NPS) Grants:** Administered by TCEQ and TSSWCB, these grants support retrofits, stream restoration, water quality monitoring, public outreach, and watershed planning.
- **Clean Water State Revolving Funding (CWSRF):** EPA-managed low-interest loans for stormwater infrastructure, green infrastructure, and green stormwater infrastructure (GSI) capital costs.
- **FEMA Hazard Mitigation & Flood Mitigation Assistance (BRIC):** Federal-funded grants for resilience infrastructure including detention basins, regional stormwater projects, and flood control.

Co-benefits Summary

- **Improved water quality:** GSI filters pollutants (e.g., oils, heavy metals, nutrients, bacteria) before they enter waterways like the San Antonio River.
- **Urban Heat Island Mitigation:** Vegetated infrastructure (green roofs, tree canopies, wetland) lowers surface and ambient air temperatures by providing shade and enhancing evapotranspiration.
- **Air Quality Improvements:** Plants used in GSI systems (e.g., native grasses, shrubs, trees) absorb pollutants and particulate matter from the air.
- **Groundwater Recharge:** Permeable GSI systems (e.g., infiltration trenches, vegetated filter strips) allow rainwater to soak into the soil.
- **Habitat Creation & Biodiversity:** GSI features create habitats for pollinators, birds, and other wildlife.

Timeline



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Wastewater Measure 1: Monitor and Reduce Impacts of Stormwater		
<p>Description: Reduce overland flooding, landslides, and water pollution vulnerabilities by incentivizing, improving, and increasing green infrastructure and other mitigating methods. Green infrastructure refers to using natural features or planned ecological systems to manage water by mimicking the natural water cycle. Green infrastructure not only excels at managing storm water but also mitigates extreme heat.</p>		
<p>Supporting actions:</p> <ul style="list-style-type: none"> • Incentivize and update policies to promote green infrastructure in new developments and retrofits. • Implement municipal projects like green streets, bioswales, and urban tree planting in flood-prone areas. • Provide training and outreach for city staff, contractors, and the public on design, benefits, and maintenance. • Track performance by monitoring stormwater runoff volume, quality, and heat mitigation impacts. 		
Geographic scope: All municipalities	<p>Existing initiatives:</p> <ul style="list-style-type: none"> • SARA Green Infrastructure Master Plan: Watershed-scale plan identifies priority areas. • San Development low impact development (LID) demonstration projects: including infiltration basins, bioswales, rain gardens, etc. • Texas Water Development Board Flood Infrastructure Fund. 	
<p>Implementing Agencies and Partners:</p> <ul style="list-style-type: none"> • Regional watershed authorities • Public works department, municipal sustainability department • TCEQ 		
Potential metrics for tracking	<ul style="list-style-type: none"> • Gallons of stormwater captured or infiltrated annually through green infrastructure. • Reduction in peak stormwater runoff rates during major rain events. • Number and type of green infrastructure installed. • Improvement in water quality indicators (e.g., total suspended solids, nitrogen, phosphorus, E. coli). 	
Quantified GHG emissions reduction impact (MT CO₂e)	2030	2050
	N/A	N/A
GHG quantification method	GHG emissions reductions have not been quantified for this measure because they are secondary/indirect.	

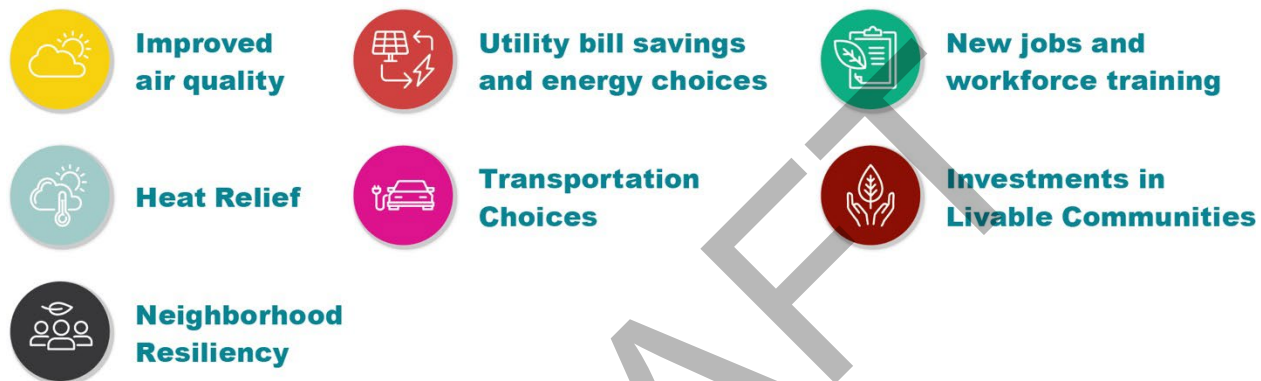
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Wastewater Measure 2: Energy and Compost from Wastewater to Reduce Costs		
<p>Description: Expand regional adoption of sustainable wastewater and biosolids management practices by building on the success of SAWS programs. This measure aims to scale up proven strategies across the Alamo Area to reduce GHG emissions, improve water quality, and enhance resource recovery, including anaerobic digestion and composting to manage biosolids, converting biogas into renewable energy, and expanding water recycling initiatives. Implementing nitrification best practices in wastewater treatment will help optimize nutrient removal and protect local waterways, while reducing waste, lowering operational costs for utilities, and strengthening regional resilience to climate impacts.</p>		
<p>Supporting actions:</p> <ul style="list-style-type: none"> Expand anaerobic digestion and composting of biosolids to produce biogas and nutrient-rich compost, reducing waste and emissions. Convert biogas generated from wastewater treatment into renewable energy to lower operational costs and carbon footprint. Enhance water recycling programs across the region by scaling up proven SAWS initiatives for sustainable water reuse. Implement nitrification best practices in treatment processes to improve water quality and optimize nutrient removal. Leverage regionalization opportunities to reduce costs to individual utilities. 		
<p>Geographic scope: All municipalities</p>	<p>Existing initiatives:</p> <ul style="list-style-type: none"> Biogas Recovery and Renewable Energy Production: SAWS partnered with Ameresco to process 1.5 million cubic feet of biogas daily from the Dos Rios Water Recycling Center. Biosolids composting program: SAWS operates a biosolids composting program that diverts up to 208,000 cubic yards of biosolids from landfills annually. 	
<p>Implementing Agencies and Partners:</p> <ul style="list-style-type: none"> Local water utilities Public works departments TCEQ 		
<p>Potential metrics for tracking</p>	<ul style="list-style-type: none"> Volume of biogas captured. Amount of renewable energy generated from biogas. Percentage of wastewater treatment energy demand met by biogas-derived energy. Volume of compost sold or distributed for agricultural / landscape use. 	
<p>Quantified GHG emissions reduction impact (MT CO₂e)</p>	2030	2050
	5,063	74,916
<p>GHG quantification method: Calculated in an Excel model based on the BAU projections developed in ClearPath.</p>	<p>Key assumptions include:</p> <ul style="list-style-type: none"> 30% reduction in GHG emissions by 2030 based on process optimizations. 90% reduction in GHG emissions by 2050 based on advanced strategies, such as membrane-based aeration, anaerobic ammonium conversion, or ammonium assimilation and recovery. <p>For more details, see Appendix B.</p>	

6.0 Benefits Analysis

Tackling air pollution is essential to protect public health and strengthen community wellbeing across the Alamo Area. Improvements in air quality not only reduce health risks - especially for vulnerable populations such as older adults and those with underlying health conditions - but also support workforce productivity and broader socioeconomic benefits.

ALAMO AREA COMMUNITY BENEFITS



Socioeconomic Summary

Approximately one-third of the Alamo Area population lives within low-income census tracts, which are defined by U.S. Department of Housing and Urban Development as having at least 50% of households earning below 60% of the Area Median Gross Income, or a poverty rate of 25% or higher.¹⁶

Communities in low-income census tracts are significantly more likely to lack a high school diploma, experience higher unemployment rates, identify as non-white, and have a lower median household and per capita income compared to the Alamo Area overall. Socioeconomic information comparing the statistics within the low-income census tracts and the Alamo Area is shown in Figure 12.

¹⁶ U.S. Department of Housing and Urban Development, Office of Policy Development and Research, 2025. [Office of Policy Development and Research. Qualified Census Tracts and Difficult Development Areas. 2025](#)

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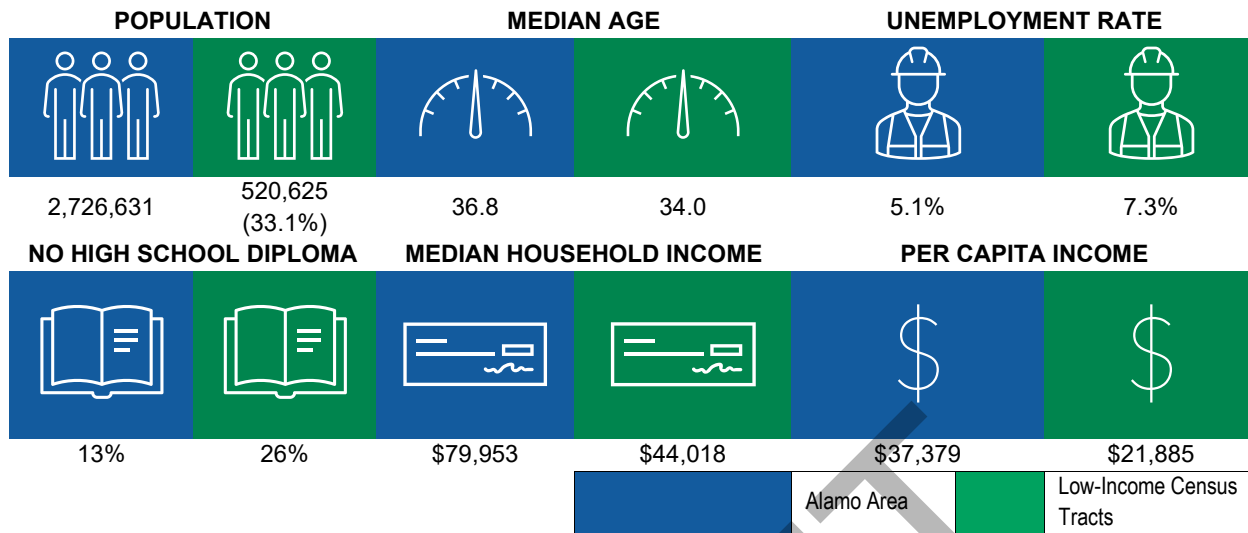


Figure 13: Socioeconomic Analysis of the Region Compared to the Low-Income Census Tracts

Source: This infographic contains data provided by Esri (2023), Esri-Data Axle (2023), American Community Survey (2017-2023).

Residents in low-income census tracts have lower homeownership rates compared to the Alamo Area (Figure 13). However, for those who do own their homes, the median value is approximately \$100,000 less than the regional median, and these houses tend to be on average 17 years older. Twenty-two percent (22%) of renters in the region and 26% of renters in low-income census tracts spend more than half their gross income on rent. Communities in low-income census tracts also have lower car ownership than the region overall and are more likely to rely on public transit for commuting to work and less likely to work from home.

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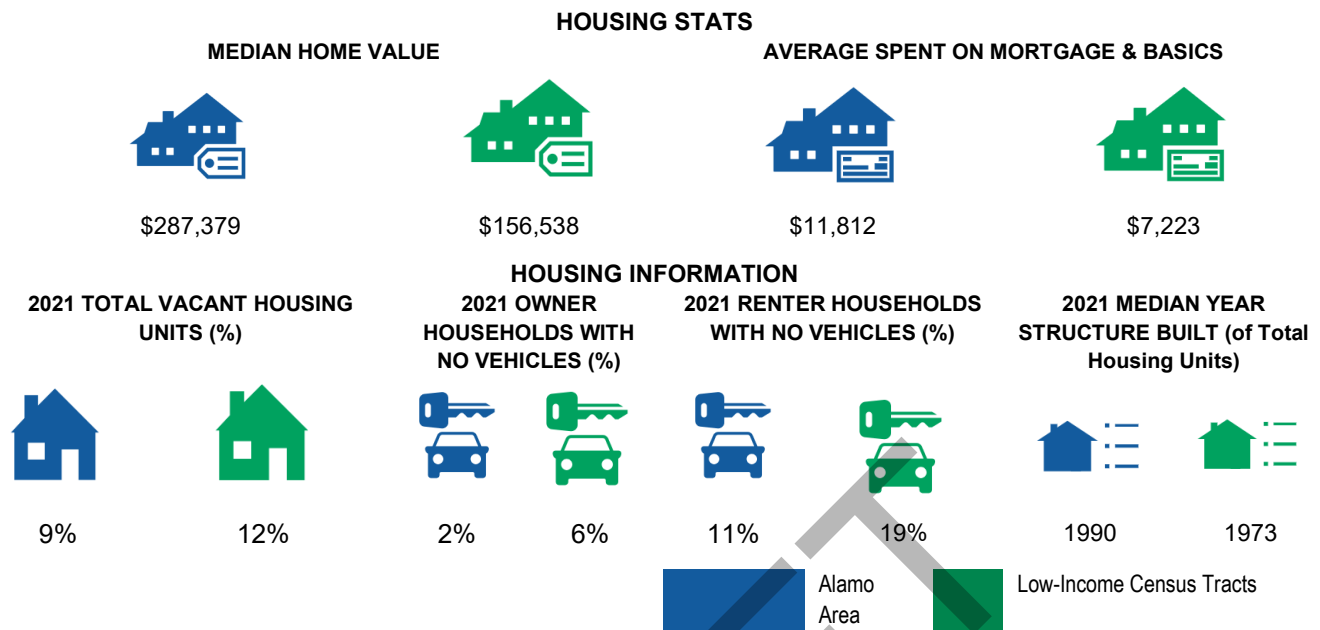


Figure 14: Housing Statistics of the Region Compared to the Low-Income Census Tracts

Source: This infographic contains data provided by Esri (2023), Esri-U.S. Bureau of Labor Statistics (2023), American Community Survey (2017-2023). Contract Rent is represented in per month numbers, and Mortgage numbers are represented annually.

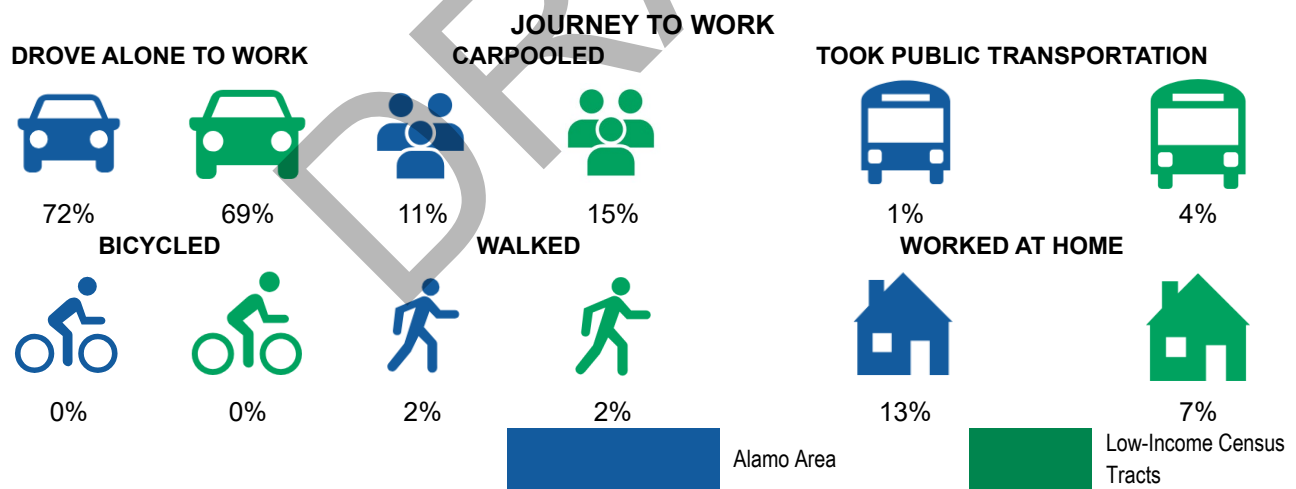


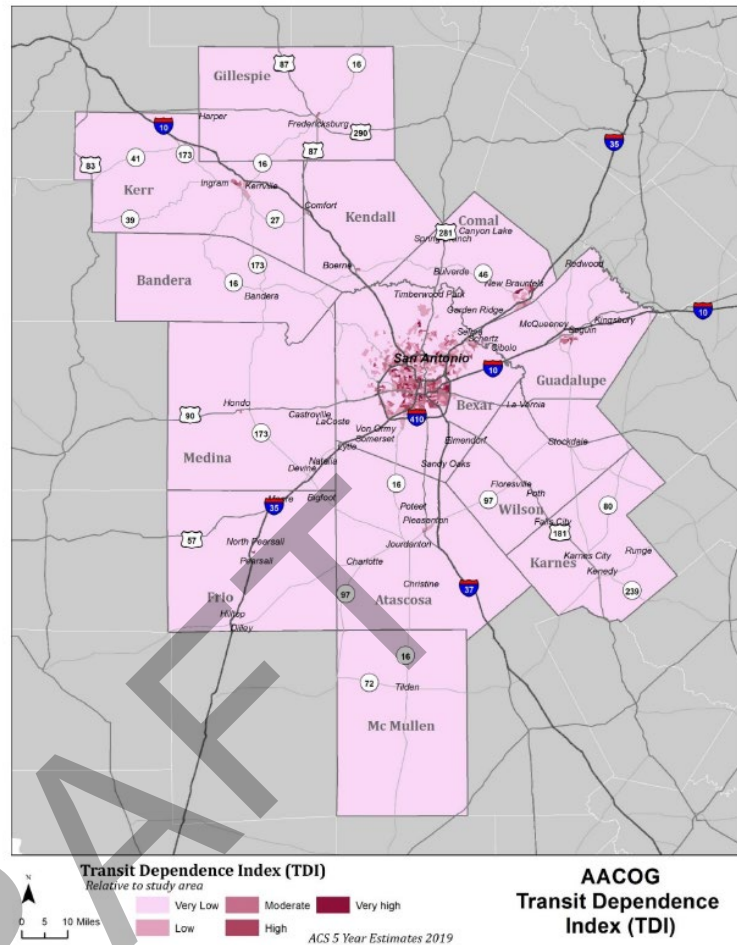
Figure 15: Summary of Commute Patterns of the Region Compared to Low-Income Census Tracts

Source: American Community Survey (2017-2023).

The commuting and work-related travel data shown in Figure 14 indicates people living in low-income census tracts carpooled and used public transportation more than others in the area and worked from home less. AACOG also mapped the Transit Dependence Index in its Regionally Coordinated Transportation Plan (Figure 15) to identify locations with populations most likely to use transit services (auto less households, older adult populations, youth populations, below poverty, and individuals with disabilities).

Figure 16: Transit Dependence Index in the Alamo Area

Source: AACOG Regionally Coordinated Transportation Plan (2022)



Air Quality Co-Benefits

Many sources of GHG emissions also produce emissions of harmful air pollutants. Low-income census tracts often have a higher prevalence of health conditions that are susceptible to environmental factors. The concentration of transportation-related emissions, for instance, disproportionately impacts low-income communities that are often located near major roadways. Engine exhaust from vehicles and nonroad equipment contribute to emissions of pollutants regulated by EPA, referred to as criteria pollutants.

Criteria pollutants are also emitted from activities in the energy sector, including natural gas combustion from residential and commercial heaters, boilers, stoves, and other appliances. Although no pollutants are emitted at the site where electricity is used, there are pollutant emissions at sites where electricity is generated from fossil fuels. The Alamo Area has a history of elevated concentrations of ozone, which is not emitted directly into the air but is created by chemical reactions between oxides of nitrogen (NO_x) and volatile organic compounds (VOC). Particulate matter (PM) can be emitted directly from a source, such as construction sites, unpaved roads, fields, smokestacks or fires. PM can also form as the result of reactions with NO_x and sulfur dioxide (SO_2).

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Exposure to elevated concentrations of criteria pollutants can contribute to respiratory and cardiovascular health impacts, including decreased lung function, aggravation of existing lung diseases, increased frequency of asthma attacks, increased frequency of heart attacks, dizziness, unconsciousness, and death.

Table 12: Air Quality Co-Benefits

Year	Description	Air Pollution Reduction (ton/year)					
		CO	NOX	VOC	PM ₁₀	PM _{2.5}	SO ₂
2030	VMT Reduction and Transportation Electrification	4,282	380	53	7.9	7.2	--
2050	VMT Reduction and Transportation Electrification	3,088	229	36	2.5	2.2	--
2030	Electricity Usage Reduction	--	206	--	--	--	149
2050	Electricity Usage Reduction	--	361	--	--	--	260
2030	Natural Gas Usage Reduction	106	124	--	10.5	--	--
2050	Natural Gas Usage Reduction	107	126	--	10.6	--	--

Air quality co-benefits were estimated for reduction measures in the transportation and energy sectors and summarized in Table 10. Pollutant emissions resulting from agriculture, solid waste, and wastewater measures were assumed to be minimal and not estimated. Measures associated with the Process and Fugitive Emissions sector would likely reduce air pollutant emissions, but emissions estimates would require specific information about industrial source processes that were not available. Transportation emission factors in units of grams per VMT were developed for each pollutant using EPA's MOVES motor vehicle emissions model. The emissions reductions presented are based on the reduction of VMT on roadways or by the reduction of VMT from gasoline vehicles that transition to electric. Emission factors for natural gas use were retrieved from EPA's AP-42: Compilation of Emission Factors from Stationary Sources. Emission factors for electricity use were retrieved from EPA's eGRID. Air pollutant emissions were estimated by applying the factors to the amount of energy reduced for each measure.

Heat Relief and Resilience

Many of the measures in this plan can significantly reduce the urban heat island effect in the Alamo Area, where extensive paved surfaces, rapid growth, and hot summers amplify local temperatures. Strategies such as expanding the region's tree canopy, increasing green infrastructure, and adopting cool roofs and reflective pavements help lower surface and air temperatures while improving comfort in neighborhoods that experience disproportionate heat. Green infrastructure and runoff control measures are also prioritized to reduce the impacts of stormwater while improving water quality. Energy efficiency and electrification of buildings and vehicles further reduce waste heat from air

conditioning systems and combustion engines, which are both major contributors to localized warming in fast-growing urban areas.

Expanding backup power options also improves community energy resilience, especially as extreme heat increases the risk of power outages and grid stress. Investments in distributed energy resources such as solar-plus-battery systems, microgrids at community centers, and critical facility backup power can keep essential services operating during emergencies and provide cooling, communications, and medical support when the grid is strained. Access to reliable, low-emission backup power strengthens preparedness for both heat waves and other hazards, ensuring that vulnerable residents have safe places to go when temperatures are extreme or power is disrupted. This integrated approach aligns climate mitigation with disaster readiness, improving safety, reliability, and community well-being across the region.

Greater Savings and Choices

The plan's recommended initiatives create opportunities for cost savings and greater consumer choice by improving efficiency, expanding energy options, and reducing long-term operating expenses. Energy-efficient buildings lower monthly utility bills for households and businesses, while electrification of appliances and vehicles often reduces fuel and maintenance costs over time. Increased adoption of distributed energy resources such as rooftop solar, community solar, and battery storage gives residents and businesses more control over their energy use and protection from price volatility. Investments in active transportation, transit, and mixed-use development provide more mobility options beyond driving alone, helping reduce household transportation expenses. The solid waste strategies also support local governments to lower waste management costs, reduce reliance on landfills, improve soil health through compost use, and increase access to recycling services across communities.

7.0 Workforce Planning Analysis

Successful implementation of the reduction measures outlined in this plan for the Alamo Area depends on having the necessary workforce. The analysis indicates that the transportation, buildings, and agriculture sectors will experience the most significant workforce demands. On the other hand, the environment and solid waste sectors are projected to have minimal or no labor impact. Given the substantial investments needed and corresponding workforce needs in the transportation, buildings, and agriculture sectors, the workforce planning analysis concentrates primarily in the areas listed in Table 11.

Table 13: Workforce Analysis Overview

Sector	Workforce Demand/ Impact	Description
Transportation	High	Construction of projects to improve congestion require construction labor. Construction and maintenance of charging infrastructure require specialized labor.
Buildings	High	Building code, building envelope, and energy efficiency upgrades require specialized labor.
Agriculture	Medium/ Low	Incorporation of technology into farming practices will require specialized knowledge and skills
Industrial Decarbonization	Medium/ Low	Incorporation of decarbonization technologies in the industrial build industry, requiring specialized labor and skills

Figure 16 illustrates the trend of impacted jobs in the transportation, buildings, and agriculture sectors within the Alamo Area. See Appendix C for detailed trends by sector. Employment in these occupations has seen a steady increase over the years, with over 91,000 jobs reported in all the associated industries in 2024 (Figure 16). Meeting GHG targets requires investments in these industries, which, in turn, will lead to sustained employment increases. These jobs see an average median annual salary of \$68,198 in 2024, with an average median hourly wage of \$32.81, approximately 20% higher than the median annual salary in Texas for a full-time year-round employee.

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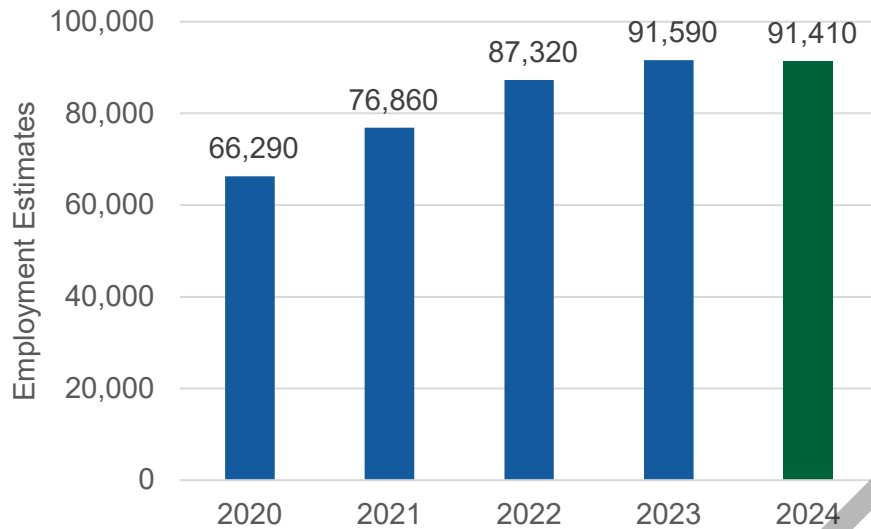


Figure 17: Total Employment in Impacted Industries, San Antonio-New Braunfels Region¹⁷

Workforce recommendations are designed to leverage programs and partnerships already in place in the Alamo Area, such as San Antonio Ready to Work (RTW) and Workforce Solutions Alamo (WSA). RTW is San Antonio's unprecedented education and job placement program. In 2020, San Antonio voters overwhelmingly approved the \$200 million program, which is funded by a 1/8-cent sales tax. Local employers have pledged support for the program and provide guidance relating to in-demand, well-paid occupations, and relevant training.

RTW supports training for specific occupations that are well paid and in high demand in the following industries:

- Construction/Trades/Utilities
- Education
- Finance/Insurance
- Healthcare
- IT/Cybersecurity
- Manufacturing/Aerospace
- Professional Services
- Transportation/Warehousing

WSA serves as the governing board for the regional workforce system, a network of service providers and contractors.

Workforce planning analysis aligned workforce needs with Bureau of Labor Statistics (BLS) occupation codes for relevant GHG reduction strategies. Note that some codes apply to multiple

¹⁷ Note: The employment included in the graph is from 2020 – 2024 from Occupational Employment and Wage Estimates determined by the BLS. This employment data is for the San Antonio-New Braunfels MSA. Please note that this data does not include all counties within the Alamo Area that are considered in the rest of this analysis. See Appendix C for details.

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strategies. Information on the available workforce in the San Antonio-New Braunfels MSA for select occupation codes is summarized in additional tables in the Appendix C.

Table 14: List of Priority Occupations by Strategy

GHG Reduction Strategy	Priority Workforce Needs by Occupation Code and Sector
Transportation	
<i>Expanding travel options and quality</i>	11-3051—Industrial Production Managers 11-1021—General and Operations Managers
<i>EV Transition-Diesel and Gasoline</i>	47-2111—Electricians 49-2096—Electrical Equipment Installers and Repairers, Motor Vehicles 49-3023—Automotive Technicians 53-3032—Heavy and Tractor-Trailer Drivers 17-3022—Civil Engineering Technologists and Technicians 41-4011—Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products
<i>Reduce VMT</i>	17-2141—Mechanical Engineers 17-2071—Electrical Engineers 49-2094—Electrical and Electronics Repairers, Commercial and Industrial Equipment 47-2061—Construction Laborers
Buildings	
<i>Energy independence, resilience, and utility bill savings</i>	17-2199—Engineers, Other (energy efficiency specialists) 17-2081—Environmental Engineers 47-2231—Solar PV Installers 47-2111—Electricians
<i>Eliminate energy waste and save on utility bills</i>	49-9021—HVAC Mechanics and Installers (energy-efficiency) 47-2111—Electricians 49-9071—Maintenance and Repair Workers, General 25-1194—Career/Technical Education Teachers, Postsecondary
<i>Modernize homes and commercial spaces</i>	19-3051—Urban and Regional Planners 47-2211—Sheet Metal Workers 17-2141—Mechanical Engineers 49-9071—Maintenance and Repair Workers, General
Agriculture	
<i>Expand methane and nitrous oxide emission reductions from agricultural operations; Protect and enhance urban ecosystems, trees, and green spaces; improve urban ecosystems</i>	45-2092—Farmworkers and Laborers, Crop, Nursery, and Greenhouse 19-1013—Soil and Plant Scientists 19-2041—Environmental Scientists

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GHG Reduction Strategy	Priority Workforce Needs by Occupation Code and Sector
Industrial Decarbonization	
<i>Increase Industrial Decarbonization Funding</i>	17-2141—Mechanical Engineers 17-2199—Engineers, All Other 19-2041—Environmental Scientists and Specialists
<i>LDAR Program</i>	51-8013—Power Plant Operators 51-8099—Plant and System Operators, All Other
<i>Local Low-Carbon Cement Utilization</i>	47-2061—Construction Laborers 11-3051—Industrial Production Managers

Transportation

Reducing emissions in the transportation sector will spur significant local economic growth and generate well-paying jobs. Implementing measures like expanded EV charging infrastructure will create demand for electricians, construction workers, and technicians. Likewise, the transition to stricter fuel efficiency standards and zero-emission fleets will boost the need for engineers, manufacturing technicians, and specialized mechanics. These combined investments will stimulate multiple sectors of the local economy, providing opportunities across a wide range of skill levels, from initial manufacturing and installation to maintenance and daily operation.

Table 13 summarizes the likely impact of identified reduction measures in the transportation sector on the local workforce. The transition to zero-emission vehicles will have the most significant impact on regional workforce. Specifically, deploying and maintaining public EV charging stations will create a demand for specialized installation and maintenance professionals. Additionally, the shift to zero-emission fleets will necessitate a workforce with distinct maintenance skills, different from those required for conventional vehicles. Congestion reduction measures, such as multi-modal hubs and TOD, will primarily generate construction-related jobs.

These identified occupations relevant to the transportation sector reduction strategies increased by 45% since 2020, with 72,570 jobs in 2024 (Shown in Appendix C; Figure C-1). These jobs had an annual salary of \$68,246 (or \$32.81 hourly) on average, which is 20% above Texas's statewide median salary for a full-time worker of \$56,836.18

Table 15: Transportation Sector Workforce Impact Summary

GHG Reduction Strategy	GHG Reduction Measure	Workforce Impact	Description
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¹⁸ The estimated annual salary for jobs related to transportation emissions reduction in the San Antonio-New Braunfels region is weighted by local employment figures. Source of employment data is Occupational Employment and Wage Estimates determined by BLS.

<i>Expand travel options and quality</i>	Investing in new public transit and improved efficiency in existing systems	Medium	Expected impact on construction related jobs.
	Prioritizing TODs in land use to shift travel modes to bus and light rail		
<i>EV Transition-Diesel and Gasoline</i>	Investing in public charging, making charging easier via zoning, enable fleet transformations, reward bidirectional charging and other grid services	High	Installation and maintenance of EV charging infrastructure requires specialized skillsets.
<i>Reduce VMT</i>	Remove restrictions on building and zoning codes	Medium	Expected impact on construction related jobs.

Buildings

Improving the Alamo Area's residential and commercial buildings offers a powerful way to cut both energy use and greenhouse gas emissions. This involves a range of upgrades: conducting building audits to pinpoint waste, implementing code updates for better efficiency in new and renovated structures, enhancing building enclosures to minimize heat gain, and installing energy-efficient measures like heat pumps and LED lighting. Additionally, integrating renewable energy sources like solar PV directly reduces electricity consumption and reliance on fossil fuels.

Table 14 summarizes the likely impact of identified reduction measures in the buildings sector on the local workforce. While every strategy is expected to boost the demand for labor, the extent of this increase will differ. For instance, building audits and code upgrades will require specialized professionals for assessments, but these alone are not projected to generate many jobs. In contrast, enhancing building enclosures—like upgrading envelopes, roofing, windows, and doors—will directly create a need for construction workers and specialized installers. Similarly, implementing energy efficiency improvements will drive demand for insulation, roofing, and window/door contractors, along with HVAC technicians and electricians. Finally, the installation of solar panels and building microgrids is set to significantly increase the need for skilled electrical workers and could also bolster local supply chains.

Table 16: Buildings Sector Workforce Impact Summary

<i>GHG Reduction Strategy</i>	GHG Reduction Measure	Workforce Impact	Description
<i>Energy independence, resilience, and utility bill savings</i>	Residential and Commercial Solar	Medium	This will create jobs related to the installation of PV roof systems and microgrids.
<i>Eliminate energy waste and save on utility bills</i>	Residential and Commercial Energy Efficiency, such as weatherization and insulation	High	This will impact construction related jobs as well as

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GHG Reduction Strategy	GHG Reduction Measure	Workforce Impact	Description
	programs, efficient appliance programs, and energy audits		specialized appliance and plumbing and heating jobs.
<i>Modernize homes and commercial spaces</i>	Optimizing building codes, work with utilities to offer incentives, provide grid benefits	Low	Changes in policies likely will not have a direct impact on the workforce, but activities relating to code upgrades require specialized labor

These identified occupations that are relevant to the buildings sector reduction strategies have steadily increased over time. The total employment in these industries has grown relatively steadily at around 7 percent from 2020-2024. These jobs had an annual salary of \$53,810 (or \$25.87 hourly) on average, which is in line with Texas's statewide median salary for a full-time worker.¹⁹

The Bureau of Labor Statistics Occupational Employment and Wage Statistics for 2024 indicates a lack of reported solar PV installers within the Alamo Area. This suggests a limited presence of this specialized workforce in the immediate area. Based on the US Census data, it appears that solar employment has moved within the state of Texas towards the Houston-Galveston region, as more solar plants and the solar industry have been expanding in that region. Anticipated projects in the region, such as the largest municipal on-site solar project in Texas, are expected to continue popping up in the area, attracting employment from outside of the local region.

Agriculture

The reduction strategies and measures identified for the Alamo Area will increase demand for specialized skills in ecological restoration and agricultural operations. Table 15 summarizes the likely impact of identified reduction measures in the agriculture sector on the local workforce. While some traditional farming roles may evolve, the growth in the emerging areas necessitates investment in workforce training and education to equip both current and future agricultural workers.

Table 17: Sector Workforce Impact Summary

GHG Reduction Strategy	GHG Reduction Measure	Workforce Impact	Description
<i>Protect and enhance urban ecosystems, trees, and green spaces;</i>	Launch of a citywide incentive program for residents and developers to use native and drought-tolerant plants, reducing water use and supporting local ecosystems; develop a green corridor network by linking parks,	None	Not expected to have a workforce impact.

¹⁹ The estimated annual salary for jobs related to transportation emissions reduction in the San Antonio-New Braunfels region is weighted by local employment figures. Source of employment data is Occupational Employment and Wage Estimates determined by BLS.

GHG Reduction Strategy	GHG Reduction Measure	Workforce Impact	Description
<i>improve urban ecosystems</i>	trails, and natural habitats to promote wildlife movement and biodiversity		
<i>Improve preservation, health, and maintenance of trees in existing urban canopy</i>	Community Tree Planting	Low	There could be an increase in tree maintenance jobs associated with the new tree plantings.
<i>Expand methane and nitrous oxide emission reductions from agricultural operations</i>	Promotion of the adoption of modern agricultural practices	Low	More specialized labor in modern agriculture advancements
<i>Support Urban-Rural agricultural connections</i>	Promotion of Farm-to-Fork concepts, strengthening local supply chains	Low	Could increase lower-barrier entry jobs that are place-based and not easily outsourced.

Between 2020 and 2024, agricultural employment in the region showed no significant growth trend, fluctuating between 740 and 1,560 positions (See Appendix C; Figure C-3). While traditional farm labor is characterized by lower wages (approximately \$14.5/hour or \$29,530 annually), the shift towards more technical agricultural practices is expected to increase demand for specialized skills. Professions like soil and plant scientists, earning around \$26.34/hour or \$54,790 annually, exemplify this higher-paying potential. However, these technical roles often present higher barriers to entry, typically requiring at least a bachelor's degree and frequently a graduate degree. Specialties in the environmental science space have been departing the region, with a level out of around 750 workers in the past 5 years. This exodus of specialization availability could be due to a host of reasons. The industry itself within the state of Texas is not expected to see much competitive development compared to other regions of the country.

Industrial Decarbonization

Industrial decarbonization – including industrial heat pumps, thermal energy storage, use of clean hydrogen, and industrial carbon capture storage – in the Alamo Area's industrial industry can significantly reduce both energy consumption and greenhouse gas emissions. There has been an increase in the workforce over time in the sector, with a slight drop in 2022, due to a slight decrease overall in the expected industries associated with the sector (See Appendix C; Figure C-4).

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Table 16 summarizes the likely impact of identified reduction measures in industrial decarbonization on the local workforce. While all strategies are projected to increase labor demand, the magnitude can vary. Industrial decarbonization upgrades will necessitate specialized labor for decarbonization methods in petroleum refineries, chemical plants, and other facilities. In addition, the sourcing of local, low-carbon cement will also impact the workforce demand for related industries. Furthermore, industries and workforce specializing in carbon capture and other transformative technologies will see an impact from the identified measures.

These identified occupations relevant to the industrial decarbonization sector reduction strategies have steadily increased over time. The total employment in these industries has seen a jump of almost 10% from 2023 to 2024. These jobs had an annual salary of \$61,428 (or \$29.50 hourly) on average, which is significantly more than Texas's statewide median salary for a full-time worker.²⁰

Table 18: Industrial Decarbonization Sector Workforce Impact Summary

GHG Reduction Strategy	GHG Reduction Measure	Workforce Impact	Description
<i>Increase Industrial Decarbonization Funding</i>	Use methods such as industrial clean air grants, industrial competitive decarbonization tax credits, and regulatory requirements to support transformative technologies	Low	Highly dependent on access to resources such as grants. If gained access to funding sources, expect an increase in workforce.
<i>LDER</i>	Reduce emissions from leaking equipment in industrial settings, such as petroleum refineries, chemical plants and other facilities	Low	Some specialization needed to monitor for leaks.
<i>Local Low-Carbon Cement Utilization</i>	Pass a local buying requirement, engage cement producers on alternative fuels, engage cement producers on energy efficiency	High	More local industry development if incentives to purchase cement locally.

²⁰ The estimated annual salary for jobs related to transportation emissions reduction in the San Antonio-New Braunfels region is weighted by local employment figures. Source of employment data is Occupational Employment and Wage Estimates determined by the Bureau of Labor Statistics (BLS).

8.0 Next Steps

As the region advances the Alamo Area Climate Plan, AACOG is ready to partner with cities, counties, utilities, community organizations, and local businesses to prioritize implementation pathways, pursue funding, and align projects that deliver both near-term benefits and long-term resilience. Immediate next steps include working with regional partners to identify high-impact measures, supporting data and technical needs, and convening stakeholders around shared opportunities. AACOG will continue serving as a regional hub to facilitate collaboration, advance resources, and help authorities translate this plan into actionable projects that support a healthier, more resilient, and more economically vibrant Alamo Area.

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Appendices





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The contents of this document do not necessarily reflect the views and policies of the EPA, nor does the EPA endorse trade names or recommend the use of commercial products mentioned in this document. Unless otherwise noted, the measures outlined in the CCAP are intended to be broadly accessible to any eligible entity within the plan's geographic scope, including those seeking support through the Climate Pollution Reduction Grants (CPRG) Implementation Grant General Competition or other relevant funding opportunities.

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Appendix A: GHG Inventory Methodology

GHG Inventory Data Sources and Methodology Summary

Table A-1: Transportation and Mobile Sources GHG Inventory Data Sources

TRANSPORTATION & MOBILE SOURCES			
ACTIVITY/SOURCE	DATA SOURCE	METHODOLOGY	DATA GAPS/ASSUMPTIONS
On-Road	TTI	Extracted VMT and emissions data by vehicle/fuel types	n/a
On-Road Transit	National Transit Database Fuel and Energy Report	Extracted region-specific data from the NTD's Fuel and Energy Report	n/a
Rail	TTI	Extracted county data by GHG type, estimated MMBtu using MT CO ₂ /MMBTU emissions factor	n/a
Aviation	TTI	Extracted emissions and fuel use data by county	n/a
Waterborne	EPA's 2020 National Emissions Inventory (NEI)	Extracted county data by GHG type, estimated MMBtu using MT CO ₂ /MMBTU emissions factor	Because NEI does not provide activity data, we estimated MMBtu using the MT CO ₂ /MMBTU emissions factor
Off-Road/Mobile	EPA's 2020 NEI	Extracted county data by GHG type, estimated MMBtu using MT CO ₂ /MMBTU emissions factor	Because NEI does not provide activity data, we estimated MMBtu using the MT CO ₂ /MMBTU emissions factor
Emissions Factors	EIA's Annual Energy Review, Bureau of Transportation Statistics Average Fuel Efficiencies, and EPA's Emission Factors for GHG Inventories	n/a	n/a



Table A-2: Grid Electricity GHG Inventory Data Sources

GRID ELECTRICITY			
ACTIVITY/SOURCE	DATA SOURCE	METHODOLOGY	DATA GAPS/ASSUMPTIONS
Residential Electricity	Energy Information Administration (EIA) State Energy Summaries, Electricity Utility Responses to Data Request	Extracted state electricity consumption data and downscaled using a ratio of county households out of state households, supplemented with utility-specific data when available	Since utility data was incomplete, this alternative was considered most applicable. This approach assumes every house uses grid electricity.
Commercial and Industrial Electricity	EIA State Energy Summaries, Electricity Utility Responses to Data Request	Extracted state electricity consumption data and downscaled using a ratio based on NREL's SLOPE county energy usage data out of state energy usage data, supplemented with utility-specific data when available	Since utility and state commercial square footage data was incomplete, this alternative was considered most applicable.
Electricity Generation	EPA FLIGHT	Extracted site-specific data per county and directly entered raw metric tons (per GHG)	This data is recorded but emissions are not considered in the GHGI total because the majority of electricity generation emissions are assumed to be captured in the residential, commercial, and industrial electricity emissions.
Emissions factors	EPA's eGRID2021, Electricity Utility Responses to Data Request	For electricity usage reported by utility, the utility-supplied emission factors were used. For remaining electricity usage, EGRID2021 emission factors were used.	n/a



Table A-3: Solid Waste GHG Inventory Data Sources

SOLID WASTE			
ACTIVITY/SOURCE	DATA SOURCE	METHODOLOGY	DATA GAPS/ASSUMPTIONS
Waste Generation	Texas Commission on Environmental Quality's (TCEQ) Municipal Solid Waste in Texas: A Year in Review, 2021 Data Summary and Analysis	Extracted tons landfilled	Assumed Typical LFG collection for all landfills due to landfill-specific data not available. Assumed that all waste received per landfill is generated by the county the landfill is located in. Mesquite Creek Landfill is on the board of two counties. Waste received was allocated to each county using population ratios.
Closed Landfills	FLIGHT data	n/a	Closed landfills are information only, Total emissions do not account for closed landfills. Since these landfills are closed, the waste was not generated during the inventory year.
Emissions factors	EPA's Documentation for Greenhouse Gas Emission and Energy Factors Used in the Waste Reduction Model (WARM)	n/a	n/a
Waste Characterization	TCEQ's Study on the Economic Impacts of Recycling, Final Report 2017	n/a	Assumed statewide waste characterization represent each landfills waste composition. Because the waste composition categories differed from ClearPath categories, the following assumptions occurred: Newspaper and Office paper each represent 1/2 of "Mixed (other recyclable)," Magazines/Third Class Mail represents "Other (non recyclable) (treated)," Food



SOLID WASTE

ACTIVITY/SOURCE	DATA SOURCE	METHODOLOGY	DATA GAPS/ASSUMPTIONS
			scraps represents "Food and Beverage Materials & "other organics," Grass, Leaves, and Branches each represent 1/3 of "Yard trimmings, Brush, and Green Waste," and Dimensional Lumber represents "clean/unpainted C&D wood."

Table A-4: Other Sources GHG Inventory Data Sources

OTHER SOURCES			
ACTIVITY/SOURCE	DATA SOURCE	METHODOLOGY	DATA GAPS/ASSUMPTIONS
Residential Stationary Fuel	EIA State Energy Summaries, Natural Gas Utility Responses to Data Request	Extracted state stationary fuel consumption data and downscaled using a ratio of county households out of state households, supplemented with utility-specific data when available	Since utility data was incomplete, this alternative was considered most applicable.
Commercial Stationary Fuel	EIA State Energy Summaries, Natural Gas Utility Responses to Data Request	Extracted state stationary fuel consumption data and downscaled using a ratio based on NREL's SLOPE county energy usage data out of state energy usage	Since utility and state commercial square footage data was incomplete, this alternative was considered most applicable.



OTHER SOURCES			
ACTIVITY/SOURCE	DATA SOURCE	METHODOLOGY	DATA GAPS/ASSUMPTIONS
		data, supplemented with utility-specific data when available	
Industrial Stationary Fuel	EPA FLIGHT	Extracted site-specific data per county and directly entered raw metric tons (per GHG)	Assumed the majority of industrial stationary fuel consumption is captured in EPA FLIGHT.
Fugitive emissions from natural gas distribution	EIA State Energy Summaries & FLIGHT	Enter natural gas consumption (MMBtu) per county	Used defaults from ClearPath Fugitive Emissions from Natural Gas Distribution Calculator.
Fugitive emissions from oil and natural gas systems	EPA FLIGHT	Extracted site-specific data per county and directly entered raw metric tons (per GHG)	Assumed any emissions from natural gas distribution is captured in "Fugitive emissions from natural gas distribution"
Industrial Process & Product use	EPA FLIGHT	Extracted site-specific data per county and directly entered raw metric tons (per GHG)	GHGs including refrigerants and others are captured internally and entered as CO ₂ equivalent (CO ₂ e)
Water Treatment Energy	n/a	n/a	Assumed to be captured in the commercial and/or industrial electricity and stationary fuel consumption estimates.
Wastewater Treatment Energy	n/a	n/a	Assumed to be captured in the commercial and/or industrial electricity and stationary fuel consumption estimates.
Wastewater Treatment	US Census Bureau	Used ClearPath's population-based calculations	Due to the unavailability of site-specific wastewater treatment operations data, we assumed each site operates under the same conditions as City of San



OTHER SOURCES			
ACTIVITY/SOURCE	DATA SOURCE	METHODOLOGY	DATA GAPS/ASSUMPTIONS
			Antonio's 2021 wastewater treatment operations: no Nitrification/Denitrification, an Industrial Commercial Discharge Multiplier of 1.25, WW generated and treated in boundary, systems are predominantly Aerobic, Effluent discharge goes into stream/river
Agriculture: Livestock and Crops	U.S. Department of Agriculture's (USDA) 2017 Census of Agriculture, County Data	Extracted livestock headcounts and crop counts and utilized the EPA's State Inventory Tool, Agriculture Module to estimate emissions	Due to the differing categorizations of the EPA's SIT Agriculture Modules and the USDA's 2017 Census of Agriculture county data, the following categories were grouped together/assumptions were made: Milks Cows = Dairy Cows, Cows and heifers that calved = Feedlot Heifers, Cattle/calves = Calves, Beef cows = Beef Cows, Other cattle = Heifer Stockers, Hogs are all assigned to the "Market 120-179 lbs" category, Layers = Layers, Pullets for laying flock replacement = Pullets/ Chickens, Broilers and other meat-type chickens = Broilers, all sheep = Sheep on Feed
Forestry and Land Use	Land Emissions And Removals Navigator (LEARN) Tool	Extracted county-level emissions and removals for forests, changes in forestry, Muurban trees, etc.	This data is recorded but emissions are not considered in the GHGI total per ICLEI's US Community Protocol (emissions and removals from forestry and land use should not count towards gross emissions) Used Austin, TX as the "representative urban area" for emissions factors
Stationary Fuel Emissions Factors	EPA's GHG Emission Factors Hub	n/a	n/a



OTHER SOURCES			
ACTIVITY/SOURCE	DATA SOURCE	METHODOLOGY	DATA GAPS/ASSUMPTIONS
Fugitive emissions from natural gas distribution	Environmental Defense Fund's (EDF) User Guide for Natural Gas Leakage Rate Modeling Tool.	n/a	n/a
Wastewater Treatment Emissions Factors	IPCC Methods for GHG Inventories	n/a	n/a
Agriculture Emissions factors	EPA's State Inventory Tool (SIT) Agriculture Module	n/a	n/a
Forestry and Land Use	U.S. Forest Service's Forest Inventory and Analysis (FIA) database	n/a	n/a



Table A-5: Expanded Inventory of GHG Emissions by Gas for Each Sector and Subsector (MT)

Emissions Source/Sink	GHG Emissions by Gas (MT)			
	CO ₂	CH ₄	N ₂ O	CO ₂ e
Residential Energy	6,595,186	332	67	6,622,534
Electricity	1,048,822	99	2	1,052,053
Natural Gas	72,676	81	2	75,475
Other Fuels	5,473,688	152	63	5,495,007
Commercial Energy	6,449,026	229	69	6,474,140
Electricity	5,536,282	121	65	5,557,341
Natural Gas	729,208	69	1	731,454
Other Fuels	183,535	39	3	185,345
Industrial Energy	3,424,953	182	29	3,437,754
Electricity	2,651,919	164	27	2,663,639
Natural Gas	717,668	14	1	718,403
Other Fuels	55,366	4	1	55,711
Transportation	14,126,210	837	155	14,191,348
On-Road	12,544,353	511	153	12,599,919
Off-Road	1,099,377	310	0	1,107,817
Rail	100,980	8	3	101,904
Marine	9,147	7	0	9,343
Aviation	372,351	0	0	372,365
Process and Fugitives	34	3,130	0	4,433,363
Manufacturing industry/construction	Unknown	Unknown	Unknown	4,340,061
Fugitive emissions from natural gas	34	3,130	0	93,302
Agriculture	0	43,560	4,360	2,374,985
Enteric fermentation	0	40,479	0	1,101,029
Manure management	0	3,045	519	224,619
Animal Runoff	0	0	114	31,020
Crops and Agricultural soils	0	35	3,727	1,018,316
Solid Waste	0	44,260	0	1,203,866
Landfilled waste	0	44,260	0	1,203,866
Water and Wastewater	0	0	220	60,150
Wastewater Treatment			11	2,968
Effluent Discharge			209	57,181
Total Emissions				41,872,797



Table A-6: Expanded Baseline Emissions by Sector (MTCO_{2e}), with Activity Data

SECTOR/ ACTIVITY	FUEL OR SOURCE	2021 USAGE/ ACTIVITY	UNITS	2021 EMISSIONS (MT CO _{2e})
Residential Energy	Electricity	14,210,729,461	kWh	5,495,007
	Wood	214,581	MMBtu	2,090
	Propane	1,182,498	MMBtu	73,385
	Natural Gas	19,781,634	MMBtu	1,052,053
	Residential Energy Total			6,622,535
Commercial Energy	Electricity	13,494,813	kWh	5,557,341
	Distillate Fuel Oil No. 2	1,180,140	MMBtu	87,866
	Propane	1,566,097	MMBtu	97,190
	Natural Gas	13,753,452	MMBtu	731,454
	Other Commercial Fuels	-	MMBtu	288
	Commercial Energy Total			6,474,139
Industrial Energy	Electricity	7,112,011,529	kWh	2,663,639
	Natural Gas	13,433,717	MMBtu	718,403
	Gasoline	266	MMBtu	19
	Distillate Fuel Oil No. 2	504	Gallons	5
	Other Industrial Fuels	70	MMBtu	264,940
	Industrial Energy Total			3,647,006
On Road Transportation	Gasoline	23,695,409,695	Vehicle Miles Traveled (VMT)	8,880,112
	Diesel	2,662,826,762	Vehicle Miles Traveled	3,664,934



SECTOR/ ACTIVITY	FUEL OR SOURCE	2021 USAGE/ ACTIVITY	UNITS	2021 EMISSIONS (MT CO ₂ e)
			(VMT)	
On Road Transit Transportation	Gasoline	108,260	MMBTU	7,653
	Diesel	101,923	MMBTU	7,537
	LPG	50,026	MMBTU	3,152
	CNG	655,228	MMBTU	36,532
Rail Transportation	Diesel	9,948,801	Gallons	101,904
Waterborne Transportation	Gasoline	106,959	MMBTU	7,707
	Diesel	22,110	MMBTU	1,636
Off Road Transportation & Mobile Sources	Gasoline	4,575,767	MMBTU	328,293
	Diesel	9,562,732	MMBTU	707,665
	CNG	127,632	MMBTU	7,981
Aviation	LPG	1,037,241	MMBTU	63,878
	Jet Fuel	5,360	Tons	372,365
Transportation & Mobile Sources Total				14,191,349
Solid Waste	Waste Generation	2,938,224	Tons	1,203,866
	Solid Waste Total			1,203,866
Water and Wastewater	Wastewater Treatment	-	-	60,152
	Water and Wastewater Total			60,152
Process & Fugitive Emissions	Fugitive Emissions from Natural Gas Distribution	50,531,017	MMBTU	93,302
	Fugitive Emissions	-	-	2,865,392



SECTOR/ ACTIVITY	FUEL OR SOURCE	2021 USAGE/ ACTIVITY	UNITS	2021 EMISSIONS (MT CO ₂ e)
	from Oil and Gas Production and Processing			
	Industrial Process & Product Use	-	-	4,340,070
	Process & Fugitive Emissions Total			7,298,764
Agriculture, Forestry, and other Land Uses (AFOLU)	Livestock	-	-	1,356,669
	Crops	-	-	1,018,317
	Land/Forestry	-	-	-1,991,462
	AFOLU Total (does not include Land/Forestry)			2,374,986
Total 2021 Regional Emissions				41,872,797



Appendix B: Emissions Projections and GHG Reductions Modeling

Includes future emissions projections, modeling assumptions, and quantification methods for GHG reduction strategies.

Table B-1: GHG Reduction Strategies

ACTIVITY/SOURCE	DATA USED	DATA GAPS/ASSUMPTIONS	DATA SOURCE
10% Gasoline VMT Reduction	10% Gasoline VMT Reduction by 2050	General benchmark	n/a
EV Adoption - Gasoline	95.63% of Gasoline VMT will switch to EVs by 2050	Follows National LDV Average	DOE Alternative Fuels Data Center, Statista, Rocky Mountain Institute (RMI)
EV Adoption - Diesel	99.63% of Diesel VMT will switch to EVs by 2050	Follows National HDV Average	DOE Alternative Fuels Data Center, Statista, Rocky Mountain Institute (RMI)
Residential Solar	-1,298.31 kWh/kW- Generation Potential -446,745.14 kW installed capacity/year	-Solar data-based Satellite imagery, 3D modeling, and shade calculations from Google. Baseline years for this data vary by county. -Because Google estimates total rooftop solar capacity without consideration of technical/financial constraints, we assume 15% of estimated capacity is achievable by 2030, and another 50% is achievable by 2050 -Because google outputs rooftop solar potential by roof orientation, we assume all directional orientations are residential	Google Project Sunroof/EIE



ACTIVITY/SOURCE	DATA USED	DATA GAPS/ASSUMPTIONS	DATA SOURCE
Commercial Solar	-1298.31 kWh/kW- Generation Potential -218,933.51kW installed capacity/year	<ul style="list-style-type: none"> -Solar data-based Satellite imagery, 3D modeling, and shade calculations from Google. Baseline years for this data vary by county. -Because Google estimates total rooftop solar capacity without consideration of technical/financial constraints, we assume 15% of estimated capacity is achievable by 2030, and another 50% is achievable by 2050 -Because google outputs rooftop solar potential by roof orientation, we assume all flat roof orientations are non-residential 	Google Project Sunroof/EIE
Residential Efficiency (Electricity/ Natural Gas)	<ul style="list-style-type: none"> -3.85% of existing housing units receiving efficiency retrofit per year -20% Savings from efficiency retrofit of existing buildings -25% Energy savings in new buildings 	<ul style="list-style-type: none"> -Default value of existing housing units receiving efficiency retrofit per year was 5%, 5% of building stock per year: Typical heating/cooling equipment life is around 15-20 years, and 20 years translates to 1/20, or 5%, each year. It can make sense to do an efficiency upgrade at the same time as equipment replacement - the efficiency may allow for a smaller, less expensive AC unit or furnace. -ACEE reported 10% typical energy savings for a 'light' retrofit and 29% for a 'medium' retrofit - so 20% falls in the middle between those. -Default Energy savings in new buildings was 37%, 37% improvement for new buildings comes from comparing estimated EUI (energy use intensity) for 2018 commercial model energy code with average EUI of existing commercial buildings from 2012 commercial buildings energy consumption survey. 	Pacific Northwest National Laboratory (PNNL), U.S. Energy Information Administration



ACTIVITY/SOURCE	DATA USED	DATA GAPS/ASSUMPTIONS	DATA SOURCE
Residential Building Electrification	<ul style="list-style-type: none"> -3.85% of existing housing units with natural gas electrified per year -85% (to 2030) and 100% (to 2050) of new construction electrified -3.58 Heat Pump Coefficient of Performance (COP) -80% Furnace Efficiency 	<ul style="list-style-type: none"> -Default value of existing housing units with natural gas electrified per year is 5%, 5% of building stock per year: Typical heating/cooling equipment life is around 15-20 years, and 20 years translates to 1/20, or 5%, each year. 	<p>EnergyStar, Schrodgers (Peiser, R., & Wiegelmann, T. "Real Estate and Sustainability: The Moral Imperative." Property Chronicle.)</p>
Commercial Efficiency (Electricity/ Natural Gas)	<ul style="list-style-type: none"> -3.85% of existing commercial building units receiving efficiency retrofit per year -20% Savings from efficiency retrofit of existing buildings -25% Energy savings in new buildings 	<ul style="list-style-type: none"> -Default value of existing housing units receiving efficiency retrofit per year was 5%, 5% of building stock per year: Typical heating/cooling equipment life is around 15-20 years, and 20 years translates to 1/20, or 5%, each year. It can make sense to do an efficiency upgrade at the same time as equipment replacement - the efficiency may allow for a smaller, less expensive AC unit or furnace. -ACEE reported 10% typical energy savings for a 'light' retrofit and 29% for a 'medium' retrofit - so 20% falls in the middle between those. -Default Energy savings in new buildings was 37%, 37% improvement for new buildings comes from comparing estimated EUI (energy use intensity) for 2018 commercial model energy code with average EUI of existing commercial buildings from 2012 commercial buildings energy consumption survey. 	<p>Pacific Northwest National Laboratory (PNNL), U.S. Energy Information Administration</p>



ACTIVITY/SOURCE	DATA USED	DATA GAPS/ASSUMPTIONS	DATA SOURCE
Commercial Building Electrification	<ul style="list-style-type: none">-3.85% of existing commercial units with natural gas electrified per year-85% (to 2030) and 100% (to 2050) of new construction electrified-3.58 Heat Pump Coefficient of Performance (COP)-80% Furnace Efficiency	<ul style="list-style-type: none">-Default value of existing commercial units with natural gas electrified per year is 5%, 5% of building stock per year: Typical heating/cooling equipment life is around 15-20 years, and 20 years translates to 1/20, or 5%, each year.	<p>EnergyStar, Schrodgers (Peiser, R., & Wiegelmann, T. "Real Estate and Sustainability: The Moral Imperative." Property Chronicle.)</p>



Table B-2: GHG Quantification Methods and Assumptions

Measure Number	Measure Name	GHG Quantification Methods and Assumptions	Source
<i>Transportation and Mobile Sources Measure 1</i>	Expand Travel Choice and Quality	The estimated emission reductions were calculated in an Excel model based on the business-as-usual projections developed in ClearPath. Key assumptions include: 10% gasoline VMT reduction by 2050.	N/A – General benchmark
<i>Transportation and Mobile Sources Measure 2</i>	Enable Consumer Choice of Electric Vehicles (EVs)	The estimated emission reductions were calculated in an Excel model based on the business-as-usual projections developed in ClearPath. Key assumptions include: 99.63% of Diesel VMT will switch to EVs and 95.63% of Gasoline VMT will switch to EVs by 2050.	DOE Alternative Fuels Data Center, Statista, Rocky Mountain Institute (RMI)
<i>Transportation and Mobile Sources Measure 3</i>	Allow Freedom to Build and Bring Back Traditional Main Streets	The estimated emission reductions were calculated in an Excel model based on the business-as-usual projections developed in ClearPath. Key assumptions include: 8% reduction in gasoline VMT by 2050	California Air Resources Board
<i>Process and Fugitive Emissions Measure 1</i>	Purchase Low-carbon Concrete from Local Producers	The estimated emission reductions were calculated in an Excel model based on the business-as-usual projections developed in ClearPath. Key assumptions include: 20% reduction in cement production emissions by 2030 and 40% reduction in cement production emissions by 2050	DOE Pathways to Commercial Liftoff: Low-Carbon Cement
<i>Process and Fugitive Emissions Measure 2</i>	Methane Leak Detection and Repair Program	The estimated emission reductions were calculated in an Excel model based on the business-as-usual projections developed in ClearPath. Key assumptions include: 20% reduction in fugitive methane emissions by 2030 and 60% reduction in fugitive methane emissions by 2030	U.S. EPA
<i>Residential Energy Measure 1</i>	Energy Independence, Resilience, and Utility Bill Savings Through Residential Solar	The estimated emission reductions were calculated in an Excel model based on the business-as-usual projections developed in ClearPath. Key assumptions include: 446,745.14 kW installed capacity/year and 1,298.31 kWh/kW Generation Potential.	Google Project Sunroof/EIE
<i>Residential Energy Measure 2</i>	Enable Residential Energy Savings	The estimated emission reductions were calculated in an Excel model based on the business-as-usual projections developed in ClearPath. Key assumptions include:	Pacific Northwest National Laboratory (PNNL), U.S.



		3.85% of existing housing units receiving efficiency retrofit per year, 20% savings from efficiency retrofit of existing buildings, and 25% energy savings in new buildings.	Energy Information Administration
<i>Residential Energy Measure 3</i>	Modernize Homes Through Electrification for Comfort and Savings	The estimated emission reductions were calculated in an Excel model based on the business-as-usual projections developed in ClearPath. Key assumptions include: 3.85% of existing housing units with natural gas electrified per year 85% (to 2030) and 100% (to 2050) of new construction electrified, 3.58 Heat Pump Coefficient of Performance (COP), and 80% Furnace Efficiency.	EnergyStar, Schroders (Peiser, R., & Wiegmann, T. "Real Estate and Sustainability: The Moral Imperative." Property Chronicle.)
<i>Commercial Energy Measure 1</i>	Create Business Value Through Solar Solutions for Commercial Properties	The estimated emission reductions were calculated in an Excel model based on the business-as-usual projections developed in ClearPath. Key assumptions include: 1298.31 kWh/kW Generation Potential and 218,933.51kW installed capacity/year.	Google Project Sunroof/EIE
<i>Commercial Energy Measure 2</i>	Eliminate Energy Waste for More Efficient Businesses	The estimated emission reductions were calculated in an Excel model based on the business-as-usual projections developed in ClearPath. Key assumptions include: 3.85% of existing commercial building units receiving efficiency retrofit per year, 20% Savings from efficiency retrofit of existing buildings, and 25% Energy savings in new buildings.	Pacific Northwest National Laboratory (PNNL), U.S. Energy Information Administration
<i>Commercial Energy Measure 3</i>	Modernize Commercial Buildings Through Electrification	The estimated emission reductions were calculated in an Excel model based on the business-as-usual projections developed in ClearPath. Key assumptions include: 3.85% of existing commercial units with natural gas electrified per year 85% (to 2030) and 100% (to 2050) of new construction electrified, 3.58 Heat Pump Coefficient of Performance (COP), and 80% Furnace Efficiency.	EnergyStar, Schroders (Peiser, R., & Wiegmann, T. "Real Estate and Sustainability: The Moral Imperative." Property Chronicle.)
<i>Industrial Energy Measure 1</i>	Optimize Industrial Energy Use	The estimated emission reductions were calculated in an Excel model based on the business-as-usual projections developed in ClearPath. Key assumptions include: 3% of facilities are engaged per year to implement energy efficiency and 2% savings of total energy annually.	DOE Industrial Decarbonization Roadmap



<i>Industrial Energy Measure 2</i>	Unlock Rooftop and Ground-Mounted Potential for Industrial Solar	The estimated emission reductions were calculated in an Excel model based on the business-as-usual projections developed in ClearPath. Key assumptions include: 25MW of new industrial solar electricity generation capacity by 2050 and 1499 kWh/kW per year generation.	N/A
<i>Industrial Energy Measure 3</i>	Modernize Industrial Facilities and Processes Through Electrification	The estimated emission reductions were calculated in an Excel model based on the business-as-usual projections developed in ClearPath. Key assumptions include: 25% of natural gas consumption electrified by 2030, 70% of natural gas consumption electrified by 2030, and average 2x efficiency gain with electrification.	N/A
<i>Industrial Energy Measure 4</i>	Carbon Capture, Utilization, and Storage (CCUS)	The estimated emission reductions were calculated in an Excel model based on the business-as-usual projections developed in ClearPath. Key assumptions include: 20% CCUS for remaining natural gas by 2030 and 50% CCUS for remaining natural gas by 2050.	N/A
<i>Industrial Energy Measure 5</i>	Support Industrial Fuel Switching	The estimated emission reductions were calculated in an Excel model based on the business-as-usual projections developed in ClearPath. Key assumptions include: 30% industrial fossil fuel use switched to low carbon fuels by 2050.	N/A
<i>AFOLU Measure 1</i>	Protect, Enhance, and Expand Urban Ecosystems, Trees, and Green Spaces	The estimated emission reductions were calculated in an Excel model. Key assumptions include: 200,000 new trees planted by 2030 and 500,000 new trees planted by 2050.	The Urban Forest and iTree Tools
<i>AFOLU Measure 2</i>	Implement Agriculture Best Practices for Methane and Nitrous Oxide Emission Reduction	The estimated emission reductions were calculated in an Excel model based on the business-as-usual projections developed in ClearPath. Key assumptions include: 5% of agriculture operations engaged annually to adopt best practices, 25% reduction in CH ₄ and N ₂ O via adoption of best practices through 2030, and 37% reduction in CH ₄ and N ₂ O via adoption of best practices 2031-2050.	EPA GHG Mitigation Potential in US Forestry and Agriculture Sector
<i>AFOLU Measure 4</i>	Support Urban-Rural Agricultural Connections	GHG emissions have not been quantified for this measure because the reductions are captured in multiple other measures in this plan.	San Antonio Food Insecurity Assessment



<i>Solid Waste Measure 1</i>	Improve Solid waste, Recycling, and Compost Programs	<p>The estimated emission reductions were calculated in an Excel model based on the business-as-usual projections developed in ClearPath. Key assumptions include: 40% solid waste diversion rate from landfills by 2030, 50% solid waste diversion rate from landfills by 2050.</p> <p>The estimated emission reductions were calculated in an Excel model based on the business-as-usual projections developed in ClearPath. Key assumptions include: 0.8% of landfilled waste is e-waste 20% recycling of currently landfilled e-waste by 2030 30% recycling of currently landfilled e-waste by 2050</p>	City of Austin - Zero Waste Plan
<i>Solid Waste Measure 2</i>	Reduce Food Waste	The estimated emission reductions were calculated in an Excel model based on the business-as-usual projections developed in ClearPath. Key assumptions include: 50% reduction in food waste by 2030, 70% reduction in food waste by 2030.	Vermont's Universal Recycling Law
<i>Solid Waste Measure 3</i>	Implement Early-stage Landfill Gas (LFG) Collection Systems	The estimated emission reductions were calculated in an Excel model based on the business-as-usual projections developed in ClearPath. Key assumptions include: 60% methane collection efficiency by 2030 90% methane collection efficiency by 2050 90% reduction in CO ₂ e through flaring and/or electricity generation	N/A
<i>Wastewater Measure 1</i>	Monitor and Reduce Impacts of Stormwater	GHG emissions reductions have not been quantified for this measure because they are secondary/indirect.	<p>"Path to zero emission of nitrous oxide in sewage treatment: is nitrification controllable or avoidable?" Current Opinion in Biotechnology, Volume 91, 2025.</p> <p>San Antonio Water System - Biogas</p>



Appendix C: Workforce Analysis

This appendix presents workforce data and analyses related to the emissions reduction sector.

Employment in Impacted Industries, San Antonio-New Braunfels Region

The employment data included in the following graphs is from 2020 – 2024 from Occupational Employment and Wage Estimates determined by the Bureau of Labor Statistics (BLS) for the San Antonio-New Braunfels MSA.

Figure C-1: Total Employment in Industries Impacted by Transportation Sector Reduction Measures

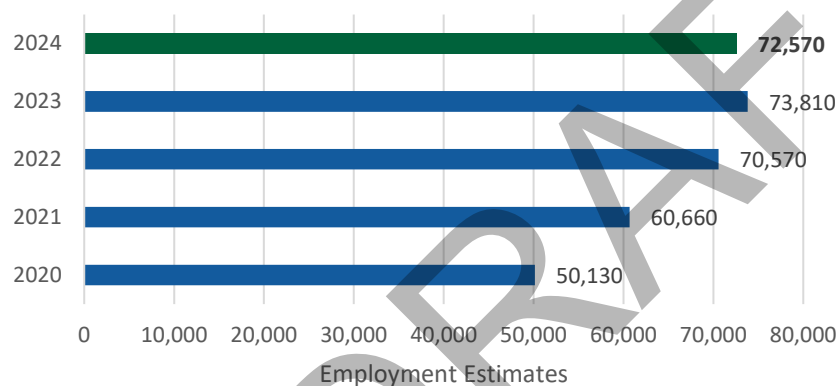


Figure C-2: Total Employment in Industries Impacted by Buildings Sector Reduction Measures

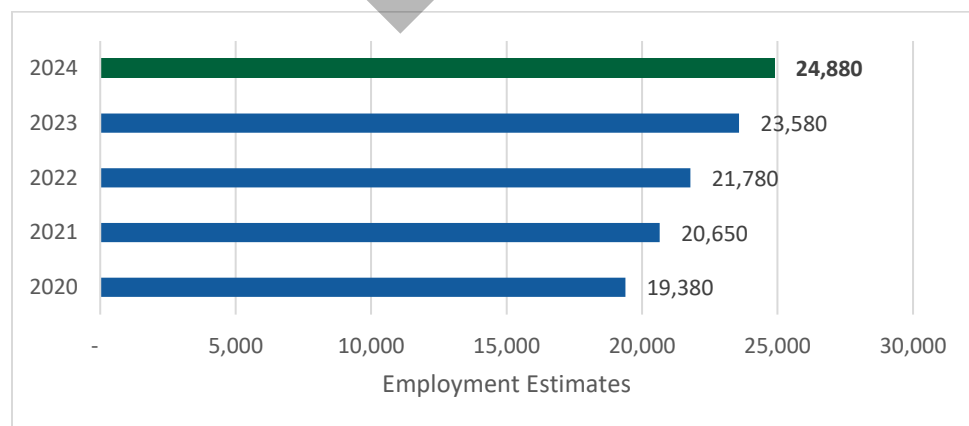




Figure C-3: Total Employment in Industries Impacted by Agriculture Sector Reduction Measures

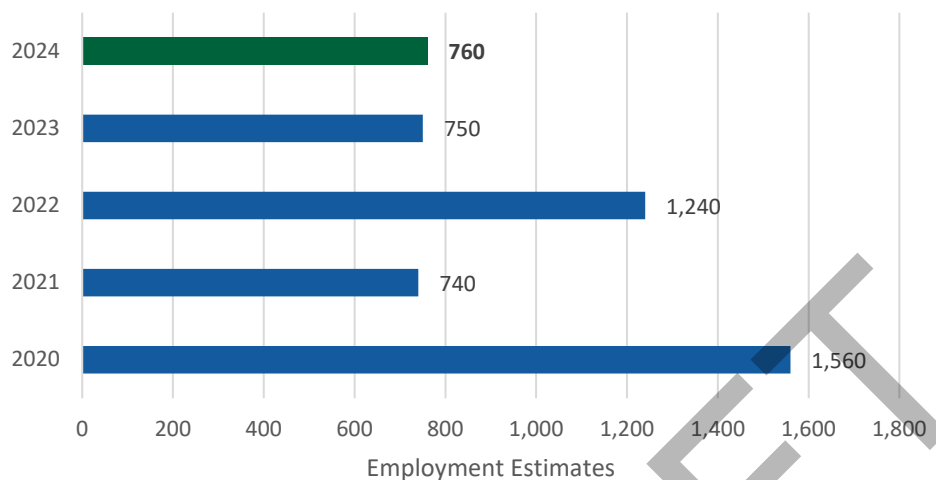
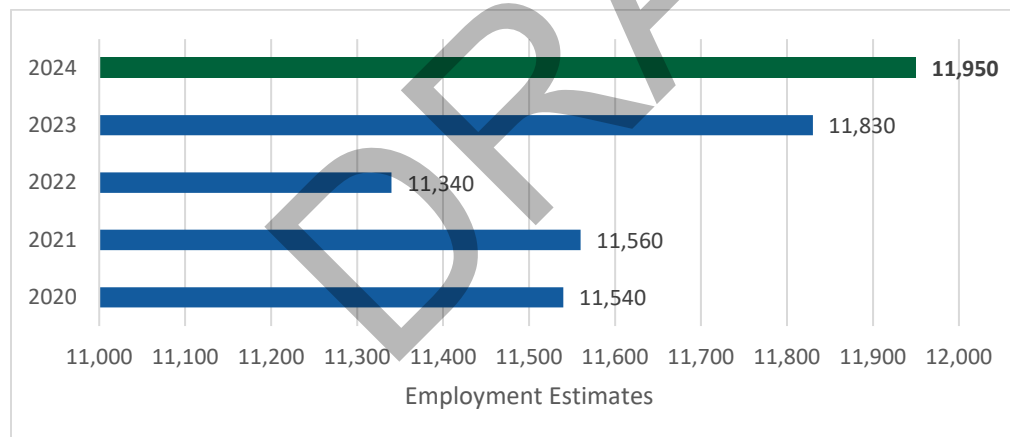


Figure C-4. Total Employment for Industrial Decarbonization





Transportation Sector Example Occupations

Table C-1: Transportation Sector—Mechanical Engineers

OES Occupation Name	Mechanical Engineers
<i>Occupation Code</i>	17-2141
<i>Description</i>	Perform engineering duties in planning and designing tools, engines, machines, and other mechanically functioning equipment. Oversee installation, operation, maintenance, and repair of equipment such as centralized heat, gas, water, and steam systems.
<i>MSA Total Employment</i>	1,150
<i>Hourly Median Salary 2024 (MSA)</i>	\$48.90
<i>Annual Median Salary 2024 (MSA)</i>	\$101,710
<i>Educational Requirements</i>	Most of these occupations require a four-year bachelor's degree, but some do not.
<i>Related Experience</i>	A considerable amount of work-related skill, knowledge, or experience is needed for these occupations.
<i>Job Training</i>	Employees in these occupations usually need several years of work-related experience, on-the-job training, and/or vocational training.
<i>Available Apprenticeships by Industry</i>	Tool Designer; Tool Design

Source: Bureau of Labor Statistics (BLS) Occupational Employment and Wage Statistics (OES) 2024 Estimate for San Antonio-New Braunfels Region; Educational Requirements and Apprenticeship information from O*Net OnLine by US Department of Labor.



Table C-2: Transportation Sector—Electrical Engineers

OES Occupation Name	Electrical Engineers
<i>Occupation Code</i>	17-2071
<i>Description</i>	Research, design, develop, test, or supervise the manufacturing and installation of electrical equipment, components, or systems for commercial, industrial, military, or scientific use.
<i>MSA Total Employment</i>	740
<i>Hourly Median Salary 2024 (MSA)</i>	\$49.37
<i>Annual Median Salary 2024 (MSA)</i>	\$102,680
<i>Educational Requirements</i>	Most of these occupations require a four-year bachelor's degree, but some do not.
<i>Related Experience</i>	A considerable amount of work-related skill, knowledge, or experience is needed for these occupations.
<i>Job Training</i>	Employees in these occupations usually need several years of work-related experience, on-the-job training, and/or vocational training.
<i>Available Apprenticeships by Industry</i>	Electrical Apprentice Training Programs

Source: Bureau of Labor Statistics (BLS) Occupational Employment and Wage Statistics (OES) 2024 Estimate for San Antonio-New Braunfels Region; Educational Requirements and Apprenticeship information from O*Net OnLine by US Department of Labor.

Table C-3: Transportation Sector—Electricians

OES Occupation Name	Electricians
<i>Occupation Code</i>	47-2111
<i>Description</i>	Install, maintain, and repair electrical wiring, equipment, and fixtures. Ensure that work is in accordance with relevant codes. May install or service street lights, intercom systems, or electrical control systems.
<i>MSA Total Employment</i>	5,930
<i>Hourly Median Salary 2024 (MSA)</i>	\$25.31
<i>Annual Median Salary 2024 (MSA)</i>	\$52,650
<i>Educational Requirements</i>	Most occupations in this zone require training in vocational schools, related on-the-job experience, or an associate's degree.
<i>Related Experience</i>	Previous work-related skill, knowledge, or experience is required for these occupations. For example, an electrician must have completed three or four years of apprenticeship or several years of vocational training, and often must have passed a licensing exam, in order to perform the job.
<i>Job Training</i>	Employees in these occupations usually need one or two years of training involving both on-the-job experience and informal training with experienced workers. A recognized apprenticeship program may be associated with these occupations.
<i>Available Apprenticeships by Industry</i>	<p>Example apprenticeship titles for this occupation:</p> <ul style="list-style-type: none"> • Electrician (Alternate Title: Interior Electrician) • Electrician (Water Trans) • Lightning Protection Technician (Conventional System) • Neon-Sign Servicer • Production Machinery Electrician (Existing Title: Electrician, Maintenance)

Source: Bureau of Labor Statistics (BLS) Occupational Employment and Wage Statistics (OES) 2024 Estimate for San Antonio-New Braunfels Region; Educational Requirements and Apprenticeship information from O*Net OnLine by US Department of Labor.

Table C-4: Transportation Sector—Automotive Technicians

OES Occupation Name	Automotive Technicians
<i>Occupation Code</i>	49-3023
<i>Description</i>	Diagnose, adjust, repair, or overhaul automotive vehicles.
<i>MSA Total Employment</i>	5,910
<i>Hourly Median Salary 2024 (MSA)</i>	\$23.23
<i>Annual Median Salary 2024 (MSA)</i>	\$48,320
<i>Educational Requirements</i>	Most occupations in this zone require training in vocational schools, related on-the-job experience, or an associate's degree.
<i>Related Experience</i>	Previous work-related skill, knowledge, or experience is required for these occupations. For example, an electrician must have completed three or four years of apprenticeship or several years of vocational training, and often must have passed a licensing exam, in order to perform the job.
<i>Job Training</i>	Employees in these occupations usually need one or two years of training involving both on-the-job experience and informal training with experienced workers. A recognized apprenticeship program may be associated with these occupations.
<i>Available Apprenticeships by Industry</i>	<p>Example apprenticeship titles for this occupation:</p> <ul style="list-style-type: none"> • Air Conditioning Mechanic (Auto Serv) • Auto Cooling System Diagnostic Tech • Auto-Radiator Mechanic • Automotive Mechanic (Existing Title: Automobile Mechanic) • Brake Repairer (Auto Serv)

Source: Bureau of Labor Statistics (BLS) Occupational Employment and Wage Statistics (OES) 2024 Estimate for San Antonio-New Braunfels Region; Educational Requirements and Apprenticeship information from O*Net OnLine by US Department of Labor.



Buildings Sector Example Occupations

Table C-5: Buildings Sector – Engineers, Other

OES Occupation Name	Engineers, Other
Occupation Code	17-2199
Description	Design, develop, or evaluate energy-related projects or programs to reduce energy costs or improve energy efficiency during the designing, building, or remodeling stages of construction. May specialize in electrical systems; heating, ventilation, and air-conditioning (HVAC) systems; green buildings; lighting; air quality; or energy procurement.
MSA Total Employment	900
Hourly Median Salary 2024 (MSA)	\$55.46
Annual Median Salary 2024 (MSA)	\$115,360
Educational Requirements	Most of these occupations require a four-year bachelor's degree, but some do not.
Related Experience	A considerable amount of work-related skill, knowledge, or experience is needed for these occupations.
Job Training	Employees in these occupations usually need several years of work-related experience, on-the-job training, and/or vocational training.
Available Apprenticeships by Industry	N/A

Source: Bureau of Labor Statistics (BLS) Occupational Employment and Wage Statistics (OES) 2024 Estimate for San Antonio-New Braunfels Region; Educational Requirements and Apprenticeship information from O*Net OnLine by US Department of Labor.



Table C-6: Buildings Sector – Environmental Engineers

<i>OES Occupation Name</i>	Environmental Engineers
<i>Occupation Code</i>	17-2081
<i>Description</i>	Research, design, plan, or perform engineering duties in the prevention, control, and remediation of environmental hazards using various engineering disciplines. Work may include waste treatment, site remediation, or pollution control technology.
<i>MSA Total Employment</i>	180
<i>Hourly Median Salary 2024 (MSA)</i>	\$50.44
<i>Annual Median Salary 2024 (MSA)</i>	\$104,910
<i>Educational Requirements</i>	Most of these occupations require a four-year bachelor's degree, but some do not.
<i>Related Experience</i>	A considerable amount of work-related skill, knowledge, or experience is needed for these occupations.
<i>Job Training</i>	Employees in these occupations usually need several years of work-related experience, on-the-job training, and/or vocational training.
<i>Available Apprenticeships by Industry</i>	N/A

Source: Bureau of Labor Statistics (BLS) Occupational Employment and Wage Statistics (OES) 2024 Estimate for San Antonio-New Braunfels Region; Educational Requirements and Apprenticeship information from O*Net OnLine by US Department of Labor.

Table C-7: Buildings Sector – HVAC Mechanics and Installers

OES Occupation Name	HVAC Mechanics and Installers (energy-efficient systems)
<i>Occupation Code</i>	49-9021
<i>Description</i>	Install or repair heating, central air conditioning, HVAC, or refrigeration systems, including oil burners, hot-air furnaces, and heating stoves.
<i>MSA Total Employment</i>	2,890
<i>Hourly Median Salary 2024 (MSA)</i>	\$25.85
<i>Annual Median Salary 2024 (MSA)</i>	\$53,770
<i>Educational Requirements</i>	Most occupations in this zone require training in vocational schools, related on-the-job experience, or an associate's degree.
<i>Related Experience</i>	Previous work-related skill, knowledge, or experience is required for these occupations. For example, an electrician must have completed three or four years of apprenticeship or several years of vocational training, and often must have passed a licensing exam, in order to perform the job.
<i>Job Training</i>	Employees in these occupations usually need one or two years of training involving both on-the-job experience and informal training with experienced workers. A recognized apprenticeship program may be associated with these occupations.
<i>Available Apprenticeships by Industry</i>	<p>Example apprenticeship titles for this occupation:</p> <ul style="list-style-type: none"> • Air & Hydronic Balancing Technician • Furnace Installer • Furnace Installer & Repairer • Heating, Ventilation, Air Conditioning (Ex. Tit: Heating&Air Cond. Inst/Ser) • Oil Burner-Servicer & Installer

Source: Bureau of Labor Statistics (BLS) Occupational Employment and Wage Statistics (OES) 2024 Estimate for San Antonio-New Braunfels Region; Educational Requirements and Apprenticeship information from O*Net OnLine by US Department of Labor.



Table C-8: Buildings Sector – Solar Photovoltaic Installers

<i>OES Occupation Name</i>	<i>Solar Photovoltaic Installers</i>
<i>Occupation Code</i>	47-2231
<i>Description</i>	Assemble, install, or maintain solar photovoltaic (PV) systems on roofs or other structures in compliance with site assessment and schematics. May include measuring, cutting, assembling, and bolting structural framing and solar modules. May perform minor electrical work such as current checks.
<i>MSA Total Employment</i>	NO employment at the MSA Level Texas Total Employment: 5,370
<i>Hourly Median Salary 2024 (MSA)</i>	Statewide Hourly Median Salary: \$22.89
<i>Annual Median Salary 2024 (MSA)</i>	Statewide Annual Hourly: \$45,870
<i>Educational Requirements</i>	These occupations usually require a high school diploma.
<i>Related Experience</i>	Some previous work-related skill, knowledge, or experience is usually needed.
<i>Job Training</i>	Employees in these occupations need anywhere from a few months to one year of working with experienced employees. A recognized apprenticeship program may be associated with these occupations.
<i>Available Apprenticeships by Industry</i>	Power Generation and Alternative Energy Program

Source: Bureau of Labor Statistics (BLS) Occupational Employment and Wage Statistics (OES) 2024 Estimate for San Antonio-New Braunfels Region; Educational Requirements and Apprenticeship information from O*Net OnLine by US Department of Labor.



Agriculture Sector Example Occupations

Table C-9: Agriculture Sector – Farmworkers and Laborers, Crop, Nursery, and Greenhouse

OES Occupation Name	Farmworkers and Laborers, Crop, Nursery, and Greenhouse
Occupation Code	45-2092
Description	Manually plant, cultivate, and harvest vegetables, fruits, nuts, horticultural specialties, and field crops. Use hand tools, such as shovels, trowels, hoes, tampers, pruning hooks, shears, and knives. Duties may include tilling soil and applying fertilizers; transplanting, weeding, thinning, or pruning crops; applying pesticides; or cleaning, grading, sorting, packing, and loading harvested products. May construct trellises, repair fences and farm buildings, or participate in irrigation activities.
MSA Total Employment	290
Hourly Median Salary 2024 (MSA)	\$15.95
Annual Median Salary 2024 (MSA)	\$33,170
Educational Requirements	Some of these occupations may require a high school diploma or GED certificate.
Related Experience	Little or no previous work-related skill, knowledge, or experience is needed for these occupations. For example, a person can become a waiter or waitress even if he/she has never worked before.
Job Training	Employees in these occupations need anywhere from a few days to a few months of training. Usually, an experienced worker could show you how to do the job.
Available Apprenticeships by Industry	N/A

Source: Bureau of Labor Statistics (BLS) Occupational Employment and Wage Statistics (OES) 2024 Estimate for San Antonio-New Braunfels Region; Educational Requirements and Apprenticeship information from O*Net OnLine by US Department of Labor.

Table C-10: Agriculture Sector – Soil and Plant Scientists

OES Occupation Name	Soil and Plant Scientists
Occupation Code	19-1013
Description	Conduct research in breeding, physiology, production, yield, and management of crops and agricultural plants or trees, shrubs, and nursery stock, their growth in soils, and control of pests; or study the chemical, physical, biological, and mineralogical composition of soils as they relate to plant or crop growth. May classify and map soils and investigate effects of alternative practices on soil and crop productivity.
MSA Total Employment	30
Hourly Median Salary 2023 (MSA)	\$26.34
Annual Median Salary 2023 (MSA)	\$54,790
Educational Requirements	Most of these occupations require graduate school. For example, they may require a master's degree, and some require a Ph.D., M.D., or J.D. (law degree).
Related Experience	Extensive skill, knowledge, and experience are needed for these occupations. Many require more than five years of experience. For example, surgeons must complete four years of college and an additional five to seven years of specialized medical training to be able to do their job.
Job Training	Employees may need some on-the-job training, but most of these occupations assume that the person will already have the required skills, knowledge, work-related experience, and/or training.
Available Apprenticeships by Industry	Example apprenticeship titles for this occupation: <ul style="list-style-type: none"> • Horticulturalist

Source: Bureau of Labor Statistics (BLS) Occupational Employment and Wage Statistics (OES) 2024 Estimate for San Antonio-New Braunfels Region; Educational Requirements and Apprenticeship information from O*Net OnLine by US Department of Labor.



Table C-11: Agriculture Sector – Environmental Scientists

<i>OES Occupation Name</i>	<i>Environmental Scientists</i>
<i>Occupation Code</i>	19-2041
<i>Description</i>	Conduct research or perform investigation for the purpose of identifying, abating, or eliminating sources of pollutants or hazards that affect either the environment or public health. Using knowledge of various scientific disciplines, may collect, synthesize, study, report, and recommend action based on data derived from measurements or observations of air, food, soil, water, and other sources.
<i>MSA Total Employment</i>	270
<i>Hourly Median Salary 2024 (MSA)</i>	\$39.94
<i>Annual Median Salary 2024 (MSA)</i>	\$83,070
<i>Educational Requirements</i>	Most of these occupations require a four-year bachelor's degree, but some do not.
<i>Related Experience</i>	A considerable amount of work-related skill, knowledge, or experience is needed for these occupations. For example, an accountant must complete four years of college and work for several years in accounting to be considered qualified.
<i>Job Training</i>	Employees in these occupations usually need several years of work-related experience, on-the-job training, and/or vocational training.
<i>Available Apprenticeships by Industry</i>	Example apprenticeship titles for this occupation: <ul style="list-style-type: none"> • Environmental Analyst

Source: Bureau of Labor Statistics (BLS) Occupational Employment and Wage Statistics (OES) 2024 Estimate for San Antonio-New Braunfels Region; Educational Requirements and Apprenticeship information from O*Net OnLine by US Department of Labor.

Industrial Decarbonization Sector Example Occupations

Table C-12: Industrial Decarbonization Sector – Power Plant Operators

OES Occupation Name	Power Plant Operators
<i>Occupation Code</i>	51-8013
<i>Description</i>	Control, operate, or maintain machinery to generate electric power. Includes auxiliary equipment operators.
<i>MSA Total Employment</i>	250
<i>Hourly Median Salary 2023 (MSA)</i>	\$23.88
<i>Annual Median Salary 2023 (MSA)</i>	\$49,680
<i>Educational Requirements</i>	These occupations usually require a high school diploma.
<i>Related Experience</i>	Some previous work-related skill, knowledge, or experience is usually needed. For example, a teller would benefit from experience working directly with the public.
<i>Job Training</i>	Employees in these occupations need anywhere from a few months to one year of working with experienced employees. A recognized apprenticeship program may be associated with these occupations.
<i>Available Apprenticeships by Industry</i>	Example apprenticeship titles for this occupation: <ul style="list-style-type: none"> • Hydroelectric-Station Operator • Power-Plant Operator • Turbine Operator

Source: Bureau of Labor Statistics (BLS) Occupational Employment and Wage Statistics (OES) 2024 Estimate for San Antonio-New Braunfels Region; Educational Requirements and Apprenticeship information from O*Net OnLine by US Department of Labor.

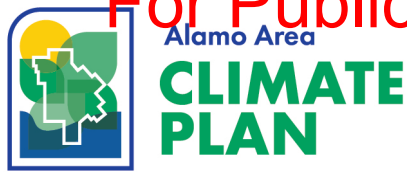


Table C-13: Industrial Decarbonization Sector – Plant and System Operators

OES Occupation Name	Plant and System Operators, All Other
<i>Occupation Code</i>	51-8099
<i>Description</i>	O*Net Does not include this information on this occupation.
<i>MSA Total Employment</i>	230
<i>Hourly Median Salary 2024 (MSA)</i>	\$51.62
<i>Annual Median Salary 2024 (MSA)</i>	\$107,360
<i>Educational Requirements</i>	O*Net Does not include this information on this occupation.
<i>Related Experience</i>	O*Net Does not include this information on this occupation.
<i>Job Training</i>	O*Net Does not include this information on this occupation.
<i>Available Apprenticeships by Industry</i>	O*Net Does not include this information on this occupation.

Source: Bureau of Labor Statistics (BLS) Occupational Employment and Wage Statistics (OES) 2024 Estimate for San Antonio-New Braunfels Region; Educational Requirements and Apprenticeship information from O*Net OnLine by US Department of Labor.