The Clean Arizona Plan
Priority Climate Action Plan
State of Arizona

Prepared by
Arizona State University and Northern Arizona University
for the
Arizona Governor’s Office of Resiliency

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Acronyms and Abbreviations

Acronym or Abbreviation	Definition
ABOR	Arizona Board of Regents
ACA	Arizona Commerce Authority
ADEQ	Arizona Department of Environmental Quality
ADOA	Arizona Department of Administration
ADOT	Arizona Department of Transportation
ASU	Arizona State University
CAIFI	Customer Average Interruption Frequency Index
CCAP	Comprehensive Climate Action Plan
CEJST	Climate and Economic Justice Screening Tool
CFI	Charging and Fueling Infrastructure Discretionary Grant
CPRG	Climate Pollution Reduction Grant
DOE	Department of Energy
EE	Energy Efficiency
EPA	Environmental Protection Agency
GHG	Greenhouse Gas
GRIC	Gila River Indian Community
IRA	Inflation Reduction Act
LIDAC	Low Income/Disadvantaged Communities
LIHEAP	Low-Income Home Energy Assistance Program
MAG	Maricopa Association of Governments
MCCCD	Maricopa County Community Colleges District
NAU	Northern Arizona University
OEO	Office of Economic Opportunity
OOR	Arizona Governor's Office of Resiliency
PCAP	Priority Climate Action Plan
PDEQ	Pima Department of Environmental Quality
QAPP	Quality Assurance Project Plan
SAIDI	System Average Interruption Duration Index
SRPMIC	Salt River Pima Maricopa Indian Community
UA	University of Arizona
WAP	Weatherization Assistance Program

Executive Summary

As funded by the Inflation Reduction Act (IRA), the Climate Pollution Reduction Grant (CPRG) program provided a total of $250 million in formula grants to states, local governments, tribes, and territories to develop plans to improve air quality and reduce greenhouse gas emissions.

Under the leadership and authority of Arizona Governor Katie Hobbs, the Governor's Office of Resiliency received $3 million to conduct planning that would identify opportunities and projects that would improve air quality throughout Arizona, with a priority focus on delivering the benefits of improved air quality to low-income and historically underserved communities in the state.

To meet these goals, the Governor's Office of Resiliency partnered with Arizona State University and Northern Arizona University to produce this Priority Climate Action Plan (PCAP) to support investment in policies, practices, and technologies that reduce pollutant emissions, create high-quality jobs, spur economic growth, and enhance the quality of life for all Arizonans.

In coordination with the Governor's Office of Resiliency, Arizona State University and Northern Arizona University hosted 6 community engagement events, and 5 stakeholder roundtables, and engaged with hundreds of Arizonans, including representatives of community-based organizations and industry leaders. These stakeholder conversations directly informed the creation of the Clean Arizona Plan through the identification of key measures, projects, and opportunities that would improve air quality, especially in low-income, historically underserved, rural, and tribal Arizona.

The measures contained herein should be construed as broadly available to any entity in the state eligible for receiving funding under the EPA's Climate Pollution Reduction Implementation Grants (CPRG) and other funding streams, as applicable.

The Governor's Office of Resiliency will prioritize measures that address the two primary sources of greenhouse gas emissions in Arizona: electric generation and transportation. Highlighted measures outlined in the Clean Arizona Plan include:

- Expanding access to weatherization, energy efficiency upgrades and electrification;
- Support for the development and deployment of renewable energy generation projects, such deploying as solar-plus-battery systems;
- Increased access to publicly accessible electric vehicle charging infrastructure;
- Accelerated adoption of electric and zero-emission vehicles; and
- Establishment of partnership programs that provide workforce training and certification for energy efficiency and emerging energy technology contracting.

By prioritizing these measures, the Clean Arizona Plan identifies opportunities totaling a reduction of 8,835,826 metric tons of greenhouse gas emissions reductions and the potential for hundreds of millions of dollars of investment in communities across Arizona.

This PCAP is organized into 5 sections:

1. Executive Summary
2. Greenhouse Gas (GHG) Emissions Inventory
3. Priority Measures including LIDAC and GHG Impact Analyses
4. Review of Authority to Implement
5. Coordination and Outreach

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Greenhouse Gas Emissions Inventory

Overview

The Governor's Office of Resiliency in conjunction with Northern Arizona University has developed a statewide inventory of GHG emissions across Arizona to support the Priority Climate Action Plan (PCAP). The *Arizona PCAP GHG Inventory* sets a baseline year of 2000 and a reporting year of 2021.[1] The baseline year of 2000 was set to provide continuity from Arizona's previous climate action plan published in 2006. The Arizona Climate Change Advisory Group's *Climate Change Action Plan* provided an overarching recommendation to reduce statewide GHG emissions to 2000 levels by 2020.[2]

The *Arizona PCAP GHG Inventory* categorizes GHG emissions into sectors that group activities based on how emissions occur. The GHG emissions sectors listed in Table 1 were chosen to provide a comprehensive summary of where and how GHGs are emitted in Arizona. In addition to the major GHGs -- carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) – minor GHGs were also inventoried (Table 1).

Table 1. GHG Emissions Sectors and GHGs Inventoried by the Arizona PCAP GHG Inventory

GHG Emissions Sector	***Greenhouse Gases (across all sectors)***
1. Transportation	• carbon dioxide (CO_2),
2. Electricity generation and/or use	• methane (CH_4),
3. Natural and working lands	• nitrous oxide (N_2O),
4. Industry	• hydrofluorocarbons (HFCs),
5. Agriculture	• perfluorocarbons (PFCs),
6. Commercial and residential buildings	• sulfur hexafluoride (SF_6), and
7. Waste and materials management	• nitrogen trifluoride (NF_3)
8. Water	
9. Wastewater	

The *Arizona PCAP GHG Inventory* is an initial inventory of GHG emissions across Arizona and will be updated and built out further throughout the Climate Pollution Reduction Grant (CPRG) project, which includes the Comprehensive Climate Action Plan (CCAP) and Status Update phases. The goal of the *Arizona PCAP GHG Inventory* was to develop a uniform and comprehensive approach to estimating GHG emissions across Arizona's diverse 15 counties. Therefore, datasets and methods that enabled the estimation of both statewide and county-level emissions were identified and utilized. These data sources included:

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[1] Inventorying more recent years will be considered during the Comprehensive Climate Action Plan (CCAP) phase of this project. The baseline year of 2021 was also chosen to reduce the impact of the COVID-19 pandemic on observed GHG emissions.

[2] Arizona Climate Change Advisory Group's *Climate Change Action Plan*. August 2006. URL: https://www.documentcloud.org/documents/4953066-AZ-Climate-Change-Action-Plan-2006

- State-level GHG inventories prepared by the EPA[3]
- Data reported to the EPA's Greenhouse Gas Reporting Program
    - Subpart C - General Stationary Fuel Combustion Sources[4]
    - Subpart DD - Use of Electric Transmission and Distribution Equipment
    - Subpart H - Cement Production[5]
    - Subpart HH - Municipal Solid Waste[6]
    - Subpart I - Electronics Manufacturing[7]
    - Subpart Q - Iron and Steel Production[8]
    - Subpart S - Lime Manufacturing[9]
    - Subpart TT - Industrial Waste Landfills[10]
    - Subpart V - Nitric Acid Production[11]
    - Subpart W - Petroleum and Natural Gas Systems[12]
- EPA Facility Level Information on Greenhouse Gas Tool[13]
- EPA National Emissions Inventory[14]

GHG emissions factor data were obtained from the following sources:

- EPA GHG Emissions Factor Hub[15]
- EPA Emissions & Generation Resource Integrated Database (eGRID)[16]

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[3] EPA (2023) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021. U.S. Environmental Protection Agency, EPA 430-R-23-002. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and- sinks-1990-2021.

[4] EPA (2024). GHG Query Builder. General Stationary Fuel Combustion Sources. URL: https://enviro.epa.gov/query-builder/ghg/GENERAL%20STATIONARY%20FUEL%20COMBUSTION%20SOURCES

[5] EPA (2024). GHG Query Builder. Cement Production: h_subpart_level_information. URL: https://enviro.epa.gov/query-builder/ghg/CEMENT%20PRODUCTION/H_SUBPART_LEVEL_INFORMATION/

[6] EPA (2024). GHG Query Builder. Municipal Solid Waste Landfills: hh_subpart_level_information. URL: https://enviro.epa.gov/query-builder/ghg/MUNICIPAL%20SOLID%20WASTE%20LANDFILLS/HH_SUBPART_LEVEL_INFORMATION

[7] EPA (2024). GHG Query Builder. Electronics Manufacture: mv_ef_i_emissions_by_ghg. URL: https://enviro.epa.gov/query-builder/ghg/ELECTRONICS%20MANUFACTURE/MV_EF_I_EMISSIONS_BY_GHG

[8] EPA (2024). GHG Query Builder. Iron and Steel Production: q_subpart_level_information. URL: https://enviro.epa.gov/query-builder/ghg/IRON%20AND%20STEEL%20PRODUCTION/Q_SUBPART_LEVEL_INFORMATION

[9] EPA (2024). GHG Query Builder. Iron and Steel Production: q_subpart_level_information. URL: https://enviro.epa.gov/query-builder/ghg/IRON%20AND%20STEEL%20PRODUCTION/Q_SUBPART_LEVEL_INFORMATION

[10] EPA (2024). GHG Query Builder. Industrial Waste Landfills: tt_subpart_ghg_info. URL: https://enviro.epa.gov/query-builder/ghg/INDUSTRIAL%20WASTE%20LANDFILLS/TT_SUBPART_GHG_INFO

[11] EPA (2024). GHG Query Builder. Nitric Acid Production: v_subpart_level_information. URL: https://enviro.epa.gov/query-builder/ghg/NITRIC%20ACID%20PRODUCTION/V_SUBPART_LEVEL_INFORMATION

[12] EPA (2024). GHG Query Builder. Petroleum and Natural Gas Systems (RY 2011-2014): w_subpart_level_information. URL: https://enviro.epa.gov/query-builder/ghg/PETROLEUM%20AND%20NATURAL%20GAS%20SYSTEMS%20(RY%202011-2014)/W_SUBPART_LEVEL_INFORMATION

[13] EPA (2024). Facility Level Information on Greenhouse Gas Tool. URL: https://ghgdata.epa.gov/ghgp/main.do

[14] EPA (2024). Online 2020 NEI Data Retrieval Tool. URL: https://awsedap.epa.gov/public/single/?appid=20230c40-026d-494e-903f-3f112761a208&sheet=5d3fdda7-14bc-4284-a9bb-cfd856b9348d&opt=ctxmenu,currsel

[15] EPA Center for Corporate Climate Leadership. GHG Emissions Factors Hub. URL: https://www.epa.gov/climateleadership/ghg-emission-factors-hub

[16] EPA eGRID (2024). https://www.epa.gov/egrid

- EIA Form EIA-176, "Annual Report of Natural and Supplemental Gas Supply and Disposition"[17]
- EIA Form EIA-861, "Annual Electric Power Industry Report"[18]
- EIA Form EIA-923[19]
- EIA State Energy Data System[20]
- The National Renewable Energy Laboratory State and Local Planning for Energy (SLOPE) tool.[21]
- Data obtained was reported by Arizona Public Service and Salt River Project to the Edison Electricity Institute ESG Reporting Program and the Climate Registry.

A full listing of datasets identified, and methods utilized for each GHG emitting activity is provided in Appendix E.

The proposed methods and data sources were submitted to EPA in a Quality Assurance Project Plan (QAPP), provided in Appendix J. QAPP approval by the EPA was a prerequisite to beginning the GHG inventory process. Due to project timing for the PCAP phase of the GHG inventory, the natural and working lands, waste and materials management, water production, and wastewater treatment sectors were estimated but will be built out in greater detail during the CCAP phase.

The focus of the *Arizona PCAP GHG Inventory* was to estimate GHG emissions where they occur; these emissions are typically called Scope 1 emissions. The CCAP and Status Updates phases will add additional complexity to the GHG inventory process by including GHG emissions induced by activity within a jurisdiction via activities like electricity consumption or depositing solid waste to regional landfills; these emissions are called Scope 2 (electricity) and Scope 3 (indirect emissions), respectively. Accounting for Scope 2 and Scope 3 GHG emissions provides additional detail on why GHG emissions occur across the state in addition to where and how GHG emissions occur (Scope 1).

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[17] Energy Information Administration (2024). Form EIA-176, "Annual Report of Natural and Supplemental Gas Supply and Disposition."

[18] Energy Information Administration (2024). Form EIA-861, “Annual Electric Power Industry Report.” URL: https://www.eia.gov/electricity/data/eia861/

[19] Energy Information Administration (2024). Form EIA-923, “detailed data with previous form data (EIA-906/920).” URL: https://www.eia.gov/electricity/data/eia923/

[20] Energy Information Administration (2024). Open Data. State Energy Data System API. URL: https://www.eia.gov/opendata/browser/seds?frequency=annual&data=value;&facets=stateId;&stateId=AZ;&start=2021&end=2021&sortColumn=period;&sortDirection=desc;.

[21] National Renewable Energy Laboratory. "Net Electricity and Natural Gas Consumption," State and Local Planning for Energy

Findings
In 2021, Arizona emitted approximately 107.8 million metric tons of CO_2e across all GHG emissions sectors (Table 2). Further, between 2000 and 2021, Arizona's GHG emissions remained relatively flat, notching only a slight increase from the 107.7 million metric tons of CO_2e emitted in 2000.

Table 2. Statewide GHG Emissions by Inventory Sector

GHG Emissions Sector	GHG Emissions (million MT CO_2e)			% Change
	2000	2005	2021	
Transportation	34.36	38.98	42.84	24.7%
Electricity Generation	45.80	52.09	34.80	-24.0%
Natural and working lands[1]	2.53	2.70	3.88	53.6%
Industry	8.71	8.90	9.55	9.8%
Agriculture	7.46	7.79	7.53	1.0%
Commercial and residential buildings	4.63	4.72	6.90	49.1%
Waste and Materials Management	3.63	3.68	1.52	-58.1%
Wastewater[1]	0.63	0.68	0.77	21.5%
Total	**107.7**	**119.5**	**107.8**	**0.1%**

[1]GHG Emissions Sectors to be refined during the *Arizona CCAP GHG Inventory*

During 2021, transportation activities were the largest source of GHG emissions in Arizona. This sector encompasses all types of transportation, including on-road vehicles, non-road equipment, aviation, and locomotives. By contrast, electricity generation was the largest statewide source of GHG emissions in 2000. Over the two decades between the baseline year and the 2021 study year, the GHG emissions from transportation increased by 24.7% while electricity generation emissions decreased by 24%. Transportation sector GHG emissions, which are dominated by on-road passenger vehicles (Appendix D), have increased with population, though the rate of increase has decreased due to fuel efficiency gains. GHG emissions from electricity generation have decreased as Arizona's electric utilities have decarbonized their generation fleet. All other GHG emissions sectors increased between 2000 and 2021 except Waste and Material Management, which decreased by 58.1%. Figure 1 shows how Arizona's GHG emissions have changed between 2000 and 2021.

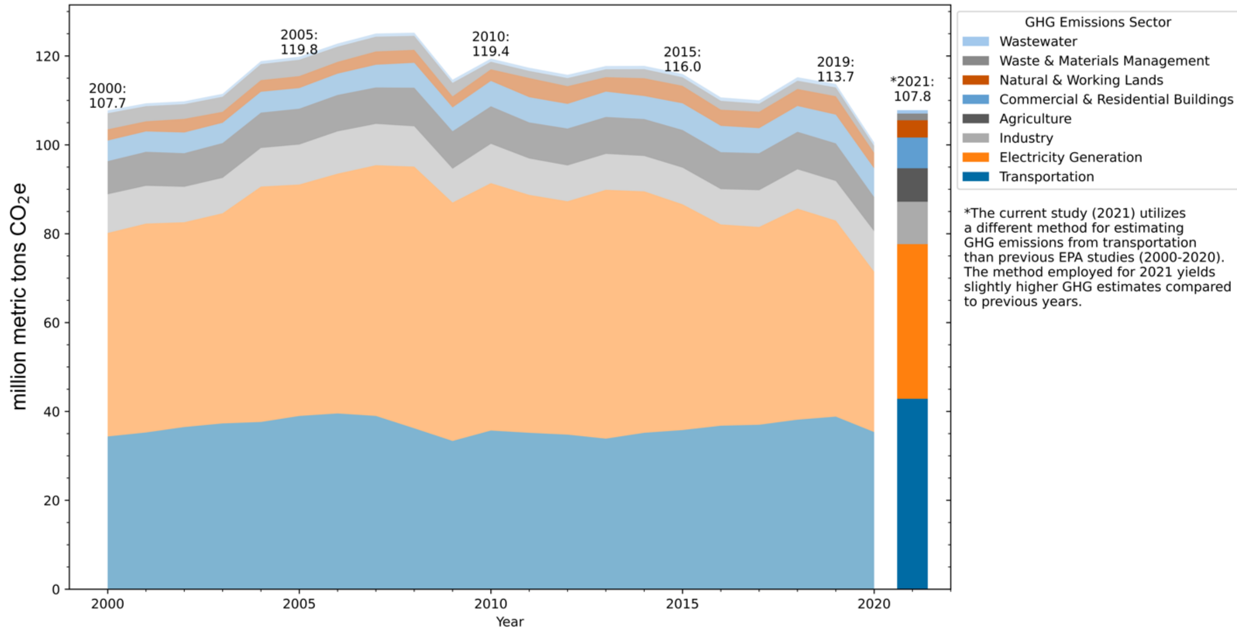


Figure 1. Statewide GHG Emissions Between 2000 and 2021

CO_2 is the primary GHG emitted in the state followed by CH_4 and N_2O (Table 3). Transportation activities and electricity generation are the largest sources of CO_2 emissions. Agricultural activities, which include GHG emissions from livestock operations and soil management, are the largest sources of CH_4 and N_2O emissions in Arizona, respectively. Hydrofluorocarbon (HFC) emissions occur primarily from the substitution (replacement) of ozone-depleting substances in air conditioning and refrigeration equipment. HFCs are also a significant source of GHG emissions.

Table 3. Statewide GHG Emissions by Greenhouse Gas

GHG Inventory Emissions Sector	**GHG Emissions (million MT CO_2e)**							
	CO_2	**CH_4**	**N_2O**	**HFCs**	**PFCs**	**SF_6**	**NF_3**	**Total**
Transportation	42.07	0.042	0.336	0.392	–	–	–	**42.84**
Electricity Generation	34.67	0.058	0.078	–	–	–	–	**34.80**
Natural and working lands[1]	3.872	0.373	–	–	–	–	–	**3.882**
Industry	7.452	0.351	0.577	0.593	0.329	0.171	0.080	**9.555**
Agriculture	–	3.181	4.353	–	–	–	–	**7.534**
Commercial and residential buildings	5.637	0.002	0.004	1.261	–	–	–	**6.905**
Waste and materials management	–	1.518	–	–	–	–	–	**1.518**
Wastewater	–	0.312	0.458	–	–	–	–	**0.770**
Total	**93.70**	**5.838**	**5.807**	**2.247**	**0.329**	**0.171**	**0.080**	**107.8**

As noted in Table 2 and Table 3, transportation activities and electricity account for the vast majority (72%) of GHG emissions statewide (Figure 2). Industrial processes, agriculture, and direct combustion at commercial and residential buildings are the next largest sources of statewide GHG emissions. Emissions from natural and work lands, solid waste, and wastewater comprise between 5%-6% of the statewide total.

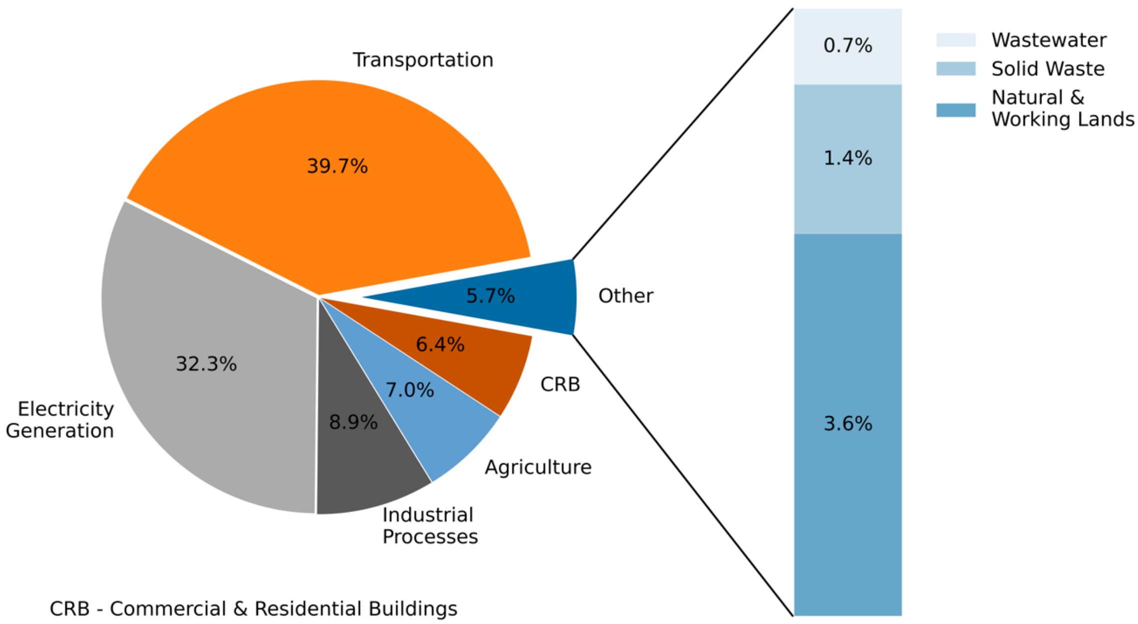


Figure 2. Relative Proportion of Statewide GHG Emissions by Emissions Sector

In 2021, Maricopa County emitted approximately 47% of the State's GHG emissions (Table 4). Transportation-related activities in Maricopa County were the largest county-level source of GHG emissions. Electricity generation was the next largest source of direct GHG emissions at the county level after transportation. Maricopa County and Apache County were the two largest sources of GHG emissions from electricity generation (Table 4). GHG emissions from the natural and working lands emissions sector were estimated only at the state level using approved EPA tools. County-level emissions from the natural working and lands emissions will be tabulated during the CCAP phase of the GHG inventory.

Table 4. Detailed GHG Emissions by Arizona County

County	GHG Emissions (million MT CO_2e)								
	Transportation	Electricity Generation	Natural and working lands	Industry	Agriculture	Commercial and residential buildings	Waste and materials management	Wastewater	Total
Apache	0.573	12.31	NE2	0.18	0.135	0.042	0	0.007	**13.25**
Cochise	0.861	1.612	NE2	0.498	1.086	0.129	0	0.013	**4.198**
Coconino	1.877	0	NE2	0.486	0.163	0.226	0.108	0.016	**2.875**
Gila	0.443	0	NE2	0.362	0.054	0.045	0	0.006	**0.909**
Graham	0.179	0	NE2	0.014	0.275	0.033	0	0.004	**0.506**
Greenlee	0.07	0	NE2	0.101	0.044	0.009	0	0.001	**0.225**
La Paz	0.621	0	NE2	0.14	0.399	0.011	0.051	0.002	**1.223**
Maricopa	25.56	14.55	NE2	4.148	1.631	4.014	0.64	0.476	**51.02**
Mohave	1.45	2.566	NE2	0.222	0.127	0.169	0.022	0.023	**4.578**
Navajo	0.938	1.892	NE2	0.094	0.097	0.124	0.108	0.011	**3.265**
Pima	4.663	0.472	NE2	0.923	0.162	1.184	0.155	0.112	**7.672**
Pinal	2.246	1.158	NE2	0.872	2.143	0.437	0.2	0.046	**7.103**
Santa Cruz	0.3	0.003	NE2	0.034	0.06	0.048	0	0.005	**0.45**
Yavapai	2.157	0	NE2	1.339	0.183	0.297	0.083	0.025	**4.085**
Yuma	0.903	0.243	NE2	0.144	0.976	0.136	0.152	0.022	**2.576**
Total	**42.84**	**34.8**	**3.882**	**9.555**	**7.534**	**6.905**	**1.518**	**0.77**	**107.8**

The data in Table 4 are shown in Figure 3 to visualize the relative magnitude of county-level GHG emissions by sector. As shown in Figure 3, transportation-related activities in Maricopa County emit more GHG emissions than any other county in Arizona. GHG emissions from electricity generation in Maricopa County and Apache County are roughly equivalent and the next largest sources of statewide emissions. Pima County and Pinal County are the next largest county-level sources of GHG emissions; transportation-related activities are the largest source of GHG emissions in these counties.

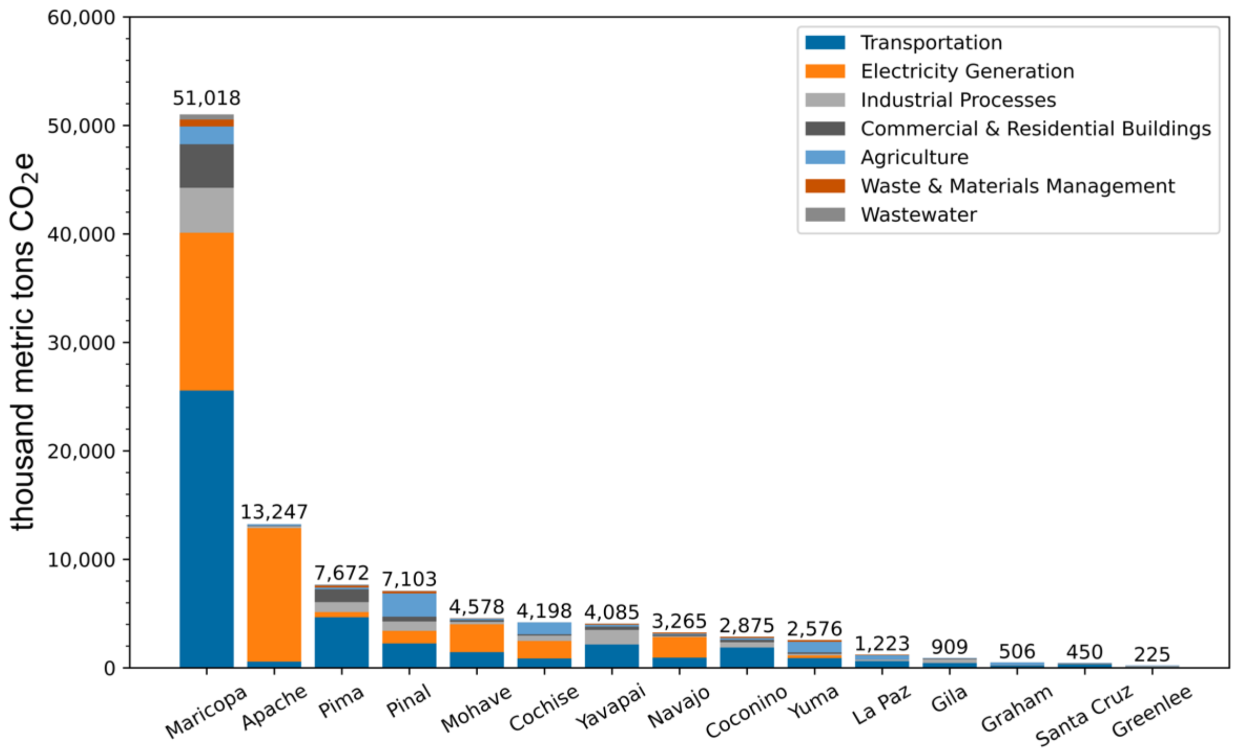


Figure 3. County-Level Direct GHG Emissions (Scope 1) Across Arizona

GHG emissions resulting from electricity generation are directly linked to electricity consumption. The amount of electricity used in a county is closely tied to its population, in addition to commercial and industrial activities. Therefore, when examining GHG emissions resulting from electricity generation compared to electricity consumption, we must look at the difference in emissions attributed to a county under each accounting method (Figure 3 and Figure 4). Figure 4 provides a summary of county-level GHG emissions based on electricity consumption rather than generation. Together, these figures show that while GHGs are emitted in Apache County, these emissions are induced by electricity consumption in Arizona's more densely populated counties – Maricopa County, Pima County, Pinal County, Yavapai County, and Coconino County.

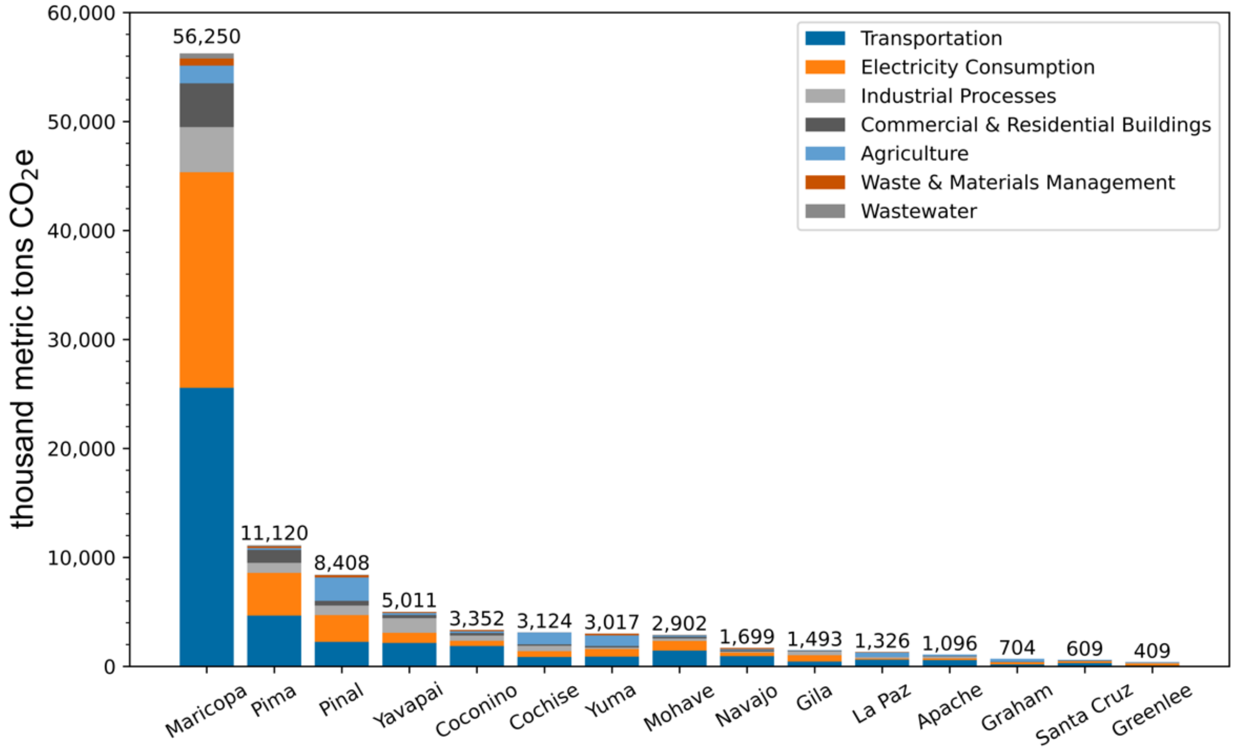


Figure 4. County-Level Direct and Indirect GHG Emissions (Scope 1 + Scope 2) Across Arizona

Priority GHG Reduction Measures

The measures in this section have been identified as "priority measures" to pursue funding through CPRG implementation grants. This list is not exhaustive of Arizona's priorities. Instead, the selected priority measures included in this PCAP meet the following criteria:

- The measure is implementation-ready, meaning that the design work for the policy, program, or project is complete enough that a full scope of work and budget can be included in a CPRG implementation grant application.
- The measure can be completed in the near term, meaning that all funds will be expended, and the project completed, within the five-year performance period for the CPRG implementation grants.
- The measure reduces greenhouse gas emissions while advancing one of the following state priority areas:
    - Improving the resiliency of Arizona homes and businesses;
    - Growing the clean energy economy with the clean energy transition;
    - Increasing access to clean, safe transportation;
    - Restoring Arizona forests as carbon sinks and economic engines.

Table 5 Provides a summary of the measures in the PCAP including cumulative GHG emissions reductions, implementing agency, and geographic scope. Following Table 5 is a detailed description of each measure organized by state priority area.

Table 5. Arizona PCAP Measures

Priority Measure	Cumulative GHG emission reductions (mT CO2e)		Implementing Agency or Agencies	Geographic Scope
	2025–2035	2025–2050		
Building Sector: Resilient Homes and Businesses				
1. Expand access to weatherization, energy efficiency upgrades and electrification.	914	3,124	OOR	Arizona
2. Support municipalities and communities statewide in adopting the most up-to-date building energy codes.	644,928	2,682,476	OOR	Arizona
Electricity Sector: Clean, Reliable Electricity				
3. Deploy solar-plus-battery systems.	20,989	191,200	OOR	Arizona
4. Implement on-site renewables generation and battery storage at public universities and community colleges.	210,078	1,288,434	ABOR, ASU, NAU, UA	Arizona
5. Resilient Local Economy	30,453	152,266	OOR	Arizona

Workforce Development: A Clean Energy Economy for All Arizonans				
6. Create a clean tech workforce.	N/A	N/A	OOR, OEO, ASU, NAU, UA, MCCCD, ABOR, ACA	Arizona
Transportation Sector: Clean, Safe Transportation				
7. Enable zero-emission fleets.	453	19,738	ASU, UA, NAU, Eligible entities statewide	Arizona
8. Public fleet electrification and publicly available charging infrastructure development.	60,000	208,000	State of Arizona, local and county governments, Tribal nations	Arizona
9. Increase publicly accessible electric vehicle charging.	53,436	2,721,256	ASU, UA, NAU, MCCCD, Eligible entities statewide	Arizona
10. Improve roads in rural and tribal communities.	7.68	25.68	ADOT, county governments, TCROs, RTPOs	Arizona
11. Clean I-40 Transportation Corridor	205,063	1,025,320	NMED with coalition members from southwestern states and municipalities	Southwest US, along the I-40 corridor
Waste, Water, and Sustainable Materials Sector				
12. Develop and pilot innovative solutions to reduce greenhouse gas emissions and air pollution from forest management, municipal solid waste, and wastewater processes, and develop local markets for biochar and other products created from liability biomass.	84,063	543,986	City of Flagstaff, Eligible entities statewide	Arizona

For each priority measure, the technical description section of this PCAP provides additional details about the following information:

- An estimate of the cumulative GHG emission reductions from 2025 through 2035;
- An estimate of the cumulative GHG emission reductions from 2025 through 2050;
- Measure-specific LIDAC Benefits Analysis
- Key implementing agency or agencies;
- Review of authority to implement;
- Geographic scope;
- Metrics for tracking progress;

Further details on the Priority Measures appear in the appendix, including:

- Appendix B – LIDAC Benefits Analysis Census Tracts and References
- Appendix C – Implementation Schedule and Milestones

Priority Measures Technical Description

Building Sector: Resilient Homes and Businesses

Measure 1: Expand access to weatherization, energy efficiency upgrades and electrification.

Measure Description

The Governor's Office of Resiliency will establish the Whole Home Health/Clean Green Affordable Homes Program in Arizona, which will be structured to provide a streamlined and accessible pathway for Arizonans to enhance the energy efficiency, indoor air quality, and renewable energy generation potential of their homes and businesses. The Whole Home Health/Clean Green Affordable Homes Program will be responsible for implementing the Inflation Reduction Act's HOPE for Homes and High-Energy Electric Home Rebate Programs to support residential energy efficiency upgrades and electrification at low or no upfront cost to low-income households. The program will leverage redevelopment tools and the Greenhouse Gas Reduction Fund to increase private capital support and capacity for these upgrades.

Building on the HOPE program, the Whole Home Health/Clean Green Affordable Homes Program will:

Provide funding for:

- Needed health and safety funding for homes before weatherization, energy efficiency, and other upgrades. Examples of eligible health and safety measures may include mold remediation and fire safety, including wiring upgrades.
- Enhancing energy efficiency and distributed generation incentives provided by municipalities, counties, and utilities.
- Low-interest loans, grants, or subsidies for energy-efficient improvements, with a focus on assisting households from low-income and historically underserved communities.

Collaboration with Utilities:

The OOR will work with utilities to provide additional financial incentives or rebates for energy-efficient appliances and systems and increase the uptake of existing assistance programs by utility customers. The program would also work to establish a more efficient program to verify income to determine eligibility for basic utility bill pay assistance, utilizing best practices developed during the COVID-19 pandemic and the implementation of the ERAP program.

Public Awareness and Education:

Develop independent studies on:

- Energy efficiency as a resource to increase the reliability and resilience of the electrical grid;

- Whole home retrofit costs and benefits to consumers, the electric grid, and the environment;
- Tax credit and DOE Loan Program Office opportunities;
- Demand Side Management;

Online Platform:
Development of a user-friendly, multilingual online platform where residents can access information about available programs, check their eligibility, and apply for assistance.

Home Energy Audits:
Provide funding to existing home energy audit programs, to help homeowners identify specific areas for improvement.

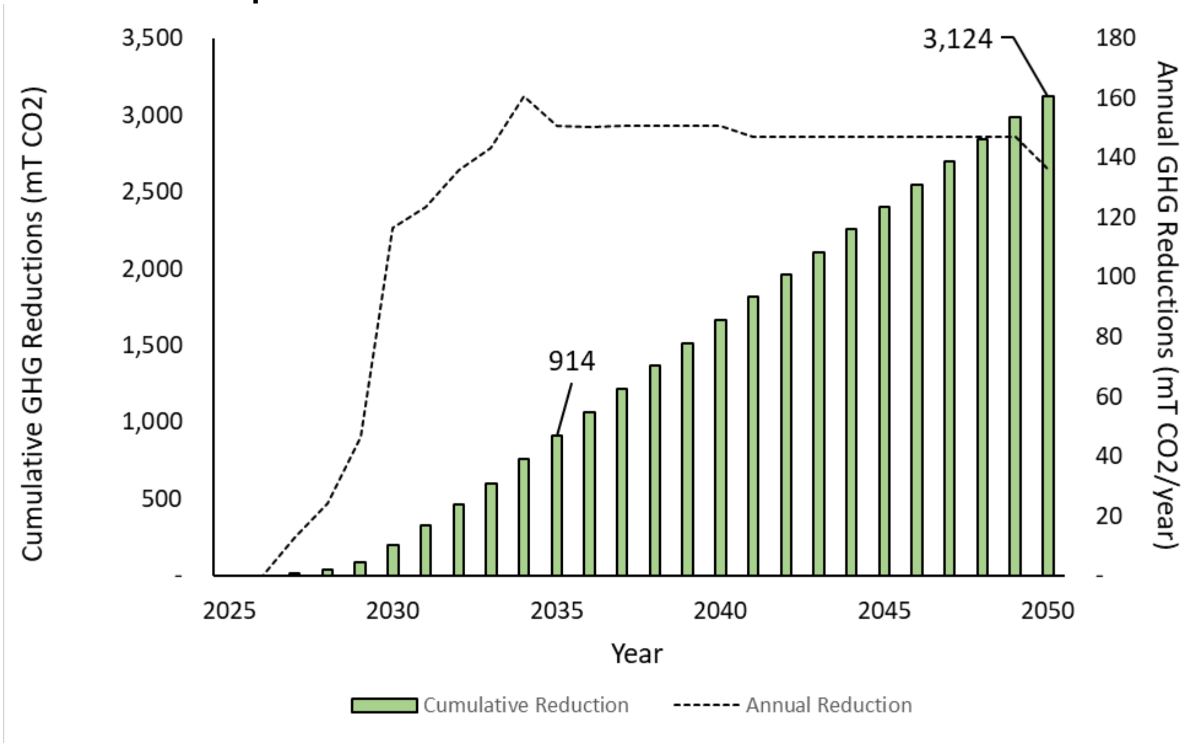
Contractor Training and Certification:
Provide funding to existing programs that train and certify local contractors in energy-efficient retrofitting, distributed solar, and pre-weatherization and weatherization implementation to ensure quality upgrades and create job opportunities within the community.

Monitoring and Evaluation:
Regular, third-party, monitoring and evaluation of the program's effectiveness to make data-driven improvements and adjustments as needed.

Community Engagement:
Engagement with local communities to ensure that the program is responsive to unique needs and encourages broad participation.

By integrating these elements, the Whole Home Health/Clean Green Affordable Homes Program aims to be a comprehensive and collaborative initiative, facilitating home energy improvements across Arizona homes while ensuring accessibility, effectiveness, and sustainability.

Estimate of the quantifiable GHG emissions reductions



Anticipated Benefits for LIDAC Residents[22]:

- Increased access for low-income Arizonians to funding for EE and solar technologies through federal government programs such as the Low-Income Home Energy Assistance Program (LIHEAP) and the Weatherization Assistance Program (WAP).
- Reduced energy bills due to properly weatherized buildings and adoption of rooftop solar, and thus decreased energy burden.
- Reduced carbon emissions from utilities due to increased use of EE and solar systems. (Kerby et al. 2024).
- Increased access to energy-efficient homes in new and existing low-income housing developments that are designed with energy efficiency and electrification technologies that can be powered through on-site solar.
- Developed market for residential energy efficiency and electrification technologies like heat pumps, electric cooking, water heating, and other electric appliances in Arizona resulting in reduced energy costs for residents. This in turn can benefit equitable outcomes and higher rates of adoption of high-efficiency and no/low-carbon technologies. (Leventis, Kramer, and Schwartz 2017).
- Increased resiliency of low-income households to extreme heat events.

[22] Census Tract ID Assumptions: Since this measure will be enacted state-wide, all LIDAC residents will benefit from its implementation.

Implementing agency or agencies

- Governor's Office of Resiliency

Review of Authority to Implement

The implementing agency has the authority to implement the measure as proposed. No additional review is required.

Geographic location

Statewide

Funding sources:

- HOMES Rebate Program (Full Award: $76.9 million)
- High-Efficiency Electric Homes Rebate Program (Full Award: $76.4 million)
- Energy Efficiency and Conservation Block Grant Program (not awarded yet)

Metrics for tracking progress

- Web traffic
- Attendance at open houses
- Number of energy audits conducted

Measure 2: Support municipalities and communities statewide in adopting the most up-to-date building energy codes.

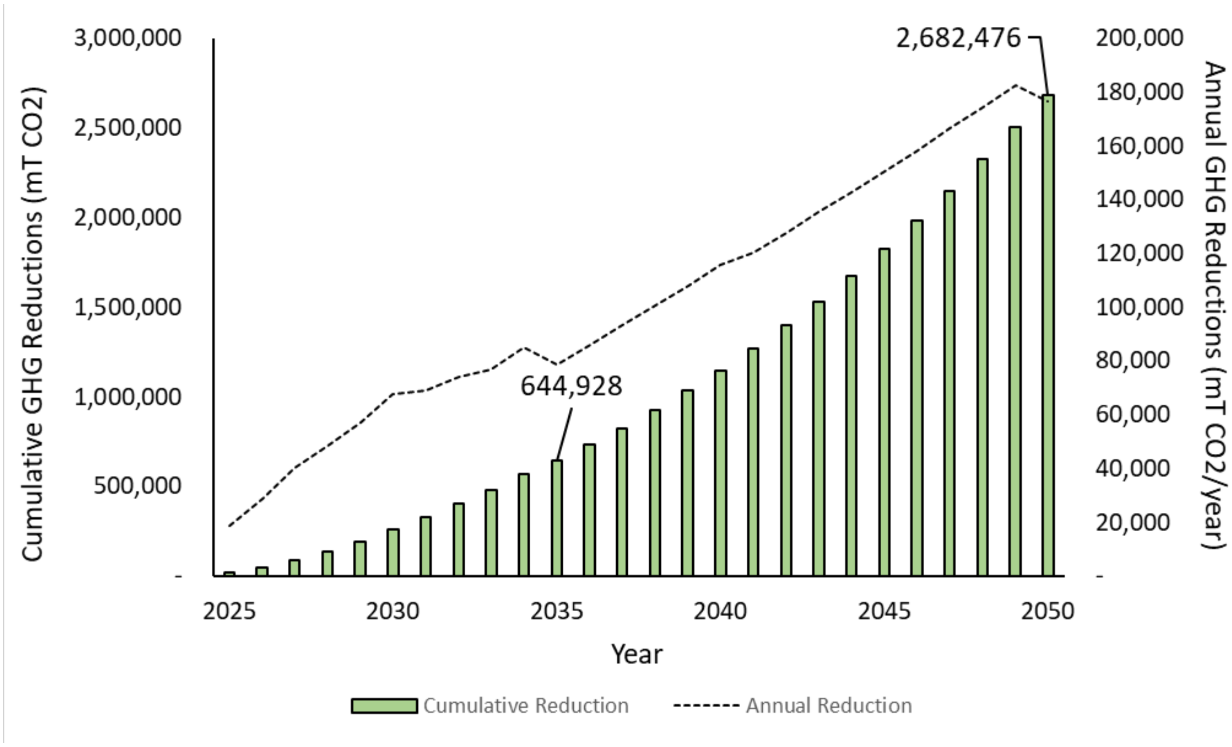
Measure Description

This measure would establish the Arizona Building Codes Advancement Initiative (ABCAI), a targeted program designed to catalyze the adoption of updated building codes by municipalities throughout the state. Arizona is a home-ruled state, and this initiative works within those parameters to support municipalities that wish to update building codes. Recognizing the critical role of energy-efficient construction in ensuring safe and livable indoor environments for Arizonans, reducing greenhouse gas emissions, and ensuring the long-term resilience of our communities, ABCAI focuses on streamlined initiatives to educate, incentivize, and support municipalities in implementing modern building codes, to reduce emissions from buildings and increase the resiliency of homes, businesses, and communities in Arizona.

Proposed program elements to be led by the Governor's Office of Resiliency:

- Engagement: Convene semi-annual meetings of interested municipalities to discuss code improvements and share best practices. Through this process, the state can recommend one or a set of preferred building codes for interested municipalities to adopt.
- Online Hub: Establish an online platform with resources on updating building codes and the economic benefits of modern building codes.
- Code Compliance Grants: Introduce grants to incentivize municipalities to actively update and enforce building codes aligned with the latest energy efficiency standards.
- Technical Support: Work with state universities and local nonprofits to provide municipalities with access to technical support for guidance on code interpretation and implementation challenges.
- Basic Modeling Tools: Equip municipalities with basic modeling tools or connect them with researchers who can conduct energy performance modeling to facilitate the initial stages of optimizing energy performance in construction projects.
- Industry Liaison Program: Facilitate partnerships between municipalities and construction industry associations to ensure a seamless transition to updated building codes.
- Basic Performance Metrics: Develop straightforward performance metrics to measure the initial impact of the program on energy savings and emissions reduction.
- Policy Guidance Sessions: Provide municipalities with concise guidance on aligning local policies with state-level initiatives for building code updates.

Estimate of the quantifiable GHG emissions reductions:



Anticipated Benefits to LIDAC Residents[23]:

- Reduced tax burden on Arizona residents and businesses, as government buildings show energy savings and therefore cost savings that are passed onto residents.
- Increased access to energy efficiency for residents of multi-family housing units.
- Reduced GHG emissions from electricity generation.
- Improved occupant comfort through enhanced thermal regulation and consistent temperatures inside buildings.

Implementing Agency
Governor's Office of Resiliency

Review of Authority to Implement
The implementing agency has the authority to implement the measure as proposed. No additional review is required.

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[23] Census Tract ID Assumptions: Since this measure will be enacted state-wide, all LIDAC residents will benefit from its implementation.

Geographic location
Statewide

Funding sources

- Assistance for Latest and Zero Building Energy Code Adoption Grant (to be submitted)

Metrics for tracking progress

- Number of municipalities represented at workshops
- Number of municipalities who update zoning code

Electricity Sector: Clean, Reliable Electricity

Measure 3: Deploy solar-plus-battery systems.

Measure Description

This measure provides grants to communities, multi-family residences, and homeowners to install solar-plus-battery systems on residences and community buildings to increase electricity access and support Arizonans' resilience in the event of power outages and in areas that lack grid connectivity. This measure will develop a grant program administered by the Governor's Office of Resiliency, in partnership with an Arizona-based green bank, to provide loans and grants for residential solar-plus-battery systems generating on average 6,100 kWh of solar per year per system and community-serving microgrid and mini-grid systems to generate 1-5 MW of solar energy. Here, microgrids are defined as grid-connected systems, and mini-grids are defined as off-grid isolated systems.

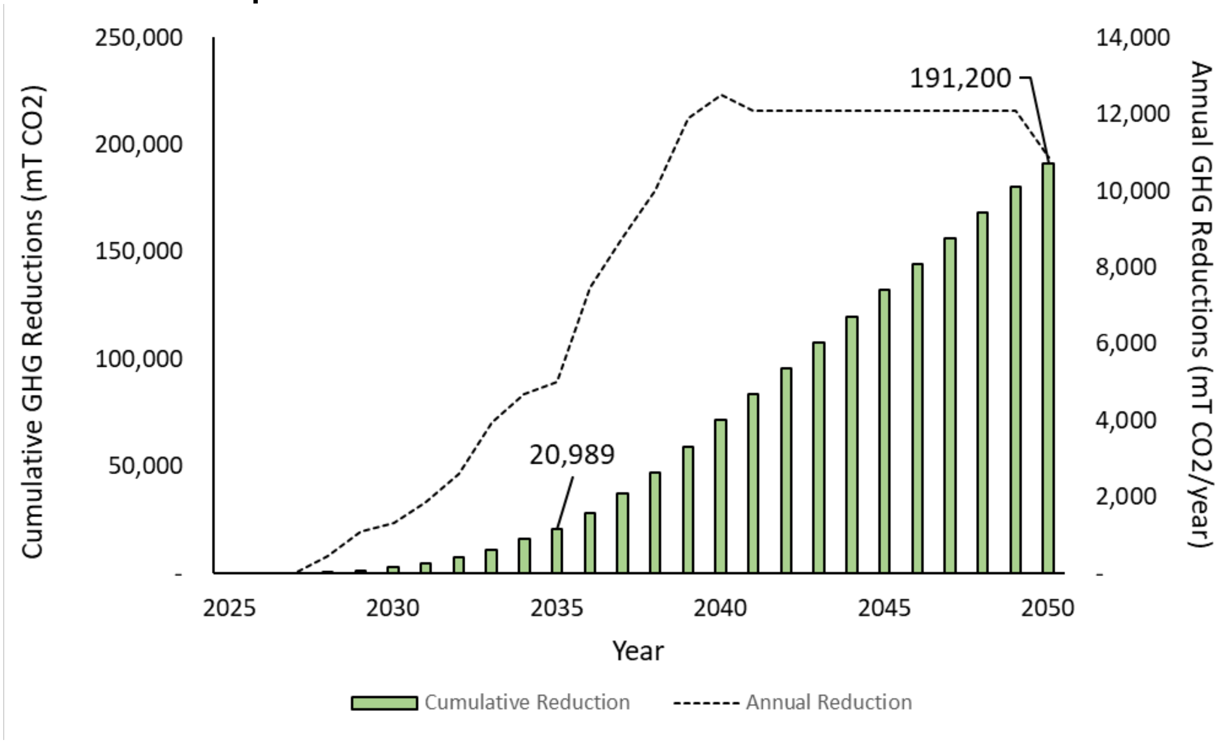
Rooftop Solar-plus Battery:

This measure will establish a program out of the Governor's Office of Resiliency and in partnership with an Arizona-based green bank that will provide loans and grants for distributed rooftop solar photovoltaic plus battery installations for homeowners, business owners, and public and community-serving entities (e.g. community centers, religious facilities) located in geographically dispersed, Tribal, and CEJST communities. In 2023, the average household utility bill in Arizona's low-income communities is $1,690 to $2,080 per year (SRP and APS respectively), based on electricity usage of 9,283 kWh per year. A household that installs a 7kW system is likely to produce 6,100 kWh per year. Depending on the utility and their specific electricity usage pattern, we estimate solar alone will reduce a household's bill by 25% to 55% annually, exceeding the EPA minimum of 20%. Adding battery storage will additionally save households 25% to 30% beyond standalone solar rooftop systems, based on the use of 10 to 13.6 kWh of battery storage (charging with solar and using stored electricity during on-peak hours to amplify savings).

Microgrid and Mini-grid Installations:

This measure also builds neighborhood solar projects, which are 1 to 5 MW distributed solar installations built with grant funding and owned by nonprofits or public agencies. Partnering utilities who choose to participate will provide bill discounts to low-income households (both owners and renters). This program will be offered through utilities' existing low- and middle-income (LMI) LMI utility discount programs or equivalent programs designed for this grant. An example is SRP's Economy Price Plan (EPP), which currently serves 78,000 customers who earn up to 150% of the federal poverty level. While the average annual bill for these residents is $1,690 (based on 9,283 kWh consumption), EPP participants receive a $23/month discount and thus have an annual bill of $1,414. The neighborhood solar program will provide a projected additional $30.57 monthly discount for EPP participants who also participate in a neighborhood solar project, providing a further 25% savings over their currently reduced bill resulting in an annual bill of $1,047.00.

Estimate of the quantifiable GHG emissions reductions:



Anticipated Benefits to LIDAC Residents[24]:

- Increased job opportunities for the construction of solar + storage projects.
- Increase in the number of residents with electricity access due to solar + storage connections.
- Improved reliability of electricity for residents measured by power reliability metrics (System Average Interruption Duration Index, Customer Average Interruption Frequency Index, etc.)
- Reduces exposure of communities GHG due to electricity being provided by solar + storage energy technologies, instead of their fossil-fuel counterpart.
- Increased reliable access to electricity that incentivizes economic activity.
- Reduced migration out of Tribal and rural areas to urban centers (Riva et al. 2018).
- Improved reliability of electricity to public services, thereby improving resident health, education, wellness, and fulfillment.
- Reduced energy costs for customers that have a high burden of energy costs relative to income.

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[24] Census Tract ID Assumptions: For this measure, LIDAC residents who qualify as Rural or Energy Burdened [2] are included as beneficiaries. Rural Census Tract is determined by guidance provided by the Office of Rural Health Policy of the United States Department of Health and Human Services, specifically using the Rural Commuting Areas (RUCA) Codes to determine rural communities [1]. RUCA Codes can also pertain to less populated regions of metro areas.

Implementing agency or agencies
Arizona Governor's Office of Resiliency

Review of authority to implement
The implementing agency has the authority to implement the measure as proposed. No additional review is required.

Geographic location
Priority will be given to geographically dispersed, Tribal and CJEST communities.

Funding Sources
- Solar for All (not yet funded)

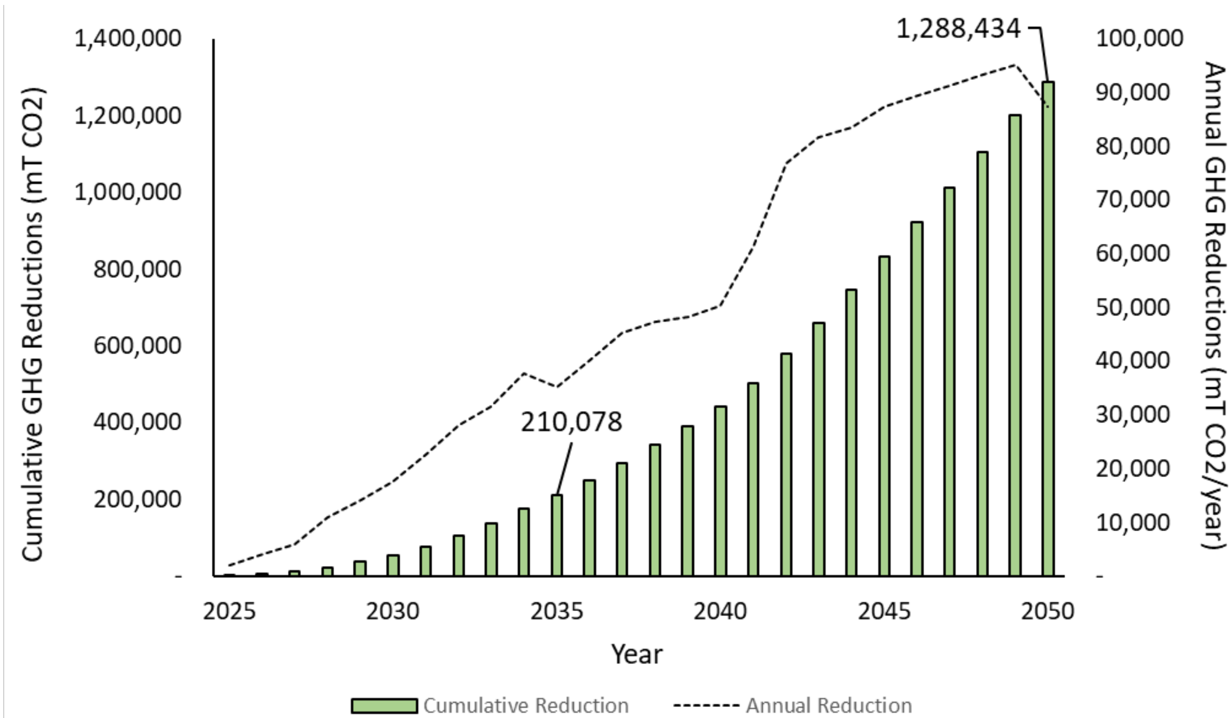
Metrics for tracking progress
- Number of loans given
- Distribution of loans among rural, Tribal, and CEJST communities
- Average annual customer savings
- MW of solar-generated

Measure 4: Implement on-site renewables generation and battery storage at public universities and community colleges.

Measure Description

This measure serves to bolster and grow existing university renewable energy programs that site renewable energy on university campuses and university-owned land. Arizona State University, The University of Arizona, and Northern Arizona University as well as community colleges throughout the state have plans to reduce carbon emissions and take advantage of the ample rooftop, parking garage, and other land available to produce renewable energy and reduce the universities' reliance on fossil-generated electricity for operations. This measure would allow universities to access CPRG funds to expand renewable energy development on campuses including battery storage to increase the long-term resilience of universities' energy systems.

Estimate of the quantifiable GHG emissions reductions:



Anticipated Benefits to LIDAC Residents[25]:

- Reduced exposure of communities to GHG due to electricity being provided by solar + storage energy technologies, instead of their fossil-fuel counterpart.

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[25] Census Tract ID Assumptions: For this measure, LIDAC Census Tracts whose residents enrollment in higher education exceeding 20% are considered to be beneficiaries. As a result, all LIDAC communities benefit using this criteria.

- With universities utilizing more solar + batteries, the inflation of energy cost is avoided due to the Levelized Cost of Energy of those technologies. Subsequently, costs are reduced for the university, helping to offset tuition increases from increases in university operating expenditures.

Implementing agency or agencies
- Public universities
- Community colleges

Review of Authority to Implement
The stated agencies have the authority to implement the measure as proposed. No additional review is required.

Geographic location
- Any state university campus located within the territorial boundaries of the State of Arizona.

Funding sources
- IRA - Direct pay tax credits
- CPR

Metrics for tracking progress
- MTCDE GHG emissions offset per year based on the latest e-grid emissions factor and an assumed solar capacity/ capacity factor of all expected projects; and
- Number of square feet of shade offered as a result of initiative; or
- Anticipated MWh of backup/off-grid power per “blackout” event (this will need to be better defined because the frequency and duration of an event would play into how many MWh of backup); or
- Anticipated demand reduction to the grid during “peak hours”

Measure 5: Resilient Local Energy

Measure Description

Arizona will support deployment of renewable energy and storage systems for local government buildings to reduce energy costs and provide resilience in case of an electric grid outage. This support will include additional incentives to complement newly available “direct pay” options for local governments to receive energy tax credits and technical assistance for such projects. Such support is contingent on securing funding for this measure. Arizona will select projects on a competitive basis. This measure could be utilized by any sub-state government actor, including without limitation cities, counties, and school districts within Arizona.

Near-term cumulative GHG emission reductions (2025 - 2030): 30,453 mtCO_2e

<=0.7*(30,000,000.00/817,154)*237*5> mt CO_2e

Long-term cumulative GHG emission reductions (2025 - 2050): 152,266 mtCO_2e

<=0.7*(30,000,000 /817,154)*237*25> mt CO_2e

Should a revolving loan fund model be utilized, emissions reductions would increase.

Criteria Emissions Reductions (metric tons)			
	NOx	**SO_2**	**PM2.5**
Annual Emissions Reductions	1.06 mt <=0.17*(30,000,000/817,154)>	1.06 mt <=0.17*(30,000,000/817,154)>	.367 mt <=0.01*(30,000,000/817,154)>

Methods and Assumptions

The emissions reduction estimates are based on a case evaluation using the National Renewable Energy Lab’s PVWatts and ReOpt Tools. For the evaluated case, a 387 kW rooftop solar installation with 60 kW battery power and 153 kWH battery capacity were assumed.

Implementing Agency

Governor’s Office of Resiliency

Review of Authority to Implement

The implementing agency has the existing authority necessary to implement this measure.

Implementation Schedule and Milestones

Tentative program schedule:

October 2024	End 2024	Early 2025	Late 2025	Early 2026
Award received from EPA	Third-party administrator selected	Local governments apply for and receive funding.	Projects installed.	Projects placed in service. Emissions reductions begin.

Should a revolving loan fund model be utilized, additional projects would be financed and installed in subsequent years.

Geographic Location

Statewide implementation.

Intersection with Other Funding Availability

This measure intends to leverage the complementary funding available through elective pay (sometimes called direct pay) of certain clean energy tax credits (§45Y, §48E). These tax credits only cover up to 30% of the projects contemplated under this measure, which may be insufficient for some local government buildings to achieve a return on investment through cost-savings from energy bills. In addition to directly supporting projects through technical assistance and deployment of renewable energy and storage systems, this measure will also serve to educate local governments on the available tax credits and provide technical assistance to local governments in designing such systems. As a result, this measure will catalyze widespread adoption of renewable energy and storage systems by local governments. The following additional funding sources were identified as available for the purpose of installing solar plus storage projects but are not believed to be duplicative due to different program foci: Department of Energy "Energy Efficiency and Conservation Block Grant", EPA "Greenhouse Gas Reduction Fund", and Federal Emergency Management Agency "Building Resilient Infrastructure and Communities."

Metrics to Track Progress

For this measure, the state intends to use the following metrics to track progress: number of facilities installing renewable energy and storage, number of kilowatts of installed renewable energy, number of kilowatts of battery power installed, number of kilowatt hours battery capacity installed, the expected lifespan of projects, and number of performance years to quantify lifetime pollution reductions.

LIDAC Benefits/Analysis

A local resilient energy program would be open to all communities in the state and funding could be prioritized to LIDAC areas in the state. Many parts of the state are identified as disadvantaged according to the IRA Disadvantaged Communities map. Implementation of this measure will reduce local government energy costs allowing these agencies to divert funding they were spending on energy to provide additional services to communities. Implementing this measure will reduce emissions of pollutants from power plants, resulting in improved health outcomes. Because LIDAC communities frequently bear a disproportionate burden of environmental harms and adverse health outcomes from pollution, such communities will receive the greatest health benefits from implementation of this measure.

Workforce Development: A Clean Energy Economy for All Arizonans

Measure 6: Create a clean-tech workforce.

Measure Description
This measure will create education programs across universities and community colleges statewide to build a clean-tech workforce that transforms climate action and the clean energy transition into a vehicle for economic growth among diverse Arizona communities. Arizona has one of the highest growth rate projections for clean energy jobs according to the National Renewable Energy Laboratory (NREL).[26] NREL data also reflects the outstanding potential for the state to expand its 'just economy' by integrating clean energy workforce development into its priority imperatives of ensuring equitable futures for low-income populations and addressing climate change impacts. As such, Arizona could become a leader in enhancing population health, societal and climate well-being, and personal and societal equitable wealth attainment through a statewide clean energy workforce coalition.

Formalizing a state-led public/private coalition provides an unprecedented opportunity to leverage the breadth and depth of the state's expansive industry sector (e.g., Advanced Manufacturing and Semiconductors, Autonomous and Electric Vehicles, Data Centers, and Integrated Energy Management); nationally recognized private and public companies; and higher education entities that are leading the country in sustainability, innovation, and galvanizing sustainable growth. Moreover, our economic and workforce development agencies, vibrant innovation and start-up culture, and public and private expertise in cross-sector energy management and climate change adaptation and mitigation offer critical support for developing a national model of excellence.

ASU and the Maricopa County Community College District (MCCCD) in alliance with the Arizona Technology Council Foundation dba SciTech Institute will coordinate with the Sustainable Cities Network, economic and workforce development entities, industry associations, community agencies, Maricopa Association of Governments, and the Arizona Department of Environmental Quality to define workforce development needs based on equity and access to support implementation of clean energy workforce across the state. This consortium will engage with the National Clean Energy Workforce Alliance led by Bank of America for which MCCCD has a Bank of America Executive on Loan for Financial Services and could leverage Bank of America support for this partnership. This Alliance shares our state's value for equitable workforce opportunities in clean energy. In addition, the Office of Economic Opportunity (OEO) will be a key stakeholder in this clean workforce and access to WIOA funding to support equity and access to these high-paying jobs is a central premise of workforce development. The City of Phoenix, Maricopa County, Pinal County WIOA, and other development entities have been coalescing as a regional workforce development partnership and will also be a key regional partner in the proposed program. The Maricopa Community Colleges have engaged with the Arizona Community

[26] https://www.nrel.gov/docs/fy22osti/82177.pdf

College Coordinating Council (AC4) Workforce Development and Tribal Nation representatives to support the future expansion of clean energy workforce training statewide. Northland Pioneer College is partnering with the Tribal Nations - Navajo, Hopi, and White Mountain Apache, industry partners, and Dine College to create phase one of a regional energy education center with Department of Energy funding that will serve five Counties most impacted by climate change and socio-economic hardship. This is an example of an integrated approach with Tribal Nations, higher education, workforce and economic development agencies, and industry partners to revitalize communities through clean energy.

The Maricopa Community Colleges have had great success recruiting and retaining diversity for our future clean energy workforce pipeline. All ten colleges are Hispanic Serving Institutions (HSIs). The current student enrollment of 99,229 for fall 2023 includes 47% first-generation college students, with 40% identifying as Hispanic, 6% Black, 5% Asian, and 2% Native American. Women comprise 57% of the student population and 72% of our students attend part-time reflecting many are working one or more jobs or have family caretaking needs. The Maricopa Community Colleges provide the highest number of workforce program graduates at the technician level in the state of Arizona. The Broadband Initiative and use of the REN (Research Education Network) would also serve as equity and access to virtual training state-wide and regionally.

The proposed program complements current Arizona industry, civic, and higher education sustainability and clean energy workforce initiatives, which have the capacity to add $660m in financial and $1B in-kind support. First is the ASU-led National Science Foundation (NSF) Regional Innovation Engine in Sustainability ($160m) in which MCCCD is the Workforce Development lead. The second is the Direct Air Capture (DAC) Hub through the Department of Energy (DOE) with ASU as the lead institution ($500m). In addition, LG is partnering with Arizona Public Service on their Data Center campus ($1B) in the East Valley to create the country's most sustainable, clean energy-based Data Center campus in late 2024. The Center will serve as a regional model that can be replicated across Arizona and the US.

Estimate of the quantifiable GHG emissions reductions
This measure does not have GHG reductions associated with it but is an enabling measure for the other measures in the priority climate action plan. To meet the reduction potential laid out in this plan, Arizona must have a clean-tech workforce to perform energy audits, implement energy efficiency upgrades, install heat pumps and electric stoves and fireplaces, install and maintain solar-plus-battery systems and microgrids, install and maintain electric vehicle charging infrastructure, and maintain electric vehicles.

Anticipated Benefits to LIDAC Residents[27]:

- Increase job opportunities and flexibility when jobs are lost due to the energy transition.
- Disadvantaged workers who participate in WFD programs receive increased wages, on average (Holzer, 2008, Hollenbeck et. al., 2017)

Implementing agency or agencies

- This program would be administered through a shared governance model with ABOR (ASU, NAU, UA), MCCCD, OEO, and SciTech Institute in the initial phases. Reporting authority to the Governor's Office or Governor's designee.
- State agencies included in this public-private partnership may include OEO, MAG, and ADEQ. Local and Tribal governments would be integrated into this program through the Sustainable Cities Network which includes many local and Tribal governments.

Review of Authority to Implement

The stated agencies have the authority to implement the measure as proposed. No additional review is required.

Implementation schedule and milestones

We anticipate a two-year timeline to assess and implement training infrastructure for a clean workforce in Arizona. Longer-term implementation would require a two to five-year plan.

The estimated cost for the plan is $10.0m to include limited program management staff; stakeholder outreach and engagement workshops and activities; educator professional development (PD); training infrastructure costs at regional locations for equitable access to training and education; and certification costs. This budget estimate is based on the similarity of the three designated hubs for advanced manufacturing.

The training would be developed from an equity and growth mindset to ensure learning technologies are available to every interested learner despite their zip code or employment, and justice status to ensure we uphold equity and access.

Geographic location

- Apache County
- Navajo County
- Navajo Nation
- Hopi Nation
- Maricopa County
- White Mountain Apache Nation

[27] Census Tract ID Assumptions: This measure is to be applied using resources at Arizona State University and the Maricopa County Community College District, LIDAC residents located in Maricopa County will benefit from its implementation.

Funding sources

This program would include braided funding from the Governor's Office (non-legislative funding), TREC funding, WIOA, NSF Regional Innovation Engine and DOE grants, in-kind part-time staff support from the educational institutions, and industry partner investments in training infrastructure costs and subject-matter expertise to co-create training programs, in addition to serving as adjunct professors in the programs.

Metrics for tracking progress

- Program enrollment
- Degrees and certificates awarded
- Student and graduate diversity, representativeness of the state population

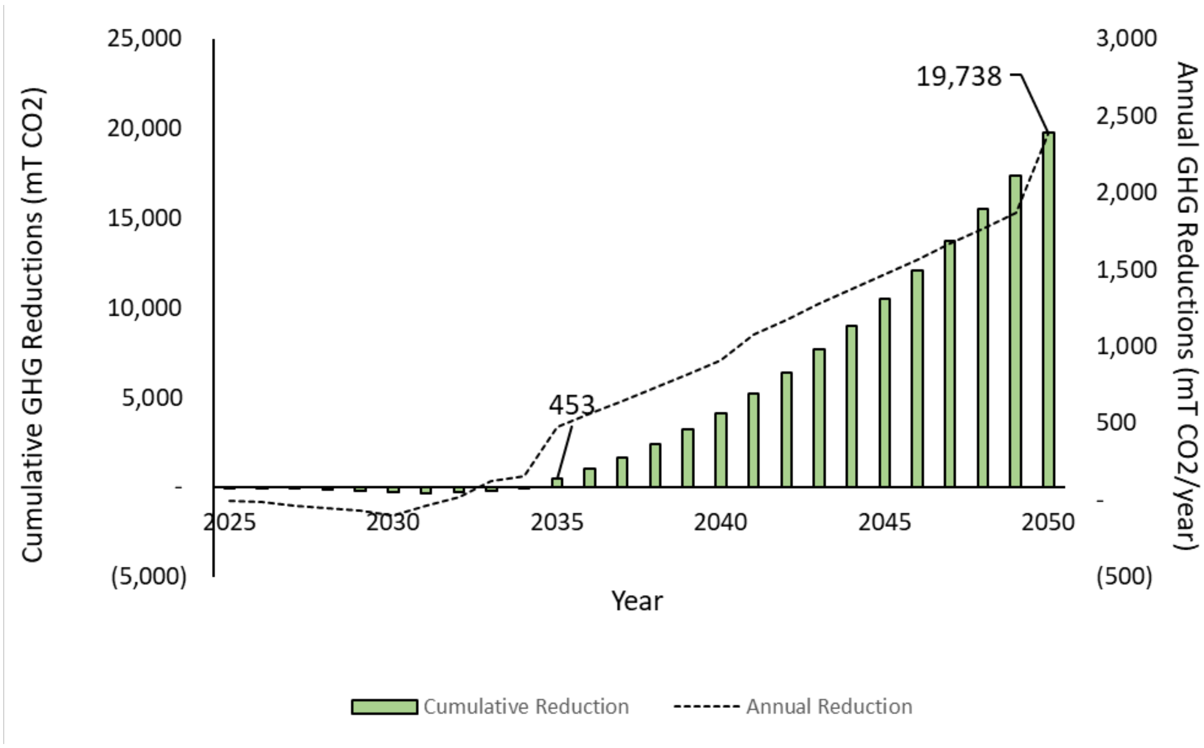
Transportation Sector: Clean, Safe Transportation

Measure 7: Enable zero-emission fleets.

Measure Description

This measure promotes the adoption of light, medium, and heavy-duty zero-emission vehicles for State, municipal, county, Tribal, university, and community college fleets through procurement and other such programs to purchase zero-emission vehicles and install electric vehicle charging at applicable fleet facilities.

Estimate of the quantifiable GHG emissions reductions:



Anticipated Benefits to LIDAC Residents[28]:

- Increased demand for and purchase of zero-emission vehicles promotes the development of the Arizona market, thereby reducing prices overall and improving accessibility and access for LIDAC Arizonans.
- Increased demand for and purchase of zero-emission vehicles promotes the development of supporting infrastructure providing alternative fuels.

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[28] Census Tract ID Assumptions: Since this measure will be enacted state-wide, all LIDAC residents will benefit from its implementation.

- Reduced GHG emissions of fine particulate matter (PM2.5) and other tailpipe pollutants, such as SO2, NOx, NH3, and volatile organic compounds from internal combustion engines (Choma et al. 2020).
- An increased number of people with positive health outcomes resulting from improved air quality (Choma et al. 2020)

Implementing agency or agencies:

- ASU
- NAU
- UA
- Other counties and municipalities

Review of Authority to Implement

The implementing agencies have the authority to implement the measure as proposed. No additional review is required.

Funding sources

- Direct Pay
- Loan Program Office, Low interest loans
- CPRG
- CFI, round two

Metrics for tracking progress

- Number of vehicles transitioned to EVs
- Chargers installed
- Electricity used from charging stations

Measure 8: Public fleet electrification, Public Fleet Charging Infrastructure, and Publicly Available Charging Infrastructure Development

Measure Description

This measure incentivizes the installation of electric vehicle (EV) charging infrastructure for public fleets and publicly available charging and funds the transition of public fleets from fossil fuel-powered vehicles to EVs. Projects include the procurement of light-, medium-, and heavy-duty service municipal and other public entity vehicles along with public transit vehicles, like the bus fleet. Workforce development will be included in this measure with the development of programs to address EV maintenance and charging station installation, beginning with current employees.

For 2020, the mobile combustion source sector generated 25,446,411 MTCO2e, or 47.7% of total Maricopa-Pinal County regional GHG emissions. For 2020, Native nation mobile combustion source sector generated 133,155 MTCO2e or 56.4% of total 2020 Maricopa-Pinal County regional Native nation GHG emissions.

Estimate of Near-term and Long-term GHG and Criteria Pollutant Emission Reductions

	CO2e Emission Reductions (MT)	**CAP Emission Reduction (MT)**
2025-2030	60,000	560
2030-2050	208,000	1,500

Implementing Agency or Agencies

State of Arizona, local jurisdictions, counties, and Tribal nations and communities.

Implementation Schedule and Milestones

Year 1	Year 2	Year 3	Year 4	Year 4
Planning phase: Finalize fleet electrification plans for each government agency that identifies appropriate vehicles, fleet and/or publicly accessible charging locations, infrastructure requirements, workforce training requirements, and implementation schedules	Continue vehicle procurement, charging infrastructure construction, and workforce development.	Continue vehicle procurement, charging infrastructure construction, and workforce development.	Continue vehicle procurement, charging infrastructure construction, and workforce development.	Procurement, construction, and workforce development phase complete and 100% implementation.

Review of Authority to Implement
The implementing agencies have the authority to implement the measure as proposed. No additional review is required.

Geographic Location
- Maricopa - Pinal County region.

Metrics for Tracking Progress
- Electricity used for charging stations (kWh);
- Number of vehicles that are transitioned to electric vehicles;
- Vehicle miles traveled by electric vehicles;
- Number of charging stations installed;
- Number of employees trained.

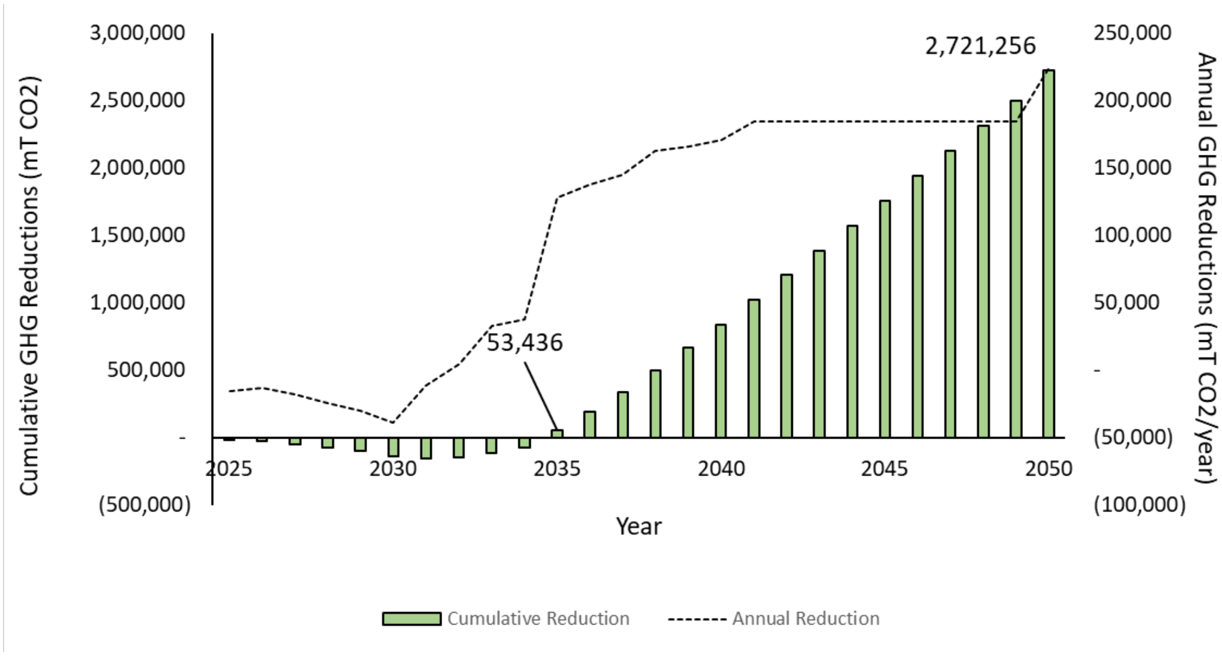
LIDAC Benefits
- Improved air quality and improved public health due to reduced air pollution.
  - CEJST Health Burden: Asthma, Diabetes, Heart Disease, Low Life Expectancy.
  - Justice40 Climate Change: Reductions of local air pollutants.

- Decreased vehicle tailpipe emissions.
    - CEJST Transportation Burden: Diesel Particulate Matter Exposure, Traffic Proximity.
    - Justice40 Clean Transportation: Reduction of exposure to harmful transportation related emissions.
- Increased public access to electric vehicle chargers.
    - Justice40 Clean Transportation: Access to affordable electric vehicles, charging stations, and purchase programs.
- Access to clean, high-frequency bus transportation.
    - Justice40 Clean Transportation: Access to clean, high-frequency transportation.
- Reduced noise pollution.
    - CPRG LIDAC Technical Guidance – Reduced noise pollution.
- Creation of high-quality jobs and workforce development opportunities.
    - CEJST Workforce Development Burden.
    - Justice40 Training and Workforce Development.

Measure 9: Increase publicly accessible electric vehicle charging.

This measure would make funds available to municipalities, counties, tribes, state agencies, and public universities to install publicly accessible electric vehicle charging and to implement programs that promote daytime charging. Eligible agencies will submit plans to expand public electric vehicle charging and plans to promote daytime charging to the State of Arizona.

Estimate of the quantifiable GHG emissions reductions:



Anticipated Benefits to LIDAC Residents[29]:

- Increased access of Arizonans to electrified transportation.
- Reduction of emissions of fine particulate matter (PM2.5) and other tailpipe pollutants, such as SO2, NOx, NH3, and volatile organic compounds from internal combustion engines. This can be measured by air quality monitors (Choma et al. 2020).
- Increased number of people with health outcomes (Choma et al. 2020)
- Reduction in range anxiety because of increased access to public charging infrastructure, thereby compounding other benefits associated with EVs. (Delacretaz, Lanz, and van Dijk 2021; Chakraborty et al. 2022).

[29] Census Tract ID Assumptions: Since this measure will be enacted state-wide, all LIDAC residents will benefit from its implementation.

Implementing agency or agencies:
- ASU
- NAU
- UA
- Other counties and municipalities

Review of Authority to Implement
The implementing agencies have the authority to implement the measure as proposed. No additional review is required.

Geographic Location
Statewide on publicly owned land.

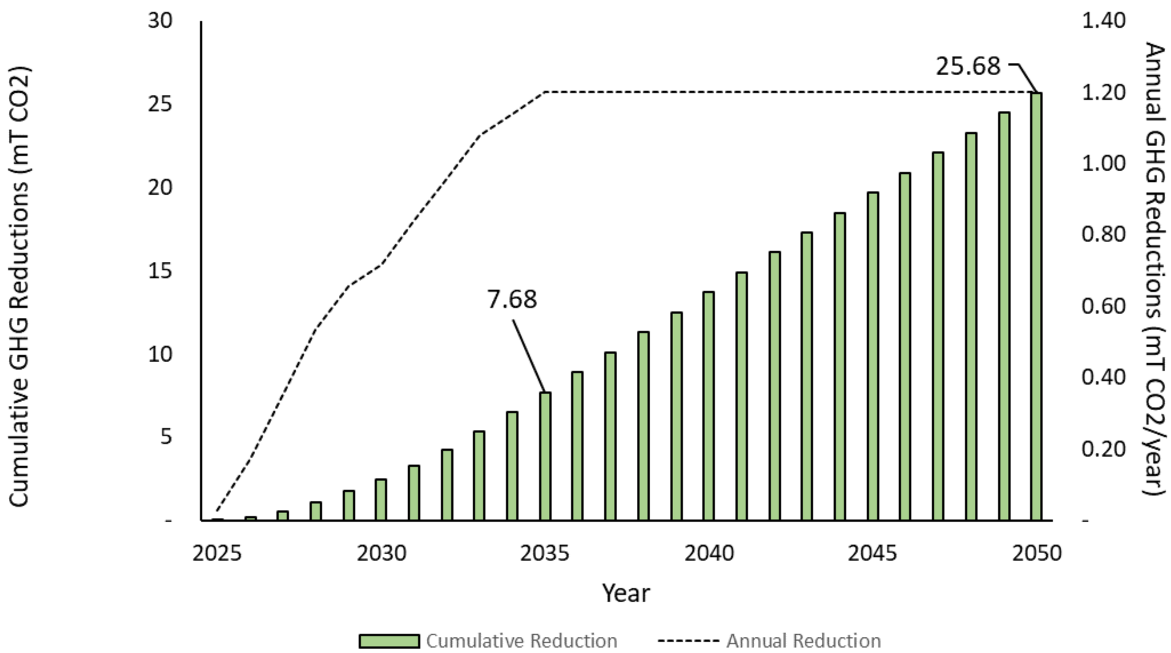
Funding sources
- CPRG
- NEVI
- CFI, round two

Metrics for tracking progress
- Number of public EV chargers installed as part of the program

Measure 10: Improve roads in rural and tribal communities.

This measure would incentivize ADEQ, ADOT, County DOTs, TCROs, and regional transportation planning partners to prioritize road improvements in rural and Tribal communities through paving and maintenance programs to reduce dust pollution and increase the fuel-efficiency of vehicle travel where this presents a significant barrier to healthy, thriving communities. Priority will be given to non-attainment areas in rural LIDAC and Tribal communities. This measure will give priority access to road paving and improvement funds to communities where road quality compromises public health. Eligibility would include developing a maintenance plan to reduce dust. The program will also prioritize those roads that feed state and national highways where EV infrastructure is planned to ensure that rural communities have equitable access to EV infrastructure along highways.

Estimate of the quantifiable GHG emissions reductions:



Anticipated Benefits to LIDAC Residents[30]:

- Increased community access to safe and reliable transportation infrastructure.
- Improved vehicle fuel efficiency from driving on paved roads versus unpaved roads (Gregory et al. 2021; AzariJafari, Gregory, and Kirchain 2020).
- Improvement in economic activity through increased access to the communities and businesses.

[30] Census Tract ID Assumptions: For this measure, LIDAC residents who qualify as both Rural and Tribal are included as beneficiaries. Rural Census Tract is determined by guidance provided by the Office of Rural Health Policy of the United States Department of Health and Human Services, specifically using the Rural Commuting Areas (RUCA) Codes to determine rural communities. RUCA Codes can also CEJST to less populated regions of metro areas. Additionally, CEJEST indicates which communities are classified as Tribal.

- Increased employment opportunities for residents where road improvements are implemented.
- Improved access to public services, thereby improving resident health, education, wellness, and fulfillment.
- Improved access for service providers (e.g., home health, home repairs) to access communities.

Implementing agency or agencies
- ADOT
- County DOTs
- TCROs
- Regional transportation planning organizations

Review of Authority to Implement
The implementing agencies have the authority to implement the measure as proposed. No additional review is required.

Geographic location
Rural and Tribal areas statewide

Funding sources
- General Fund
- Highway User Revenue Fund (HURF)

Metrics for tracking progress

Miles of road improvement

Reduction of dust emissions (PM10 and PM2.5) associated with travel on unpaved roads

Measure 11: Clean I-40 Transportation Corridor

Measure Description
Arizona and New Mexico sit at the heart of one of the largest east-west freight corridors nationwide – Interstate 40 (I-40). To showcase how transportation and logistics can be cleaner and less polluting, the New Mexico Environment Department (NMED) intends to lead a coalition of state agencies along I-40 in a bold proposal for CPRG Phase 2 funding.

The Clean I-40 Transportation Corridor: The New Mexico-led coalition's transformative vision centers on establishing a network of electric charging and hydrogen refueling stations specifically designed for medium- and heavy-duty (MHD) zero emission trucks (MHD ZETs) along I-40. This infrastructure will:

A. Facilitate the clean, sustainable transportation of goods between California's Port of Los Angeles and Arizona, New Mexico, Texas, Oklahoma, and beyond.

B. Empower communities by strategically placing clean transportation complexes to deliver access to a clean energy economy, directly creating workforce development opportunities and improving air quality, particularly for residents in LIDAC along the corridor.

C. Catalyze tailpipe emission reductions that translate to improved public health, fewer pollution-related illnesses and deaths, and a significant contribution to local, state, and national climate goals.

Aligned with national momentum: Demand for clean transportation infrastructure is skyrocketing, fueled by corporate sustainability goals and federal and state investments and regulations. Recognizing this critical need, the U.S. Department of Transportation (USDOT) designated the Port of Los Angeles to Albuquerque, NM corridor as a national priority for clean transportation.

Building on existing momentum: The USDOT's 2021 Regional Infrastructure Accelerator (RIA) Grant award to Bernalillo County, NM, Kingman, AZ, and Winslow, AZ kick-started crucial infrastructure planning in these key locations. This CPRG proposal leverages this foundational work by:

A. Providing initial implementation funding at these three planned sites, rapidly accelerating the deployment of electric charging and hydrogen refueling stations.

B. Expanding the corridor through replication of the RIA model to plan and implement six additional sites along I-40, maximizing the impact of public funding by attracting private investment and building economic opportunities.

Focused on MHD ZETs, CPRG implementation funds will directly support:

A. Installation of electric vehicle (EV) charging stations,
B. Deployment of stationary and mobile hydrogen refueling stations,
C. On-site renewable energy generation with storage (primarily for battery-electric ZETs), and
D. Planning and implementation of six additional sites beyond the initial three RIA locations.

The Clean I-40 Transportation Corridor is not just an infrastructure project; it's a catalyst for sustainable economic growth, environmental protection, and healthier communities.

Key Implementing Agencies
NMED will lead this coalition, composed of key stakeholders committed to the Clean I-40 Transportation Corridor's success. This robust coalition represents a powerful synergy of governments, united in their pursuit of a cleaner, more prosperous future for the I-40 corridor.

Authority to Implement:
The implementing agencies have the authority to implement the measure as proposed. No additional review is required.

Geographic Scope
The geographic scope of the measure spans Interstate-40, across the southwest United States, including through additional states such as California, Arizona, Texas, and Oklahoma.

Metrics for Tracking Progress
To evaluate the post-project efficacy of the Clean I-40 Transportation Corridor, the following metrics will be monitored from the outset of the project:

Environmental impact

- **Reduction in GHG emissions:** Track the total tons of climate pollution avoided annually by MHD ZETs using data from the charging stations compared to baseline diesel truck emissions.
- **Reduction in co-pollutant emissions:** Track the total tons of climate pollution avoided annually by MHD ZETs using data from the charging stations compared to baseline diesel truck emissions.
- **Renewable energy generation:** Measure the amount of clean energy generated by on-site renewable energy projects.

Economic impact

- **Job creation**: Track the number of jobs created directly and indirectly through the project, including construction, station operation, and related industries.
- **Private investment**: Monitor the amount of private investment attracted to the corridor due to the project's infrastructure.

- **Economic development**: Measure changes in economic indicators like business growth and tax revenue in communities near clean transportation complexes.

Community Impact
- **Equity and access**: Monitor the distribution of benefits and ensure stations are accessible to all communities, including LIDAC.
- **Community engagement**: Track satisfaction and participation of communities in the project through surveys and community meetings.

Project implementation
- Station utilization: Monitor the usage rates of charging and refueling stations to assess project demand and optimize resource allocation.
- Project completion rates: Track the timely completion of planned infrastructure and ensure adherence to budgets and timelines.

Implementation Schedule and Milestones
To implement this measure, there are two primary stages. Stage 1 involves implementing the RIA plans to begin construction at the three shovel-ready locations. Stage 2 includes planning and then construction of additional sites. The timelines below (1) indicate the expected schedules for full implementation, and (2) are presented as time to complete from the date of award.

Stage 1
- Construction: 2-3 years
  - Permitting and Infrastructure
  - Technology Integration
  - Testing and Commissioning
    - Testing various components of the infrastructure

Stage 2
- Siting / Feasibility Assessments, Planning, and Design: 2 years
  - Conducting feasibility studies for potential locations
  - Engaging in community outreach
  - Developing a comprehensive project plan
  - Developing architectural and engineering designs
  - Issuing RFPs and finalizing contracts and arrangements
  - Implementing funding and application structure
- Construction: 2-3 years
  - Permitting and Infrastructure
  - Technology Integration
  - Testing and Commissioning
    - Testing various components of the supercenter

Benefits
Primary Benefits

GHG Emission Reductions

Estimate of Cumulative GHG Emission Reductions in Arizona

CATEGORY	GHG EMISSION REDUCTIONS 2025 – 2030 (MT CO_2E)	GHG EMISSION REDUCTIONS 2025 – 2050 (MT CO_2E)
Small transportation complex (e.g., Kingman)	102,386.9	511,934.4
Small transportation complex (e.g., Winslow)	102,677.3	513,386.4
Total	*205,063.3*	*1,025,320.8*

Co-benefits

Health Benefits

Emissions from gasoline and diesel vehicles are major contributors to air pollution, including harmful pollutants like nitrogen oxides (NOx), ozone, and particulate matter ($PM_{2.5}$). These pollutants are linked to a range of health problems, including respiratory illnesses, heart disease, and even cancer. Both EVs and hydrogen fuel cell vehicles produce zero tailpipe emissions, meaning they wouldn't contribute to air pollution along the I-40 corridor. This measure would lead to improved air quality in nearby communities, especially around densely populated areas and major intersections, and subsequently a reduction in respiratory illness, heart disease, and cancer in the communities along the I-40 corridor.

Environmental Benefits

Air Quality Benefits

Air quality benefits from this measure are being calculated and will be available soon.

Land and Soil Benefits

In addition to water quality degradation, oil leakage from ICE vehicles can contaminate land and soil along roadways and lots. Soil degradation due to pollution can lead to a reduction in the ecosystem's functions and services, decline in soil fertility, and adverse changes in chemical composition, which can lead to excessive erosion and, subsequently, flooding. Providing the infrastructure necessary to fuel ZEVs and transition away from the use of ICE vehicles will reduce contamination of land and soil and minimize these harmful effects.

Ecological Benefits

Aside from the ecological benefits associated with improving soil quality listed above, providing the infrastructure necessary to fuel ZEVs and transition away from the use of ICE will result in a reduction of noise pollution. Noise pollution is an invisible threat to the health and well-being of wildlife. It can affect communication, distribution, foraging, or homeostasis of organisms. A reduction in noise pollution will not only create a better environment for the communities along the I-40 corridor, but also the wildlife we share the environment with.

Economic Benefits

This measure promises a clean economic win-win for the Southwest, stimulating trade with its Port of Los Angeles connection, sparking regional infrastructure upgrades, and igniting economic opportunity in LIDAC. Regional economic benefits include new clean energy jobs and transportation complexes, increased private investment, and healthier, more productive workforces, all fueled by cleaner, more efficient freight transportation. This measure is not just about infrastructure, it's a strategic investment in a cleaner, more prosperous future for the entire region.

Low-Income and Disadvantaged Communities Benefits Analysis
Tailpipe emissions have varying deleterious effects on public health, with populations closer to and downstream of the source most impacted. However, the entire state is impacted by these emissions to some degree. Thus, this measure's benefits accrue to all US Census Tract Block Groups in Arizona and along the I-40 Corridor

Benefits

Improved air quality

Reduced tailpipe emissions from MHD ICE trucks will significantly improve air quality for residents in LIDAC along the I-40 corridor, leading to a decrease in respiratory illnesses and healthcare costs.

Economic development

Clean transportation complexes mindfully placed in proximity to people living in LIDAC can offer new job opportunities and attract private investment, boosting local economies and potentially leading to higher wages and better living standards.

Workforce development

Programs tailored to training residents from LIDAC for jobs in the clean energy sector (e.g., installation and maintenance of charging stations) can provide valuable career pathways and upward mobility.

Enhanced community health

Improved air quality and economic opportunities can contribute to overall well-being for people living in LIDAC, potentially leading to lower crime rates, better educational outcomes, and stronger social cohesion.

Environmental justice

Focusing infrastructure development and economic benefits towards residents in LIDAC can help address historical inequities and ensure a more just distribution of environmental and economic benefits.

Overall, the measure has the potential to significantly improve the lives of people living in LIDAC along the I-40 corridor. However, careful planning and implementation are necessary to ensure that the program delivers its benefits equitably and avoids unintended negative consequences.

Waste, Water, and Sustainable Materials Sector

Measure 12: Develop and pilot innovative solutions to reduce greenhouse gas emissions and air pollution from forest management, municipal solid waste, and wastewater processes, and develop local markets for biochar and other products created from liability biomass.

Measure Description

This measure would support local governments in developing and piloting innovative, sustainable, and scalable solutions for reducing emissions from liability biomass including:

1. Advanced pyrolysis of forest byproducts from hazardous fuels reduction treatments.
2. Advanced pyrolysis of biosolids from municipal wastewater treatment plants, and
3. Industrial-scale composting of or advanced pyrolysis of organic materials from municipal landfills.
4. Distribution of firewood (forest treatment byproduct) and funding wood stove retrofits to EPA-certified clean burning wood stoves for in-need communities.

Local municipalities need support for designing, developing, and testing solutions such as advanced pyrolysis, wood vaulting, and composting. Local and regional governments seek eligibility to use CPRG implementation grant funding to offset prohibitively high startup costs, aid in local workforce development, implement research and demonstration projects, and catalyze the development of regional markets for biochar and other sustainable products resulting from the implementation of these pilots. This measure aims to reduce the risk of catastrophic wildfires, create local solutions to local climate problems, and promote cleaner air, with an emphasis on benefitting low-income and disadvantaged communities.

The City of Flagstaff is seeking to implement pilot projects to reduce emissions from each of the three liability biomass sources (forests, wastewater, and solid waste) by diverting material to advanced pyrolysis and composting processes and testing electric refuse trucks for organic waste collection. The City plans to collaborate with other local jurisdictions, academic institutions, and nonprofits to spur innovation, catalyze local markets, test the efficacy of carbon capture strategies, and provide workforce training to support and scale these pilots over time.

Estimate of the Quantifiable Greenhouse Gas (GHG) Emissions Reductions

Total Estimated GHG Emissions Reductions		
Technology	**GHG Emissions reduction** estimate through **2030**	**GHG Emissions reduction** estimate through **2050**
Advanced pyrolysis processing of byproducts of forest treatment	77,813 tons of MTCO2e	504,141 tons of MTCO2e
Advanced pyrolysis processing of biosolids	2,890 tons of MTCO2e	15,733 tons of MTCO2e
Green and Food Waste Composting	3,360 tons of MTCO2e	24,112 tons of MTCO2e
TOTAL	**84,063 tons of MTCO2e GHG emissions reduction** estimate through **2030**	**543,986 tons of MTCO2e GHG emissions reduction** estimate through **2050**

Note: The final greenhouse gas (GHG) emissions reductions will depend on the total funding received through the Climate Pollution Reduction Grant.

See below for emissions reduction estimates based on the three technologies above.

Advanced Pyrolysis of Forest Byproducts from Hazardous Fuels Reduction Treatments Preliminary GHG emissions reduction estimates					
Technology	**Time period**	**Amount**	**Assumptions**	**GHG Emissions Reduction Estimates** (MTCO2e)	
				through **2030**	through **2050**
Advanced pyrolysis processing of byproducts from **6,000** acres of forest treatment	Over the 5-year grant period (2025-2029)	150,000 tons of wood chips and other waste over 5 years	1 ton of finished biochar leads to 3 tons of MTCO2e stabilized. Assume 1% degradation per year, in each of the first 10 years. Assume biochar processing is	54,609	50,625

			operational in 2026.		
Advanced pyrolysis processing of byproducts from **52,500** acres of forest treatment	2030 - 2050	1,312,500 tons of wood chips and other waste, years 6 - 26	[Same as above]	23,203	453,516
Total Emissions Reductions				77,813	504,141

Note: The calculations above assume that the infrastructure and capital investments put in place through the CPRG grant remain operational through 2050, with continual funding from the City or other sources, for operations and maintenance.

Advanced Pyrolysis of Biosolids from Municipal Wastewater Treatment Plants Preliminary GHG emissions reduction estimates				
Technology	**Amount**	**Assumptions**	**GHG Emissions Reduction Estimates** (tons of MTCO2e)	
			through **2030**	through **2050**
Advanced Pyrolysis processing of biosolids	4,000 lbs per day	This only takes into account the GHG reductions from reduced energy use at the treatment plant – not reductions from anaerobic processing (e.g., methane avoided)	2,890	15,733
Total Emissions Reductions			2,890	15,733

Note: The calculations above assume that the infrastructure and capital investments put in place through the CPRG grant remain operational through 2050, with continual funding from the City or other sources, for operations and maintenance.

Industrial-scale composting of or advanced pyrolysis of organic materials from municipal landfills. Preliminary GHG emissions reduction estimates				
Technology	**Total Amount Composted 2027 - 2050**	**Assumptions**	**GHG Emissions Reduction Estimates** (tons of MTCO2e)	
			through **2030**	through **2050**
Green waste diverted from landfill and composted	37,116 tons	Utilizes EPA estimates for green waste sent to landfills. Assumes composting 10% of all green waste in year 3, increasing to 15% in year 4, to 20% in year 5 and beyond	562	4,083
Food waste diverted from landfill and composted	133,529 tons	Utilizes EPA estimates for food waste sent to landfills. Assumes composting 10% of all food waste in year 3, increasing to 15% in year 4, to 20% in year 5 and beyond	2,798	20,029
Total Emissions Reductions			3,360	24,112

Note: The calculations above assume that the infrastructure and capital investments put in place through the CPRG grant remain operational through 2050, with continual funding from the City or other sources, for operations and maintenance.

Anticipated Benefits to LIDAC Residents:

- Reduced risk of catastrophic wildfires that threaten lives and property, release significant GHG emissions, disrupt ecosystem functions, and negatively impact the local quality of life and tourism. Low-income neighborhoods and disadvantaged communities are already experiencing greater impacts due to climate change and extreme weather events. The Southside neighborhood in Flagstaff, for example, is a designated disadvantaged community in the 95^{th} percentile for projected wildfire risk.
- Improved local air quality from the reduced incidence of prescribed forest burning following hazardous fuels reduction treatments. Smoke is a significant source of local particulate matter in some parts of the state, and a serious health concern for those with asthma and other respiratory illnesses. The percentage of people suffering from asthma is disproportionately higher in Flagstaff's disadvantaged communities. The Sunnyside community on the east side of Flagstaff is in the 68th percentile for the share of people with asthma (Tract 04005000300,

CEJST); while the Southside community is in the 87th percentile (Tract 04005000800, CEJST). Neighboring Native communities are located downwind from wildfires and prescribed burns, affected by smoke, and disproportionately impacted by environmental and health burdens including asthma rates in the 98th percentile. (Tract 04005945100, CEJST). Reducing the number of prescribed burns will contribute to better public health.

- Reduced risk of flooding in communities that lie in floodplains (e.g., Southside and Sunnyside neighborhoods in Flagstaff), communities that have experienced redlining and disinvestment, and that lack adequate infrastructure to handle the flooding that has intensified due to the intensity of wildfires (Southside and Sunnyside neighborhoods). Sunnyside is in the 90th percentile for projected flood risk, while Southside is in the 92nd percentile (CEJST). Both low-income communities have a history of flooding and infrastructure-related issues. Sunnyside experienced devastating post-wildfire flooding of homes, buildings, and an elementary school due to the Museum Fire in the summer of 2021. Concentrating full fiber removal operations on the San Francisco Peaks would reduce the impacts of flooding on the Rio de Flag, which would positively affect these communities.
- Clean wood-burning stove retrofits will be provided to residents in census-designated tracts and will result in emissions reductions while improving the indoor air quality and health of the members in such households. The retrofits will be EPA-certified clean burning stoves.
- A free source of firewood for community members who rely on wood for home heating and/or cooking through public wood banks, with an emphasis on supporting rural community members and Tribal Nations.
- Improved public awareness of EPA's smart burning resources through the distribution of handouts highlighting safe and clean burning practices and providing free moisture meters to low-income residents in Flagstaff and nearby Native communities will result in improved indoor air quality. Approximately 80% of residents surveyed in Hopi villages and Navajo chapters depend on firewood for heating and/or cooking. (Wood for Life Needs Assessment conducted by Ecological Restoration Institute, preliminary results, Feb. 2024).
- Diverting biosolids from the current wastewater treatment and land application process in Flagstaff to an advanced pyrolysis process will reduce the risk of contaminating groundwater supplies while improving the environmental health and overall well-being of residents through land remediation where biomass solids (sludge) currently are located at the wastewater treatment plant. Ecological restoration benefits the whole community, especially the Southside neighborhood (Tract 04005000800), which is in the 94^{th} percentile for projected risk of wastewater discharge and 92^{nd} percentile for projected flood risk (CEJST).
- This measure will support entrepreneurial growth and expanded job creation opportunities through an innovation marketing grants program and partnership with Coconino Community College. Microgrants will support entrepreneurs in developing markets for biochar and other products created from liability biomass while a certification program will train a local workforce.

- The pilot projects may provide a free source of compost and/or biochar for low-income community members and community gardens and school gardens in census-designated tracts. A partnership with Northern Arizona University will prioritize scientific research concerning carbon removal strategies including pyrolysis, wood vaulting, and composting. Soil health and productivity will be monitored, and the results will help inform the project, which may positively impact soil health in the communities receiving free compost and/or biochar.
- Reduced air and noise pollution by utilizing electric refuse trucks for residential and/or commercial compost pickup instead of conventional diesel refuse trucks.

Implementing Agency or Agencies
Arizona local governments, including the City of Flagstaff.

Review of Authority to Implement
The implementing agencies have the authority to implement the measure as proposed. No additional authority is required.

Budget
The total anticipated budget to implement pilot projects led by the City of Flagstaff is $49M.

Geographic Location
This measure will significantly impact the treatment, processing, and emissions of liability biomass in the Greater Flagstaff Region. It pertains especially to forested areas of Northern Arizona that are susceptible to catastrophic wildfires, including the City of Flagstaff and the greater Coconino County area.

Funding Sources

- EPA’s Climate Pollution Reduction Grant

Metrics for tracking progress

- Number of advanced pyrolysis reactor units deployed at regional facilities.
- Number of industrial-scale composting facilities created.
- Annual volume of biomass (in tons) diverted from business-as-usual forest management processes to advanced pyrolysis processing.
- Annual volume of biomass (in tons) diverted from business-as-usual wastewater management processes to advanced pyrolysis processing.
- Annual volume of forest byproducts provided to low-income and disadvantaged communities for space heating.
- Annual volume (in tons) of waste diverted from the landfill.
- Annual number of technicians certified to operate pyrolysis equipment.
- Annual volume (in tons) of biochar created.
- Annual volume (in tons) of compost created.

Low-Income and Disadvantaged Community Analysis

The implementation of the measures included in this PCAP is anticipated to provide significant benefits to low-income and disadvantaged communities (LIDACs). This section identifies each LIDAC within the jurisdiction covered by this PCAP, how Arizona meaningfully engaged with LIDACs in the development of this PCAP, and how Arizona will continue to engage in the future.

Identification of and Engagement with LIDACs

The OOR identified LIDACs using the Climate and Economic Justice Screening Tool (CEJST). The OOR created an engagement plan for seeking feedback on community priorities during the development of this PCAP. See the Coordination and Outreach section of this PCAP for the engagement plan, a record of outreach activities, and a summary of input received during the engagement process. Strategies for engagement with LIDACs are summarized below:

- Online resources:
  - State CPRG webpage: https://resilient.az.gov/resiliency-programs/energy-programs/climate-pollution-reduction-grant-cprg/climate-pollution;
  - Social media;
  - Portal for submitting ideas: https://docs.google.com/forms/d/e/1FAIpQLSdhKf0hokFae2HyHezLGOCtTYWAzGCdcHneu39KopGBigAY3A/viewform.
- Community meetings across the state with options for in-person and online participation in English and Spanish;
- Targeted outreach to known community-based organizations; and
- Attendance at known community events to disseminate information about how to provide input.

Impact of PCAP Implementation on LIDACs

A discussion of the benefits to LIDACs associated with the implementation of Priority Measures is included with the technical description of the Priority Measures. In those sections, the benefits are described along with the assumptions of how Census Tract IDs are selected from CEJST. In Appendix B, the list of affected Census Tract IDs is shown along with references with supporting information for the anticipated benefits.

The Office of Resiliency will perform culturally appropriate, community-based stakeholder engagement activities with LIDAC communities every other month throughout the grant funded period. Information gathered from these engagement activities shall directly inform future work.

The Office of Resiliency will actively invite, engage, and work with Tribal nations and communities in Arizona in all stakeholder engagement processes. OOR will ensure that Tribal and LIDAC priorities, thoughts, and concerns are respected and incorporated into all future work.

Review of Authority to Implement

The Governor's Office of Resiliency has reviewed existing statutory and regulatory authority to implement each priority measure continued in this PCAP. For any priority measure where authority must still be obtained, this section contains a schedule of milestones for actions needed by key entities (e.g, legislature, administrative agency, etc.) for obtaining any authority needed to implement such measure(s)

Priority Measure	**Implementing Agency**	**Review of Authority to Implement**
Resilient Homes and Businesses		
1. Expand access to weatherization, energy efficiency upgrades and electrification.	OOR	The implementing agency has the authority to implement the measure as proposed. No additional review is required
2. Support municipalities and communities statewide in adopting the most up-to-date building energy codes.	OOR	The implementing agency has the authority to implement the measure as proposed. No additional review is required
Electricity Sector: Clean, Reliable Electricity		
3. Deploy solar-plus-battery systems.	OOR	The implementing agencies have the authority to implement the measure as proposed. No additional review is required
4. Implement on-site renewables generation and battery storage at public universities and community colleges.	ABOR, ASU, NAU, UA	The implementing agencies have the authority to implement the measure as proposed. No additional review is required
5. Resilient Local Economy	OOR	The implementing agency has the authority to implement the measure as proposed. No additional review is required
Workforce Development: Clean Energy Economy for All Arizonans		
6. Create a clean tech workforce.	OOR, OEO, ASU, NAU, UA, MCCCD, ABOR, ACA	The implementing agencies have the authority to implement the measure as proposed. No additional review is required
Transportation Sector: Clean, Safe Transportation		
7. Enable zero-emission fleets.	ASU, UA, NAU, Eligible entities statewide	The implementing agencies have the authority to implement the measure as proposed. No additional review is required
8. Public fleet electrification and publicly available charging infrastructure development.	State of Arizona, local and county governments, Tribal nations	The implementing agency has the authority to implement the measure as proposed. No additional review is required.

9. Increase publicly accessible electric vehicle charging.	ASU, UA, NAU, MCCCD, Eligible entities statewide	The implementing agencies have the authority to implement the measure as proposed. No additional review is required.
10. Improve roads in rural and tribal communities.	ADOT, county governments, TCROs, RTPOs	The implementing agencies have the authority to implement the measure as proposed. No additional review is required.
11. Clean I-40 transportation Corridor	NMED with coalition members from southwestern states and municipalities	The implementing agencies have the authority to implement the measure as proposed. No additional review is required.
Waste, Water and Sustainable Materials Sector		
12. Develop and pilot innovative solutions to reduce greenhouse gas emissions and air pollution from forest management, municipal solid waste, and wastewater processes, and develop local markets for biochar and other products created from liability biomass.	City of Flagstaff, Eligible entities statewide	The implementing agencies have the authority to implement the measure as proposed. No additional review is required.

Coordination and Outreach

The Governor's Office of Resiliency (OOR) conducted extensive intergovernmental coordination and outreach in the development of this PCAP. This section describes the framework OOR used to support robust and meaningful engagement strategies to ensure comprehensive stakeholder representation and overcome obstacles to engagement, including linguistic, cultural, institutional, geographic, and other barriers.

Identification of Stakeholders

Arizona State Office of Resiliency identified stakeholders representative of the entities, groups, and individuals who may be impacted by the implementation of this PCAP. Stakeholders included:

- Other state agencies;
- Metropolitan planning organizations;
- Economic development organizations;
- Environmental advocates;
- Utilities;
- Agricultural associations;
- Waste management organizations;
- Consumer advocates;
- Local elected officials;
- Community-based organizations;
- Other interested organizations; and
- Residents of Arizona.

To identify stakeholders, OOR contacted local elected officials, community organizations, and advocacy organizations known to be interested in clean energy infrastructure and practices. OOR will update this list of stakeholders as needed.

Interagency and Intergovernmental Coordination

OOR hosted biweekly coordination meetings with MAG, Pima County DEQ, Navajo Nation, Hopi Tribe, San Carlos Apache, Gila River Indian Community, and Salt River Pima Maricopa Indian Community. Additionally, OOR engaged with key state agencies including ADOT and ADEQ on a weekly basis.

The purpose of these coordination meetings was to ensure feedback from key inter-agency and community partners was incorporated.

No sub-awards outside of contracts with ASU and NAU were issued.

Outreach Plan

The Governor's Office of Resiliency contracted with Arizona State University to develop an outreach plan that could contribute to the development of the Priority Climate Action Plan. A two-pronged strategy was identified, including a focus on stakeholder engagement and public engagement. Stakeholder engagement involved targeted conversations with other PCAP recipients, potential implementation partners, non-profits, and businesses and community groups already working to advance resilience and climate action across the State of Arizona. During stakeholder engagement, conversations focused on where the state and other implementation grant-eligible entities have the capacity to implement actions that reduce greenhouse gas emissions and improve quality of life for Arizonans, particularly low-income and disadvantaged communities. These conversations resulted in a set of action areas that reflect both the need for climate action and where action can be taken across the state in a timeline that fits with that required by the implementation grants competition. Public engagements were held to gather public input on these action areas. The results of the public engagements appear in Appendix A. Table 4 provides a log of the outreach and coordination efforts.

Strategies to Overcome Linguistic, Cultural, Institutional, Geographic, and Other Barriers to Participation

- Two meetings were held virtually for statewide participation, one in the evening and one in the afternoon. Recordings of all virtual and hybrid meetings are available here.
- All virtual meetings were held in English with live subtitles provided in English and Spanish.
- Meetings held in predominantly Spanish-speaking areas were held in both Spanish and English with materials provided in both languages. The website was launched by the State's Office of Resiliency to provide a link to a form for collecting feedback in both English and Spanish: https://resilient.az.gov/resiliency-programs/energy-programs/climate-pollution-reduction-grant-cprg/climate-pollution
- Events were posted on ASU's Event website: https://asuevents.asu.edu/

Outreach and Coordination Documentation

Table 4 provides a log of interagency and intergovernmental coordination and stakeholder and public engagement efforts associated with the development of this PCAP.

Table 4. Outreach and Coordination Log

Date	Topic	Organizations Involved	Outreach Method	Location	Outcome(s) and Next Steps	Notes/Links
9/25/23	Rural Engagement in Climate Action Plan	Local First Arizona	Zoom	Virtual	Work together to distribute information to rural counties	
10/19/23	Community Engagement with PCAP	Chispa and Unlimited Potential	Zoom	Virtual	Agreed to share outreach materials about the PCAP	
10/24/23	Input on the Arizona PCAP	SciTech Innovation Council	Tabling and Keynote Speech	Arizona Science Center, Phoenix, Maricopa County, AZ	Partnership with AZ Sci Tech for high school engagement on CCAP	
10/24/23	Sharing resources in developing PCAP	San Carlos Apache	Zoom	Virtual	Further collaboration on CCAP with San Carlos	
10/26/23	Collaboration on Outreach events	Maricopa County Association of Governments	Zoom	Virtual	Agree to participate in MAG outreach events and share resources	
10/27/23	Pima County's interest in PCAP measures	Pima County, Pima Environmental Quality District	Zoom	Virtual	Discuss engaging agriculture stakeholders in the CAP process.	
10/5/23	Rural Engagement in Climate Action Plan	Local First Arizona	Zoom	Virtual	Develop a plan to expand public engagement with the LFA network	
11/1/23	Coconino's interest in PCAP measures	Coconino County, City of Flagstaff, City of Sedona	Zoom	Virtual	Plan public engagements in Coconino County	
11/1/23	AZ Dept. of Air Quality's interest in measures	ADEQ	Zoom	Virtual	ASU to work with ADEQ on public engagements	
11/2/23	Implementation Grants and the Communities' interest in PCAP measures	Salt River Pima Indian Community, Gila River Indian Community	Zoom	Virtual	Continue conversations on CAP collaboration	
11/2/23	Implementation Grants and the Communities' interest in PCAP measures	Hopi Nation	Zoom	Virtual	Offer technical assistance, explore shared measures for PCAP	

11/3/23	Yuma County Implementation grant	Yuma County, Town of Somerton	Zoom	Virtual	Yuma County will talk among its municipalities about the highest priority implementation projects.	
11/3/23	Arizona Department of Transportation Involvement in PCAP	ADOT, ASU, Governor's Office of Resiliency	Zoom	Virtual	Identifying ADOT projects to include in measures for PCAP	
11/30/23	Community Forum on Clean Arizona Plan	Unlimited Potential, Chispa	Public Meeting/Public Engagement	South Phoenix, Maricopa County, AZ	Provided feedback on proposed measures in the state's priority climate action plan	
12/4/23	Northern Arizona Business Leaders Roundtable on Clean Arizona Plan	Arizona Forward Northern Arizona members	Roundtable	Virtual	Provided feedback on proposed measures in the state's priority climate action plan	
12/4/23	Clean Arizona Plan	Maricopa Association of Governments	Tabling	West Phoenix, Maricopa County, AZ	Gathered input from the public on proposed measures in the state's priority climate action plan	Clean AArizonaPlan Input Form-4.pdf https://forms.gle/PmhKWojLUaSjaG2N9
12/7/23	Clean Arizona Plan Town Hall	ASU, OOR	Public Meeting/Public Engagement	Virtual	Gathered input from the public on proposed measures in the state's priority climate action plan via polls and unstructured feedback	Virtual Engagement CAP slides.pptx-1.pdf
12/7/23	Maricopa County Healthcare Workers Forum on Clean Arizona Plan	Unlimited Potential	Stakeholder Engagement	Virtual	Gathered input from healthcare workers on proposed measures in the state's priority climate action plan	
12/11/23	Clean Arizona Plan	Maricopa Association of Governments	Tabling	South Phoenix, Maricopa County, AZ	Gathered input from the public on proposed measures in the state's priority climate action plan	https://forms.gle/PmhKWojLUaSjaG2N9 Clean Arizona Plan Input Form-4.pdf
12/12/23	Clean Arizona Plan Town Hall	Coconino County, City of Sedona and Flagstaff, ASU, ASU, Governor's Office of Resiliency	Public Meeting /Public Engagement	Flagstaff, Coconino County, AZ	Gathered input from the public on proposed measures in the state's priority climate action plan	Virtual Engagement CAP slides.pptx-1.pdf Appendix A, Section 2

12/12/23	Clean Arizona Plan Town Hall	Coconino County, Flagstaff, ASU, ASU, Governor's Office of Resiliency	Public Meeting/Public Engagement	Flagstaff, Coconino County, AZ	Gathered input from the public on proposed measures in the state's priority climate action plan	Virtual Engagement CAP slides.pptx-1.pdf Appendix A, Section 2
12/13/23	Clean Arizona Plan	Maricopa Association of Governments	Tabling / Public Engagement	Eloy Town Hall, Pinal County, AZ	Gathered input from the public on proposed measures in the state's priority climate action plan	
12/15/23	Clean Arizona Plan Town Hall	ASU, Governor's Office of Resiliency	Public Meeting/Public Engagement	Virtual	Gathered input from the public on proposed measures in the state's priority climate action plan	
12/16/23	Clean Arizona Plan	Maricopa Association of Governments	Tabling/Public Engagement	Mesa Community College	Gathered input from the public on proposed measures in the state's priority climate action plan	
1/9/2024	Virtual Small Business Roundtable	Local First Arizona	Roundtable	Virtual	Asking local business owners across the state for their input on the state's climate action plan	Appendix A, Section 3
1/18/2024	Verde Valley Roundtable	Local First Arizona	Roundtable	Cottonwood, Yavapai County, AZ	Gathered input for PCAP from Yavapai County residents	Appendix A, Section 3
1/24/2024	Statewide Tribal Leader Roundtable	Local First Arizona	Roundtable	Virtual	Gathered input for PCAP from tribal leaders	Appendix A, Section 3
1/25/2024	Yuma County Roundtable	Local First Arizona	Roundtable	San Luis, Yuma County, AZ	Gathered input for PCAP from Yuma County	Appendix A, Section 3

Appendix A: Community Engagement Results and Input

Table 1. Poll Questions Asked and Associated Proposed Measures

<table>
<tr><th>PCAP Measures</th><th>Poll Questions Alignment with Measures</th></tr>
<tr><td>1. Expand access to weatherization, energy efficiency upgrades and electrification.
2. Support municipalities and communities statewide in adopting the most up-to-date building energy codes.</td><td>Q1: Should the State of Arizona support people in updating their homes to keep homes cooler in the summer and warmer in the winter?</td></tr>
<tr><td>8. Public fleet electrification and publicly available charging infrastructure development.
9. Increase publicly accessible electric vehicle charging.</td><td>Q3: Should the State of Arizona prioritize installing more electric vehicle chargers throughout the state?</td></tr>
<tr><td>10. Improve roads in rural and tribal communities.</td><td>Q4: Would you like to see the State of Arizona prioritize road improvements in rural and Tribal communities in the Clean AIRizona Plan?</td></tr>
<tr><td>11. Develop and pilot innovative solutions to reduce greenhouse gas emissions and air pollution from forest management, municipal solid waste, and wastewater processes, and develop local markets for biochar and other products created from liability biomass.</td><td>Q7: Should the State of Arizona prioritize reducing wildfires through forest restoration as part of the Clean AIRizona Plan?</td></tr>
<tr><td>3. Deploy solar-plus-battery systems.</td><td>Q8: Should the State of Arizona work with utilities, communities and tribes to increase electricity access throughout Arizona?</td></tr>
<tr><td rowspan="4">Additional Questions not directly tied to Measures</td><td>Q2: Should the State of Arizona work with municipalities throughout the state to make it easier for people to walk, bike, or take the bus or light rail?</td></tr>
<tr><td>Q5: Should the State of Arizona work with municipalities to plant and maintain shade trees in communities throughout the State?</td></tr>
<tr><td>Q6: Should the State of Arizona work with utilities and energy companies to have solar shade structures installed in parking lots, schools, parks, and other available spaces within communities?</td></tr>
<tr><td>Q9: Should the Clean AIRizona Plan include measures to help farmers and ranchers improve soil quality?</td></tr>
</table>

	Q10: Should the State of Arizona explore how Bioenergy with Carbon Capture, Direct Air Capture and other carbon dioxide removal technologies can support emissions reductions?

Table 2. Poll results from Town Halls

GRAND TOTALS	Green	Yellow	Red	Green	Yellow	Red	Y+R	Summary
Poll Name				Percentages				
Q1 - support people in updating their homes	60	10	1	84.50%	14.10%	1.40%	15.50%	Widespread support for weatherization of homes
Q2 - make it easier to walk, bike, or bus	52	3	0	94.50%	5.50%	0.00%	5.50%	Widespread support for improving walking, biking, and public transport in communities
Q3 - installing more electric vehicle chargers	63	14	4	77.80%	17.30%	4.90%	22.20%	Concern for EV costs, availability, and range
Q4 - Road improvements	38	30	7	50.70%	40.00%	9.30%	49.30%	Almost 50% of respondents reject investments in rural road improvements
Q5 - shade trees	55	15	2	76.40%	20.80%	2.80%	23.60%	Widespread support, but concern over cost and shade potential
Q6 - solar shade structures installed in parking	59	10	0	85.50%	14.50%	0.00%	14.50%	Widespread support, but concern over cost/ownership vs beneficiaries
Q7 - forest restoration	64	11	0	85.30%	14.70%	0.00%	14.70%	Widespread support for forest restoration and health
Q8 - increase electricity access	57	13	0	81.40%	18.60%	0.00%	18.60%	Widespread support, concerns over cost, reliability, and lack of support for renewables from utilities
Q9 - improve soil quality	44	21	1	66.70%	31.80%	1.50%	33.30%	While this is supported, impact is less known; promote regenerative agriculture

Q10 - carbon dioxide removal technologies	39	18	12	56.50%	26.10%	17.40%	43.50%	Concern about the cost and technical feasibility of CCS technologies

1. *Key takeaways from Roundtables*

January 9, 2024 - Small Business Convening Report

Key themes identified in Breakout Groups:

Financial:

- **Finance**: Recognition that there is not sufficient finance for small businesses to implement sustainability projects
- **Incentives (rebates, grants, tax breaks, etc.)**: Additional tax incentives for small businesses to implement building and transportation electrification (including work like upgrading electrical boxes, running wiring for EV chargers, etc.), battery storage, energy efficiency, and renewable energy generation would be helpful. This would help maximize small businesses' ability to take advantage of IRA tax incentives and utility rebates which would make projects more financially feasible to small businesses. Emphasis that more grants/rebates would be most helpful for businesses as they don't have excess capital to spend on projects with 3+ year ROIs.
- **Assistance for energy audits/assessments for small businesses**: To help small businesses to better plan energy related projects, it is hard to identify quality companies/organizations to do energy audits. Utility audits, while better than nothing, don't provide enough information about the whole building structure to be able to implement projects that create significant savings and impacts for business owners.
- **Public Procurement**: Prioritizing locally owned businesses that are implementing sustainable practices to support businesses that implement climate solutions into their business models and operations.
- **Need greater public investment in green transportation infrastructure across the state** (public, electric vehicle, and non-motorized transportation)
- **Incentives to update existing buildings to become more energy efficient versus demolishing and building new structures**: Lots of old building stock which is worth keeping but often needs deep work in weatherization and retrofitting to make them energy efficient.
- **Work with utilities to develop financing tools to support small businesses in implementing sustainability projects.**
- **Public investment in organic waste programs for residential and commercial.**

Education

- **Quality education/information**: Many 'green' programs end up being a waste of small business owners' limited time. Need more robust educational programs that provide trusted and vetted information to assist them in executing sustainability projects.
- **Green Financial Literacy Programs:** Existing financial (tax incentives, utility rebates) are overly complicated and challenging for small businesses to navigate. Additionally, finding trusted contractors is also a big challenge. Businesses need trusted educational programs, like Local First Arizona, to provide them the information, access to trusted professionals, and assistance in developing projects to make larger environmental impacts.

- **Project Technical Assistance**: Many don't have staff necessary to dedicate the needed time to sustainability projects. Small business owners need trusted organizations to assist them through the process and provide technical assistance through ideation, project development, financing, and execution.
- **Technical assistance to apply for and implement complicated federal grant programs**. Large corporations have people they hire to do this, small businesses don't have the capital or people on staff to effectively help them compete for larger grants. Additionally, support is needed on the back end to ensure proper implementation and compliance. Big pain point for small businesses

Policy

Waste: Too much of our waste is destined for landfills. Policies are needed to incentivize other types of waste disposal like composting (which impacts methane emissions) and recycling to avoid further extraction of raw materials.

Municipal standards for Solar Energy: Municipalities adopt their own permitting requirements for rooftop solar which creates challenges for installers and contractors who have to navigate a patchwork of municipal policies and requirements. A (more) standardized statewide policy would help simplify the implementation of rooftop solar and reduce costs for consumers by streamlining permitting and reducing time required by solar installers to ensure local compliance. Question if the state can offer incentives for cities to upgrade their codes or offer discounts on other fees charged to developers to ensure they don't lose revenues?

Tenants: Many renters struggle to implement sustainability projects because their landlords do not approve them. Can the state look for ways to make it easier for tenants (who generally are responsible for the upkeep of the HVAC, lighting, etc. equipment anyways) to implement sustainability projects without repercussions from landlords?

Additional compliance for large corporations and polluting industries

Workforce development

With the emerging green economy, there is great need for new trained employees. State needs to invest in long-term workforce development strategies to provide the employees businesses need to implement the work.

January 24, 2024 Tribal CPRG Convening Notes

Key themes identified in Breakout Groups:

Main Takeaways

Tribal communities broadly struggle to meet government grant requirements. This is due to many reasons, from the trust land status of Arizona's 22 Indian Tribes, the lack of Tribal revenue, to the daily challenges related to transportation and lack of infrastructure. For example, many Tribal community-specific grants require physical addresses; however, many Tribal organizations and residents do not have physical addresses, but instead rely on PO Boxes. Additionally, organizations that act as fiscal sponsors (like Indigihub) struggle to meet reporting requirements as the internet is unreliable and dirt roads and long distances create logistical issues when it comes to reporting. Navigating these challenges that disproportionately impact Tribal communities will be key to increasing opportunities to invest in Arizona's Tribal nations.

Clean & reliable energy

- Tribal communities regularly experience brownouts, which are disruptive to health, community well-being, and economic opportunity. This is an ongoing issue on the Hopi Nation as they are located at the end of APS' service territory and power access is incredibly unreliable. For the Tohono O'odham Nation, their electrical coop is too small and neither the coop nor the tribe can afford the costs of new renewable energy generation and grid improvements.
- Tribal communities need funding for residential energy-efficient appliances, as many of the appliances are old and inefficient or nonexistent, & improving electrical systems (boxes, wiring, etc.) is necessary to handle the increased loads.
- Need greater capacity for generating energy on-site to avoid the ongoing brownouts (at utility and individual residential scales). For off-grid homes, solar+battery systems will make a massive impact. Energy generated on-site in Tribal nations should prioritize providing power to Tribal members. Many tribes rely on outside companies for their energy needs.
- There is a large lack of workforce and training opportunities for the emerging green economy in Tribal nations. High unemployment rates and lack of investments in revenue-generating projects impact the health and well-being of tribes.
- Challenges of providing clean, safe, reliable energy vary significantly between regions, electric utilities, and tribes.
- Additional funding is needed not just for Tribal governments, but the diverse non-profit organizations that support this type of work across Arizona's Tribal communities.

Resilient homes & businesses

1) Invest in quality business startups and support resources for entrepreneurs that are tailored to each tribe
2) Invest in foundational Ingredients for enterprise development on Tribal land (facilities/land, business plan support, start-up funding, entrepreneur support)
3) Invest in connecting Universities, colleges, nonprofits, and Tribes to bring technical training that will translate into jobs (carpentry, solar, water, etc.,) needed in communities
4) Increase access to capital to support community, economic, and workforce development.

Clean & safe transportation & roads

- Before addressing additional transportation challenges, road infrastructure needs investment on Tribal lands. Existing roads are so bad that they are impacting access to resources, causing continuing vehicle costs for Tribes, and creating additional challenges to expanding/implementing different clean transportation options.
    - Some examples include:
        - Food banks struggle with food distribution at chapter houses because of bad roads.
        - Chapter and Tribal nation governments have ongoing vehicle maintenance and repair costs due to the damage incurred by bad roads.
        - Electric bike programs are being explored, but the bikes must be mountain bikes to successfully travel on existing roads. (Potentially means more expensive bikes, more expensive maintenance costs, etc.)

        - Road conditions and remoteness increase costs for goods and services provided from outside resources to Tribal communities.
- Road closures have impacted bus systems on Tribal lands, causing people to travel greater distances to get bus stops, to take more buses to get to their destination, and to wait longer for buses.
- Bus stops do not have shaded areas, which is a concern due to high temperatures that particularly impact elders.
- Transportation impacts the workforce — access to their workplace is dependent on good roads and viable transportation options.
- Multiple Tribal communities are exploring options for electric bicycles.
    - Currently planning to use Tribal nations' transit and transportation funds to kickstart the project and purchase the bikes.
    - There will be a need for future funding to cover maintenance of the bikes, labor required to complete the maintenance, warehousing for the bikes, and where the maintenance will occur.
    - Considering tying workforce development to clean transit options — how can folks who participate in workforce development programming get an electric bicycle to get to work? How can Workforce Innovation and Opportunity Act (WIoA) funds be used here? Can funds be leveraged with other funding sources to address the heightened needs in these communities?
- There is an interest in electric vehicles, but there needs to be the certainty that charging stations will have widespread availability. Affordability will be a critical factor.
- Generally, Tribal councils and chapter leadership need to be involved at the beginning of projects as major stakeholders. They need to be consulted and engaged throughout the process, not only at the end.
    - How can we ensure that information is trickling over to everyone from the individual level to the chapter level to the Tribal council level?
- Tribal Nations all have different policies — how can we work with Tribal nations to update their policies to incentivize climate resiliency projects? To make it easier to take on these projects?
    - Increased access to funding will pave the way for Tribal nations to implement climate resiliency projects.
    - Increasing access to technical assistance specific to policy development and systems change will offset capacity challenges often faced by Tribal governments and organizations.
- Tribes need support identifying and applying for funding. Workshops should be developed to build capacity around grants and funding opportunities to make them more accessible.

Healthy forests & agriculture

- Investment in microenterprise for traditional Tribal practices of ranching, and farming. This includes support in localizing supply chains and practices that lead to greater carbon capture to reduce carbon emissions while increasing local access to nutritious food and reducing vehicle miles to travel to grocery stores.
- Increase funding to invest in multi-function prefabricated buildings that are energy efficient and renewable energy plug-in ready (or equipped). It takes 5-20 years to build new buildings through Tribal processes. Energy-efficient prefabricated buildings with solar and battery capacity can also serve as critical community and resiliency centers. Indigihub has teachers willing to teach freeze-drying/canning programs in place, just need the space.

- Additional roundtables will be useful to engage indigenous chefs, farmers, retailers, owners, etc. in this process.

** Important data **

- Data shows 65% of Arizona food producers are indigenous but 75% of those producers report less than $1000 in annual revenue!
- Navajo Nation is the size of West Virginia and they have 12 operating grocery stores.

Investment in climate-adapted heritage foods reduces carbon emissions while helping farmers secure their livelihood.

Investments in energy-efficient and reliable equipment from tractors to forklifts will support the work on healthy forests, food production, facilities, operational activities, and development projects.

Addendum:

Hopi Relief, a nonprofit organization, sent feedback after the Tribal gathering:

They identified a need for funding to sustain the organization's food pantry, business development, and community outreach.

Need reliable equipment to manage the food pantry activities, vehicles to distribute food, and engage the community.

San Carlos All Board Cattle Association:

Need funding for processing healthier food options, implementing best practices to grow cattle, lessening the impact on the environment, range management training, workforce development, and facilities to manage cattle, farming, land, and water resources. The focus is to protect the cattle and ranching business by implementing sustainable practices based on ancestral and traditional knowledge.

January 18, 2024 - Verde Valley Convening Report

Key themes identified in Breakout Groups:

Clean, Safe Transportation:

- **Alternative Fuels/Vehicles**: Desire to explore alternative fuels in both land and air transportation; incentives and tax breaks will bring alternative fuel technology to Arizona as well as electric aircraft technology
- **Regulations:** Support for statewide emissions testing of all vehicles;
- **Transportation Systems:** Desire for increased connectivity to urban areas and between rural communities, including safe walking/biking paths
- **Working/Desired Programs/Projects:**
    - EV Charger Installation Programs through APS
    - Regional EV Maintenance Facility (Ideation)

    - Public Safety Education Programs on multimodal transportation
- **Challenges**: Jurisdictional ownership of roads and subsequent division of responsibilities and decision making power make solving problems difficult. Additional support for local governments will assist in working collaboratively with other agencies on transportation and road issues.

Road Improvement

- **Working/Desired Programs/Projects:**
    - Pavement Improvement Projects (Existing projects between Cottonwood and Clarkdale that can be connected geographically; more like this)
    - Historic Communities Pavement Preservation Programs
    - Regional Roadway Safety and Improvement Plan with an emphasis on connectivity, neighborhoods and transportation efficiencies
    - (Potential) 89A & 260 Off Ramp to eliminate traffic build up (Cottonwood)
    - (Potential) N Main & E Mingus Park & Ride (Old Circle K lot - Cottonwood)
- **Challenges:**
    - Lack of clarity on jurisdictional ownership and responsibilities regarding debris, safety, and collaboration
    - Jurisdictional conflicts leading to safety challenges in some rural neighborhoods.
    - Regional transportation and road projects are tedious, and funding is piecemeal, often causing projects to be drawn out for years.
- **Rebates:** Rebates for businesses who are partnering on road projects; costs are still very high for small business owners
- **Road Conditions:** Desire for new technology such as cooling or permeable hard surfaces or advanced dust abatement exploration for unpaved rural roads which high traffic

Clean, Reliable Electricity

- **Concerns:**
    - Lack of Renewable Energy Workforce (solar consultants/installers, auditors, maintenance/repair, etc.)
    - Power Supply - Local businesses are often on the hook when it comes to expanding existing buildings' electrical capacity. There is a need to expand the amount of energy available to the Verde Valley to support business and economic growth.
    - Many rural families still cannot afford solar (Camp Verde).
- **Solutions:**
    - Broadband: As more and more energy efficiency is connected to the internet (smart homes and businesses, etc.), the internet is an important tool in demand side management. Areas like the Verde Valley and surrounding areas lack adequate broadband and as such, cannot take full advantage of these technologies.
    - Rethinking energy rates: Commercial rates based on a business' peak demand interval doesn't incentivize them to use less energy overall, just to lessen their peak demand
    - Microgrids for municipalities (emergency management, resiliency, increased renewables for the grid)
    - Additional resources to explore solar and rebates with utility (processes are difficult)

- Funding to support additional energy efficiency and renewable energy projects at water and wastewater plants.
- **Rebates, Incentives, Tax Credits, etc.:**
  - Incentives for small businesses to install solar covered parking, EV charging
  - Rebates for rural and low income families to help cover upfront costs of solar installation
- **Commercial and residential solar:**
  - is a great program but could be better with extra capacity to assist individual businesses and additional funding (like LFA's REAP Tech. Assistance Program)
  - Fund to equalize costs attributed to the varying solar policies from states/regions
  - Funding for increased technical assistance capacity on the front and back end of the application/reporting processes (for municipal and county governments)
- **Energy in Waste Management:** Currently there is a lack of waste management infrastructure in the rural communities and in the Verde Valley as a whole.
  - Funding to maintain and expand current recycling facilities and capacity
  - Funding for composting programs that benefit Verde Valley growers (commercial and recreational)
  - Funding for exploring biogas and blue fuel capturing projects/programs
  - Reconsideration of pre-emptive state laws (like those prohibiting bag bans) that are causing negative local impacts
  - Incentives and resources to create sustainable circular economies that incorporate waste management as a business practice in rural parts of the state outside of major population centers

Resilient Homes & Businesses

- **Homes:**
  - More focus on water (quality, quantity, efficiency, rainwater capture, electricity associated with movement of…, etc.)
  - Green/alternative friendly building codes and incentives for lessening impact on municipal or county systems and financial/technical support for municipalities in their design and implementation
  - Fire Resilience Incentives and Programs
- **Businesses:** Verde Valley business needs mirror responses for home resiliency needs (technical assistance support, education, and financial)
- **Existing Programs that work:**
  - Home Energy Retrofit Program (Sedona)
  - River Friendly Home & Businesses (Friends of the Verde River)
  - REAP
  - APS Solar Communities
  - Solar United Neighbors (SUN) Community Solar Co-Op
  - APS Rebate Program (Commercial & Residential) (Application process is difficult)
  - APS Energy Audits (Need better and more contractors)
  - Moonshot Pioneer Pitch Competition
  - VVREO Microloan Fund
- **Programs/Projects/Initiatives to explore (with funding and resource support):**
  - Municipal Decarbonization Road Map (Sedona)
  - Sustainable Neighborhoods Program (Sedona)
- **Needs**
  - Low income assistance programs for improving resilience of residential homes

- Community Level Programming with Consultants, Project Managers and Grant Writers to help residents and business owners take on resiliency projects
- Better communication of policies (language translated documents, agency responsibilities and due diligence requirements, etc.)
- Collaborative local governments to evaluate local building codes for preventative or disincentivizing regulations (energy storage/battery bank, greywater reuse, etc.)
- Subsidizing resilient housing projects (workforce housing solution)
- Professional development or technical training/certification in green job fields that are needed right now in the Verde Valley
- Regional coordination and funding on sustainability and resiliency projects
- Additional support for unincorporated areas
- More funding opportunities

January 25, 2024 Yuma County CPRG Convening Notes

Key themes identified in breakout groups:

Clean & Safe Transportation:

- Existing funding for transportation projects:
  - MPDG, RAISE grant, BIL (IIJA), STBG, Operations and maintenance
- Need for education and workforce development:
  - More workforce development to accompany any new projects/ideas
    - Example: there's a need for charging stations for electric vehicles and the corresponding workforce needs to install these stations in the community.
  - Broad education would speed the adoption of clean transportation - starting with children. They are great proselytizers for energy-efficient and clean transportation measures to their parents
- Impeding policies:
  - The international border complicates regional progress on pollution improvement. For example, Yuma will get dinged for its bad air quality, while much of the pollution comes from across the border. Need for greater binational collaboration on air quality improvements
  - Major cities get the lion's share of funding:
    - State/federal funding opportunities and policies frequently don't take the unique needs of rural Arizona into consideration.
    - The amount of available funding is not the same for rural versus larger cities.
  - Cost increases
    - Project costs have doubled and tripled in the last five years. Funding opportunities have not increased commensurate to project costs; because of that, projects can't be completed.
  - Region lacks infrastructure to improve and therefore can't take advantage of improvement funding:
    - There are only two main roads in and out of San Luis which causes them to lose out on many infrastructure funding opportunities.
- Public Transit
  - Yuma County Area Transit (YCAT)
    - Turning YCAT system to electric/green
    - Focus on charging stations
  - Bike routes

        - Change/update city ordinances/policies to encourage bicycling
        - Community development should work on bike routes with shade to help with Yuma heat
    - Rail system
        - Help college students from the southern part of the county get to Yuma.
- Research road materials/color

Resilient Homes & Businesses:

- Many Yuma county residents struggle to pay their energy bills. Low-income families turn off the AC during the summer while they are at work, exposing them to extreme heat when they return home and wait for their AC to cool off the home's interior.
- Yuma County has a high percentage of seasonal employment, meaning that many people have their lowest income when their electricity bill is the highest. How can residents with fluctuating incomes be supported?
- Challenges in connecting low-income families with residential solar power:
    - Solar and energy efficiency are unaffordable for low- to moderate-income families without significant financial support (current loan rates saddle them with long-term debt they cannot afford; not enough grant funding).
    - There need to be consistent solar regulations to ensure there are trusted providers:
        - Solar companies push residents to put solar on their roofs before investing in energy efficiency, burdening them with debt from oversized solar systems .
        - Solar providers provide no cost transparency and usually have extremely high interest rates.
        - There is little trust with solar providers. We need to identify what providers are relying on predatory tactics. Possibly consider partnerships with local providers that meet certain criteria. Local providers are subject to additional accountability from the community.
- Nonprofits, like the Comite de Bien Estar, are working on affordable housing and seeking opportunities to connect green construction with housing affordability:
    - As nonprofits, they're weighing the question of how to make this process cost-efficient. How do they include solar in homes without passing on the financial burden to the new homeowners *and* without causing financial hardship for the nonprofit?
    - Existing programs have long waitlists. Campesinos Sin Fronteras has a home weatherization program that has a waitlist of 200 families. They don't have the funding necessary to make a dent in the need.
- Loans aren't sufficient for solar programs, for example. The loan amounts don't compare to the actual costs and rates frequently aren't low enough to be affordable. Insufficient grant funding to offset costs to both nonprofits and residents.
- Existing funding:
    - APS has programs/rebates for businesses to make transition to energy-efficient systems.
    - USDA is oftentimes a starting resource, but is not enough for future/maintenance costs.
- Existing resources:
    - Yuma County Housing Rehabilitation Program
    - Housing America
    - USDA programs
    - WACOG

- Consumer education is desperately needed with a focus on financing models, maintenance costs and processes, and how to maximize incentives/tax credits.
    - Educational programs should be created for new homeowners to take advantage of all possible savings from energy efficiency and solar programs..
- Funding needs:
    - Increased rebates/grants for residential energy efficiency or renewable energy (for homeowners and renters).
    - Possible incentives for new homeowners to make energy-efficient changes, both for new builds and for decades-old homes that haven't been upgraded.
- Possible policies:
    - Many nonprofits/programs that built homes for communities at a low-cost decades ago are **now** including some of these upgrades in their new builds. However, owners of the older homes are now in need of those efficiency measures. .
        - Grant funds could help these organizations return to the original homes and provide these upgrades at low or no cost to the homeowners.

Clean and reliable electricity:
Challenges to increasing access to clean and reliable energy:

- Concerns that low-moderate income families and small businesses bear the cost of reducing their environmental impact when they lack the funding to do so.
- Lots of concern about the end-of-life of solar panels and batteries; need to ensure there is a plan to deal with products that have expired to not just turn them into another environmental issue
- With so much Arizona generated energy being sold across state lines, there is great concern that renewable energy projects built in AZ will go to power other states (CA)

Opportunities to reduce greenhouse gas impacts:

- Need for additional funding and support to improve the efficiency of new-building codes/enforcement to adopt more energy efficiency. More funding is needed. There is support from contractors and developers to move in this direction.
- Solar on canals is a big opportunity that generates energy while reducing evaporation on the canals.
- Solar can be expanded broadly at produce processing facilities (because Yuma grow so many leafy greens, agrivoltaics are not a great solution)
- Wastewater and water plants are the biggest energy consumers in the municipalities. They need additional funding to make them energy efficient and to invest more in renewable energy to power them.
- Crop waste in Yuma area presents opportunities for Biogas generation

4. Comments from public

Timestamp	Your zip code / su codigo postal	**What would you like to see in the Clean AIRizona Plan?** **Some examples include:** **-energy efficiency measures for homes** **-electric vehicle chargers** **-better public transportation options** ***¿Qué te gustaría ver en el Plan Clean AIRizona?*** ***Por ejemplo:*** ***-medidas de eficiencia energética para viviendas*** **-puntos de recarga para vehículos eléctrico** ***-mejores opciones de transporte público***
12/7/2023 10:39:29	85042	Transporte publico y efficiencies energetically en los hogares
12/7/2023 11:01:20	85043	medidas de eficiencia energeticas para vivienda
12/7/2023 19:25:04	85008	Increased nuclear capacity. lower electric costs.
12/8/2023 14:13:11	85255	Electric vehicle chargers, reduce tailpipe pollution, move utilites to all clean energy, conservation provisions, move all state vehicles to electric, make all state buildings energy efficient and so on.
12/10/2023 11:47:01	85053	1) First and foremost, GET THE WORD OUT, i.e., flooding all forms of information sharing with how to apply/receive free energy efficiency measures for homes, especially those in low income/often heavily minority neighborhoods. This could include contracting with neighborhood non profits to literally knock on doors; working with food banks, churches/religious institutions, schools to share the info widely. 2) Actually providing FREE funding of such energy efficiency measures to include replacing heat pumps with AC units; additional insulation; solar panels; energy efficient lighting etc. 3) Providing no interest loans to folks whose incomes are slightly above the income levels for those in categories 1 &2. If the goal is energy efficiency, as many people as possible should be included with no interest loans helping more people take advantage of such. 4) Same approach to electrifying off grid homes in rural and Tribal communities with a focus on residential solar and battery and microgrids!! 5) Make sure all state buildings are upgraded to meet energy efficiency requirements. 6) All state vehicles should be electrified.

12/10/2023 13:06:12	85014	My top five: • Promotion of Clean Energy Sources: Encouraging the adoption of renewable energy sources like solar power is crucial. Arizona receives abundant sunlight, making it an ideal location for solar energy. Investing in solar farms and incentivizing rooftop solar panels for residential and commercial buildings can significantly reduce reliance on fossil fuels for electricity generation. • Transportation Reforms: Improving public transportation infrastructure and incentivizing the use of electric or hybrid vehicles can cut down vehicle emissions, a major contributor to air pollution. This might involve expanding public transit options, installing electric vehicle charging stations, and offering subsidies or tax incentives for purchasing eco-friendly vehicles. • Dust Control Measures: Implementing strategies to manage dust, a significant issue in desert regions, is essential. This could involve planting vegetation to stabilize soil, paving more roads, using dust suppressants, and enforcing regulations on construction sites to minimize dust emissions. • Stringent Industrial Regulations: Enforcing strict emissions standards for industries, particularly those using fossil fuels, can greatly reduce air pollution. Implementing and monitoring pollution control technologies in power plants, refineries, and other manufacturing facilities is vital. • Public Awareness and Education: Raising awareness among the public about the impact of individual actions on air quality is crucial. Promoting practices like reducing waste, proper recycling, and limiting outdoor burning can make a significant difference. Education campaigns can empower communities to take ownership of their role in reducing air pollution.
12/11/2023 9:23:47	85006	Better public transportation, home energy efficiency incentives
12/11/2023 13:47:30	86301	Better public transportation in Prescott to help reduce traffic and provide transportation for the many disabled and elderly who live here.
12/11/2023 14:32:19	85233	Increased EV charging facilities, in conjunction with public transit locations.
12/11/2023 15:04:49	86004	Green infrastructure, better public transportation options
12/11/2023 15:22:19	85032	Energy efficiency for commerial, residential, municipal, statewide. Electric statewide.
12/11/2023 22:54:36	85018	eery efficient cars & trucks...perhaps retrofitted somehow
12/11/2023 23:02:44	86005	Please keep the current value statement and do not amend it.
12/12/2023 7:56:02	85203	1) Consistent charging opportunities for electric vehicles. Transportation is the biggest carbon emitter and heat emitter (contributing to the heat island effect in warm weather), we need to get internal combustion engines off the road. 2) Weatherization efforts for homes in low/middle income neighborhoods - the least expensive option for reducing energy use and costs. 3) Conversion of buildings from gas to electric heating/cooling of space and water. 4) Improvements to fertilizer technologies - fertilizer is a great contributor to green house gas emissions and gets into the water supply, causing algal blooms. 5) Eliminating our single use, throw away society by encouraging repair, reuse, repurposing items or engendering the idea maybe we don't need to purchase an

		item in the first place. 6) Solar should be installed on every new home built in Maricopa and Pinal counties and the entire state and an EV charger should automatically be installed in all new builds.
12/12/2023 8:59:46	85716	- Rebates/incentives for conversion of business/residential HVAC to heat pumps and electric water heating with increased incentive for full conversion to zero natural gas use in buildings - Economic studies supporting the legislative implementation of annual mileage based road tax and the adoption of a Zero Emission Vehicle (ZEV) program in Arizona.
12/12/2023 12:46:20	85286	Policies to reduce dependency on fossil fuels (higher tax rates, subsidies to renewables and/or nuclear) Electric car infrastructure Walkable design and urban heat island countermeasures (cool pavement, trees and artificial shading, underground parking instead of open parking lots
12/12/2023 13:27:38	85716	Include an independent study on the most rapid and equitable way to transition Arizona's monopoly utilities to zero GHG emissions. Solar and wind energy are cheaper and cleaner to both build and maintain now. So, this transition is economically inevitable, yet delayed indefinitely by corporate control of electricity generation in AZ. APS and TEP are creating their own transition plans, with their primary responsibility to their shareholders and not to the public. The ACC and the Legislature are not protecting public interests and public health, so it will be up to the Governor's Office. The first step is commissioning a comprehensive energy system study and transition plan--and there could be 2 or 3 consultants hired, like asking for a second opinion from doctors in an important case.
12/12/2023 13:40:55		Major Forest Restoration efforts Support WoodTech efforts to utilize small-diameter trees removed in forest restoration Support the use of sustainable construction material that is fire resistant
12/12/2023 14:13:15	85251	Definitely a priority to increase public EV charging stations so that people will feel they can buy all electric vehicles. 2nd and 3rd priorities would be conversion of public buses as well as government vehicles to electric and then subsidizing energy efficiency for homes.
12/12/2023 14:18:59	86004	Community choice aggragation
12/12/2023 14:39:56	85750	100% clean energy statewide, energy efficiency measures for homes, electric vehicle chargers and electric vehicle incentives, improved public transportation including light rail and expanded Amtrak

12/12/2023 15:15:40	86301	improved public transportation; vehicle emission restriction on diesel engines; vehicle emission testing on older vehicles; renewable energy sources for power generation; reduced harmful air emissions on current power generation facilities
12/12/2023 15:20:03		Forest Restoration Service Contracts We are one hot summer away from a catastrophic wildfire!
12/12/2023 15:58:04	85739	I'd like to see ANYTHING that helps us utilize clean energy, fight pollution, and develop sustainability. I'd LOVE there to be better public transit options that really work and get fewer cars off the road. I'd LOVE to have better incentives to put solar on homes. I put solar on my house immediately, but the power companies dis-incentivize it. I think that ALL new construction in AZ should rely on 100% solar for power needs, and that we should move all government buildings (like schools) to 100% solar as quickly as possible. I'd like to see parking lots with solar panels shading the parking -- to both keep our cars cooler and produce clean energy. (My 82 year old mother shops at Safeway at 7th St. & Glendale for this reason -- she likes them b/c they are producing solar.)
12/12/2023 17:42:56	85259	Hello Governor's Office of Resiliency and Coconino County, I'm Lyla Yango, and a sophomore at Desert Mountain High School in Scottsdale. I'm also a member of Arizona Youth Climate Coalition and Northern Arizona Climate Change Alliance. I am here today to urge you to support CCA in Arizona's state Climate Action plan. Community Choice Aggregation is a renewable energy model that gives local governments the authority to source and purchase electricity that their residents and businesses choose, while still relying on the existing utilities for distribution of power and infrastructure maintenance. In this way, CCAs provide consumer choice and protection, local job creation, and power resiliency! CCAs across the country have also significantly lowered electricity rates by increasing competition in the energy market, which are prevented under the current monopoly system for electric utilities. Nearly 10% of the US population is enrolled in a CCA and ratepayers are saving, on average 2 to 25% across the country. Perhaps the thing I like most about CCEs is that they secure sustainable natural resources because cities can choose a higher portion of renewable power and a more efficient energy supply if they want to. We must make the just transition from fossil fuel power to renewable power to combat the climate crisis and the detrimental effects stemming from an unstable climate. CCA will speed up the transition to renewable energy. Because of these benefits I am trying to meet with Scottsdale city council members and mayor Ortega about CCA to persuade them to join the 8 other AZ cities that support CCA, and I am meeting with state legislators to get their support for a CCA study bill. I hope you will support our vision of protected people and protected nature in Arizona by including Community Choice Aggregation in our state climate action plan. Thank you.

12/12/2023 23:48:00	85351	Building permits should not be permitted until the new builds can show they are using sufficient energy efficient techniques like thicker walls and other passive energy elements like reflective roofs and underground parking and parking lots with solar panels.Desert appropriate plantings need to be required rather than allowing for grass plantings and water intensive plants, and habitat features for wildlife should be encouraged esp. ensuring connected pathways and crossings when roads are built. Transportation: Instead of running large buses along routes have smaller ones with more frequency and develop on-demand services like UBER but run by professionals and similar to Dial a Ride but without the days in advance reservations since people need to have freedom to go when they want instead of having to plan in advance, esp. dealing with people who are older who won't know in advance if they will be "having a good day" or "a bad day" because of their conditions and when they feel good they may want to get their shopping in or take a fun trip, but they can't know days in advance and this would greatly help their independence. We also need safe sidewalks with more shade to encourage walking. We need to get back the reputation of being a healthy place to breathe like we used to have, so anything to reduce excessive vehicle use should be promoted. Car license and registration prices need to be increased esp. for gas hogs and every extra car per family and that $ could be used for transportation alternatives. More park and ride areas are needed in the West Valley. The Grand Ave. rail line should be a shared line with passenger cars running periodically. Tourists to downtown should be able to ride it to Wickenberg for a real Western experience and to benefit cities along the way. Developments need to be more mixed use so there can be places for people to live. Strip malls should have apts. above them to maximize the use of the development's footprint and it would make these nighttime wastelands safer by not having them deserted when stores close. Educate and require licensing for landscaping companies since they often ruin trees and plant inappropriate plants, doing damage throughout the state. They could be given discounts for having certified arborists, etc. as this would encourage professionalism and proper practices. Discourage use of leaf blowers that add to all that particulate matter. Curbside pickup of compostables should be instituted so our soil can be improved and material won't be burned.
12/13/2023 13:35:07	85032	-energy efficiency measures for existing homes -electric vehicle subsidies, chargers, incentives to get out of cars - transit and e-bikes ect. -improve building codes for new construction -more renewable energy - utilities need to get off coal
12/13/2023 18:20:26	86336	more electric vehicle charging stations, incentives for residential and commercial solar, including battery storage. Restrictions on diesel vehicles with eventual phase out.
12/14/2023 9:52:09	85392	Incentives and financing support for rooftop solar (interest rates are prohibitively high right now) Expanded EV charging State incentives for EV purchase (particularly for lower cost used vehicles)

12/14/2023 16:01:09	86001	Better public transportation options, including rail transport between Tucson, Phoenix and Flagstaff.
12/15/2023 13:29:03	85021	*better public transportation *support for electric vehicles *better insulation for homes and all buildings
12/15/2023 14:29:14	85201	Thank you for hosting the CAP session today thru ASU. Well designed, to the point, efficient and thoughtful! You had asked about reliable electricity in Tribal communities… it's still amazing and appalling that our Tribal communities are without power and water in 2023!! So that is definitely a priority. As far as urban areas are concerned, making significant progress in fighting the effects of climate change must also happen at the local level since local communities endure the biggest impacts, especially low income communities. We must start by changing our sources of electricity that power our homes and businesses. Today cities that are powered by investor-owned utilities like APS and TEP have no way to transition to renewable energy because they are stuck w/the energy mix imposed by these IOUs on residents and businesses, which is primarily fossil fuels. For cities that have their own climate action plans they cannot achieve their decarbonization goals under this current energy mix. For example, the city of Sedona participates in APS's Green Partners Program which provides wind power for the City's municipal operations. When asked if the Green Partners program could be extended to residents and businesses the answer was "we'll look into it." But nothing has happened to date. We need to find a way for cities to have the option of procuring and/or generating their own green electricity without having to form a municipal power which costs millions, sometimes billions of dollars and years to form. Community Choice Aggregation (CCA) is one proven solution that should be under consideration for the Air-izona CAP. The EPA has a great description of CCA - https://www.epa.gov/green-power-markets/community-choice-aggregation. Basically CCA, which is authorized in 10 states, allows cities, groups of cities and counties to buy electricity on behalf of the communities they serve, while maintaining a functional partnership with the local utility which continues to deliver the power, manage the grid, and bill customers. We would be happy to provide a briefing on CCA and bring in city leaders from some of these CCA-authorized states to provide "on the ground" case studies and answer questions. Definitely worth exploring.
12/15/2023 19:52:41	85044	electric vehicle chargers
12/16/2023 11:09:13	85281	All your suggestions are important. I support active transportation connectivity state-wide that is accessible for all ages and abilities.

12/16/2023 21:23:06	85716	The Clean AIRizona Plan should include promotion of state authorization for community choice energy (aka community choice aggregation -- CCE/CCA), which would reduce CO2 emitted by the electric sector in Arizona, by over 95% and reduce water consumption from power plants by over 80% within 9 years, while reducing bills for ratepayers, according to the statewide CCE modeling I have created and continually update. Additionally, the Plan should promote much more energy conscious and energy efficiency-promoting building code standards.
12/17/2023 14:18:38	85716	The Arizona climate action plan should include permission for cities and counties to form Community Choice Aggregation (CCA) departments or nonprofit organizations to supplement local buildout of locally-owned solar and wind generation. The monopoly market model is outdated and certainly not equitable. Rural communities have self-governed co-ops, while urban and suburban communities are stuck with government-assigned, government-imposed monopoly utilities. There is no competition to incentivize clean energy, lower rates, better investments, and better service. Our regulator, the ACC, is looking the other way and the monopolies are virtually unregulated. This is not how the monopoly model was intended to work, i.e. to provide the public with regulated, reliable, affordable energy that enhances their wellbeing. Instead, our current, corrupted, monopoly utilities are guaranteed generous profits despite bad investments and unhealthy and unnecessary GHG emissions. Let's begin with a Governor-sponsored study of the best way to engineer a transition to CCA and energy choice. Concurrently, or as part of the same study, we need scientifically-based recommendations re the most rapid and cost-effective way to boost the economy with locally-built and locally-owned renewable generation. There is no reason these exploratory studies can't be done immediately. Please act now. Thank you.
12/17/2023 16:43:54	86301	energy efficiency measures for homes, electric vehicle chargers, and better public transportation options, plus assistance to non-profits and houses of worship
12/17/2023 16:47:07	86301	Electrify Public Fleets, including bus fleets, Electrify Lawn & Garden Equipment, Adopt Green Energy Codes (both Residential and Commercial Buildings), Electrification of Municipal, Commercial, and Residential Buildings, and Energy Efficiency Upgrades for Municipal Operations
12/18/2023 7:35:19	85207	Better public transportation options and more options.
12/18/2023 10:53:17	86336	I'd like to see investment in : Clean mass transit for rural communities, regulation of tailpipe emissions from vehicles in Yavapai county while we transition to EVS, reuse of treated effluent water for greening communities to promote walking, biking, safe bike lanes/paths (perhaps raised), rail transit between easily connected communities such as Sedona and Cottonwood for commuter, Energy retrofits for all on a sliding scale.
12/18/2023 10:54:42	85258	energy efficiency measures for homes and community electric vehicle charging options on the freeways better public transportation options and bike lanes
12/19/2023 11:56:41	85013	Consistent enforcement of existing laws (no burn days, auto emissions, litter flying out of solid waste transfer vehicles). Better public transportation options, more convenient, more comfortable, safe; improved, safer biking and walking

		options.
12/27/2023 14:20:29	85282	#1: Energy efficiency measures for homes, #2: Electric vehicle chargers
12/28/2023 11:53:31	86303	-Adopt zero-waste goals as a cross-cutting climate solution that builds equity and local economic development opportunities -Acknowledge the importance of reducing waste and materials consumption to climate protection -Support local decentralized food rescue and composting -Help urban and rural farmers in producing and utilizing compost -Build an understanding of the connections of healthy soils to food system resilience -Fund and contract with existing independent reuse, recycling, and composting enterprises -Educate the public to reduce and conserve materials -Embrace a transition from single-use to durable products -Encourage reuse, repair, and repurpose projects -Commit to closing any trash incinerators and stemming the flow of materials to landfills -Promote reuse of building materials and reduce construction and demolition waste
12/29/2023 19:02:08	85284	Electric vehicle chargers
12/29/2023 19:38:01	85021	Community Choice Aggregation/Community Choice Energy Begin to regulate the selling of gas powered vehicles Expansion of public transportation such as the Valley Metro Rail
12/29/2023 21:39:40	86004	- More consistent public transportation (more widespread service and less time between buses/trams/what have you, so that public transportation actually makes sense for individuals) - More choice for consumers and communities in their utilities, rather than forced reliance on a single utility (community choice aggregate would be a great way to go about that) - Serious steps to curb Arizona's increasing reliance on natural gas (just dreaming)
12/30/2023 16:50:49	85750	Energy efficiency measures for homes and businesses, electric vehicle chargers and subsidies for vehicles, improved public transportation including bullet trains between major cities and light rail within cities, clean power grid with solar, wind, and nuclear, Community Choice Aggregation
12/31/2023 11:09:46	85248	better public transportation options
12/31/2023 15:29:38	85719	Community Choice Aggregation or a Public Power Utility. Continued support for all forms of public transport as well as bicycle infrastructure as well as infrastructure that encourages walkability.

1/5/2024 8:28:24	86004	My vision for a clean energy Arizona (and therefore a reduction in air pollution) includes more community resilience thanks to local or regional power grids incorporating renewable energy sources and battery storage. These "micro-grids" are being planned and built in California and New Mexico - furnishing much greater resiliency in the face of unplanned or emergency disruptions of the grid, making it much easier to incorporate diverse local renewable power sources. I know this requires action from our Corporation Commission and the legislature - but I think it is one of the most important steps we could take! It would free up communities to take broader advantage of the market, too - reducing the monopoly power that APS and SRP currently have. For a high-fire-risk region like Northern Arizona, this reduction in reliance on the current main transmission lines would be a huge improvement in resilience. Meanwhile, it would increase our benefits from the plentiful solar and wind power available in our state.
1/5/2024 16:29:27		Not burning plastics at dumps / transfer stations at the Bisbee / Douglas AZ
1/7/2024 13:35:53	85705	energy efficient measures for homes, more rainwater harvesting and tree cover to alleviate energy necessity pertaining to electric and water
1/7/2024 17:28:03	85750	Electrification and accessibility of public transportation
1/8/2024 9:51:12	86301	Community Choice Energy (CCE). Such a procurement model allows cities and counties to take control of their local energy supply. It can give local governments the authority to source and purchase electricity on behalf of their residents and businesses, while still relying on existing utility infrastructure for distribution, maintenance, and billing. By embracing CCE, cities and counties can provide residents with alternatives to monopoly utility offerings, achieve the cost savings that seeking long-term wholesale purchase power purchase agreements can bring, and with greener renewable energy options—including zero or reduced greenhouse gas emissions.
1/9/2024 8:26:05	86305	-plan for a complete phaseout of coal to be replaced by other less pollution forms of energy -accessible and affordable public transportation options and safer bike lanes
1/9/2024 17:10:55	85004	A training and education pipeline for new infrastructure jobs that includes industry recognized credential is VITAL for succesful Climate iniatives. EVSE, EVs, Solar Panels, among many other new technologies will require someone who can build, service, and maintain them. A successful implementation of those new technology iniatives will fail if they dont have a planned workforce pieline starting in k-12 education. 60% of all funding for this plan should go toward training and education for those to servicethem, business owners who will use them, and consumer awareness campaigns. This is why Legacy EV is at the forefront of building the EV & EVSE technician workforce here in Arizona and we'd love to help design this pipeline.

1/11/2024 12:15:00		RE-volv is a 501c3 nonprofit with a mission to empower people and communities to invest collectively in renewable energy. We envision a world where people are thriving in communities powered by clean energy. RE-volv helps nonprofit organizations in historically excluded communities across the country install solar and storage on their properties with $0 down through leases, loans, or power purchase agreements while engaging local community members to go solar and advocate for clean energy at home. Since 2011, we've developed solar and storage installations for 65 community-serving nonprofits in 17 states, helping each of them save a minimum of 15% on their electricity bills. RE-volv is actively establishing a presence in Arizona with several potential nonprofit projects in the state in our pipeline. We are submitting this form to express our support for more nonprofit solar initiatives to be included in the PCAP, and we are open to working with the state to support these efforts through any CPRG grant funding opportunities that may become available in the future.
1/13/2024 7:05:23	85712	More programs to support low and middle income families getting energy efficient appliances; interest rate buy downs; money for down payment on solar and batteries; matching funds for other donations; First Time Solar/Battery program like first time homebuyer programs; Community Choice Energy programs authorized; anti-idling requirements especially in cities; free technical support for homeowners on energy efficiency projects; tax credits (or direct payments) for water conservation projects; Energy/Water Consumer Navigators throughout state to help people make good decisions on prioritizing energy conservation projects; assistance and advice to companies to remove diesel trucks; better signage for EV charging locations on roads and highways; financial assistance for rural areas to install EV chargers; support local government conversion to EV fleets; remove state fund investment in banks which support fossil fuel projects; train HVAC contractors in "Heat Pump First" responses to customers; and fund community college training programs for EV mechanics, heat pump installers, wind turbine workers, solar/battery installers and energy efficiency analysts and installers.
1/18/2024 13:41:29	85249	Energy Efficiency Measures for homes Subsidies for E- vehicles charging stations Improve public transit and availability(times) Improvements on water usages and projects to use more reuses for water for landscaping Eliminate water waste Safety of non toxic chemicals for weeds and landscapes in AZ Incentivize farmers and local produce growers
1/31/2024 9:49:40	85742	Reuse and refill systems that reduce the use of single-use products. Curbside collection of food waste, such as a subscription-based or opt-in programs. Education and outreach programs that promote waste reduction and food loss prevention at home. Exclude carbon-producing waste-to-energy plants from the plan, such as combustion (with energy recovery), chemical recycling (pyrolysis and gasification) and refused-derived fuel for cement plants.
2/2/2024 17:21:15	85710	Community Choice Aggregation
2/14/2024 11:00:31	86511	proper disposal of lithium and gallium electronic devices and vehicles

Date of event	Your zip code	What would you like to see in the Clean AIRizona Plan?
12/11/2023	85004	EV Chargers on state highways are great. Thankful for National Electric Vehicle Infrastructure (NEVI)! However there is a gap in public chargers within cities/neighborhoods. As an apartment dweller, we desperately need more chargers accessible to communities, not just peole traveling long distances. Please include programs/incentives to help low-income homeowners install rooftop solar. Green uilding codes - electrification of new buildings Why are we builing new homes with gas infrastructure that will have to be retrofitted in 10, 20 years?
12/13/2023	85131	More wildlife friendly habitats along all new infrastructure. We need to include wildlife cooridors withn our urban infrastruture.
12/13/2023	85122	EVs aren't selling. Why take more? Your starting with your conclusion then working your way to your premise (greenhouse gases only 2020)
12/16/2023	85203	Re: building codes. I believe every NEW home and/or structure should have solar panels on the roof or nearby. Also, every new home & apartment dwelling should have EV automatically built in.
12/16/2023	85260	Forest management/trees/shade Public buildings & commercial/public fleets like school buses, postal delivery trucks More green building materials for roads and buildings
12/16/2023	85016	Infrastructure & implementation of composting to replace methane/heat/preserve water and engage individuals. All leaf & landscape equipment to electric. Incentives to scale renewables.
12/7/23	85379	Creative new transit projects that cover areas that are in need (don't have it now) for seniors and persons of low income. Open to inovate operators with experience.
12/7/23		We work very hard to be more energy afficient but still suffer from heat problems in our home. We need support, proffessional analysis to determine how to do better. Weather assistance I see as critical. Those most impacted by heat can't afford all of this. We need help to do our part -not just info.
12/7/23	83375	Afforestation, canopy cover, trees help in so many ways develop more public changing stations for electric vehicles purchase electric vehicles for use by state employees critical need for public transportation in west vally of Phoenix metro area improve recycling options boost green stormwater infrustructure.
10/24/23		Climate plan, budegtting, what's currently being done, how it can be improve, what kind of improvements specifically anyone is looking for, and overlap with industry

10/24/23		Looking for companies/organziations that want to have interactive displays at our Air Show in March. Focus audience is kids through high school
10/24/23		Connecting high school students with this particular project
10/24/23		Host events with CPLC - also have a space in San Luis and want to host there
10/24/23		Speak to Environmental Science class, juniors, about plan
10/24/23	Graham / 85552	Funding for public transport in rural communities, environmental studies presentations for middle/high school and college
10/24/23		Climate plan, classroom presentation about climat change and sustainability, workshop or activites for STEM night
10/24/23		For Clean AIRzona to attend our STEAM Fest 2/28th and have an interactive opportunity for our K-6th graders :)
10/24/23		to keep in touch with the program results and expose students to what is being worked on.
10/24/23		get more info for Yuma
10/24/23		giving a voice to students in the area
10/24/23	85602	If farmers keep being blamed, then food prices will continue to rise and go out of control. So lets all work together instead of blaming / shaming
10/24/23	85635	When using solar please allow local counties or state to use the energy.
10/24/23	85711	Lower emissions from Air Force Base in air all across Tucson. Plus noise levels all the time. How about a light rail to cut # of cars.
10/24/23	85364	More EV stations, incentives for efficient appliances

Appendix B: LIDAC Benefits Analysis Census Tract IDs and References

According to CEJST, the EPA approved tool for locating LIDAC communities, the state of Arizona contains 566 communities that qualify for the criteria. In the table below, there are some measures where implementations are expected to impact all LIDAC communities. This assumes that all communities have access to the measure, such as those that apply to state-wide application. The list of LIDAC Census Tract IDs are as follows, which are indicated by “All LIDACs” in the table:

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Priority Measure	LIDAC Census Tract IDs
Measure 1	All LIDAC Communities
Measure 2	All LIDAC Communities
Measure 3	4001942600, 4001942700, 4001944000, 4001944100, 4001944201, 4001944202, 4001944300, 4001944901, 4001944902, 4001945001, 4001945002, 4001945100, 4001970200, 4001970300, 4001970501, 4001970502, 4003000100, 4003000201, 4003000202, 4003000203, 4003000301, 4003000302, 4003000303, 4003000400, 4003000500, 4003000600, 4003000700, 4003000800, 4003000901, 4003000902, 4003001000, 4003001100, 4003001200, 4003001300, 4003002002, 4003002100, 4005001302, 4005001500, 4005001600, 4005001700, 4005002000, 4005002100, 4005002300, 4005942201, 4005942202, 4005944900, 4005945000, 4005945100, 4005945200, 4007000100, 4007000200, 4007000301, 4007000302, 4007000400, 4007000500, 4007000600, 4007000700, 4007000800, 4005001000 4007000900, 4007001000, 4007001100, 4007001200, 4007001300, 4007940200, 4005001500 4007940400, 4005001600 4009940500, 4009961100, 4005002000 4009961201, 4009961202, 4009961300, 4005002300 4009961400, 4009961500, 4005942202 4009961600, 4005944900 4009961700, 4005945000 4011960100, 4005945100 4011960200, 4005945200 4011960300, 4007000100 4012020100, 4007000200 4012020201, 4012020202, 4007000302 4012020501, 4007000400 4012020502, 4012020602, 4007000600 4012940200, 4007000700 4012940300, 4007000800 4012980000, 4007000900 4013010101, 4007001000 401340502, 4007001100 4013040515, 4013040516, 4007001300 4013040517, 4007940200 4013040518, 4007940400 4013040519, 4009940500 4013040520, 4013050603, 4013050604, 4013050605, 4013050606, 4013050607, 4009961500 4013050608, 4013050609, 4013050610, 4013050611, 4013050701, 4013050702, 4012020100 4013061009, 4012020201 4013061010, 4012020202 4013061011, 4012020501 4013061012, 4012020502 4013061014, 4012020602 4013061015, 4013061016, 4012940300 4013061017, 4013061018, 4013061019, 4013061020, 4013061021, 4013061022, 4013061023, 4013061024, 4013061044, 4013061045, 4013061046, 4013061047, 4013061100, 4013061200, 4013061300, 4013061401, 4013061402, 4013082012, 4013082017, 4013082019, 4013082020, 4013082021, 4013082022, 4013082023, 4013040527 4013082025, 4013082026, 4013082207, 4013082209, 4013040531 4013082211, 4013050603 4013116733, 4013050604 4013723303, 4013723304, 4013723305, 4013723306, 4013723307, 4013050609 4013723308, 4013940700, 4013941000, 4013941100, 4013050702 4013941200, 4013060801 4013980100, 4013980500, 4013980600, 4013060902 4013980700, 4013060903 4015940400, 4015940501, 4015950100, 4015950401, 4015950402, 4015950500, 4015950600, 4015950703, 4015950704, 4015950705, 4015950706, 4015951401, 4015951402, 4015951501, 4015951502, 4015951601, 4015951602, 4013061024 4015951700, 4015951800, 4013061026 4015951900, 4015952001, 4015952002, 4015952003, 4015952004, 4015953601, 4015953602, 4015953800, 4015953900, 4015954800, 4015954900, 4015955000, 4017940008, 4017940010, 4017940011, 4017940012, 4013061042 4017940013, 4017940014, 4017940015, 4017940100, 4017940301, 4017940302, 4017942300, 4013061200 4017942400, 4013061300 4017942500, 4013061401 4017960100, 4013061402 4017960200, 4017960400, 4017960500, 4017960600, 4017961300, 4017961700, 4017962500, 4017963300, 4017963400, 4017963700, 4017963800, 4017964201, 4017964202, 4017964800, 4013071600 4017964900, 4017965200,

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Measure 4	All LIDAC Communities
Measure 5	All LIDAC Communities
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Measure 7	All LIDAC Communities
Measure 8	All LIDAC Communities
Measure 9	All LIDAC Communities
Measure 10	4001942600, 4001942700, 4001944000, 4001944100, 4001944201, 4001944202, 4001944300, 4001944901, 4001944902, 4001945001, 4001945002, 4001945100, 4001970501, 4003000100, 4003000201, 4003000202, 4003000203, 4003000301, 4003000303, 4003000500, 4003000600, 4003000700, 4003000800, 4003000901, 4003000902, 4003001000, 4003001100, 4003001200, 4003001300, 4005001700, 4005002000, 4005002100, 4005942201, 4005942202, 4005944900, 4005945000, 4005945100, 4005945200, 4007000200, 4007000301, 4007000302, 4007000400, 4007000500, 4007000600, 4007000700, 4007000800, 4007000900, 4007001000, 4007001100, 4007001200, 4007001300, 4007940200, 4007940400, 4009940500, 4009961100, 4009961300, 4009961700, 4011960100, 4011960300, 4012020100, 4012020201, 4012020501, 4012020502, 4012020602, 4012940200, 4012940300, 4013040515, 4013040517, 4013050603, 4013050607, 4013050701, 4013050702, 4013061046, 4013061200, 4013061300, 4013061401, 4013061402, 4013082012, 4013082017, 4013082207, 4013082209, 4013723305, 4013723306, 4013940700, 4013941000, 4013941100, 4013941200, 4015940400, 4015940501, 4015950100, 4015950401, 4015950402, 4015950500, 4015950600, 4015950703, 4015950705, 4015950706, 4015951401, 4015951501, 4015951601, 4015951602, 4015951700, 4015951800, 4015952001, 4015952003, 4015952004, 4015953602, 4015953800, 4015954800, 4015955000, 4017940008, 4017940010, 4017940011, 4017940012, 4017940013, 4017940014, 4017940015, 4017940100, 4017940301, 4017940302, 4017942300, 4017942400, 4017942500, 4017960200, 4017960400, 4017960500, 4017960600, 4017961300, 4017963300, 4017963400, 4017963700, 4017963800, 4017964201, 4017964202, 4017964800, 4017965300, 4019004313, 4019004316, 4019004317, 4019004419, 4019004424, 4019004425, 4019940600, 4019940700, 4019940800, 4021000400, 4021000700, 4021000803, 4021000901, 4021000902, 4021001000, 4021001100, 4021001200, 4021001703, 4021001900, 4021002001, 4021002002, 4021002003, 4021002101, 4021002102, 4021002200, 4021002400, 4021941200, 4021941300, 4021941400, 4023966103, 4023966104, 4023966105, 4023966200, 4023966301, 4023966302, 4023966401, 4023966402, 4025000204, 4025000700, 4025001401, 4025001402, 4025001500, 4025001601, 4025001602, 4025001603, 4025002001, 4025002002, 4025002003, 4025002100, 4027010914, 4027011201, 4027011202, 4027011403, 4027011405, 4027011406, 4027011501, 4027011503, 4027011504, 4027011600, 4027011800, 4027980005
Measure 11	All LIDAC Communities
Measure 12	All LIDAC Communities

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[1] RUCA Codes corresponding to 2 through 10 are rural by definition. Codes 1 through 3 are classified as Metropolitan. https://www.hrsa.gov/sites/default/files/hrsa/rural-health/resources/forhp-eligible-areas.pdf
[2] "Energy Burdened" in this case are those communities who are above the 70th percentile in terms of energy burden, according to CEJST.
[3]https://www.aztechcouncil.org/15000-native-american-families-live-without-electricity-how-can-solar-power-help

Appendix C: State of Arizona Trends in Greenhouse Gas Emissions and Sinks by IPCC Sector

GHG emissions for calendar year 2000, 2005, and 2020 were adapted from the previous EPA statewide GHG emissions inventories of Arizona.[i] The GHG inventory data presented for calendar year 2021 were developed as part of this study. GHG inventory data and methods for the 2021 inventory are presented in Appendix G; detailed results are presented in Appendix H; and a quality assurance review is presented in Appendix I.

Table 1. State of Arizona Trends in Greenhouse Gas Emissions and Sinks by IPCC Sector (thousand MT CO_2e)

Sector	2000	2005		2020	2021
Energy	**90,142.5**	**101,269.8**		**82,223.8**	**88,834.9**
Fossil Fuel Combustion	86,554.0	97,954.5		79,488.8	87,055.8
Natural Gas Systems	1,634.9	1,463.1		1,454.4	1,012.7
Non-Energy Use of Fuels	303.2	267.0		322.1	IE
Petroleum Systems	1.7	1.5		0.5	IE
Coal Mining	103.8	95.6		NO	NO
Stationary Combustion	605.1	706.4		499.1	205.2
Mobile Combustion	938.3	780.2		457.5	561.3
Incineration of Waste	NO	NO		NO	NO
Abandoned Oil and Gas Wells	1.5	1.4		1.3	NE
Abandoned Underground Coal Mines	NO	NO		NO	NO
Industrial Processes and Product Use	**3,649.1**	**3,699.0**		**5,138.3**	**5,271.1**
Substitution of Ozone Depleting Substances	920.9	1,334.3		2,101.7	2,167.3
Iron and Steel Production & Metallurgical Coke Production	158.3	73.5		25.7	58.9
Cement Production	568.2	677.4		1,256.6	1,257.5
Petrochemical Production	NO	NO		NO	NO
Ammonia Production	NO	NO		NO	NO
Lime Production	277.2	320.7		402.8	440.5
Nitric Acid Production	263.0	223.4		365.4	297.8
Other Process Uses of Carbonates	53.9	69.2		75.5	35.9
Urea Consumption for Non-Agricultural Purposes	76.2	71.2		124.5	108.2
Adipic Acid Production	NO	NO		NO	NO
Carbon Dioxide Consumption	26.6	26.8		106.4	108.2
Electronics Industry	971.9	613.2		526.9	642.3
Electrical Equipment	256.7	215.1		71.9	72.4
N_2O from Product Uses	75.2	73.1		80.3	81.3
Fluorochemical Production	NO	NO		NO	NO
Aluminum Production	NO	NO		NO	NO
Soda Ash Production	NO	NO		NO	NO
Ferroalloy Production	NO	NO		NO	NO
Titanium Dioxide Production	NO	NO		NO	NO

Caprolactam, Glyoxal, and Glyoxylic Acid Production	NO	NO	NO	NO
Glass Production	NO	NO	NO	NO
Zinc Production	NO	NO	NO	NO
Magnesium Production	NO	NO	NO	NO
Phosphoric Acid Production	NO	NO	NO	NO
Lead Production	NO	NO	NO	NO
Carbide Production and Consumption	1.1	1.1	0.6	0.7
Agriculture	**7,169.9**	**7,804.8**	**7,322.9**	**7,533.8**
Agricultural Soil Management[1,2]	4,225.9	4,403.3	3,794.7	4,016.0
Enteric Fermentation	1,846.8	2,125.8	2,388.8	2,380.0
Manure Management	1,079.9	1,257.9	1,124.6	1,127.6
Rice Cultivation	NO	NO	NO	NO
Urea Fertilization	9.9	10.7	9.5	10.2
Liming	NO	NO	NO	NO
Field Burning of Agricultural Residues[1,2]	7.5	7.2	5.4	NE
Waste	**4,260.0**	**4,353.0**	**2,333.4**	**2,288.5**
Landfills	3,604.1	3,643.0	1,566.5	1,518.4
Wastewater Treatment	633.8	677.2	765.4	770.1
Composting	21.9	32.6	0.9	NE
Anaerobic Digestion at Biogas Facilities	0.2	0.2	0.6	NE
Total Emissions (Sources)[a]	**105,221.5**	**117,126.6**	**97,018.4**	**103,928.3**
Land Use, Land-Use Change, and Forestry	**2,527.0**	**2,698.5**	**3,511.2**	**3,881.6**
Forest land[2]	1,475.5	1,503.8	2,290.3	2,247.3
Cropland[1]	31.7	136.3	96.2	85.4
Grassland[1]	1,091.3	1,110.4	1,291.3	1,715.3
Wetlands[1,2,3]	546.5	544.9	537.9	537.5
Settlements	(617.8)	(596.9)	(704.6)	(703.8)
Net Emission (Sources and Sinks)[b]	**107,748.6**	**119,825.0**	**100,529.6**	**107,809.9**

Notes: LULUCF source and sink categories are not allocated to economic sectors. Total emissions presented without LULUCF. Total net emissions presented with LULUCF. The LULUCF Sector Net Total is the net sum of all CH_4 and N_2O emissions to the atmosphere plus net carbon stock changes. Totals may not sum due to independent rounding. Parentheses indicate negative values or sequestration. EPA is using 100-year Global Warming Potentials (GWP) from IPCC's Fifth Assessment Report, as required in reporting annual inventories to the UNFCCC. Changes in carbon stocks from Croplands, Grasslands, Wetlands and Settlements in Alaska are currently not estimated in the LULUCF Sector Net Total, with the exception of Flooded Lands. Changes in carbon stocks from Forest Land and Wetlands in Hawaii are currently not estimated in the LULUCF Sector Net Total, with the exception of Flooded Lands. DC is currently included only for Coastal Wetlands, Peatlands, Landfilled Yard Trimmings and Food Scraps, and Settlement Trees. Puerto Rico is also included for Flooded Lands.

NO = Not occurring.

Symbol "-" indicates value not estimated at this time or are not applicable to the State.

"+" Does not exceed 0.005 MMT CO_2 Eq.

[1] Alaska: For Agricultural Soil Management, estimates for Alaska include only N_2O emissions from managed manure and PRP N, and biosolid additions. Emissions from Field Burning of Agriculture Residues are currently not estimated.

[2] Hawaii: For Agricultural Soil Management, estimates for Hawaii only include N_2O emissions from managed manure and PRP N, biosolid additions, crop residues, and drained organic soils. Field Burning of Agriculture Residues are currently not estimated.

[i] EPA. 2023. Methodology Report: Inventory of U.S. Greenhouse Gas Emissions and Sinks by State: 1990–2021. U.S. Environmental Protection Agency, EPA-430-R-23-003. https://www.epa.gov/ghgemissions/state-ghg-emissionsand-removals

Appendix D: Detailed GHG Emissions by Emitting Activity

Detailed GHG inventory data by emitting activity and sector are provided in the tables below.

Table 1. Detailed GHG Emissions Inventory Data by Emitting Activity and Sector

GHG Emissions Sector	GHG Emissions (thousand MT CO_2e)							
	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	NF_3	Total
Stationary Combustion	**10,316**	**105**	**147**	**NO**	**NO**	**NO**	**NO**	**10,568**
Direct Emissions	*10,316*	*105*	*147*	*NO*	*NO*	*NO*	*NO*	*10,568*
Indirect Emissions	*31,268*	*55.54*	*70.76*	*NO*	*NO*	*NO*	*NO*	*31,394*
Direct Emissions + Indirect Emissions	*41,584*	*160*	*218*	*NO*	*NO*	*NO*	*NO*	*41,962*
Residential								
Direct Emissions + Indirect Emissions	*16,811*	*25.94*	*33.27*	*NO*	*NO*	*NO*	*NO*	*16,870*
Direct Emissions	*2,515*	*0.55*	*0.92*	*NO*	*NO*	*NO*	*NO*	*2,517*
Natural Gas	2,194	0.12	0.11	NO	NO	NO	NO	2,194
Propane	321	0.43	0.81	NO	NO	NO	NO	322
Kerosene	0.08	0.00	0.00	NO	NO	NO	NO	0.08
Lubricants	NO	NO	NO	NO	NO	NO	NO	NO
Special Naphthas	NO	NO	NO	NO	NO	NO	NO	NO
Motor Gasoline	NO	NO	NO	NO	NO	NO	NO	NO
Asphalt	NO	NO	NO	NO	NO	NO	NO	NO
Diesel	0.74	0.00	0.00	NO	NO	NO	NO	0.74
Coal	NO	NO	NO	NO	NO	NO	NO	NO
Indirect Emissions	*14,296*	*25.39*	*32.35*	*NO*	*NO*	*NO*	*NO*	*14,354*
Electricity Consumption	13,809	24.53	31.25	NO	NO	NO	NO	13,865
Transmission & Distribution Loss	487	0.86	1.10	NO	NO	NO	NO	489
Purchased Heat	NE	NE	NE	NO	NO	NO	NO	NE
Purchased Chilled Water	NE	NE	NE	NO	NO	NO	NO	NE
Commercial								
Direct Emissions + Indirect Emissions	*14,669*	*22.16*	*29.16*	*NO*	*NO*	*NO*	*NO*	*14,720*

GHG Emissions Sector	GHG Emissions (thousand MT CO_2e)							
	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	NF_3	Total
Direct Emissions	*3,122*	*1.65*	*3.03*	*NO*	*NO*	*NO*	*NO*	*3,127*
Natural Gas	1,833	0.10	0.09	NO	NO	NO	NO	1,833
Propane	227	0.30	0.57	NO	NO	NO	NO	228
Kerosene	0.08	0.00	0.00	NO	NO	NO	NO	0.08
Lubricants	NO	NO	NO	NO	NO	NO	NO	NO
Special Naphthas	NO	NO	NO	NO	NO	NO	NO	NO
Motor Gasoline	665	0.80	1.51	NO	NO	NO	NO	667
Asphalt	0.00	NO	NO	NO	NO	NO	NO	NO
Diesel	397	0.45	0.85	NO	NO	NO	NO	398
Coal	NO	NO	NO	NO	NO	NO	NO	NO
Indirect Emissions	*11,547*	*20.51*	*26.13*	*NO*	*NO*	*NO*	*NO*	*11,594*
Electricity Consumption	11,154	19.81	25.24	NO	NO	NO	NO	11,199
Transmission & Distribution Loss	393	0.70	0.89	NO	NO	NO	NO	395
Purchased Heat	NE	NE	NE	NO	NO	NO	NO	NE
Purchased Chilled Water	NE	NE	NE	NO	NO	NO	NO	NE
Industrial								
Direct Emissions + Indirect Emissions	*10,104*	*112*	*155*	*NO*	*NO*	*NO*	*NO*	*10,371*
Direct Emissions	*4,679*	*103*	*143*	*NO*	*NO*	*NO*	*NO*	*4,925*
Natural Gas	1,098	0.06	0.05	NO	NO	NO	NO	1,098
Propane	78.96	0.11	0.20	NO	NO	NO	NO	79.27
Kerosene	NO	NO	NO	NO	NO	NO	NO	NO
Lubricants	113	0.13	0.24	NO	NO	NO	NO	113
Special Naphthas	33.56	0.04	0.07	NO	NO	NO	NO	33.68
Motor Gasoline	624	0.75	1.41	NO	NO	NO	NO	626
Asphalt	NO	NO	NO	NO	NO	NO	NO	NO
Diesel	2,149	2.44	4.62	NO	NO	NO	NO	2,156
Coal	583	99.16	137	NO	NO	NO	NO	818
Indirect Emissions	*5,425*	*9.64*	*12.28*	*NO*	*NO*	*NO*	*NO*	*5,447*
Electricity Consumption	5,240	9.31	11.86	NO	NO	NO	NO	5,261

GHG Emissions Sector	GHG Emissions (thousand MT CO_2e)							
	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	NF_3	Total
Transmission & Distribution Loss	185	0.33	0.42	NO	NO	NO	NO	185
Purchased Heat	NE	NE	NE	NO	NO	NO	NO	NE
Purchased Chilled Water	NE	NE	NE	NO	NO	NO	NO	NE
Electricity Generation								
EIA Form EIA-923 (used in inventory)	***34,667***	***58.41***	***77.94***	**NO**	**NO**	**NO**	**NO**	***34,804***
EPA GHGRP Subpart D (informational item)	*34,460*	*60.55*	*79.16*	NO	NO	NO	NO	*34,600*
EPA eGRID (informational item)	*35,672*	*58.52*	*76.59*	NO	NO	NO	NO	*35,807*
Waste	**0.00**	**1,830**	**458**	**NO**	**NO**	**NO**	**NO**	**2,289**
Subpart HH - Municipal Solid Waste	*0.00*	*1,414*	*0.00*	NO	NO	NO	NO	*1,414*
Subpart TT - Industrial Waste Landfills	*0.00*	*104*	*0.00*	NO	NO	NO	NO	*104*
Wastewater	*0.00*	*312*	*458*	NO	NO	NO	NO	*770*
Industrial Processes	**2,774**	**249**	**434**	**79.41**	**329**	**171**	**80.32**	**4,116**
Subpart C - General Stationary Fuel Combustion Sources	*IE*	*IE*	*IE*	*NO*	*NO*	*NO*	*NO*	*0.00*
Subpart DD - Use of Electric Transmission and Distribution Equipment	*NO*	*NO*	*NO*	*NO*	*NO*	*72.44*	*NO*	*72.44*
Subpart H - Cement Production	*1,257*	*NO*	*NO*	*NO*	*NO*	*NO*	*NO*	*1,257*
Subpart I - Electronics Manufacturing	*NO*	*NO*	*54.89*	*79.41*	*329*	*98.26*	*80.32*	*642*
Subpart Q - Iron and Steel Production	*58.86*	*NO*	*NO*	*NO*	*NO*	*NO*	*NO*	*58.86*
Subpart S - Lime Manufacturing	*441*	*NO*	*NO*	*NO*	*NO*	*NO*	*NO*	*441*
Subpart V - Nitric Acid Production	*0.00*	*NO*	*298*	*NO*	*NO*	*NO*	*NO*	*298*
Subpart W + C - Petroleum and Natural Gas Systems	*764*	*249*	*0.38*	*NO*	*NO*	*NO*	*NO*	*1,013*
Urea Consumption for Non-Agricultural Purposes	*108*	*NO*	*NO*	*NO*	*NO*	*NO*	*NO*	*108*
Carbon Dioxide Consumption	*108*	*NO*	*NO*	*NO*	*NO*	*NO*	*NO*	*108*
N2O from Product Uses	*0.00*	*NO*	*81.33*	*NO*	*NO*	*NO*	*NO*	*81.33*
Other Process Uses of Carbonates	*35.85*	*NO*	*NO*	*NO*	*NO*	*NO*	*NO*	*35.85*
Carbide Production and Consumption	*0.73*	*NO*	*NO*	*NO*	*NO*	*NO*	*NO*	*0.73*
Mobile Combustion	**42,072**	**41.89**	**336**	**NO**	**NO**	**NO**	**NO**	**42,450**
Gasoline Highway	***21,988***	***17.12***	***112***	***NO***	***NO***	***NO***	***NO***	***22,118***
Passenger Cars	*15,289*	*11.16*	*77.95*	*NO*	*NO*	*NO*	*NO*	*15,378*
Light-Duty Trucks	*6,309*	*4.84*	*30.15*	*NO*	*NO*	*NO*	*NO*	*6,344*

GHG Emissions Sector	GHG Emissions (thousand MT CO_2e)							
	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	NF_3	Total
Heavy-Duty Vehicles	*321*	*0.85*	*3.88*	*NO*	*NO*	*NO*	*NO*	*326*
Motorcycles	*69.39*	*0.27*	*0.26*	*NO*	*NO*	*NO*	*NO*	*69.91*
Diesel Highway	***11,584***	***2.62***	***80.11***	***NO***	***NO***	***NO***	***NO***	***11,667***
Passenger Cars	*93.83*	*0.25*	*1.52*	*NO*	*NO*	*NO*	*NO*	*95.60*
Light-Duty Trucks	*257*	*0.47*	*3.31*	*NO*	*NO*	*NO*	*NO*	*261*
Heavy-Duty Vehicles	*10,733*	*1.79*	*69.58*	*NO*	*NO*	*NO*	*NO*	*10,804*
Heavy-Duty Buses	*500*	*0.11*	*5.71*	*NO*	*NO*	*NO*	*NO*	*506*
Non-Highway	***8,463***	***20.51***	***144***	***NO***	***NO***	***NO***	***NO***	***8,627***
Aviation	*5,259*	*1.39*	*42.61*	*NO*	*NO*	*NO*	*NO*	*5,303*
Boats	*170*	*2.54*	*0.40*	*NO*	*NO*	*NO*	*NO*	*173*
Locomotives	*92.75*	*0.23*	*0.69*	*NO*	*NO*	*NO*	*NO*	*93.66*
Other	*2,940*	*16.35*	*100*	***NO***	***NO***	***NO***	***NO***	*3,057*
Alternative Fuel Vehicles	***37.47***	***1.64***	***0.15***	*NO*	*NO*	*NO*	*NO*	***39.25***
Light Duty Vehicles	*0.61*	*0.02*	*0.03*	*NO*	*NO*	*NO*	*NO*	*0.65*
Heavy Duty Vehicles	*6.22*	*0.12*	*0.03*	*NO*	*NO*	*NO*	*NO*	*6.37*
Buses	*30.63*	*1.51*	*0.09*	*NO*	*NO*	*NO*	*NO*	*32.23*
Substitution of Ozone Depleting Substances (Refrigerant Recharge)	**NO**	**NO**	**NO**	**2,167**	**NE**	**NO**	**NO**	*2,167*
Commercial	*NO*	*NO*	*NO*	741	*NE*	*NO*	*NO*	*741*
Industrial	*NO*	*NO*	*NO*	514	*NE*	*NO*	*NO*	*514*
Residential	*NO*	*NO*	*NO*	520	*NE*	*NO*	*NO*	*520*
Transportation	*NO*	*NO*	*NO*	392	*NE*	*NO*	*NO*	*392*
Agriculture	**NO**	**3,181**	**4,353**	**NO**	**NO**	**NO**	**NO**	**7,534**
Fertilizer Use	*NO*	*NO*	*4,026*	*NO*	*NO*	*NO*	*NO*	*4,026*
N2O From Agricultural Soil Management	NO	NO	4,016	NO	NO	NO	NO	4,016
Urea Fertilization	NO	NO	10	NO	NO	NO	NO	10
Livestock	*NO*	*3,181*	*327*	*NO*	*NO*	*NO*	*NO*	*3,508*
Enteric Fermentation	NO	2,380	0	NO	NO	NO	NO	2,380
Manure Management	NO	801	327	NO	NO	NO	NO	1,128
Forestry & Wildfire (Informational, Not Included in Total)	**3,872**	**373**	**0**	**NO**	**NO**	**NO**	**NO**	**4,245**

GHG Emissions Sector	GHG Emissions (thousand MT CO_2e)							
	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	NF_3	Total
Forest Wildfires	*3,822*	*368*	*0*	*NO*	*NO*	*NO*	*NO*	*4,190*
Prescribed Burns	*50*	*5*	*0*	*NO*	*NO*	*NO*	*NO*	*55*

Table 2. GHG Inventory Emissions Data Summarized by Sector

GHG Inventory Emissions Sector	GHG Emissions (thousand MT CO_2e)							
	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	NF_3	Total
Transportation	42,072	41.89	336	392	–	–	–	42,843
Electricity Generation	34,667	58.41	77.94	–	–	–	–	34,804
Natural and working lands[1]	3,872	373	–	–	–	–	–	3,882
Industry	7,452	351	577	593	329	171	80.32	9,555
Agriculture	–	3,181	4,353	–	–	–	–	7,534
Commercial and residential buildings	5,637	2.19	3.95	1,261	–	–	–	6,905
Waste and materials management	–	1,518	–	–	–	–	–	1,518
Wastewater	–	312	458	–	–	–	–	770
Total	**93,701**	**5,838**	**5,807**	**2,247**	**329**	**171**	**80.32**	**107,810**

Appendix F – Detailed Methods and Data Sources for the *Arizona PCAP GHG Inventory*

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1 Overview of GHG Emissions Inventory Data and Methods

This appendix to *The Clean Arizona Plan* details methods and data for estimating statewide GHG emissions for the *Arizona Preliminary Climate Action Plan (PCAP) GHG Inventory.* Hereafter, this GHG inventory will be referred to as the *Arizona PCAP GHG Inventory.*

1.1 Inventory Approach

The *Arizona PCAP GHG Inventory* estimates statewide and county-level GHG emissions by emitting activity. Below is the general approach taken for estimating Arizona's GHG emissions.

1. Source data were obtained from multiple sources on the level or intensity of an emitting activity in the state.
2. GHG emissions were estimated at the state-level from data on emitting activities using standard GHG emissions calculations and emissions factors.
3. Statewide GHG emissions from an emitting activity were then compared to a QC dataset. For the *Arizona PCAP GHG Inventory,* the EPA SIT[1] was the default dataset compared to as a standard.
4. Statewide GHG emissions for an emitting activity were downscaled to the county-level. County-level GHG emissions estimation approaches varied depending on the type and structure of the data utilized for the statewide estimate.
    - GHG emissions reported at the facility-level were aggregated to the county-level rather than the state-level.
    - GHG emissions estimate at the state-level were downscaled to the county-level used relevant indicators. For example, NREL SLOPE county-level estimates of electricity and natural gas combustion or county-level population.
    - GHG emissions estimated from national-level data and downscaled to the state-level using population as an indicator utilized county population data to downscale further from the state-level to the county-level.
5. Finally, county-level GHG emissions estimates were compared to independent estimates of county GHG emissions.

The following sections in Appendix G provide a detailed list of data and methods used for each GHG emissions sector inventoried. All data and methods are cited when they are mentioned so each section can serve as a standalone reference for estimating statewide and county-level GHG emissions.

The data and methods outlined in Appendix G will undergo review during the CCAP Phase. All adjustments to source data and methods made for the *Arizona CCAP GHG Inventory* will be documented in a corrigenda document. The corrigenda will be published as part of the *Arizona CCAP GHG Inventory.*

[1] EPA (2024). State Inventory and Projection Tool. URL: https://www.epa.gov/statelocalenergy/download-state-inventory-and-projection-tool

2 Transportation (Mobile Combustion)

GHG emissions from transportation activities (or mobile combustion) are categorized broadly into on-road vehicles, non-road equipment and vehicles, aviation, locomotives, and boats. All relevant fuel types were inventoried by transportation mode. As transportation activities are the largest source of GHG emissions in Arizona, the data and methods for calculating these emissions will be revisited and refined where necessary during the CCAP phase of the GHG inventory.

2.1.1 Data

Several federal and state data sources were identified for inclusion in the *Arizona PCAP GHG Inventory.* Federal data sources included the EPA National Emissions Inventory[2], EIA SEDS[3], and multiple datasets available from the Department of Transportation (DOT).[4,5,6] Statewide data sources included the Arizona Department of Transportation (ADOT) Gasoline and Diesel Gallonage dataset and ADOT submissions to the DOT Highway Performance Monitoring System.[7,8,9]

2.1.2 Statewide GHG Emissions Estimation Method

GHG emissions obtained from the NEI for calendar year 2020 were compared to EPA SIT[10] results from 2021. However, after comparison, the decision was made to incorporate GHG emissions estimated by the EPA SIT using vehicle miles traveled (VMT).

EPA SIT estimates mobile combustion GHG emissions using two approaches: a VMT approach and a fuel sales/consumption-based approach. The VMT approach was used as the basis for comparison due to the limitations that fuel sales approaches have for estimating GHG emissions. For example, while a fuel sales approach will capture all emissions from fuel dispensed within a state, it will undercount GHG emissions from

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[2] EPA (2024). Online 2020 NEI Data Retrieval Tool. URL: https://awsedap.epa.gov/public/single/?appid=20230c40-026d-494e-903f-3f112761a208&sheet=5d3fdda7-14bc-4284-a9bb-cfd856b9348d&opt=ctxmenu,currsel

[3] EIA SEDS (2024). Table F35. Total Energy Consumption, Price and Expenditure Estimates, 2021. URL: https://www.eia.gov/state/seds/data.php?incfile=/state/seds/sep_fuel/html/fuel_te.html&sid=US&sid=AZ.

[4] Department of Transportation. Highway Statistics Series. Highway Statistics 2021. Annual Vehicle Distance Traveled in Miles and Related Data by Highway Category and Vehicle Type – 2021. URL: https://www.fhwa.dot.gov/policyinformation/statistics/2021/vm1.cfm#foot1

[5] Department of Transportation. Highway Statistics Series. Highway Statistics 2021. Functional System Travel Annual Vehicle-Miles – 2021. URL: https://www.fhwa.dot.gov/policyinformation/statistics/2021/vm2.cfm#foot1

[6] Department of Transportation. National Transit Database. 2021 Fuel and Energy. URL: https://www.transit.dot.gov/ntd/ntd-data?field_product_type_target_id=All&year=all&combine=fuel

[7] Arizona Department of Transportation (2024). Fuel Gallonage by County Since Fiscal Year 2000. URL: https://azdot.gov/about/financial-management-services/transportation-funding/vehicle-license-tax-and-fuel-gallonage

[8] ADOT Highway Performance Monitoring System (HPMS) 2020 Data. URL: https://azgeo-open-data-agic.hub.arcgis.com/maps/84fa258305c94aa99a428e1f09dc529a/about

[9] 2021 ADOT Highway Performance Monitoring System (HPMS) Data. URL: https://azgeo-open-data-agic.hub.arcgis.com/maps/d2afcd06d1e4471a86af6c775b807cf1/about

[10] EPA (2024). State Inventory and Projection Tool. URL: https://www.epa.gov/statelocalenergy/download-state-inventory-and-projection-tool

inbound transboundary and pass through trips. This is a methodological shortcoming given the prominence of transboundary freight trips that travel Arizona's interstate corridors. A VMT-based approach should capture emissions from all on-road activity in Arizona.[11] To ensure methodological consistency, EPA SIT was also used to estimate GHG emissions from non-road equipment and vehicles rather than the EPA NEI, including aviation, locomotives, and boats. On-road and non-road GHG emissions estimation models will be revisited during the *Arizona CCAP GHG Inventory.*

The *Arizona PCAP GHG Inventory* utilizes a fuel sales approach for aviation emissions, which is methodologically similar to the EPA SIT. The EPA NEI utilizes the FAA Aviation Environmental Design Tool (AEDT) to estimate GHG emissions.[12] The AEDT estimates emissions from ground support equipment in addition to flights. EPA NEI aviation GHG emissions estimates were not used for the *Arizona PCAP GHG Inventory* because they are based on calendar year 2020 activity. Airport activity was significantly lower in 2020 compared to 2019 and 2021 due to the COVID-19 pandemic. For example, Phoenix Sky Harbor Airport, the busiest in Arizona, saw a 29% decrease in landing and takeoff operations (LTOs) between 2019 and 2020 and 31% increase in LTOs between 2020 and 2021.[13] It was decided that the calendar year 2020 used by the EPA NEI is not a representative year that can serve as the basis for estimating calendar year 2021 GHG emissions.

A notable difference exists between the fuel sales approach and GHG emissions estimates from the AEDT, and thus the EPA NEI. The fuel sales approach attributes all GHG emissions from Jet Fuel and Aviation Gasoline dispensed to an aircraft to the airport at which it was dispensed. However, the AEDT only attributes GHG emissions from landing and takeoff operations (LTOs) to an airport. The LTO-based approach employed by the AEDT is in line with IPCC methods.[14] The fuel sales approach was utilized for the *Arizona PCAP GHG Inventory* due to time constraints and the AEDT will be used for the *Arizona CCAP GHG Inventory*.

2.1.3 County-Level Downscaling Method

County-level VMT estimates were used an indicator for downscaling statewide emissions at the county-scale. County-level VMT estimates were derived from average annual daily trip (AADT) and road segment length data derived from ADOT Highway Performance Monitoring System (HPMS) 2020 Data.[15] ADOT HPMS data from 2020 were the most relevant data for downscaling. While 2021 ADOT Highway Performance Monitoring

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[11] Greenhouse Protocol for Cities. P. 77, Figure 7.3. URL: https://ghgprotocol.org/sites/default/files/ghgp/standards/GHGP_GPC_0.pdf

[12] Eastern Research Group, Inc. (2022). 2020 National Emissions Inventory: Aviation Component. URL: https://www.epa.gov/system/files/documents/2023-01/2020%20NEI%20Aviation%20Documentation%20Revised%20-%2010252022.pdf

[13] Phoenix Sky Harbor International Airport. Airport Statistics. URL: https://www.skyharbor.com/about-phx/history-economic-development/airport-statistics/

[14] IPCC Aircraft Emissions. Page 95, Figure 1. URL: https://www.ipcc-nggip.iges.or.jp/public/gp/bgp/2_5_Aircraft.pdf

[15] ADOT Highway Performance Monitoring System (HPMS) 2020 Data. URL: https://azgeo-open-data-agic.hub.arcgis.com/maps/84fa258305c94aa99a428e1f09dc529a/about

System (HPMS) Data are available, this dataset only contains future AADT projections and does not contain calendar year 2021 AADT data.[16] County-level VMT data were used to downscale all on-road mobile combustion activity data.

Non-road transportation GHG emissions were downscaled from the state-level to the county-level using county-level VMT estimates. Activity specific non-road transportation downscaling factors will be developed for the *Arizona CCAP GHG Inventory* or primary data sources will be identified to obviate the need to downscale from the state-level to the county-level.

Aviation GHG emissions were downscaled differently from the state-level to county-level for Aviation Gasoline and Jet Fuel consumption. Airport operations GHG emissions data obtained from the EPA 2020 NEI were used to downscale aviation gasoline GHG emissions from the state-level to the county-level. Jet Fuel GHG emissions were downscaled from the state-level to the county-level using 2021 facility-level LTO data for Air Carriers, Air Taxi, and Military flights obtained from the FAA Operations Network (OPSNET) system.[17]

3 Electricity Generation

3.1 Data

Electricity generation data for the State of Arizona were obtained from multiple federal sources. Federal data sources included EIA Form EIA-923, EPA eGRID, and the EPA GHGRP Subpart D.

- Form EIA-923, "collects detailed electric power data – monthly and annually – on electricity generation, fuel consumption, fossil fuel stocks, and receipts at the power plant and prime mover level."[18]

- EPA eGRID, which is used as the primary data source of emissions factors for estimating GHG emissions from electricity consumption, also provides data on the environmental characteristics of electric power generation in the U.S.[19] EPA eGRID contains information on the GHG emissions of each electric power plant in Arizona, covering annual GHG emission in addition to annual emissions of some criteria air pollutants.

- Finally, annual power plant GHG emissions were obtained from self-reported data to the EPA GHG Reporting Program (GHGRP). Power plants report CO_2, CH_4, N_2O, and biogenic CO_2 as part of Subpart D (Electricity Generation) of the EPA GHGRP. Subpart D data for Arizona were obtained directly from the EPA via the

[16] 2021 ADOT Highway Performance Monitoring System (HPMS) Data. URL: https://azgeo-open-data-agic.hub.arcgis.com/maps/d2afcd06d1e4471a86af6c775b807cf1/about
[17] Federal Aviation Administration. The Operations Network (OPSNET). URL: https://aspm.faa.gov/opsnet/sys/main.asp
[18] Energy Information Administration (2024). Form EIA-923, "detailed data with previous form data (EIA-906/920)." URL: https://www.eia.gov/electricity/data/eia923/
[19] EPA eGRID (2024). https://www.epa.gov/egrid

GHG Query Builder.[20] Since GHGRP Subpart D only requires reporting by facilities that emit >25,000 CO_2e, some small electricity generation units that are included in Form EIA-923 and EPA eGRID may be excluded from this dataset.

- EIA data on the supply and disposition of electricity in Arizona were used to estimate the statewide electricity transmission and distribution loss rate.[21]

3.2 Statewide GHG Emissions Estimation Method

GHG emissions from electricity generation were estimated differently for each source dataset.

For data collection from Form EIA-923, electric fuel consumption data (MMBtu) across all plants were summarized by reported fuel type. Fuel consumption data were then multiplied by fuel specific CO_2, CH_4, and N_2O emissions factors obtained from the EPA GHG Emissions Factors Hub obtained for calendar year 2021 and then converted to CO_2e using IPCC AR5 GWPs.[22] Fuel specific GHG emissions factors available from the GHG Emissions Factors Hub are sourced from 40 CFR 98.38; specifically, Table C-1 to Subpart C of Part 98, Title 40. As

As both EPA eGRID and EPA GHGRP Subpart D already report facility-level GHG emissions data. Data obtained from these sources were summarized up to the state-level. CH_4 and N_2O emissions were multiplied by IPCC AR5 GWPs to obtain CO_2e emissions. It should be noted that EPA eGRID reports emissions imperial units – short tons of CO_2 and pounds of CH_4 and N_2O. EPA eGRID data were converted to units of metric tons to enable comparability between datasets.

Form EIA-923, EPA eGRID, and EPA GHGRP provide similar data with small difference in report fuel consumption (Table 1) and net generation (Table 2). These datasets were compared to the electricity generation data obtained from the EPA SIT[23] using default Arizona data. Quality analysis results are presented in the Quality Analysis section. GHG emissions derived Form EIA-923 utilized in the *Arizona PCAP GHG Inventory* because this data sets lends itself best to reproducibility. Electricity transmission and distribution loss was calculated using published EIA methods.[24]

[20] EPA (2024). GHG Query Builder. Electricity Generation: d_subpart_level_information. URL: https://enviro.epa.gov/query-builder/ghg/ELECTRICITY%20GENERATION/D_SUBPART_LEVEL_INFORMATION.

[21] Statewide supply and disposition of electricity is derived from the following datasets: U.S. Energy Information Administration, Form EIA-923, Power Plant Operations Report and predecessor forms. U.S. Energy Information Administration, Form EIA-860, Annual Electric Generator Report. U.S. Energy Information Administration, Form EIA-861, Annual Electric Power Industry Report. Form EIA-111, Quarterly Imports and Exports Report. Transmission and distribution loss rates are calculated using a method available from EIA: https://www.eia.gov/tools/faqs/faq.php?id=105&t=3.

[22] EPA Center for Corporate Climate Leadership. GHG Emissions Factors Hub. URL: https://www.epa.gov/climateleadership/ghg-emission-factors-hub

[23] EPA (2024). State Inventory and Projection Tool. URL: https://www.epa.gov/statelocalenergy/download-state-inventory-and-projection-tool

[24] EIA (2023): How much electricity is lost in electricity transmission and distribution in the United States? EIA: https://www.eia.gov/tools/faqs/faq.php?id=105&t=3.

Table 1. Electricity Net Generation Fuel Consumption

Reported Fuel Type	Form EIA-923 Fuel Consumption (MMBtu)	EPA eGRID Fuel Consumption (MMBtu)	EPA GHGRP Subpart D Fuel Consumption (MMBtu)
Natural Gas	369,833,540	360,085,558	349,598,025
Coal	153,948,326	177,486,733	164,747,418
Petroleum (Diesel)	490,653	1,229	282,152
Landfill gas	218,110	218,110	0
Biomass	2,884,913	2,886,338	0
Total	**527,375,542**	**540,677,967**	**514,627,596**

Table 2. Electricity Net Generation by Reported in MWh

Reported Fuel Type	EIA Form EIA-923 Net Generation (MWh)	EPA eGRID Net Generation (MWh)	EPA GHGRP Subpart D Net Generation (MWh)*
Natural Gas	48,053,133	46,840,316	NA
Coal	14,300,572	15,467,889	NA
Petroleum (Diesel)	43,534	62	NA
Landfill gas	19,470	19,470	NA
Biomass	190,646	190,741	NA
Total	**62,607,356**	**62,518,478**	**NA**

NA – Not Available. Reported net generation by fuel type was not found on the EPA GHGRP API.

3.3 County-Level Downscaling Method

GHG emissions from power generation are estimated at the facility-level. Facility-level GHG emissions data is aggregated up to the county-level. Electricity transmission and distribution loss was calculated using published EIA methods.[25]

4 Stationary Combustion

GHG emissions from Stationary Combustion are categorized as either direct or indirect.

Direct GHG emissions from stationary combustion occurs at the point of combustion – e.g., a natural gas boiler or on-site electric generator. The *Arizona PCAP GHG Inventory* categorizes GHG emissions from direct stationary combustion into the industrial emissions sector and the commercial and residential building emissions sector.

Indirect GHG emissions occur primarily from electricity consumption and the transmission and distribution loss associated with the electricity grid. The *Arizona PCAP GHG*

[25] EIA (2023): How much electricity is lost in electricity transmission and distribution in the United States? EIA: https://www.eia.gov/tools/faqs/faq.php?id=105&t=3.

Inventory categorizes GHG emissions from indirect stationary combustion into electricity consumption sector.

4.1 Direct Stationary Combustion

This section details the data evaluated and methods used to estimate GHG emissions from the direct combustion of fossil fuels for stationary energy uses. Fuels inventoried include asphalt, coal, diesel, kerosene, lubricants, motor gasoline, natural gas, propane, and special naphthas.

4.1.1 Asphalt

4.1.1.1 Data

Asphalt consumption data for residential, commercial, and industrial end use sectors were obtained from EIA SEDS. EIA SEDS data series included: ARICB – Asphalt and road oil consumed by the industrial sector.

Energy consumption estimates were adjusted for fuel-specific non energy uses. Fuel specific non-energy use data were obtained from the EPA *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021*.[26]

4.1.1.2 Statewide GHG Emissions Estimation Methods

Data on the total statewide consumption of asphalt by end use – residential, commercial, industrial, and transportation – were obtained from EIA SEDS. Next, non-energy use and product storage were subtracted from total consumption to obtain an adjusted total for asphalt consumption.[27] This adjusted total represents the amount combusted for stationary energy purposes.

The adjusted total consumption was then multiplied by fuel specific stationary combustion CO_2, CH_4, and N_2O emissions factors obtained from the EPA GHG Emissions Factors Hub for calendar year 2021. CH_4 and N_2O emissions were then converted to CO_2e using IPCC AR5 GWPs.[28] Fuel specific GHG emissions factors available from the GHG Emissions Factors Hub are sourced from 40 CFR 98.38; specifically, Table C-1 to Subpart C of Part 98, Title 40.

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[26] EPA (2023) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021. U.S. Environmental Protection Agency, EPA 430-R-23-002. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and- sinks-1990-2021. Data on the non-energy use fuels were obtained from, “Table A-4: 2021 Energy Consumption Data by Fuel Type (TBtu) and Adjusted Energy Consumption Data”.

[27] EPA (2023) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021. U.S. Environmental Protection Agency, EPA 430-R-23-002. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and- sinks-1990-2021.

[28] EPA Center for Corporate Climate Leadership. GHG Emissions Factors Hub. URL: https://www.epa.gov/climateleadership/ghg-emission-factors-hub

Table 3. Stationary Combustion of Asphalt in Arizona

Asphalt Consumption	EIA SEDS Data Series	Unadjusted Energy Consumption (billion Btu)	NEU %	Storage %	NEU Adjusted Energy Consumption (billion Btu)
Industrial	ARICB	20,278	100%	100%	0
Total	**–**	**20,278**	**–**	**–**	**0**

Fuel usage and GHG emissions from the stationary combustion of asphalt were compared with results obtained from EPA SIT.[29] Asphalt combusted for stationary energy uses was deemed an insignificant source of GHG emissions.

4.1.1.3 County-Level Downscaling Method

State-level consumption of asphalt was downscaled to the county-level using the relative length of road miles in a county as an indicator of consumption. However, no GHG emissions were reported with respect to the combustion of asphalt as a stationary energy fuel source.

4.1.2 Coal

4.1.2.1 Data

Distillate Fuel Oil (Diesel) consumption data for residential, commercial, and industrial end use sectors were obtained from EIA SEDS. EIA SEDS data series included: CLICB – Coal consumed by the industrial sector; and CLISB – Coal consumed by the industrial sector excluding refinery fuel.

Energy consumption estimates were adjusted for fuel-specific non energy uses. Fuel specific non-energy use data were obtained from the EPA *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021*.[30]

4.1.2.2 Method

Data on the total statewide consumption of coal by end use – residential, commercial, industrial, and transportation – were obtained from EIA SEDS. Next, non-energy use and product storage were subtracted from total consumption to obtain an adjusted total for asphalt consumption.[31] This adjusted total represents the amount of total consumption combusted for stationary energy purposes.

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[29] EPA (2024). State Inventory and Projection Tool. URL: https://www.epa.gov/statelocalenergy/download-state-inventory-and-projection-tool

[30] EPA (2023) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021. U.S. Environmental Protection Agency, EPA 430-R-23-002. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and- sinks-1990-2021. Data on the non-energy use fuels were obtained from, “Table A-4: 2021 Energy Consumption Data by Fuel Type (TBtu) and Adjusted Energy Consumption Data”.

[31] EPA (2023) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021. U.S. Environmental Protection Agency, EPA 430-R-23-002. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and- sinks-1990-2021.

The adjusted total consumption was then multiplied by fuel specific stationary combustion CO_2, CH_4, and N_2O emissions factors obtained from the EPA GHG Emissions Factors Hub for calendar year 2021. CH_4 and N_2O emissions were then converted to CO_2e using IPCC AR5 GWPs.[32] Fuel specific GHG emissions factors available from the GHG Emissions Factors Hub are sourced from 40 CFR 98.38; specifically, Table C-1 to Subpart C of Part 98, Title 40.

If necessary, to avoid double counting between stationary combustion and industrial process emissions activities, reported GHG emissions were removed from industrial processes and inventoried as direct stationary combustion. This process will be refined further in the *Arizona CCAP GHG Inventory*.

Table 4. Stationary Combustion of Coal in Arizona for non-Electricity Generation Purposes

Coal Consumption	EIA SEDS Data Series	Unadjusted Energy Consumption (billion Btu)	NEU %	Storage %	NEU Adjusted Energy Consumption (billion Btu)
Industrial	CLICB	6,351	23%	10%	6,205
Total	**–**	**6,351**	**0%**	**0%**	**6,205**

Fuel usage and GHG emissions from the stationary combustion (non-electricity generation use) of coal were compared with results obtained from EPA SIT[33].

4.1.2.3 County-Level Downscaling Method

State-level consumption of coal for stationary combustion purposes was downscaled to the county-level using county-level estimates of industrial natural gas consumption obtained from NREL SLOPE.[34] Natural gas combustion was assumed to be an adequate of industrial activity and potential on-site coal combustion. These assumptions will be refined during the *Arizona CCAP GHG Inventory*.

4.1.3 Distillate Fuel Oil (Diesel)

4.1.3.1 Data

Distillate Fuel Oil (Diesel) consumption data for residential, commercial, and industrial end use sectors were obtained from EIA SEDS. EIA SEDS data series included: DFCCB – Distillate fuel oil consumed by the commercial sector; DFICB – Distillate fuel oil consumed by the industrial sector; and DFRCB – Distillate fuel oil consumed by the residential sector.

[32] EPA Center for Corporate Climate Leadership. GHG Emissions Factors Hub. URL: https://www.epa.gov/climateleadership/ghg-emission-factors-hub
[33] EPA (2024). State Inventory and Projection Tool. URL: https://www.epa.gov/statelocalenergy/download-state-inventory-and-projection-tool
[34] National Renewable Energy Laboratory. "Net Electricity and Natural Gas Consumption," State and Local Planning for Energy, accessed 2/16/2024, https://maps.nrel.gov/slope.

Energy consumption estimates were adjusted for fuel-specific non energy uses. Fuel specific non-energy use data were obtained from the EPA *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021*.[35]

4.1.3.2 Method

Data on the total statewide consumption of distillate fuel oil by end use – residential, commercial, industrial, and transportation – was obtained from EIA SEDS. Next, non-energy uses of the fuel and product storage were subtracted from total consumption to obtain an adjusted total for asphalt consumption.[36] This adjusted total represents the amount of total consumption combusted for stationary energy purposes.

The adjusted total consumption was then multiplied by fuel specific stationary combustion CO_2, CH_4, and N_2O emissions factors obtained from the EPA GHG Emissions Factors Hub for calendar year 2021. CH_4 and N_2O emissions were then converted to CO_2e using IPCC AR5 GWPs.[37] Fuel specific GHG emissions factors available from the GHG Emissions Factors Hub are sourced from 40 CFR 98.38; specifically, Table C-1 to Subpart C of Part 98, Title 40.

If necessary, to avoid double counting between stationary combustion and industrial process emissions activities, reported GHG emissions were removed from industrial processes and inventoried as direct stationary combustion. This process will be refined further in the *Arizona CCAP GHG Inventory*.

Table 5. Stationary Combustion of Distillate Fuel Oil (Diesel) in Arizona

Distillate Fuel Oil Consumption	EIA SEDS Data Series	Unadjusted Energy Consumption (billion Btu)	NEU %	Storage %	NEU Adjusted Energy Consumption (billion Btu)
Residential	DFRCB	10	0	0	10
Commercial	DFCCB	5,368	0	0	5,368
Industrial	DFICB	29,160	1%	50%	29,055
Total	**–**	**34,538**	**–**	**–**	**34,433**

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[35] EPA (2023) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021. U.S. Environmental Protection Agency, EPA 430-R-23-002. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and- sinks-1990-2021. Data on the non-energy use fuels were obtained from, “Table A-4: 2021 Energy Consumption Data by Fuel Type (TBtu) and Adjusted Energy Consumption Data”.

[36] EPA (2023) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021. U.S. Environmental Protection Agency, EPA 430-R-23-002. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and- sinks-1990-2021.

[37] EPA Center for Corporate Climate Leadership. GHG Emissions Factors Hub. URL: https://www.epa.gov/climateleadership/ghg-emission-factors-hub

Fuel usage and GHG emissions from the stationary combustion of distillate fuel oil (diesel) were compared with results obtained from EPA SIT[38].

4.1.3.3 County-Level Downscaling Method

State-level consumption of distillate fuel oil (diesel) for stationary combustion purposes was downscaled to the county-level using county-level estimates of residential, commercial, and industrial natural gas consumption obtained from NREL SLOPE.[39] County-downscaling assumptions will be refined during the *Arizona CCAP GHG Inventory*.

4.1.4 Kerosene

4.1.4.1 Data

Kerosene consumption data for residential, commercial, and industrial end use sectors were obtained from EIA SEDS. EIA SEDS data series included: KSCCB – Kerosene consumed by the commercial sector; and KSRCB – Kerosene consumed by the residential sector.

Energy consumption estimates were adjusted for fuel-specific non energy uses. Fuel specific non-energy use data were obtained from the EPA *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021*.[40]

4.1.4.2 Method

Data on the total statewide consumption of kerosene by end use – residential, commercial, industrial, and transportation – was obtained from EIA SEDS. Next, non-energy uses of the fuel and product storage were subtracted from total consumption to obtain an adjusted total for asphalt consumption.[41] This adjusted total represents the amount of total consumption combusted for stationary energy purposes.

The adjusted total consumption was then multiplied by fuel specific stationary combustion CO_2, CH_4, and N_2O emissions factors obtained from the EPA GHG Emissions Factors Hub for calendar year 2021. CH_4 and N_2O emissions were then converted to CO_2e using IPCC AR5 GWPs.[42] Fuel specific GHG emissions factors available from the GHG Emissions Factors Hub are sourced from 40 CFR 98.38; specifically, Table C-1 to Subpart C of Part 98, Title 40.

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[38] EPA (2024). State Inventory and Projection Tool. URL: https://www.epa.gov/statelocalenergy/download-state-inventory-and-projection-tool

[39] National Renewable Energy Laboratory. "Net Electricity and Natural Gas Consumption," State and Local Planning for Energy, accessed 2/16/2024, https://maps.nrel.gov/slope.

[40] EPA (2023) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021. U.S. Environmental Protection Agency, EPA 430-R-23-002. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and- sinks-1990-2021. Data on the non-energy use fuels were obtained from, "Table A-4: 2021 Energy Consumption Data by Fuel Type (TBtu) and Adjusted Energy Consumption Data".

[41] EPA (2023) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021. U.S. Environmental Protection Agency, EPA 430-R-23-002. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and- sinks-1990-2021.

[42] EPA Center for Corporate Climate Leadership. GHG Emissions Factors Hub. URL: https://www.epa.gov/climateleadership/ghg-emission-factors-hub

Table 6. Stationary Combustion of Kerosene in Arizona

Kerosene Consumption	EIA SEDS Data Series	Unadjusted Energy Consumption (billion Btu)	NEU %	Storage %	NEU Adjusted Energy Consumption (billion Btu)
Residential	KSRCB	1.00	0	0	1.00
Commercial	KSCCB	1.00	0	0	1.00
Total	**–**	**2.00**	**–**	**–**	**2.00**

Fuel usage and GHG emissions from the stationary combustion of kerosene were compared with results obtained from EPA SIT[43].

4.1.4.3 County-Level Downscaling Method

State-level consumption of kerosene for stationary combustion purposes was downscaled to the county-level using county-level estimates of residential and commercial natural gas consumption obtained from NREL SLOPE as an indicator.[44] County-downscaling assumptions will be refined during the *Arizona CCAP GHG Inventory*.

4.1.5 Lubricants

4.1.5.1 Data

Lubricant consumption data for residential, commercial, and industrial end use sectors were obtained from EIA SEDS. EIA SEDS data series included: LUICB – Lubricants consumed by the industrial sector.

Energy consumption estimates were adjusted for fuel-specific non energy uses. Fuel specific non-energy use data were obtained from the EPA *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021*.[45]

4.1.5.2 Method

Data on the total statewide consumption of lubricants by end use – residential, commercial, industrial, and transportation – was obtained from EIA SEDS. Next, non-energy uses of the fuel and product storage were subtracted from total consumption to

[43] EPA (2024). State Inventory and Projection Tool. URL: https://www.epa.gov/statelocalenergy/download-state-inventory-and-projection-tool

[44] National Renewable Energy Laboratory. "Net Electricity and Natural Gas Consumption," State and Local Planning for Energy, accessed 2/16/2024, https://maps.nrel.gov/slope.

[45] EPA (2023) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021. U.S. Environmental Protection Agency, EPA 430-R-23-002. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and- sinks-1990-2021. Data on the non-energy use fuels were obtained from, "Table A-4: 2021 Energy Consumption Data by Fuel Type (TBtu) and Adjusted Energy Consumption Data".

obtain an adjusted total for asphalt consumption.[46] This adjusted total represents the amount of total consumption combusted for stationary energy purposes.

The adjusted total consumption was then multiplied by fuel specific stationary combustion CO_2, CH_4, and N_2O emissions factors obtained from the EPA GHG Emissions Factors Hub for calendar year 2021. CH_4 and N_2O emissions were then converted to CO_2e using IPCC AR5 GWPs.[47] Fuel specific GHG emissions factors available from the GHG Emissions Factors Hub are sourced from 40 CFR 98.38; specifically, Table C-1 to Subpart C of Part 98, Title 40.

If necessary, to avoid double counting between stationary combustion and industrial process emissions activities, reported GHG emissions were removed from industrial processes and inventoried as direct stationary combustion. This process will be refined further in the *Arizona CCAP GHG Inventory*.

Table 7. Stationary Combustion of Lubricants in Arizona

Lubricants Consumption	EIA SEDS Data Series	Unadjusted Energy Consumption (billion Btu)	NEU %	Storage %	NEU Adjusted Energy Consumption (billion Btu)
Industrial	LUICB	1,669	100%	9%	1,519
Transportation	LUACB	2,475	100%	9%	2,252
Total	**LUTCB**	**4,144**	**100%**	**9%**	**3,771**

Fuel usage and GHG emissions from the stationary combustion of lubricants were compared with results obtained from EPA SIT.[48]

4.1.5.3 County-Level Downscaling Method

State-level consumption of lubricants for stationary combustion purposes was downscaled to the county-level using county-level estimates of industrial natural gas consumption obtained from NREL SLOPE.[49] County-downscaling assumptions will be refined during the *Arizona CCAP GHG Inventory*.

[46] EPA (2023) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021. U.S. Environmental Protection Agency, EPA 430-R-23-002. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and- sinks-1990-2021.
[47] EPA Center for Corporate Climate Leadership. GHG Emissions Factors Hub. URL: https://www.epa.gov/climateleadership/ghg-emission-factors-hub
[48] EPA (2024). State Inventory and Projection Tool. URL: https://www.epa.gov/statelocalenergy/download-state-inventory-and-projection-tool
[49] National Renewable Energy Laboratory. "Net Electricity and Natural Gas Consumption," State and Local Planning for Energy, accessed 2/16/2024, https://maps.nrel.gov/slope.

4.1.6 Motor Gasoline

4.1.6.1 Data

Motor gasoline consumption data for residential, commercial, and industrial end use sectors were obtained from EIA SEDS. EIA SEDS data series included: MGCCB – Motor gasoline consumed by the commercial sector; and MGICB – Motor gasoline consumed by the industrial sector.

Energy consumption estimates were adjusted for fuel-specific non energy uses. Fuel specific non-energy use data were obtained from the EPA *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021*.[50]

4.1.6.2 Method

Data on the total statewide consumption of motor gasoline by end use – residential, commercial, industrial, and transportation – was obtained from EIA SEDS. Next, non-energy uses of the fuel and product storage were subtracted from total consumption to obtain an adjusted total for asphalt consumption.[51] This adjusted total represents the amount of total consumption combusted for stationary energy purposes.

The adjusted total consumption was then multiplied by fuel specific stationary combustion CO_2, CH_4, and N_2O emissions factors obtained from the EPA GHG Emissions Factors Hub for calendar year 2021. CH_4 and N_2O emissions were then converted to CO_2e using IPCC AR5 GWPs.[52] Fuel specific GHG emissions factors available from the GHG Emissions Factors Hub are sourced from 40 CFR 98.38; specifically, Table C-1 to Subpart C of Part 98, Title 40.

If necessary, to avoid double counting between stationary combustion and industrial process emissions activities, reported GHG emissions were removed from industrial processes and inventoried as direct stationary combustion. This process will be refined further in the *Arizona CCAP GHG Inventory*.

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50 EPA (2023) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021. U.S. Environmental Protection Agency, EPA 430-R-23-002. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and- sinks-1990-2021. Data on the non-energy use fuels were obtained from, "Table A-4: 2021 Energy Consumption Data by Fuel Type (TBtu) and Adjusted Energy Consumption Data".

51 EPA (2023) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021. U.S. Environmental Protection Agency, EPA 430-R-23-002. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and- sinks-1990-2021.

52 EPA Center for Corporate Climate Leadership. GHG Emissions Factors Hub. URL: https://www.epa.gov/climateleadership/ghg-emission-factors-hub

Table 8. Stationary Combustion of Motor Gasoline in Arizona

Motor Gasoline Consumption	EIA SEDS Data Series	Unadjusted Energy Consumption (billion Btu)	NEU %	Storage %	NEU Adjusted Energy Consumption (billion Btu)
Commercial	MGCCB	9,469	0%	0%	9,469
Industrial	MGICB	8,883	0%	0%	8,883
Total	**–**	**18,352**	**0%**	**0%**	**18,352**

Fuel usage and GHG emissions from the stationary combustion of motor gasoline were compared with results obtained from EPA SIT.[53]

4.1.6.3 County-Level Downscaling Method

State-level consumption of lubricants for stationary combustion purposes was downscaled to the county-level using county-level estimates of commercial and industrial natural gas consumption obtained from NREL SLOPE.[54] County-downscaling assumptions will be refined during the *Arizona CCAP GHG Inventory*.

4.1.7 Natural Gas

4.1.7.1 Data

Natural gas combustion data were obtained from multiple federal and state data sources.

Federal data sources included the EIA Form EIA-176, "Annual Report of Natural and Supplemental Gas Supply and Disposition."[55] Form EIA-176 data were obtained through the Natural Gas Annual Respondent Query System.[56] Form EIA-176 summarizes consumption and revenue by customer class for typical consumers, who receive natural gas directly from their utility, and 'transport' consumers who "buy their gas from a company other than the one that delivered it to them."[57] Modeled estimates of Arizona-wide natural gas combustion were also obtained from the NREL State and Local Planning for Energy (SLOPE) Tool[58]. Natural gas consumption data for residential, commercial, and industrial end use sectors were also obtained from the EIA State Energy Data

[53] EPA (2024). State Inventory and Projection Tool. URL: https://www.epa.gov/statelocalenergy/download-state-inventory-and-projection-tool

[54] National Renewable Energy Laboratory. "Net Electricity and Natural Gas Consumption," State and Local Planning for Energy, accessed 2/16/2024, https://maps.nrel.gov/slope.

[55] Energy Information Administration (2024). Form EIA-176, "Annual Report of Natural and Supplemental Gas Supply and Disposition."

[56] Energy Information Administration (2024). Natural Gas Annual Respondent Query System. URL: https://www.eia.gov/naturalgas/ngqs/#?year1=2019&year2=2022&company=Name

[57] Energy Information Administration (2024). Natural Gas. Definitions, Sources, and Explanatory Notes. URL: https://www.eia.gov/dnav/ng/TblDefs/ng_cons_num_tbldef2.asp.

[58] National Renewable Energy Laboratory. "Net Electricity and Natural Gas Consumption," State and Local Planning for Energy, accessed 2/16/2024, https://maps.nrel.gov/slope.

System.[59] EIA SEDS data series included: NGPZB – Natural gas for pipeline and distribution use; NGACB – Natural gas consumed by the transportation sector; NGICB – Natural gas consumed by the industrial sector (including supplemental gaseous fuels); NGCCB – Natural gas delivered to the commercial sector, used as consumption (including supplemental gaseous fuels); and NGRCB – Natural gas delivered to the residential sector, used as consumption (including supplemental gaseous fuels).

State-level data on natural gas consumption data were obtained from Gas Company Annual Reports submitted to the Arizona Corporation Commission (ACC).[60] The Electric Company Annual Reports contain annual consumption and revenue data by customer class – residential, commercial, and industrial.

After evaluating each data source, Form EIA-176 were incorporated into the *Arizona PCAP GHG Inventory* because it provided the most comprehensive data for Arizona for each utility by customer class.

Energy consumption estimates were adjusted for fuel-specific non energy uses. Fuel and customer class specific non-energy use data were obtained from the EPA *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021*.[61]

4.1.7.2 Method

Data on the total statewide consumption of natural gas by end use – residential, commercial, industrial, and transportation – was obtained from EIA SEDS. Next, non-energy uses of the fuel and product storage were subtracted from total consumption to obtain an adjusted total for asphalt consumption.[62] This adjusted total represents the amount of total consumption combusted for stationary energy purposes.

The adjusted total consumption was then multiplied by fuel specific stationary combustion CO_2, CH_4, and N_2O emissions factors obtained from the EPA GHG Emissions Factors Hub for calendar year 2021. CH_4 and N_2O emissions were then converted to CO_2e using IPCC AR5 GWPs.[63] Fuel specific GHG emissions factors available from the GHG Emissions Factors Hub are sourced from 40 CFR 98.38; specifically, Table C-1 to Subpart C of Part 98, Title 40.

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[59] Energy Information Administration (2024). Open Data. State Energy Data System API. URL: https://www.eia.gov/opendata/browser/seds?frequency=annual&data=value;&facets=stateId;&stateId=AZ;&start=2021&end=2021&sortColumn=period;&sortDirection=desc;.

[60] Arizona Corporation Commission (2024). Gas Company Annual Reports. URL: https://www.azcc.gov/utilities/gas/gas-annual-reports

[61] EPA (2023) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021. U.S. Environmental Protection Agency, EPA 430-R-23-002. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and- sinks-1990-2021. Data on the non-energy use fuels were obtained from, “Table A-4: 2021 Energy Consumption Data by Fuel Type (TBtu) and Adjusted Energy Consumption Data”.

[62] EPA (2023) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021. U.S. Environmental Protection Agency, EPA 430-R-23-002. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and- sinks-1990-2021.

[63] EPA Center for Corporate Climate Leadership. GHG Emissions Factors Hub. URL: https://www.epa.gov/climateleadership/ghg-emission-factors-hub

If necessary, to avoid double counting between stationary combustion and industrial process emissions activities, reported GHG emissions were removed from industrial processes and inventoried as direct stationary combustion. This process will be refined further in the *Arizona CCAP GHG Inventory*. Natural gas combustion for transportation purposes were not reported in this sector as they are included in the Mobile Combustion sector.

Table 9. Stationary Combustion of Natural Gas in Arizona

Revenue Class	Statewide Consumption (therms)	Data Source
Residential	2,193,829	EIA Form EIA-176 accessed via Natural Gas Annual Respondent Query System
Commercial	1,833,068	
Industrial	1,098,397	
Transportation	107,533	
Total	**5,232,827**	**–**

Fuel usage and GHG emissions from the stationary combustion of natural gas were compared with results obtained from EPA SIT.[64]

4.1.7.3 County-Level Downscaling Method

State-level consumption of natural gas for stationary combustion purposes was downscaled to the county-level using county-level estimates of residential, commercial, and industrial natural gas consumption obtained from NREL SLOPE.[65] The *Arizona CCAP GHG Inventory* will pursue natural utility data to improve GHG emissions estimates. Comprehensive utility data collection across the state was not feasible during the compressed PCAP timeline.

4.1.8 Propane

4.1.8.1 Data

Propane combustion data were obtained from multiple federal and state data sources.

The primary federal data source on statewide propane consumption was EIA SEDS. EIA SEDS contain propane consumption data for residential, commercial, and industrial end use sectors.[66] EIA SEDS data series included: PQCCB – Propane consumed by the commercial sector; PQICB – Propane consumed by the industrial sector; and PQRCB – Propane consumed by the residential sector.

[64] EPA (2024). State Inventory and Projection Tool. URL: https://www.epa.gov/statelocalenergy/download-state-inventory-and-projection-tool

[65] National Renewable Energy Laboratory. "Net Electricity and Natural Gas Consumption," State and Local Planning for Energy, accessed 2/16/2024, https://maps.nrel.gov/slope.

[66] Energy Information Administration (2024). Open Data. State Energy Data System API. URL: https://www.eia.gov/opendata/browser/seds?frequency=annual&data=value;&facets=stateId;&stateId=AZ;&start=2021&end=2021&sortColumn=period;&sortDirection=desc;.

State-level data on natural gas consumption data were obtained from Gas Company Annual Reports submitted to the Arizona Corporation Commission (ACC).[67] The Electric Company Annual Reports contain annual consumption and revenue data by customer class – residential, commercial, and industrial.

After evaluating each data source, EIA were incorporated into the *Statewide Inventory of Arizona* because it provided the most comprehensive data for Arizona by customer class. ACC Gas Company Annual Reports does provide data on propane consumption in Arizona but is limited to propane utilities in Bagdad, Arizona, Paige, Arizona, and Payson, Arizona. [68]

Propane consumption estimates were adjusted for fuel-specific non energy uses. Fuel and customer class specific non-energy use data were obtained from the EPA *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021*.[69]

4.1.8.2 Method

Data on the total statewide consumption of propane by end use – residential, commercial, industrial, and transportation – was obtained from EIA SEDS. Next, non-energy uses of the fuel and product storage were subtracted from total consumption to obtain an adjusted total for asphalt consumption.[70] This adjusted total represents the amount of total consumption combusted for stationary energy purposes.

The adjusted total consumption was then multiplied by fuel specific stationary combustion CO_2, CH_4, and N_2O emissions factors obtained from the EPA GHG Emissions Factors Hub for calendar year 2021. CH_4 and N_2O emissions were then converted to CO_2e using IPCC AR5 GWPs.[71] Fuel specific GHG emissions factors available from the GHG Emissions Factors Hub are sourced from 40 CFR 98.38; specifically, Table C-1 to Subpart C of Part 98, Title 40.

If necessary, to avoid double counting between stationary combustion and industrial process emissions activities, reported GHG emissions were removed from industrial processes and inventoried as direct stationary combustion.

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[67] Arizona Corporation Commission (2024). Gas Company Annual Reports. URL: https://www.azcc.gov/utilities/gas/gas-annual-reports

[68] Arizona Corporation Commission (2024). Gas Company Annual Reports. URL: https://www.azcc.gov/utilities/gas/gas-annual-reports

[69] EPA (2023) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021. U.S. Environmental Protection Agency, EPA 430-R-23-002. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and- sinks-1990-2021. Data on the non-energy use fuels were obtained from, "Table A-4: 2021 Energy Consumption Data by Fuel Type (TBtu) and Adjusted Energy Consumption Data".

[70] EPA (2023) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021. U.S. Environmental Protection Agency, EPA 430-R-23-002. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and- sinks-1990-2021.

[71] EPA Center for Corporate Climate Leadership. GHG Emissions Factors Hub. URL: https://www.epa.gov/climateleadership/ghg-emission-factors-hub

Table 10. Stationary Combustion of Propane in Arizona

Propane Consumption	EIA SEDS Data Series	Unadjusted Energy Consumption (billion Btu)	NEU %	Storage %	Adjusted Energy Consumption (billion Btu)
Residential	PQRCB	5,101	0	0	5,101
Commercial	PQCCB	3,614	0	0	3,614
Industrial	PQICB	1,258	98%	63%	478
Transportation	PQACB	557	0	0	557
Total	**PQTCB**	**10,530**	**–**	**0**	**9,750**

Fuel usage and GHG emissions from the stationary combustion of propane were compared with results obtained from EPA SIT.[72]

4.1.8.3 County-Level Downscaling Method

State-level consumption of propane for stationary combustion purposes was downscaled to the county-level using county-level estimates of residential, commercial, and industrial natural gas consumption obtained from NREL SLOPE.[73]

4.1.9 Special Naphthas

4.1.9.1 Data

Special naphthas consumption data for residential, commercial, and industrial end use sectors were obtained from EIA SEDS. EIA SEDS data series included: SNICB – Special naphthas consumed by the industrial sector.[74]

Energy consumption estimates were adjusted for fuel-specific non energy uses. Fuel specific non-energy use data were obtained from the EPA *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021*.[75]

4.1.9.2 Method

Data on the total statewide consumption of special naphthas by end use – residential, commercial, industrial, and transportation – was obtained from EIA SEDS. Next, non-energy uses of the fuel and product storage were subtracted from total consumption to

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[72] EPA (2024). State Inventory and Projection Tool. URL: https://www.epa.gov/statelocalenergy/download-state-inventory-and-projection-tool

[73] National Renewable Energy Laboratory. "Net Electricity and Natural Gas Consumption," State and Local Planning for Energy, accessed 2/16/2024, https://maps.nrel.gov/slope.

[74] Energy Information Administration (2024). Open Data. State Energy Data System API. URL: https://www.eia.gov/opendata/browser/seds?frequency=annual&data=value;&facets=stateId;&stateId=AZ;&start=2021&end=2021&sortColumn=period;&sortDirection=desc;.

[75] EPA (2023) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021. U.S. Environmental Protection Agency, EPA 430-R-23-002. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and- sinks-1990-2021. Data on the non-energy use fuels were obtained from, “Table A-4: 2021 Energy Consumption Data by Fuel Type (TBtu) and Adjusted Energy Consumption Data”.

obtain an adjusted total for asphalt consumption.[76] This adjusted total represents the amount of total consumption combusted for stationary energy purposes.

The adjusted total consumption was then multiplied by fuel specific stationary combustion CO_2, CH_4, and N_2O emissions factors obtained from the EPA GHG Emissions Factors Hub for calendar year 2021. CH_4 and N_2O emissions were then converted to CO_2e using IPCC AR5 GWPs.[77] Fuel specific GHG emissions factors available from the GHG Emissions Factors Hub are sourced from 40 CFR 98.38; specifically, Table C-1 to Subpart C of Part 98, Title 40.

If necessary, to avoid double counting between stationary combustion and industrial process emissions activities, reported GHG emissions were removed from industrial processes and inventoried as direct stationary combustion.

Table 11. Stationary Combustion of Special Naphthas in Arizona

Special Naphthas Consumption	EIA SEDS Data Series	Unadjusted Energy Consumption (billion Btu)	NEU %	Storage %	NEU Adjusted Energy Consumption (billion Btu)
Industrial	SNICB	1,254	100%	63%	464
Total	**–**	**1,254**	**100%**	**63%**	**464**

Fuel usage and GHG emissions from the stationary combustion of special naphthas were compared with results obtained from EPA SIT.[78]

4.1.9.3 County-Level Downscaling Method

State-level consumption of lubricants for stationary combustion purposes was downscaled to the county-level using county-level estimates of residential, commercial, and industrial natural gas consumption obtained from NREL SLOPE.[79]

4.2 Indirect Stationary Combustion (Electricity Consumption)

4.2.1 Data

Electricity consumption data for the State of Arizona were obtained from multiple federal and state sources.

[76] EPA (2023) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021. U.S. Environmental Protection Agency, EPA 430-R-23-002. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and- sinks-1990-2021.
[77] EPA Center for Corporate Climate Leadership. GHG Emissions Factors Hub. URL: https://www.epa.gov/climateleadership/ghg-emission-factors-hub
[78] EPA (2024). State Inventory and Projection Tool. URL: https://www.epa.gov/statelocalenergy/download-state-inventory-and-projection-tool
[79] National Renewable Energy Laboratory. "Net Electricity and Natural Gas Consumption," State and Local Planning for Energy, accessed 2/16/2024, https://maps.nrel.gov/slope.

Federal sources of data included NREL State and Local Planning for Energy (SLOPE) Tool[80] and the EIA Form EIA-861, "Annual Electric Power Industry Report."[81] Form EIA-861 data contains self-reported utility data on annual consumption and revenue data by residential, commercial, industrial, and transportation customer classes.

State-level sources of electricity consumption data were obtained from Electric Company Annual Reports submitted to the Arizona Corporation Commission (ACC).[82] The Electric Company Annual Reports contain annual consumption and revenue data by residential, commercial, industrial, and transportation customer classes.

After evaluating each data source, Form EIA-861 was chosen for use for the *Arizona PCAP GHG Inventory.* Form EIA-861 contains data reported to EIA directly by all electric utilities in Arizona. While NREL SLOPE does provide statewide electricity consumption estimates, NREL SLOPE data are modeled estimates whereas Form EIA-861 are directly reported by utilities. There is overlap between Form EIA-861 and the ACC Electric Company Annual Reports – i.e., both data sources contain the same data if a utility. However. Form EIA-861 contains data for all utilities that sell electricity in Arizona rather than just those regulated by the ACC. For that reason, Form EIA-861 was chosen as the primary data source.

Table 12. Electricity Deliveries in Arizona by Revenue Class

Revenue Class	EIA-861 (MWh)	NREL SLOPE (MWh)
Residential	37,130,339	31,301,448
Commercial	29,990,064	37,040,658
Industrial	14,089,072	16,044,758
Transportation	10,515	–
Total	**81,219,990**	**84,386,864**

4.2.2 Statewide GHG Emissions Estimation Method

Indirect GHG emissions from electricity consumption were calculated using the activity data approach.[83] GHG emissions from electricity consumption were estimated using the equation: $GHG\ Emissions = Electricity\ Consumtion\ \times\ Emissions\ Factor$.

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[80] National Renewable Energy Laboratory. "Net Electricity and Natural Gas Consumption," State and Local Planning for Energy, accessed 2/16/2024, https://maps.nrel.gov/slope.
[81] Energy Information Administration (2024). Form EIA-861, "Annual Electric Power Industry Report." URL: https://www.eia.gov/electricity/data/eia861/
[82] Arizona Corporation Commission (2024). Electric Company Annual Reports. URL: https://www.azcc.gov/utilities/electric/electric-annual-reports
[83] Greenhouse Protocol for Cities

The Arizona-specific electricity GHG emissions factor was obtained from the EPA Emissions & Generation Resource Integrated Database (eGRID)[84] for the Arizona-New Mexico Subregion for calendar year 2021. Using EPA eGRID, indirect GHG emissions were estimated for CO_2, CH_4, and N_2O and then for CO_2e using IPCC AR5 GWPs.

Consumption estimates and GHG emissions from electricity consumption were compared with results obtained from EPA SIT.[85]

4.2.3 County-Level Downscaling Method

State-level consumption of electricity for stationary combustion purposes was downscaled to the county-level using county-level estimates of residential, commercial, and industrial natural gas consumption obtained from NREL SLOPE.[86] The *Arizona CCAP GHG Inventory* will pursue electric utility data to improve GHG emissions estimates. Comprehensive statewide utility data collection was not feasible during the compressed PCAP timeline.

5 Industrial Processes

Facility-level GHG emissions data on industrial processes were obtained from the EPA GHGRP were obtained from the EPA GHG Query Builder. Subpart level information, which details GHG emissions for each facility within each subpart, were downloaded for each subpart via EPA's GraphQL API endpoint. Subpart level-information was then filtered for facilities located in Arizona based GHGRP Facility Identification Numbers.

Industrial process information was also obtained from the EPA *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021*[87] for the state of Arizona.[88]

Since not all types of industrial process GHG emissions occur in Arizona, this section only details methods for relevant EPA GHGRP subparts. If a specific type of industrial process GHG emission is not listed in this section, it is because the review of EPA GHGRP data indicated that it did not occur in Arizona above reporting thresholds.

5.1 General Stationary Fuel Combustion Sources

5.1.1 Data

General Stationary Fuel Combustion Sources GHG emissions data were obtained from federal and local sources. Federal sources included the EPA GHGRP as part of Subpart

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[84] EPA eGRID (2024). https://www.epa.gov/egrid
[85] EPA (2024). State Inventory and Projection Tool. URL: https://www.epa.gov/statelocalenergy/download-state-inventory-and-projection-tool
[86] National Renewable Energy Laboratory. "Net Electricity and Natural Gas Consumption," State and Local Planning for Energy, accessed 2/16/2024, https://maps.nrel.gov/slope.
[87] EPA (2023) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021. U.S. Environmental Protection Agency, EPA 430-R-23-002. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and- sinks-1990-2021.
[88] EPA. 2023. Methodology Report: Inventory of U.S. Greenhouse Gas Emissions and Sinks by State: 1990–2021. U.S. Environmental Protection Agency, EPA-430-R-23-003. https://www.epa.gov/ghgemissions/state-ghg-emissionsand-removals

D (General Stationary Fuel Combustion Sources).[89] All Subpart D tables were downloaded from the EPA GHG Query Builder and filtered for Arizona facilities. Subpart D requires reporting by facilities that emit >25,000 CO_2e.

5.1.2 Statewide GHG Emissions Estimation Method

These GHG emissions are assumed to be included in the data collected for the Direct Stationary Combustion GHG Emissions subsector. Therefore, Subpart D GHG emissions were not included in the *Arizona PCAP GHG Inventory*. Reported Subpart D data indicated numerous types of fossil fuels were combusted for stationary energy. Subpart D GHG emissions were excluded for all fossil fuels to avoid double counting.

5.1.3 County-Level Downscaling Method

GHG emissions from GHGRP Subpart D are reported at the facility-level. Facility-level GHG emissions data is aggregated up to the county-level.

5.2 Use of Electric Transmission and Distribution Equipment

5.2.1 Data

Electronics manufacture GHG emissions data were obtained from federal. Federal sources included the EPA GHGRP as part of Subpart DD (Use of Electric Transmission and Distribution Equipment).[90] Subpart DD requires reporting by facilities that emit >25,000 CO_2e. Use of Electric Transmission and Distribution Equipment GHG emissions were also obtained from the EPA's *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021*[91] for the state of Arizona.[92] Data were also obtained from reports by Arizona Public Service and Salt River Project to the Edison Electricity Institute ESG Reporting Program[93] and the Climate Registry[94], respectively.

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[89] EPA (2024). GHG Query Builder. General Stationary Fuel Combustion Sources. URL: https://enviro.epa.gov/query-builder/ghg/GENERAL%20STATIONARY%20FUEL%20COMBUSTION%20SOURCES.

[90] EPA (2024). GHG Query Builder. Subpart DD – Use of Electric Transmission and Distribution Equipment: dd_subpart_level_information. URL: https://enviro.epa.gov/query-builder/ghg/SUBPART%20DD%20-%20USE%20OF%20ELECTRIC%20TRANSMISSION%20AND%20DISTRIBUTION%20EQUIPMENT/DD_SUBPART_LEVEL_INFORMATION

[91] EPA (2023) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021. U.S. Environmental Protection Agency, EPA 430-R-23-002. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and- sinks-1990-2021.

[92] EPA. 2023. Methodology Report: Inventory of U.S. Greenhouse Gas Emissions and Sinks by State: 1990–2021. U.S. Environmental Protection Agency, EPA-430-R-23-003. https://www.epa.gov/ghgemissions/state-ghg-emissionsand-removals

[93] Pinnacle West Capital Corporation. ESG Reporting. URL: https://www.pinnaclewest.com/corporate-responsibility/esg-reporting/default.aspx

[94] The Climate Registry. Salt River Project. URL: https://theclimateregistry.org/members/salt-river-project/

5.2.2 Statewide GHG Emissions Estimation Method

GHG emissions from the Use of Electric Transmission and Distribution Equipment were obtained from EPA GHGRP Subpart DD data and the EPA GHG inventory of Arizona[95]. Due to the large difference between the two reported values, the EPA State Inventory of Arizona data were used since it was the higher of the two values. SF_6 emissions were converted to CO_2e using IPCC AR5 GWPs. Methods for estimating GHG emissions from the Use of Electric Transmission and Distribution Equipment will be refined during the *Arizona CCAP GHG Inventory.*

The CO_2e emissions totals were compared with results obtained from EPA SIT.[96]

5.2.3 County-Level Downscaling Method

GHG emissions Use of Electric Transmission and Distribution Equipment were downscaled to the county-level using estimated county-level electricity consumption as an indicator.

5.3 Cement Production

5.3.1 Data

Cement Production GHG emissions data were obtained from EPA GHGRP Subpart H (Cement Production). [97] Subpart H requires reporting by facilities that emit >25,000 CO_2e. Three cement production facilities were identified – two in Yavapai County and one in Pima County. Further inspection of these data on the EPA Facility Level Information on Greenhouse Gases Tool indicated that Subpart D (General Stationary Energy Combustion) emissions may be reported along with Subpart H emissions.[98, 99, 100] For this reason, cement production data were also obtained from the EPA's *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021*[101] for the state of Arizona.[102]

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[95] EPA. 2023. Methodology Report: Inventory of U.S. Greenhouse Gas Emissions and Sinks by State: 1990–2021. U.S. Environmental Protection Agency, EPA-430-R-23-003. https://www.epa.gov/ghgemissions/state-ghg-emissionsand-removals

[96] EPA (2024). State Inventory and Projection Tool. URL: https://www.epa.gov/statelocalenergy/download-state-inventory-and-projection-tool

[97] EPA (2024). GHG Query Builder. Cement Production: h_subpart_level_information. URL: https://enviro.epa.gov/query-builder/ghg/CEMENT%20PRODUCTION/H_SUBPART_LEVEL_INFORMATION/

[98] EPA (2024). Facility Level Information on Greenhouse Gas Tool – Drake Cement. URL: https://ghgdata.epa.gov/ghgp/service/facilityDetail/2021?id=1001689&ds=E&et=&popup=true

[99] EPA (2024). Facility Level Information on Greenhouse Gas Tool – Phoenix Cement Company's Clarkdale Facility. URL: https://ghgdata.epa.gov/ghgp/service/facilityDetail/2022?id=1003643&ds=E&et=&popup=true

[100] EPA (2024). Facility Level Information on Greenhouse Gas Tool – CalPortland Company Rillito Plant. URL: https://ghgdata.epa.gov/ghgp/service/facilityDetail/2022?id=1006669&ds=E&et=&popup=true

[101] EPA (2023) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021. U.S. Environmental Protection Agency, EPA 430-R-23-002. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and- sinks-1990-2021.

[102] EPA. 2023. Methodology Report: Inventory of U.S. Greenhouse Gas Emissions and Sinks by State: 1990–2021. U.S. Environmental Protection Agency, EPA-430-R-23-003. https://www.epa.gov/ghgemissions/state-ghg-emissionsand-removals

5.3.2 Statewide GHG Emissions Estimation Method

Cement production GHG emissions from EPA's *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021*[103] for the state of Arizona[104] were compared with results obtained from EPA SIT. [105]

5.3.3 County-Level Downscaling Method

GHG emissions from GHGRP Subpart H were used to downscale statewide cement production GHG emissions estimated by EPA to the county-level.

5.4 Electronics Manufacture

5.4.1 Data

Electronics manufacture GHG emissions data were obtained from federal. Federal sources included the EPA GHGRP as part of Subpart I (Electronics Manufacture).[106] Subpart I requires reporting by facilities that emit >25,000 CO_2e. Electronics manufacture GHG emissions were also obtained from the EPA's *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021*[107] for the state of Arizona.[108]

5.4.2 Statewide GHG Emissions Estimation Method

Electronics manufacturing GHG emissions obtained from EPA GHGRP were converted to CO_2e using IPCC AR5 GWPs. The CO_2e emissions totals were compared with results obtained from EPA SIT.[109]

5.4.3 County-Level Downscaling Method

GHG emissions from GHGRP Subpart I are reported at the facility-level. Facility-level GHG emissions data is aggregated up to the county-level.

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[103] EPA (2023) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021. U.S. Environmental Protection Agency, EPA 430-R-23-002. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and- sinks-1990-2021.

[104] EPA. 2023. Methodology Report: Inventory of U.S. Greenhouse Gas Emissions and Sinks by State: 1990–2021. U.S. Environmental Protection Agency, EPA-430-R-23-003. https://www.epa.gov/ghgemissions/state-ghg-emissionsand-removals

[105] EPA (2024). State Inventory and Projection Tool. URL: https://www.epa.gov/statelocalenergy/download-state-inventory-and-projection-tool

[106] EPA (2024). GHG Query Builder. Electronics Manufacture: mv_ef_i_emissions_by_ghg. URL: https://enviro.epa.gov/query-builder/ghg/ELECTRONICS%20MANUFACTURE/MV_EF_I_EMISSIONS_BY_GHG

[107] EPA (2023) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021. U.S. Environmental Protection Agency, EPA 430-R-23-002. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and- sinks-1990-2021.

[108] EPA. 2023. Methodology Report: Inventory of U.S. Greenhouse Gas Emissions and Sinks by State: 1990–2021. U.S. Environmental Protection Agency, EPA-430-R-23-003. https://www.epa.gov/ghgemissions/state-ghg-emissionsand-removals

[109] EPA (2024). State Inventory and Projection Tool. URL: https://www.epa.gov/statelocalenergy/download-state-inventory-and-projection-tool

5.5 Iron and Steel Production

5.5.1 Data

Iron and steel production GHG emissions data were obtained from the EPA GHGRP as part of Subpart Q (Iron and Steel Production).[110] Subpart Q requires reporting by facilities that emit >25,000 CO_2e. Iron and steel production GHG emissions were also obtained from the EPA's *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021*[111] for the state of Arizona.[112]

5.5.2 Statewide GHG Emissions Estimation Method

Iron and steel production GHG emissions obtained from EPA GHGRP Subpart Q were converted to CO_2e using IPCC AR5 GWPs. The CO_2e emissions totals were compared with results obtained from EPA SIT.[113]

5.5.3 County-Level Downscaling Method

GHG emissions from GHGRP Subpart Q are reported at the facility-level. Facility-level GHG emissions data is aggregated up to the county-level.

5.6 Lime Manufacturing

5.6.1 Data

Lime manufacturing GHG emissions data were obtained from the EPA GHGRP as part of Subpart S (Lime Manufacturing).[114] Subpart S requires reporting by facilities that emit >25,000 CO_2e. Lime manufacturing GHG emissions were also obtained from the EPA's *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021*[115] for the state of Arizona.[116]

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110 EPA (2024). GHG Query Builder. Iron and Steel Production: q_subpart_level_information. URL: https://enviro.epa.gov/query-builder/ghg/IRON%20AND%20STEEL%20PRODUCTION/Q_SUBPART_LEVEL_INFORMATION

111 EPA (2023) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021. U.S. Environmental Protection Agency, EPA 430-R-23-002. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and- sinks-1990-2021.

112 EPA. 2023. Methodology Report: Inventory of U.S. Greenhouse Gas Emissions and Sinks by State: 1990–2021. U.S. Environmental Protection Agency, EPA-430-R-23-003. https://www.epa.gov/ghgemissions/state-ghg-emissionsand-removals

113 EPA (2024). State Inventory and Projection Tool. URL: https://www.epa.gov/statelocalenergy/download-state-inventory-and-projection-tool

114 EPA (2024). GHG Query Builder. Iron and Steel Production: q_subpart_level_information. URL: https://enviro.epa.gov/query-builder/ghg/IRON%20AND%20STEEL%20PRODUCTION/Q_SUBPART_LEVEL_INFORMATION

115 EPA (2023) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021. U.S. Environmental Protection Agency, EPA 430-R-23-002. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and- sinks-1990-2021.

116 EPA. 2023. Methodology Report: Inventory of U.S. Greenhouse Gas Emissions and Sinks by State: 1990–2021. U.S. Environmental Protection Agency, EPA-430-R-23-003. https://www.epa.gov/ghgemissions/state-ghg-emissionsand-removals

5.6.2 Statewide GHG Emissions Estimation Method

Lime manufacturing GHG emissions were data obtained from EPA's *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021*[117] for the state of Arizona[118] and were converted to CO_2e using IPCC AR5 GWPs. Subpart S data were not used for the same reason as Subpart H data: the potential double counting of Subpart D GHG emissions. The CO_2e emissions totals were compared with results obtained from EPA SIT.[119]

5.6.3 County-Level Downscaling Method

GHG emissions from GHGRP Subpart S were used to downscale statewide lime manufacturing GHG emissions estimated by EPA to the county-level.

5.7 Nitric Acid Production

5.7.1 Data

Nitric acid production GHG emissions data were obtained from the EPA GHGRP as part of Subpart V (Nitric Acid Production).[120] Subpart V requires reporting by facilities that emit >25,000 CO_2e. Nitric acid GHG emissions were also obtained from the EPA's *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021*[121] for the state of Arizona.[122]

5.7.2 Statewide GHG Emissions Estimation Method

Nitric acid production GHG emissions obtained from EPA GHGRP were converted to CO_2e using IPCC AR5 GWPs. The CO_2e emissions totals were compared with results obtained from EPA SIT.[123]

5.7.3 County-Level Downscaling Method

GHG emissions from GHGRP Subpart V are reported at the facility-level. Facility-level GHG emissions data is aggregated up to the county-level.

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[117] EPA (2023) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021. U.S. Environmental Protection Agency, EPA 430-R-23-002. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and- sinks-1990-2021.

[118] EPA. 2023. Methodology Report: Inventory of U.S. Greenhouse Gas Emissions and Sinks by State: 1990–2021. U.S. Environmental Protection Agency, EPA-430-R-23-003. https://www.epa.gov/ghgemissions/state-ghg-emissionsand-removals

[119] EPA (2024). State Inventory and Projection Tool. URL: https://www.epa.gov/statelocalenergy/download-state-inventory-and-projection-tool

[120] EPA (2024). GHG Query Builder. Nitric Acid Production: v_subpart_level_information. URL: https://enviro.epa.gov/query-builder/ghg/NITRIC%20ACID%20PRODUCTION/V_SUBPART_LEVEL_INFORMATION

[121] EPA (2023) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021. U.S. Environmental Protection Agency, EPA 430-R-23-002. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and- sinks-1990-2021.

[122] EPA. 2023. Methodology Report: Inventory of U.S. Greenhouse Gas Emissions and Sinks by State: 1990–2021. U.S. Environmental Protection Agency, EPA-430-R-23-003. https://www.epa.gov/ghgemissions/state-ghg-emissionsand-removals

[123] EPA (2024). State Inventory and Projection Tool. URL: https://www.epa.gov/statelocalenergy/download-state-inventory-and-projection-tool

5.8 Petroleum and Natural Gas Systems

5.8.1 Data

Data on GHG emissions from petroleum and natural gas system were obtained from the EPA GHGRP as part of Subpart W (Petroleum and Natural Gas Systems).[124] Subpart W requires reporting by facilities that emit >25,000 CO_2e. Petroleum and natural gas system GHG emissions were also obtained from the EPA's *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021*[125] for the state of Arizona.[126] Data on natural gas consumption by petroleum and natural gas system were also obtained from EIA SEDS: NGPZB – natural gas for pipeline and distribution use.

5.8.2 Statewide GHG Emissions Estimation Method

Petroleum and natural gas system GHG emissions data obtained from EPA GHGRP were converted to CO_2e using IPCC AR5 GWPs. The CO_2e emissions totals were compared with results obtained from EPA SIT.

5.8.3 County-Level Downscaling Method

GHG emissions from GHGRP Subpart W are reported at the facility-level. Facility-level GHG emissions data is aggregated up to the county-level.

5.9 Urea Consumption for Non-Agricultural Purposes

5.9.1 Data

Data on GHG emissions from urea consumption for non-agricultural purposes were only available from the EPA's *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021*[127] for the state of Arizona.[128]

[124] EPA (2024). GHG Query Builder. Petroleum and Natural Gas Systems (RY 2011-2014): w_subpart_level_information. URL: https://enviro.epa.gov/query-builder/ghg/PETROLEUM%20AND%20NATURAL%20GAS%20SYSTEMS%20(RY%202011-2014)/W_SUBPART_LEVEL_INFORMATION

[125] EPA (2023) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021. U.S. Environmental Protection Agency, EPA 430-R-23-002. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and- sinks-1990-2021.

[126] EPA. 2023. Methodology Report: Inventory of U.S. Greenhouse Gas Emissions and Sinks by State: 1990–2021. U.S. Environmental Protection Agency, EPA-430-R-23-003. https://www.epa.gov/ghgemissions/state-ghg-emissionsand-removals

[127] EPA (2023) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021. U.S. Environmental Protection Agency, EPA 430-R-23-002. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and- sinks-1990-2021.

[128] EPA. 2023. Methodology Report: Inventory of U.S. Greenhouse Gas Emissions and Sinks by State: 1990–2021. U.S. Environmental Protection Agency, EPA-430-R-23-003. https://www.epa.gov/ghgemissions/state-ghg-emissionsand-removals

5.9.2 Statewide GHG Emissions Estimation Method

These emissions are modeled by EPA SIT.[129] However, there is an error in the EPA SIT that prevents direct comparison. GHG emissions were utilized from the existing EPA GHG inventory for the state of Arizona[130] and will be revisited during the CCAP phase.

5.9.3 County-Level Downscaling Method

EPA downscales Urea Consumption for Non-Agricultural Purposes from the national-level to the state-level using population as a primary indicator. Population was used as an indicator in the *Arizona PCAP GHG Inventory* to downscale statewide data to the county-level.

5.10 Carbon Dioxide Consumption

5.10.1 Data

Data on GHG emissions from carbon dioxide consumption were only available from the EPA's *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021*[131] for the state of Arizona.[132]

5.10.2 Statewide GHG Emissions Estimation Method

These emissions are not modeled by EPA SIT. GHG emissions were utilized from the existing EPA GHG inventory for the state of Arizona[133] and will be revisited during the CCAP phase.

5.10.3 County-Level Downscaling Method

EPA downscales Carbon Dioxide Consumption from the national-level to the state-level using population as a primary indicator. Population was used as an indicator in the *Arizona PCAP GHG Inventory* to downscale statewide data to the county-level.

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[129] EPA (2024). State Inventory and Projection Tool. URL: https://www.epa.gov/statelocalenergy/download-state-inventory-and-projection-tool

[130] EPA. 2023. Methodology Report: Inventory of U.S. Greenhouse Gas Emissions and Sinks by State: 1990–2021. U.S. Environmental Protection Agency, EPA-430-R-23-003. https://www.epa.gov/ghgemissions/state-ghg-emissionsand-removals

[131] EPA (2023) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021. U.S. Environmental Protection Agency, EPA 430-R-23-002. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and- sinks-1990-2021.

[132] EPA. 2023. Methodology Report: Inventory of U.S. Greenhouse Gas Emissions and Sinks by State: 1990–2021. U.S. Environmental Protection Agency, EPA-430-R-23-003. https://www.epa.gov/ghgemissions/state-ghg-emissionsand-removals

[133] EPA. 2023. Methodology Report: Inventory of U.S. Greenhouse Gas Emissions and Sinks by State: 1990–2021. U.S. Environmental Protection Agency, EPA-430-R-23-003. https://www.epa.gov/ghgemissions/state-ghg-emissionsand-removals

5.11 N_2O from Product Uses

5.11.1 Data

Data on GHG emissions from N_2O from Product Uses were only available from the EPA's *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021*[134] for the state of Arizona.[135]

5.11.2 Statewide GHG Emissions Estimation Method

These emissions are not modeled by EPA SIT.[136] GHG emissions were utilized from the existing EPA GHG inventory for the *Arizona PCAP GHG Inventory.*[137] and will be revisited during the *Arizona CCAP GHG Inventory*.

5.11.3 County-Level Downscaling Method

EPA downscales N_2O from Product Uses from the national-level to the state-level using population as a primary indicator. Population was used as an indicator in the *Arizona PCAP GHG Inventory* to downscale statewide data to the county-level.

5.12 Other Process Uses of Carbonates

5.12.1 Data

Data on GHG emissions from this industrial process were only available from the EPA's *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021*[138] for the state of Arizona.[139]

5.12.2 Statewide GHG Emissions Estimation Method

These emissions are not modeled by EPA SIT.[140] GHG emissions were utilized from the existing EPA GHG inventory for the *Arizona PCAP GHG Inventory*[141] and will be revisited during the *Arizona CCAP GHG Inventory*.

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[134] EPA (2023) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021. U.S. Environmental Protection Agency, EPA 430-R-23-002. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and- sinks-1990-2021.

[135] EPA. 2023. Methodology Report: Inventory of U.S. Greenhouse Gas Emissions and Sinks by State: 1990–2021. U.S. Environmental Protection Agency, EPA-430-R-23-003. https://www.epa.gov/ghgemissions/state-ghg-emissionsand-removals

[136] EPA (2024). State Inventory and Projection Tool. URL: https://www.epa.gov/statelocalenergy/download-state-inventory-and-projection-tool

[137] EPA. 2023. Methodology Report: Inventory of U.S. Greenhouse Gas Emissions and Sinks by State: 1990–2021. U.S. Environmental Protection Agency, EPA-430-R-23-003. https://www.epa.gov/ghgemissions/state-ghg-emissionsand-removals

[138] EPA (2023) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021. U.S. Environmental Protection Agency, EPA 430-R-23-002. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and- sinks-1990-2021.

[139] EPA. 2023. Methodology Report: Inventory of U.S. Greenhouse Gas Emissions and Sinks by State: 1990–2021. U.S. Environmental Protection Agency, EPA-430-R-23-003. https://www.epa.gov/ghgemissions/state-ghg-emissionsand-removals

[140] EPA (2024). State Inventory and Projection Tool. URL: https://www.epa.gov/statelocalenergy/download-state-inventory-and-projection-tool

[141] EPA. 2023. Methodology Report: Inventory of U.S. Greenhouse Gas Emissions and Sinks by State: 1990–2021. U.S. Environmental Protection Agency, EPA-430-R-23-003. https://www.epa.gov/ghgemissions/state-ghg-emissionsand-removals

5.12.3 County-Level Downscaling Method

EPA downscales Other Process Use of Carbonates from the national-level to the state-level using population as a primary indicator. Population was used as an indicator in the *Arizona PCAP GHG Inventory* to downscale statewide data to the county-level.

5.13 Carbide Production and Consumption

5.13.1 Data

Data on GHG emissions from carbide production and consumption were only available from the EPA's *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021*[142] for the state of Arizona.[143]

5.13.2 Statewide GHG Emissions Estimation Method

These emissions are not modeled by EPA SIT.[144] GHG emissions were utilized from the existing EPA GHG inventory for the *Arizona PCAP GHG Inventory*[145] and will be revisited during the *Arizona CCAP GHG Inventory*.

5.13.3 County-Level Downscaling Method

EPA downscales Carbide Production and Consumption from the national-level to the state-level using population as a primary indicator. Population was used as an indicator in the *Arizona PCAP GHG Inventory* to downscale statewide data to the county-level.

6 Waste

6.1 Data

Waste GHG emissions data were obtained from federal and local sources. Federal sources included the EPA GHGRP.

Landfills CO_2, CH_4, N_2O, and biogenic CO_2 as part of Subpart HH (Municipal Solid Waste) and Subpart TT (Industrial Waste Landfills) of the EPA GHGRP. Subpart HH[146] and

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[142] EPA (2023) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021. U.S. Environmental Protection Agency, EPA 430-R-23-002. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and- sinks-1990-2021.

[143] EPA. 2023. Methodology Report: Inventory of U.S. Greenhouse Gas Emissions and Sinks by State: 1990–2021. U.S. Environmental Protection Agency, EPA-430-R-23-003. https://www.epa.gov/ghgemissions/state-ghg-emissionsand-removals

[144] EPA (2024). State Inventory and Projection Tool. URL: https://www.epa.gov/statelocalenergy/download-state-inventory-and-projection-tool

[145] EPA. 2023. Methodology Report: Inventory of U.S. Greenhouse Gas Emissions and Sinks by State: 1990–2021. U.S. Environmental Protection Agency, EPA-430-R-23-003. https://www.epa.gov/ghgemissions/state-ghg-emissionsand-removals

[146] EPA (2024). GHG Query Builder. Municipal Solid Waste Landfills: hh_subpart_level_information. URL: https://enviro.epa.gov/query-builder/ghg/MUNICIPAL%20SOLID%20WASTE%20LANDFILLS/HH_SUBPART_LEVEL_INFORMATION

Subpart TT[147] data for Arizona were obtained directly from the EPA via the GHG Query Builder. Since GHGRP Subpart HH and Subpart T only requires reporting by facilities that emit >25,000 CO_2e, some landfills from this dataset.

The list of landfills of reporting to the EPA GHGRP were compared against of statewide solid waste facilities and other GHG emissions inventories for completeness. If a landfill was missing from the GHGRP generated list, and GHG emissions data was available for a local source, GHGRP data were supplemented with local data.

Landfills included in the *Arizona PCAP GHG Inventory* are listed in Table 10. Table 10 also contains the data source for each landfill GHG emissions estimate and the year of the estimate. Some smaller landfills were only inventoried for 2020 and not updated for 2021. These emissions totals will be updated for the *Arizona CCAP GHG Inventory*.

Table 13. Landfills Included in the Arizona PCAP GHG Inventory

Landfill Name	County	Year	Data Source
Coronado Generating Station	Apache	2021	EPA GHGRP Subpart HH
City Of Flagstaff – Cinder Lake Landfill	Coconino	2021	EPA GHGRP Subpart HH
La Paz County Landfill	La Paz	2021	EPA GHGRP Subpart HH
19th Avenue	Maricopa	2020	City of Phoenix 2020 GHG Inventory[148]
Butterfield Station Landfill	Maricopa	2021	EPA GHGRP Subpart HH
Cave Creek MSW Landfill	Maricopa	2021	EPA GHGRP Subpart HH
City Of Chandler Landfill	Maricopa	2021	EPA GHGRP Subpart HH
City Of Glendale – Landfill	Maricopa	2021	EPA GHGRP Subpart HH
City Of Phoenix – Skunk Creek Landfill	Maricopa	2021	EPA GHGRP Subpart HH
City Of Phoenix 27th Ave Landfill	Maricopa	2021	EPA GHGRP Subpart HH
Deer Valley	Maricopa	2020	City of Phoenix 2020 GHG Inventory[149]
Del Rio	Maricopa	2020	City of Phoenix 2020 GHG Inventory[150]
Estes	Maricopa	2020	City of Phoenix 2020 GHG Inventory[151]
Lone Cactus Landfill	Maricopa	2021	EPA GHGRP Subpart HH
North Center Street Landfill	Maricopa	2021	EPA GHGRP Subpart HH
Northwest Regional Landfill	Maricopa	2021	EPA GHGRP Subpart HH
Queen Creek MSW Landfill	Maricopa	2021	EPA GHGRP Subpart HH
Salt River Landfill	Maricopa	2021	EPA GHGRP Subpart HH
Southwest Regional Landfill	Maricopa	2021	EPA GHGRP Subpart HH

[147] EPA (2024). GHG Query Builder. Industrial Waste Landfills: tt_subpart_ghg_info. URL: https://enviro.epa.gov/query-builder/ghg/INDUSTRIAL%20WASTE%20LANDFILLS/TT_SUBPART_GHG_INFO
[148] City of Phoenix 2020 Greenhouse Gas Emissions Inventory for Government Operations. URL: https://www.phoenix.gov/oepsite/Documents/2020-Government-Ops-GHG-Report-FINAL.pdf
[149] City of Phoenix 2020 Greenhouse Gas Emissions Inventory for Government Operations. URL: https://www.phoenix.gov/oepsite/Documents/2020-Government-Ops-GHG-Report-FINAL.pdf
[150] City of Phoenix 2020 Greenhouse Gas Emissions Inventory for Government Operations. URL: https://www.phoenix.gov/oepsite/Documents/2020-Government-Ops-GHG-Report-FINAL.pdf
[151] City of Phoenix 2020 Greenhouse Gas Emissions Inventory for Government Operations. URL: https://www.phoenix.gov/oepsite/Documents/2020-Government-Ops-GHG-Report-FINAL.pdf

SR-85 Landfill	Maricopa	2021	EPA GHGRP Subpart HH
Tri Cities Landfill	Maricopa	2021	EPA GHGRP Subpart HH
Lake Havasu Landfill	Mohave	2021	EPA GHGRP Subpart HH
Mohave Valley Landfill	Mohave	2021	EPA GHGRP Subpart HH
Novo Biopower	Navajo	2021	EPA GHGRP Subpart TT
Painted Desert Landfill	Navajo	2021	EPA GHGRP Subpart HH
Harrison Landfill	Pima	2021	EPA GHGRP Subpart HH
Los Reales Landfill	Pima	2021	EPA GHGRP Subpart HH
Marana Regional Landfill	Pima	2021	EPA GHGRP Subpart HH
Tangerine Landfill	Pima	2021	EPA GHGRP Subpart HH
Apache Junction Landfill	Pinal	2021	EPA GHGRP Subpart HH
Cactus Landfill	Pinal	2021	EPA GHGRP Subpart HH
Casa Grande Landfill	Pinal	2020	Maricopa County GHG Inventory[152]
Durham Regional Landfill	Pinal	2021	EPA GHGRP Subpart HH
Ironwood Landfill	Pinal	2021	EPA GHGRP Subpart HH
Sierra Estrella Landfill	Pinal	2020	Maricopa County GHG Inventory[153]
Gray Wolf Regional Landfill	Yavapai	2021	EPA GHGRP Subpart HH
Copper Mountain Landfill	Yuma	2021	EPA GHGRP Subpart HH
South Yuma County Landfill	Yuma	2021	EPA GHGRP Subpart HH

6.2 Statewide GHG Emissions Estimation Method

EPA GHGRP Subparts HH and TT and local data are facility-level GHG emissions data. Data obtained from these sources were summarized up to the state-level. CH_4 and N_2O emissions were multiplied by IPCC AR5 GWPs to obtained CO_2e emissions.

Landfill GHG emissions were compared with results obtained from EPA SIT.[154]

6.3 County-Level Downscaling Method

GHG emissions from landfills (GHGRP Subparts HH and TT) are reported at the facility-level. Facility-level GHG emissions data is aggregated up to the county-level.

7 Wastewater

7.1 Data

Statewide data on wastewater treatment facilities, technologies, and the prevalence of septic systems were surveyed. Given the lack of currently available data, the *Arizona PCAP GHG Inventory* utilizes estimates developed by the EPA for the *Inventory of U.S.*

[152] Maricopa Association of Governments. Maricopa-Pinal County Region 2020 Greenhouse Gas Emissions Inventory. February 2024.
[153] Maricopa Association of Governments. Maricopa-Pinal County Region 2020 Greenhouse Gas Emissions Inventory. February 2024.
[154] EPA (2024). State Inventory and Projection Tool. URL: https://www.epa.gov/statelocalenergy/download-state-inventory-and-projection-tool

Greenhouse Gas Emissions and Sinks: 1990-2021[155] for the state of Arizona.[156] Wastewater treatment data will be developed for the *Arizona CCAP GHG Inventory*.

7.2 Statewide GHG Emissions Estimation Method

Wastewater GHG emissions were compared with results obtained from EPA SIT.[157]

7.3 County-Level Downscaling Method

Population is used as an indicator to downscale state-level data to the county-level. In other words, the generation of wastewater and the resulting GHG emissions occurs proportionally with population levels. The *Arizona CCAP GHG Inventory* will pursue wastewater utility data and septic population data to improve GHG emissions estimates. Comprehensive statewide utility data collection was not feasible during the compressed PCAP timeline.

8 Agriculture

8.1 Data

Statewide data on agricultural activities were surveyed. Given the lack of currently available data, the *Arizona PCAP GHG Inventory* utilizes estimates developed by the EPA for the *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021*[158] for the state of Arizona.[159] Agriculture data will be developed for the *Arizona CCAP GHG Inventory*.

8.2 Statewide GHG Emissions Estimation Method

Agriculture GHG emissions were compared with results obtained from EPA SIT.[160]

8.3 County-Level Downscaling Method

County-wide acres of cropland and grassland were used as an indicator for county-level downscaling N_2O emissions from agricultural lands. County-level cattle population is used as an indicator to downscale livestock-based GHG emissions. Statewide agriculture experts will be consulted on how to improve existing data and methods during the *Arizona*

[155] EPA (2023) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021. U.S. Environmental Protection Agency, EPA 430-R-23-002. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and- sinks-1990-2021.

[156] EPA. 2023. Methodology Report: Inventory of U.S. Greenhouse Gas Emissions and Sinks by State: 1990–2021. U.S. Environmental Protection Agency, EPA-430-R-23-003. https://www.epa.gov/ghgemissions/state-ghg-emissionsand-removals

[157] EPA (2024). State Inventory and Projection Tool. URL: https://www.epa.gov/statelocalenergy/download-state-inventory-and-projection-tool

[158] EPA (2023) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021. U.S. Environmental Protection Agency, EPA 430-R-23-002. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and- sinks-1990-2021.

[159] EPA. 2023. Methodology Report: Inventory of U.S. Greenhouse Gas Emissions and Sinks by State: 1990–2021. U.S. Environmental Protection Agency, EPA-430-R-23-003. https://www.epa.gov/ghgemissions/state-ghg-emissionsand-removals

[160] EPA (2024). State Inventory and Projection Tool. URL: https://www.epa.gov/statelocalenergy/download-state-inventory-and-projection-tool

CCAP GHG Inventory. Comprehensive statewide engagement with agricultural experts was not feasible during the compressed PCAP timeline. Subject matter experts from Arizona Cooperative Extension were consulted with regarding the availability of agriculture datasets and the appropriateness of soil N_2O emissions models for Arizona's climate.

9 Substitution of Ozone-Depleting Substances

9.1 Data

Statewide data on substitution of ozone depleting substances (ODS) were surveyed. Given the lack of currently available data, the *Arizona PCAP GHG Inventory* utilizes estimates developed by the EPA for the *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021*[161] for the state of Arizona.[162] ODS data will be developed for the *Arizona CCAP GHG Inventory*, but if no additional data are discovered, the state inventory will default to EPA estimates for the State of Arizona.

9.2 Statewide GHG Emissions Estimation Method

ODS GHG emissions were not able to be compared with results obtained from EPA SIT.[163] However, EPA SIT had errors within its ODS module.

9.3 County-Level Downscaling Method

EPA downscales ODS from the national-level to the state-level using population as a primary indicator. Population was used as an indicator in the *Arizona PCAP GHG Inventory* to downscale statewide data to the county-level.

10 Natural and Working Lands

10.1 Data

Given the lack of currently available data, the *Arizona PCAP GHG Inventory* utilizes estimates developed by the EPA for the *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021*[164] for the state of Arizona.[165] Natural and Working Lands data will be developed for the *Arizona CCAP GHG Inventory*. One caveat to this is that GHG

[161] EPA (2023) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021. U.S. Environmental Protection Agency, EPA 430-R-23-002. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and- sinks-1990-2021.

[162] EPA. 2023. Methodology Report: Inventory of U.S. Greenhouse Gas Emissions and Sinks by State: 1990–2021. U.S. Environmental Protection Agency, EPA-430-R-23-003. https://www.epa.gov/ghgemissions/state-ghg-emissionsand-removals

[163] EPA (2024). State Inventory and Projection Tool. URL: https://www.epa.gov/statelocalenergy/download-state-inventory-and-projection-tool

[164] EPA (2023) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 19902021. U.S. Environmental Protection Agency, EPA 430-R-23-002. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and- sinks-1990-2021.

[165] EPA. 2023. Methodology Report: Inventory of U.S. Greenhouse Gas Emissions and Sinks by State: 1990–2021. U.S. Environmental Protection Agency, EPA-430-R-23-003. https://www.epa.gov/ghgemissions/state-ghg-emissionsand-removals

emissions from wildfires and prescribed burns were estimated from the 2020 National Emissions Inventory.

10.2 Statewide GHG Emissions Estimation Method

Natural and Working Lands GHG emissions were compared with results obtained from EPA SIT. Wildfire GHG emissions for 2021 were estimated from the 2020 NEI and scaling by the number of acres burned in each year.[166]

10.3 County-Level Downscaling Method

GHG emissions from Natural and Working Lands were not downscaled to the county-level due to a lack of appropriate data for downscaling. Sector experts will be sought out for guidance during the *Arizona CCAP GHG Inventory.*

[166] Arizona Department of Forestry and Fire Management (2024. Arizona State Wildfire Information. URL: https://dffm.az.gov/intelligence

Appendix G – Detailed Results from the *Arizona PCAP GHG Inventory*

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1 Overview

The Governor's Office of Resiliency, in conjunction with Northern Arizona University, has developed a statewide inventory of GHG emissions across Arizona to support the Preliminary Climate Action Plan (PCAP). The *Arizona PCAP GHG Inventory* sets a baseline year of 2000 and a reporting year of 2021.[1] The baseline year of 2000 was set to provide continuity from Arizona's previous climate action plan published in 2006. The Arizona Climate Change Advisory Group's *Climate Change Action Plan* provided an overarching recommendation to reduce statewide GHG emissions to 2000 levels by 2020.[2]

The *Arizona PCAP GHG Inventory* categorizes GHG emissions into sectors that group emissions based on they occur. The GHG emissions sectors listed in Table 1 were chosen to provide a comprehensive summary of where and how GHGs are emitted in Arizona. In addition to the major GHGs -- carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) – minor GHGs were also inventoried (Table 1).

Table 1. GHG Emissions Sectors and GHGs Inventoried by the Arizona PCAP GHG Inventory

GHG Emissions Sector	***Greenhouse Gases (across all sectors)***
1. Transportation	• carbon dioxide (CO_2),
2. Electricity generation and/or use	• methane (CH_4),
3. Natural and working lands	• nitrous oxide (N_2O),
4. Industry	• hydrofluorocarbons (HFCs),
5. Agriculture	• perfluorocarbons (PFCs),
6. Commercial and residential buildings	• sulfur hexafluoride (SF_6), and
7. Waste and materials management	• nitrogen trifluoride (NF_3)
8. Water	
9. Wastewater	

The *Arizona PCAP GHG Inventory* is an initial inventory of GHG emissions across Arizona. It will be updated and built out further throughout the Climate Pollution Reduction Grant (CPRG) project, which includes the Comprehensive Climate Action Plan (CCAP) and Status Update phases. The goal of the *Arizona PCAP GHG Inventory* was to develop a uniform and comprehensive approach to estimating GHG emissions across Arizona's diverse 15 counties. Therefore, datasets and methods that enabled the estimation of both statewide and county-level emissions were identified and utilized. These data sources included:

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[1] Inventorying more recent years will be considered during the Comprehensive Climate Action Plan (CCAP) phase of this project. The baseline year of 2021 was also chosen to reduce the impact of the COVID-19 pandemic on observed GHG emissions.

[2] Arizona Climate Change Advisory Group's *Climate Change Action Plan*. August 2006. URL: https://www.documentcloud.org/documents/4953066-AZ-Climate-Change-Action-Plan-2006

- State-level GHG inventories prepared by the EPA[3]
- Data reported to the EPA's Greenhouse Gas Reporting Program
    - Subpart C - General Stationary Fuel Combustion Sources[4]
    - Subpart DD - Use of Electric Transmission and Distribution Equipment
    - Subpart H - Cement Production[5]
    - Subpart HH - Municipal Solid Waste[6]
    - Subpart I - Electronics Manufacturing[7]
    - Subpart Q - Iron and Steel Production[8]
    - Subpart S - Lime Manufacturing[9]
    - Subpart TT - Industrial Waste Landfills[10]
    - Subpart V - Nitric Acid Production[11]
    - Subpart W - Petroleum and Natural Gas Systems[12]
- EPA Facility Level Information on Greenhouse Gas Tool[13]
- EPA National Emissions Inventory[14]

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[3] EPA (2023) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021. U.S. Environmental Protection Agency, EPA 430-R-23-002. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and- sinks-1990-2021.

[4] EPA (2024). GHG Query Builder. General Stationary Fuel Combustion Sources. URL: https://enviro.epa.gov/query-builder/ghg/GENERAL%20STATIONARY%20FUEL%20COMBUSTION%20SOURCES

[5] EPA (2024). GHG Query Builder. Cement Production: h_subpart_level_information. URL: https://enviro.epa.gov/query-builder/ghg/CEMENT%20PRODUCTION/H_SUBPART_LEVEL_INFORMATION/

[6] EPA (2024). GHG Query Builder. Municipal Solid Waste Landfills: hh_subpart_level_information. URL: https://enviro.epa.gov/query-builder/ghg/MUNICIPAL%20SOLID%20WASTE%20LANDFILLS/HH_SUBPART_LEVEL_INFORMATION

[7] EPA (2024). GHG Query Builder. Electronics Manufacture: mv_ef_i_emissions_by_ghg. URL: https://enviro.epa.gov/query-builder/ghg/ELECTRONICS%20MANUFACTURE/MV_EF_I_EMISSIONS_BY_GHG

[8] EPA (2024). GHG Query Builder. Iron and Steel Production: q_subpart_level_information. URL: https://enviro.epa.gov/query-builder/ghg/IRON%20AND%20STEEL%20PRODUCTION/Q_SUBPART_LEVEL_INFORMATION

[9] EPA (2024). GHG Query Builder. Iron and Steel Production: q_subpart_level_information. URL: https://enviro.epa.gov/query-builder/ghg/IRON%20AND%20STEEL%20PRODUCTION/Q_SUBPART_LEVEL_INFORMATION

[10] EPA (2024). GHG Query Builder. Industrial Waste Landfills: tt_subpart_ghg_info. URL: https://enviro.epa.gov/query-builder/ghg/INDUSTRIAL%20WASTE%20LANDFILLS/TT_SUBPART_GHG_INFO

[11] EPA (2024). GHG Query Builder. Nitric Acid Production: v_subpart_level_information. URL: https://enviro.epa.gov/query-builder/ghg/NITRIC%20ACID%20PRODUCTION/V_SUBPART_LEVEL_INFORMATION

[12] EPA (2024). GHG Query Builder. Petroleum and Natural Gas Systems (RY 2011-2014): w_subpart_level_information. URL: https://enviro.epa.gov/query-builder/ghg/PETROLEUM%20AND%20NATURAL%20GAS%20SYSTEMS%20(RY%202011-2014)/W_SUBPART_LEVEL_INFORMATION

[13] EPA (2024). Facility Level Information on Greenhouse Gas Tool. URL: https://ghgdata.epa.gov/ghgp/main.do

[14] EPA (2024). Online 2020 NEI Data Retrieval Tool. URL: https://awsedap.epa.gov/public/single/?appid=20230c40-026d-494e-903f-3f112761a208&sheet=5d3fdda7-14bc-4284-a9bb-cfd856b9348d&opt=ctxmenu,currsel

GHG emissions factor data were obtained from the following sources:

- EPA GHG Emissions Factor Hub[15]
- EPA Emissions & Generation Resource Integrated Database (eGRID)[16]
- EIA Form EIA-176, "Annual Report of Natural and Supplemental Gas Supply and Disposition"[17]
- EIA Form EIA-861, "Annual Electric Power Industry Report"[18]
- EIA Form EIA-923[19]
- EIA State Energy Data System[20]
- The National Renewable Energy Laboratory State and Local Planning for Energy (SLOPE) tool.[21]
- Data were also obtained from reports by Arizona Public Service and Salt River Project to the Edison Electricity Institute ESG Reporting Program[22] and the Climate Registry[23], respectively.

A full listing of datasets identified, and methods utilized, for each GHG emitting activity is provided in *Appendix G*.

The proposed methods and data sources were submitted to EPA in a Quality Assurance Project Plan (QAPP). QAPP approval by EPA was a prerequisite to beginning the GHG inventory process. Due to project timing for the PCAP-phase of the GHG inventory, the natural and working lands, waste and materials management, and wastewater treatment sectors were inventoried using high-level estimates. The water sector, which includes energy used to move and treat water in Arizona, was not inventoried as a distinct sector due to time constraints. These emissions are currently included in the industry and commercial and residential buildings sectors. The water sector will be built out during the CCAP phase.

The focus of *Arizona PCAP GHG Inventory* was to estimate GHG emissions where they occur; these emissions are typically called Scope 1 emissions. The CCAP and Status Updates phases will add additional complexity to the GHG inventory by accounting for GHG emissions induced by activities within a jurisdiction. Induced GHG emissions include

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[15] EPA Center for Corporate Climate Leadership. GHG Emissions Factors Hub. URL: https://www.epa.gov/climateleadership/ghg-emission-factors-hub
[16] EPA eGRID (2024). https://www.epa.gov/egrid
[17] Energy Information Administration (2024). Form EIA-176, "Annual Report of Natural and Supplemental Gas Supply and Disposition."
[18] Energy Information Administration (2024). Form EIA-861, “Annual Electric Power Industry Report.” URL: https://www.eia.gov/electricity/data/eia861/
[19] Energy Information Administration (2024). Form EIA-923, “detailed data with previous form data (EIA-906/920).” URL: https://www.eia.gov/electricity/data/eia923/
[20] Energy Information Administration (2024). Open Data. State Energy Data System API. URL: https://www.eia.gov/opendata/browser/seds?frequency=annual&data=value;&facets=stateId;&stateId=AZ;&start=2021&end=2021&sortColumn=period;&sortDirection=desc;.
[21] National Renewable Energy Laboratory. "Net Electricity and Natural Gas Consumption," State and Local Planning for Energy
[22] Pinnacle West Capital Corporation. ESG Reporting. URL: https://www.pinnaclewest.com/corporate-responsibility/esg-reporting/default.aspx
[23] The Climate Registry. Salt River Project. URL: https://theclimateregistry.org/members/salt-river-project/

those from electricity consumption or depositing solid waste in regional landfills; these emissions are called Scope 2 (electricity) and Scope 3 (indirect emissions), respectively. Accounting for Scope 2 and Scope 3 GHG emissions provides additional details on why GHG emissions occur across the state in addition to the where and how GHG emissions occur (Scope 1).

1.1 Findings

In 2021, Arizona emitted approximately 107.8 million metric tons of CO_2e across all GHG emissions sectors (Table 2). Further, between 2000 and 2021, Arizona's GHG emissions remained relatively flat, notching only a slight increase from the 107.7 million metric tons of CO_2e emitted in 2000.

Table 2. Statewide GHG Emissions by Inventory Sector

GHG Emissions Sector	GHG Emissions (million MT CO_2e)			% Change
	2000	2005	2021	
Transportation	34.36	38.98	42.84	24.7%
Electricity Generation	45.80	52.09	34.80	-24.0%
Natural and working lands[1]	2.53	2.70	3.88	53.6%
Industry	8.71	8.90	9.55	9.8%
Agriculture	7.46	7.79	7.53	1.0%
Commercial and residential buildings	4.63	4.72	6.90	49.1%
Waste and materials management[1]	3.63	3.68	1.52	-58.1%
Wastewater[1]	0.63	0.68	0.77	21.5%
Total	**107.7**	**119.5**	**107.8**	**0.1%**

[1]GHG Emissions Sectors to be refined during the *Arizona CCAP GHG Inventory*

During 2021, the transportation sector was the largest source of GHG emissions in Arizona. This sector encompasses all types of transportation activities, including on-road vehicles, non-road equipment, aviation, locomotives, and boats. By contrast, electricity generation was the largest statewide source of GHG emissions in 2000. Over the two decades between the baseline year and the 2021 study year, GHG emissions from transportation increased 24.7% while electricity generation emissions decreased 24%. Transportation sector GHG emissions, which are dominated by on-road passenger vehicles, have increased with population, though the rate of increase has decreased due to fuel efficiency gains.[24] GHG emissions from electricity generation have decreased as Arizona's electric utilities have reduced the GHG intensity of their generation fleet.[25] All other GHG emissions sectors increased between 2000 and 2021 except Waste and Material Management, which decreased 58.1%.Figure 1 shows how Arizona's GHG emissions have changed between 2000 and 2021.

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[24] U.S. Department of Transportation. Average Fuel Efficiency of U.S. Light Duty Vehicles. URL: https://www.bts.gov/content/average-fuel-efficiency-us-light-duty-vehicles

[25] EPA eGRID (2024). https://www.epa.gov/egrid

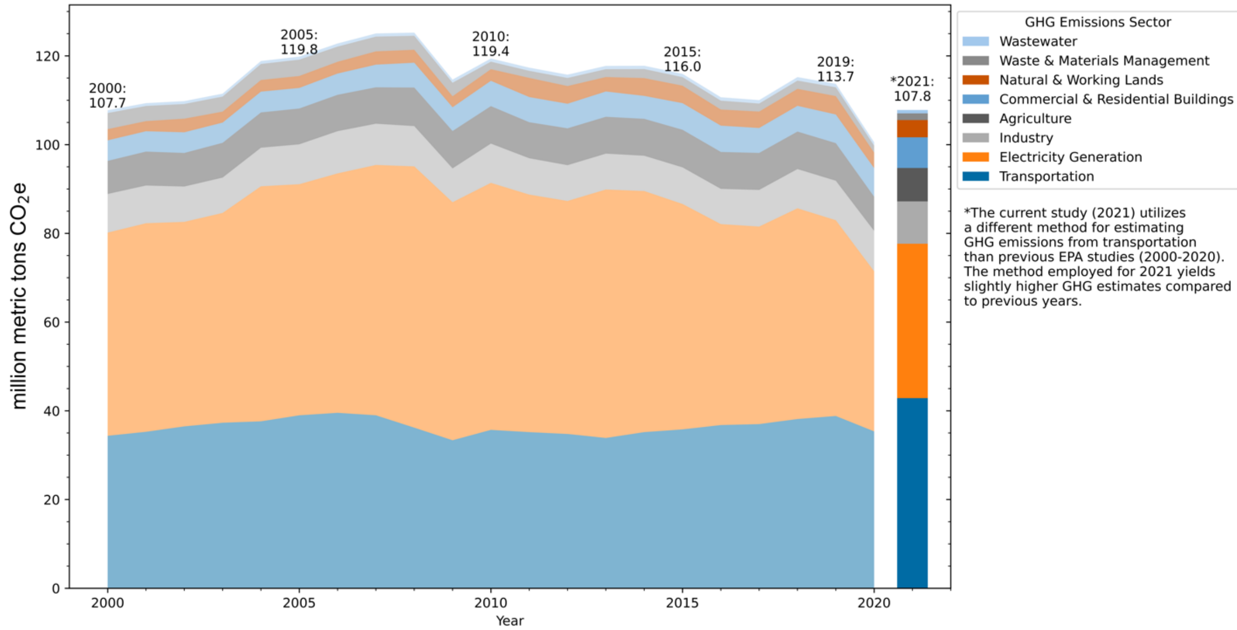

Figure 1. Statewide GHG Emissions Between 2000 and 2021

CO_2 is the primary GHG emitted in Arizona, followed by CH_4 and N_2O (Table 3). Transportation activities and electricity generation are the largest sources of CO_2 emissions. Agricultural activities, which include GHG emissions from livestock operations and soil management, are the largest sources of CH_4 and N_2O emissions in Arizona, respectively. Hydrofluorocarbon (HFC) emissions occur primarily from the substitution (replacement) of ozone depleting substances in air conditioning and refrigeration equipment. HFCs are also a significant source of statewide GHG emissions.

Table 3. Statewide GHG Emissions by Greenhouse Gas

GHG Inventory Emissions Sector	GHG Emissions (million MT CO_2e)							
	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	NF_3	Total
Transportation	42.07	0.042	0.336	0.392	–	–	–	**42.84**
Electricity Generation	34.67	0.058	0.078	–	–	–	–	**34.80**
Natural and working lands[1]	3.872	0.373	–	–	–	–	–	**3.882**
Industry	7.452	0.351	0.577	0.593	0.329	0.171	0.080	**9.555**
Agriculture	–	3.181	4.353	–	–	–	–	**7.534**
Commercial and residential buildings	5.637	0.002	0.004	1.261	–	–	–	**6.905**
Waste and materials management	–	1.518	–	–	–	–	–	**1.518**
Wastewater	–	0.312	0.458	–	–	–	–	**0.770**
Total	**93.70**	**5.838**	**5.807**	**2.247**	**0.329**	**0.171**	**0.080**	**107.8**

As noted in Table 2 and Table 3, transportation activities and electricity generation account for the vast majority (72%) of GHG emissions statewide (Figure 2). Industrial processes, agriculture, and direct combustion at commercial and residential buildings are the next largest sources of statewide GHG emissions. Emissions from natural and working lands, solid waste, and wastewater comprise <6% of the statewide total.

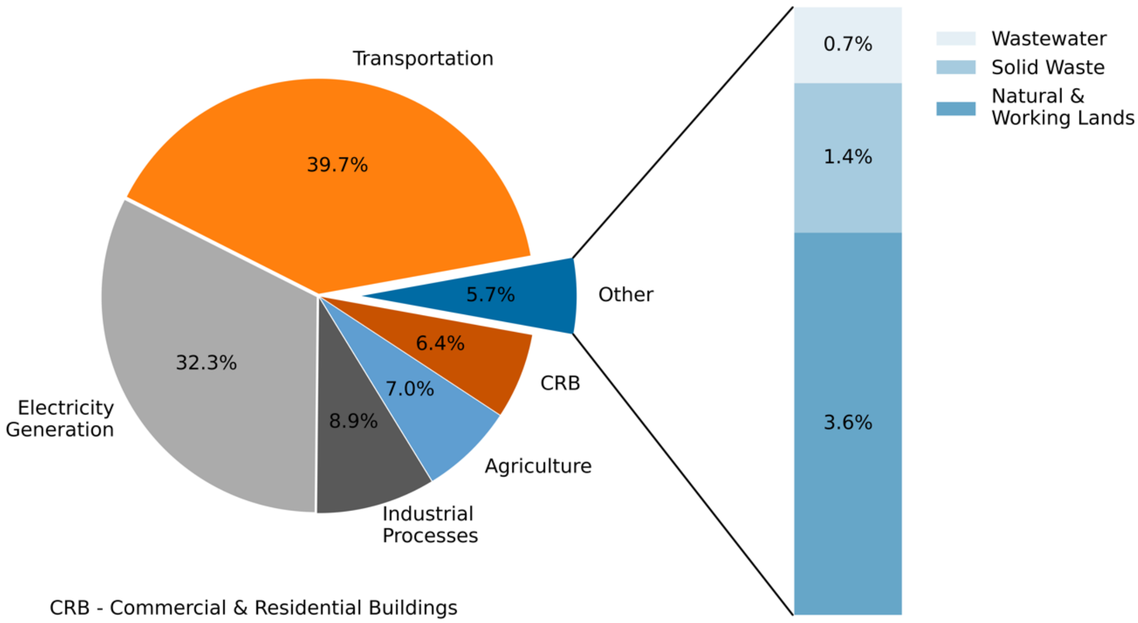

Figure 2. Relative Proportion of Statewide GHG Emissions by Emissions Sector

In 2021, Maricopa County emitted approximately 47% of the State's GHG emissions (

Table 4). Transportation-related activities in Maricopa County were the largest county-level source of GHG emissions. Electricity generation was the next largest source of direct GHG emissions at the county-level. Maricopa County and Apache County were the two largest sources of GHG emissions from electricity generation (

Table 4). GHG emissions from the natural and working lands emissions sector were estimated only at the state-level using approved EPA tools. County-level emissions from the natural working and lands emissions sector will be tabulated during the CCAP phase of the GHG inventory.

Table 4. Detailed GHG Emissions by Arizona County

County	GHG Emissions (million MT CO_2e)								
	Transportation	Electricity Generation	Natural and working lands[1]	Industry	Agriculture	Commercial and residential buildings	Waste and materials management	Wastewater	Total
Apache	0.573	12.31	NE[2]	0.180	0.135	0.042	0.000	0.007	**13.25**
Cochise	0.861	1.612	NE	0.498	1.086	0.129	0.000	0.013	**4.198**
Coconino	1.877	0.000	NE	0.486	0.163	0.226	0.108	0.016	**2.875**
Gila	0.443	0.000	NE	0.362	0.054	0.045	0.000	0.006	**0.909**
Graham	0.179	0.000	NE	0.014	0.275	0.033	0.000	0.004	**0.506**
Greenlee	0.070	0.000	NE	0.101	0.044	0.009	0.000	0.001	**0.225**
La Paz	0.621	0.000	NE	0.140	0.399	0.011	0.051	0.002	**1.223**
Maricopa	25.56	14.55	NE	4.148	1.631	4.014	0.640	0.476	**51.02**
Mohave	1.450	2.566	NE	0.222	0.127	0.169	0.022	0.023	**4.578**
Navajo	0.938	1.892	NE	0.094	0.097	0.124	0.108	0.011	**3.265**
Pima	4.663	0.472	NE	0.923	0.162	1.184	0.155	0.112	**7.672**
Pinal	2.246	1.158	NE	0.872	2.143	0.437	0.200	0.046	**7.103**
Santa Cruz	0.300	0.003	NE	0.034	0.060	0.048	0.000	0.005	**0.450**
Yavapai	2.157	0.000	NE	1.339	0.183	0.297	0.083	0.025	**4.085**
Yuma	0.903	0.243	NE	0.144	0.976	0.136	0.152	0.022	**2.576**
Total	**42.84**	**34.80**	**3.882**	**9.555**	**7.534**	**6.905**	**1.518**	**0.770**	**107.81**

[1]Statewide GHG Emissions were estimated using the EPA State Inventory Tool but were not estimated at the county-level. County-level estimates will be developed for the CCAP Phase.
[2]NE – Not Estimated

The data in Table 4 are shown in Figure 3 to visualize the relative magnitude of county-level GHG emissions by sector.[26] As shown in Figure 3, transportation-related activities in Maricopa County emit more GHG emissions than any other county in Arizona. GHG emissions from electricity generation in Maricopa County and Apache County are roughly equivalent and the next largest sources of statewide emissions. Pima County and Pinal County are the next largest county-level sources of GHG emissions; transportation-related activities are the largest source of GHG emissions in these counties.

[26] Emissions totals may not match between Table 4 and Figure 3 due to rounding.

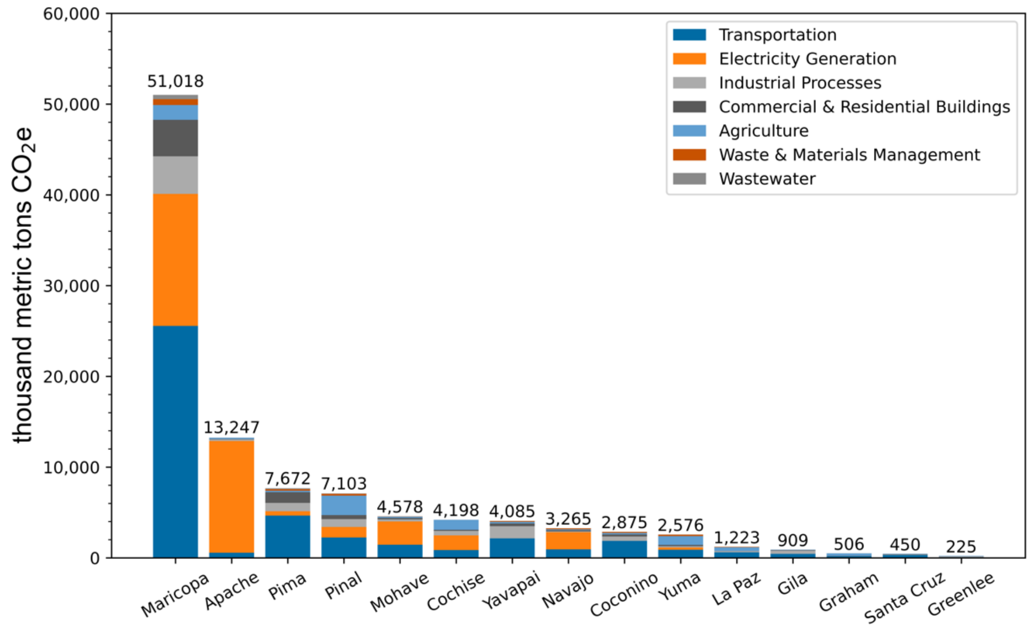

Figure 3. County-Level Direct GHG Emissions (Scope 1) Across Arizona

GHG emissions from electricity generation occurs due to electricity consumption. County-level electricity consumption is highly correlated with population in addition to commercial and industrial activities. Therefore, the GHG emissions from electricity generation that occur in Apache County (Figure 3) are induced by consumption in Arizona's more populous counties, and the greater Southwestern U.S. (Figure 4). As shown in Figure 4, Apache County becomes of one the smallest county-level sources of GHG emissions when accounting for electricity consumption rather electricity generation. The emissions totals of Pima County, Pinal County, Yavapai County, and Coconino County increase due to electricity consumption in these counties.

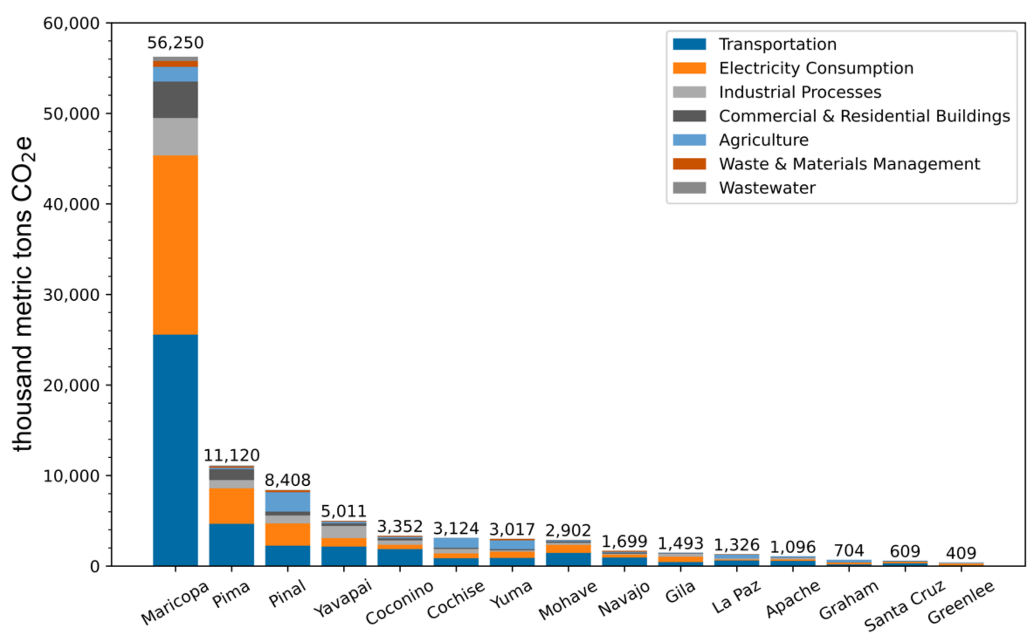

Figure 4. County-Level Direct and Indirect GHG Emissions (Scope 1 + Scope 2) Across Arizona

2 Transportation (Mobile Combustion)

Transportation is the largest source of GHG emissions in Arizona. Specifically, on-road transportation – gasoline-powered passenger cars and light-duty trucks – are among the largest GHG emissions sources in the state. GHG emissions from heavy-duty trucks, mostly diesel-fueled, are another significant contributor to statewide GHG emissions. Aviation and non-road transportation are also significant sources of transportation GHG.

The data shown in Table 5 summarizes mobile combustion GHG emissions by major categories – gasoline highway vehicles, diesel highway vehicles, non-highway vehicles (including aviation), and alternative fuel vehicles. GHG emissions shown in Table 5 were derived from the EPA SIT[27] vehicle miles traveled GHG emissions model. A VMT model was chosen for estimating Arizona's mobile combustion GHG emissions (specifically on-road) because it captures all activities in the state and is more comprehensive of transboundary road travel than a fuel-sales based approach. The EPA SIT was used over other VMT-based model due to the reproducibility of results compared to the EPA NEI VMT model, which utilizes input from proprietary data sources.

Table 5. Statewide Transportation GHG Emissions

Mobile Combustion	GHG Emissions (million MT CO_2e)			
	CO_2	CH_4	N_2O	CO_2e
Gasoline Highway	**21.99**	**0.017**	**0.112**	**22.12**
Passenger Cars	15.29	0.011	0.078	15.38
Light-Duty Trucks	6.309	0.005	0.030	6.344
Heavy-Duty Vehicles	0.321	0.001	0.004	0.326
Motorcycles	0.069	0.000	0.000	0.070
Diesel Highway	**11.58**	**0.003**	**0.080**	**11.67**
Passenger Cars	0.094	0.000	0.002	0.096
Light-Duty Trucks	0.257	0.000	0.003	0.261
Heavy-Duty Vehicles	10.73	0.002	0.070	10.80
Heavy-Duty Buses	0.500	0.000	0.006	0.506
Non-Highway	**8.463**	**0.021**	**0.144**	**8.627**
Aviation	5.259	0.001	0.043	5.303
Boats	0.170	0.003	0.000	0.173
Locomotives	0.093	0.000	0.001	0.094
Other	2.940	0.016	0.100	3.057
Alternative Fuel Vehicles	**0.037**	**0.002**	**0.000**	**0.039**
Light Duty Vehicles	0.001	0.000	0.000	0.001
Heavy Duty Vehicles	0.006	0.000	0.000	0.006
Buses	0.031	0.002	0.000	0.032
Total	**42.07**	**0.042**	**0.336**	**42.45**

[27] EPA (2024). State Inventory and Projection Tool. URL: https://www.epa.gov/statelocalenergy/download-state-inventory-and-projection-tool

Improvements to the current on-road VMT model will be explored during the *Arizona CCAP GHG Inventory.* These improvements will focus on providing greater resolution on on-road and nonroad vehicle types to align more closely with the vehicle categories in the EPA NEI mobile GHG emissions categories.

The *Arizona PCAP GHG Inventory* utilizes a fuel sales approach for aviation emissions, which is methodologically similar to the EPA SIT. The EPA NEI utilizes the FAA Aviation Environmental Design Tool (AEDT) to estimate GHG emissions.[28] A notable difference exists between the fuel sales approach and GHG emissions estimates from the AEDT, and thus the EPA NEI. The fuel sales approach attributes all GHG emissions from Jet Fuel and Aviation Gasoline dispensed to an aircraft to the airport at which it was dispensed. However, the AEDT only attributes GHG emissions from landing and takeoff operations (LTOs) to an airport. The LTO-based approach employed by the AEDT is in line with IPCC methods.[29] The fuel sales approach was utilized for the *Arizona PCAP GHG Inventory* due to time constraints and the AEDT will be used for the *Arizona CCAP GHG Inventory*.

The data in Table 6 shows county-level GHG emissions from transportation. GHG emissions from gasoline and diesel vehicles in Maricopa County (19.35 million MT CO_2e) are larger than GHG emissions totals from all other Arizona counties (Table 4).

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[28] Eastern Research Group, Inc. (2022). 2020 National Emissions Inventory: Aviation Component. URL: https://www.epa.gov/system/files/documents/2023-01/2020%20NEI%20Aviation%20Documentation%20Revised%20-%2010252022.pdf

[29] IPCC Aircraft Emissions. Page 95, Figure 1. URL: https://www.ipcc-nggip.iges.or.jp/public/gp/bgp/2_5_Aircraft.pdf

Table 6. County-Level Transportation Sector GHG Emissions

Mobile Combustion	GHG Emissions (million MT CO_2e)															
	Apache	Cochise	Coconino	Gila	Graham	Greenlee	La Paz	Maricopa	Mohave	Navajo	Pima	Pinal	Santa Cruz	Yavapai	Yuma	Total
Gasoline Highway	**0.339**	**0.507**	**0.909**	**0.262**	**0.105**	**0.041**	**0.369**	**12.67**	**0.840**	**0.555**	**2.438**	**1.321**	**0.177**	**1.057**	**0.530**	**22.12**
Passenger Cars	0.236	0.352	0.632	0.182	0.073	0.029	0.257	8.808	0.584	0.386	1.695	0.918	0.123	0.735	0.368	15.38
Light-Duty Trucks	0.097	0.145	0.261	0.075	0.030	0.012	0.106	3.634	0.241	0.159	0.699	0.379	0.051	0.303	0.152	6.344
Heavy-Duty Vehicles	0.005	0.007	0.013	0.004	0.002	0.001	0.005	0.187	0.012	0.008	0.036	0.019	0.003	0.016	0.008	0.326
Motorcycles	0.001	0.002	0.003	0.001	0.000	0.000	0.001	0.040	0.003	0.002	0.008	0.004	0.001	0.003	0.002	0.070
Diesel Highway	**0.179**	**0.267**	**0.479**	**0.138**	**0.055**	**0.022**	**0.195**	**6.682**	**0.443**	**0.293**	**1.286**	**0.697**	**0.093**	**0.558**	**0.279**	**11.67**
Passenger Cars	0.001	0.002	0.004	0.001	0.000	0.000	0.002	0.055	0.004	0.002	0.011	0.006	0.001	0.005	0.002	0.096
Light-Duty Trucks	0.004	0.006	0.011	0.003	0.001	0.000	0.004	0.149	0.010	0.007	0.029	0.016	0.002	0.012	0.006	0.261
Heavy-Duty Vehicles	0.166	0.248	0.444	0.128	0.051	0.020	0.180	6.188	0.410	0.271	1.191	0.645	0.086	0.516	0.259	10.80
Heavy-Duty Buses	0.008	0.012	0.021	0.006	0.002	0.001	0.008	0.290	0.019	0.013	0.056	0.030	0.004	0.024	0.012	0.506
Non-Highway	**0.051**	**0.079**	**0.479**	**0.040**	**0.016**	**0.006**	**0.056**	**5.945**	**0.153**	**0.084**	**0.878**	**0.203**	**0.027**	**0.527**	**0.081**	**8.627**
Aviation	0.000	0.003	0.343	0.001	0.000	0.000	0.000	4.041	0.027	0.001	0.512	0.005	0.001	0.368	0.002	5.303
Boats	0.003	0.004	0.007	0.002	0.001	0.000	0.003	0.099	0.007	0.004	0.019	0.010	0.001	0.008	0.004	0.173
Locomotives	0.001	0.002	0.004	0.001	0.000	0.000	0.002	0.054	0.004	0.002	0.010	0.006	0.001	0.004	0.002	0.094
Other	0.047	0.070	0.126	0.036	0.015	0.006	0.051	1.751	0.116	0.077	0.337	0.183	0.024	0.146	0.073	3.057
Alternative Fuel Vehicles	**0.001**	**0.001**	**0.002**	**0.000**	**0.000**	**0.000**	**0.001**	**0.022**	**0.001**	**0.001**	**0.004**	**0.002**	**0.000**	**0.002**	**0.001**	**0.039**
Light Duty Vehicles	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001
Heavy Duty Vehicles	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.006
Buses	0.000	0.001	0.001	0.000	0.000	0.000	0.001	0.018	0.001	0.001	0.004	0.002	0.000	0.002	0.001	0.032
Total	0.570	0.854	1.869	0.440	0.177	0.070	0.620	25.32	1.438	0.932	4.606	2.223	0.298	2.144	0.891	42.45

3 Electricity Generation

Electricity generation is the second largest source of GHG emissions in Arizona and approximately 32% of overall statewide GHG emissions. Maricopa County and Apache County are the two largest sources of GHG emissions from power plants, accounting for 40% and 36% of these emissions statewide, respectively.

Electricity generation data for the State of Arizona were obtained from multiple federal sources. Federal data sources included EIA Form EIA-923[30], EPA eGRID[31], and the EPA GHGRP Subpart D.[32]

Table 7. GHG Emissions from Electricity Generation

County	EIA Form EIA-923	EPA GHGRP Subpart D	EPA eGRID
Apache	12.31	12.44	12.43
Cochise	1.612	1.671	1.670
Coconino	0.000	0.000	0.000
Gila	0.000	0.000	0.000
Graham	0.000	0.000	0.000
Greenlee	0.000	0.000	0.000
La Paz	0.000	0.000	0.000
Maricopa	14.55	13.97	15.16
Mohave	2.566	2.531	2.531
Navajo	1.892	2.291	2.293
Pima	0.472	0.277	0.300
Pinal	1.158	1.206	1.206
Santa Cruz	0.003	0.000	0.003
Yavapai	0.000	0.000	0.000
Yuma	0.243	0.219	0.213
Total	**34.80**	**34.60**	**35.81**

Electricity generation GHG emissions in Apache County are induced by electricity consumption in the Phoenix and Tucson metropolitan areas stretching from Maricopa to Pima counties -- in addition to electricity demand across the greater U.S. Southwest. Table 8 shows county-level differences in GHG emissions between electricity generation and electricity consumption.

[30] Energy Information Administration (2024). Form EIA-923, "detailed data with previous form data (EIA-906/920)." URL: https://www.eia.gov/electricity/data/eia923/

[31] EPA eGRID (2024). https://www.epa.gov/egrid

[32] EPA (2024). GHG Query Builder. Electricity Generation: d_subpart_level_information. URL: https://enviro.epa.gov/query-builder/ghg/ELECTRICITY%20GENERATION/D_SUBPART_LEVEL_INFORMATION.

Table 8. Comparison of County-level GHG Emissions from Electricity Generation and Electricity Consumption

County	GHG Emissions (million MT CO_2e)	
	Electricity Generation (Form EIA-923)	Electricity Consumption (Form EIA-861)
Apache	12.31	0.153
Cochise	1.612	0.520
Coconino	NO	0.460
Gila	NO	0.565
Graham	NO	0.191
Greenlee	NO	0.178
La Paz	NO	0.099
Maricopa	14.55	19.11
Mohave	2.566	0.860
Navajo	1.892	0.315
Pima	0.472	3.787
Pinal	1.158	2.379
Santa Cruz	0.003	0.156
Yavapai	NO	0.895
Yuma	0.243	0.662
Total	**34.80**	**30.32**

The results shown in Table 8 are shown as relative changes in county-level GHG emissions in Figure 5. In addition to Apache County, Cochise County, Mohave County, and Navajo County all emit more GHG emissions from electricity generation than electricity consumption (Figure 5).

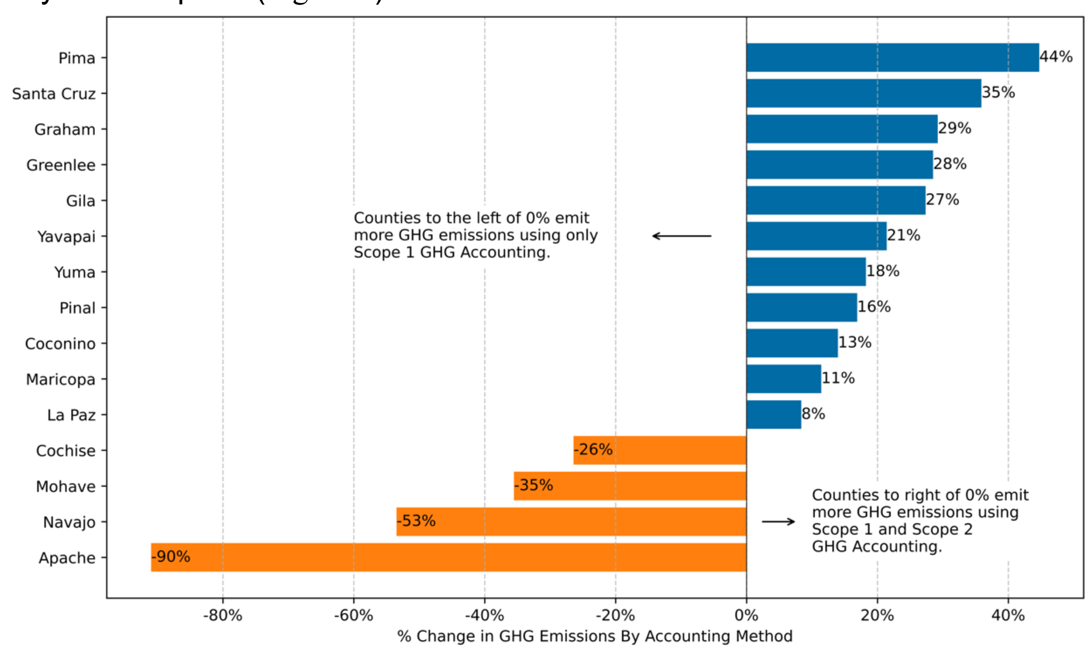

Figure 5. County-Level Change in GHG Emissions Based on Accounting for Electricity GHG Emissions from a Generation Versus Consumption Perspective

It should be noted that the GHG emissions from electricity generation are greater than the GHG emissions associated from electricity consumption. This occurs for two primary reasons. First, Arizona is a net electricity exporter, meaning that Arizona generates more electricity than is consumed by the state and excess electricity generation flows to neighboring states to be consumed.[33] Secondly, GHG emissions from electricity consumption is estimated using a regional grid mix emissions factor, which includes most of Arizona and New Mexico. New Mexico has a lower GHG intensity associated with electricity generation than Arizona, making the regional GHG emissions factor lower than an Arizona's.[34]

4 Stationary Energy

Statewide and county-level stationary energy consumption, and the associated GHG emissions, were estimated as part of the *Arizona PCAP GHG Inventory.* Stationary Energy GHG emissions are categorized as either direct or indirect. Direct GHG emissions from stationary energy use occurs at the point of combustion – e.g., a natural gas boiler or electric generating station. Indirect stationary energy GHG emissions occur primarily from electricity consumption and the transmission and distribution losses associated with the electricity grid.

For reference, residential and commercial GHG emissions from direct stationary energy use reported in this section comprise the Commercial and Residential Buildings GHG emissions sector. Industrial GHG emissions from direct stationary energy use reported in this section are a portion of the Industrial GHG emissions sector along with the emissions from Industrial Processes.

4.1 Direct Combustion

Direct GHG emissions from stationary energy use occurs at the point of fossil fuel combustion. GHG emissions from natural gas combustion are the most prevalent source of these emissions across Arizona. On-site combustion of distillate fuel oil (i.e., diesel fuel), motor gasoline, and propane are also significant sources of GHG emissions from direct combustion. These emissions may occur from a variety of equipment and appliances, but major sources include heating equipment, portable electric generators, and cooking equipment.

The largest source of GHG emissions from direct combustion are industrial activities (Table 9). Distillate fuel oil and natural gas are the primary sources of industrial stationary energy use GHG emissions. Direct combustion GHG emissions from commercial and residential buildings are primarily from on-site natural gas combustion. Stationary energy combustion of motor gasoline and diesel are additional sources of GHG emissions from commercial activities. Natural gas and propane are the primary fuel combusted at residential buildings.

[33] EIA (2024). Arizona State Energy Profile. URL: https://www.eia.gov/state/print.php?sid=AZ
[34] EPA eGRID (2024). https://www.epa.gov/egrid

Table 9. Statewide GHG Emissions Resulting from the Direct Combustion of Fossil Fuels

Fuel	GHG Emissions (million MT CO_2e)			
	Residential	Commercial	Industrial	Total
Coal	NO	NO	0.82	**0.82**
Distillate Fuel Oil (Diesel)	0.00	0.40	2.16	**2.56**
Kerosene	0.00	0.00	0.00	**0.00**
Lubricants	NO	NO	0.11	**0.11**
Motor Gasoline	NO	0.67	0.63	**1.29**
Natural Gas	2.19	1.83	1.10	**5.13**
Propane	0.32	0.23	0.08	**0.63**
Special Naphthas	NO	NO	0.03	**0.03**
Total	**2.52**	**3.13**	**4.92**	**10.57**

Fossil fuel combustion and the resulting GHG emissions were downscaled from statewide totals to county-level estimates (Table 10) using data obtained from NREL SLOPE.[35] The full method is documented in Appendix G. GHG emissions resulting from the direct combustion of fossil fuels are highly correlated with population. Therefore, the majority of these GHG emissions occur in Arizona's most populated counties.

Table 10. County-Level Estimates of GHG Emissions from the Direct Combustion of Fossil Fuels

County	GHG Emissions (million MT CO_2e)								
	Coal	Diesel	Kerosene	Lubricants	Motor Gasoline	Natural Gas	Propane	Special Naphthas	Total
Apache	0.004	0.006	0.000	0.000	0.003	0.028	0.004	0.000	0.045
Cochise	0.017	0.042	0.000	0.002	0.019	0.101	0.013	0.001	0.194
Coconino	0.026	0.058	0.000	0.003	0.028	0.182	0.024	0.001	0.322
Gila	0.047	0.162	0.000	0.008	0.048	0.112	0.010	0.003	0.389
Graham	0.003	0.004	0.000	0.000	0.003	0.023	0.003	0.000	0.036
Greenlee	0.013	0.045	0.000	0.002	0.013	0.029	0.003	0.001	0.107
La Paz	0.005	0.018	0.000	0.001	0.006	0.015	0.001	0.000	0.047
Maricopa	0.437	1.487	0.000	0.064	0.800	2.845	0.344	0.019	5.996
Mohave	0.021	0.055	0.000	0.003	0.025	0.125	0.016	0.001	0.245
Navajo	0.015	0.032	0.000	0.001	0.014	0.099	0.013	0.000	0.174
Pima	0.075	0.147	0.000	0.005	0.123	0.787	0.106	0.001	1.245
Pinal	0.101	0.371	0.000	0.018	0.153	0.414	0.045	0.005	1.107
Santa Cruz	0.006	0.013	0.000	0.001	0.006	0.037	0.005	0.000	0.068
Yavapai	0.031	0.054	0.000	0.002	0.026	0.229	0.031	0.001	0.374
Yuma	0.019	0.059	0.000	0.003	0.027	0.099	0.012	0.001	0.219
Total	**0.818**	**2.555**	**0.000**	**0.113**	**1.293**	**5.125**	**0.629**	**0.034**	**10.57**

[35] National Renewable Energy Laboratory. "Net Electricity and Natural Gas Consumption," State and Local Planning for Energy

As the natural gas combustion data for the *Arizona PCAP GHG Inventory* relies on data reported by Arizona utilities to federal authorities, the *Arizona CCAP GHG Inventory* will focus on data collection from the state's natural gas utilities.

4.2 Indirect Combustion (Electricity Consumption)

Statewide and county-level electricity consumption, and the associated GHG emissions, were estimated as part of the *Arizona PCAP GHG Inventory.* GHG emissions from electricity consumption are presented for informational purposes. Electricity generation consumption GHG emissions are excluded from the statewide total to avoid double counting associated with including the emissions from both electricity generation and consumption.

Table 11 shows statewide GHG emissions from electricity consumption by GHG and customer class. The estimates in Table 11 were derived from data obtained from the Energy Information Administration's Form EIA-861.[36] As detailed in Appendix G, other sources of data on electricity consumption were considered but Form EIA-861 was chosen for the *Arizona PCAP GHG Inventory* due to completeness and reproducibility.

Table 11. Statewide GHG Emissions Resulting from the Electricity Consumption

Customer Class	GHG Emissions (million MT CO_2e)			
	CO_2	CH_4	N_2O	Total
Residential	13.81	0.02	0.03	13.87
Commercial	11.15	0.02	0.03	11.20
Industrial	5.24	0.01	0.01	5.26
Subtotal	**30.20**	**0.05**	**0.07**	**30.32**
T&D Loss	*1.06*	*0.00*	*0.00*	*1.07*
Total	**31.27**	**0.06**	**0.07**	**31.39**

Statewide electricity consumption and the resulting GHG emissions were downscaled to county-level estimates (Table 12) using data obtained from NREL SLOPE.[37] The full method is documented in Appendix G.[38]

GHG emissions from electricity consumption are calculated by multiplying electricity consumption by an emissions factor for CO_2, CH_4, and N_2O. The Arizona-New Mexico Subregional eGRID GHG emissions factor (AZ-NM eGRID emissions factor) was used for the *Arizona PCAP GHG Inventory*. Location-based approaches that utilize a regional

[36] Energy Information Administration (2024). Form EIA-861, "Annual Electric Power Industry Report." URL: https://www.eia.gov/electricity/data/eia861/
[37] National Renewable Energy Laboratory. "Net Electricity and Natural Gas Consumption," State and Local Planning for Energy
[38] *Appendix G – Detailed Methods and Data Sources for the Arizona PCAP GHG Inventory*

eGRID emissions factor, like AZ-NM eGRID emissions factor[39], are standard practice for GHG emissions inventories of geographic areas because these emissions factors capture the dynamics of transborder electricity flows. However, to provide a nuanced look at how utilities provide electricity to customers, the *Arizona CCAP GHG Inventory* will compare utility-specific GHG emissions factors in addition to the location-based AZ-NM eGRID emissions factor.

GHG emissions resulting from electricity consumption are highly correlated with population. Therefore, the majority of GHG emissions associated with electricity consumption are induced by electricity demand in Arizona's most populated counties.

Table 12. County-Level GHG Emissions Estimates by Customer Class

County	GHG Emissions (million MT CO_2e)				
	Residential	Commercial	Industrial	T&D Loss	Total
Apache	0.046	0.019	0.088	0.005	**0.158**
Cochise	0.183	0.145	0.192	0.018	**0.538**
Coconino	0.163	0.202	0.096	0.016	**0.476**
Gila	0.103	0.064	0.398	0.020	**0.585**
Graham	0.050	0.030	0.112	0.007	**0.198**
Greenlee	0.015	0.004	0.159	0.006	**0.184**
La Paz	0.041	0.012	0.046	0.003	**0.103**
Maricopa	9.298	7.429	2.380	0.674	**19.78**
Mohave	0.395	0.222	0.243	0.030	**0.890**
Navajo	0.109	0.101	0.105	0.011	**0.326**
Pima	1.832	1.554	0.401	0.134	**3.920**
Pinal	0.798	0.873	0.708	0.084	**2.463**
Santa Cruz	0.069	0.066	0.021	0.005	**0.161**
Yavapai	0.388	0.300	0.207	0.032	**0.926**
Yuma	0.377	0.180	0.105	0.023	**0.685**
Total	**13.87**	**11.20**	**5.261**	**1.069**	**31.39**

As the electricity consumption data for the *Arizona PCAP GHG Inventory* relies on data reported by Arizona utilities to federal authorities, the *Arizona CCAP GHG Inventory* will focus on data collection from the state's electric utilities.

[39] EPA eGRID (2024). https://www.epa.gov/egrid

5 Industrial Processes

The Industrial sector comprises approximately 9% of Arizona's total GHG emissions inventory. Industrial Processes comprise approximately 43% of Industrial GHG emissions; the remaining 57% of Industrial GHG emissions are due to stationary energy use. Cement production is the largest source of industrial GHG emissions in Arizona, followed by natural gas losses along utility and regional pipelines. Lime and electronics manufacturing are also significant sources of industrial GHG emissions (Table 13). Table 13 shows industrial process emissions by greenhouse gas and primary data sources are identified.

Table 13. GHGs Emitted by Industrial Processes in Arizona

Industrial Process	Source	GHG Emissions (thousand MT CO_2e)							
		CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	NF_3	Total
General Stationary Fuel Combustion Sources	EPA GHGRP Subpart C	IE	IE	IE	NO	NO	NO	NO	**0.00**
Use of Electric T&D Equipment	EPA GHGRP Subpart DD	NO	NO	NO	NO	NO	72	NO	**72**
Cement Production	EPA State Estimate	1,257	NO	NO	NO	NO	NO	NO	**1,257**
Electronics Manufacturing	EPA GHGRP Subpart I	NO	NO	55	79	329	98	80	**642**
Iron and Steel Production	EPA GHGRP Subpart Q	59	NO	NO	NO	NO	NO	NO	**59**
Lime Manufacturing	EPA State Estimate	441	NO	NO	NO	NO	NO	NO	**441**
Nitric Acid Production	EPA GHGRP Subpart V	NO	NO	298	NO	NO	NO	NO	**298**
Petroleum and Natural Gas Systems	EPA State Estimate	764	249	0.38	NO	NO	NO	NO	**1,013**
Urea Consumption for Non-Agricultural Purposes	EPA State Estimate	108	NO	NO	NO	NO	NO	NO	**108**
Carbon Dioxide Consumption	EPA State Estimate	108	NO	NO	NO	NO	NO	NO	**108**
N_2O from Product Uses	EPA State Estimate	NO	NO	81	NO	NO	NO	NO	**81**
Other Process Uses of Carbonates	EPA State Estimate	36	NO	NO	NO	NO	NO	NO	**36**
Carbide Production and Consumption	EPA State Estimate	0.73	NO	NO	NO	NO	NO	NO	**0.73**
Total		**2,774**	**249**	**434**	**79**	**329**	**171**	**80**	**4,116**

IE – Included Elsewhere; NO – Not Occurring

Table 14 shows industrial process GHG emissions by county.

Table 14. County-Level GHG Emissions from Industrial Processes

Industrial Processes	GHG Emissions (million MT CO_2e)															
	Apache	Cochise	Coconino	Gila	Graham	Greenlee	La Paz	Maricopa	Mohave	Navajo	Pima	Pinal	Santa Cruz	Yavapai	Yuma	Total
Use of Electric T&D Equipment	0.365	1.241	1.099	1.349	0.457	0.425	0.237	45.6	2.054	0.752	9.046	5.684	0.372	2.137	1.581	**72.4**
Cement Production	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	507.8	NO	NO	749.7	NO	**1,257**
Electronics Manufacturing	NO	NO	NO	NO	NO	NO	NO	642.3	NO	NO	NO	NO	NO	NO	NO	**642.3**
Iron and Steel Production	NO	NO	NO	NO	NO	NO	NO	58.9	NO	NO	NO	NO	NO	NO	NO	**58.9**
Lime Manufacturing	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	440.5	NO	**440.5**
Nitric Acid Production	NO	297.8	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	**297.8**
Petroleum and Natural Gas Systems	157.6	96.5	346.2	NO	NO	NO	98.0	112.8	81.6	12.0	38.8	69.3	NO	NO	NO	**1,013**
Urea Consumption for Non-Agricultural Purposes	0.986	1.878	2.190	0.795	0.580	0.142	0.250	66.9	3.216	1.600	15.7	6.522	0.720	3.582	3.079	**108.2**
Carbon Dioxide Consumption	0.986	1.878	2.190	0.795	0.580	0.142	0.250	67.0	3.216	1.600	15.7	6.523	0.720	3.582	3.079	**108.2**
N_2O from Product Uses	0.741	1.412	1.646	0.598	0.436	0.107	0.188	50.3	2.417	1.203	11.8	4.902	0.541	2.692	2.314	**81.3**
Other Process Uses of Carbonates	0.327	0.622	0.726	0.263	0.192	0.047	0.083	22.2	1.066	0.530	5.208	2.161	0.239	1.187	1.020	**35.9**
Carbide Production and Consumption	0.007	0.013	0.015	0.005	0.004	0.001	0.002	0.449	0.022	0.011	0.105	0.044	0.005	0.024	0.021	**0.725**
Total	**161.0**	**401.3**	**354.0**	**3.805**	**2.248**	**0.865**	**99.0**	**1,066**	**93.6**	**17.7**	**604.2**	**95.1**	**2.596**	**1,203**	**11.1**	**4,116**

IE – Included Elsewhere; NO – Not Occurring

6 Substitution of Ozone-Depleting Substances

Ozone-depleting substances (ODSs) are used in a variety of applications across the economy. These applications include various industrial processes such as solvent cleaning and fire suppression in addition to refrigeration and air conditioning equipment in commercial and residential buildings and transportation equipment. GHG emissions from this activity result from the substitution of chemicals like chlorofluorocarbons (CFCs), halons, carbon tetrachloride, methyl chloroform, and hydrochlorofluorocarbons (HCFCs) with hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and CO_2. While the substitutes for ODSs do not harm the stratospheric ozone layer, they are GHGs.[40]

EPA estimates state-level GHG emissions from the substitution of ODSs from estimates of national use developed using the Vintaging Model[41]. National-level estimates are scaled to states based on population and climatic factors.[42] Table 15 shows EPA state-level estimates of GHG emissions from the substitution of ODSs scaled to the county-level using population as an indicator.

Table 15. County-Level Estimates of GHG Emissions from the Substitution of Ozone-Depleting Substances

County	GHG Emissions (thousand MT CO_2e)				
	Commercial	Industrial	Residential	Transportation	Total
Apache	6.824	4.731	4.793	3.612	19.76
Cochise	12.97	8.989	9.106	6.864	37.62
Coconino	14.95	10.36	10.50	7.914	43.86
Gila	5.519	3.826	3.876	2.921	15.92
Graham	3.972	2.754	2.790	2.103	11.61
Greenlee	0.980	0.679	0.688	0.519	2.854
La Paz	1.723	1.195	1.210	0.912	5.004
Maricopa	457.7	317.4	321.5	242.3	1,341
Mohave	22.13	15.34	15.54	11.72	64.41
Navajo	11.07	7.672	7.772	5.858	32.05
Pima	107.7	74.66	75.63	57.01	314.8
Pinal	44.77	31.04	31.44	23.70	130.6
Santa Cruz	4.942	3.426	3.471	2.616	14.42
Yavapai	24.57	17.03	17.26	13.01	71.75
Yuma	21.11	14.64	14.83	11.18	61.67
Total	**741.0**	**513.7**	**520.4**	**392.2**	**2,167**

GHG emissions from the replacement of ODSs are incorporated into sector-level estimates.

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[40] Section summarized from: EPA. 2023. Methodology Report: Inventory of U.S. Greenhouse Gas Emissions and Sinks by State: 1990–2021. U.S. Environmental Protection Agency, EPA-430-R-23-003. https://www.epa.gov/ghgemissions/state-ghg-emissionsand-removals

[41] EPA. 2023. Methodology Report: Inventory of U.S. Greenhouse Gas Emissions and Sinks by State: 1990–2021. U.S. Environmental Protection Agency, EPA-430-R-23-003. https://www.epa.gov/ghgemissions/state-ghg-emissionsand-removals

[42] EPA. 2023. Methodology Report: Inventory of U.S. Greenhouse Gas Emissions and Sinks by State: 1990–2021. U.S. Environmental Protection Agency, EPA-430-R-23-003. https://www.epa.gov/ghgemissions/state-ghg-emissionsand-removals

7 Agriculture & Land Management

The *Arizona PCAP GHG Inventory* includes the largest sources of agricultural emissions in the state. These emissions occur from the use of fertilizers on agricultural lands and the management of grasslands in addition to emissions from livestock operations.

EPA's state-level estimates[43] of N_2O emissions from agricultural soil management using the same approach as the national inventory, which relies on the DAYCENT[44] biogeochemical model. N_2O emissions from urea fertilization are estimated using urea fertilizer sales data. State-level N_2O estimates were estimates obtained from EPA were downscaled to the county-level using the acres of agricultural lands and grassland as an indicator (Table 16). A full discussion of the method is located in Appendix G.

Table 16. State-Level GHG Emissions from Major Agricultural Sources

Agriculture GHG Emissions Source	GHG Emissions (thousand MT CO_2e)		
	CH_4	N_2O	Total
Fertilizer Use			
N_2O From Agricultural Soil Management	0.000	4.016	4.016
Urea Fertilization	0.000	0.010	0.010
Livestock			
Enteric Fermentation	2.380	0.000	2.380
Manure Management	0.801	0.327	1.128
Total	**3.181**	**4.353**	**7.534**

EPA's state-level estimates[45] from livestock operations, primarily enteric fermentation and manure management, are developed utilizing the same methods as the National GHG Inventory, which are based on IPCC methods (Table 17). State-level livestock GHG emissions data were downscaled to the county-level using cattle population as an indicator of livestock GHG emissions.

[43] Section summarized from: EPA. 2023. Methodology Report: Inventory of U.S. Greenhouse Gas Emissions and Sinks by State: 1990–2021. U.S. Environmental Protection Agency, EPA-430-R-23-003. https://www.epa.gov/ghgemissions/state-ghg-emissionsand-removals
[44] Natural Resource Ecology Lab. DAYCENT MODEL. URL: https://www.nrel.colostate.edu/projects/daycent/
[45] Section summarized from: EPA. 2023. Methodology Report: Inventory of U.S. Greenhouse Gas Emissions and Sinks by State: 1990–2021. U.S. Environmental Protection Agency, EPA-430-R-23-003. https://www.epa.gov/ghgemissions/state-ghg-emissionsand-removals

Table 17. County-Level Estimates of GHG Emissions from Agriculture and Land Management

County	GHG Emissions (thousand MT CO_2e)				
	N_2O From Agricultural Soil Management	**Urea Fertilization**	**Enteric Fermentation**	**Manure Management**	**Total**
Apache	0.399	0.001	91.07	43.15	134.62
Cochise	619.07	1.568	315.72	149.59	1,085.94
Coconino	0.268	0.001	110.50	52.35	163.12
Gila	1.712	0.004	35.21	16.68	53.62
Graham	227.41	0.576	32.06	15.19	275.23
Greenlee	10.91	0.028	22.10	10.47	43.51
La Paz	360.42	0.913	25.34	12.00	398.67
Maricopa	913.06	2.313	485.72	230.13	1,631.23
Mohave	51.53	0.131	51.00	24.16	126.82
Navajo	0.189	0.000	65.57	31.07	96.83
Pima	104.57	0.265	39.10	18.53	162.46
Pinal	1,119.85	2.837	692.15	327.94	2,142.77
Santa Cruz	3.648	0.009	38.37	18.18	60.21
Yavapai	16.51	0.042	112.93	53.51	182.99
Yuma	586.46	1.486	263.18	124.69	975.82
Total	**4,015.99**	**10.17**	**2,380.03**	**1,127.64**	**7,533.83**

8 Natural and Working Lands

Given the lack of currently available data, the *Arizona PCAP GHG Inventory* utilizes estimates developed by the EPA for the *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021*[46] for the state of Arizona.[47] This EPA report estimates GHG emissions Arizona's natural and working lands as 3,881,570 metric tons CO_2e, or 3.88 million metric tons CO_2e. Natural and Working Lands GHG emissions were compared with results obtained from EPA SIT. GHG emissions from Natural and Working Lands were not downscaled to the county-level due to a lack of appropriate data for downscaling. Sector experts will be sought out for guidance during the *Arizona CCAP GHG Inventory.*

Natural and working lands GHG emissions will be developed for the *Arizona CCAP GHG Inventory*. That said, GHG emissions from wildfires and prescribed burns were estimated from the 2020 National Emissions Inventory. Wildfire GHG emissions for 2021 were estimated from the 2020 NEI and scaling by the number of acres burned in each year (Table 18).[48] These GHG emissions are reported in Table 18 but included in the GHG emissions total for this sector due to the uncertainty surrounding estimates emissions for this sector.

[46] EPA (2023) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 19902021. U.S. Environmental Protection Agency, EPA 430-R-23-002. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and- sinks-1990-2021.

[47] EPA. 2023. Methodology Report: Inventory of U.S. Greenhouse Gas Emissions and Sinks by State: 1990–2021. U.S. Environmental Protection Agency, EPA-430-R-23-003. https://www.epa.gov/ghgemissions/state-ghg-emissionsand-removals

[48] Arizona Department of Forestry and Fire Management (2024. Arizona State Wildfire Information. URL: https://dffm.az.gov/intelligence

Table 18. GHG Emissions from Wildfire and Prescribed Burns

Forestry & Wildfire	CO_2	N_2O	Total
Forest Wildfires	3.822	0.368	4.190
Prescribed Burns	0.050	0.005	0.055
Total	**3.872**	**0.373**	**4.245**

Appendix K: Assumptions for GHG Reductions Estimates

Common Assumptions:

- The average electrical energy consumption of a residential customer is **9,823 kWh/year**
- The average heat energy consumption of a residential customer is **3,458 kWh/ year**
- The average electrical energy consumption of a residential customer is **239,344 kWh/year**
- The average heat energy consumption of a residential customer is **80,449 kWh/year**
- Residential Solar PV penetration is based on a 5 kW average size and 0.2 capacity factor. Therefore, it meets demand for **90%** of customer energy when paired with batteries[9].
- Commercial Solar PV penetration is based on a 100 kW average size and 0.2 capacity factor. Therefore, it meets demand for **91%** of customer energy when paired with batteries[10].
- Gasoline cars produce **8.78 kilograms** of CO2 per gallon burned. On average, vehicles drive **11,500 miles per year**.

Measure 1:

- The estimated budget for this measure limits the number of residents impacted by its improvements to **214**.
  - The average capital cost for a household to receive energy efficiency improvements is **$5,117**[1,2].
- **50%** of projects will be implemented **by 2030**, and **100%** of them will be implemented **by 2035**
- The average savings from a residential energy efficiency project is **30%**[3].

Measure 2:

- Due to budget limitations, not all municipalities will apply for or receive budget incentives to update building codes. **50%** of new builds will be impacted by the measure.
- Commercial new builds have a growth rate of **1%**
- Residential new build rate decays from the 2023 peak of **31,000**[4].
- New residential builds can save **10%** in energy use from efficient design[5].
- New commercial builds can save **15%** from efficient design[6].

Measure 3:

- The estimated budget for this measure limits the number of residents impacted by its improvements to **3,278 residential** systems and **195 commercial** systems [7,8].
- **6%** of projects will be implemented **by 2030** and **100% by 2040**.

Measure 4:

- Arizona public universities have **3,280 acres** of available land in their control. This GHG reduction estimate assumes that 10% of this area can be inhabited by solar PV installations.

- 1 acre of land can hold a maximum of **2,500** solar panels, and each panel has an average capacity of **400 Watts**. The capacity factor in this case is still modeled as 0.2, as in other measures.
- **10%** of projects will be installed **by 2030** and **100% by 2050**.

Measure 5:

- Annual emissions reductions:
  - CO2<=0.7*(30,000,000.00/817,154)*237*t> mt CO2e
  - NOX <=0.17*(30,000,000/817,154)>
  - SO2 <=0.17*(30,000,000/817,154)>
  - PM2.5 <=0.01*(30,000,000/817,154)>

The emissions reduction estimates are based on a case evaluation using the National Renewable Energy Lab's PVWatts and ReOpt Tools. For the evaluated case, a 387 kW rooftop solar installation with 60 kW battery power and 153 kWH battery capacity were assumed.

Measure 6:

- NA

Measure 7:
GHG reduction per vehicle: 3.53 MT CO2e

Type:	Quantity:	Unit Price	Total Price
EV	280	$65,000	$ 18,200,000.00
Level 2 Charger 2 plugs	140	$68,577.59	$ 9,600,862.60
Lever 3 Charger 2 plugs	8	$234,431.53	$ 1,875,452.24

Measure 8:

- In the state of Arizona, there are about **48,000** vehicles owned by the state, cities, and municipalities[14].
- **25%** of publicly owned vehicles reside outside of Maricopa and Pinal counties and will be affected by this measure[15].
- GHG reductions estimates consider the savings from adoption of *new* vehicles that are electric and not gasoline powered. Fleets are estimated to grow at **0.5% per year** (~ 60 new vehicles purchased).

Measure 9:

- There are **5,744,900** registered fossil fuel vehicles in the state of Arizona. **25%** of these will be impacted by charging infrastructure at public buildings[16].
- On average, those vehicles affected by this measure will charge their vehicles **3 times per year**.

- The measure will be implemented **50% by 2033** and **100% by 2040**.

Measure 10:

- GHG emissions reductions from this measure come primarily through paving dirt roads.
- Budget limitations for this measure limits the number of miles of road that can be paved to about **20 miles** of road.
- On average, a 1 mile stretch of road sees a travel throughput of **1,000 miles per year**. This number increases by **1% per year**.
- By paving roads, vehicle fuel efficiency is **improved** by an average of **15%**[13].

Measure 11:

- Assumptions are stated in the measure description.

Measure 12:

- Assumptions are stated in the measure description.

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