Central Iowa
Priority Climate Action Plan

March 1, 2024

Acknowledgments

This planning process was like no other in my professional history – six months, seven counties, 800,000 people, and one priority climate action plan. While only just the beginning of "What's Next, Central Iowa?", this document—plus its creation process, opened doors, filled tables, and authentic dialogues—is a strong indication that Central Iowans are up to the challenge of coming together to seek solutions that make sense.

This Priority Climate Action Plan would not have been possible without:

- Polk County leadership's willingness to take a chance on leading positive change and accepting this EPA award that extends beyond their jurisdictional boundaries. Without their openness for collaboration with neighbors, this effort would not have gotten off the ground or be soaring towards new heights as we enter the next phase.
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- The United States Environmental Protection Agency, their national staff, and most importantly, the Region 7 staff: Jenny, Molly, and Stephanie. Thank you for the opportunity to make this project a reality, and for answering our metric tons of questions as we navigated the fast-paced process.
- And finally, all the Central Iowans who participated in the planning process already.

Teamwork truly does make the dream work, and this plan is evidence of that. My team and I look forward to working with you all and many, many more Central Iowans as we continue into the Comprehensive portion of our regional climate action planning process.

In partnership,

Allison van Pelt
Polk County Sustainability Planner & CPRG Project Lead

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Acronyms and Abbreviations

Acronym or Abbreviation	Definition
ALICE	Asset Limited, Income Constrained, Employed
AMI	Area Median Income
CAAs	Community Action Agencies
CCAP	Comprehensive Climate Action Plan
CIRTPA	Central Iowa Regional Transportation Planning Alliance
CH_4	Methane
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
CPRG	Climate Pollution Reduction Grant
DMAMPO	Des Moines Area Metropolitan Planning Organization
DOE	Department of Energy
EPA	United States Environmental Protection Agency
F-gases	Fluorinated Gases
FLIGHT	EPA Facility Level Information on Greenhouse Gases tool
FPL	Federal Poverty Limit
GHG	Greenhouse Gas
GHGI	Greenhouse Gas Emissions Inventory
GPC	Global Protocol for Community Greenhouse Gas Inventories
GWP	Global Warming Potential
HAP	Hazardous Air Pollutant

HFC	Hydrofluorocarbon
HMP	Hazard Mitigation Plan
HVACs	Heating, Ventilation, and Air Conditioning systems
LGGIT	EPA Local GHG Inventory Tool
LGO	Local Government Operations
LHTF	Local Housing Trust Fund
LIDACs	Low-Income and Disadvantaged Communities
LIHEAP	Low-Income Home Energy Assistance Program
MSA	Metropolitan Statistical Area
mt CO_2e	Metric tons of carbon dioxide equivalents
NF_3	Nitrogen Trifluoride
N_2O	Nitrous Oxide
NOx	Nitrogen Oxides
O_3	Ozone
PCAP	Priority Climate Action Plan
PFC	Perfluorocarbon
$PM_{2.5}$	Fine Particulate Matter
RLF	Revolving Loan Fund
SF_6	Sulfur Hexafluoride
SO_2	Sulfur Dioxide
SLOPE	DOE State and Local Planning for Energy Platform
TREC	Training for Residential Energy Contractors
VOC	Volatile Organic Compounds

Introduction

The Polk County Public Works Department (hereinafter "Polk County") prepared 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 in Central Iowa. This project has been funded wholly or in part by the United States Environmental Protection Agency (EPA) under assistance agreement 96704601 to Polk County. The contents of this document do not necessarily reflect the views and policies of the EPA, nor does the EPA endorse trade names or recommend the use of commercial products mentioned in this document.

The measures contained herein should be construed as broadly available to any entity within the geographic scope of this PCAP that is eligible to receive funding under the EPA's Climate Pollution Reduction Implementation Grants (CPRG) and other funding streams, as applicable.

PLANNING AREA

The EPA Phase I guidance defines the CPRG planning area for our region using 2020 U.S. Census data for metropolitan statistical areas (MSAs) to identify metropolitan areas eligible for funding. The Des Moines-West Des Moines MSA includes Guthrie, Dallas, Polk, Jasper, Madison, and Warren Counties.

However, due to the nature of our region and its interconnected economics, transportation, workforce, and more, Story County was invited to join Central Iowa's CPRG effort. From the outset of this planning process, Polk County staff met with Story County staff and leadership to discuss the inclusion of their county in the CPRG process. After a productive dialogue between the representatives, Story County accepted the invitation. Therefore, our regional CPRG planning area extends beyond the EPA prescribed MSA boundaries and has expanded to seven counties instead of the original six. Figure 1, below, depicts the region this plan will refer to as "Central Iowa."

Figure 1. Map of Counties in Central Iowa Planning Area
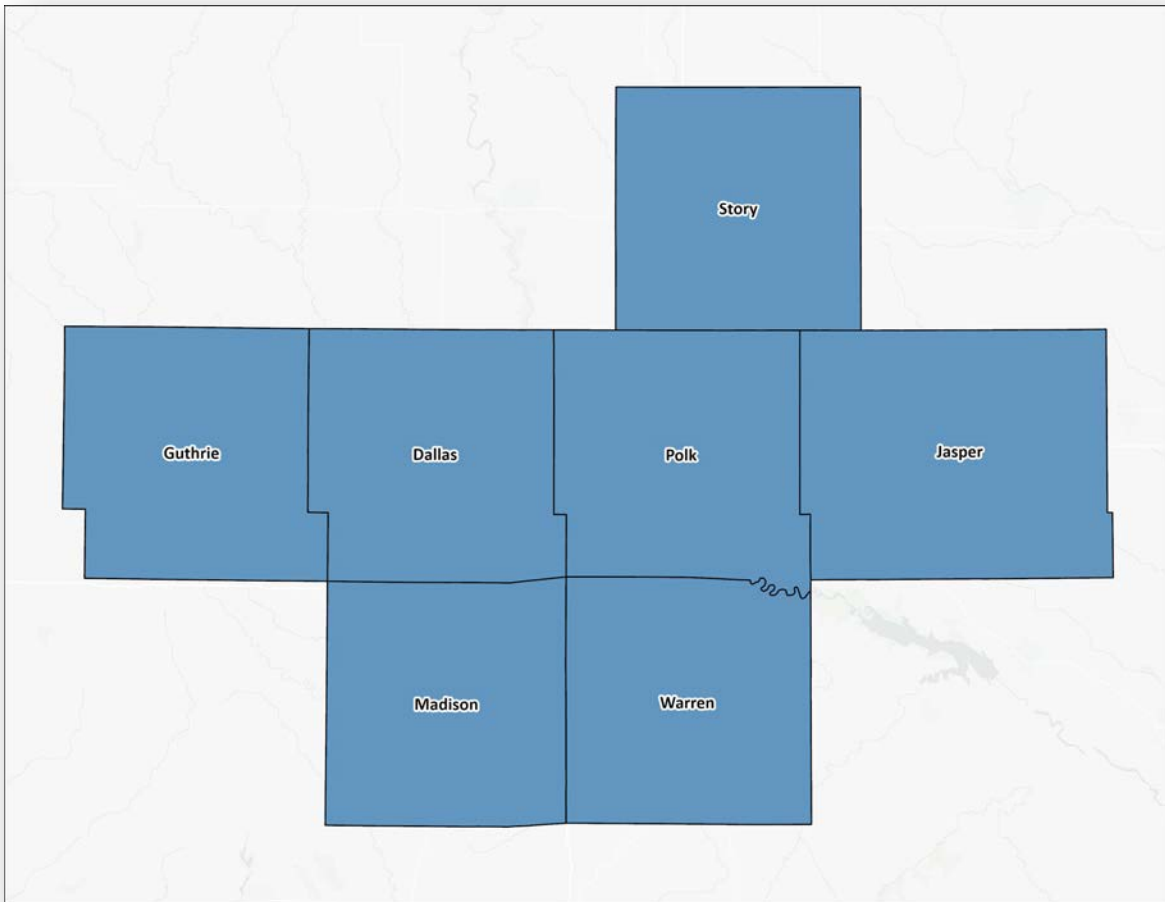
CLIMATE IMPACTS

What is Climate Change?

Climate change is any significant change in precipitation, wind patterns, temperature, and/or other patterns that continues over several decades. Overwhelmingly, human-driven activities have led to increased greenhouse gases (GHGs) in the atmosphere. This in turn has raised Earth's average surface temperature. Climate change has already led to severe weather events globally and in Iowa, impacting food systems, infrastructure, ecosystems, homes, and more.

Adverse Weather Impacts

The negative impacts of climate change on Iowa and its people are already apparent and will only grow in severity with time. A 2020 derecho killed four people, caused over $11 billion of damage to infrastructure and canopy cover, and did an estimated $500 million of damage to crops. In 2019, Mississippi and Missouri River floods led to a federal disaster declaration in 67 Iowa counties, killing at least three people, impacting 14 million people, and causing almost $3 billion of damage. Droughts followed by major rain events reduce corn yields, and Central Iowa has experienced

both in recent years. Average spring precipitation in the last decade (2010-2019) was 27% higher than the 20th century average.[1]

Major weather events are the most apparent impacts of climate change in Iowa, but the daily changes are critical as well. Temperatures in Central Iowa have been steadily rising for over a century,[2] as shown in Figure 2.

Figure 2. Annual Average Daily High Temperature in the Des Moines Area[3]
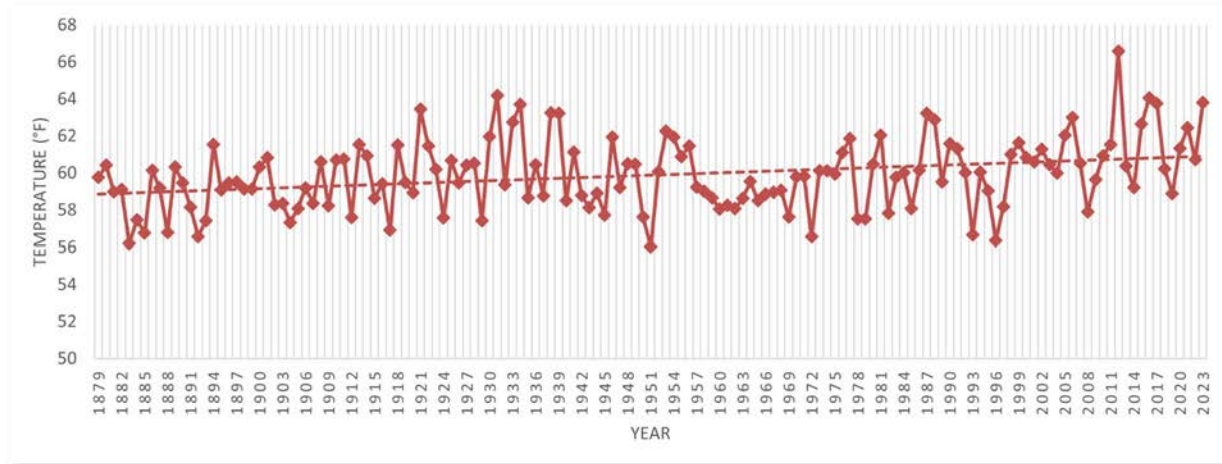
Higher temperatures pose many risks to Iowans, including health complications like heat stroke in the summer, red flag days & wildland fires, crop shortages caused by false springs, and financial stress from higher energy, grocery, and other bills. Figure 3 depicts the period between the first and last red flag warning for the years 2006 through 2024 and the number of red flag days, highlighting recent years when fire danger has been elevated. Air conditioning will run more often, raising bills and ultimately increasing emissions.

Mitigation strategies like natural shading and home weatherization can reduce costs and slow the effects of climate change.

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[1] Iowa Natural Heritage Foundation. (n.d.). *Iowa Climate Assessment*. https://www.inhf.org/iowa-climate-assessment/.
[2] Iowa State University. (2024). *IEM "Climodat" Reports*.
https://mesonet.agron.iastate.edu/climodat/index.phtml?network=IACLIMATE&station=IATDSM&report=14.
[3] Iowa State University. (2024). *IEM "Climodat" Reports*.
https://mesonet.agron.iastate.edu/climodat/index.phtml?network=IACLIMATE&station=IATDSM&report=14.

Figure 3. Period Between First and Last Red Flag Warning, 2006-2024[4]
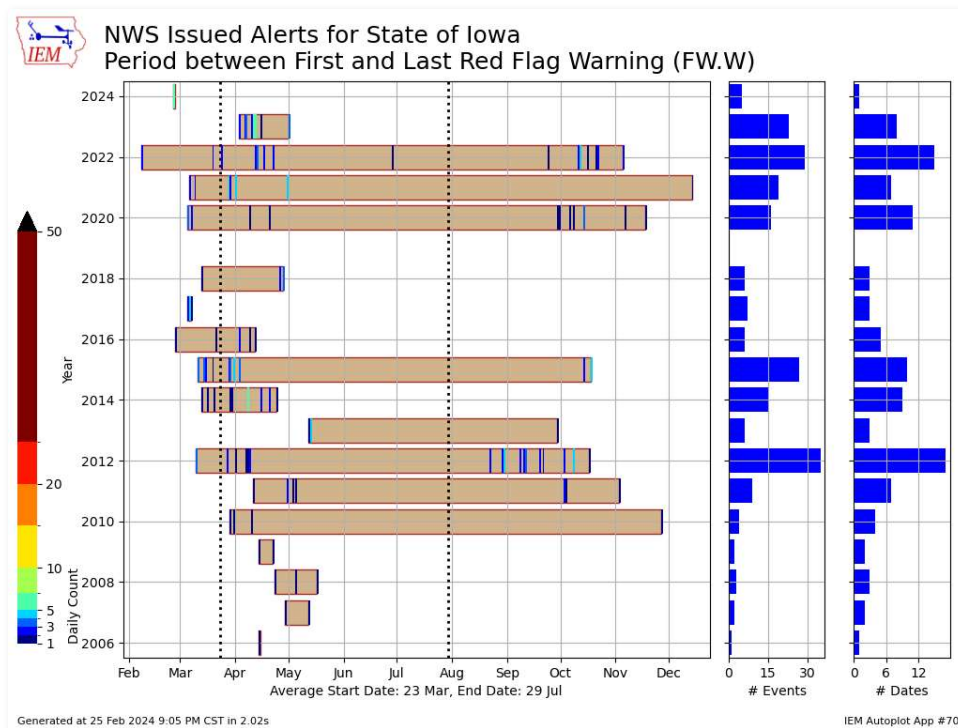
Adverse Health Impacts

As documented by the EPA, climate change has many adverse health impacts. Heart and lung problems caused by ozone (O_3) and fine particulate matter ($PM_{2.5}$) pollution are exacerbated by higher temperatures. These impacts have led to the increased prevalence of asthma as higher temperatures increase the production of ground-level ozone. In rural Iowa, ozone levels are high enough that they have already reduced soybean yields. Climate change has also led to increased allergies for many as the pollen season is longer during warmer periods: the ragweed season in the Upper Midwest can now be anywhere from 10 to 21 days longer than it was in 1995.[5] Higher temperatures can negatively impact human health as prolonged exposure to high temperatures puts individuals at risk of heat stroke and dehydration.[6] Because many houses and apartments lack air conditioning and protective weather infrastructure, many Iowans are at risk of heat stress, which has caused the deaths of hundreds across the Midwest over the last decade. Climate change can also cause increases in the transmission of diseases carried by insects that thrive in warmer climates.

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[4] Iowa State University. (2024). *IEM "Climodat" Reports*.
https://mesonet.agron.iastate.edu/climodat/index.phtml?network=IACLIMATE&station=IATDSM&report=14
[5] U.S. Environmental Protection Agency. (2016, August). *What Climate Change Means for Iowa*.
https://19january2017snapshot.epa.gov/sites/production/files/2016-09/documents/climate-change-ia.pdf.
[6] Center for Disease Control and Prevention. (2023, September 12). *Natural Disasters and Severe Weather About Extreme Heat*. https://www.cdc.gov/disasters/extremeheat/heat_guide.html.

Inequality of Climate Impacts

Globally, all communities are adversely impacted by climate change. However, there is evidence that climate change disproportionately affects certain communities. Low-income groups, children, the elderly, communities of color, and Indigenous peoples are particularly vulnerable. By targeting support towards those with the greatest need, this plan aims to build a resilient future for all communities.

Disadvantaged communities in Iowa have been identified using the EPA EJ Screen Tool. These communities are determined based on multiple data sets that consider aspects including, but not limited to, socioeconomic indicators, health disparities, climate change, critical service gaps, people of color, etc.[7] Approximately 49% of the census block groups in Central Iowa were identified as IRA disadvantaged communities, with the majority share located within Polk County. More details about the proportion of disadvantaged tracts in each Central Iowa county can be viewed in Table 1. A map of low-income and disadvantaged census block groups in Central Iowa can be found in Figure 6.

Table 1. Proportion of IRA Disadvantaged Census Tracts by County in Central Iowa[8]

County	Total Number of Census Block Groups (based off Census data from 2020)	Number of IRA Disadvantaged Community Census Block Groups	Proportion of Census Block Groups that are IRA Disadvantaged Community
Dallas County	42	4	10%
Guthrie County	8	0	0%
Jasper County	37	11	30%
Madison County	12	2	17%
Polk County	336	230	68%
Story County	75	20	27%
Warren County	33	1	3%
Total	**543**	**268**	**49%**

EXISTING PLANS

Hazard Mitigation Plans

All counties in Iowa are required to have a hazard mitigation plan (HMP) in place and updated every five years to maintain validity, per state requirements. Among the potential hazards identified in each county's current HMPs were drought, extreme temperatures, floods, severe

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[7] U. S. Environmental Protection Agency. 2023 version. EJScreen. Retrieved: February 1, 2024, from https://ejscreen.epa.gov/mapper/
[8] U.S. Environmental Protection Agency. 2023 version. EJScreen. Retrieved: February 1, 2024, from https://ejscreen.epa.gov/mapper/

winter storms, and severe thunderstorms. These hazards are worsened by rising average temperatures and rainfall totals.

In a recent survey during the 2024 updated of Polk County's HMP, Emergency Management found 53% of respondents are at least somewhat concerned about their community facing a natural disaster, including floods and drought. More than half reported being at least somewhat concerned about natural hazard impacts from climate change.

When respondents were asked to select the top five hazards facing their community, 21% reported extreme temperatures, 22% reported climate change, 28% reported drought, 30% reported flash flooding, 41% reported winter storm, 52% reported severe thunderstorms, and 55% reported windstorm/derecho. When asked what programs they would like to see offered, 60% of respondents reported a desire for property tax breaks for homeowners who make their home more resilient to disasters, and 35% reported a desire for either loans or subsidies for homeowners who implement property retrofits. Community concern and homeowner interest in mitigation programs align with the measures included in this PCAP and help enlighten future community outreach within the climate action space in Central Iowa.

Local Community-wide Climate Action Plans

There are few existing climate action plans in Central Iowa. In most cases, the CPRG endeavor will be the first time that many communities discuss the topic. Nevertheless, Polk County reviewed the two climate action plans that exist in the region—for the cities of Des Moines and Ames—and worked with city staff to ensure the plans are incorporated into the CPRG and PCAP processes. Polk County will continue engaging with these plans throughout the Comprehensive Climate Action Plan (CCAP) process.

CITY OF DES MOINES

Adopted in December 2023, ADAPT DSM is the City of Des Moines's guide to decision-making, policy, and program development to address the impacts of climate change.[9] The four primary goals outlined by this plan include:

- 28% reduction in emissions from 2008 levels by 2025,
- 45% reduction in emissions from 2010 levels by 2030,
- 100% 24/7 carbon-free electricity citywide by 2025, and
- net-zero greenhouse gas emissions by 2050.

All efforts to achieve these goals will consider the input of community members and partners. The four focus areas of the plan include equity, innovation, green economy, and health. These climate solutions align with the focus areas by improving energy use and resources, buildings and infrastructure, transportation and land use, food systems and security, waste management and reduction, climate preparedness and resilience, and natural systems and water resources.

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[9] City of Des Moines. (2023, December). *Climate Action & Adaptation Plan.* https://cms2.revize.com/revize/desmoines/document_center/City%20Manager/Sustainability/ADAPT%20DSM/ADAPT%20DSM%20Final%20v2.pdf?pdf=Review%20the%20approved%20plan&t=1709236279704&pdf=Review%20the%20approved%20plan&t=1709236279704

CITY OF AMES

The City of Ames released its climate action plan in 2023, with a primary goal to transition to clean energy while benefiting the economy and improving quality of life.[10] The plan's target is aligned with the international goal of limiting warming to 1.5°C, resulting in a municipal model that will reduce GHG emissions by 71% by 2030 and reach net-zero emissions by 2050. The plan models potential investments that reduce energy use per capita, improve energy used versus lost, and switch to zero-carbon fuel sources. Opportunities listed include heat pumps, building retrofits, renewable energy technologies, energy storage, electric vehicles, and energy controls, with other possibilities in mind. The Ames plan could serve as an example for other municipalities in Central Iowa to implement their own climate action plans.

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[10] City of Ames. (2023, April 18). *Climate Action Plan*.
https://www.cityofames.org/home/showpublisheddocument/72522/638219262478230000.

Coordination and Outreach

Polk County conducted extensive intergovernmental coordination, outreach, and engagement with governmental entities and other stakeholders during the development of the PCAP. This section describes the framework Polk County used to support robust and meaningful engagement strategies to ensure comprehensive stakeholder representation and overcome obstacles to engagement.

IDENTIFICATION OF STAKEHOLDERS

Polk County identified stakeholders who are representative of the entities, groups, and individuals who may assist in furthering or be impacted by the implementation of this PCAP. Stakeholders include but are not limited to:

- State agencies;
- Metropolitan planning organizations;
- Cities;
- Counties;
- Local elected officials and staff;
- Economic development organizations;
- Utilities;
- Consumer advocates;
- Community-based organizations;
- Chambers of commerce;
- Other interested organizations; and
- Residents of Central Iowa.

Stakeholders engaged throughout the process are listed below and in Appendix A.

INTERAGENCY AND INTERGOVERNMENTAL COORDINATION

The Polk County planning team coordinated with state, regional, and local governmental agencies throughout the PCAP process, including other Polk County departments (e.g., Public Works, Public Health, Emergency Management, etc.), elected officials and staff from the seven-county region, regional planning entities, and state agencies. Intergovernmental coordination included:

- Providing information about CPRG and the PCAP process to government agency representatives via email, presentations, and meetings;
- Providing multiple opportunities to submit ideas and provide feedback on PCAP priorities and measures via online forms, large & small group meetings, and one-on-one conversations; and
- Notifying eligible government entities about their eligibility to apply for CPRG implementation grants and the applicability of the PCAP to any potential CPRG implementation grant application.

A summary of governmental and regional coalition stakeholders engaged during the PCAP process is listed below; see Appendix A for a detailed log of outreach and coordination with all stakeholders.

- Dallas County Board of Supervisors
- Guthrie County Board of Supervisors
- Jasper County Board of Supervisors
- Madison County Board of Supervisors
- Polk County Board of Supervisors
- Story County Board of Supervisors
- Warren County Board of Supervisors
- City of Altoona
- City of Ames
- City of Ankeny
- City of Bondurant
- City of Clive
- City of Colfax
- City of Des Moines
- City of Indianola
- City of Johnston
- City of Norwalk
- City of Perry
- City of Pleasant Hill
- City of Polk City
- City of Urbandale
- City of Waukee
- City of West Des Moines
- City of Windsor Heights
- City of Winterset
- Central Iowa Regional Transportation Planning Alliance (CIRTPA)
- Des Moines Area Metropolitan Planning Organization (DMAMPO)
- Des Moines Area Regional Transit Authority
- East Central Iowa Council of Governments
- Mid-Iowa Planning Alliance for Community Development
- Metro Advisory Council
- Mid-Iowa Association of Local Governments
- Iowa Economic Development Authority
- Iowa Finance Authority (IFA)
- Iowa Department of Health and Human Services
- Iowa Department of Natural Resources
- Iowa Homeland Security & Emergency Management
- Region XII Council of Governments
- Polk County Public Health

- Polk County Public Works
- Polk County Emergency Management
- Polk County Conservation
- Story County Conservation
- Madison County Conservation

The planning team also reviewed relevant existing city, county, and regional plans while developing the PCAP, including the City of Des Moines Climate Action & Adaptation Plan (ADAPT DSM), the City of Ames Climate Action Plan, and each of the county hazard mitigation plans.

Additionally, prior to the CPRG award in August 2023, Polk County has participated in the development of or reviewed numerous other plans and initiatives including, but not limited to, the following:

- Capital Crossroads Strategic Plan Update[11]
- CIRTPA Long-Range Transportation Plan[12]
- Here We Grow![13]
- Mobilizing Tomorrow [14]
- State of Iowa Drought Plan[15]
- United Way of Central Iowa's OpportUNITY Plan[16]
- United Way of Iowa's 2023 ALICE (Asset-Limited, Income Restrained, Employed) Report[17]

This PCAP has been aligned with the above plans and initiatives wherever possible.

OUTREACH SUMMARY

The Polk County planning team engaged with a wide variety of stakeholders during the PCAP process. Due to the short timeline, engagement focused on connecting with "grasstop" stakeholders. In this effort, Polk County met with staff and leadership from many organizations and sectors that will be involved in the CPRG process, as well as the Board of Supervisors from each of the seven participating Central Iowa counties. Once the CPRG Phase II guidance was

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[11] Capital Crossroads. (2024). *Capital Crossroads Roadmap.*
https://www.capitalcrossroadsvision.com/capitalcrossroadsroadmap/
[12] Central Iowa Regional Transportation Planning Alliance. (2020, May). *Horizon Year 2040 Long-Range Transportation Plan.* https://cirtpadotorg.files.wordpress.com/2020/09/final-hy-2040-lrtp-cirtpa.pdf
[13] *Here We Grow!* (n.d.). https://www.herewegrow.city/
[14] Des Moines Area Metropolitan Planning Organization. (2019, November). *Mobilizing Tomorrow 2020-2050: A Transportation Plan for a Greener Greater Des Moines.* https://dmampo.org/plan/mobilizing-tomorrow/
[15] Iowa Department of Natural Resources, Iowa Department of Agriculture and Land Stewardship, & Iowa Department of Homeland Security and Emergency Management. (2023, January). *Iowa Drought Plan.*
https://www.iowadnr.gov/Portals/idnr/uploads/files/2023-iowa-drought-plan.pdf
[16] United Way of Central Iowa. (2018, June 5). *OpportUNITY Plan.*
https://www.unitedwaydm.org/hubfs/Opportunity%20Plan%206.7.18%20lower%20res.pdf
[17] United Ways of Iowa & United for ALICE. (2023). *ALICE in the Crosscurrents: COVID and Financial Hardship in Iowa*. https://www.uwiowa.org/sites/uwiowa/files/ALICE/23UFA_Report_Iowa_4.11.23_FINAL.pdf

released, Polk County built connections with all organizations involved in pursuing a CPRG implementation grant.

Polk County also conducted a survey of city staff and leadership priorities for each community in Central Iowa and released a public survey to garner feedback on initial wants and needs, as well as interest in climate action and other sustainability issues. These surveys led to the establishment of the "What's Next, Central Iowa?" title for Central Iowa's CPRG efforts, as there were many differing viewpoints and lots of ideas, but little concerted effort towards one priority over another. As such, the initial PCAP outreach will provide the basis for meaningful sustained engagement during the CCAP and beyond.

Polk County educated stakeholders about CPRG and the PCAP process and asked for feedback and ideas through:

- Virtual large & small group stakeholder meetings;
- One-on-one, large, and small group meetings;
- An online form to submit potential PCAP measures;
- A community-wide survey;
- A survey of local government officials; and
- A survey of programs that administer owner-occupied housing upgrade programs.

A summary of non-governmental stakeholders engaged during the PCAP process is listed below in alphabetical order; see Appendix A for a detailed log of outreach and coordination with all stakeholders.

- 1000 Friends of Iowa
- AARP
- BlueGreen Alliance
- Center for Rural Affairs
- Central Iowa Housing Trust Fund
- Community Foundation of Greater Des Moines
- Des Moines Film
- Des Moines Area Community College
- Drake University
- Environmental Law & Policy Center
- Fourmile Creek Watershed Management Authority
- Greater Des Moines Habitat for Humanity
- Greater Des Moines Partnership
- Green Iowa AmeriCorps
- Grow Solar Polk County
- IMPACT Community Action Partnership
- Iowa Association for Energy Efficiency
- Iowa Business for Clean Energy
- Iowa Environmental Council
- Iowa Clean Cities Coalition
- Iowa Labor Center

- Iowa Natural Heritage Foundation
- Iowa State University
- Iowa Waste Reduction Center
- Midwest Climate Collaborative
- Midwest Renewable Energy Association
- MidAmerican Energy
- Mud Camp Spring Creek Watershed Management Authority
- Neighborhood Finance Corporation
- New Opportunities, Inc.
- Polk County Clean Energy District
- Polk County Housing Trust Fund
- Story County Housing Trust Fund
- Transportation for America
- Trees Forever
- The Nature Conservancy
- United Way
- Urban Land Institute
- Urban Sustainability Directors Network
- Walnut Creek Watershed Management Authority
- Wells Fargo Foundation

Online Measure Submission Form

Polk County sent an online measure submission form to governmental and non-governmental stakeholders in January 2024. It provided an opportunity for respondents to submit ideas for measures to be included in the PCAP and asked for a description of the idea, GHG sector, geographic scope, and implementation recommendations. Twenty-eight measure ideas were submitted and considered for inclusion in the PCAP. Some elements were incorporated into the PCAP. Other ideas will be saved for the CCAP planning process, during which the planning team will have ample time for analysis and decision-making.

Community-Wide Survey

Polk County sent a survey to relevant partners (listed in the stakeholders list above and the Outreach Log in Appendix A) across the planning area to gauge community interest in different sustainability topics for CPRG. The survey was open from December 13 through December 31, 2023 and received 105 responses from Polk County, 16 responses from Story County, three responses from Dallas County, and three responses from Warren County.

Respondents were asked what sustainability-related items interested them personally. Answers and the number of times they were selected are listed below, starting with the item that was most frequently selected:

1. Lower energy bills - 83
2. Cleaner water - 83

3. More renewable energy in my community - 69

4. Solar panels on my roof - 64

5. Less smoke in the summer skies - 62

6. More local and sustainable options when shopping - 54

7. More trees in my yard/neighborhood - 46

8. An electric vehicle and charging station – 31

9. New windows - 31

Local Government Survey

Polk County sent a survey to city managers, mayors, and clerks from municipalities across the planning area to gauge interest in preliminary measure ideas. The survey was open from November 10 to December 15, 2023.

The top six climate planning topics of interest were:

1. Transportation

2. Utilities (water, electric, natural gas, etc.)

3. Residential buildings

4. Commercial buildings

5. Community engagement

6. Waste management

While transportation and utilities were the top topics of interest for governmental staff, these two areas were not chosen as priorities in the PCAP. Discussions with utilities have begun; however, due to the short PCAP development timeline, there was not sufficient time for the discussions needed to find solutions with energy utilities. There are numerous individual and collective agreements in place between cities and their utilities that would need to be worked out. This topic area will be discussed during the CCAP process.

Additionally, transportation was not selected as a priority for this plan due to the large amount of transportation-related funding and training opportunities already available to the region. Furthermore, when reviewing DMAMPO and CIRTPA's long-range transportation plans, it is apparent that political leadership as well as the public are not ready to make major moves in transportation climate action. Transit, active transportation, electric vehicle infrastructure, etc. are only minor pieces of each plan, and therefore will need much more discussion and outreach to ensure these become significant elements of the agencies' work.

Respondents were also asked about an example measure focused on increasing tree canopy. Respondents generally felt that increasing canopy cover is a multi-beneficial method of addressing GHG emissions that could have relatively easy buy-in from non-traditional partners. Benefits like air quality improvement, stormwater retention, reduced cooling costs for buildings, and neighborhood beautification are attractive to groups that might not otherwise be involved in sustainability.

Appendix B is a summary of feedback on GHG reduction pathways received from partners during the PCAP process. Because the PCAP cannot address everything in its six-month timeline, the planning team created a matrix to document and score each of the proposed pathways using FEMA's STAPLEE evaluation criteria.[18] The proposed GHG reduction pathways in Appendix B are still priorities, but they require more discussion and/or do not fit the criteria of the CPRG Implementation Grant. Therefore, they will be continued into the CCAP process rather than this PCAP.

Additional Feedback

Polk County hosted two large virtual meetings on January 22 and February 8, 2024 that provided 1.) an overview of CPRG and the PCAP process and 2.) time for in-depth group discussions about the measure included in this PCAP. Attendees included local governments, CAP agencies, housing trust funds, and other potential implementers and partner organizations. High-level feedback included:

- There is a high need for energy auditors and contractors to do residential energy efficiency upgrades.
- Existing weatherization programs typically serve households up to 80% area median income (AMI), but funding is needed to serve households that are 80-100% AMI.
- Residential efficiency and electrification programming should be aligned with existing programs so that households experience a streamlined "one-stop shop".

Future Outreach Plan

Polk County is committed to deepening its engagement with local governments, community-based organizations, stakeholders, LIDAC residents, and residents of Central Iowa as the county drafts a comprehensive climate action plan (CCAP) to be delivered in 2025 and a status update on implementation of this PCAP and the CCAP in 2027.

Potential strategies for engagement with LIDACs and other communities during the PCAP process are summarized below:

- Online resources:
  - Web page
  - Email list
  - Social media
  - Portal for submitting ideas
  - Community survey
- Community meetings across the state with options for in-person, livestream, and video conference participation;
- Targeted outreach to known community-based organizations;
- Working with trusted messengers (e.g., community-based organizations) to reach residents who don't typically participate in government-sponsored events;

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[18] FEMA. (2004, August). *Using HAZUS-MH for Risk Assessment: How-To Guide*, 144-145. https://www.fema.gov/pdf/plan/prevent/hazus/fema433.pdf

- Push cards and flyers;
- Attendance at established community events to disseminate information about climate change/action and help community members provide input about individual sectors or sustainability as a whole; and
- Public comment period on the draft plan.

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

During the PCAP process, large group virtual stakeholder meetings were held on Zoom to overcome geographical barriers to participation and ensure that people from across the seven-county region could participate. Closed captioning was available to Zoom meeting participants.

As described above, the bulk of Polk County's engagement with members of LIDACs and other residents will occur during the CCAP development process. During that process, the planning team will provide ample opportunities to overcome barriers to participation, including, but not limited to, hosting events and meetings in each of the seven counties, providing virtual options for participation, providing interpretation and translation services when requested, and sharing online and print resources developed with accessibility in mind.

Outreach and Coordination Documentation

Appendix A provides a log of interagency and intergovernmental coordination and stakeholder and public engagement efforts associated with developing this PCAP.

Greenhouse Gas Emissions Inventory

A greenhouse gas emissions inventory (GHGI) accounts for all emissions within a defined boundary throughout a calendar year. This GHGI uses data for the calendar year 2020 in Central Iowa.

EMISSIONS SECTORS

Emissions are calculated by sector. Definitions for each sector are below.

- **Mobile combustion**: The combustion of fuels to power a moving vehicle, such as gasoline or diesel fuel in a car or truck.
- **Electricity generation** from fossil fuels such as coal, oil, and natural gas releases CO_2 and other GHGs.
- **Urban forestry** involves the assessment of carbon sequestration and emissions associated with trees and vegetation in urban areas. Trees absorb CO_2 through photosynthesis, helping to offset emissions from other sources. (This sector is called "land use, land-use change, and forestry" under international inventory protocols.[19])
- **Agriculture and land management** activities include an assessment of emissions from the use of synthetic fertilizers. Additional land management practices such as livestock production, deforestation, land use changes, and soil management can release substantial amounts of CO_2 and other GHGs, but those practices were not included in this PCAP inventory.
- **Stationary combustion**: The on-site combustion of fuels to produce electricity, heat, or motor power using equipment in a fixed location.
- **Solid waste** emissions refer to greenhouse gases released during the decomposition of organic waste in landfills, as well as emissions from waste treatment and disposal processes.
- **Wastewater treatment** involves the management and treatment of domestic and industrial wastewater. The treatment process can release CH_4 and N_2O, both potent GHGs.

EMISSIONS BY SECTOR

Calculations for this GHGI are based on community-wide data from 2020, the most recent year for which sufficient data was available. To provide consistency across jurisdictions, data was obtained from high-confidence data sets from government sources and supplemented with data obtained directly from emitting agencies. Additional data sources, details, and methodology are provided in Appendices C and D.

92% of Central Iowa GHG emissions come from Electricity Use, Mobile Combustion, and Stationary Combustion

For a quick view of GHG emissions by sector for Central Iowa, see Table 2 below.

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[19] United Nations Climate Change. (n.d.)   *Land Use, Land-Use Change and Forestry (LULUCF)*
https://unfccc.int/topics/land-use/workstreams/land-use--land-use-change-and-forestry-lulucf

Table 2. Central Iowa GHG Emissions by Source/Sector, 2020 (mt CO$_2$e)

Source/Sector	Residential	Commercial /Institutional	Industrial	GHG emissions (mt CO$_2$e)	Percent of Total
Stationary Combustion	951,624	1,063,521	663,407	2,678,552	22%
Mobile Combustion	2,277,031	2,129,655		3,564,470	30%
Solid Waste		137,821		137,821	1%
Wastewater		250,507		250,507	2%
Electricity Use	1,245,917	2,636,739	888,705	4,771,361	40%
Ag & Land Management			569,335	569,335	5%
Urban Forestry	-172,095			-172,095	-1%
Total (Gross Emissions)	4,474,573	5,376,027	2,121,447	11,972,047	100%
Total (Net Emissions)	4,302,478	5,376,027	2,121,447	11,799,952	100%

Data from Table 2 is presented in chart format in Figure 4 below.

Figure 4. Central Iowa GHG Emissions by Source/Sector, 2020
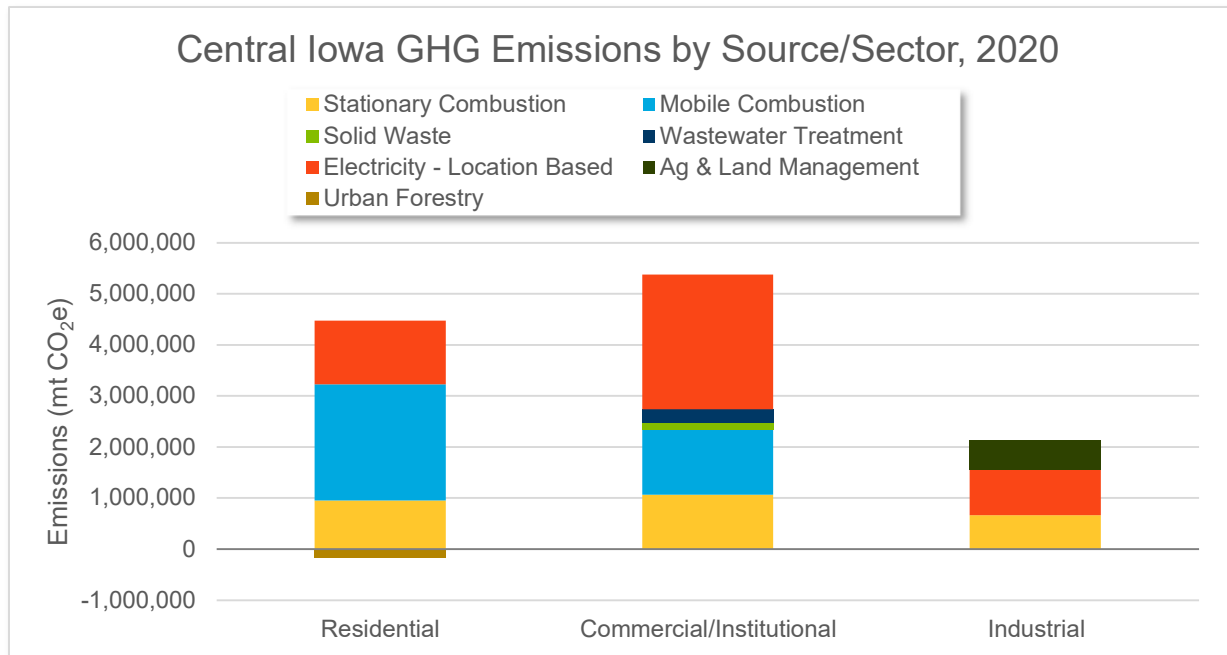
Though CO$_2$ is not the most potent greenhouse gas, it is the most prolific. Figure 5, below, shows Central Iowa emissions by source gas, with CO$_2$ emissions far exceeding the proportion of emissions from CH$_4$ or N$_2$O.

Figure 5. Central Iowa GHG Emissions by Source/Gas, 2020

Central Iowa GHG Emissions by Source/Gas, 2020

■ CO2 ■ CH4 ■ N2O
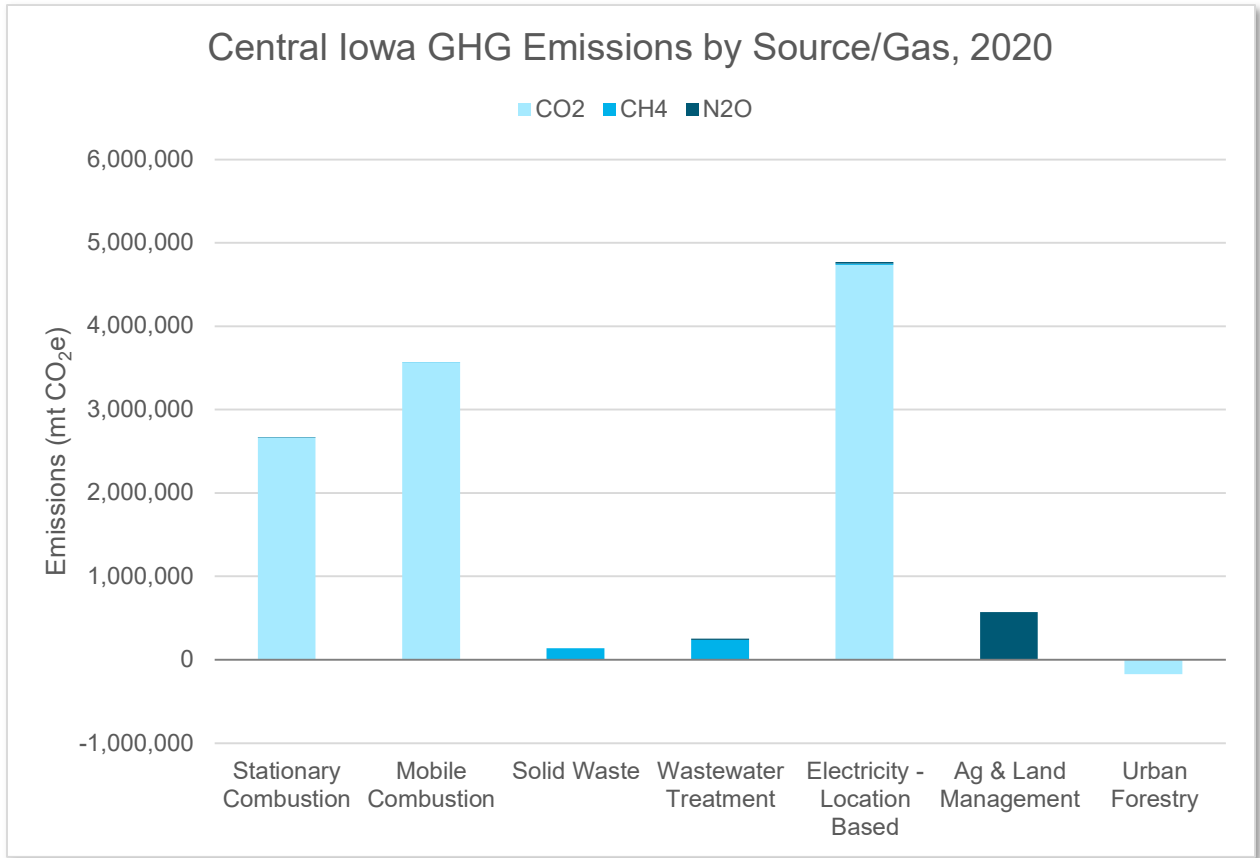
Priority Measure and Implementation Strategies

As described in the outreach and coordination section of this plan, Polk County conducted extensive outreach and received many ideas to reduce GHGs as part of the "What's Next, Central Iowa?" planning process. This section details a measure that pulls together a suite of these ideas that collectively reduce residential home energy use for low-income Central Iowans. This measure is not exhaustive of Central Iowa's priorities. Instead, the measure included in this PCAP was selected because it met 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.

Polk County will continue to engage with governmental entities, community-based organizations, and other stakeholders to expand upon and collect additional ideas for measures to include in its CCAP.

MEASURE SUMMARY

Measure

Reduce home fossil energy use and increase carbon sequestration through residential efficiency and ecosystem services for low-income households.

Implementation Strategies

- Expand upon existing energy audit and weatherization programs to increase low-income households served and provide additional incentives for energy efficiency, electrification, renewable energy, and ecosystem services offerings.
- Fund energy auditor and contractor training and certification programs, including outreach to recruit prospective contractors.
- Conduct neighborhood assessments of LIDACs and plant diverse native trees and shrubs to sequester carbon and reduce heat island effects.
- Partner with workforce organizations and institutions of higher learning on training programs for energy audits and follow-up services.

Cumulative GHG Emissions Reductions

See Appendices E and F for the methodology, assumptions used, and other details about the GHG emission reduction calculations.

- 2025 – 2030: 18,007 mt CO_2e
- 2025 – 2050: 138,053 mt CO_2e

MEASURE DETAILS

As noted in the introduction, Central Iowa is already experiencing increasingly extreme temperatures, severe and intense wind and storm events, and long-lasting drought conditions. As Central Iowans weather extreme temperatures, heating, ventilation, and air conditioning systems (HVACs) within homes are under major stress as they try to keep up with the need for interior climate controls. Extended HVAC use increases cost and consumption of energy in nearly every household. Additionally, wind, hail, and intense storms have made a significant physical and fiscal impact on Central Iowa in recent years, leaving behind damaged property and an influx of insurance claims to homes and automobiles.[20]

Due to this increase in extreme events and associated costs, Central Iowa will build off existing weatherization and energy efficiency work conducted by city, county, and regional organizations. Polk County will establish further funding and incentives for energy efficiency, electrification, renewable energy, and ecosystem service offerings that specifically focus on low-income households and LIDAC census block groups. At present, there are programs available to low-income Central Iowans that require a home energy audit as a pre-requisite. However, the existing programs are woefully underfunded and unable to keep up with the increasingly large demand for assistance. Implementing this measure will increase the number of homes that can be audited and retrofitted, thereby reducing energy consumption and costs in low-income households.

Furthermore, this measure includes neighborhood assessments in LIDACs to inform delivery of ecosystem services in the urban setting, such as planting of native trees and shrubs to replace trees lost to recent storm events, like the August 2020 derecho. As benefit multipliers, these neighborhood-wide tree and shrub plantings will provide shade for homes and streets, thereby reducing urban heat island stresses and creating more walkable spaces, increasing biodiversity and habitat, and increasing carbon sequestration capacity year over year.

This measure's implementation will go beyond typical weatherization processes and aim to increase the number of homes with electrical capacity such that low-income households could add electric vehicle charging, electrified appliances, and/or solar as those technologies become more accessible and economically feasible. This measure aims to break down barriers to adopting low- and no-carbon practices where possible for low-income households.

To ensure success of this measure, Central Iowa will expand energy auditor and contractor capacity by directly providing training opportunities through CPRG efforts and connecting into training and professional development programs that the State of Iowa or other partners are currently developing.

Sectors associated with this measure include residential electricity use and natural and working lands. The measure will be implemented in all Central Iowa counties covered in this PCAP (Dallas, Guthrie, Jasper, Madison, Polk, Story, and Warren).

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[20] National Oceanic and Atmospheric Administration. (n.d.). *Iowa Summary*.
https://www.ncei.noaa.gov/access/billions/state-summary/IA.

MAJOR FEATURES

This measure has been developed and will be implemented as a partnership between a centralized coordinating agency, Polk County, and regional and local government housing and community development agencies.

Centralized Marketing and Outreach with Localized Administration

Polk County is aware that what works in urban areas of Central Iowa may not be advantageous in rural areas. Therefore, Polk County will develop centralized marketing materials through the CCAP process and make those available to all participating agencies for their use and localization. As Polk County seeks to ensure relevant material is available throughout the region and process, they anticipate regularly convening administrators and working with coordinating agencies to localize program offerings and administrative processes and bring any needs to partners for discussion and action.

Home Energy Audits and Services Selection

The program will expand existing home energy efficiency audit programs to include additional electrical and ecosystem service capacity checks at no cost to participants. To qualify for an audit and services, households must be approved for the Low-Income Home Energy Assistance Program (LIHEAP) or earn at or below 200% of the federal poverty level, which is consistent with state protocols and many of the local programs within this sector. When complete, auditors will submit their findings to the program administrators. The program administrator will use audit results to produce a curated list of additional reduced-cost service offerings, including expectations for service delivery timing and participant costs. Polk County continues to explore opportunities to ensure this program has navigators that will help participants receive a smooth process and delivery from start to finish.

Program service offerings may include, but are not limited to:

- **Energy efficiency upgrades**
  - Energy-efficient appliances
  - Insulation
  - Windows
  - Smart thermostats
  - Heating, ventilation, and air-conditioning
  - Smart irrigation
- **Renewables and Electrification**
  - Electric panel upgrades
  - Residential electric vehicle infrastructure
  - Solar tubes & other passive lighting
  - Small-scale renewables (e.g., solar water heater)
- **Ecosystem Services**
  - Native tree & shrub planting

The administrator will coordinate the delivery of service offerings selected by audit participants. Delivery methods will prioritize full-cost coverage for participants but will continue to seek

pathways to incorporate available rebates, cost-share programs, and batch-and-build methods to deliver energy efficiency and capacity benefits to as many households as possible.

Furthermore, Polk County and partners will continue to monitor the release of details on additional grants for LIDAC residents and tap into those resources where possible to maximize funding efficiencies. Polk County anticipates service delivery will be aligned and coordinated with existing programs, including weatherization and home rehabilitation, and will work to form public-private partnerships to increase reach and impact.

Neighborhood Native Trees and Shrubs Assessment and Plantings

The program administrator will coordinate assessments of LIDAC neighborhoods to determine whether such communities would benefit from plantings of native trees and plants. The administrator will obtain consent from residents to plant native trees and shrubs to reduce home energy needs and mitigate urban heat island effects. Native trees and shrubs will be planted and maintained in cooperation with local partners and technical experts, and where possible, in accordance with local urban forest master plans.

Workforce Development

Throughout this PCAP process and measure development, workforce has been the number one discussion topic, specifically in regards to qualified contractors and energy auditors. Polk County has worked with Des Moines Area Community College (DMACC), Iowa Labor Center, labor unions, and other agencies to determine how to rectify this need. That work includes, but is not limited to, determining what competencies and courses are already available through DMACC that might need retooling to meet the needs of this proposed measure.

Additionally, Polk County has identified funding sources—including the Training for Residential Energy Contractors, or TREC program— which may soon be available to develop trainings at the state-level. The county will continue to explore options and collaborate with partners to determine which agency will lead collective workforce development efforts, as well as where new energy positions stemming from this program could be employed. Again, Polk County will work to develop public-private partnerships to ensure cohesive action throughout the region.

Polk County will continue to partner with local, regional, and state government organizations and institutions of higher learning to create and provide energy auditor and contractor training, certification, and professional development programs. Furthermore, all agencies involved in this measure are willing to be involved in outreach to recruit prospective contractors and auditors to the varying degrees their agencies have capacity and connection.

MEASURE EVALUATION & MAINTENANCE

Polk County anticipates convening the partner administering organizations at least once a year to evaluate whether any changes to implementation guidance, coordination mechanisms, or the audit addendum form are needed and to incorporate lessons learned and best practices from implementation.

TASKS AND MILESTONES

Table 3. Tasks and Milestones

Task #	Task Description	Anticipated Milestones
1	Pursue and receive implementation funding.	Spring - Fall 2024
2	Enter funding agreements with local and regional implementers.	Fall 2024
3	Community engagement around measure implementation administration specifics	Fall 2024
4	Produce implementation guidance and an energy audit addendum form that assesses the feasibility of the additional service offerings available under this measure.	Winter 2024
5	Coordinate with volunteer organizations and institutions of higher learning to establish training and apprenticeship programs.	Winter 2024
6	Measure implementation (audits, services, and workforce training)	January 2025 – December 2029 or beyond if additional funding is secured

EXPECTED OUTPUTS AND OUTCOMES

Expected outputs include:

- Approximately 1674 low-income households audited and weatherized, with at least 49% of serviced homes located in LIDACs
- New auditors trained and certified
- New contractors trained
- Energy savings in therms, gallons, and MWh in low-income households
    - See the GHG calculation spreadsheet for savings estimates
- More than 35,000 native trees and shrubs planted in LIDACs

Expected outcomes include:

- Cumulative GHG emissions reduced or sequestered:
    - 2025 – 2030: 18,007 mt CO_2e
    - 2025 – 2050: 138,053 mt CO_2e
- Reduced air pollutant emissions
- Reduced energy cost burdens
- Reduced urban heat island effects
- Increased LIDAC access to energy efficiency & technology
- Increased energy auditing and efficiency workforce capacity

RISKS

Table 4. Measure Risks & Mitigation Strategies

Risk	Effect on GHG emission reductions	Mitigation strategies
Insufficient energy auditor and contractor capacity for additional home audits and service offerings. Existing weatherization and retrofit programs have expressed a need for additional auditor and contractor capacity.	Insufficient capacity could create delays in delivering program offerings. Any delay could reduce near-term cumulative GHG emission reductions.	Provide funding for energy contractor training and certification programs, including outreach to recruit prospective contractors. If such funding is unnecessary due to other available programs, like TREC, any implementation funding allocated to this area will be reallocated pro-rata to weatherization and ecosystem services projects. Partner with Green Iowa AmeriCorps and University of Northern Iowa students on energy audits, neighborhood assessments, and follow-up services
Participant costs not covered by program incentives may present a barrier to uptake of the full suite of offerings that could reduce household energy use. Some households will be interested in additional upgrades and services that would be above the cap per household.	Limited uptake could reduce the ability of the program to capture all potential near- and long-term cumulative GHG emission reductions.	Partner with community development financial institutions to provide low-interest financing for participant costs not covered by the program. Partner with municipal utilities to provide opportunities for "pay as you save" financing on utility bills.

TRANSFORMATIVE IMPACT

Implementing this measure will create transformative impacts that lead to significant additional GHG emission reductions for low-income households and neighborhoods. The implementation strategy described above would increase energy auditor and contractor capacity to reach more homes than are currently served by existing programs. "Make-ready" offerings like the electric panel upgrade and residential electric vehicle charging infrastructure will enable households to more easily invest in electric vehicles, electrified appliances, and residential solar in the future—choices that can reduce their carbon footprint beyond what can be achieved under this measure.

Further, administrators would also connect participants with other existing financing and grant programs for home energy services that can boost uptake and GHG reduction beyond the initial implementation goals of this measure. The measure is scalable and can be replicated by communities across the United States.

Need for Funding and Intersection with Other Funding Availability

Cities, counties, regional agencies, and other organizations across Central Iowa receive state and federal funding to administer various programs that fund weatherization, energy efficiency, and/or home rehabilitation upgrades for owner-occupied single-family homes. (See Appendix G for a summary of programs that relate to this measure.) However, these programs do not meet the existing need. For example, the Polk County weatherization program has a waitlist of more than 9,000 households; the New Opportunities, Inc. weatherization program has a waitlist of more than 3,000 households; and the IMPACT Community Action Partnership weatherization program has a waitlist of hundreds of households. Statewide, the Low-Income Weatherization Assistance Program approves approximately 80,000 applications, but only 2,000 of these can be served each year based on current funding levels.[21]

Agencies carrying out these programs in Central Iowa were asked to participate in the development of this measure. In addition to in-depth discussions about measure delivery, they were surveyed regarding their offerings, barriers, and needs. More than 12,500 homes are currently waitlisted in the region, and less than 600 are completed each year at current funding and staffing levels. Polk County and all coordinating agencies acknowledge additional funding and capacity is needed to reduce low-income household energy burdens, increase staffing levels, and reduce emissions in Central Iowa. This measure aims to ensure all three.

Table 5, below, describes the funding sources that cities, counties, regional agencies, and the State of Iowa have secured or are pursuing that would complement this measure and associated workforce development.

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[21] Iowa Health & Human Services. (2024, February 9). *Weatherization Assistance FAQ.* https://hhs.iowa.gov/programs/programs-and-services/weatherization/faq.

Table 5. Existing Funding Sources

Funding Program	Funding Entity	Description	Gaps
Existing Funding Sources			
Weatherization Assistance Program (WAP)	U.S. Department of Energy	State of Iowa (hereafter, "State") passes WAP funding through to local Community Action Agencies (CAAs).	• WAP funds can only be used for cost-effective upgrades, which wouldn't fund the electric panel upgrades, EV chargers, and other provisions. • CAAs have long waitlists for current weatherization services. • The programs have a 200% FPL income cap.
LIHEAP[22]	U.S. Department of Health & Human Services	Provides energy bill assistance to low-income households. State passes funding through to CAAs. LIHEAP applications inform weatherization program lists and indicate the high level of need.	• Cannot be used to implement projects. • CAP agencies have long waitlists. • The programs have a 200% FPL income cap.
Community Development Block Grant Program[23]	U.S. Department of Housing and Urban Development	Provides formula funding to states and local governments to provide decent housing and support low-moderate-income households. Eligible activities can include rehabilitation of residential and non-residential structures and energy conservation and renewable energy resources.	• Not typically used for extensive energy efficiency or electrification upgrades • Not available to cities under 50,000 or counties under 200,000 residents

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[22] U.S. Department of Health & Human Services. (n.d.). *Low Income Home Energy Assistance Program (LIHEAP).* https://www.acf.hhs.gov/ocs/programs/liheap.

[23] U.S. Department of Housing and Urban Development. (n.d.). *Community Development Block Grant Program.* https://www.hud.gov/program_offices/comm_planning/cdbg.

USDA Housing Preservation Grants[24]	U.S. Department of Agriculture	Region XII Council of Governments used this to fund repair/rehabilitation of housing owned or occupied by low-income rural citizens in Dallas and Guthrie counties. Can be used to replace insulation, electrical wiring, and heating systems.	• Can only be used for areas considered rural by USDA. • Out of the counties included in the planning area, this has only been used in Dallas and Guthrie County.
National Housing Trust Fund[25] **&** **State Housing Trust Fund**[26]	U.S. Department of Housing and Urban Development State of Iowa	Local Housing Trust Funds (LHTF) receive funding from the IFA to develop or preserve affordable housing. Services include rental assistance, home repair, and homelessness assistance.	• Most LHTFs focus their spending on critical household rehabilitation needs, rather than energy efficiency, renewable energy, or electrification services. • Some LHTFs have a spending cap per household (e.g., Story County limited owner-occupied rehab costs up to $15,000 per household). • In most cases, households must be at or below 80% AMI.
Pending Funding Sources			
Inflation Reduction Act Home Energy Rebates[27]	U.S. Department of Energy	Funded by the IRA, the Home Efficiency Rebates and Home Electrification and Appliance Rebates will be administered by the State and fund efficiency and electrification upgrades for single- and multi-family households.	• The State is still in the process of designing these rebates. Historically, rebates have been less accessible to low-income and ALICE populations because they cannot afford the due to upfront costs of the product/action/measure.[28]

[24] U.S Department of Agriculture Rural Development. (n.d.). *Housing Preservation Grants*. https://www.rd.usda.gov/programs-services/single-family-housing-programs/housing-preservation-grants.

[25] Iowa Finance Authority. (n.d.). *National Housing Trust Fund*. https://www.iowafinance.com/programs-for-property-developers/national-housing-trust-fund/.

[26] Iowa Finance Authority. (n.d.). *State Housing Trust Fund*. https://www.iowafinance.com/state-housing-trust-fund/.

[27] Department of Energy Office of State and Community Energy Program. (n.d.). *Home Energy Rebates Program*. https://www.energy.gov/scep/home-energy-rebates-programs.

[28] United Ways of Iowa & United for ALICE. (2023). *ALICE in the Crosscurrents: COVID and Financial Hardship in Iowa*. https://www.uwiowa.org/sites/uwiowa/files/ALICE/23UFA_Report_Iowa_4.11.23_FINAL.pdf

State-Based Home Energy Efficiency Contractor Training Grants (alt. title: TREC)[29]	U.S. Department of Energy	The Iowa Economic Development Authority will provide contractor training on energy auditing and the proper installation of high energy efficient equipment and energy-saving practices.	• The State of Iowa will receive $2.19 million for statewide work through TREC formula funding. • The need for auditors and contractors in Central Iowa is high.
Energy Efficiency Revolving Loan Fund Capitalization Grant Program[30]	U.S. Department of Energy	Program will provide a capitalization grant to the State to establish a revolving loan fund (RLF) to provide loans and grants for energy efficiency audits, upgrades, and retrofits. Awards anticipated spring 2024.	• The State of Iowa is planning to use the funding for energy efficiency upgrades and retrofits for commercial buildings and multifamily housing, so this will not provide funding for the residential upgrades.
Energy Efficiency and Conservation Block Grants[31]	U.S. Department of Energy	Several cities in Central Iowa and the State of Iowa received EECBG formula funding. The State is using its funds for two competitive grant programs. The Community Fund focuses on energy efficiency retrofits in communities that are not eligible to receive a direct EECBG allocation, while the Innovation Fund allows innovative projects with either an energy efficiency or renewable energy focus at local governments, nonprofits, and for-profit entities.	• It is not yet known what specific projects will be funded through the state grant programs.

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[29] Department of Energy Office of State and Community Energy Program. (n.d.). *State-Based Home Energy Efficiency Contractor Training Grants*. https://www.energy.gov/scep/state-based-home-energy-efficiency-contractor-training-grants.

[30] Department of Energy Office of State and Community Energy Program. (n.d.). *Energy Efficiency Revolving Loan Fund Capitalization Grant Program*. https://www.energy.gov/scep/energy-efficiency-revolving-loan-fund-capitalization-grant-program.

[31] Department of Energy Office of State and Community Energy Program. (n.d.). *Energy Efficiency and Conservation Block Grants*. https://www.energy.gov/scep/energy-efficiency-and-conservation-block-grant-program.

Review of Authority to Implement

County, city, and regional government agencies in Central Iowa have existing authority to implement the strategies outlined in this measure.

Low-Income and Disadvantaged Community Analysis

Implementing this PCAP will significantly benefit low-income and disadvantaged communities (LIDACs). This section identifies each LIDAC within the jurisdiction covered by this PCAP, how Polk County and its partners meaningfully engaged with LIDACs in developing this PCAP, and how Polk County and its partners will continue to engage with LIDACs in the future.

IDENTIFICATION OF AND ENGAGEMENT WITH LIDACS

Climate change impacts will affect all communities in Central Iowa. Polk County recognizes the disproportionate impacts that climate change has had and will have on its low-income and disadvantaged community members. Polk County has utilized the following resources to identify and analyze the anticipated benefits and potential disbenefits of each priority measure on its LIDACs:

- EPA's **Environmental Justice Screening and Mapping Tool (EJScreen Version 2.2)**[32]: a mapping database that utilizes both environmental impacts and socio-economic impacts to identify the highest intersection of low-income populations, people of color, and a given environmental indicator. EJScreen provides thirteen environmental indicators, including air pollutants, water pollutants, toxic elements and chemicals, and hazardous waste.
    - The EJScreen tool also features an **EPA IRA Disadvantaged Communities** map layer that allows for a combined view of both datasets. Specifically, the purpose of the EPA IRA Disadvantaged Communities map is to allow potential funding applicants to determine whether a community is disadvantaged for the purposes of implementing programs under the IRA.
- The **Climate and Economic Justice Screening Tool (CEJST)**[33]: another mapping tool that identifies environmental, health, and social-economic burdens by census tract. The CEJST allowed Polk County to supplement its LIDAC identification and analysis to ensure broad consideration of how the priority measures will affect LIDACs' resilience and response to unprecedented environmental effects.

Figure 6, below, is a map of Central Iowa census block groups that are designated as disadvantaged according to the EPA IRA Disadvantaged Communities map.

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[32] U. S. Environmental Protection Agency. 2023 version. EJScreen. Retrieved: February 1, 2024, from https://ejscreen.epa.gov/mapper/

[33] Council on Environmental Quality. (2022, November). *Climate and Economic Justice Screening Tool*. https://screeningtool.geoplatform.gov/en/#3/33.47/-97.5.

Figure 6. IRA Disadvantaged Communities in Central Iowa[34]
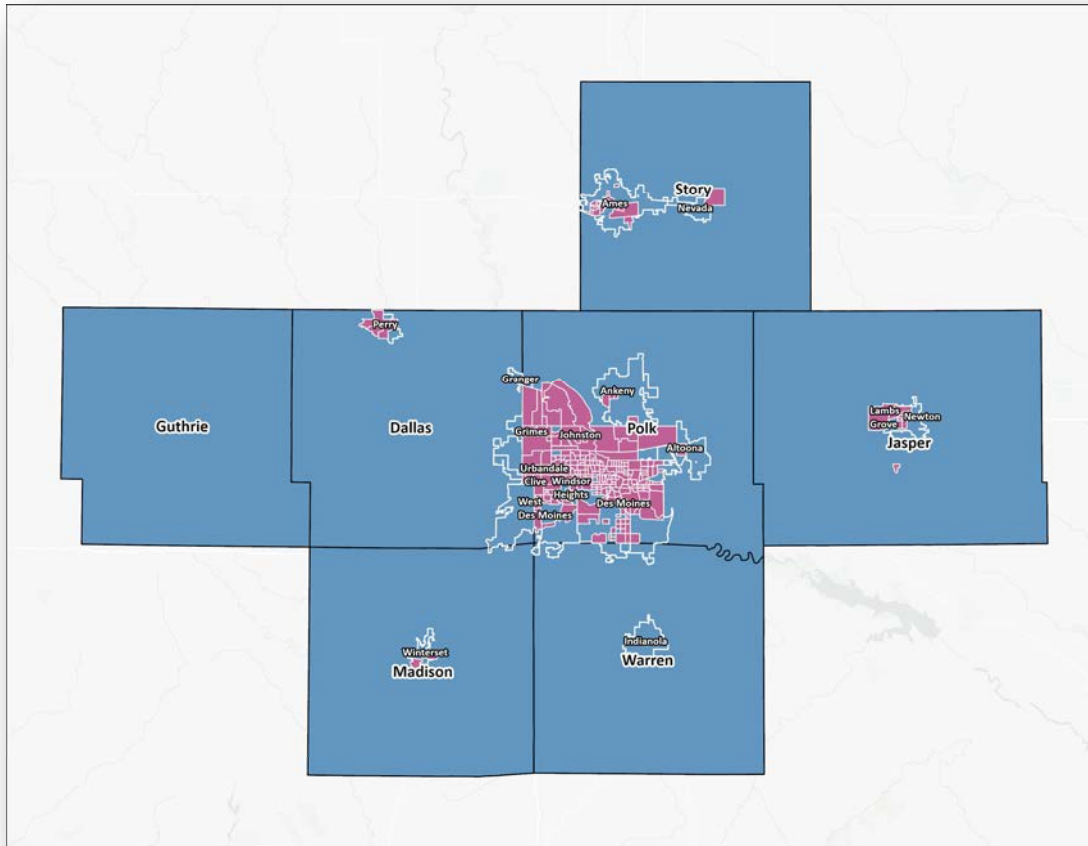
Note. IRA disadvantaged census block groups are designated in pink.

This PCAP and the measure recommended within are wholly centered around climate equity. The measures focus on serving low-income Central Iowans to reduce their energy burdens and achieve a greater quality of life. Throughout this PCAP process, Polk County engaged with many community-based organizations representing LIDAC residents throughout Central Iowa. A full list of those organizations can be found in the Outreach and Coordination Section.

Polk County will continue to deepen its community conversations and engagement as it moves toward planning for a CCAP to be delivered in 2025 and a status update on implementation of this PCAP and the CCAP in 2027. See the Outreach and Coordination section and Appendix A

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[34] U. S. Environmental Protection Agency. 2023 version. EJScreen. Retrieved: February 1, 2024, from https://ejscreen.epa.gov/mapper/

for a record of outreach activities, a summary of input received during the PCAP engagement process, and a plan for deeper engagement with LIDACs during the CCAP process.

IMPACT OF PCAP IMPLEMENTATION ON LIDACS

Appendix H lists the LIDAC census block groups in Central Iowa anticipated to be affected by each priority measure included in this PCAP. Anticipated benefits or potential disbenefits associated with measure implementation are summarized in this section.

Anticipated Benefits and Disbenefits of PCAP Implementation

Implementing strategies outlined in this PCAP will provide residential energy efficiency, electrification, and ecosystem services that will reduce home energy bills, improve resiliency, and mitigate heat island effects in Central Iowa for low-income households and neighborhoods. The services provided will fill a significant gap that Central Iowa's weatherization service providers and energy efficiency rebate programs cannot currently meet due to limited resources and capacity.

The offerings will be stackable and allow residents with lower incomes to identify and pursue the services that best fit their needs, with expert guidance from home energy auditors. Given that household heating, cooling, and powering account for around 20% of the country's energy-related GHG emissions, implementation of this PCAP will produce significant benefits both at the individual and community level for thousands of Iowans whose needs have not yet been met through existing programs.[35]

Most notably, implementation will help low-income residents reduce their energy consumption and save money. For example, services such as insulation upgrades, air leakage reduction, and window upgrades will directly reduce the amount of energy that can escape homes due to old or original infrastructure. In turn, such services will also reduce residents' energy bills and increase comfort because they will no longer need to overheat or overcool their home in response to air leaks. Furthermore, a decrease in individual residential energy use will reduce the grid's overall energy demand. Throughout the year, energy demand peaks in response to extreme weather conditions; peaks are further exacerbated by inefficient residential energy use, whether intentional or not. Providing energy efficiency services to residential homes will support a more reliable and resilient grid, even during extreme weather conditions.

Electrification of household appliances will result in healthier homes for Iowans. Gas stoves and ovens, water heaters, furnaces, and dryers that rely on fossil fuel combustion have all been known to emit air pollutants such as nitrogen oxides (NOx), carbon monoxide (CO), $PM_{2.5}$, and formaldehyde, which can cause and exacerbate health issues like respiratory diseases,

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[35] Goldstein, B., Gounaridis, D., & Newell, J. P. (2020). The carbon footprint of household energy use in the United States. *Proceedings of the National Academy of Sciences, 117*(32). 19122–19130. https://doi.org/10.1073/pnas.1922205117.

neurological disabilities, and cardiovascular complications.[36] Replacing these appliances with fully electrified versions will reduce indoor air pollution and improve household health.

In addition to household benefits, PCAP implementation will also promote community health and economic sustainability. Notably, ecosystem services such as planting native trees and shrubs will enhance green spaces within the community, which has a proven benefit on individual mental health and overall well-being.[37] Furthermore, trees within neighborhoods provide shade for cooling bodies and homes, create more walkable streets which can further enhance GHG reductions as alternative transportation options become more viable and appealing, and decrease the amount of stormwater runoff during weather events which, increasing community resilience as storms continue to intensify.

Additionally, implementation of the PCAP will directly incentivize the creation of new, well-paying clean energy jobs through increased demand for energy auditors, engineers, appliance installers, etc. Overall, the services allow residents to make clean energy decisions that meet their needs. By providing these services, Polk County will be able to promote GHG emissions reductions, efficient energy usage, individual and community health, local economic sustainability, and more, all while providing experiential education around clean energy and household energy efficiency for the benefit of the community and generations to come.

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[36] Tan Y.A. & Jung, B. (2021). Decarbonizing Homes Improving Health in Low-Income Communities through Beneficial Electrification. *RMI*. 15-16. https://passivehousenetwork.org/wp-content/uploads/2022/11/RMI_Decarbonizing_Homes_Report-_2021.pdf.

[37] Lee, A. C., Jordan, H. C., & Horsley, J. (2015). Value of urban green spaces in promoting healthy living and wellbeing: prospects for planning. *Risk management and healthcare policy*. (8). 131–137. https://doi.org/10.2147/RMHP.S61654.

Conclusion

This PCAP is the first deliverable under the CPRG planning grant awarded to Polk County. Polk County and its partners will continue planning, engagement, and action to reduce emissions; invest in sustainable infrastructure, technologies, and practices; build our economy; and enhance the quality of life in Central Iowa. In 2025, Polk County will publish a CCAP that establishes equitable and sustainable economic development strategies that reduce emissions across all sectors. The CCAP will include near- and long-term emissions projections, a suite of emission reduction measures, a robust analysis of measure benefits, plans to leverage federal funding, and a workforce planning analysis. In 2027, Polk County will publish a status report that details implementation progress for measures included in the PCAP and CCAP, any relevant updates to PCAP and CCAP analyses, and next steps and future budget and staffing needs to continue implementation of CCAP measures.

If you have questions about this PCAP or suggestions for the upcoming CCAP and status report, contact Polk County's Sustainability Planner and CPRG Project Lead, Allison van Pelt, at sustainability@polkcountyiowa.gov.

Appendix A: Outreach and Coordination Log

The table below lists most of the outreach and coordination events and meetings held during the PCAP development. Significant stakeholder meetings are highlighted in green.

Date	Organizations Involved	Topic	Attendees
Recurring Meetings			
8/1/23-2/28/24 (weekly)	Polk County Sustainability Planning Team	Phase I and Phase II organization and planning	Polk County Sustainability Team
8/1/23-2/15/24 (monthly)	Polk County Weatherization	Discussion of current program and future needs	Weatherization Program Manager
8/1/23-2/15/24 (monthly)	Iowa Natural Heritage Foundation	Discussion of climate assessment and planning	Climate assessment lead staff
11/23-8/23 (monthly)	Polk County Climate Action Team	Internal capacity discussions, focus group of CPRG ideas, etc.	Interdepartmental Polk County Staff
8/29/23 & 10/17/23	Polk County Conservation	Coordination of existing work	Polk County Conservation Green Team

10/5/23 & 10/11/24	Des Moines Area Metropolitan Planning Organization	PCAP overview and discussion	DMAMPO Technical Committee and Executive Committee members
10/4/23 & 10/17/23	Polk County Emergency Management	Coordination and Planning	Resiliency Coordinator & Program Assistant
11/17/23 & 1/26/24	BlueGreen Alliance	Discussion of labor needs, alignment, data, and ways to engage with their networks in the PCAP & CCAP	Iowa Federation of Labor Environmental Law & Policy Center Iowa Labor Center
12/11/23 & 12/15/23	Green Iowa AmeriCorps	Discussion needs, goals, capacity, funding, etc.	GIA Director & Recruitment Staff
Individual Events and Meetings			
8/11/23	Iowa Department of Natural Resources	PCAP overview and discussion	Air Quality Staff
9/8/23	Polk County Board of Supervisors	PCAP overview and discussion of priorities	Public and Board of Supervisors
9/9/23	EPA staff	PCAP overview and discussion	Project Manager, CPRG Regional Lead, & other EPA Staff
9/12/23	Madison County Board of Supervisors	PCAP overview and discussion of priorities	Public and Board of Supervisors

9/19/23	Guthrie County Board of Supervisors	PCAP overview and discussion of priorities	Public and Board of Supervisors
9/21/23	Central Iowa Regional Transportation Planning Alliance	PCAP overview and discussion of priorities	Joint Policy & Technical Committee members
9/25/23	East Central Iowa Council of Governments	Discussion of coordination between MSAs regarding CPRG Phase I & II	ECICOG CPRG Staff
9/26/23	Jasper County Board of Supervisors	PCAP overview and discussion	Public and Board of Supervisors
9/29/23	Mid-Iowa Planning Alliance for Community Development (MIPA)	PCAP presentation and discussion	Largest regional forum. Elected officials and high-level staff from 50+ communities
10/3/23	Wells Fargo Foundation	Discussion on "role" of other sectors in climate planning	Philanthropy Staff
10/4/23	Trees Forever	Discussion of One Million Trees effort across Central Iowa & CPRG	Trees Forever Director & City of Johnston Staff
10/5/23	Polk County Diversity & Inclusion Staff	Discussion about project alignment & outreach	Diversity, Inclusion, and Organizational Development Specialist
10/6/23	Greater Des Moines Partnership & Urban Land Institute	Discussion on "role" of other sectors in climate planning	GDMP Economic Development Staff & Urban Land Institute Board Member

10/10/23	Dallas County Board of Supervisors	PCAP presentation and discussion	Public and Board of Supervisors
10/10/23	Metro Advisory Council	City priority discussion ***Housing identified as a priority.***	Elected officials from across the metropolitan area
10/11/23	Mud Camp Spring Watershed Management Authority	Presentation and discussion on "role" of other sectors in climate planning	Elected officials and city staff; other stakeholders from eastern part of the region
10/12/23	AARP staff	Discussion on "role" of other sectors in climate planning	AARP Executive Council Member
10/16/23	Walnut Creek Watershed Management Authority	Presentation and discussion on "role" of other sectors in climate planning	Elected officials and city staff, other stakeholders from western part of the region.
10/17/23	United Way and Community Foundation of Greater Des Moines	Discussion on "role" of other sectors in climate planning	Philanthropy Staff
10/18/23	Metro Managers	Coordination and planning	City managers from Des Moines area urban cities and county seats: Des Moines, West Des Moines, Waukee, Pleasant Hill, Urbandale, Grimes, Johnston, Norwalk, Perry, Adel, Winterset, Clive

10/20/23	Story County Green Team	Presentation of CPRG and discussion of interconnection between work	Multi-department sustainability strategic planning group
10/24/23	Warren County Board of Supervisors	PCAP presentation and discussion; work session	Board of Supervisors, staff, & public
10/24/23	Des Moines Film	Community Engagement Discussion	DSM Film Staff
10/25/23	Transportation for America	Discussion of grants and Phase II *Transportation downgraded as priority*	DMAMPO, Transportation for America, & CIRTPA Staff
10/26/23	Fourmile Watershed Management Authority	Presentation and discussion on "role" of other sectors in climate planning	Elected officials and city staff; other stakeholders from east-central part of the region
10/30/23	City of Des Moines	Discussion city priorities and CAP work	City Manager & staff
11/8/23	Johnston, Des Moines, Urbandale sustainability committee/task forces	Discussion of grants and Phase II	Johnston Climate Change Committee, City of Des Moines Citizen Task Force for Sustainability, City of Urbandale Climate Change & Social Justice Committee
11/9/23	City of Urbandale	Presentation and discussion about existing work, priorities, and potential for collaboration during PCAP and CCAP	City staff

11/14/23	United Way OpportUNITY Program	Discussion on alignment between poverty reduction work and climate work; priorities **_Low-Income Residential identified as priority_**	OpportUNITY Program Director
11/16/23	Iowa State University	Discussion on alignment between research and practice	College of Engineering Faculty
11/20/23	City of Johnston	Discussion of priorities	Staff, public, and elected officials
11/27/23	Iowa Homeland Security & Emergency Management	Discussion of FEMA and other hazard mitigation/resilience strategies	Polk County Public Works & Emergency Management, IHSEMD, Polk Soil & Water & Polk County Conservation staff
11/28/23	Regional administration and leadership	Discussion of CPRG progress, Phase II grant proposals	Ames, West Des Moines, Des Moines, Polk County, Ankeny, & Urbandale City/County Managers
12/4/23	Iowa Environmental Council, Environmental Law & Policy Center, Center for Rural Affairs, ECICOG staff	Discussion of technical, outreach & coordination possibilities in PCAP & CCAP	Technical, Policy, and Legal Staff
12/6/23	Iowa State University	Discussion of PCAP & CCAP coordination, potential projects, research needs, etc.	Iowa State University College of Agriculture & Life Science Staff

12/6/23	Grow Solar Polk County	Discussion of ongoing and future work & funding	The Nature Conservancy Climate and Communications Manager
12/12/23	Iowa Clean Cities	Update and coordination	Clean Cities Program Manager
12/14/23	Drake University	Align project needs & coordinated efforts	Environmental Science Staff
12/14/23	Urban Sustainability Directors Network	Gain feedback on planning process, etc.	Technical and Communication Staff
12/20/23	Polk County Leadership	Discussion of progress, current and future grants, refinements & updates on PCAP & Phase II grant	County Administrator, Federal Grants Administrator, Public Works Director
12/20/23	Iowa Business for Clean Energy	Discussion of progress, current and future grants, refinements & updates on PCAP & Phase II grant	Executive Director & leadership in future Greenhouse Reduction Fund
12/20/23	Polk County Staff	Drafted outreach schedule, tools, methods, staffing, etc.	Water Resources Team
1/3/24	Mud Camp Spring WMA	Discussion of alignment of CPRG and watershed plan	Selected city staff and WMA plan update consultants
1/8/24	Midwest Climate Collaborative	Discussion of educational offerings in the climate and sustainability space	Executive Director & regional peers
1/15/24	Drake University MLK Jr. Day event	Discussion of equity and social service organizations	Drake University & Regional Non-profit Leadership

1/18/24	Central Iowa Water Works	Discussion and orientation of DMWW personnel to climate action and adaptation needs at the utility	DMWW Leadership & Technical staff
1/29/24	MIPA, MPO, CIRTPA	Collaboration on measures	Principal Planner
1/22/24	**What's Next, Central Iowa? Engagement Meeting**	**Zoom meeting - overview of CPRG and draft measures; breakout group discussions**	**56 registrants, including local, regional, and state government representatives, non-profits, utilities, and more.**
1/24/24	IMPACT Community Action Partnership	Discussion of measure and collaboration on outreach and implementation	Chief Executive Officer
1/30/24	Iowa Economic Development Authority/State Energy Office	Discussion and planning	Clean Cities Coalition Program Manager
2/6/24	State Weatherization Program	Discussion and planning	Program Director
2/6/24	1000 Friends of Iowa	Discussion of overlap in work and ways to collaborate	Executive Director
2/7/24	Polk County Media Relations	Discussion of CRPG roll out	Media Relations Staff

2/8/24	PCAP Residential Efficiency and Ecosystem Services Measure Discussion	Zoom meeting - discussion about Home Suites measure	Representatives from CAP agencies, housing trust funds, and other potential implementers
2/11/24	Polk County Public Works Staff Focus Group	Discussion of measures	Staff from Air Quality, Administration, Engineering, Accounting, Water Resources, Housing, Weatherization, Sustainability Divisions
2/14/24	City of Windsor Heights Staff	Discussion of outreach and goals	Council member
2/15/24	Polk County Housing Trust Fund	Discussion and orientation of personnel to climate action and adaptation needs within the affordable housing sector	Executive Director
2/20/24	Iowa Waste Reduction Center	Coordination and collaboration	Associate Director
2/27/24	Polk County Global Neighbors Program	Introduction to CPRG and connections with immigrant populations moving to Iowa; coordination of outreach	Program Director
2/28/24	Mid-Iowa Local Government	Presentation about CPRG overall and priority measures included in PCAP	Regional mayors

Appendix C: Greenhouse Gas Inventory Methods and Sources

The greenhouse gas inventory conducted for the Central Iowa planning area in 2020 shows that the total estimated emissions amounted to 11,972,047 metric tons of gross carbon dioxide equivalent (mt CO_2e). These emissions were classified into different sectors based on their sources. EPA's Local Greenhouse Gas Inventory Tool (LGGIT) was used to develop the GHG Inventory under the accounting protocol of the Global Protocol for Community-Scale Greenhouse Gas Inventories (GPC). See the LGGIT inventory in Appendix D.

Carbon Dioxide Equivalent (CO_2e)

While carbon dioxide (CO_2) is the primary focus of fossil fuel reduction efforts due to its abundance in the Earth's atmosphere, it is not the only GHG. In fact, CO_2 has a global warming potential (GWP) lower than other GHGs. CO_2e attributes the impacts of other fossil fuels emitted, such as methane (CH_4) and nitrous oxide (N_2O), which have significantly higher Global Warming Potential (GWP).

Emissions data is expressed as CO_2e, or carbon dioxide equivalent. This is a standard unit for GHG contributions.

Table C1. Greenhouse Gases Global Warming Potential (GWP)[1]

Kyoto Greenhouse Gases	Global Warming Potential
CO_2	1
CH_4	25
N_2O	298
Hydrofluorocarbons (HFCs)	124 - 14,800
Perfluorocarbons (PFCs)	7,390 - 12,200
Sulfur hexafluoride (SF_6)	22,800
Nitrogen trifluoride (NF_3)	17,200

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[1] United Nations Climate Change (n.d.) Global Warming Potentials (IPCC Fourth Assessment Report). https://unfccc.int/process-and-meetings/transparency-and-reporting/greenhouse-gas-data/frequently-asked-questions/global-warming-potentials-ipcc-fourth-assessment-report.

GHG Emissions Summary Table

This inventory provides further details on the composition of emissions within each sector. The analysis shows that stationary emissions account for 22% of the total, indicating the contribution of activities such as heating with fossil fuels. Electricity consumption represents 40% of emissions, while mobile emissions from transportation make up 30% of emissions. Data for other sectors is summarized in Table C2.

Table C2. Central Iowa GHG Emissions by Source and Gas, 2020* (mt CO2e)

*Note: In the limited cases where 2020 data wasn't available, the closest available year was used. See Table C5 for details.

Source	CO_2	CH_4	N_2O	Total (mt CO_2e)	% Total
Stationary Combustion	**2,670,486**	**6,530**	**1,536**	**2,678,552**	**22%**
Natural Gas	2,572,692	6,399	1,289	2,580,380	
Propane	97,794	131	247	98,172	
Mobile Combustion	**3,564,316**	**153**	**1**	**3,564,470**	**30%**
Residential On-road, Gasoline	2,229,570			2,229,570	
Residential On-road, Diesel	47,461			47,461	
Commercial/Institutional On-road, Gasoline	18,481			18,481	
Commercial/Institutional On-road, Diesel	426,742			426,742	
Commercial/Institutional Nonroad, all	842,062	153	1	842,219	
Solid Waste	**-**	**137,821**	**-**	**137,821**	**1%**
Wastewater Treatment	**-**	**236,030**	**14,477**	**250,507**	**2%**
Electricity - Location Based	**4,738,048**	**14,085**	**19,227**	**4,771,361**	**40%**
Residential	1,237,218	3,678	5,021	1,245,917	
Commercial/Institutional	2,618,330	7,784	10,625	2,636,739	

Industrial	882,450	2,624	3,581	888,704	
Ag & Land Management	-	-	569,335	569,335	**5%**
Urban Forestry	-172,095	-	-	-172,095	**-1%**
Total (Gross Emissions)	10,972,850	394,620	604,577	11,972,047	100%
Total (Net Emissions)	10,800,755	394,620	604,577	11,799,952	100%

Table C3. Central Iowa GHG Emissions by Scope, 2020[*]

	Definition	Sources	% Total	Total (mt CO_2e)
Scope 1	All direct GHG emissions from activities taking place within the planning area. This scope covers emissions sources that are owned or controlled from within the community.	• Stationary Combustion of Fossil Fuels: Emissions from burning fossil fuels at fixed installations, such as power plants, boilers, and furnaces. • Mobile Combustion of Fossil Fuels: Emissions from burning fossil fuels in mobile sources, such as vehicles and equipment. • Solid Waste Disposal: Emissions from the decomposition of waste in landfills, including the release of methane, a potent greenhouse gas. • Wastewater Treatment: Emissions from the treatment of wastewater, which can include the release of methane and nitrous oxide from biological sources.	55%	6,631,350
Scope 2	Energy-related indirect emissions that result as a consequence of consumption of grid-supplied electricity.	• Building/Facility Electricity Consumption: Emissions resulting from the use of electricity in the community.	40%	4,771,361
Scope 3	All other indirect emissions not covered in Scope 2, such as emissions resulting from the extraction and	• Agriculture & Land Management: Emissions resulting from agricultural practices. This inventory includes emissions generated from fertilizer use, but not livestock production,	3%	397,241

production of purchased materials and fuels, outsourced activities, waste disposal, etc.	crop cultivation, and land-use changes. • Urban Forestry: Emissions and removal of greenhouse gases associated with the management and preservation of urban trees and forests.

NOTE: These numbers are based on the best calculations and estimations available by scope. Though they do not add up to 100%, Polk County would rather attribute correctly based on LGGIT outputs rather than double count any particular source. The comprehensive GHGI conducted in the CCAP process will aim to get even closer to 100% accounting of scope as the data will be more directly from sources of emission and less estimations.

Figure C1. GHG Emission Scopes[2]
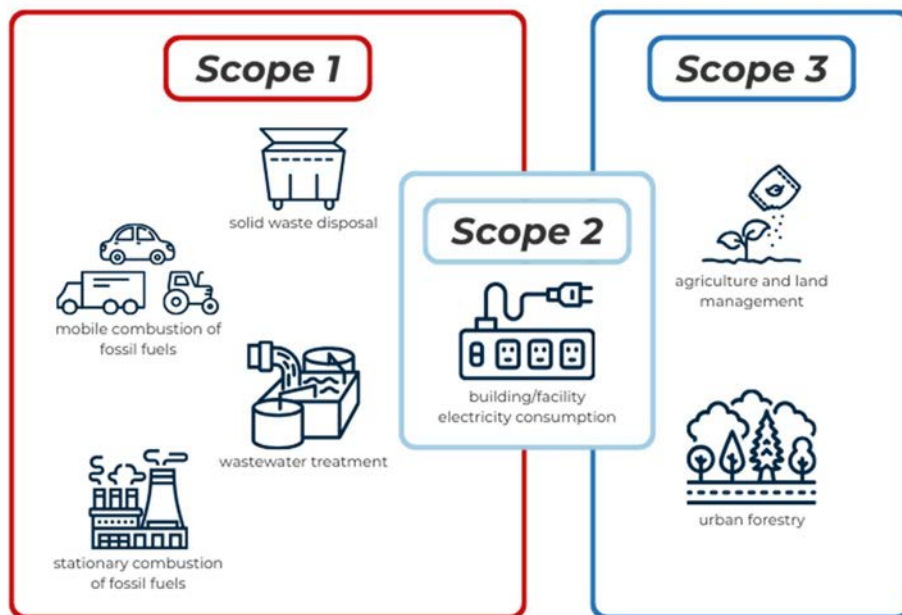
ELECTRICITY CONSUMPTION

The electric power sector was the largest emissions source, accounting for 40% of total Central Iowa GHG emissions in 2020.

MOBILE COMBUSTION

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[2] U. S. Environmental Protection Agency. (n.d.). Greenhouse Gases at EPA.

Transportation activities were the second-largest source (30%) of Central Iowa GHG emissions in 2020. This subsector includes emissions resulting from transportation activities, including emissions from cars, trucks, airplanes, and ships. All heavy-duty vehicles are categorized as commercial/institutional. All other vehicles are categorized as residential. All nonroad emissions are categorized as commercial/institutional.

STATIONARY COMBUSTION

In 2020, stationary source combustion from natural gas and propane use accounted for 22% percent of GHG emissions in the planning area. Natural gas is widely used for heating, electricity generation, and industrial applications. Liquid propane is often used as a fuel for heating and cooking.

URBAN FORESTRY

In the inventory, the net CO_2e removed from the atmosphere by urban trees in Central Iowa amounted to approximately -1% of the region's total GHG emissions. This negative percentage indicates that urban trees in Central Iowa had a slight net carbon sequestration effect, meaning they absorbed more CO_2e than they emitted.

AGRICULTURE & LAND MANAGEMENT

Agriculture made up approximately 5% of total GHG emissions. A significant portion of these emissions can be attributed to the use of synthetic fertilizers in agricultural practices. Synthetic fertilizers release N_2O, a potent greenhouse gas, during their application and subsequent soil processes. However, it's important to note that the inventory did not include other agricultural contributions to GHG emissions, such as methane emissions from livestock or manure management. These emissions are significant and can vary depending on the agricultural practices employed. Integrating these emissions into future inventories will be essential for developing a more accurate understanding of the agriculture sector's overall emissions and designing effective mitigation measures.

SOLID WASTE

The solid waste sector encompasses various activities such as landfilling and anaerobic digestion, which collectively accounted for approximately 1% of GHG emissions. Landfills are a significant contributor to these emissions due to the decomposition of organic waste, which generates methane. Methane is released when organic waste breaks down in anaerobic (oxygen-deprived) conditions. Anaerobic digestion, on the other hand, involves the controlled decomposition of organic waste to produce biogas, which can be used as a renewable energy source.

WASTEWATER TREATMENT

Wastewater treatment accounted for approximately 2% of total emissions. Wastewater treatment plays a critical role in maintaining public health and protecting the environment by removing contaminants from wastewater before it is discharged back into natural water bodies. However, the process of treating wastewater itself can contribute to greenhouse gas (GHG) emissions. Biological processes within the treatment systems, particularly during the breakdown

of organic matter, generate methane and nitrous oxide. These emissions occur during the natural decomposition of sewage by microorganisms.

Figure C2. Central Iowa GHG Emissions by Sector, 2020*
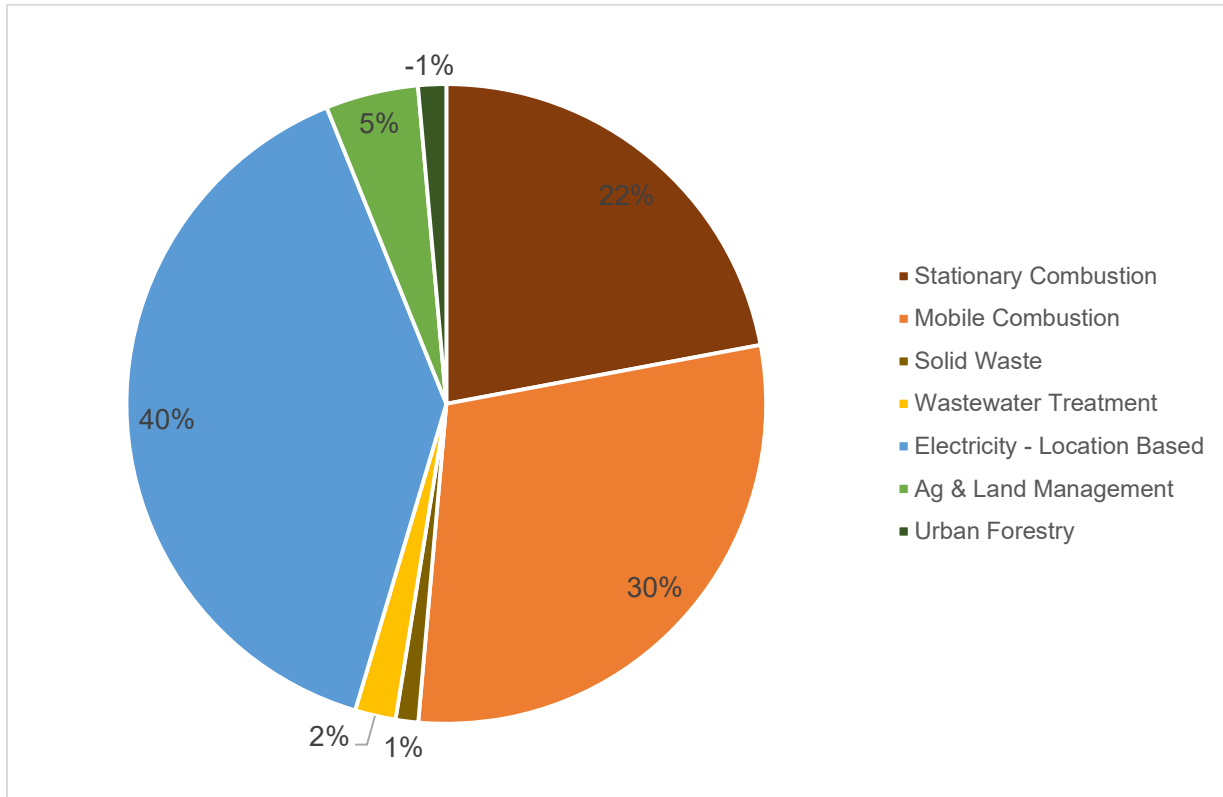
GHG Inventory Methods

Polk County identified, evaluated, and utilized existing data resources to develop a local inventory of the major sources of GHG emissions within the planning area. This inventory was conducted for the year 2020 due to the availability of data from highest quality sources (Table C4). In the instances where data for 2020 was unavailable, the closest available year was substituted. The vast majority of the GHGI uses 2020 data. For additional information on methods and quality assurance, see the Quality Assurance Project Plan (QAPP) in Appendix I.

Table C4. Data Quality Ranking Hierarchy[3]

Quality Rank	Source Type
Highest	Federal, state, and local government agencies
Second	Consultant reports for state and local government agencies
Third	Non-governmental organization studies; peer-reviewed journal articles; trade journal articles; conference proceedings
Fourth	Conference proceedings and other trade literature: non-peer-reviewed
Fifth	Individual estimates (e.g., via personal communication with vendors)

Table *C5*. Sectors and Years Included in GHGI

Sector	Inclusion	Inventory years
Mobile Combustion	Yes	2020
Stationary Combustion	Yes	2020
Electricity Consumption	Yes	2020
Solid Waste	Yes	2019, 2022
Urban Forestry	Yes	2011
Agriculture & Land Management	Yes	2015, 2016
Water Use	No*	-
Waste Generation	No*	-
Wastewater Treatment	Yes	2019, 2021, 2022

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3 Polk County. 2023. *Des Moines MSA Quality Assurance Project Plan*.

Not occurring in the region. Water is not being imported. Waste is not being exported.

Data Sources

Sector	Source
Mobile Combustion	Iowa Department of Transportation https://iowadot.gov/ EPA's Motor Vehicle Emission Simulator (MOVES) https://www.epa.gov/moves
Stationary Combustion	National Renewable Energy Laboratory (NREL) State and Local Planning for Energy (SLOPE) Platform https://maps.nrel.gov/slope U.S. Energy Information Administration https://www.eia.gov/ U.S. Census Bureau https://www.census.gov/
Electricity Consumption	NREL SLOPE https://maps.nrel.gov/slope
Solid Waste	EPA's Facility Level Information on GreenHouse gases Tool (FLIGHT) http://ghgdata.epa.gov/ghgp/main.do South Dallas County SLF Waste Volumes https://www.sdclandfill.com/reports
Urban Forestry	National Land Cover Data (NLCD) 2011 https://www.usgs.gov/centers/eros/science/national-land-cover-database
Agriculture & Land Management	EPA Ag Land Management County Regional Guidance https://www.epa.gov/system/files/documents/2023-10/ag_land_management_county_regional_guidance_9.20.23_508.pdf

	EPA's State Inventory Tool
	https://www.epa.gov/statelocalenergy/state-inventory-and-projection-tool
Wastewater Treatment	Iowa Department of Natural Resources (NPDES)
	https://www.iowadnr.gov/Environmental-Protection/Water-Quality
	U.S. Census Bureau
	https://www.census.gov/

Appendix E: Residential Efficiency, Electrification, and Ecosystem Services Measure

This appendix explains the methodology and assumptions used for developing the estimated greenhouse gas (GHG) emissions reduced under the Residential Efficiency, Electrification, and Ecosystem Services measure (hereinafter referred to as "Home Suites") in the Central Iowa Priority Climate Action Plan. See Appendix F – "Home Suites GHG Emission Reduction Calculation Spreadsheet" – for emission reduction calculations.

METHODS AND ASSUMPTIONS

Emission Reductions Estimate Method

Data obtained from the Iowa Weatherization Assistance Program, the Des Moines Urban Forest Master Plan, the Report on the Impact of Costs of the Iowa Low-Income Weatherization Program for Calendar Year 2022, EPA's Greenhouse Gas Equivalencies Calculator – Calculations and References, and EPA's Avoided Emissions and geneRation Tool (AVERT) were used to generate measure-related activity data and GHG reduction estimates.

Models & Tools Used

AVERT version 4.2 released by the EPA was used to calculate GHG and co-pollutant emission reductions for electricity savings. For reduced fuel use and tree plantings, EPA emission factors were used to quantify reductions based on activity data assumptions for Home Suites.

Measure Implementation Assumptions

The following key assumptions about measure implementation were used to quantify emissions reductions and costs for this measure.

- **Task assumptions:** The following implementation milestones are met:

Task #	Task Description	Anticipated Milestones
1	Pursue and receive implementation funding	Spring - Fall 2024
2	Enter funding agreements with local and regional implementers	Fall 2024
3	Community engagement around measure implementation administration specifics	Fall 2024

4	Produce implementation guidance, marketing materials, and an energy audit addendum form that assesses the feasibility of the additional service offerings available under this measure	Winter 2024
5	Coordinate with volunteer organizations and institutions of higher learning on establishing training and apprenticeship programs	Spring 2025
6	Measure implementation (audits, services, and workforce training)	January 2025 – December 2029 or beyond if additional funding is secured

- **Cost assumptions:** Average site-built single-family home statistics from the "Report on the Impacts and Costs of the Iowa Low-Income Weatherization Program for Calendar Year 2022" were used to estimate costs for implementation of weatherization offerings for Home Suites. The Des Moines Urban Forest Master Plan was used to estimate native tree and shrub planting and maintenance costs.
  - Average expenditures for weatherization of a site-built single-family home: $19,992
  - Cost to plant 3800 trees per year and maintain urban trees: $1,000,000/year
- **Measure lifetime:** The emissions benefits associated with this measure are assumed to last at least 25 years.
- **Measure uptake:** Because the Iowa Weatherization Program receives approximately 78,000 more applications per year than households that can be served, we assume that the Home Suites program will be fully subscribed.[1]

Emission Reduction Estimate Assumptions

The following key assumptions about emission reductions were used to quantify emission reductions for this measure:

- Emission factors:[2]
  - Home heating fuels:
    - Natural gas: 0.1 million British thermal units (mmbtu)/1 therm × 14.43 kilogram (kg) Carbon (C)/mmbtu × 44 kg CO_2/12 kg C × 1 metric ton (mt)/1,000 kg = **0.0053 mt CO_2/therm**
    - Propane: 1/42 barrels/gallon × 236.0 kg CO2/barrel × 1/1,000 kg/mt = **0.0056 mt CO_2/gallon**

1 Iowa Health & Human Services. (2024, February 9). *Weatherization Assistance FAQ.* https://hhs.iowa.gov/programs/programs-and-services/weatherization/faq.
2 U.S. Environmental Protection Agency. (n.d.). *Greenhouse Gases Equivalencies Calculator - Calculations and References*. https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references.

- Fuel Oil: 1/42 barrels/gallon × 426.1 kg CO2/barrel × 1/1,000 kg/mt = **0.0101 mt CO$_2$/gallon**
  - Urban Trees: 36.4 lbs C/tree × (44 units CO$_2$/12 units C) × 1 mt/2,204.6 pounds (lbs) = **0.060 mt CO$_2$ per urban tree planted**
- AVERT Assumptions:
  - AVERT Region: Midwest
  - Energy Efficiency Impacts: Reductions spread evenly throughout the year

Reference Case Scenario

According to the 2020 greenhouse gas inventory prepared for the What's Next, Central Iowa? PCAP, direct residential emissions were 951,624.27 mt CO$_2$e per year with 15,509,822 thousand cubic feet natural gas, 17,093,369 gallons of propane and fuel oil, and 17,639,182 mmbtu of energy used per year. Electricity sector emissions resulting from residential use were 1,245,917.33 mt CO$_2$e per year.

Measure-Specific Activity Data and Implementation Tracking Metrics

Average site-built single-family home statistics from the "Report on the Impacts and Costs of the Iowa Low-Income Weatherization Program for Calendar Year 2022" were used to estimate heat (therms, gallons) and electricity savings in kilowatt hours (kWh) for implementation of weatherization offerings for Home Suites. The budget for the Home Suites program (see GHG calculation spreadsheet) was used to identify the number of households that could be served and trees and shrubs planted in Central Iowa neighborhoods. Activity data assumptions used to estimate emission reductions are summarized below:

- Number of additional households served through Home Suites: 1674 (approximately 335 per year between 2025 and 2029)
- Household main heating source percentages:
  - Natural Gas: 79.7%
  - Propane: 13.2%
  - Fuel Oil: 0.5%
  - Electricity: 6.6%
- First-year fuel savings per household from weatherization by main heating source:
  - Natural Gas: 278 therms
  - Propane: 324 gallons
  - Fuel Oil: 195 gallons
- First-year electricity savings per household from weatherization by main heating source:
  - Natural Gas: 891 kWh
  - Propane: 1280 kWh
  - Fuel Oil: 1292 kWh
  - Electricity: 4441 kWh
- Trees planted: 35,326 (approximately 7,065 per year between 2025 and 2029)

The Home Suites program will track the first-year energy savings (fuel and electricity), first-year energy cost savings, trees planted, and program expenditures for each year of the program to verify the emission reductions achieved from implementation of this measure.

GHG EMISSIONS REDUCED

Implementation of this measure is anticipated to reduce:
- 1200 $mtCO_2e$ in 2026,
- 2400 $mtCO_2e$ in 2027,
- 3601 $mtCO_2e$ in 2028,
- 4801 $mtCO_2e$ in 2029, and
- 6002 in 2030 and each year thereafter.

This measure will reduce 18,007 cumulative $mtCO_2e$ for the period between 2025 – 2030 and 138,053 cumulative $mtCO_2e$ for the period between 2025 – 2050.

Appendix H: Central Iowa LIDAC Census Block Groups

This appendix outlines the Census Block Groups that are considered low-income, underserved, overburdened, or otherwise disadvantaged in the planning area. Table H1 identifies the proportion of Census Block Groups in each county that are designated a "disadvantaged community" by the EPA's IRA Disadvantaged Communities map. Table H2 lists each block group that has been designated a "disadvantaged community" by the EPA's IRA Disadvantaged Communities map, categorized by county and municipality. The EPA IRA Disadvantaged Communities map combines data and criteria from EJScreen and the Climate and Economic Justice Screening Tool (CEJST).

Table H1. Summary of Central Iowa Disadvantaged Community Census Block Groups

County	Total Number of Census Block Groups (2020 Census Data)	Number of IRA Disadvantaged Community Census Block Groups	Proportion of Census Block Groups that are an IRA Disadvantaged Community
Dallas County	42	4	10%
Guthrie County	8	0	0%
Jasper County	37	11	30%
Madison County	12	2	17%
Polk County	336	230	68%
Story County	75	20	27%
Warren County	33	1	3%
Total	**543**	**268**	**49%**

Table H2. List of IRA Disadvantaged Community Census Block Groups

County	Municipality	Census Block Groups
Dallas	Perry	190490503001, 190490503002, 190490504001, 190490504002
Jasper	Lambs Grove	190990403002
	Newton	190990403001, 190990404004, 190990405001, 190990405002, 190990405003, 190990405004, 190990405005, 190990405006, 190990405007
	Unincorporated	190999800001
Madison	Winterset	191210602002, 191210602004
Polk	Altoona	191530107071
	Ankeny	191530102071, 191530102072, 191530102073
	Clive	191530112031, 191530112032, 191530112033, 191530112051, 191530112052, 191530112061, 191530112062
	Des Moines	191530001011, 191530001012, 191530001023, 191530001031, 191530001032, 191530002011, 191530002012, 191530002021, 191530002022, 191530002023, 191530002024, 191530003001, 191530003002, 191530003003, 191530003004, 191530004001, 191530004002, 191530004003, 191530004004, 191530004005, 191530005001, 191530005002, 191530005003, 191530005004, 191530005005, 191530006001, 191530006002, 191530006003, 191530006004, 191530007011, 191530007012, 191530007013, 191530007021, 191530007022, 191530007023, 191530007031, 191530007032, 191530007033, 191530007041, 191530007042, 191530007043, 191530007044, 191530008011, 191530008012, 191530008013, 191530008015, 191530008016, 191530008021, 191530008022, 191530008023, 191530008031, 191530008032, 191530008033, 191530008034, 191530009011, 191530009012, 191530009013, 191530009014, 191530009021, 191530009022, 191530009023, 191530010001, 191530010002, 191530010003, 191530011001, 191530011002, 191530011003, 191530011004, 191530012001, 191530012002, 191530012003, 191530015001, 191530015002, 191530017001, 191530017002, 191530018001, 191530018002, 191530019002, 191530019003, 191530021001, 191530021002, 191530021003, 191530021004, 191530021005, 191530021006, 191530026001, 191530027001, 191530027002, 191530027003, 191530027004, 191530028001, 191530028002, 191530028003, 191530028004, 191530029001, 191530029002, 191530029003, 191530030011, 191530030012, 191530039011, 191530039012, 191530039022, 191530040012, 191530040042, 191530042001,

		191530042002, 191530043001, 191530043004, 191530044001, 191530044002, 191530044003, 191530044004, 191530045011, 191530045012, 191530045013, 191530045021, 191530046021, 191530046022, 191530046024, 191530046025, 191530046032, 191530047011, 191530047012, 191530047014, 191530047021, 191530047022, 191530048001, 191530048002, 191530049001, 191530049002, 191530050001, 191530050002, 191530050003, 191530050004, 191530051011, 191530051012, 191530051013, 191530051014, 191530051015, 191530051021, 191530052001, 191530052002, 191530052003, 191530053001, 191530053002, 191530053003, 191530108061
	Grimes	191530113031, 191530113032, 191530113033, 191530114051
	Johnston	191530113051, 191530113052, 191530114052, 191530114062, 191530114063, 191530117021, 191530117022, 191530117023, 191530117031, 191530117032, 191530117041
	Unincorporated	191530008014, 191530102144, 191530105001, 191530105002, 191530105003, 191530105004, 191530106011, 191530113011, 191530113021, 191530114053, 191530114061, 191530117042
	Urbandale	191530104041, 191530104042, 191530104043, 191530104061, 191530104062, 191530104071, 191530104072, 191530104074, 191530104081, 191530104082, 191530104083, 191530104091, 191530104092, 191530104093, 191530104101, 191530104102, 191530104111, 191530104112, 191530104113, 191530113041, 191530113042
	West Des Moines	191530110011, 191530110211, 191530110212, 191530110251, 191530110252, 191530110261, 191530110262, 191530110263, 191530110264, 191530110265, 191530110283, 191530111111, 191530111114, 191530111115, 191530111131, 191530111141, 191530111142, 191530111143, 191530111144
	Windsor Heights	191530112011, 191530112012, 191530112013, 191530112014, 191530112015
Story	Ames	191690003002, 191690005001, 191690005002, 191690007001, 191690007002, 191690007003, 191690007004, 191690010002, 191690010003, 191690010004, 191690011011, 191690011021, 191690011022, 191690013022, 191690013032, 191690013041, 191690013042, 191690013043, 191690013044
	Nevada	191690104003
Warren	Indianola	191810210001

Appendix I: Des Moines MSA Quality Assurance Project Plan

Climate Pollution Reduction Grants Program:

Des Moines Metropolitan Statistical Area

Quality Assurance Project Plan

Prepared by the Polk County Public Works

October 31, 2023

1. Project Management (Group A)
1.1. Title and Approval Page

<div align="center">

Quality Assurance Project Plan for
Central Iowa Climate Action Plan -
Des Moines Metropolitan Statistical Area

Grant Number: 96704601

Prepared by:

Polk County Public Works
5885 NE 14th Street
Des Moines, IA 50313
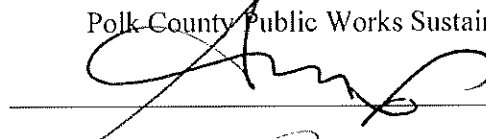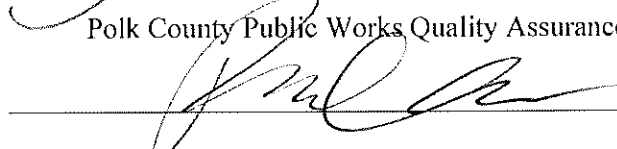
Prepared for:
US EPA Region 7
11201 Renner Blvd
Lenexa, KS 66219

October 31, 2023

</div>

APPROVALS:

Polk County Public Works Sustainability Planner: Date:

_11/3/2023_

Polk County Public Works Quality Assurance Manager: Date:

_11/3/23_

USEPA Region 7 Grants Project Officer: Date:

USEPA Region 7 Quality Assurance Manager: Date:

QAPP Revision History

Revision No.	Description	Author	Date
0	Original Version	Polk County Public Works	10/31/2023

1.2. Table of Contents

List of Tables

List of Exhibits

Abbreviations

CAA	Clean Air Act
CFR	Code of Federal Regulations
CCAP	Comprehensive Climate Action Plan
CPRG	Climate Pollution Reduction Grant
EPA	U.S. Environmental Protection Agency
GHG	Greenhouse Gas
GHGRP	Greenhouse Gas Reporting Program (40 CFR Part 98)
ICR	Information Collection Request
LGGIT	Community - GHG Inventory Tool (provided by the EPA)
MSA	Metropolitan Statistical Area
NEI	EPA's National Emissions Inventory
OAR	EPA Office of Air and Radiation
PCAP	Priority Climate Action Plan
PM	Project Manager
PO	EPA Project Officer for Grant
POP	Period of Performance
POR	EPA Project Officer's Representative
PWP	Project Work Plan
QA	Quality Assurance
QAM	Quality Assurance Manager

QAMD	Quality Assurance Manager Delegate
QAPP	Quality Assurance Project Plan
QC	Quality Control
QCC	Quality Control Coordinator
TL	Task Leader

1.3. Distribution List

This section presents the primary staff who will be working on the project. These staff will be identifying existing[1] data resources for evaluation and potential use under the project or serving in project-specific roles for implementing the Quality Assurance Project Plan (QAPP). The listing in **Table 1.1** includes staff responsible for implementing independent internal quality management steps and staff serving in external oversight roles.

This QAPP and, as applicable, all major deliverables relying on existing data will be distributed to the staff presented in **Table 1.1**. Additionally, this QAPP will be provided to any unlisted staff who are assigned to perform work under this project. A secured copy of this QAPP will be maintained in the project files in the East Central Iowa Climate Pollution Reduction Grant SharePoint maintained by Polk County Public Works and the TL master file containing physical copies of documents for the project.

Table 1.1 QAPP Distribution List

Name	Organization	Role
Molly Schreiner	US EPA, Region 7	EPA Project Officer (PO) or PO Representative (POR)
Diane Harris	US EPA, Region 7	EPA Quality Assurance Manager or Delegate
Allison van Pelt	Polk County Public Works	Grantee Project Manager, Sustainability Planner
Erin Carpenter	Polk County Public Works	Grantee Task Leader, Sustainability Coordinator
Rachel Conrad	Polk County Public Works	Grantee Quality Assurance Manager
Brett Norris	Polk County Public Works	Grantee Technical Staff, Sustainability Coordinator
Ava Hohn	Polk County Public Works	Grantee Technical Staff 2, Sustainability Coordinator

1.4. Project/Task Organization

The primary personnel responsible for implementation of this project are the Polk County Public Works Project Manager (PM), Quality Assurance Manager (QAM), and Task Leaders (TLs). Their duties are outlined briefly in this section. The project QAM is independent of the unit generating the data.

Allison van Pelt is the Polk County Public Works PM and will provide senior-level oversight as needed. The PM is responsible for Polk County Public Works' technical and financial performance as well as maintaining communications with the EPA to ensure mutual understanding of grant requirements, EPA expectations, and conformity with EPA quality procedures; managing oversight and conduct of project activities including allocation of resources to specific tasks; ensuring that quality procedures are incorporated into all aspects of the project; developing, conducting, and/or overseeing QA plans as necessary; ensuring that any corrective actions are implemented; operating project activities within the

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[1] The term "existing data" is defined by the EPA's *Environmental Information Quality Policy* ([CIO 2105.3](CIO 2105.3)) as "... data that have been collected, derived, stored, or reported in the past or by other parties (for a different purpose and/or using different methods and quality criteria). Sometimes referred to as data from other sources." The term "secondary data" may also be used to describe "existing data" in historical EPA quality-related documents.

documented and approved Quality Assurance Project Plan; and ensuring that all products delivered to the EPA are of specified type, quantity, and quality.

The Polk County Public Works PM will assign a TL for each technical task with instructions to complete a baseline emissions inventory for the sector(s) under the task and to validate any existing baseline emissions inventory for portions of the Des Moines MSA. The TL will develop options for potential emissions reductions with estimated reductions per option, and to develop uncertainty estimates for each reduction estimate. **Table 1.1** presents the TLs for each technical task. Each TL is responsible for the day-to-day technical activities under their assigned task, including planning, reporting, and controlling of technical and financial resources allocated to the task by the PM. Accordingly, each TL is primarily responsible for implementing the Quality Program and this QAPP on task-level assignments.
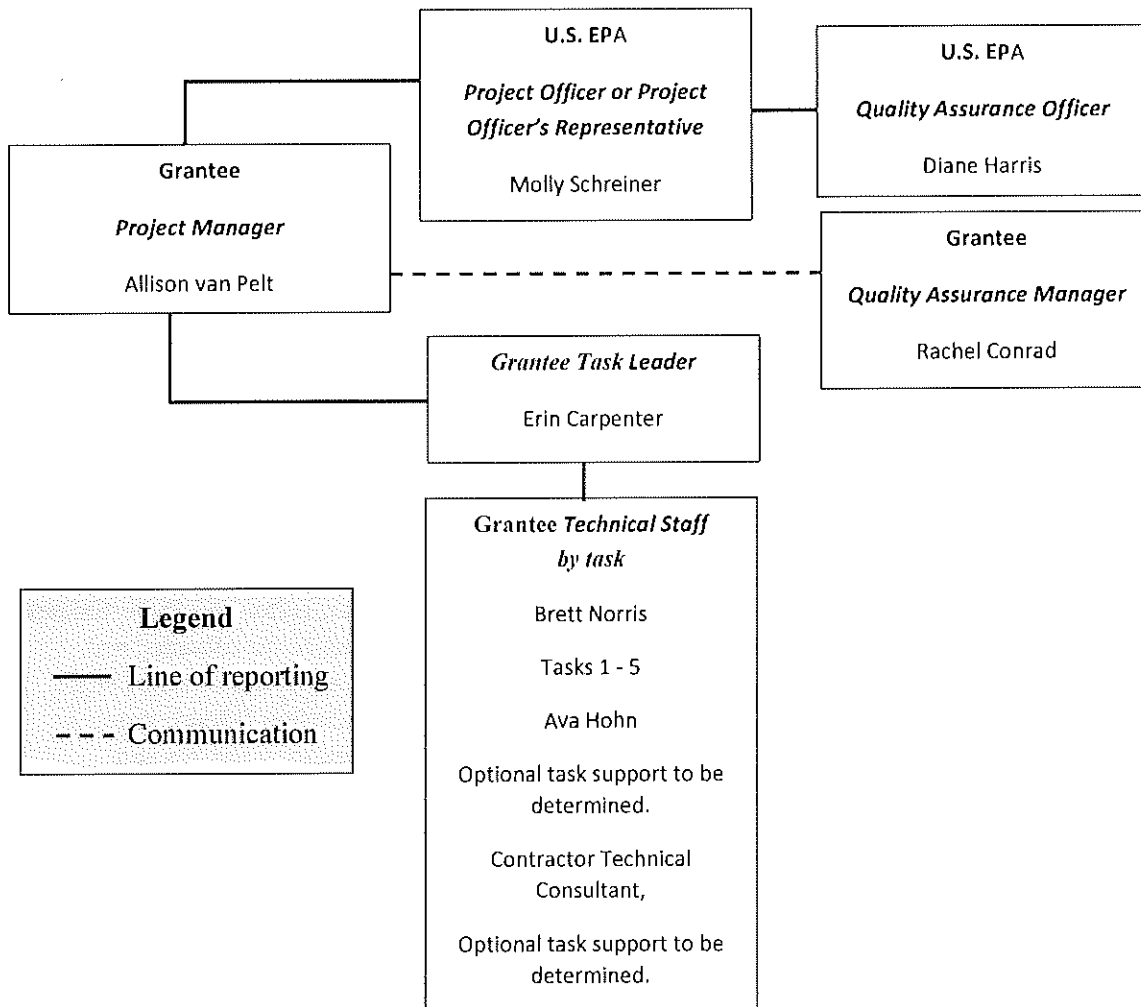
Task-level management system. For each of the major deliverables under each task, the assigned TL will review all QA-related plans and reports and is responsible for transmitting them to the QA Manager (or delegate) for review and approval. Each TL is responsible for ensuring that quality procedures are implemented at the task level and for maintaining the official, approved, task-level QAPP content. Each TL will discuss any concerns about quality or any proposed revisions to task-level QAPP content with the QA Manager (or delegate) to identify, resolve, or preclude problems or to amend task-level plans, if necessary. In addition, each TL will work with the Polk County Public Works PM and the QA Manager to identify and implement quality improvements. The Polk County Public Works PM is responsible for ensuring the consistency of similar or related QA measures across tasks, and the TLs are responsible for overseeing task-level work performed by technical staff and providing assurance that all required QA/QC procedures are being implemented.

Project-level management system. Tasks are expected to proceed concurrently, in parallel. The PM will maintain close communications with each TL and ensure any difficulties encountered or proposed changes at the task level are reviewed for implications on other similar or related tasks. The PM is also responsible for communicating progress or difficulties encountered (across all tasks) to the EPA PO or POR, who provides the EPA's primary oversight function for this project at EPA Region 7 and is responsible for review and approval of this QAPP and any future revisions. The PM (with support from TLs and assigned Polk County Public Works technical staff) will be responsible for consulting with the EPA PO or POR, on planning, scheduling, and implementing the QA/QC for all project deliverables and obtaining required EPA approvals.

The QA Manager, Rachel Conrad, is responsible for overseeing the quality system, monitoring, and facilitating QA activities on tasks, and generally helping the Polk County Public Works PM and TLs understand and comply with EPA QA requirements. They will not be involved in data collection or analyses, which is in a separate division from Polk County Public Works' Sustainability Program Team identifying and using existing data. At the request of the Polk County Public Works PM, the QA Manager is responsible for conducting periodic independent audits of this project's QA program, and they will produce written documentation of the audit results and recommendations.

In addition, QC functions will be carried out by other technical staff and will be carefully monitored by the PM, who will work with the QA Manager to oversee this plan and implement quality improvements. For work done under this project, technical staff may include persons with expertise in the local residential, commercial, and industrial activities. Technical staff may also include persons with expertise in air pollution engineering, technical reviewers, database specialists, quality auditors, and technical editors. The PM will ensure that technical staff do not review work in a QA capacity for which they were a primary or contributing author. **Exhibit 1** presents the organizational chart for the project.

Exhibit 1. Project Organization[2]

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                    ┌─────────────────────────┐
                    │        U.S. EPA         │
                    │                         │
          ┌─────────┤  Project Officer or     │
          │         │  Project Officer's      │──────────┐
          │         │  Representative         │          │
          │         │                         │          │
          │         │     Molly Schreiner     │          │
          │         └─────────────────────────┘          │
┌─────────────────┐                            ┌─────────────────────────┐
│     Grantee     │                            │        U.S. EPA         │
│                 │                            │                         │
│  Project        │                            │  Quality Assurance      │
│  Manager        │                            │  Officer                │
│                 │- - - - - - - - - - - - -   │                         │
│ Allison van Pelt│                            │     Diane Harris        │
│                 │                            └─────────────────────────┘
└─────────────────┘                            ┌─────────────────────────┐
          │                                    │        Grantee          │
          │         ┌─────────────────────────┐│                         │
          └─────────┤   Grantee Task Leader   ││  Quality Assurance      │
                    │                         ││  Manager                │
                    │     Erin Carpenter      ││                         │
                    │                         ││     Rachel Conrad       │
                    └─────────────────────────┘└─────────────────────────┘
                                 │
                    ┌─────────────────────────┐
                    │ Grantee Technical Staff │
                    │        by task          │
                    │                         │
                    │      Brett Norris       │
                    │                         │
                    │      Tasks 1 - 5        │
                    │                         │
                    │       Ava Hohn          │
                    │                         │
                    │  Optional task support  │
                    │  to be determined.      │
                    │                         │
                    │  Contractor Technical   │
                    │  Consultant,            │
                    │                         │
                    │  Optional task support  │
                    │  to be determined.      │
                    └─────────────────────────┘
```

Legend

—— Line of reporting

– – – Communication

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[2] Under the EPA's QAPP standard (CIO 2105-5-02.0, section 3) the organization chart must also identify any contractor relationships relevant to environmental data operations.

1.5.   Problem Definition / Background

Under this project, Polk County Public Works will identify, evaluate, and utilize existing data resources[3] to develop a local inventory of the major sources of greenhouse gas (GHG) emissions within the Des Moines MSA and use that inventory data to develop a climate action plan. This QAPP focuses on the handling of environmental information under sector-specific tasks by technical staff charged with completing the following subtasks in a future planning project implemented in accordance with this QAPP:

1.   Develop a comprehensive GHG inventory for the largest sources within each sector,
2.   Develop options for reducing emissions within each sector,
3.   Develop estimates or ranges of estimates for reductions achievable under each option,
4.   Develop uncertainty analyses for each option's emissions reduction estimate, and
5.   Present these analyses and options in technical reports consistent with the deliverables required under the CPRG planning grants.

The GHG inventory may utilize the EPA's Local – GHG Inventory Tool (LGGIT),[4] facility-specific GHG data published by the EPA in the Facility Level Information on Greenhouse gases Tool (FLIGHT),[5] data reported to the EPA's Greenhouse Gas Reporting Program (GHGRP),[6] EPA's National Emissions Inventory (NEI),[7] DOE's State and Local Planning for Energy (SLOPE) Platform,[8] the Global Protocol for Community-Scale (GPC) Greenhouse Gas Inventories,[9] the Local Government Operations (LGO) Protocol,[10] and/or 3rd party data or tools, together with any independent, sector-specific estimates prepared by Polk County Public Works. The FLIGHT and GHGRP datasets can be downloaded and filtered by state, city, county, and/or zip code. Any independent local or MSA estimates or ratios (e.g., electricity usage per customer-by-customer class) will be compared to corresponding federal, state, or local estimates for validation, as available. Significant differences between primary estimates and validation estimates will be evaluated and discussed in the inventory report with the underlying data and methodologies used for the estimates. As applicable, the local inventory will include the following sources and gases (divided into the Residential, Commercial/Institutional, Industrial, and Energy Generation sectors):

LGGIT Source Categories

1.   Mobile Combustion
2.   Stationary Combustion
3.   Electricity Consumption
4.   Solid Waste
5.   Urban Forestry
6.   Agriculture & Land Management
7.   Water Use

Greenhouse Gases (across all sectors)

carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), fluorinated gases (F-gases) including hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6)

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[3] EPA, Environmental Information Quality Policy, CIO 2105.3, 03/07/2023 (p. 8) provides common examples of environmental information used to support the EPA's mission at https://www.epa.gov/system/files/documents/2023-04/environmental_information_quality_policy.pdf

[4] https://www.epa.gov/statelocalenergy/local-greenhouse-gas-inventory-tool

[5] Facility Level Information on Greenhouse gases Tool (FLIGHT) at https://ghgdata.epa.gov/

[6] https://www.epa.gov/ghgreporting/data-sets

[7] https://www.epa.gov/air-emissions-inventories/national-emissions-inventory-ne

[8] https://www.energy.gov/scep/slsc/state-and-local-planning-energy-slope-platform

[9] https://ghgprotocol.org/ghg-protocol-cities

[10] https://ww2.arb.ca.gov/sites/default/files/classic/cc/protocols/lgo_protocol_v1_1_2010-05-03.pdf

8. Waste Generation
9. Wastewater Treatment

1.5.1. Rationale for Selection of Sectors

For each sector included in the local inventory, **Table 1.2** briefly describes why the sector was included in the inventory and the relative significance of the sector in terms of the magnitude of air emissions from existing inventories, the associated geographic distribution of the sources, and recent trends in readily available activity data for the source category.

Table 1.2 Rationale for Sector Selection

Sectors Included in Inventory	Rationale for Including in GHG Inventory
Mobile combustion	Transportation activities were the largest source (29 percent) of total U.S. greenhouse gas emissions in 2021. From 1990 to 2021, transportation CO_2 emissions from fossil fuel combustion increased by 19 percent. Transportation activities occur in all communities.
Electricity consumption	The electric power sector accounted for 25 percent of total U.S. greenhouse gas emissions in 2021. Power generation and/or consumption occurs among all communities.
Urban forestry[11]	This sector includes fluxes of carbon from activities such as converting forests to agricultural use and practices that remove CO_2 from the atmosphere and store it in long-term carbon sinks like forests. In 2021, the net CO_2 removed from the atmosphere by natural and working lands was 12% of total U.S. greenhouse gas emissions. Between 1990 and 2021, total carbon sequestration in this sector decreased by 14%, primarily due to a decrease in the rate of net carbon accumulation in forests, as well as an increase in CO_2 emissions from urbanization.
Agriculture & land management	Agriculture accounted for about 10 percent of U.S. greenhouse gas emissions in 2021, and agricultural soil management was the largest source of N_2O emissions. Enteric fermentation was the largest source of CH_4 emissions.
Stationary combustion (including for commercial and residential heating)	In 2021, the commercial and residential sectors accounted for 7 and 6 percent of total U.S. greenhouse gas emissions, respectively. Emissions from the commercial and residential sectors have increased since 1990. Total residential and commercial greenhouse gas emissions, including direct and indirect emissions, in 2021 have increased by 2% since 1990. In 2021, an increase in heating degree days (0.5 percent) increased energy demand for heating in the residential and commercial sectors, however, a 1.8 percent decrease in cooling degree days compared to 2020 reduced demand for air conditioning in the residential and commercial sectors.

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[11] Under international GHG inventory protocols this category is called "Land use, land-use change, and forestry."

Solid waste and waste generation	This sector includes landfills, composting, and anaerobic digestion. Landfills were the third largest source of anthropogenic methane emissions in 2021, and landfills accounted for 1.9 percent of total U.S. greenhouse gas emissions.
Wastewater treatment	Wastewater treatment, both domestic and industrial, was the third largest anthropogenic source of N_2O emissions in 2021, accounting for 5.2 percent of national N_2O emissions and 0.3 percent of total U.S. greenhouse gas emissions. Emissions from wastewater treatment increased by 6.1 MMT CO_2e (41.6 percent) since 1990 as a result of growing U.S. population and protein consumption.
Water	This sector includes indirect emissions associated with the electricity used to deliver water to local communities.

1.5.2. Decisions to be Made

The EPA's recommended tool for local GHG inventories (the LGGIT) covers categories of GHG emissions by source category (e.g., mobile combustion, stationary combustion, electricity consumption, solid waste, etc.). The LGGIT provides many default values to facilitate developing local estimates using methods consistent with the Global Protocol for Community-Scale GHG Emissions.[12] There are four primary decisions to be made under each task of this project for each source category, and each Task Leader will be charged with the following decisions:

1. Determine (for each major activity) if the LGGIT estimate, a different federal estimate or tool, or a non-federal estimate should be used for the local GHG baseline estimate.
2. Determine the best options for reducing emissions of air pollution and achieving the following Congressional objectives under the Inflation Reduction Act:
   a. Reduce climate pollution while supporting creation of good jobs and lowering energy costs for families.
   b. Accelerate work addressing environmental injustice and empowering community driven solutions in overburdened neighborhoods.
   c. Deliver cleaner air by reducing harmful air pollution in places where people live, work, play, and go to school.
3. Develop an estimate or a range of estimates for reductions achievable under each option.
4. Estimate the uncertainty of the emissions reduction estimate(s) or ranges under each option.

1.5.3. Actions to be Taken, Action Limits, and Expected Outcomes

Local estimates will be derived using the LGGIT tool for each source category. Subsequently, the community may elect to supplement estimates derived using the LGGIT with estimates for each source category from existing local inventories, existing local activity data, or from other EPA or state resources. Calculated estimates derived from local activity data will be compared to federal datasets and/or downscaled state estimates for validation. The rationale for including any emissions estimates that show significant discrepancies from state or federal estimates will be documented in the community's GHG inventory report along with the underlying data and calculation methodology.

When identifying the best options for reducing air pollution, each TL will consider the activities affecting the largest numbers of families, business establishments, recreation areas, and schools. Options

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[12] https://ghgprotocol.org/sites/default/files/standards/GPC_Full_MASTER_RW_v7.pdf

may include potential reductions in task-level activities impacting residential, commercial, and school districts near the largest sources of air pollution. Polk County Public Works expects that each task will produce one or more options for sector-specific emissions reduction projects for further consideration by management and policymakers.

1.5.4. Reason for Project

The baseline GHG inventory and options analyses developed under this local community project will be utilized by Polk County Public Works for planning purposes to support the Des Moines MSA's development of the following three CPRG planning deliverables:

- Des Moines MSA's **Priority Climate Action Plan** (PCAP), which is due March 1, 2024. This plan will include near-term, implementation-ready, priority GHG reduction measures and is a prerequisite for any implementation grant.
- Des Moines MSA's **Comprehensive Climate Action Plan** (CCAP), which is due in 2025. This plan will review all sectors that are significant GHG sources or sinks and include both near- and long-term GHG emission reduction goals and strategies.
- Des Moines MSA's **Status Report** on progress towards goal, which is due in 2027. This progress report will include updated analyses, plans, and next steps for key metrics.

This QAPP describes in detail the necessary QA and QC requirements and technical activities that will be implemented to ensure the baseline GHG inventory and the sector-specific emissions reduction options are reliable for the PCAP. An additional QAPP will be developed for the GHG inventory and the sector-specific emissions reduction options are reliable for the CCAP. As necessary, revisions to the QA and QC requirements defined in this QAPP will be updated in the 2027 Status Report.

1.5.5. Relevant Clean Air Act Mandates and Authorizations

The inventory produced under this project will support the deliverables required under EPA's Climate Pollution Reduction Planning Grants. The inventory will be used to evaluate opportunities for reducing GHG emissions from all major-emitting sources including both mobile source categories and stationary source categories. This project will include the fundamental research necessary to evaluate and plan new programs (and amendments to existing Clean Air Act [CAA] programs) for reducing emissions from fossil fuel combustion activities. Many activities in the GHG inventory (and subsequent emissions reductions options analyses) include major sources of criteria and toxic pollutants. Accordingly, the purpose of this project (to evaluate and plan for reductions in GHG emissions, including reductions from usage or production of fossil fuels) is also consistent with the following statutory mandates and authorizations under Clean Air Act Title I:

- *§ 7403. Research, investigation, training, and other activities*
  (a) Research and development program for prevention and control of air pollution
  The Administrator shall establish a national research and development program for the prevention and control of air pollution ….
    (1) conduct, and promote the coordination and acceleration of, research, investigations ... and studies related to the causes ... extent, prevention, and control of air pollution;
    (2) encourage, cooperate with, and render technical services and provide financial assistance to air pollution control agencies and other appropriate public or private agencies, institutions, and organizations, and individuals in the conduct of such activities ….
  (b) Authorized activities of Administrator in establishing research and development program
  In carrying out the provisions of [paragraph (a)] the Administrator is authorized to–

    (1) collect and make available, through publications and other appropriate means, the results of and other information, including appropriate recommendations by him in connection therewith, pertaining to such research and other activities; ....

    (2) make grants to air pollution control agencies ... for purposes ... in subsection (a)(1) ....

- **§ 7404. Research related to fuels and vehicles**
  (a) Research programs; grants; ....

  The Administrator shall give special emphasis to research and development into new and improved methods, having industry-wide application, for the prevention and control of air pollution and control of air pollution resulting from the combustion of fuels... he shall–

      (1) conduct and accelerate research programs directed toward development of improved, cost-effective techniques for–

          (A) control of combustion byproducts of fuels, ...

          (B) improving efficiency of fuels combustion so as to decrease atmospheric emissions ....

- **§ 7405. Grants for support of air pollution planning and control programs**
  (a) Amounts; limitations; assurances of plan development capability.

  (1)(A) The Administrator may make grants to air pollution control agencies ... in an amount up to three-fifths of the cost of implementing programs for the prevention and control of air pollution. For the purpose of this section, "implementing" means any activity related to the planning, developing, establishing, carrying out, improving, or maintaining of such programs....

      (C) With respect to any air quality control region or portion thereof for which there is an applicable implementation plan under section 7410 ... grants under subparagraph (A) may be made only to air pollution control agencies which have substantial responsibilities for carrying out such applicable implementation plan.

1.5.6. Information Provided by the EPA under § 7403(b)(1)

Under authority of CAA § 7403(b)(1) the EPA has provided the following resources to ensure reliable air emissions inventories are produced to support plans for reducing emissions.

- <u>Agency-wide Quality Program Documents</u>
- Quality Assurance-specific Directives
  - <u>CIO 2105.3</u> – Environmental Information Quality Policy, April 10, 2023
  - <u>CIO 2105-P-01.3</u> – Environmental Information Quality Procedure, March 7, 2023
  - <u>CIO 2105-S-02.0</u> – EPA's Environmental Information QA Project Plan (QAPP) Standard
  - EPA Regional Sites for Quality Management Plans and Guidance:

▪ <u>Region 1</u>	▪ <u>Region 6</u>
▪ <u>Region 2</u>	▪ <u>Region 7</u>
▪ <u>Region 3</u>	▪ <u>Region 8</u>
▪ <u>Region 4</u>	▪ <u>Region 9</u>
▪ <u>Region 5</u>	▪ <u>Region 10</u>

- QA Guidance

  - <u>EPA QA/G-4</u> – *Guidance on Systematic Planning Using Data Quality Objectives Process*
  - <u>EPA QA/G-5</u> – *Guidance for Quality Assurance Project Plans*

Polk County Public Works will utilize these resources, as applicable, to ensure evaluation of existing data and utilization of those data are consistent with the EPA's relevant directives and guidance.

1.6.   Project / Task Description

An example schedule of deliverables for the technical tasks (Tasks 1-5) for GHG inventory QAPPs is presented in **Tables 2.1** through **2.5**. The work to be performed under this project involves preparing a local GHG emissions inventory for the Des Moines MSA. The organization of the work is based on the use of the EPA's Local – GHG Inventory Tool (LGGIT)[13] under the following sector-specific tasks:

Task 1: Local inventory of mobile combustion GHG emissions.

Task 2: Local inventory of electric power consumption (indirect) GHG emissions.

Task 3: Local inventory of solid waste GHG emissions.

Task 4: Local inventory of GHG emissions from other sectors.

        4.1   Stationary combustion
        4.2   Agriculture and land management
        4.3   Waste generation
        4.4   Water
        4.5   Wastewater treatment

Task 5: Local inventory of urban forestry resources.

For each sector-specific task, **Tables 2.1–2.5** provide planned activities and a schedule of deliverables for use by communities preparing GHG inventories. The EPA's LGGIT, other resources, and answers to frequently asked questions are also located on the Local GHG Inventory Tool Page Greenhouse Gas Data and Resources webpage.[14] The LGGIT User's Guides provide a summary of required data inputs for each module (Table 1 of each LGGIT User's Guide).

Table 2.1 Technical Task Descriptions for Task 1.

Tasks and Deliverables	Schedule
Task 1. Mobile Combustion (Transportation)	
1. The PM or TL will assign staff to download the EPA's Local – GHG Inventory Tool (LGGIT) at https://www.epa.gov/statelocalenergy/local-greenhouse-gas-inventory-tool and use that tool to estimate emissions from mobile combustion sources. 2. Staff will read the [Introduction] worksheet and the [Read Me] worksheet to become familiar with the organization of the tool and the tool's terminology. Staff will become familiar with Rows 42 through 59 of the [Read Me] sheet that reflect a brief summary of the steps necessary to complete the calculations for each sector. Additionally, staff can reference the LGGIT User's Guide for the Community Module that is included within the downloaded zip file. 3. Staff will complete the four (4) initial setup steps on the [Control Sheet].	Within 180 days of QAPP approval by EPA.

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[13] https://www.epa.gov/statelocalenergy/local-greenhouse-gas-inventory-tool .
[14] Ibid.

Table 2.1 Technical Task Descriptions for Task 1.

Tasks and Deliverables	Schedule
Task 1. Mobile Combustion (Transportation)	
4. Staff will review Chapter 7 - Transportation in the GPC GHG Emissions Inventories, and/or Chapter 7 - Vehicle Fleet in the LGO Protocol. Staff will obtain from a state or local motor vehicle agency, the most recent listing of vehicles registered at addresses located in the local community or MSA including (as available) year-manufactured, make, model, body style, fuel, and description.	
5. In the LGGIT: Community Module [community_ghg_inventorytool.xlsm], staff will use the [Mobile-Entry] sheet to load the community's or MSA's population of fossil-fueled motor vehicles. Staff will prepare an aggregated listing (i.e., listing of sets of vehicles with counts by vehicle type, model, year, and fuel) for all of registered vehicles and an estimate of the average fuel consumed for each set of similar vehicles.	
6. The PM, TL, or QAM will assign a staff member who did not support steps 1-5 of this task to complete a QC review. Staff will independently review the original source data for all inputs and supporting calculations used to populate the [Mobile-Detail Calcs] sheet. Staff will also complete an independent review of all inputs to the LGGIT and complete independent calculations for at least 2 types of vehicles (as directed by the PM or TL) on the [Mobile-Detail Calcs] sheet. The assigned QC staff member will also be directed to compare the LGGIT-based estimate to the estimate published in the EPA's National Emissions Inventory (NEI) and available using the *Data Queries* tool at https://www.epa.gov/air-emissions-inventories/2020-nei-supporting-data-and-summaries. This NEI query tool provides national, state, county, and tribal emissions estimates for mobile sources.	.
7. In the GHG inventory report or in a separate report based on the GHG inventory, Polk County Public Works will include a listing of options for emissions reductions from this sector that may include one or more of the following components or other components (that are not listed below) that assigned staff may identify during preparation of the inventory in the future during implementation of this task:	
a. The specific source categories and activities affected by the proposed option.	
b. The quantity of GHG emissions reduced by the options with an associated uncertainty estimate.	
c. The quantity of criteria emissions reduced by the options with an associated uncertainty estimate.	
d. The quantity of toxic air pollutant emissions (as defined under applicable local, state or federal rules for air toxics) reduced by the option with an associated uncertainty estimate.	

Table 2.1 Technical Task Descriptions for Task 1.

Tasks and Deliverables	Schedule
Task 1. Mobile Combustion (Transportation)	
e. The number of people living in any nonattainment areas where the option would reduce emissions (regardless of the specific pollutant triggering nonattainment). f. A description of any benefits that the option will impart to communities with known environmental injustice issues such as close proximity to major transportation corridors.	

Table 2.2 Technical Task Descriptions for Task 2.

Tasks and Deliverables	Schedule
Task 2. Electric Power Consumption	

1. The PM or TL will assign a staff member to use the EPA's LGGIT tool [community_ghg_inventorytool.xlsm] and to verify that the four (4) initial steps required on the [Control Sheet] have been completed.
 2. Staff will review Chapter 6.5 - Calculating Emissions from Grid-Supplied Energy Consumption in the GPC GHG Emissions Inventories, and/or Chapter 6.2 - Electricity Use in the LGO Protocol.
 3. Staff will obtain total electricity consumption data for the community or MSA from one or more of the following local, state, or federal resources to be used for the baseline estimate or QC validation of the baseline estimate:
    a. Summaries of metered consumption obtained from the local electric utilities that serve the community or MSA by customer class.
    b. EIA Form 861 data published by the DOE and available at https://www.eia.gov/electricity/data/eia861/.
    c. The State and Local Planning for Energy (SLOPE) model datasets available at https://maps.nrel.gov/slope/about. Note these data are published as electricity usage in the units of MMBtu/year for the entire county. Estimates are provided for residential, commercial, and institutional customer classes. These data will be converted to kilowatt-hours per year prior to entry into the LGGIT tool. The projections available in this tool (for future years) may also be used for estimating emissions reductions associated with options listed for the electric utility sector.
 4. Staff will use the [Electricity-Entry] sheet of the EPA's LGGIT tool. Staff will read the explanation of the *Data Entry & Calculations* starting in cell A3. Staff will enter the data for each chosen entity. These entities may be of any scale as chosen by the grantee (e.g., the entire community by sector; individual building, such as a commercial or institutional facility; or a set of similar facilities (e.g., a group of similar residential units). For groups of similar units, when entering the *Unit Description* in cell C10 of the [Electricity-Entry] sheet, staff will include in the description the number of units that were included when the
	Within 180 days of QAPP approval by EPA.

Table 2.2 Technical Task Descriptions for Task 2.

Tasks and Deliverables	Schedule
Task 2. Electric Power Consumption	

electricity purchased (kWh) value was summed or otherwise calculated for entry into cell C16. Staff will document in the inventory each calculation with associated units of measure for each record added on the [Electricity-Entry] sheet in a manner similar to the following example:

A	B	C		D	
Count of Units in Set	**Set Description**	**Avg. Annual kWh Used (per Unit)**		**Annual Usage (All Units)**	
1000	Single-family home	750 kWh	=	750,000	kWh
		(Single-family home) (1 Year)			Year

Staff will document the source of the MW-hr usage per customer entered in column C.

5. Staff will determine if EIA Form 861 at https://www.eia.gov/electricity/data/eia861/ includes one of the following types of data that may be useful for estimating or validating the usage per customer entered in column C of step 2:

   a. The community's or MSA's total electricity usage. (See *Attachment 1* for some of the service territories included under EIA Form 861),

   b. The service territory or territories that include the community or MSA. (See the EIA Form 861 file entitled [Service_Territory_2020.xlsx] for a listing of the utilities that serve each county in the United States,

   c. A service territory adjacent to the community or MSA with similar usage patterns that may be comparable to the community's or MSA's estimate, or

   d. Make a determination that there are no data under EIA Form 861 that are relevant to estimating or validating local usage per customer in column C of step 2.

6. If the community locates EIA 861 electricity data relevant to estimating or validating local usage, staff will include in the inventory the following values from EIA Form 861 to reflect electricity usage per customer most similar to local usage:

Table 2.2 Technical Task Descriptions for Task 2.

Tasks and Deliverables	Schedule
Task 2. Electric Power Consumption	

EIA 861 Column Name	EIA Form 861 Value
Year of Data	
Utility Name	
Utility Number	
State	
BA Code	
Residential Sales (MW-hrs)	
Residential Customers	
Commercial Sales (MW-hrs)	
Commercial Customers	
Industrial Sales (MW-hrs)	
Industrial Customers	
Transportation Sales (MW-hrs)	
Transportation Customers	

7. In the GHG inventory report or in a separate report based on the GHG inventory, include a listing of options for emissions reductions from this sector that includes the following components:

    a. The specific source categories and activities affected by the proposed option.

    b. Quantity of GHG emissions reduced by the options with an associated uncertainty estimate.

    c. Quantity of criteria emissions reduced by the options with an associated uncertainty estimate.

    d. Quantity of toxic air pollutant emissions (as defined under applicable local, state or federal rules for air toxics) reduced by the option with an associated uncertainty estimate.

    e. Number of people living in any nonattainment areas where option would reduce emissions (regardless of pollutant triggering nonattainment).

    f. Description of any benefits that the option will impart to communities with known environmental injustice issues such as close proximity of the

Table 2.2 Technical Task Descriptions for Task 2.

Tasks and Deliverables	Schedule
Task 2. Electric Power Consumption	
g. community to an affected source under the option that emits toxic air pollutants.	

Table 2.3 Technical Task Descriptions for Task 3.

Tasks and Deliverables	Schedule
Task 3. Solid Waste (Landfills)	
1. The PM or TL will assign technical staff to develop estimates for this source using the LGGIT's [Solid Waste_Control] and [Solid Waste-Entry] worksheets. (The [Solid Waste-Entry] worksheet only provides locations to enter data after the [Solid Waste-Control] worksheet is populated.)	Within 180 days of QAPP approval by EPA.
2. Staff will review Chapter 8 - Waste in the GPC GHG Emissions Inventories, and/or Chapter 9 - Solid Waste Facilities in the LGO Protocol.	
3. On the LGGIT's [Solid Waste_Control] worksheet, staff will enter the total number of landfills in the community, the landfill name, whether or not the landfill has a landfill gas (LFG) collection system, and if the LFG collection system is partial or comprehensive (definitions are provided).	
4. On the [Solid Waste_Entry] sheet, staff will enter the following data per landfill type:	
a. For landfills without a LFG collection system, staff will obtain and enter the annual quantities of waste deposited into the landfill for the life of the landfill, and the opening and closing years of the landfill. The instructions then provide the option to click on a link that takes you to the LGO Protocol Landfill Emissions Tool, where this data is entered.	
b. For landfills with a comprehensive LFG collection system, staff will obtain and enter the annual amount of landfill gas collected.	
c. For landfills with a partial LFG collection system, staff will obtain and enter the annual amount of landfill gas collected and the ratio of uncollected surface area over the collected surface area.	
5. In the inventory report or in a separate report based on the inventory, include a listing of options for emissions reductions from this sector that includes the following components:	
a. The specific source categories and activities affected by the proposed option.	
b. The quantity of GHG emissions reduced by the options with an associated uncertainty estimate.	

Table 2.3 Technical Task Descriptions for Task 3.

Tasks and Deliverables	Schedule
Task 3. Solid Waste (Landfills)	
c. The quantity of criteria emissions reduced by the options with an associated uncertainty estimate.	
d. The quantity of toxic air pollutant emissions (as defined under applicable local, state or federal rules for air toxics) reduced by the option with an associated uncertainty estimate.	
e. The number of people living in any nonattainment areas where the option would reduce emissions (regardless of the specific pollutant triggering nonattainment).	
f. A description of any benefits that the option will impart to communities with known environmental injustice issues such as close proximity of the community to an affected source under the option that emits toxic air pollutants.	

Table 2.4 Technical Task Descriptions for Task 4.

Tasks and Deliverables	Schedule
Task 4. Inventory of GHG Emissions for Other Sources	
1. The PM or TL will assign the primary technical staff member(s) to use the EPA's LGGIT tool and the following worksheets to develop the primary estimates for other sectors.	Within 180 days of QAPP approval by EPA.

Other Sources	LGGIT Worksheet(s)
Stationary combustion	[Stationary-Entry] [Stationary-Data] [Stationary-Calcs]
Agriculture & land management	[Agriculture & Land Management]
Water	[Water]
Wastewater treatment	[Wastewater-Control] [Wastewater-Entry] [Wastewater-Calcs]
Waste generation (disposal external to community's geopolitical boundary)	[Waste Production]

2. After the primary LGGIT calculations are complete, the PM, TL or QAM will assign a QC staff member to complete the following steps:

   a. Review the original source(s) of data for all inputs to the LGGIT tool.

   b. Validate that values from original source(s) were correctly entered into the primary LGGIT tool.

Table 2.4 Technical Task Descriptions for Task 4.

Tasks and Deliverables	Schedule
Task 4. Inventory of GHG Emissions for Other Sources	

      c.   Populate a blank version of the LGGIT tool with the inputs in a QC version.

      d.   Compare the outputs of the primary version of the LGGIT versus the QC version of the LGGIT.

      e.   Compare source listing LGGIT's [Summary-Emissions] sheet to previous inventories published by community or by neighboring or similar communities to determine if any major sources of GHGs were omitted from the inventory.

      f.   Document findings and submit findings to the PM, TL and QAM for resolution.

      g.   Document steps taken to resolve any findings.

3.   In the GHG inventory report or in a separate report based on the GHG inventory, include a listing of options for emissions reductions from this sector that includes the following components:

      a.   The specific source categories and activities affected by the proposed option.

      b.   The quantity of GHG emissions reduced by the options with an associated uncertainty estimate.

      c.   The quantity of criteria emissions reduced by the options with an associated uncertainty estimate.

      d.   The quantity of toxic air pollutant emissions (as defined under applicable local, state or federal rules for air toxics) reduced by the option with an associated uncertainty estimate.

      e.   The number of people living in any nonattainment areas where the option would reduce emissions (regardless of the specific pollutant triggering nonattainment).

      f.   A description of any benefits that the option will impart to communities with known environmental injustice issues such as close proximity of the community to an affected source under the option that emits toxic air pollutants.

Table 2.5 Technical Task Descriptions for Task 5.

Tasks and Deliverables	Schedule
Task 5. Urban Forestry (Natural Working Lands and Forestry)	

1. The PM or TL will assign technical staff to develop estimates for this sector using the LGGIT's [Urban_Forestry] worksheet. 2. In order to estimate the areas of land with similar percentages of tree cover, staff will use a web-based mapping application to develop a listing of tree-covered tracts of land (i.e., polygons) with the following attributes: a. Identifier describing area (e.g., Area 1 between Crooked Creek and boundary). b. Sector (residential, commercial/institutional, industrial, energy generation) c. Total area in square kilometers (km²). d. Percentage of area with tree cover based on local estimate.	Within 180 days of QAPP approval by EPA.

3. For each sector, staff will calculate weighted percentage tree cover using **Equation 1.**

Equation 1 for weighted percentage of tree cover for a sector:

$$\frac{\sum_{i=1}^{i=30}(km^2\ of\ area\ i)(\%\ tree\ cover\ of\ area\ i)}{\sum_{i=1}^{i=30}(km^2\ i)}$$

Where:

$i = 1$ to 30	Designates 30 tree covered areas in a sector on local lands.
km^2 of area i	The measured area (in square kilometers) of area i.
% tree cover of area i	The estimated percentage of tree cover for area i.
$\sum_{i=1}^{i=30}(km^2\ i)$	The denominator is the total combined area of all 30 areas within the sector.

4. For each sector on the LGGIT's [Urban Forestry] worksheet staff will enter total area for the sector in column C rows 11 through 14 and enter weighted % tree cover in Column D.
5. For the two sectors with the largest areas of tree cover, the QAM will assign a QC staff member who did not support steps 1 through 4, to develop independent estimates and to complete the following QC steps:

    a.   Review the original source(s) of data for all inputs to the primary LGGIT tool.
    b.   Validate correct entry of values from original source(s) into the primary LGGIT.
    c.   Populate a blank version of the LGGIT tool with the inputs in a QC version.
    d.   Compare the primary outputs of the LGGIT versus the QC version of the LGGIT.
    e.   Compare the listing of resources by sector on the LGGIT's [Summary-Emissions] sheet to previous inventories published by the locality or by neighboring or similar localities to identify any major discrepancies.
    f.   Document findings and submit findings to the PM, TL, and QAM for resolution.
    g.   Document steps taken to resolve any findings.

Table 2.5 Technical Task Descriptions for Task 5.

Tasks and Deliverables	Schedule
Task 5. Urban Forestry (Natural Working Lands and Forestry)	

6. In the inventory report or in a separate report based on the inventory, include a listing of options for emissions reductions from this sector that includes the following components:
   a. Specific source categories and activities affected by the proposed option.
   b. Quantity of GHG emissions reduced by option with uncertainty estimate.
   c. Quantity of criteria emissions reduced or mitigated (such as by adsorption of PM2.5 on leaf surfaces) by the option with an associated uncertainty estimate.
   d. The number of people living in any nonattainment areas where the option would reduce emissions or improve air quality conditions by providing shade to urban heat islands (regardless of the specific pollutant triggering nonattainment).
   e. A description of any benefits that the option will impart to communities with known environmental injustice issues such as providing windbreaks to communities in close proximity to sources of nuisance dust (e.g., dirt roads used for mining operations).
   f. The number of schools, miles of roadways, or public traffic counts at major commuting destinations that would be positively affected by options that include planting of trees or other vegetation.	

1.7.   Quality Objectives / Criteria

The primary objectives for this project are to develop reliable inventories for each of the GHG-emitting sectors in the Des Moines MSA and to identify options for reducing emissions from those sectors. Accordingly, all quality objectives and criteria are aligned with these objectives. The quality system used for this project is the joint responsibility of the Polk County Public Works PM, Task Leaders, and QA Manager. As discussed in section 1.4, an organizationally independent QA Manager will maintain oversight of all required measures in this QAPP. QC functions will be carried out by technical staff and will be carefully monitored by the responsible Task Leaders, who will work with the QA Manager to identify and implement quality improvements. All activities under this project will conform to this QAPP.

1.7.1. Data Quality, Management, and Analyses

For this project, Polk County Public Works will use a variety of QC techniques and criteria to ensure the quality of data and analyses. Data of known and documented quality are essential components for the success of the project, as these data will be used to inform the decision-making process for the PCAP and CCAP as discussed in Section 1.5.4. The table in **Appendix A** lists the QC techniques and criteria that are part of this QAPP.

The data quality objectives and criteria for this project are accuracy, precision, bias, completeness, representativeness, and comparability. *Accuracy* is a measure of the overall agreement of a measurement to a known value. It includes a combination of random error (precision) and systematic error (bias). *Precision* is a measure of how reproducible a measurement is or how close a calculated estimate is to the actual value. *Bias* is a systematic error in the method of measurement or calculation. If the calculated value is consistently high or consistently low, the value is said to be biased. Our goal is to ensure that information and data generated and collected are as accurate, precise, and unbiased as possible within project constraints. It is not anticipated that this project will include primary data collection. Generally, existing data and tools provided by the EPA and other qualified sources will be used for project tasks. A subject matter specialist familiar with technical reporting standards (such as a permit writer or compliance engineer with knowledge of the community's facilities operating in the sector) will be used to QA all data utilized for developing the local GHG inventory. Polk County Public Works will verify the accuracy of all data by checking for logical consistency among datasets. All existing environmental data shall meet the applicable criteria defined in CFR and associated guidance, such as the validation templates provided in the *EPA QA Handbook Volume II*.

Uncertainty can be evaluated using a few different approaches. The most useful uncertainty analysis is quantitative and is based on statistical characteristics of the data such as the variance and bias of estimates. In a sensitivity analysis, the effect of a single variable on the resulting emissions estimate generated by a model (or calculation) is evaluated by varying its value while holding all other variables constant. Sensitivity analyses will help focus on the data that have the greatest impact on the output data. Additional statistical tests may be utilized depending on the need for more or less rigorous tools and on the specific project activity being evaluated.

When available, data originally gathered using published methods whose applicability, sensitivity, accuracy, and precision have been fully assessed, such as EPA reference methods, will be preferred and considered to be of acceptable quality. Project decisions may be adversely impacted if, for example, existing data were used in a manner inconsistent with the originator's purpose. Metadata can be described as the amount and quality of information known about one or more facets of the data or a dataset. It can be used to summarize basic information about the data (e.g., how, why, and when the existing data were collected), which can make working with specific data or datasets easier and provides the user with more

confidence. Metadata are valuable when evaluating existing data, as well as when planning for collection primary data that may be required in the future. However, the effort needed to locate and obtain original source materials can be costly. Accordingly, a graded approach to planning will be applied and ongoing discussions with the EPA will be held to determine what magnitude and rigor of QA effort are appropriate and affordable for the project.

For the data analysis completed under this project, analytical methods will be reviewed to ensure the approach is appropriate and calculations are accurate. Spreadsheets will be used to store data and complete necessary analyses. Design of spreadsheets will be configured for the intended use. All data and methodologies specific to each analysis will be defined and documented. Tables and fields will be clearly and unambiguously named. Spreadsheets will be checked to ensure algorithms call data correctly and units of measure are internally consistent. Hand-entered or electronically transferred data will be checked to ensure the data are accurately transcribed and transferred.

The draft inventory will be evaluated for GHG-emitting-sector and geographic completeness. Polk County Public Works will utilize the framework of sectors in the EPA's LGGIT tool, previous local inventories, or previous inventories completed by similar communities to ensure that the inventory prepared under this project includes all major GHG-emitting sectors. To ensure the inventory is geographically complete, the draft inventory will also be submitted for review by Polk County Public Works staff, the project Technical Advisory Committee, or a contractor technical support person familiar with all activities subject to local or federal standards issued under Title I of the CAA to ensure that all major-emitting, local activities are included in the inventory.

Representativeness is a qualitative term that expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Polk County Public Works will use the most complete and accurate information available to compile representative data for the community's GHG-emitting activities.

Data comparability is a qualitative term that expresses the measure of confidence that one dataset can be compared to another and can be combined for the decision(s) to be made. Polk County Public Works will compare datasets when available from different sources to check for the quality of the data. This QA step will also ensure that any highly correlated datasets or indicators are identified. Supporting data, such as information on reference methods used and complete test reports, are important to ensure the comparability of emissions data.

1.7.2. Document Preparation

All documents produced under this project will undergo internal QC review, as well as technical review and an editorial review, prior to submission to the EPA PO. QC will be performed by an engineer, scientist, economist, or other expert, as appropriate, with sufficient knowledge. The technical reviewer will review the document for accuracy and integrity of the technical methodologies, analyses, and conclusions.

An editorial review of all final documents will be performed. Editors will verify clarity, spelling, and grammatical correctness, and ensure documents are free of typographical errors. Editors will verify that references are cited correctly. This will include a comparison against the original documents.

The *QC Documentation Form* (**Appendix B**) will be used to track the approval process. The form must be completed and signed for all document deliverables. The signatures required include those of the TL and technical and editorial reviewers. Completion of this form certifies that technical review, editorial

review, and all required QC procedures have been completed to the satisfaction of the TL and QAM or QCC. Copies of these signed forms will be maintained in the project files.

1.8. Special Training / Certifications

All Polk County Public Works staff assigned to work on this project shall have appropriate technical and QA training to properly perform their assignments. Polk County Public Works staff serving in the QAM role under this project will have completed a training course on QA/QC activities similar to the course available at https://www.epa.gov/quality/training-courses-quality-assurance-and-quality-control-activities. The PM and all TLs under this project will have completed an online training course on air emissions inventories on the Air Knowledge website at https://airknowledge.gov/EMIS-SI.html.

If training is required for new staff or for particular segments of the GHG inventory, the PM in coordination with the associated TL will identify available training resources for the inventory segment and incorporate the required training into the project schedule.

1.9. Documents and Records

Polk County Public Works will document in electronic form (and/or hard copy) QC activities for this project. The TL is responsible for ensuring that copies of all completed QC forms, along with other QA records (including this QAPP), will be maintained in the project files. Project files will be retained by Polk County Public Works for at least seven years after the period of performance (POP). The types of documentation that will be prepared for this project include:

- Planning documentation (e.g., QAPP)
- Implementation documentation (i.e., Review/Approval Forms and QC records)
- Assessment documentation (i.e., audit reports and independent calculations).

Detailed documentation of QC activities for a specific task or subtask will be maintained using the *QC Documentation Form* shown in **Appendix B**. This form will document the completion of the QC techniques planned for use on this project as listed in the table in **Appendix A**. One or more completed versions of these forms, as necessary, will be maintained in the project files. The types of documents and activities for which QC will be conducted and documented may include raw data, data from other sources such as data bases or literature, data entry into the LGGIT tool, calculations necessary to transform raw data into forms required for LGGIT entry, and comparisons of primary estimates with QC estimates.

Technical reviews will be used along with other technical assessments (i.e., QC checks) and QA audits to corroborate the scientific defensibility of any data analyses. A technical review (i.e., internal senior review) is a documented critical review of a specific technical work product. It is conducted by subject matter experts who are collectively equivalent (or senior) in technical expertise to those who performed the work. Given the nature of the deliverables under this project, a technical review is an in-depth assessment of the assumptions, calculations, extrapolations, alternative interpretations, and conclusions in technical work products. Technical review of proposed methods and associated data will be documented in the *QC Documentation Form* shown in **Appendix B**. The form will include the reviewer's charge, comments, and corrective actions taken.

Additionally, Polk County Public Works has developed and instituted document control mechanisms for the review, revision, and distribution of QAPPs. Each QAPP has a signed approval form, title page, table of contents, and an EPA-approved document control format (see header at top of the page). The distribution list for this QAPP was presented in **Table 1.1**. During the course of the project, any revision to the QAPP will be circulated to everyone on the distribution list, as well as to any additional staff supporting this project. Any revision to the QAPP will be documented in a QAPP addendum, approved by the same signatories to this QAPP, and circulated to everyone on the distribution list by the Polk County Public Works PM.

At this time, Polk County Public Works does not know if the project will collect or handle personally identifiable information (PII) subject to the Privacy Act of 1974. However, if during the course of this project technical staff determine that PII is required to support project objectives, Polk County Public Works will meet all requirements of the Privacy Act of 1974. **Appendix C** indicates the status of our determination regarding applicability of the Privacy Act of 1974 under this project.

2. Existing Data Acquisition and Management Protocols (Group B)

2.1. Sampling Process Design

2.1.1. Need and Intended Use of Data Used

As indicated in **Tables 2.1 – 2.5**, a wide range of data for a diverse set of GHG-emitting activities is necessary to prepare a local inventory. Existing data resources may include sector-specific or facility-specific GHG emissions estimates, emissions factors, or activity data for use with emissions factors. The experimental design for this inventory project relies on the EPA's LGGIT tool together with independent estimates prepared by Polk County Public Works assigned QC staff. Existing data resources (including but not limited to data from previously completed inventories) will be utilized to develop GHG emissions estimates that are comparable to the LGGIT estimates. Subsequently, estimates for each source category will be compared to available federal or state data by assigned QC staff.

2.1.2. Identification of Data Sources and Acquisition

The following data sources will be evaluated for use under each task to develop estimates for the major-emitting sectors in the Des Moines MSA or for use in validation of estimates:

- Task 1:
  - Vehicle registration data from Iowa Department of Transportation (DOT).
  - State or federal averages on vehicle miles traveled and miles per gallon from the U.S. DOT.
  - National Emissions Inventory (NEI) county-level estimates for mobile sources.
- Task 2:
  - U.S. Department of Energy's (DOE's) SLOPE Platform which reports county-level electricity usage in million British thermal units.
  - DOE's EIA Form 861 which reports sub-county-level usage in MWh and customer counts as reported by the different distribution utilities operating within each county.
  - Electricity consumption by customer class obtained directly from local utility providers.
- Task 3:
  - Number of community landfills and information on landfill gas (LFG) collection systems, as applicable, from local solid waste management facilities.
  - Landfill emissions data reported to the EPA's GHGRP.
- Task 4:
  - Data published by the EPA under the Greenhouse Gas Reporting Program for fossil fuel consumption by customer class from local utility providers.
  - County-level natural gas consumption data from DOE's SLOPE Platform;
  - Agriculture data from USDA Census of Agriculture.
  - Wastewater management data from local water utilities
- Task 5:
  - Area calculations from web-based map applications.
  - Tree cover estimates from local or state surveys or forestry databases.

2.2. Quality Control

All data operations conducted for this project will involve existing, non-direct measurement data. All data received will be reviewed by a senior technical staff member to assess data quality and completeness before their use. In addition to reviewing and assessing the data collected, all data entered into spreadsheets and all calculations completed for analyses will be reviewed by a senior technical QC reviewer. The QC reviewer will evaluate the approach to ensure the methods are appropriate and have been applied correctly to the analysis. The QC reviewer will also confirm all data were entered correctly and that calculations are complete and accurate. Calculations will be checked by repeating each calculation, independently, and comparing the results of the two calculations. Any data entry and calculation errors will be identified and corrected. Data tables prepared for the draft and final reports will be checked against the spreadsheets used to store the data and complete the analysis.

Where calculations are required to assess the data/datasets, QC calculations will be performed using computer spreadsheets and calculators to reduce typographical or translation errors—mathematical/ statistical calculations are performed using spreadsheets or software programs with predefined formulas and functions. Polk County Public Works will ensure that any manipulations performed on the data/dataset were done correctly. Such calculations could involve statistical checks to look for data outliers. One approach, for example, that may be used to identify outliers or unusual data points is sorting a datasheet for one or more data variables. This approach is a simple but effective way to highlight unusually high or low values. Graphing data using boxplots, histograms, and scatterplots is another method that may be used to identify gaps in the data (missing data), outliers, or unusual data points. Another approach that may be used is the use of Z-scores, which can quantify the unusualness of an observation when data follow a normal distribution. A Z-score for a particular value indicates the number of standard deviations above and below the mean that the value falls. For example, a Z-score of 2 indicates that an observation is two standard deviations above the average while a Z-score of -2 indicates the value is two standard deviations below the mean. A Z-score of zero represents a value that equals the mean. As appropriate, we will also use hypothesis tests to find outliers, or an interquartile range (IQR) to calculate boundaries for what constitutes minor and major outliers. The methods used will be driven by the scale and type of data. Polk County Public Works will determine outlier detection methods to be used based on the initial review of the data. Identified outliers will be highlighted to the PM, TL, QAM, or delegate with options for treatment.

2.3. Non-direct Measurements for GHG Inventory and Options Identification

All data operations conducted on this project will involve existing, non-direct measurement data. All existing data received will be reviewed by a senior technical staff member to assess data quality and completeness before their use.

Consistent with the EPA's QA requirements, this QAPP describes the procedures that will be used to ensure the selection of appropriate data and information to support the goals and objectives of this project. Specific elements addressed by this QAPP include:
- Identifying the sources of existing data,
- Presenting the hierarchy for data selection,
- Describing the review process and data quality criteria,
- Discussing quality checks and procedures should errors be identified, and
- Explaining how data will be managed, analyzed, and interpreted.

Data presented in the GHG inventory will be traced to its source (e.g., database input and output). Key resources include data collected by the EPA (e.g., GHGRP data), and data from EPA-approved data

sources (e.g., Department of Energy and other federal data sources). These sources may include primary literature (i.e., peer-reviewed journal articles and reports) or databases. We may also use approved existing sources (e.g., handbooks, databases). Original sources for all information and data contained in the document will be included in a list of references with appropriate citations. When peer-reviewed literature or EPA-approved data sources cannot be used, we will document any significant limitations to the data sources used.

We will document information regarding each dataset and our rationale/selection criteria for selecting the data sources used in the inventory. The TL will be responsible for overseeing and confirming the selection of the data for the project tasks.

Table 3.1 provides a hierarchy for data quality when identifying and reviewing available sources of data and information. When evaluating data resources, efforts will be made to identify and select data sources that most closely conform to the highest ranked criteria. Data quality metrics and documentation may not be provided by each source, and as necessary, we may consult with subject matter experts from permitted facilities or trade associations operating in the Des Moines MSA to qualify data for use to meet project objectives.

Any available data quality information will be reviewed by Polk County Public Works. and project advisors to ensure that the data represent full-scale designs and commercial processes, and that they are applicable to economic and regulatory conditions in the United States. Polk County Public Works will document data sources used and any significant limitations of utilized data or information to ensure that the data are appropriate for their intended use. An internal technical reviewer will review the approach for selecting and compiling data; the review will include examination of the data sources and the intended use of the data. The specific QC techniques used will depend on the technical activity or analysis to which they are applied. The Polk County Public Works TL is responsible for verifying the usability of data and related information.

Table 3.1 Existing Data Quality Ranking Hierarchy

Quality Rank	Source Type
Highest	Federal, state, and local government agencies
Second	Consultant reports for state and local government agencies
Third	NGO studies; peer-reviewed journal articles; trade journal articles; conference proceedings
Fourth	Conference proceedings and other trade literature: non-peer-reviewed
Fifth	Individual estimates (e.g., via personal communication with vendors)

Polk County Public Works will work with EPA to ensure that all data used for the project are appropriate for their intended use. The main criteria that will be used in the selection of the data are the vintage and quality of the data (based on peer review). The quality of the data will consider the credibility of the source, and the QA documentation provided by the data source. Senior technical staff will also evaluate the availability of alternative datasets, suitability of the selected data for the intended purpose, and agreement with LGGIT estimates.

Polk County Public Works will use the Secondary Data Quality Ranking Hierarchy when identifying and reviewing available sources of data and information. The source types in **Table 3.1** appear in the order in which they are likely to meet the data quality criteria. For example, federal government data are more likely to be from a credible source, thoroughly reviewed, suitable, available, and representative, and any exceptions to these data criteria are likely to be noted in the government data, providing transparency. Data from individuals are expected to be less reliable, not peer reviewed, and may not be suitable or representative of local activities.

If it is determined that data meeting the fourth (i.e., conference proceedings and other trade literature: non-peer-reviewed) or fifth (i.e., individual estimates such as personal communications with vendors) level compose the best or only available data source, the TL will include in the inventory a description of these data with associated limitations for review and approval by the PM and QAM.

These measures of data quality will be used to judge if the data are acceptable for their intended use. In cases where available data do not or may not meet data quality acceptance criteria, the TL will include in the inventory a discussion for review and approval by the PM and QAM explaining how emissions estimates that relied on such data compare to LGGIT estimates.

We will also consider, for example, the age (i.e., date of the source dataset) and the representativeness of the data and will include in the inventory report for review and approval by the PM and QAM any quality concerns or uncertainties introduced with use of these data, such as data gaps or inconsistencies with other sources. Any data source utilized that is older than 10 years will specifically be flagged in the inventory report.

Representativeness will be evaluated by determining that the emissions or activity data are descriptive of conditions in the United States, that the data are current, and that the data are descriptive of similar processes within the Des Moines MSA. Any incomplete datasets will be identified, and deficiencies will be evaluated to determine if data are missing or confusing and if they meet secondary-use quality objectives.

Key screening criteria will be used to screen the sources identified. The Polk County Public Works TL will provide oversight to the screening process to ensure sources collected are the most relevant and meet quality requirements. Available data and information from the selected sources will be compiled and relevant summary information will be extracted from the information sources to develop the required output for each of the project tasks.

2.3.1. Criteria for Accepting Existing Data for Intended Use

The criteria for determining if the data are acceptable for use in developing the local inventory will be based on the following:

- Data Source: Ensure the data originated from a credible source that is generally accepted by the experts or authority in the relevant field.
- Transparency: Ensure data collection and calculation methods and assumptions are clearly documented.
- Data Completeness: Determine if the data is complete and provide explanations for data gaps. All data will be reviewed by staff familiar with each data type to ensure the data aligns with expectations and are within reasonable ranges.
- Data Comparison of County-developed Estimates: The Des Moines Area Metropolitan Planning Organization & City of Des Moines have completed a baseline greenhouse gas inventories including most major sources of greenhouse gases utilizing the ICLEI ClearPath tool, among other methods. For those portions already completed, Polk County

Public Works will validate the county-developed emissions estimate to an emissions estimate using the EPA's LGGIT tool. While some differences between the primary calculations and independent calculations are expected, significant differences must be accompanied by an explanation subject to approval by the PM and QAM prior to using the estimate in the MSA's inventory.

2.3.2. Criteria for Options Identification

Review of activities under each task and identification of options for emissions reductions to be considered by policymakers will be based on the following criteria:

1. Quantity of reductions in emissions of climate pollution under the option.
2. Number of jobs likely to be created by the option.
3. Environmental justice benefits of the project including the number of people living in overburdened neighborhoods that will benefit from the option.
4. Quantity of reductions in criteria and toxic air pollutants that can be achieved by option.
5. Number of people living, working, recreating, and going to school in the area(s) benefiting from the option.

2.4. Data Management

Data management procedures include file storage and file transfer. All project and data files will be stored on Polk County Public Works' shared drive folder named Central Iowa Climate Pollution Reduction Grant Program. Files will be organized and maintained by the TL in folders by project, task, and function, including a system of file labeling to ensure version control. Any files containing confidential business information will be stored on secure computers. The TL will make sure that staff are trained and adhere to the project file organization and version control labeling to ensure that files are placed in consistent locations. All files will be backed up each night to avoid loss of data. Data are stored in various formats that correspond to the software being used. As necessary, data will be transferred using various techniques, including email, File Transfer Protocol, or shared drives. Typically, records will be archived once the project is completed. Record retention times will be based on contractual and statutory requirements or will follow Polk County Public Works practices for storing materials of up to seven years after the end of the period of performance (POP). Multiple project staff are granted access rights to the archived file system for each project. Records may be retrieved from archived file system by the TL, PM, or other project staff with access during the records retention period. As soon as allowed by applicable regulations or the grant agreement, records will be destroyed according to Polk County Public Works' policies and procedures. For any sensitive information that is gathered under the project, Polk County Public Works' policy is consistent with EPA-recommended methods of destruction, which include degaussing, reformatting, or secure deletion of electronic records; physical destruction of electronic media; recycling; shredding; incineration; and pulping. Should the grant specify some other manner of disposition (e.g., transfer to the client), Polk County Public Works will comply with that directive. As noted above, Polk County Public Works has developed a file naming convention/nomenclature for electronic file tracking and record keeping. Foremost, all files must be given a short but descriptive name. For those records and files gathered or provided to Polk County Public Works, the filename may include the identification of "original" in its filename.

Similarly, files that have undergone a review by an independent, qualified person will include, at the end of the filename, the initials of the reviewer or the suffix "rev" (in lieu of initials) if more than one reviewer reviewed the file, along with the date reviewed and version number, as a way to track which staff person(s) reviewed the file and when. Filenames of draft versions will follow an incremental, decimal numbering system. More specifically, each successive draft of a document is numbered sequentially from version 0.1, 0.2, 0.3... until a final version is complete. Final versions will be indicated by whole numbers (e.g., version 1.0). Final versions of documents that undergo revisions will be labeled

version X.1 for the first set of revisions. While the document is under review, subsequent draft versions will increase incrementally (e.g., 1.2, 1.3, 1.4) until a revised final version is complete (e.g., version 2.0).

In the event data retrieval is requested and to prevent loss of data, all draft and final file versions will be retained electronically—that is, superseded versions will not be deleted.

Note that changes made to deliverables will be documented using the software's *track changes* feature, which allows a user to track and view all changes that are made to the document version. All deliverable reviews will be documented in a QC Documentation Form (see **Appendix B**) for the project. This form will be maintained in the project files.

For this project, it is not anticipated that any special hardware or software will be used. General software available through Microsoft Suite including Excel, PowerPoint, Access, and Word will be sufficient to perform the work (described in **Tables 2.1 – 2.5**) for this project.

3.   Assessment and Oversight (Group C)

Polk County Public Works is committed to preparing a comprehensive and reliable inventory of GHG emissions for the Des Moines MSA. Under this project our senior management team has dedicated the necessary resources to ensure we deliver an inventory that can be relied upon for future policy decisions. Accordingly, under this project, we will concurrently implement existing quality management systems that Polk County Public Works has previously utilized for submissions to the EPA under Title I of the Act where task-level deliverables will be subjected to required, regular reviews (e.g., quarterly) to ensure that technical, financial, and schedule requirements of this project are consistent with the EPA PO's and QAM's expectations for handling and producing deliverables that reflect high-quality environment data. This section discusses Elements C1 (assessments and response actions) and C2 (reporting) applicable to this project.

3.1.   Assessments and Response Actions

The QA program includes periodic review of data files and draft deliverables. The essential steps in the QA program are as follows:

1.   Identify and define the problem
2.   Assign responsibility for investigating the problem
3.   Investigate and determine the cause of the problem
4.   Assign and accept responsibility for implementing appropriate corrective actions
5.   Establish the effectiveness of and implement the corrective action
6.   Verify that the corrective action has eliminated the problem.

The TL will provide day-to-day oversight of the quality system. Periodic project file reviews will be carried out by the QA Manager, at least once per year to verify that required records, documentation, and technical review information are maintained in the files. The QAM will ensure that problems found during the review are brought to the attention of the TL and are corrected immediately. All nonconforming data will be noted, and corrective measures to bring nonconforming data into conformance will be recorded.

The TLs and QA Manager are responsible for determining if the quality system established for the project is appropriate and functioning in a manner that ensures the integrity of all work products. All technical staff have roles and will participate in the corrective action process. Corrective actions for errors found during QC checks will be determined by the TL and, if necessary, with direction from the QA Manager or PM, as appropriate. The originator of the work will make the corrections and will note on the QC form that the errors were corrected. A reviewer or TL, not involved in the creation of the work, will review the corrections to ensure the errors were corrected. Any problems noted during audits will be reviewed and corrected by the QA Manager and discussed with the TL as needed. Depending on the severity of the deficiency, the TL may consult the QA Manager and stop work until the cited deficiency is resolved. Deficiencies identified and their resolution will be documented in monthly project reports, as applicable. The QA Manager and TL will comply and respond to all internal and EPA audits on the project, as needed. The QA Manager will produce a report outlining any corrective actions taken.

3.2.   Reports to Management

The periodic progress reports (to the EPA PO) required in the grant agreement will be reviewed by the PM and the PM's manager (Karen Kurt, Polk County Public Works Executive Director) to ensure the project is meeting milestones and that the resources committed to the project are sufficient to meet project objectives. These periodic progress reports will describe the status of the project, accomplishments during the reporting period, activities planned for the next period, and any special problems or events including any QA/QC issues. Reports to the EPA will be drafted by the TL or other project staff familiar with project activities during the reporting period.

Any QC issues impacting the quality of a deliverable, the project budget, or schedule will be identified and promptly discussed with the assigned TL and the PM or QAM as appropriate. All significant findings will be included in monthly reports with the methods used to resolve the specific QC issue or the recommendations for resolution for consideration by the EPA's PO or designee.

Based on the technical work completed during the reporting period, progress reports will be reviewed internally by an independent, qualified technical person (equivalent or senior to the TL), prior to submitting to the PM. The PM will conduct a final review of the report before transmitting the progress report to the EPA PO, and the PM's manager will be cc'd on all progress reports

4. Data Validation and Usability (Group D)

4.1. Data Review, Verification, Validation

All work conducted under this project will be subject to technical and editorial review. When existing data for the same GHG-emitting activity are available from multiple sources, the background information documents will be reviewed for all sources to determine the dataset that is the most representative of local operations. Additionally, the inventory report will include the vintage of the existing data resource and preference will be given to the most recent dataset that is representative of similar GHG-emitting local activities. Reviews will be conducted by an independent, qualified person— or a person not directly involved in the production of the deliverable. The term "validation" refers to whether the data meets the QAPP-defined user requirements while the term "verification" refers to whether conclusions can be correctly drawn from the data. The quality of data used and generated for the project will be reviewed and verified at multiple levels by the project team. This review will be conducted by the Polk County Public Works TL or a senior technical reviewer with specific, applicable expertise. All original and modified data files will be reviewed for input, handling, and calculation errors. Additionally, all units of measure will be checked for consistency. Any potential issues identified through this review process will be evaluated and, if necessary, data will be corrected, and analysis will be revised as necessary, using corrected data. These corrections will be documented in project records. These measures of data quality will be used to judge whether the data are acceptable for their intended use. In cases where available data do not or may not meet data quality acceptance criteria, the TL will document these findings in the inventory along with corrective actions or use of alternative data sources.

4.2. Verification and Validation Methods

As a standard operating procedure, all data (retrieved and generated) will be verified and validated through a review of data files by an independent, qualified technical staff member (i.e., someone other than the document originator), and ultimately, the Polk County Public Works TL. A checklist of QC activities for deliverables under this project is provided as **Appendix A**. Forms for documenting QC activities and review of deliverables are included in **Appendix B**. Documentation of calculations will be included in spreadsheet work products and in supporting memoranda, as appropriate.

The TL is responsible for day-to-day technical activities of tasks, including planning, data gathering, documentation, reporting, and controlling technical and financial resources. The TL is the primary person responsible for quality of work on tasks under this project and will approve all-related plans and reports. These reports will be transmitted by the TL to the QAM for final review and approval.

Source data will be verified and validated through a review of data files by the technical staff, and ultimately the TL. Reviews of analyses will include a thorough evaluation of content and calculated values. All original and modified data files will be reviewed for input, handling, and calculation errors. Additionally, all measurement units will be checked for consistency. Any potential issues identified through this review process will be evaluated, errors corrected, and analysis repeated using the corrected data. All corrections will be documented in project records.

Source data will be verified and validated through a review of data files by the technical staff, and ultimately the TL. Typical data verification reviews can include checks of the following:

- Data sources are clearly documented,
- Calculations are appropriately documented,

- All relevant assumptions are clearly documented,
- Conclusions are relevant and supported by results,
- Text is well-written and easy to understand.

The documented review process will be stored with deliverables for the project. For the narrative describing the methodologies used for the inventory, all comments on drafts will be clearly and concisely summarized including a description of how substantive issues raised by commenters were resolved.

As discussed in Section 1.7, QC objectives include verification that data in database tables are stored and transferred correctly, algorithms call data correctly, units are internally consistent, and reports pull the required data. These data management issues will be addressed as part of the QC checks of data acquisition and document preparation.

For this project, it is not anticipated that any special data validation software will be required. However, where calculations are required to assess the data/datasets, calculations will be performed using computer spreadsheets (like Excel spreadsheets with predefined functions, or formulas) and calculators to reduce typographical or translation errors. General software available through Microsoft Suite including Excel, PowerPoint, Access, and Word will be sufficient to perform the work as described in Section 1.6 for this project.

4.3.   Reconciliation with User Requirements

All data (retrieved and generated) and deliverables in this project will be analyzed and reconciled with project data quality requirements. To ensure deliverables meet user requirements, the TL will review all data and deliverables throughout the project to ensure that the data, methodologies, and tools used meet data quality objectives, are clearly conveyed, and represent sound and established science.

Polk County Public Works will review each project with the EPA at the planning stage to ensure the approach is fundamentally sound and will meet the project objectives. The TL will evaluate data continuously during the life term of the project to ensure they are of sufficient quality and quantity to meet the project goals. Prior to submission of draft and final products, the TL will make a final assessment to determine if the objectives have been fulfilled in a technically sound manner. Assumptions made in preparing project analyses will be clearly specified in the inventory.

As discussed in Section 1.7.1, uncertainty can be evaluated using a few different approaches. The most useful uncertainty analysis is quantitative and is based on statistical characteristics of the data such as the variance and bias of estimates. In a sensitivity analysis, the effect of a single variable on the resulting emissions estimate generated by a model (or calculation) is evaluated by varying its value while holding all other variables constant. Sensitivity analyses will help focus on the data that have the greatest impact on the output data. Additional statistical tests may be utilized depending on the need for more or less rigorous tools and on the specific inventory activity being evaluated.

5. References

EPA, Chief Information Officer's Policy Directive on Information Technology / Information Management available at EPA IT/IM Directive: Environmental Information Quality Policy, Directive # CIO 2105.3

EPA, *Chief Information Officer's Policy Directive on Information Technology / Information Management: Quality Assurance Project Plan (QAPP) Standard*, Directive # CIO 2105-S-02.0. Available at https://www.epa.gov/irmpoli8/quality-assurance-project-plan-qapp-standard. Accessed on 7/24/2023.

EPA, EPA-454/B-17-001, *Quality Assurance Handbook for Air Pollution Measurement Systems, Ambient Air Quality Monitoring Program, Volume II*. Available at https://www3.epa.gov/ttnamti1/files/ambient/pm25/qa/Final%20Handbook%20Document%201_17.pdf. Accessed on 6/23/2023.

EPA, Fact Sheet: Areas where differences between state GHG inventories and the EPA's Inventory of U.S. GHG Emissions and Sinks by State: 1990-2020 estimates may occur. Available at https://www.epa.gov/system/files/documents/2022-03/fact-sheet-differences-epa-and-offical-state-ghgi.pdf. Accessed on 6/23/2023.

EPA, US GHG Inventory by State. Available at https://www.epa.gov/ghgemissions/state-ghg-emissions-and-removals. Accessed on 6/23/2023.

EPA, GHG Reporting Program Facility-level Local Information. Available at https://ghgdata.epa.gov/ghgp/main.do. Accessed on 7/18/2023.

EPA, Data reported to EPA's Greenhouse Gas Reporting Program (GHGRP) at https://www.epa.gov/ghgreporting/data-sets

EPA, National Inventory at https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks-1990-2021

EPA, Publications, Tools, and Data for State, Local, and Tribal Governments at https://www.epa.gov/statelocalenergy/publications-tools-and-data-state-local-and-tribal-governments. Accessed on 7/27/2023.

EPA, Fuel heating values and CO2 emission factors at eCFR :: 40 CFR Part 98 -- Mandatory Greenhouse Gas Reporting

EPA, Global warming potentials at https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-98/subpart-A?toc=1

USDA/NASS, Quick Stats for Census of Agriculture at https://quickstats.nass.usda.gov/

USDA, Forest Service at https://www.fs.usda.gov/research/treesearch/62418

US DOT, Federal Highway Administration Transportation Statistics at https://www.fhwa.dot.gov/policyinformation/statistics/2021/vm1.cfm

Appendix A: Example Check Lists of Quality Control Activities for Deliverables

Tasks and Deliverables	Quality Control Procedures

Local inventory of GHG emissions from mobile sources with documentation of the following QC activities:
 	
(1) narrative report describing data sources and QC measures for data acquisition steps,
 	
(2) description of methodology and QC measures for validated proper implementation of methodology, and
 	
(3) documentation of QAPP implementation.
 	
(4) listing of emissions reductions options are present with documentation of rationale for each option.
	1. Technical review—Review methods, calculations, and underlying datasets.
	
	   a. Determine if data are appropriate for intended use, originated from a credible source, and that sources are documented. When comparing any two datasets, ensure that the units of measure are converted to a consistent basis prior to making the comparison.
	   b. Ensure that all assumptions and calculation methods are clearly documented.
	   c. Ensure analytical methods are appropriate, and that calculations are accurate.
	   d. Include any QC findings and reconciliation.
	2. Review by TL or senior technical reviewer—analytical methods / results are explained clearly, technical terms are defined, conclusions are reasonable based on information presented, and level of technical detail is appropriate.
	3. Editor review—verify that writing is clear and free of grammatical and typographical errors.

Appendix C: Compliance with Requirements Under the Privacy Act of 1974

Important Note about Personally Identifiable Information (PII)

The Privacy Act of 1974 (5 U.S.C. § 552a) mandates how federal agencies maintain records about individuals. Per OMB Circular A-130, Personally Identifiable Information (PII) is "information that can be used to distinguish or trace an individual's identity, either alone or when combined with other information that is linked or linkable to a specific individual."

EPA systems/applications that collect PII must comply with EPA's Privacy Policy and procedures to guard against unauthorized disclosure or misuse of PII in all forms. For more information click here. If PII are collected, then the QAPP will describe how the PII are managed and controlled.

Personally identifiable information (PII):

__Please verify one of the following two options by checking the corresponding box:__

1. This project **will not** collect Personally Identifiable Information (PII) ☒:
2. This project **will** collect Personally Identifiable Information (PII): ☐

This QAPP will comply with 5 U.S.C. § 552a and EPA's Privacy Policy.

Personally identifiable information (PII) and the requirements for safeguarding this information are described for EPA grantees within the EPA Privacy Policy (CIO 2151, current version). PII is defined as any information about an individual's identity, including personal information which is linked or linkable to an individual (e.g., name, date of birth, address). The Privacy Act of 1974 (5 U.S.C. § 552a) sets forth requirements for federal agencies when they collect, maintain, or disseminate Privacy Act information.

Appendix B: Example QC Documentation Form

Polk County Public Works
Documentation of QA Review and Approval of Electronic Deliverables

Approvals on this form verify that all technical and editorial reviews have been completed and the deliverable meets the criteria for scientific defensibility, technical and editorial accuracy, and presentation clarify as outlined in the Quality Assurance (QA) Project Plan, QA Narrative, Quality Management Plan, and/or according to direction from the EPA PO.

Client:	EPA Region 7
Grant Number:	96704601
EPA Project Officer:	Molly Schreiner
Project Name:	Des Moines MSA CPRG
Grantee Org. Project Manager:	Allison van Pelt

QA Form Details

Item Number	File Name (Copy the name of the file reviewed)	Deliverable Description	Date Sent to Client	Deliverable (Draft)	Deliverable (Final)	Document Originator	QA Review Information (Review Type)	(Reviewer Name)	(Date Review was Performed)	(Brief Summary of Review Findings and Other Notes)	QA Review Information (Have all Findings Been Resolved?)	(Originator Signature)	(Reviewer Signature)	(File Location) Copy Long Folder Path Name
01				☐	☐		*Technical*				☐ Yes			
02				☐	☐		*Technical*				☐ Yes			
03				☐	☐		*Technical*				☐ Yes			
04				☐	☐		*Technical*				☐ Yes			
05				☐	☐		*Technical*				☐ Yes			
06				☐	☐		*Technical*				☐ Yes			