PRIORITY CLIMATE ACTION PLAN

Twin Cities Metropolitan Statistical Area

March 2024

METROPOLITAN COUNCIL

The Council's mission is to foster efficient and economic growth for a prosperous metropolitan region

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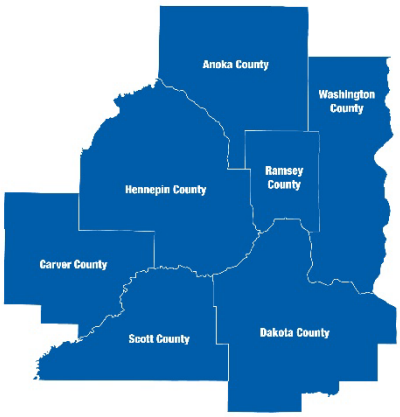

The Metropolitan Council is the regional planning organization for the seven-county Twin Cities area. The Council operates the regional bus and rail system, collects and treats wastewater, coordinates regional water resources, plans and helps fund regional parks, and administers federal funds that provide housing opportunities for low- and moderate-income individuals and families. The 17-member Council board is appointed by and serves at the pleasure of the governor.

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Key Definitions and Acronyms

BWSR: Board of Water and Soil Resources

CO_2e: Carbon dioxide equivalent

Comprehensive Climate Action Plan (CCAP): A narrative report that provides an overview of the grantees' significant GHG sources/sinks and sectors, establishes near-term and long-term GHG emission reduction goals, and provides strategies and identifies measures that address the highest priority sectors to help the grantees meet those goals.

CPRG: Climate Pollution Reduction Grant programs from the Environmental Protection Agency

DEED: Minnesota Department of Employment and Economic Development

DNR: Minnesota Department of Natural Resources

DOE: United States Department of Energy

EPA: United States Environmental Protection Agency

EQB: Environmental Quality Board

GHG: Greenhouse gas

Greenhouse gas (GHG) Inventory: A list of emission sources and sinks and the associated emissions quantified using standard methods.

IPCC: United Nations Intergovernmental Panel on Climate Change

IRA: Inflation Reduction Act

LCA: Livable Communities Act

Low Income / Disadvantaged Communities (LIDACs): Communities with residents that have low incomes, limited access to resources, and disproportionate exposure to environmental or climate burdens. Although the Inflation Reduction Act does not formally define LIDACs, EPA strongly recommends grantees use the Climate and Economic Justice Screening Tool and the Environmental Justice Screening and Mapping Tool to identify LIDACs in their communities. These tools identify LIDACs by assessing indicators for categories of burden: air quality, climate change, energy, environmental hazards, health, housing, legacy pollution, transportation, water and wastewater, and workforce development.

MDA: Minnesota Department of Agriculture

MHFA: Minnesota Housing Finance Agency

MPCA: Minnesota Pollution Control Agency

MMt: Million metric tons

MnDOT: Minnesota Department of Transportation

MSA: Metropolitan statistical areas as defined by the U.S. Census 2020 MSA population. A list of eligible MSAs can be found in Appendix 15.2 in EPA's CPRG: Formula Grants for Planning, Program Guidance for States, Municipalities, and Air Control Agencies.

Municipality: EPA defines municipality for the Climate Pollution Reduction Grants as "a city, town, borough, county, parish, district, or other public body created by or pursuant to State law. Consistent with section 137(d)(1) of the Clean Air Act, a group of municipalities, such as a council of governments, may also be considered an eligible entity under this program in some cases." This definition can be found in Section 4 in EPA's CPRG: Formula Grants for Planning, Program Guidance for States, Municipalities, and Air Control Agencies

PM 2.5: Particulate matter of 2.5 micrometers and smaller

Priority Climate Action Plan (PCAP): A narrative report that includes a focused list of near-term, high-priority, and implementation-ready measures to reduce GHG pollution and an analysis of GHG emissions reductions.

State: All 50 U.S. states and the District of Columbia and Puerto Rico.

SHIP: Statewide Health Improvement Partnership

USDA: United States Department of Agriculture

VMT: Vehicle miles traveled

1 Introduction

The Twin Cities Metropolitan Priority Climate Action Plan is led by the Metropolitan Council in collaboration with the Minnesota Pollution Control Agency, the Minnesota Department of Health, and the State of Wisconsin. This plan has been created under the Climate Pollution Reduction Grant program, authorized under the Inflation Reduction Act. It builds on the Met Council's existing climate change mitigation work including the greenhouse gas inventory and strategy planning tool, Climate Action Work Plan, Minnesota's Climate Action Framework, and ongoing natural systems and climate engagement and policy work as part of the 2050 regional planning process.

Climate Pollution Reduction Grant program overview

The Climate Pollution Reduction Grant (CPRG) program provides $5 billion in grants to states, local governments, tribes, and territories to develop and implement ambitious plans for reducing greenhouse gas (GHG) emissions and other harmful air pollution. Authorized under Section 60114 of the Inflation Reduction Act, this two-phase program provides $250 million for noncompetitive planning grants (of which $1 million was awarded to the Met Council) and approximately $4.6 billion for competitive implementation grants.

The CPRG program is part of the Justice40 initiative, which sets a goal that 40% of the benefits of certain federal investments flow to disadvantaged communities that are "marginalized, underserved, and overburdened" by pollution.

The two phases of the grant include two deliverables: the Priority Climate Action Plan (PCAP) due March 1, 2024, and a Comprehensive Climate Action Plan (CCAP) due in 2025 along with ongoing status reports through 2027.

This document, the PCAP, provides a focused list of near-term, high-priority, implementation-ready measures to reduce climate pollution from GHG emissions. The PCAP components include:

- A GHG inventory
- Quantified GHG reduction measures
- Low-income and disadvantaged communities benefits analysis
- A review of authority to implement

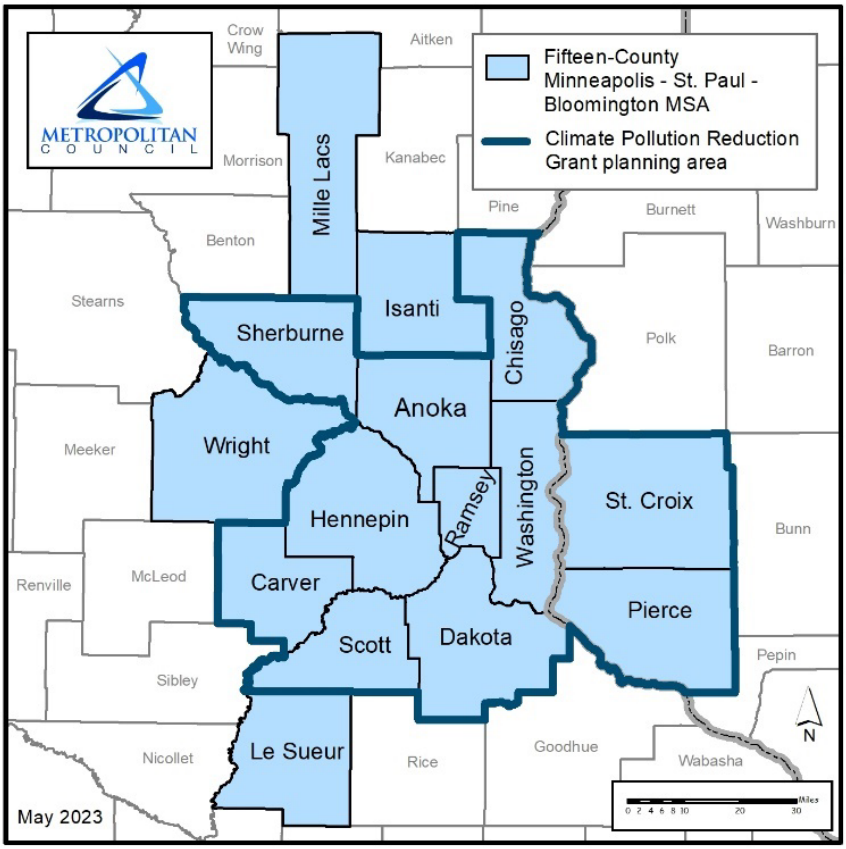
The EPA has launched two CPRG implementation grant competitions. Eligible entities, whether they received planning grants in Phase 1 or not, can apply to implement measures outlined in their Priority Climate Action Plans (PCAPs). Individual grants will range between $2 million and $500 million. Additional information on the PCAP elements can be found in EPA's CPRG: Formula Grants for Planning, Program Guidance for States, Municipalities, and Air Control Agencies.

The Comprehensive Climate Action Plan (CCAP) is due in July 2025 and consists of several key components, such as a comprehensive GHG inventory, projections for GHG emissions, clearly defined GHG reduction targets, specified measures for GHG reduction, and a thorough benefits analysis covering the entire geographic scope and population addressed by the plan.

Geographic scope of the PCAP

This PCAP applies to 11 counties in the Twin Cities Metropolitan Statistical Area (MSA), including Anoka, Carver, Chisago, Dakota, Hennepin, Ramsey, Scott, Sherburne, and Washington counties in Minnesota along with Pierce and Saint Croix counties in Wisconsin.

Figure 1 - Map of Twin Cities Metropolitan Statistical Area and CPRG Planning Area



Source: Metropolitan Council, 2024.

State and MSA Context

As the regional planning agency for the seven-county metro region (inclusive of 181 cities and townships in the counties of Anoka, Carver, Dakota, Hennepin, Ramsey, Scott, and Washington), the Met Council is responsible for guiding the growth and development of the region, including planning for three regional systems: the regional wastewater system, the metropolitan transportation system, and the regional parks and open space system. The planning process for the statutorily required 2050 metropolitan development guide is underway, with a scheduled Met Council adoption date by February 2025.

As part of the planning process, the Met Council has endorsed a draft vision to guide its work. The draft vision states “We lead on addressing climate change: We have mitigated greenhouse gas emissions and have adapted to ensure that our communities and systems are resilient to climate impacts.”

Further, in the 2023 session, the Minnesota State Legislature passed a bill requiring the regional development guide to plan for and consider climate adaptation and mitigation, including mitigation goals and strategies that meet or exceed the greenhouse gas emissions reduction goals established by the state to reduce emissions by 50% in 2030 and to become carbon-neutral by 2050.

The bill requires local governments in the seven-county metro to also consider the same greenhouse gas emissions reductions efforts and climate adaptation as a part of their local comprehensive plans. By state law, local comprehensive plans are required to be completed and submitted to the Met Council for review by the year 2028.

The Met Council has organized an internal Climate and Natural Systems team of staff from across its divisions (community development, transit, transportation, environmental services) to develop supporting analyses and information and support policy development for the regional planning process, in addition to conducting engagement with stakeholders in the region. The Met Council coordinates stakeholder engagement between its planning process and the grant activities, given the strong alignment between them.

Approach to Developing the Priority Climate Action Plan (PCAP)

This PCAP is built on the foundation established in the Met Council's previous climate change mitigation work, including the existing greenhouse gas inventory and strategy planning tool. The greenhouse gas inventory summarizes the major sources of emissions by city and township in the seven-county Twin Cities region. The GHG strategy planning tool quantifies how a range of specific strategies may reduce future GHG emissions relative to baseline at the city and township level. This tool was developed in collaboration with academic partners in the Sustainable Healthy Cities Network alongside Met Council staff, with engagement and input from local governments and other regional stakeholders.

Expanding the existing GHG inventory

The existing Met Council GHG inventory quantifies emissions from major sectors for every city and township in the seven-county Twin Cities region. The inventory was expanded to include Sherburne, Chisago, Pierce, and St. Croix counties as well as 7- and 11-county totals.

Engagement to inform initial GHG reduction measures

The prioritized measures included in the existing GHG strategy planning tool provided the basis for the measures selected in the PCAP. Met Council staff developed the initial draft list of reduction measures together with staff at Urban Land Institute, academic partners in the Sustainable Healthy Cities Network, the Minnesota Environmental Quality Board, and the Minnesota Department of Transportation. The Met Council partnered with faculty at the University of Minnesota to lead five stakeholder engagement meetings on the draft measures with local government officials and staff, environmental advocate groups, and technical experts from academia, nonprofits, government, and the private sector. Finally, the Met Council convened a cohort of staff from cities and counties throughout the region representing rural, suburban, and urban contexts was convened to discuss the findings from the engagement and decide on the final set of measures.

Refining GHG reduction measures for the PCAP

These measures were further refined by drawing from the State of Minnesota's PCAP engagement and measures, input from the Met Council's Regional Climate and Natural

Systems policy team, and by analyzing findings from the Met Council's regional development guide engagement, which included significant engagement with low income and disadvantaged communities. Finally, the Met Council led a public input process including a webinar and online portal to gain feedback and input on the prioritized GHG reduction measures.

Low-Income and Disadvantaged Communities

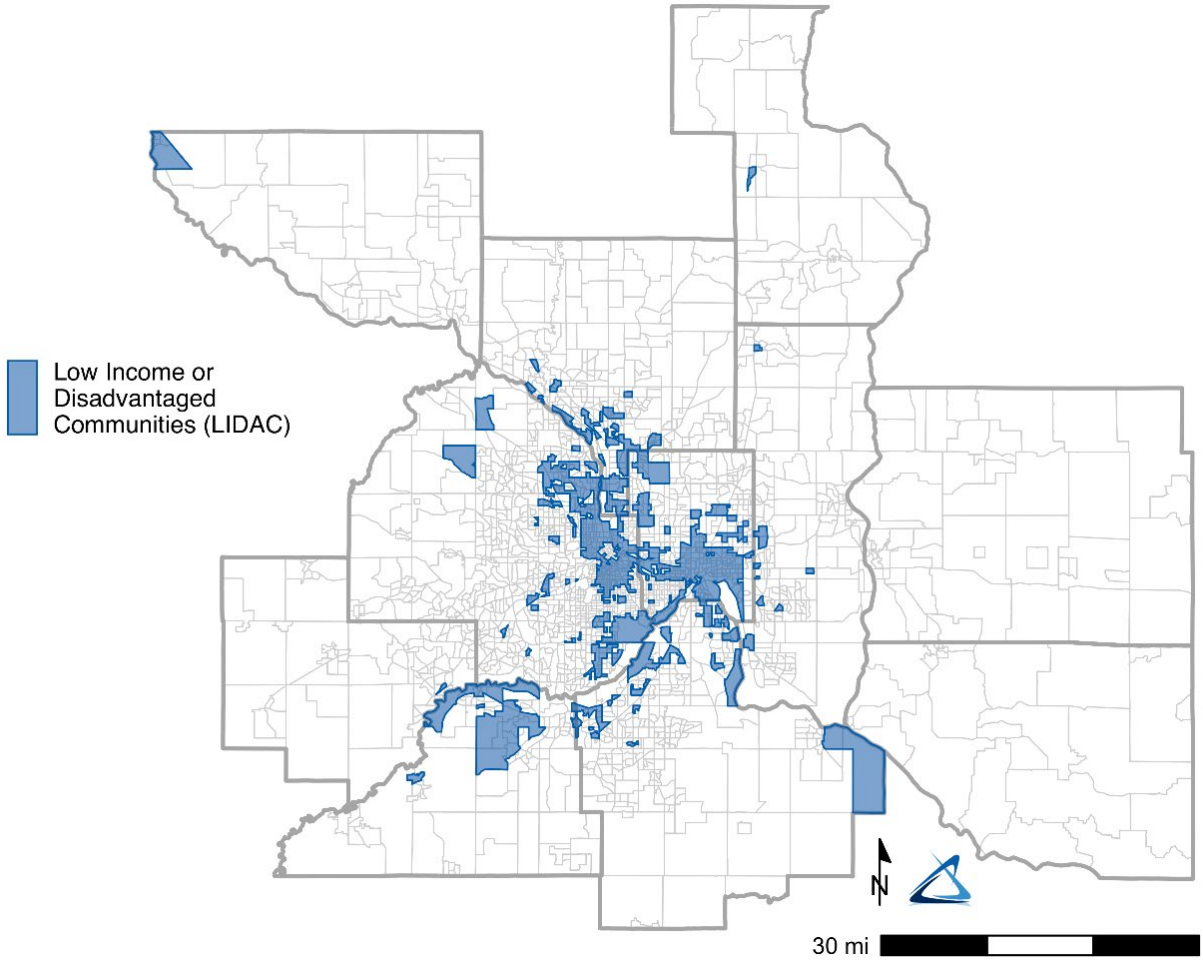
Everyone will be affected by climate change, but elderly people, households with low incomes, and communities that have faced historical and ongoing oppression and marginalization will be impacted most (including, but not limited to, Black, Indigenous, and communities of color). This PCAP recommends strategies that recognize the unique needs of these communities and work to identify and minimize potential adverse effects from climate change.

Geographies for Low Income and Disadvantaged Communities (LIDAC) were identified and downloaded directly from the EPA's Inflation Reduction Act Disadvantaged Communities Map. These communities are identified based on the following criteria:

- Any census block group at or above the 90th percentile for any of EJScreen's Supplemental Indexes when compared to the nation or state
- And/or any tribal lands category in EJScreen

By using the data from this tool, 659 LIDAC block groups were identified. Approximately 817,000 (24%) of residents in the 11-county area are living in LIDAC block groups. These areas are primarily located in eastern Hennepin County and southern Ramsey County, centered in the cities of Minneapolis and Saint Paul.

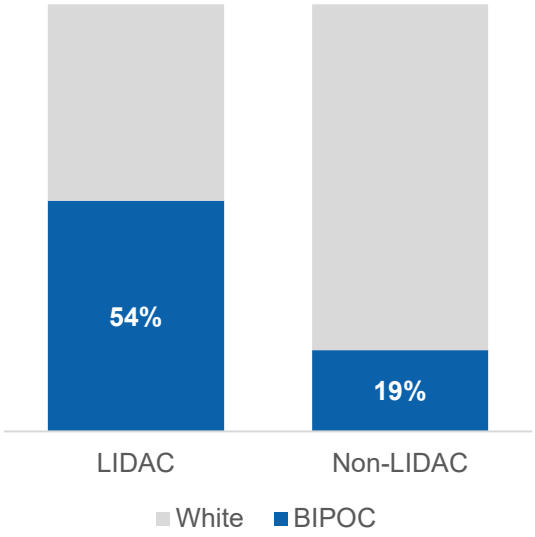
Figure 2 - Low Income and Disadvantaged Communities (LIDAC) in the Twin Cities' CPRG Planning Area



Source: Metropolitan Council analysis of EPA's Inflation Reduction Act Disadvantaged Communities Map data (2020).

LIDAC designated areas are substantially more racially and ethnically diverse than the rest of the 11-county area. About 54% of people living in LIDAC-designated block groups are Black, Indigenous, or people of color (BIPOC), compared to 19% of non-LIDAC communities. Black, Indigenous, and people of color comprise a much larger share of the population in LIDACs.

Figure 3 - Share of white and BIPOC population in CPRG Planning Area by LIDAC status



Source: Metropolitan Council analysis of Environmental Protection Agency EJScreen Data.

Climate risks, vulnerabilities, and impacts

"I worked at [Minnesota Department of Health] in two counties. In one county, there weren't a lot of trees. I think it leads to more health complications. People who live in more populated areas, or [areas] not as financed as in well-kept like suburban areas where mostly white people live. I think [heat and lack of shade] is affecting minorities a lot."

- Community Resource Center Somali Organization (Shakopee)

"There's a difference in air quality between the suburbs, rural areas, and Saint Paul. It's pretty clean over there, I wish it was like that here too."

- Urban Roots Youth (Saint Paul)

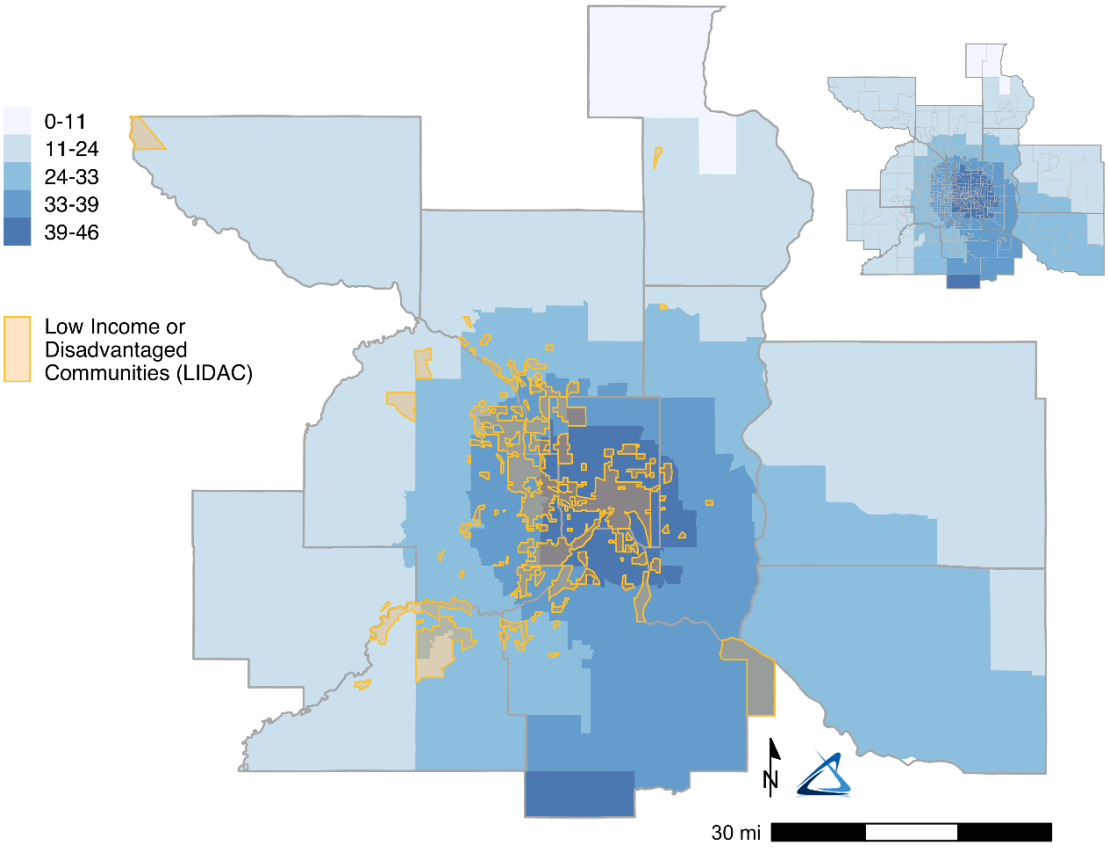
On average, life expectancy in LIDACs is significantly lower; PM 2.5 air pollution and diesel particulate exposure is significantly higher; homes are more likely to have lead paint; air toxics, superfund and hazardous chemicals and waste sites are more likely to be present; impervious surfaces comprise more of the area; and housing and energy cost burden is significantly higher.[1] The historical disenfranchisement of these communities resulting in these outcomes underscores the importance of focusing emissions reductions efforts in LIDACs.

[1] All differences in vulnerabilities comparing LIDAC to non-LIDAC tracts are statistically significant at the p <.001 level.

$PM_{2.5}$ air pollution

LIDACs are substantially more likely to be in places with higher levels of $PM_{2.5}$ fine particulate air pollution. Exposure to these particles is associated with respiratory injury including asthma, respiratory inflammation, pneumonia, chronic obstructive pulmonary disease, lung cancer, increased mortality, and a host of other health hazards.[2]

Figure 4 - Distribution of inhalable particulate matter ≤ 2.5 µm ($PM_{2.5}$) by percentiles



Source: Metropolitan Council analysis of Council on Environmental Quality Climate and Economic Justice Screening Tool and Environmental Protection Agency EJScreen Data.

Diesel particulate exposure

"Whenever I'm walking anywhere where a lot of buses drop by, it smells like a bunch of smoke, and sometimes you can see the smoke in the air. It's harder to breathe."

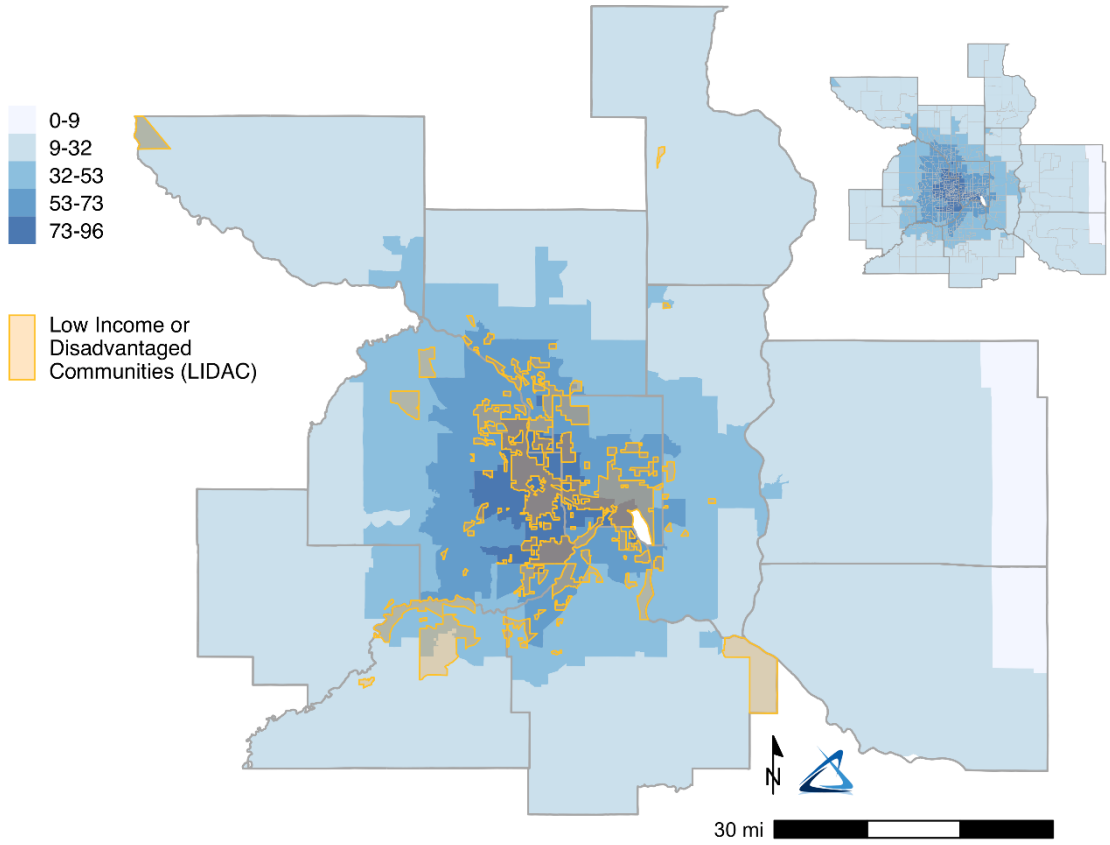
- Urban Roots Youth (Saint Paul)

LIDACs are also substantially more likely to be in places with higher levels of diesel particulate exposure. Diesel exhaust has been linked to airway inflammation, vascular dysfunction,

[2] Nan, N., Yan, Z., Zhang, Y., Chen, R., Qin, G., & Sang, N. (2023). Overview of $PM_{2.5}$ and health outcomes: Focusing on components, sources, and pollutant mixture co-exposure, *Chemosphere*, *323* (May 2023).

developmental toxicity, neuroinflammation, respiratory mortality, and is carcinogenic to humans.[3] Most diesel particulate exposure is the result of commercial trucking; the greenhouse gas inventory in this report totaled over 869 million commercial vehicle miles traveled.[4]

Figure 5 - Distribution of exposure to inhalable diesel particulate matter by percentiles



Source: Metropolitan Council analysis of Council on Environmental Quality Climate and Economic Justice Screening Tool and Environmental Protection Agency EJScreen Data.

[3] Weitekamp, C., Kerr, L.B., Dishaw, L., Nichols, J., Lein, M., & Stewart, M. (2020). A systematic review of the health effects associated with the inhalation of particle-filtered and whole diesel exhaust, *Inhalation Toxicology*, 32:1, 1-13, DOI: https://doi.org/10.1080/08958378.2020.1725187

[4] This figure includes medium- and heavy-duty vehicles miles traveled in the seven-county Twin Cities metro region, generated from StreetLight Data, 2021.

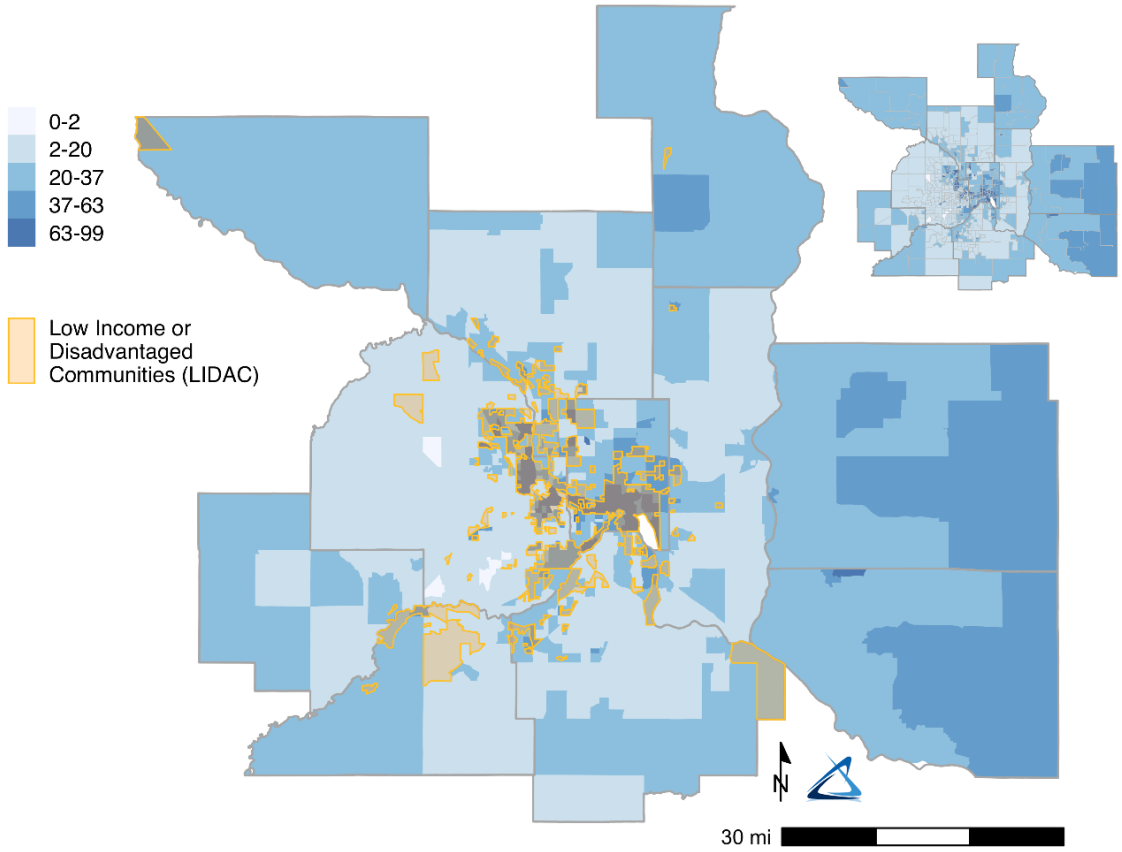
Asthma prevalence

"Why are there such high asthma rates here in the cities, but not in the suburbs? The air quality needs to be addressed because it's poisoning us."

- Minnesota Indian Women's Resource Center (Minneapolis)

Given the long-term exposure to fine particulates, it is not surprising that many LIDACs are in places with the highest percentiles of asthma prevalence of asthma among adults.

Figure 6 - Distribution of asthma in adults (age 18+) by percentiles



Source: Metropolitan Council analysis of Council on Environmental Quality Climate and Economic Justice Screening Tool and Environmental Protection Agency EJScreen Data.

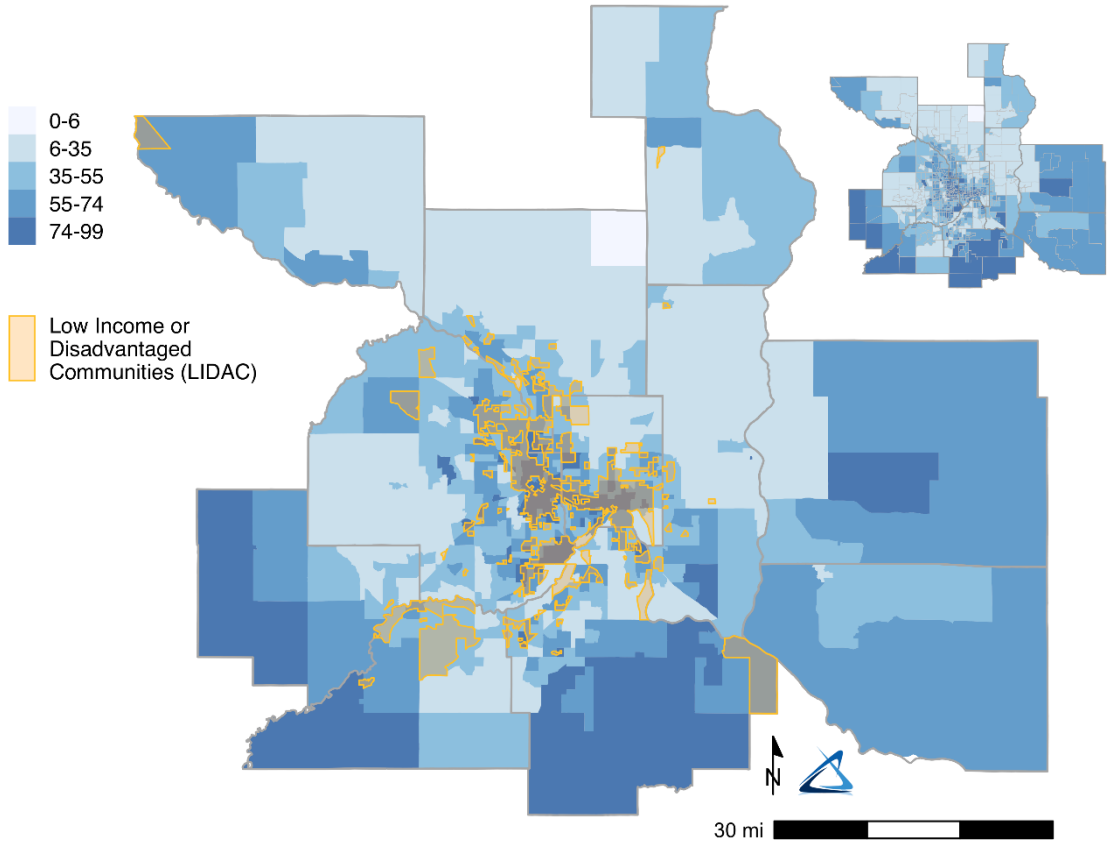
Impervious surface or cropland

"So many city areas don't have nature around. It's just concrete, houses, roads, and stuff."

- Roseville Area High School Students for Climate Action (Roseville)

LIDACs are among the most likely places to have more impervious surface as a share of the tract land area. These conditions make areas hotter and can result in higher energy costs to cool residents.[5]

Figure 7 - Impervious surface or cropland coverage by percentile

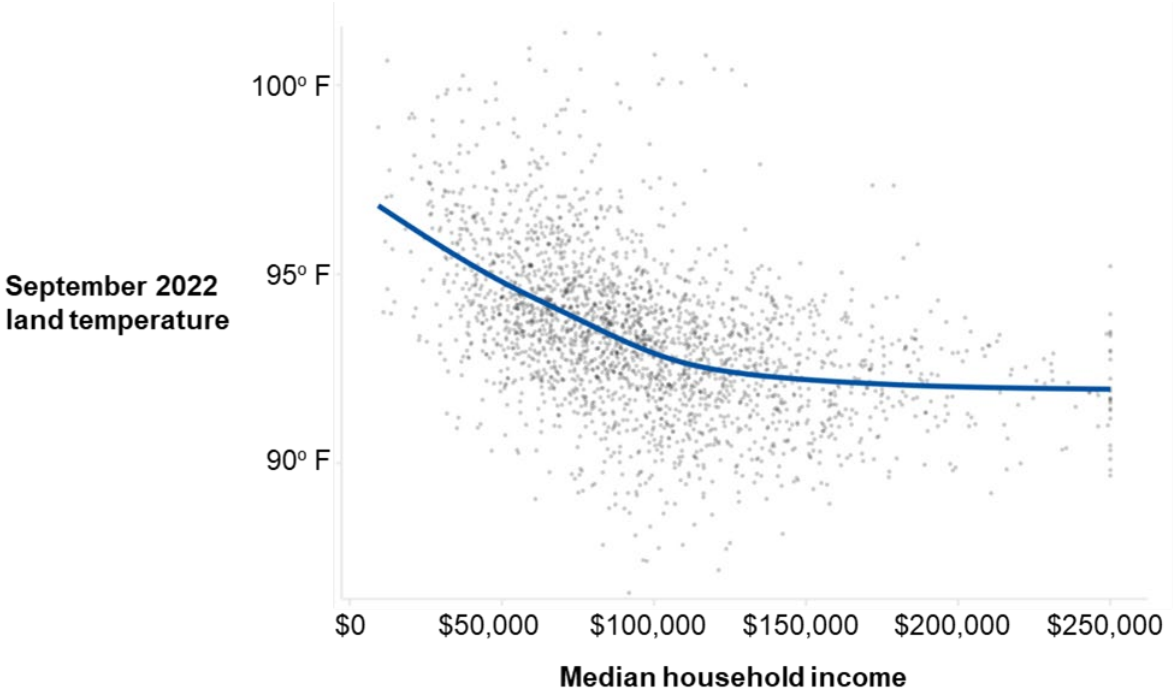


Source: Metropolitan Council analysis of Council on Environmental Quality Climate and Economic Justice Screening Tool and Environmental Protection Agency EJScreen Data.

Past research at the Met Council has also shown that individuals with low incomes are more likely to live in areas with less tree cover and more impervious surfaces compared to wealthier individuals and experience hotter temperatures.[6] As shown in Figure 8, households with median household incomes less than $100,000, particularly the lowest income households, are more likely to experience the highest temperatures during heat waves with several degrees difference between the hottest and coolest areas in the metro. The Met Council's extreme heat tool can be accessed here.

[5] Heat Island Effect | US EPA
[6] Extreme Heat | Metropolitan Council

Figure 8 - Land temperature by median household income



Source: Metropolitan Council analysis of Landsat and Sentinel-2 satellite imagery (2022) and U.S. Census Bureau, American Community Survey (ACS), five-year estimates, 2017-2021.

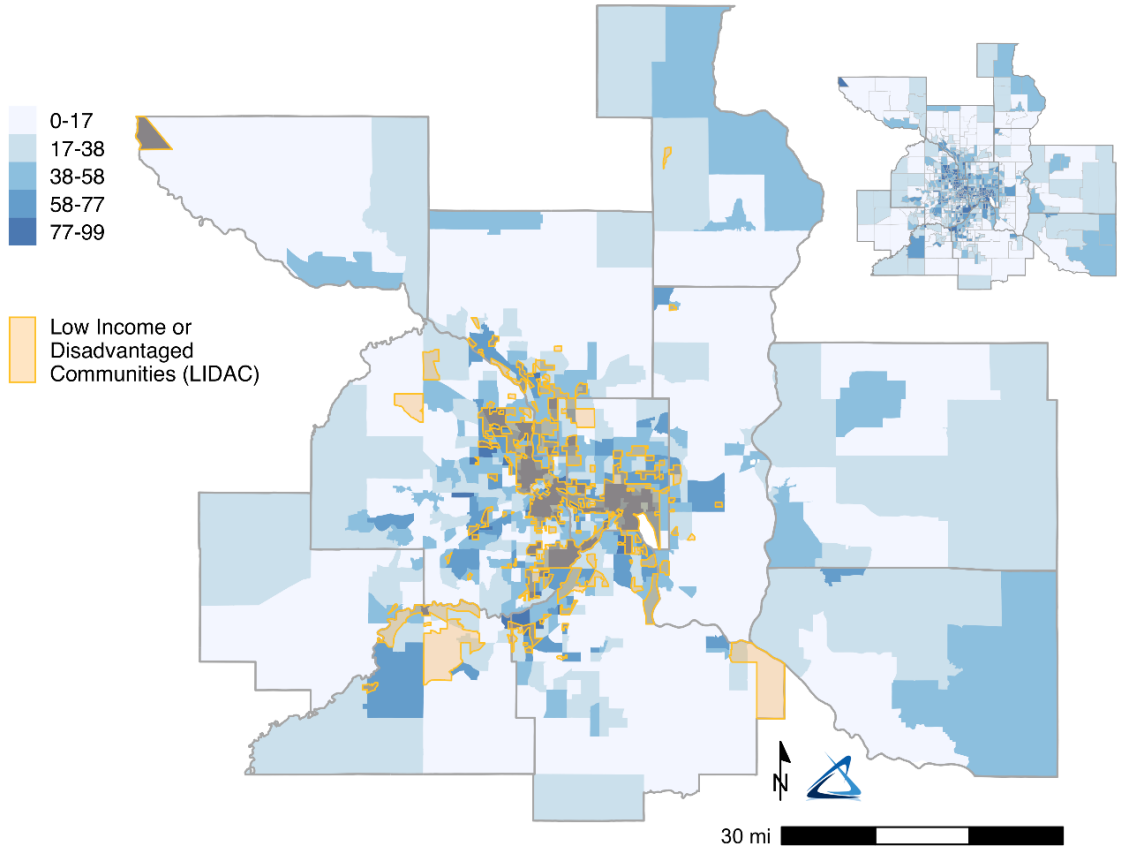
Housing cost burden

"When people are struggling to pay their housing, that means they have to cut on other essentials like food, electricity bills, or their kids' schooling."

- Youth from World Youth Connect

A household that pays more than 30% of their income toward housing is considered housing cost-burdened. People living in LIDACs are much more likely to be cost burdened.

Figure 9 - Distribution of housing cost-burdened households by percentiles



Source: Metropolitan Council analysis of Council on Environmental Quality Climate and Economic Justice Screening Tool and Environmental Protection Agency EJScreen Data.

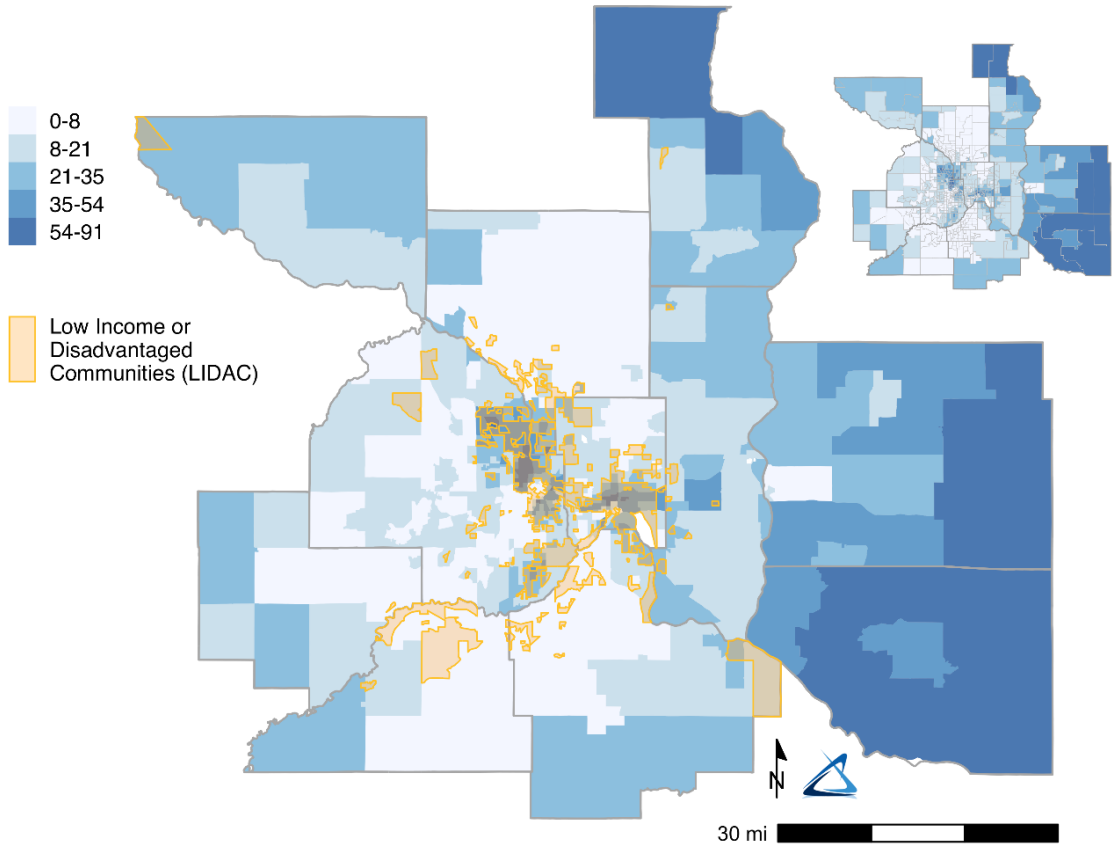
Energy cost-burden

"I don't have central air conditioning because it's too expensive. I don't even open my window because it doesn't even help, it's still too hot."

- Urban Roots Youth (Saint Paul)

LIDACs are more likely to be in areas with the highest percentiles for energy cost-burden. Households with high energy cost-burden are also located in the most rural portions of the region.

Figure 10 - Distribution of energy cost-burdened households by percentiles



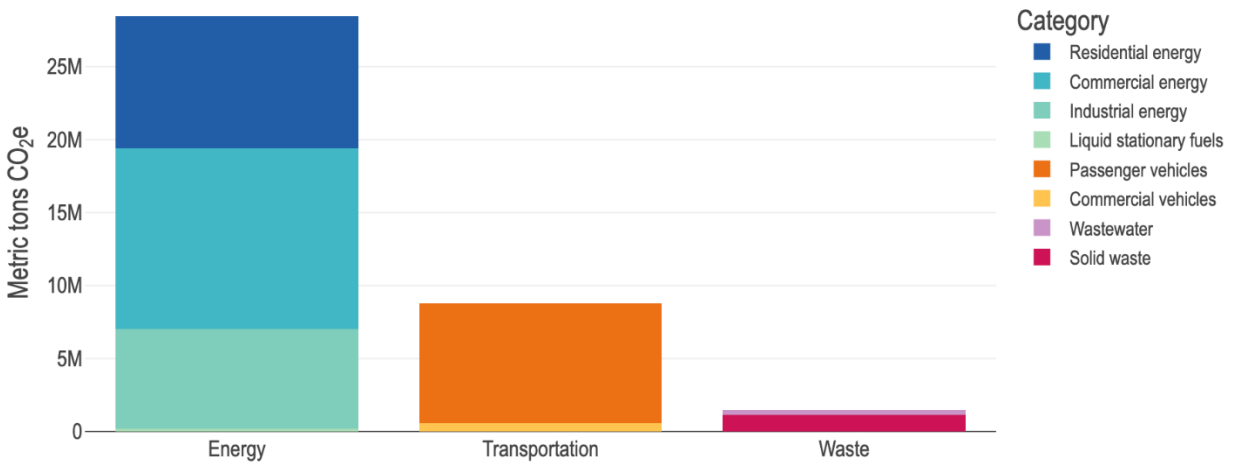
Source: Metropolitan Council analysis of Council on Environmental Quality Climate and Economic Justice Screening Tool and Environmental Protection Agency EJScreen Data.

2 Greenhouse Gas (GHG) Inventory

In 2021, the Twin-Cities MSA generated 38.73 million metric tons of CO_2 equivalent ($MMtCO_2e$) emissions from the energy, transportation, and waste sectors. Energy was the largest contributor to GHG emissions (73.6%), followed by transportation (22.6%), and waste (3.8%).

Methods used to estimate GHG emissions varied by sector. In all cases, the Global Warming Potentials from IPCC5 was used for converting all gases to CO_2 equivalency.

Figure 11 – 2021 Greenhouse gas emissions by sector in the Twin Cities' CPRG Planning Area

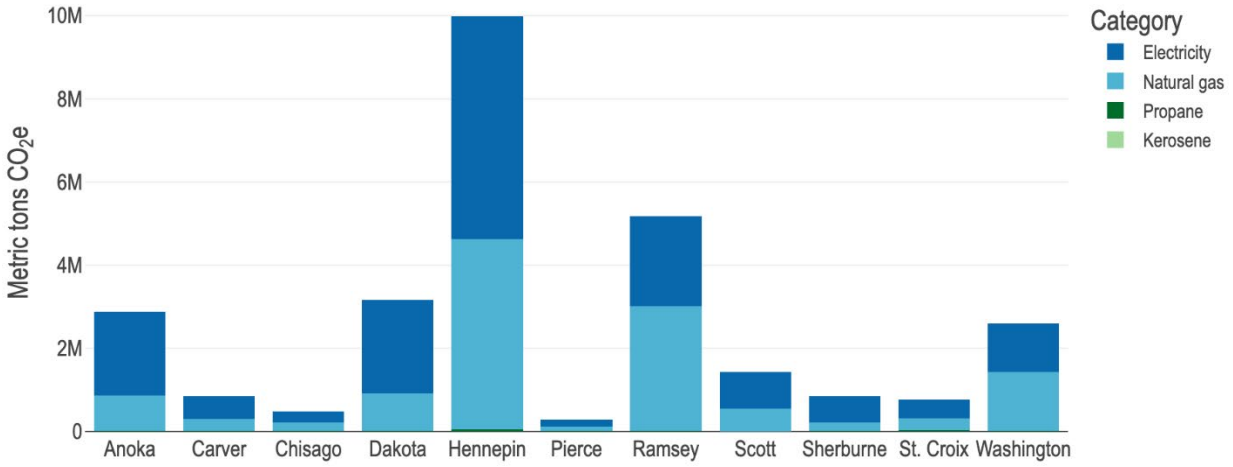


Data management and review

All data manipulation and analysis were conducted in the R programming environment and were tracked in a Metropolitan Council GitHub repository. Sectors were broken up into subtasks and assigned to researchers. As researchers completed tasks, all code and data were submitted for a peer review by another team member before being merged into the main branch of the repository. Datasets and functions were regularly tested and evaluated for reproducibility and consistency. Final datasets were compared with other GHG inventories and contextual data, like population estimates, for correlation and logical consistency. The Twin Cities Region's Greenhouse Gas Inventory is available on Met Council's website at: www.metrocouncil.org/tcghginventory.

Energy sector

Figure 12 – 2021 Energy greenhouse gas emissions by category and county



Source: Metropolitan Council analysis of energy usage in 2021.

Summary

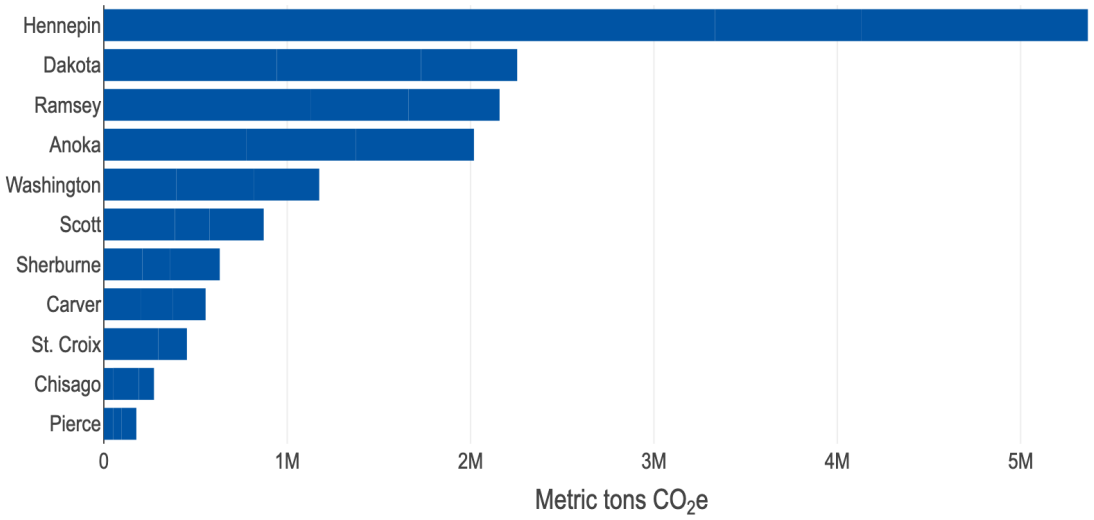
The energy sector generated 28.49 $MMtCO_2e$ of emissions in the Twin Cities MSA in 2021. Most of the energy emissions are from electricity followed by natural gas. Other fuels (propane and kerosene) make up a small proportion of energy emissions in the metro.

Electricity

Summary

The Twin Cities MSA generated 15.94 $MMtCO_2e$ of emissions from electricity use in 2021 and was the largest single contributor to emissions across all sectors despite recent improvements in clean energy generation.

Figure 13 – 2021 Greenhouse gas emissions from electricity consumption by county



Source: Metropolitan Council analysis of mandatory[7,8] reporting from electric companies and co-operatives.

Accounting method

Emissions were apportioned to the county level by identifying all electric utilities in the Twin Cities MSA, collecting their reports on energy delivered to customers, and using EPA eGrid emission factors for the Midwest Reliability Organization – West to calculate estimated emissions. The inventory presented here therefore reports demand-side emissions as opposed to within-boundary emissions by the utilities themselves (Scope 2). Utilities with operations in Minnesota reported the specific amount of electricity delivered to each of the Minnesota counties in our inventory. In contrast, utilities with operations in Wisconsin counties reported statewide numbers, which were allocated to Wisconsin counties in our inventory based on either a) the proportion of customer accounts in total utility service territories within the inventory counties, or b) the proportion of population in total utility service territories within the inventory counties, subject to data availability.

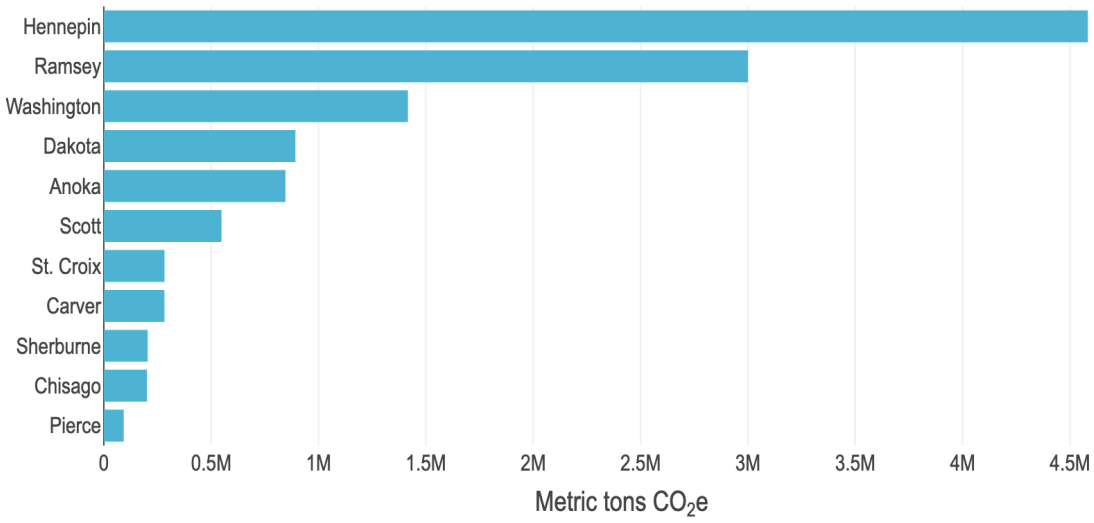
[7] CHAPTER 7610, ENERGY INFORMATION REPORTING (2005). https://www.revisor.mn.gov/rules/7610/
[8] Chapter 196, Regulation of Public Utilities, 35.18 1 (2024). https://docs.legis.wisconsin.gov/statutes/statutes/196

Natural gas

Summary

The Twin Cities MSA generated 12.35 $MMtCO_2e$ of emissions from natural gas use in 2021, the second largest single contributor to emissions across all sectors in the region.

Figure 14 – 2021 Greenhouse gas emissions from natural gas use by county



Source: Metropolitan Council analysis of reporting from natural gas utilties

Accounting method

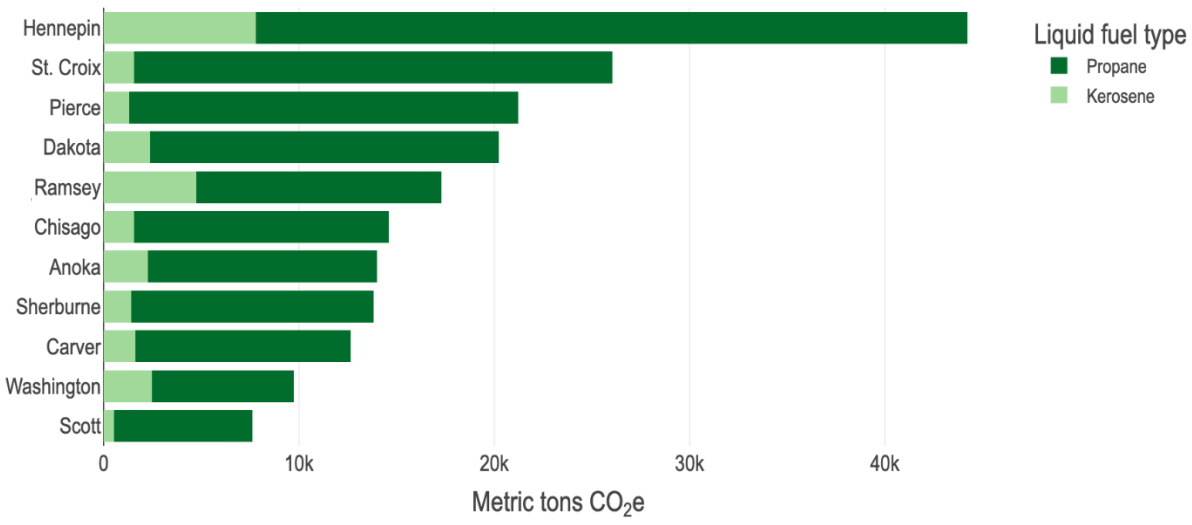
Emissions were apportioned to the county level by identifying all natural gas utilities in the Twin Cities MSA, collecting their reports on energy delivered to customers, and using emission factors from the 2021 EPA Emissions Factor Hub to calculate estimated emissions. The inventory presented here therefore reports demand-side emissions as opposed to within-boundary emissions by the utilities themselves (Scope 2). Utilities with operations in Minnesota reported the specific amount of natural gas delivered to each of the Minnesota counties in our inventory. In contrast, utilities with operations in Wisconsin counties reported statewide numbers, which were allocated to Wisconsin counties in our inventory based on the proportion of customer accounts in total utility service territories within the inventory counties.

Other stationary fuels

Summary

The Twin Cities MSA generated 0.17 $MMtCO_2e$ from residential propane use and 0.027 $MMtCO_2e$ from residential kerosene use in 2021.

Figure 15 – 2021 Greenhouse gas emissions from residential combustion of other fuels by county



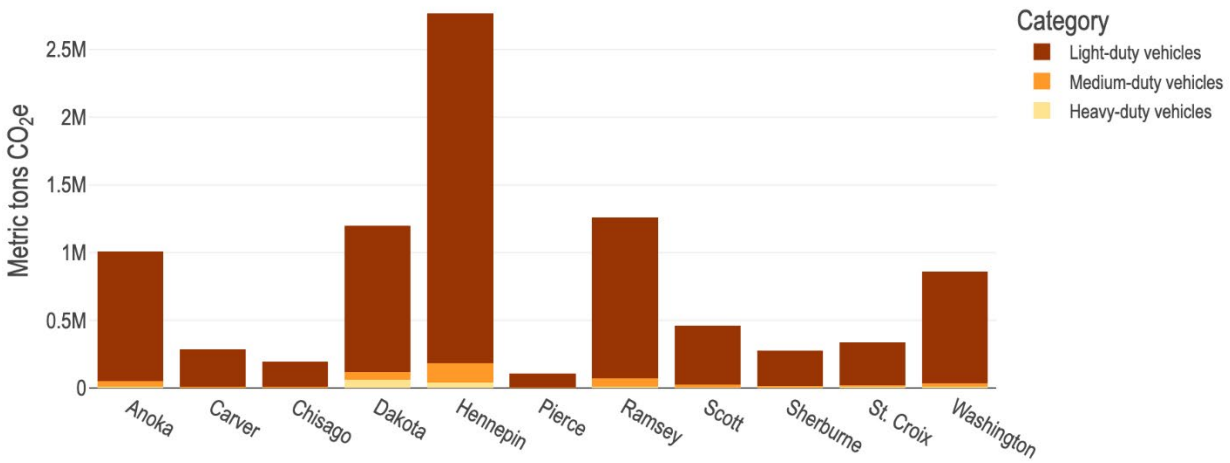
Source: Metropolitan Council analysis of US Energy Information Administration's Residential Energy Consumption Survey

Accounting method

The U.S. Energy Information Administration provides estimates of residential heat generation from propane and kerosene at the state level every five years, with the most recent estimate occurring in 2020. These statewide estimates were apportioned to the county level by using the 2021 American Community Survey estimates of county-level numbers of households using each fuel divided by the statewide estimate of households using each fuel. This accounting assumes 2021 statewide heat generation from the fuels was equivalent to 2020 heat generation and that there is equal heat generation from fuel use per household across counties.

Transportation Sector

Figure 16 – 2021 Transportation greenhouse gas emissions by category and county

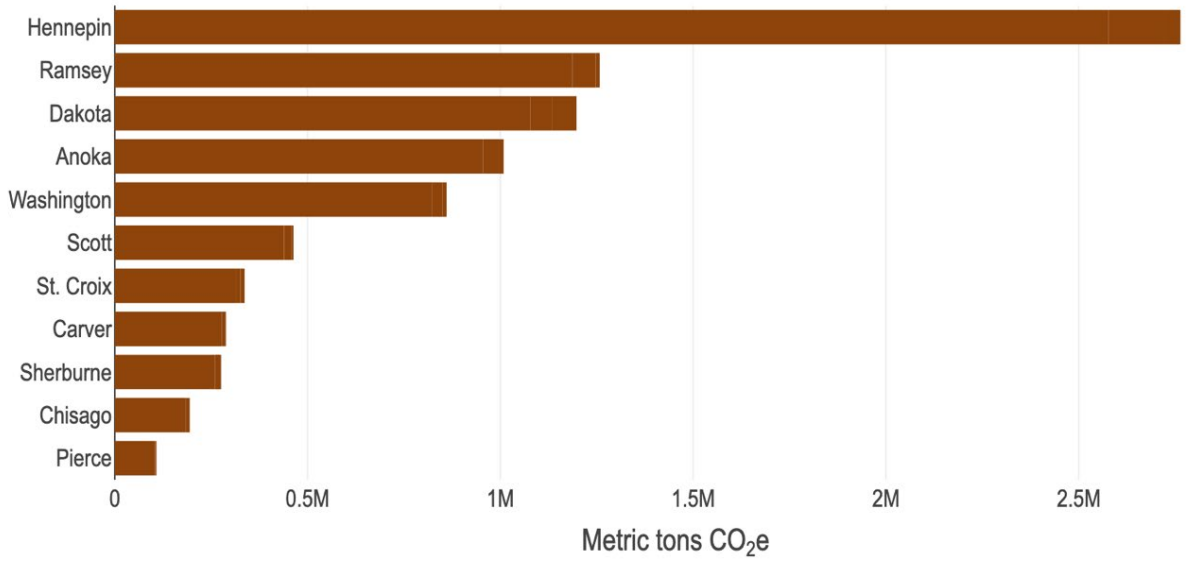


Source: Metropolitan Council analysis of Streetlight data.

Summary

The transportation sector generated 8.76 $MMtCO_2e$ of emissions in the Twin Cities MSA in 2021. This is a county-level, activity-based estimate that accounts for the total number of vehicle trips that originate in the county, terminate in the county, or both originate and terminate within the county for passenger and medium-duty commercial vehicles. Heavy-duty commercial vehicles are only accounted for trips that both originate and terminate within the county.

Figure 17 – 2021 Transportation greenhouse gas emissions by county



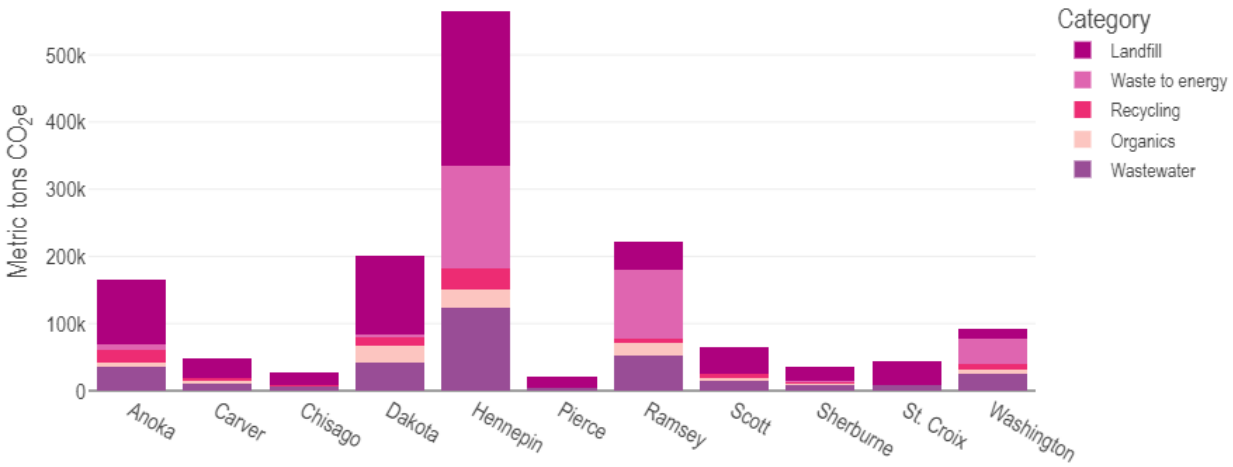
Source: Metropolitan Council analysis of Streetlight data.

Accounting method

Emissions were estimated using StreetLight Data, a transportation analytics platform that uses aggregated location-based services (LBS) data from cell phones, GPS data, and connected vehicle data to deliver insights on travel patterns. Using StreetLight, we calculated the number of trips and then multiplied by the average trip length to produce vehicle miles traveled (VMT). Emissions were calculated from VMT by multiplying by the per-mile emissions factor generated from EPA MOVES. These results were compared to emission estimates generated by the EPA Local Greenhouse Gas Inventory Tool (LGGIT), which was populated by the 2021 Metropolitan Council Travel Behavior Inventory. LGGIT estimates were similar to our calculations, estimating 8.89 $MMtCO_2e$ in 2021.

Waste Sector

Figure 18 – 2021 Greenhouse gas emissions from waste by county



Source: Metropolitan Council analysis of emissions from the waste sector

Summary

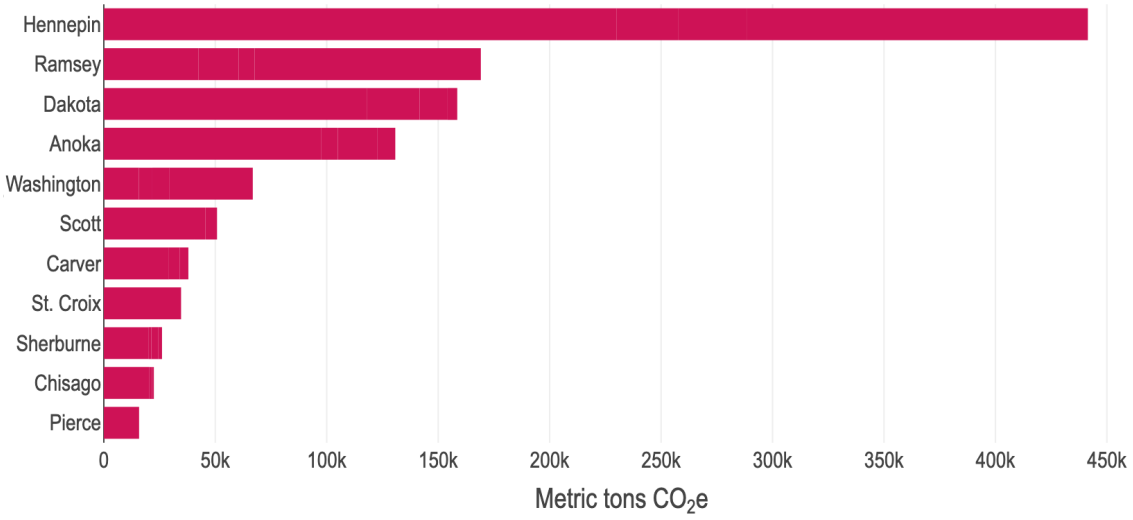
Emissions from waste is the smallest of the three sectors in the Twin Cities MSA. Waste generated 1.49 $MMtCO_2e$ of emissions in the Twin Cities MSA in 2021. Solid waste, including landfills, recycling, and organics, generates the largest share of emissions in the waste sector, with wastewater treatment comprising a smaller share of waste emissions.

Solid waste

Summary

Solid waste generated 1.15 $MMtCO_2e$ of emissions in the Twin Cities MSA in 2021. Of that total, 57.5% of emissions came from landfills, 26.5% from waste-to-energy facilities, and the remaining 16% from organics and recycling.

Figure 16 - 2021 Greenhouse gas emissions from solid waste (estimated) by county



Source: MN Pollution Control Agency and the Wisconsin DNR

Accounting method

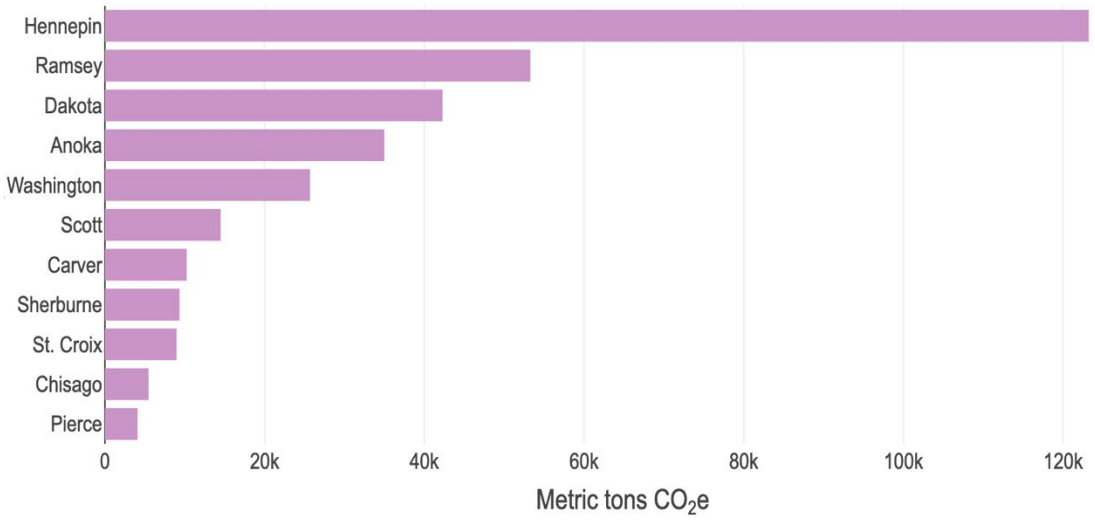
The Minnesota Pollution Control Agency collects an annual inventory of solid waste, recycling, and organics as reported by counties. Emissions estimates for Minnesota were obtained by multiplying these totals by emissions factors specific to waste subsectors. Wisconsin data is derived from a Wisconsin DNR 2018 estimate of solid waste using the EPA State Inventory and Projection tool. The Wisconsin DNR report shows little change from a baseline year of 2005 to 2018, so this was projected forward as an adequate estimate for 2021. The statewide estimate for Wisconsin was apportioned to each Wisconsin county based on their percentage of the statewide population as estimated by the 2021 American Community Survey five-year estimates.

Wastewater

Summary

Wastewater generated 0.33 $MMtCO_2e$ of emissions in the Twin Cities MSA in 2021. These emissions account for direct CH_4 and N_2O emssions from the treatment of municipal wastewater, and not additional indirect anthropogenic emissions such as the electricity needed to operate processing plants.

Figure 20 – 2021 Greenhouse gas emissions from wastewater (estimated) by county



Source: EPA's State Inventory and Projection Tool

Accounting method

Wastewater estimates were generated at the state level for Minnesota and Wisconsin using the EPA State Inventory and Projection tool. Statewide estimates were apportioned to each county based on their percentage of their respective statewide population as estimated by the 2021 American Community Survey five-year estimates.

The Metropolitan Council Environmental Services (MCES) division also tracks estimated emissions from wastewater treatment at MCES-operated wastewater processing plants. Comparisons between these two data sources are incompatible because MCES inventories all scope 1 emissions, such as combustion of fuel in boilers and transport vehicles, and the MCES service area does not encompass the entirety of the seven-county region the Met Council serves.

3 Greenhouse Gas Reduction Measures

This section describes the priority GHG reduction measures as well as quantifiable GHG emission reductions, benefits, and challenges for LIDAC communities, implementing authority, metrics for tracking progress, and funding sources. GHG emission reductions for each measure are dependent on the level and geographic coverage of investment. Accordingly, this document describes the relationship between each measure and emissions reductions, while detailed GHG reduction estimates in metric tons of CO_2e for user-specified investment levels can be found in the Metropolitan Council's GHG Strategy Planning tool.

Building Energy Sector

Decarbonize residential homes

Retrofitting can considerably reduce the energy consumption of single- and multifamily homes. Examples include enhancing insulation, installing energy-efficient windows, upgrading HVAC systems, incorporating smart technologies, promoting electrification, and installing solar panels and heat pumps. Cities can adopt policies or programs encouraging new single-family homes to achieve energy efficiency similar to LEED Gold and other green building standards.

Retrofitting and building new energy-efficient housing can be accelerated by educating residents and providing incentives, designs, and navigation support.

Estimate of quantifiable GHG emissions: On average, retrofitted single-family homes will use 32% less energy compared to homes that have not undergone retrofits.[9] LEED Gold equivalent new homes will use 64% less energy.

LIDAC benefits and challenges: Energy-efficient housing can result in reduced utility costs for low-income families, cleaner indoor and outdoor air, and increased resilience to extreme weather events. Implementation measures should consider how to overcome prohibitive upfront costs associated with retrofitting that are a barrier for low-income households. Additionally, navigator programs paired with community-based partners can help overcome knowledge, access, language, and trust barriers to increase LIDAC participation. Implementation should also incentivize property owners to retrofit because cost-savings benefit renters at the property owner's expense. Affordable housing developers may currently lack the ability to build energy-efficient *and* affordable housing, creating market incompatibilities in the immediate future.

Implementing agencies: Several agencies play a role in implementing this measure, and often in partnership with one another. Agencies include local governments who often directly connect with residents; nonprofit organizations that provide services for households such as home energy audits and connections to programs; utilities that often fund programs and offer rebates; and the state of Minnesota with funding opportunities and in supporting navigation of resources and rebates.

Review of authority to implement: Implementing agencies have existing authority needed to implement this measure, and the above reflects the roles that organizations play today. Different or new roles may also be possible within existing authorities.

[9] Less, B., & Walker, I. (2014). A Meta-Analysis of Single-Family Deep Energy Retrofit Performance in the U.S. (LBNL-6601E). Lawrence Berkeley National Lab. (LBNL), Berkeley, CA (United States). https://doi.org/10.2172/1129577

Geographic location: Metrowide, with an additional focus on LIDACs to reduce co-pollutant emissions and provide co-benefits of reduced energy cost-burden and healthier indoor air quality.

Metrics for tracking progress: Number of homes weatherized, number of homes retrofitted with energy-efficient HVAC systems, number of homes electrified (HVAC, appliances).

Intersection with other funding availability: Complementary funding sources include:

- Minnesota Pre-weatherization Program
- Minnesota Climate Innovation Finance Authority
- Minnesota Department of Commerce Conservation Improvement Program
- MPCA Project Stove Swap
- MHFA Impact Fund
- MHFA Rehab Loan Program
- MHFA Home Improvement Fix Up Fund
- MHFA Consolidated Request for Proposals
- MHFA Rental Rehabilitation Deferred Loan
- MHFA Community Stabilization Program
- Rebate programs from energy utilities
- Complementing federal funding, including:
    - DOE Buildings Upgrade Prize
    - EPA Environmental Justice Collaborative Problem Solving Grant
    - EPA Solar for All
    - IRA rebates and credits for home energy upgrades
    - Federal Weatherization Assistance Program

Decarbonize commercial and public buildings

Retrofitting can considerably reduce the energy consumption of commercial buildings. Examples include enhancing insulation, upgrading heating and cooling systems, replacing outdated lighting systems with energy-efficient alternatives, electrification, and expansion and improvement of district heating and cooling. Once facilities are retrofitted, it is critical that technicians have the skills to operate and maintain technologies correctly and efficiently. This ensures that new equipment will operate as intended for its expected lifetime.

Estimate of quantifiable GHG emissions: Energy savings for retrofitted commercial buildings can vary; however, a recent meta-analysis of 4,765 whole building retrofit projects found that over one-fifth of the projects reported energy savings of 20% or more.[10]

LIDAC benefits and challenges: Reduced utility costs can benefit small and BIPOC-owned businesses, but this requires prioritization of these businesses. Property owners may require incentivization where business owners lease space and pay utilities.

Implementing agencies: Like residential decarbonization, many of the same agencies play a role in implementing this measure, and often in partnership with one another. Agencies include local governments, nonprofit organizations, utilities that often fund programs and offer rebates, and the state of Minnesota with funding opportunities and in supporting navigation of resources

[10] Regnier, C., Mathew, P., Robinson, A., Shackelford, J., & Walter, T. (2020). Systems Retrofit Trends in Commercial Buildings: Opening Up Opportunities for Deeper Savings. Lawrence Berkeley National Laboratory.

and rebates. Many local governments in the metro have already initiated work to decarbonize their publicly owned buildings through a variety of methods, such as energy-efficiency improvements, solar installations, and purchasing renewable energy. This work can be built upon to inspire others and to decarbonize all public buildings.

Review of authority to implement: Implementing agencies have existing authority needed to implement the measure, and the above reflects the roles that organizations play today. Different or new roles may also be possible within existing authorities.

Geographic location: Metrowide, with an additional focus on small and BIPOC-owned businesses.

Metrics for tracking progress: Number of public buildings weatherized, number of public buildings retrofitted with energy-efficient HVAC systems, number of public buildings retrofitted with LEDs, square footage of commercial/industrial space decarbonized, estimated British Thermal Units conserved.

Intersection with other funding availability: Complementary funding sources include:

- Minnesota Climate Innovation Finance Authority
- Minnesota Department of Commerce school building controls grants
- Minnesota Department of Commerce Conservation Improvement Program
- Utility rebates
- Proposed Xcel Energy Community Ground Source Heat Pump demonstration project
- Jobs and business development programs
- Complementing federal funding including:
  - IRA 179D Commercial Building Energy-Efficiency Tax Deduction
  - USDA Small Community Facilities Grant
  - USDA Rural Development Funds

Transportation Sector

Increase public transportation options

Replacing single-occupancy vehicle travel with transit trips reduces overall vehicle miles traveled (VMT), decreasing air pollution and greenhouse gas emissions.

Estimate of quantifiable GHG emissions: Based on observed trends from Metro Transit and service elasticities from the literature, we assume that a 1% increase in public transit service has a long-term impact of 0.9% increase in transit ridership.[11]

LIDAC benefits and challenges: Increased access to public transit reduces cost of travel and benefits those unable to drive for physical or financial reasons.

Implementing agencies: Implementing agencies include Metro Transit and suburban transit providers. These agencies provide both bus and light rail service. The region's transit providers are also expanding beyond typical fixed-route bus service to more on-demand services.

[11] Litman, T. (2021). Understanding Transport Demands and Elasticities: How Prices and Other Factors Affect Travel Behavior (pp. 1–78). Victoria Transport Policy Institute. http://www.vtpi.org/elasticities.pdf

Review of authority to implement: Existing transit providers have the authority needed to implement this measure.

Geographic location: The focus for this measure is primarily in the urbanized extent of the region, with commuter routes connecting from park-and-rides to employment centers.

Metrics for tracking progress: Total ridership, the proportion of miles traveled from transit ridership, and ridership by service type (for example, light rail transit, arterial bus rapid transit, local routes, express routes, etc.)

Intersection with other funding availability: Complementary funding sources include:

- FTA RAISE program
- FTA
- Regional Solicitation
- Metro Area Transportation Sales and Use Tax

Accelerate transition to low- and no-carbon fuels in vehicles and equipment

Ways to accomplish this include:

- Electrify light-duty public fleet vehicles and equipment, such as sedans, light-duty trucks, maintenance vehicles, and outdoor recreation-related vehicles.
- Replace vehicles with lower-carbon alternatives where possible, such as e-bikes and e-cargo bikes with or without trailers.
- Install supporting charging infrastructure.
- Provide planning, contracting, financial, and technical assistance to facilitate this transition.

It is also necessary to transition fossil-fueled medium-duty, heavy-duty, and off-road vehicles and engines to low- and no-carbon-fueled alternatives. Vehicles and equipment include: transit and school buses, heavy-duty and medium-duty trucks, terminal tractors, construction equipment, agricultural equipment, short haul locomotives, and ground and maritime freight equipment. Low- and no-carbon fuels include electricity and green hydrogen.

Local governments can incentivize the transition to private passenger battery-electric vehicles (BEVs) by supporting electric vehicle infrastructure like charging stations, encouraging charging through local zoning changes, and sharing up-to-date and trusted information for potential BEV owners. Local governments can also support shared mobility programs, like the Evie Carshare program in Saint Paul and Minneapolis, a municipally owned fleet operated in partnership with a local nonprofit. Incentives should improve equitable access to electric vehicle charging infrastructure by installing charging stations in rural areas and at multifamily housing sites, providing public chargers, and assisting low- and moderate-income households to charge vehicles at home.

Estimate of quantifiable GHG emissions: The Minnesota Statewide Multimodal Transportation Plan lays out goals of reducing transportation sector emissions 50% by 2030 and 80% by 2040, relative to 2005 baseline emissions.[12] This includes increasing the number of

[12] Minnesota GO: 2022 Final SMTP Plan. Retrieved February 27, 2024, from https://minnesotago.org/final-plans/smtp-final-plan-2022

zero emission vehicles registered by 20% in 2030 and 65% in 2040. This leads to a cumulative emission reduction estimate of 76.7 MMT CO2e by 2050 in Minnesota.

LIDAC benefits and challenges: BEV uptake decreases the per-mileage cost of driving and benefits public health by limiting pollutants. LIDACs experience barriers to BEV uptake due to high upfront costs and low access to charging options (for example, street parking). LIDACs are often located near high traffic transportation corridors with higher levels of air and noise pollution and higher temperature levels (urban heat island). LIDACs are also more likely to have higher rates of carless households and lower access to living wage jobs, goods, services, and green space.[13]

Co-benefits include improved air quality through reductions in localized transportation-related air pollution. Carshare programs can help to overcome BEV uptake.

Implementing agencies: Several state agencies play a role, including but not limited to the departments of transportation, pollution control, and administration. In addition, cities, counties, tribal nations, and port authorities play an important role in strategies such as providing public charging options, planning, regulation, education, internal fleets, and shared mobility.

Review of authority to implement: Implementing agencies have existing authority needed to implement the measure.

Geographic location: Metrowide, with additional focus on vehicles and equipment that operate in LIDACs, especially where air pollutants are high. Additional focus on electrifying vehicles for rural households, as these households often drive the longest distances.

Metrics for tracking progress: Number of registered electric vehicles (by weight class, public and private), the proportion of BEV miles traveled, carbon intensity of transportation fuels, greenhouse gas emissions from transportation, and air quality.

Intersection with other funding availability: Complementary funding sources include:

- Diesel Emissions Reduction Act
- Federal Highway Administration Congestion Mitigation and Air Quality Improvement Program
- Inflation Reduction Act Clean Ports
- Federal Highway Administration Charging and Fueling Infrastructure Discretionary Grant
- Federal Highway Administration National Electric Vehicle Infrastructure Program
- Inflation Reduction Act Alternative Fuel Vehicle Refueling Property Credit Direct Pay
- Minnesota Electric Vehicle Rebate Program
- Volkswagen settlement grants – available in Minnesota to fund vehicle replacements and invest in electric vehicle charging stations

[13] Fleming, K. L. (2018). Social equity considerations in the new age of transportation: Electric, automated, and shared mobility. *Journal of Science Policy & Governance*, *13*(1), 20.

Encourage reduction of reduced vehicle miles traveled

Many options exist to encourage voluntary reduction of vehicle miles traveled (VMT). These include:

- Increase parking fees. Increased parking charges can drive down passenger VMT by disincentivizing single-occupancy vehicle trips.
- Encouraging carpooling. Increasing the average number of people in cars can help reduce vehicle miles traveled and encourage more efficient trip planning. This can be done through programs that support ridesharing and carpooling, such as Dynamic Ride Sharing.
- Promote teleworking, which reduces VMT from daily commuting
- Enhance the availability and adoption of clean travel options such as bicycling, walking, transit. Examples include:
    - Deploying community-designed quick-build projects such as curb extensions to reduce street crossing distance or paths physically separated from vehicle traffic.
    - Facilitate adoption of e-bikes and e-cargo bikes through purchase incentives, bike-share programs, e-bike infrastructure (such as solar-powered shelters and separated paths) and charging networks. Increase adoption in LIDACs through navigator programs and strategic placement of bikeshare sites, such as at multifamily residences.
    - Facilitate equitable access to transit and electric vehicle car-share programs.

Estimate of quantifiable GHG emissions: A 10% increase in the price of parking corresponds to a 7% decrease in passenger VMT by 2040.[14]

We assume carpool trips combine previously separate personal vehicle trips and do not generate additional trips or shift trips from public transit.

We estimate a 2.75% decrease in personal vehicle miles traveled for every 10% increase in percent of people teleworking.[15]

LIDAC benefits and challenges: LIDACs have a higher percentage of zero-car and transit-dependent households, leading to a high transportation cost burden that causes financial insecurity, housing instability, and stress. Improving walkability and access to alternative transit options (e-bikes, car-sharing) can reduce these burdens while simultaneously reducing pollutants.

Telework jobs offers flexibility regarding childcare, healthcare, and other daily household needs, but these jobs may be less accessible in LIDACs and require reliable internet access and workspace in the home.

Implementing agencies: A wide variety of agencies support implementation of this strategy, including cities and counties through land use planning and street design as well as through supporting other programs; the Met Council; employers; MnDOT; and transit agencies.

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[14] Litman, T. (2021). Understanding Transport Demands and Elasticities: How Prices and Other Factors Affect Travel Behavior (pp. 1–78). Victoria Transport Policy Institute. http://www.vtpi.org/elasticities.pdf

[15] Kim, S. N., Choo, S., & Mokhtarian, P. L. (2015). Home-based telecommuting and intra-household interactions in work and non-work travel: A seemingly unrelated censored regression approach. *Transportation Research Part A: Policy and Practice*, *80*, 197-214.

Review of authority to implement: Implementing agencies have the authority needed to implement this measure.

Geographic location. Metrowide, with focus on LIDACs to reduce co-pollutant emissions and provide greater access to walkable communities, e-bike programs, and EV car sharing.

Metrics for tracking progress: Vehicle miles traveled per capita.

Intersection with other funding availability: Complementary funding sources include:

- Federal Highway Administration Congestion Mitigation and Air Quality Improvement Program
- New 2023 regional sales tax for active transportation
- Each road authority in the region invests in active transportation including the state, counties and cities.

Land Use Sector

Increase population density

Implementing smart growth principles and transit-oriented development can lead to more compact, walkable, and transit-friendly communities, reducing the need for personal vehicle use and associated greenhouse gas emissions. To be most effective, this measure emphasizes development of mixed-use communities, where people can access important daily destinations (for example, grocery stores, employment) without needing a car and have access to green spaces. Rezoning to implement local comprehensive plans (which already generally plan for higher densities around stations areas, for example) and removing other hurdles like minimum parking requirements can facilitate and encourage increased multifamily housing construction. This results in consuming less land, alleviating traffic congestion, and decreasing greenhouse gas emissions relative to single-family homes.

Estimate of quantifiable GHG emissions: A 10% increase in population density is correlated with a 4% decrease in passenger vehicle miles traveled. Population density is measured as population per developed land area. This adjustment can allow for no more than a 25% reduction in vehicle miles traveled.[16]

LIDAC benefits and challenges: Increased density reduces reliance on personal vehicles and increases access to household needs (for example, groceries), especially when implemented with a mix of uses. Increased housing stock from multifamily home construction can reduce rent/mortgage costs. However, infill and redevelopment can displace LIDACs, especially when multifamily housing is not specifically developed as affordable housing.

Implementing agencies: Cities are the primary implementing agencies for this measure as they are the land use regulating authority for the urbanized extent of the region. While counties and townships also have land use authorities, the geographic area they cover is primarily rural. As the regional planning agency, the Met Council sets community-wide and station area residential density expectations for the seven-county portion of the MSA. The Met Council also provides technical assistance to local governments to support the implementation of this measure.

[16] Ewing, R., & Cervero, R. (2010). Travel and the Built Environment: A Meta-Analysis. Journal of the American Planning Association, 76(3), 265–294. https://doi.org/10.1080/01944361003766766

Review of authority to implement: Implementing agencies have the authority needed to implement this measure.

Geographic location. The focus of this measure is to increase population density where urban services already exist or are planned for the near future, with focus on LIDACs to reduce co-pollutant emissions and provide greater access to walkable communities, e-bike programs, and EV car sharing. Some parts of the region may need to focus on providing for a greater mix of uses where residential uses currently dominate, while other portions of the region may focus more on intensifying existing uses.

Metrics for tracking progress: Population per developed area, planned mix of uses by community type, planned residential density by community type.

Intersection with other funding availability: This measure can be implemented without additional funding as it is a regular course of municipal business. However, the Met Council incentivizes increased residential density through its Livable Communities Act grant programs.

- The Livable Communities Demonstration Account (LCDA) supports development and redevelopment projects that link housing, jobs, and services and use community and regional infrastructure efficiently.
- The LCDA Transit Oriented Development program focuses on high-density projects that contribute to a mix of uses in defined station areas along light rail, commuter rail, bus rapid transit, and high-frequency bus corridors.
- The LCA programs also support additional planning and outreach efforts through its Pre-Development grant program.
- In addition, the Met Council's LCA Policy Development program supports the development and adoption of local policies that advance the LCA program goals and plans and policies of the regional development guide, *Thrive MSP 2040*.

Increase employment density

Increasing employment density decreases travel distances and encourages transit, cycling, and walking, reducing greenhouse gas emissions from personal vehicle use.

Estimate of quantifiable GHG emissions: A 10% increase in employment density is correlated with a 7% decrease in passenger vehicle miles traveled. Employment density is calculated as the amount of jobs per developed area.[17]

LIDAC benefits and challenges: Increased accessibility to jobs and improved air quality near LIDACs.

Implementing agencies: Cities are the primary implementing agencies for this measure as they are the land use regulating authority for the urbanized extent of the region. While counties and townships also have land use authorities, the geographic areas they cover are primarily rural. As the regional planning agency, the Met Council sets targets for station area activity activity includes the number of jobs for the seven-county portion of the MSA. The Met Council also provides technical assistance to local governments to support the implementation of this measure.

[17] Stevens, M. R. (2017). Does Compact Development Make People Drive Less? Journal of the American Planning Association, 83(1), 7–18. https://doi.org/10.1080/01944363.2016.1240044

Review of authority to implement: Implementing agencies have the authority needed to implement this measure.

Geographic location. The focus of this measure is to increase employment density where urban services already exist or are planned for in the near future, with focus on LIDACs and proximity to LIDACs to reduce co-pollutant emissions and provide greater access to walkable communities and proximity to jobs. Some parts of the region may need to focus on providing for a greater mix of uses where residential uses currently dominate, while other portions of the region may focus more on intensifying existing uses.

Metrics for tracking progress: Jobs per developed area, jobs located in employment centers.

Intersection with other funding availability: This measure can be implemented without additional funding as it is a regular course of municipal business. However, the Met Council incentivizes increased employment density through its Livable Communities Act (LCA) grant programs (see funding availability in 3.3.1). In addition, the LCA has a Tax Base Revitalization Account, one of the goals of which is job retention and creation. The account supports the clean-up of polluted land, largely in the fully developed portions of the region, for redevelopment.

Conservation and carbon stock sector

Invest in climate-smart agriculture

Climate-smart agriculture practices improve soil health, increase nutrient-use efficiency, reduce nitrous oxide emissions, and reduce nitrogen runoff and methane production from livestock and manure management. Examples include cover crops, conservation tillage, forest farming, prescribed grazing, silvipasture, perennial crops, and winter annual crops. These measures can be supported through market development, specialized equipment needs, and other infrastructure adoption of climate-smart practices.

Estimate of quantifiable GHG emissions: Soil organic carbon content can increase from 1% up to 1.54% under conservation tillage.[18] No-till agriculture can reduce tractor fuel consumption by 3.2 gallons/acre.[19]

LIDAC benefits and challenges: Prioritizing historically underserved farmers supports economic development and mental health. Introduction of climate-smart farming best practices builds resilience and offers economic benefits to rural communities. Potentially high starting costs of climate-smart agriculture needs to be taken into account in low-income rural areas.

Implementing agencies: This measure can be implemented by state agencies including the Minnesota Department of Agriculture (MDA), the Minnesota Pollution Control Agency, the Board of Water and Soil Resources, (BWSR), and the Minnesota Department of Employment and Economic Development (DEED). Local governments, including soil and water conservation

[18] Zomer, R. J., Bossio, D. A., Sommer, R., & Verchot, L. V. (2017). Global Sequestration Potential of Increased Organic Carbon in Cropland Soils. Scientific Reports, 7(1), Article 1. https://doi.org/10.1038/s41598-017-15794-8

[19] Creech, E. (2017). Saving Money, Time and Soil: The Economics of No-Till Farming | USDA. Retrieved February 26, 2024, from https://www.usda.gov/media/blog/2017/11/30/saving-money-time-and-soil-economics-no-till-farming

districts, also play a role, in addition to tribal nations, and the University of Minnesota Extension Service.

Review of authority to implement: Implementing agencies have the authority needed to implement this measure.

Geographic location: Metrowide with a focus on the agricultural extent of the region, areas of concentrated livestock operations with high nitrate levels in the groundwater, known aquifer depleted areas, and facilities that contribute to high nitrate levels.

Metrics for tracking progress: Acreage converted to climate-smart practices.

Intersection with other funding availability: Complementary funding sources include:

- BWSR Soil Health Cost-Share Program
- MDA Continuous Living Cover Grant
- MDA Minnesota Agricultural Water Quality Certificate Program
- MDA AGRI Livestock Investment Grant
- MDA Down Payment Assistance Grant
- MDA Emerging Farmer Technical Assistance Grant
- Minnesota Clean Water, Land and Legacy Amendment Funds
- Federal funds including:
    - USDA NRCS Regional Conservation Partnership Program funds
    - USDA Environmental Quality Incentives Program (EQIP)
    - USDA Conservation Reserve Program
    - Inflation Reduction Act Investment Tax Credits and Production Tax Credits
    - Other federal conservation and stewardship programs

Invest in emerging localized and urban agricultural practices

Build local food systems by providing resources and workforce development for urban and community gardens, rooftop gardens, year-round indoor greenhouses, food waste composting, food makers, and farmers markets; expanding the Local Food Purchase Assistance Program; and providing financial and technical assistance to local food producers. Develop markets for long-lived wood products that store carbon and incentivize beneficial uses for waste wood such as millwork, mulch, and biochar.

Estimate of quantifiable GHG emissions: Amending urban soils with compost and biochar can double soil organic matter, from 3.5% to 7.1% and effectively sequester carbon. Similarly, these amendments can double nitrogen content in urban soil, from 0.14% to 0.31% and reduce N_2O venting to the atmosphere. These effects were strongest in reclamation sites.[20]

LIDAC benefits and challenges: Increased local investment in food production can improve affordability, availability, access, quality, stability, cultural acceptability, and healthfulness of the food environments in LIDACs. Community-based agriculture has co-benefits of engaged and cohesive communities, reduced ethnocentrism, multicultural integration, increased civic engagement, self-determination, strengthened cultural identity, improved mental health,

[20] Malone, Z., Berhe, A. A., & Ryals, R. (2023). Impacts of organic matter amendments on urban soil carbon and soil quality: A meta-analysis. Journal of Cleaner Production, 419, 138148. https://doi.org/10.1016/j.jclepro.2023.138148

decreased stress, increased physical activity, healthy nutrition knowledge, improved community safety, and increased access to greenspace.

Implementing agencies: A variety of agencies play a role, including state agencies such as the Department of Natural Resources (DNR) and Minnesota Pollution Control Agency (MPCA), tribal nations, and local governments. Agencies may offer workforce development, market development, and grants or other incentives, in addition to permitting specific uses (land use, farmers markets). Several nonprofits in the region also support localized and urban agricultural practices.

Review of authority to implement: Implementing agencies have the authority needed to implement this measure.

Geographic location: Metrowide with a focus on LIDACs, particularly in areas with food deserts.

Metrics for tracking progress: Participation rates from LIDACs in local farmer markets, tonnage of locally produced food accessible in LIDACs, acreage of community gardens and rooftop greenhouses.

Intersection with other funding availability: Complementary funding sources include:

- The Good Acre's Local Emergency Assistance Farmer Fund (LEAFF)
- MDA Local Food Purchase Assistance Program
- Minnesota Forestry Association Call Before You Cut Program
- State funding for woodland owners
- Some municipalities offer local funding for building financing and cost-share
- Complementary federal funds include:
    - USDA Environmental Quality Incentives Program (EQIP)
    - USDA Conservation Stewardship Program
    - Federal funding for woodland owners

Invest in urban tree planting and maintenance

Trees act as natural carbon sinks by absorbing carbon dioxide (CO_2) from the atmosphere and storing it in their biomass (trunks, branches, leaves, and roots). Increased tree planting can also provide additional benefits, such as reducing urban heat island effects, improving air quality, promoting biodiversity, and enhancing aesthetic appeal.

Estimate of quantifiable GHG emissions: A mature urban forest can hold up to 115 metric ton of carbon per hectare, and a tree that grows for one year can sequester carbon annually at a rate of 1.27 metric tonnes of carbon per hectare per year.[21]

LIDAC benefits and challenges: Due to racial residential segregation through explicit codification in laws and institutional practices, and historic disinvestment in segregated areas, LIDACs in the metro have lower access to greenspace, and less tree coverage.[22] Urban trees can reduce the urban heat island effect, increase natural cooling, improve air quality and

[21] Milnar, M., & Ramaswami, A. (2020). Impact of Urban Expansion and In Situ Greenery on Community-Wide Carbon Emissions: Method Development and Insights from 11 US Cities. Environmental Science & Technology, 54(24), 16086–16096. https://doi.org/10.1021/acs.est.0c02723
[22] Growing Shade, Metropolitan Council, 2023. Growing Shade Tool

aesthetics, help manage stormwater runoff, increase property value, and improve mental health. LIDAC communities in the MSA have decreased tree cover relative to non-LIDACs.

Green gentrification can be a challenge to LIDAC communities; GHG reduction projects that engage LIDACs in the planning and implementation can facilitate self-determination and career-building opportunities.

Implementing agencies: Cities, counties, townships, and tribal nations all play a role in managing the tree canopy in public spaces and along transportation corridors. Local governments can also support private property canopy programs to increase tree canopy across their jurisdictions. Nonprofit organizations, such as the Tree Trust and the Nature Conservancy, can support local government efforts to increase and manage tree canopy. State agencies including but not limited to DNR, BWSR, MDA, MPCA, and MnDOT also play a role in supporting the metro's tree canopy.

Review of authority to implement: Implementing agencies have the authority needed to implement this measure.

Geographic location: Metrowide with a focus on public lands and in LIDAC areas with limited canopy (Equity Priority areas in the Growing Shade Tool).

Metrics for tracking progress: Percent canopy coverage by community, percent canopy coverage increased in LIDACs, number of trees planted in LIDACs.

Intersection with other funding availability: Complementary funding sources include:

- MPCA ReLeaf Community Forestry Grants Program
- Local urban forestry shade tree replacement

Restore and protect natural land

Grasslands, forests, and wetlands are effective natural carbon sequestration and storage options and offer a multitude of co-benefits. The co-benefits include protecting biodiversity, water quality improvement, flood mitigation, public recreation, and aesthetics. Restoration can happen on a variety of lands, ranging from large-scale abandoned agricultural areas to small-scale areas like converting urban lawns to pollinator habitats.

Estimate of quantifiable GHG emissions: The net carbon sequestration potential of restoring natural systems varies depending on the prior land use. For example, conversion of cultivated land to grassland systems is estimated to sequester 0.87 metric tons of carbon per hectare per year.[23] Freshwater wetlands can store up to 478 metrics tons of carbon per hectare, making them among the most efficient carbon storage natural systems on a per area basis.[24]

LIDAC benefits and challenges: Due to racial residential segregation through explicit codification in laws and institutional practices, and historic disinvestment in segregated areas,

[23] Conant, R. T., Cerri, C. E., Osborne, B. B., & Paustian, K. (2017). Grassland management impacts on soil carbon stocks: a new synthesis. *Ecological Applications*, *27*(2), 662-668.
[24] Nahlik, A. M., & Fennessy, M. S. (2016). Carbon storage in US wetlands. Nature Communications, 7(1), 1-9.

LIDACs in the metro have lower access to greenspace.[25] Increasing access to greenspace in LIDACs can have wide-ranging benefits including reducing stress, improving mental health, reducing asthma rates, reducing extreme heat exposure, and improving social cohesion. Green gentrification can be a challenge to LIDAC communities; GHG reduction projects that engage LIDACs in the planning and implementation can facilitate self-determination and career-building opportunities.

GHG reduction projects that partner with tribal nations and restore species, habitats, and areas that are culturally significant to Indigenous traditions can have a wide range of benefits including improved cultural cohesion, improved financial security, and improved mental and physical health through preservation of subsistence harvesting traditions, spiritual relationships, ceremonies, language, and stories.

Implementing agencies: Like tree canopy, cities, townships, and counties all play a role in conserving and restoring natural areas in their communities. Other agencies that support this measure include but are not limited to BWSR, watershed districts, conservation districts, DNR, PCA, MDA, and MPCA. Nonprofit conservation partners also play an important role across the spectrum of land acquisition, management, and educational programs.

Review of authority to implement: Implementing agencies have the authority needed to implement this measure.

Geographic location: Metrowide, with a focus on areas with limited natural areas, where restoration opportunities arise such as along rivers and streams, and within transportation corridors, particularly those within or near LIDACs.

Metrics for tracking progress: Acres protected, acres restored, total acres of protected natural lands.

Intersection with other funding availability: Complementary funding sources include:

- BWSR Lawns to Legumes
- State funding for Habitat Friendly Utilities program
- Statewide Health Improvement Partnership (SHIP) initiatives
- Complementing federal funding from the U.S. Department of Agriculture

Waste Sector

Promote waste prevention, waste reduction, and recycling

Reduce greenhouse gas emissions by preventing waste, effectively managing solid waste, increasing opportunities for reuse and recycling, diverting and managing organics, promoting alternative packaging methods, fixing landfill methane leaks, promoting zero waste practices, a circular economy, and climate-smart development. Promote biochar for environmental and economic benefits including landfill methane mitigation and soil contamination remediation.

[25] Borunda, A. (2020). Racist housing policies have created some oppressively hot neighborhoods. National Geographic. Retrieved from https://www.nationalgeographic.com/science/article/racist-housing-policies-created-some-oppressively-hot-neighborhoods

For the seven-county metro region, the MPCA leads the development and implementation of the Metropolitan Solid Waste Management Policy Plan. The most recent plan for the 2022-2042 timeframe was released in January of 2024 and includes the following related goals:[26]

- Reduce waste production in the metro area by 15% compared to current projections.
- Establish curbside organics collection in all cities with a population greater than 5,000 by 2030.
- Each of the seven counties in the metro area must recycle a minimum of 75% (by weight) of total municipal solid waste they generate by 2030.

Estimate of quantifiable GHG emissions: The above MPCA waste reduction plan estimates a cumulative 7.02 $MMTCO_2e$ reduced by 2030 and 35.08 $MMTCO_2e$ reduced by 35.08 from the seven-county metro region.[27]

LIDAC benefits and challenges: LIDACs may be disproportionately at risk of waste mismanagement. Studies have shown that landfills are linked to significant forms of environmental harm, such as groundwater contamination, production of greenhouse gases, and leaching and accumulation of toxic compounds in humans and ecosystems. Landfills across the region are often located in or near LIDACs.

Potential co-benefits of expanded organics management, such as composting and anaerobic digesters, help to reduce waste streams sent to landfills or incinerators, reduce fossil fuel use, and decrease waste collection fees.

Implementing agencies: MPCA, counties that are responsible for waste planning and management, cities, tribal nations, and commercial and industrial businesses. Other state agencies include, but are not limited to, MDA, MDH, SHIP, and DEED.

Review of authority to implement: Implementing agencies have the authority needed to implement this measure.

Geographic location: Metrowide with a focus on LIDACs.

Metrics for tracking progress: Reduced waste production, percent of total MSW recycled, total households served by organic curbside collection.

Intersection with other funding availability: Complementary funding sources include:

- MPCA Prevention of Wasted Food Grants
- SCORE funds
- SHIP funds

Manage wastewater efficiently

Improper wastewater management emits CH_4 and N_2O and can pollute waterways, while emerging technology can mitigate its environmental harm and recapture clean water, nutrients, and energy. The Met Council serves most of the urbanized extent of the region, providing

[26] Minnesota Pollution Control Agency. 2024. Metropolitan Solid Waste Management Policy Plan, 2022-2042. Retrieved from: https://www.pca.state.mn.us/sites/default/files/w-sw7-22.pdf
[27] Food Waste Solutions—Reduce Food Waste, Food Recycling & Recovery. Retrieved February 27, 2024, from https://refed.org/

wastewater services to 111 communities, home to more than 2.8 million of the region's 3.4 million people. By pursuing energy efficiency and electrification opportunities, increasing our purchase and generation of renewable energy, and maximizing energy and resource recovery from our operations, the Met Council has been working to reduce emissions in our operations across our nine wastewater treatment plants. Several other smaller plants serve the remainder of primarily smaller cities in the region like St. Francis and Jordan.

In addition to emissions from wastewater treatment, there is an opportunity to recover wasted thermal energy from wastewater to produce clean, carbon-free thermal energy for integration into existing hot water district energy heating systems, further reducing reliance on fossil fuels.

Estimate of quantifiable GHG emissions: Wastewater treatment plants can feasibly reach 100% energy independence through thermal recapture, depending on methods deployed and the chemical contents of the treated wastewater.[28]

LIDAC benefits and challenges: The largest wastewater treatment facility is located in a LIDAC in Saint Paul. Offsetting natural gas use within LIDAC communities results in reduced emissions, reduced energy costs, reduced particulate matter associated with existing energy sources, and a reduced heat island effect due to less industrial heat/emissions dissipated into the environment/surrounding communities.

Implementing agencies: Metropolitan Council Environmental Services and municipal and wastewater operators can continue to implement improvements to reduce operational emissions. Additional partners include district energy operators to capture thermal energy.

Review of authority to implement: Implementing agencies have the authority needed to implement this measure. Permitting and approvals may be required for specific project implementation. Draft legislation is being discussed for the 2024 session to clarify state statutes and remove hurdles to recovering waste heat from wastewater treatment plants.

Geographic location: The urbanized extent of the metro area, primarily in cities. Thermal energy recovery for district energy systems should be focused in LIDAC communities where co-benefits of improved air quality and reduced urban heat island can be realized.

Metrics for tracking progress: Greenhouse gas emissions, renewable energy produced or purchased.

Intersection with other funding availability: Complementary funding sources include utility conservation improvement programs.

[28] Wang, H., Yang, Y., Keller, A. A., Li, X., Feng, S., Dong, Y., & Li, F. (2016). Comparative analysis of energy intensity and carbon emissions in wastewater treatment in USA, Germany, China and South Africa. Applied Energy, 184, 873–881. https://doi.org/10.1016/j.apenergy.2016.07.061

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