# Montana Climate Pollution Reduction Priorities

*Supporting healthy communities through innovative Montana-made solutions*

March 2024

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# INTRODUCTION

This document is intended to meet the needs of the U.S. Environmental Protection Agency's (EPA) Climate Pollution Reduction Grant (CPRG) program. The CPRG program is an opportunity for Montana businesses and communities to access over $4 billion in federal funding for Montana-made projects. It is an opportunity to help Montanans tackle real needs that limited state resources may not fully address.

Montanans experience a changing climate through record-setting summer heat, longer wildfire seasons, changing snowpack, more frequent drought in some areas and historic flooding in others. The CPRG program is an opportunity to support Montana-made solutions to the changing climate.

The CPRG program is a two-phase federal grant program that allows the state to develop and implement community-driven projects that reduce ambient air pollution while supporting the creation of quality jobs and lowering energy costs for Montanans.

- **Phase I** provided $250 million for noncompetitive planning grants, of which states were eligible for $3 million each to support the development of a climate action plan.

- **Phase II** includes $4.6 billion in competitive implementation grants to execute the projects identified in the climate action plan.

In August 2023, the State of Montana received a four-year $3 million planning grant under the CPRG program. Governor Gianforte designated the Department of Environmental Quality (DEQ) as the lead agency to receive the grant and facilitate a broad planning process.

## COORDINATION AND OUTREACH

Since August, DEQ has engaged a wide range of interested parties from across Montana to identify emission reduction measures that will cut pollution and improve the lives of Montanans. From the start, DEQ established an expectation that the measures included in Montana's plan would be non-regulatory, incentive-based actions that focus on innovation and do not expand government.

As lead agency, DEQ conducted extensive intergovernmental coordination and outreach in the development of this PCAP. DEQ engaged the following state agencies, to varying degrees, in discussions about this plan:

- Department of Natural Resources and Conservation
- Fish, Wildlife & Parks
- Department of Commerce
- Department of Agriculture
- Department of Transportation

- Department of Public Health and Human Services
- Department of Labor & Industry
- Disaster & Emergency Services
- Governor's Office of Indian Affairs

DEQ also solicited input from a broad range of stakeholders representing the organizations, groups, and individuals who may be impacted by implementation of this plan. While DEQ actively identified potential interested parties, the list of stakeholders expanded as groups and individuals became aware of the program and contacted DEQ to be involved in the planning process. Stakeholders included:

- Economic development organizations
- Environmental advocates
- Utilities
- Local elected officials
- Universities
- Community-based organizations
- Other interested organizations; and
- Montana residents.

DEQ actively engaged with our regional and national organization partners, including the Conveners Network, in order to hear and learn from other states as we worked through the planning process.

DEQ used multiple outreach channels—including a new CPRG webpage, email distribution lists, in-person and virtual public meetings, DEQ's existing public notice web pages, online surveys, press releases, and social media—to share information about the planning process. DEQ prioritized information sharing and transparency throughout the PCAP development process and will continue to develop and maintain stakeholder engagement strategies.

DEQ solicited public input on potential emission reduction priorities from late-October through early-January and received more than 350 individual submittals from individuals, organizations, and businesses across the state. In collaboration with other state agencies and the Governor's office, DEQ then reviewed and prioritized project proposals, focusing on projects that will cut harmful pollution, catalyze innovation, reduce energy cost burdens, and provide real benefits to our communities without any new red tape.

## THE MONTANA POLLUTION REDUCTION PLAN

As lead agency, DEQ is responsible for developing the grant deliverables for the State of Montana under the CPRG program, including a Priority Climate Action Plan (PCAP). This "Montana Pollution Reduction Plan" represents the state's PCAP. This plan differs from past climate planning because it is directly tied to federal funding made available to implement the projects states identify. This is an opportunity for Montana-made, market-driven solutions focused on innovation that will also reduce emissions.

This plan includes strategies to reduce emissions and support thriving Montana communities through innovation, not regulation. DEQ produced this plan to support investment in practices and technologies that reduce air pollution, create high-quality jobs, spur economic growth, and enhance the quality of life for all Montanans. Nothing in this plan is intended to be implemented through new policies, regulations, or requirements, and projects that propose to use regulation to cut emissions are not covered by this plan.

This document is organized into the following sections:

1. Montana's Greenhouse Gas Emission Inventory
2. Priority Emission Reduction Measures
3. Low-Income & Disadvantaged Community (LIDAC) Benefits Analysis
4. Conclusion & Next Steps
5. Appendices

## FUNDING ACKNOWLEDGEMENT

The development of Montana's PCAP has been funded wholly or in part by the United States Environmental Protection Agency (EPA) under assistance agreement 00105500 to the state of Montana. 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.

# GREENHOUSE GAS INVENTORY

The Montana Greenhouse Gas (GHG) inventory was prepared by the DEQ using EPA's State Inventory Tool (SIT). For the purposes of this plan, the simplified inventory is based on existing data, much of which uses estimates for sectors that do not currently track or report GHG emissions. The inventory provides information about GHG emissions resulting from major economic sectors in the state, using 2019 as the base year.

**Table 1. Summary of GHG Emissions by Sector in Montana, 2019[1]**

| **Sector** | **2019 Emissions (MMT CO2e)** |
|---|---:|
| Energy | 32.12 |
| $CO_2$ from Fossil Fuel Combustion | 29.41 |
| - *Residential* | *1.96* |
| - *Commercial* | *1.74* |
| - *Industrial* | *5.42* |
| - *Transportation* | *7.85* |
| - *Electric Utilities* | *12.29* |
| - *International Bunker Fuels* | *0.15* |
| Stationary Combustion | 0.24 |
| Mobile Combustion | 0.09 |
| Coal Mining | 0.56 |
| Natural Gas and Oil Systems | 1.96 |
| Industrial Processes | 1.55 |
| Agriculture | 6.61 |
| Land Use, Land Use Change, and Forestry (LULUCF) | 8.01 |
| Waste | 0.67 |
| Municipal Solid Waste | 0.57 |
| Wastewater | 0.10 |
| Indirect $CO_2$ from Electricity Consumption* | 9.25 |
| **Gross Emissions** | **48.96** |
| **Sinks** | **-** |
| **Net Emissions** | **48.96** |

* Emissions from Electricity Consumption are not included in totals in order to avoid double counting with Fossil Fuel Combustion estimates.

The base year of 2019 was chosen for the Montana GHG inventory because it is the most representative of baseline GHG emissions in the most recent five years of available GHG

[1] Data for both **Table 1** and **Table 2** were obtained from the EPA's State Inventory Tool (SIT), available at https://www.epa.gov/statelocalenergy/state-inventory-and-projection-tool; accessed January 6, 2024.

inventory data. The COVID-19 pandemic significantly disrupted business as usual across almost every economic sector in 2020 and 2021and activities are just beginning to return to normal.

DEQ elected to use the 2019 baseline with one modification. GHG emissions from two coal-fired electric generating units at the Colstrip power plant (3.365 MMT) were removed from the 2019 baseline data. These units were permanently taken offline as of January 6, 2020. This modification to the 2019 GHG emission baseline will provide for the most accurate representation of baseline GHG emissions for the purposes of the CPRG Planning Grant.

**Table 2. Summary of GHG Emissions by Gas in Montana, 2019[2]**

| GHG Emission Sources by Gas | 2019 Emissions (MMT CO2e)* |
|---|---|
| **Carbon Dioxide ($CO_2$)** | **38.14** |
| $CO_2$ from Fossil Fuel Combustion | 29.26 |
| Industrial Processes | 0.87 |
| Waste | 0.01 |
| Land Use, Land Use Change, and Forestry (LULUCF) | 8.01 |
| **Methane ($CH_4$)** | **9.09** |
| Stationary Combustion | 0.15 |
| Mobile Combustion | 0.01 |
| Coal Mining | 0.56 |
| Natural Gas and Oil Systems | 1.96 |
| Agriculture | 5.78 |
| Waste | 0.56 |
| Wastewater | 0.08 |
| **Nitrous Oxide ($N_2O$)** | **0.24** |
| Stationary Combustion | 0.09 |
| Mobile Combustion | 0.08 |
| Agriculture | 0.04 |
| Wastewater | 0.03 |
| **HFC, PFC, $SF_6$ and $NF_3$ Emissions** | **0.68** |
| Industrial Processes | 0.68 |
| **Indirect $CO_2$ from Electricity Consumption**** | **9.25** |
| **Gross Emissions** | **48.15** |
| **Sinks** | **0.00** |
| **Net Emissions (Sources and Sinks)** | **48.15** |

* The data was obtained from EPA's Synthesis modules with the EPA's State Inventory Tool (SIT). Slight variations exist between EPA's Gas and Sector tables.

[2] Ibid.

# PRIORITY MEASURES

The measures in this section have been identified as priorities for the purposes of the CPRG program. These measures are intentionally broad to ensure they are available to any entity in Montana that is eligible to receive funding under Phase II of the CPRG program or other funding streams, as applicable.

This list is not meant to be exhaustive of Montana's priorities related to pollution reduction or climate resiliency. Rather, the priority measures in this plan were developed to meet the specific requirements and deadlines of the CPRG program. The measures meet the following criteria:

- The measure is implementation ready, meaning that the design work for the program or project is complete enough that a full scope of work and budget could be included in a CPRG implementation grant application.
- The measure can be completed in the near term, meaning that all funds would be expended, and the project completed, within the five-year performance period for the CPRG implementation grants.
- The measure advances or is otherwise consistent with Montana's priorities as identified in existing climate, energy, and natural resource planning efforts, including that the measure is innovative, cost-effective, reliable, affordable, and prioritizes incentives over mandates.

For the purposes of this plan, Montana selected key focus areas that represent the state's priorities. Within each focus area, the plan outlines potential projects (measures) that may advance GHG emission reductions in line with the requirements of the CPRG program. These focus areas include:

- Healthy, Resilient Forests
- Sustainable 21$^{st}$ Century Schools
- Innovative Agricultural Practices & Working Lands
- Clean, Reliable Transportation
- Industrial & Power Sector Innovation
- High Performance Homes & Businesses
- Waste Reduction or Diversion

**Table 3** on the following page summarizes Montana's priority measures. Each measure is discussed in more detail later in this chapter.

**Table 3. Summary of Montana's Priority Measures**

| Focus Area | Priority Measure | Cumulative GHG Emission Reductions (MMTCO2e) | |
|---|---|---|---|
| | | By 2030 | By 2050 |
| **Healthy, Resilient Forests** | Expand Forest Management & Wildfire Mitigation | 0.22 | 1.09 |
| **Healthy, Resilient Forests** | Expand Healthy Urban & Community Forests | 0.010 | 0.72 |
| **Healthy, Resilient Forests** | Mitigate and Extinguish Coal Seam Fires | 4.0 | 20.0 |
| **Sustainable Schools** | Incentivize School Energy Performance Measures | 0.00774 | 0.038 |
| **Innovative Agricultural Practices** | Fertilizer Use Innovation for Improved Soil Health | 0.25 | 1.24 |
| **Innovative Agricultural Practices** | Ranchland Stewardship Program | 0.60 | 6.0 |
| **Innovative Agricultural Practices** | Incentivize Innovation in the Cattle and Beef Industry | 0.1731 | 0.6575 |
| **Innovative Agricultural Practices** | Reduce Nonpoint Source Nutrient Pollution | $4x10^{-9}$ | $2x10^{-8}$ |
| **Clean, Reliable Transportation** | Strategic Conversion of Fleet Vehicles to Cleaner Alternatives | 0.014 | 0.077 |
| **Industrial & Power Sector Innovation** | Investment & Improvement in Electric Grid Technology | 1.49 | 7.02 |
| **Industrial & Power Sector Innovation** | Incentivize Industrial Process Efficiencies | * | * |
| **High Performance Homes & Businesses** | Improve Efficiency of Government, Nonprofit, and Commercial Buildings and Operations | variable | variable |
| **High Performance Homes & Businesses** | Low-Emission Home Heating Incentives | 0.14 | 0.073 |
| **High Performance Homes & Businesses** | Residential Energy Performance Incentives | variable | variable |
| **Waste Reduction or Diversion** | Develop or Expand Local Recycling and Composting Capacity | * | * |

*Calculations were not made due to the myriad of projects that could take place under the measure. Eligible entities wishing to apply for certain project funding will calculate the estimated GHG reductions of their work.

Consistent with the requirements of the CPRG program, this plan provides the following information for each measure, to the extent the information is available at the time of drafting:

- Measure description
- An estimate of the cumulative GHG emission reductions
- Key implementing agency or agencies
- Implementation schedule and milestones
- Geographic scope
- Metrics for tracking progress
- Funding - Cost estimates for implementation & intersection with other funding
- Impacts on low-income and disadvantaged communities
- Analysis of authority to implement

## HEALTHY, RESILIENT FORESTS

Due to its vast, open landscapes, Montana has a unique outdoor heritage that depends on a healthy environment. Forests help ensure a healthy environment by providing good air quality, clean water, and other human health benefits.

Yet Montana forests currently face significant forest health issues and wildfire risk, whether it's the excessive smoke in our skies during the summer, the increase in insects and disease outbreaks, or the overstocked stands. These same forests support thriving industries and good paying jobs and provide the characteristic backdrop of many Montana communities. Our forests also draw thousands of recreational visitors every year, contributing significantly to the state's tourism economy.

Without careful management, unhealthy forests can quickly turn into disaster areas. Today, Montana forests are struggling. Forest fire and decay have turned them from carbon sinks to net emitters of GHGs. The 2020 Montana Forest Action Plan identified 3.9 million acres as priority areas for focused attention. These priority areas were identified using a data-informed geospatial model to identify priority landscapes in need of forest restoration and management. Such areas were designated using current landscape attributes, in order to draw attention to the urgency with which action should be considered and help identify resources that should be allocated to protect Montana's communities and infrastructure and improve forest health conditions.

The Montana Department of Natural Resources & Conservation (DNRC) effectively runs programs that improve forest health and reduce wildfire risk on private and public lands. These existing programs are consistently overdrawn, leading to a backlog of critical projects lacking the funding to complete them. Additional federal funding would help reduce the backlog of forest management work through pass-through grants to communities, private landowners and investment in school trust lands. The funds could also support workforce development to train and employ Montanans in forestry-related careers.

This suite of measures aims to help turn that trend around, protecting Montana communities while reducing GHG emissions. The measures discussed below would also inject new funding into the existing Urban & Community Forestry program, helping underserved communities develop and maintain local forestry programs. Trees are a critical part of the urban and community landscape, especially in a warming climate. They provide for better air quality and improved aesthetics, reduce stormwater runoff, and help mitigate the impacts of urban heat island effects, resulting in lower energy demand for cooling in summer months. The program currently supports around 75 communities each year through nearly $150,000 per year in grants. Additional funding would allow more communities to take advantage of the program and leverage millions of dollars to improve carbon sinks and enhance community resiliency.

## Measure 1. Expand Forest Management and Wildfire Mitigation

In addition to forest management and wildfire mitigation projects on public and private land, eligible projects would also include other actions to improve forest health and carbon sequestration through better management and restoration of degraded lands. Funding may also support enabling measures such as identification and development of market streams for woody biomass waste products and forestry workforce development. Workforce development may include partnerships with the university system, development of firefighter recruitment and training programs, or advancement of internship, apprenticeship, or national service programs.

The measure would expand funding for a critical range of activities, including fuel reduction, controlled burns, pest management, reforestation projects, and biomass utilization. Its primary aim would be to continue to enhance forest resilience against wildfires, pests, and diseases, while promoting carbon sequestration in forest ecosystems.

### Estimate of GHG Emission Reductions

| Priority Measure | Cumulative GHG Emission Reductions (MMT $CO_2e$) | |
|---|---|---|
| | By 2030 | By 2050 |
| Expand forest management and wildfire mitigation | | |
| Reforestation (per 1,000 acres) | 0.010 | 0.049 |
| Natural Forest Management (per 1,000 acres) | 0.0044 | 0.022 |
| Avoided Forest Conversion (per 1,000 acres) | 0.20 | 1.012 |
| Fire Management (per 1,000 acres) | 0.002 | 0.008 |
| **TOTAL** | **0.22** | **1.09** |

*Quantification tool(s) utilized: "Natural climate solutions for the United States" Fargione et al. 2018*

### Key Implementing Agency or Agencies

Montana's Department of Natural Resources & Conservation (DNRC)'s Forestry and Trust Lands Division is responsible for planning and implementing forestry and fire management programs across the state. The division delivers the following major functions: fire protection, forestry assistance, implementing the Good Neighbor Authority, executing the Montana Forest Action Plan, business management, and policy-planning & outreach.

### Implementation Schedule and Milestones

2,000 acres treated per year: 1,200 acres per year to be treated west of the continental divide and 800 acres to be treated east of the continental divide.

44,000 tons of slash will be chipped and hauled to Weyerhaeuser Mill in Columbia Falls, which will allow Weyerhaeuser to replace a fossil fuel (natural gas) with biomass and significantly reduce the pollution from burning this slash during open burning.

**<u>GEOGRAPHIC SCOPE</u>**

Montana's state and private forested lands, which cover approximately 23 million acres (Private: ~5.5 million acres (24%); Tribal: ~1.1 million acres (5%), and state: ~0.9 million acres (4%)).[3] A map of these areas is provided in **Figure 1** below.

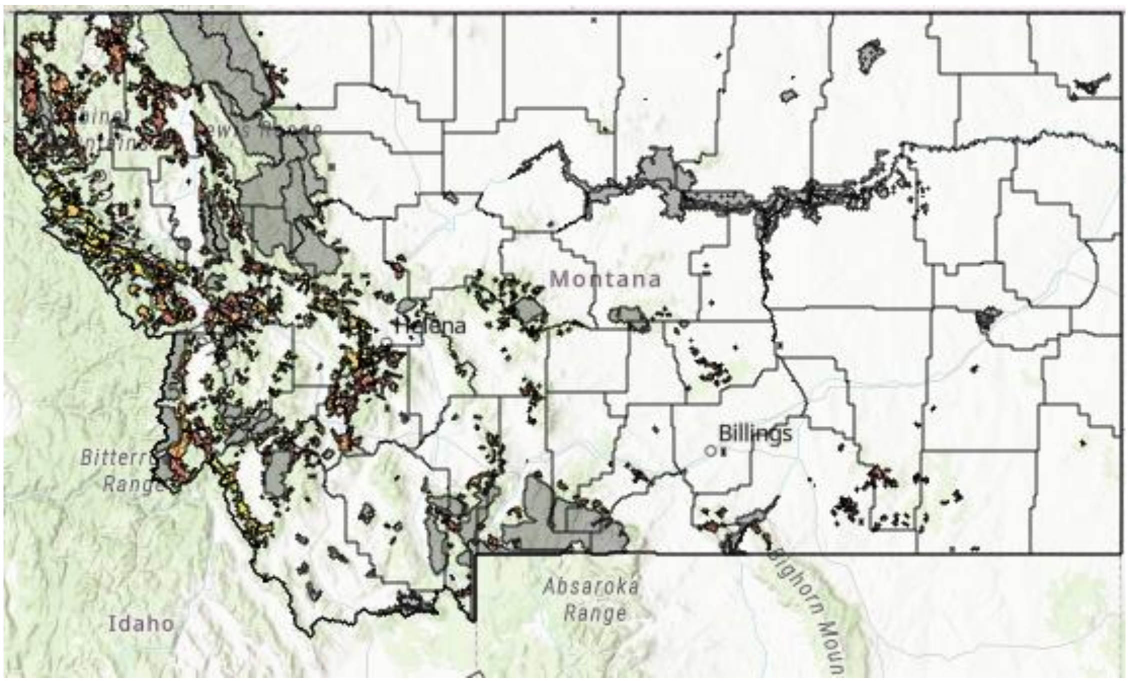


**Figure 1. Montana's Priority Areas for Forest Management. Gray areas denote federal forests, which were not assessed for fire risk or forest health.**

**<u>METRICS FOR TRACKING PROGRESS</u>**

GHG reductions realized, with the ultimate goal of turning Montana's state and private forests from carbon emitters to carbon sinks. Additional metrics include acres treated, wildfire risk reduction, the number of communities and watersheds protected, jobs created, and partners engaged.

**<u>FUNDING</u>**

Cost estimates for implementation: $7.75 million

It has become evident over the last few years that a significant decline has occurred around available workforce for fire fighters, woods workers, wood products industry workers and two-

[3] Montana DNRC, "Montana Statewide Assessment of Forest Conditions," December 2020, https://dnrc.mt.gov/_docs/forestry/Montana_Assessment_of_Forest_Conditions.pdf.

and four-year degreed natural resource professionals. This decline coincides with the need to get more work done in the forest to reduce wildfire risk and improve forest health. DNRC will establish capacity for survey and assessment towards better understanding what exists today in workforce development opportunities and how these can be better tailored to meet the needs of secondary education and post-secondary education. These can be better integrated through efforts to network and complement existing programs. Once the assessment is completed, DNRC will work with partners to implement a more integrated natural resource work force training program across the state.

### INTERSECTION WITH OTHER FUNDING

Traditionally, the DNRC Forestry Assistance program receives approx. $3.5M annually in federal funding through the US Forest Service's State, Private, and Tribal Forestry programs to implement wildfire mitigation activities and forest health improvement and restoration activities. Recent BIL & IRA authorities have resulted in a four-fold increase of federal funds in the last year.

Additionally, state-funding investments of approx. $2.5M annually to support the DNRC and the implementation of the MT Forest Action Plan have nearly doubled in the last year.
Combined, the DNRC is currently administering more than $16M annually, funding sustainable forest management activities which include hazardous fuels reduction, prescribed burns, managing forest insects and disease, reforestation, supporting ecosystem services, biomass utilization, and conserving important forest ecosystems.

DNRC Trust Lands Forest Management program annually invests over $6 million dollars into managing forested trust lands including conducting a commercial timber sale program as well as concurrent forest improvement activities which include activities like thinning, planting, site preparation and the application of prescribed fire.

In July of 2023, the Montana state legislature allocated $30 million to the DNRC to improve forest health and decrease wildfire risk to communities across the state. Projects across private, state, and federal lands are being delivered through DNRC's Forestry and Trust Lands Division programs.

### IMPACTS ON LOW-INCOME AND DISADVANTAGED COMMUNITIES

This measure would deliver substantial benefits to low-income and disadvantaged communities, aligning with Justice40. This strategic focus addresses the heightened risks these communities face due to climate change and their limited resources to adapt or recover from such impacts. In addition, the measure would help protect public health by reducing wildfire smoke, a significant source of air pollution. The measures also support rural economies through the development of sustainable wood products markets and improved biodiversity and water quality.

**AUTHORITY TO IMPLEMENT**

Montana Code Annotated: State Fire Policy- 76-13-115(7). The legislature finds and declares that: sound forest management activities to reduce fire risk, such as thinning, prescribed burning, and insect and disease treatments, improve the overall diversity and vigor of forested landscapes and improve the condition of related water, wildlife, recreation, and aesthetic resources.

Montana Code Annotated: 76-13-701.The legislature declares that it is the policy of this state to promote the sustainable use of all public forests within the state through sound management and collaboration with local, state, and federal entities.

## Measure 2. Expand Healthy Urban and Community Forests

This measure would incentivize the expansion of urban and community forests by maximizing available grant funding to support the development and maintenance of local urban forestry and green infrastructure programs, particularly in underserved communities.

According to the 2020 Montana Forest Action Plan, nearly 70% of Montana's population live within incorporated towns and unincorporated centers.[4] As the population grows and development increases, community trees face a multitude of challenges. Development is causing community forest fragmentation and canopy loss, along with various social, environmental, and economic challenges. Healthy urban forests can strengthen a community's ability to withstand and manage climate-related threats.

According to most recent estimates, street and park trees across the state provide over $17 million per year in economic and ecological benefits. Every dollar spent on managing urban and community forests (UCFs) is matched by nearly two dollars in environmental services and increased property values in return.[5] UCFs provide shade during hot summers in urban heat islands. Shaded spaces can mean the difference of 20-45 °F cooler than peak temperatures of exposed surfaces.[6]

Trees serve as critical wind breaks in wind-prone rural communities. Windbreaks and shelterbelts have an amazing capability to capture carbon, typically 3 times that of a natural forest due to the fact the force of the wind presses more $CO_2$ from the atmosphere as it comes into contact with tree leaves. Trapped air compressed by the wind contains 10 times the carbon of a naturally prevailing wind.[7] The state's publicly owned urban forests provide over $1.8

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[4] Montana DNRC, "Montana Forest Action Plan," December 2020, https://dnrc.mt.gov/Forestry/Forest-Management/montana-forest-action-plan.

[5] Community Tree Guide: Benefits, Costs, and Strategic Planting (McPherson et al. 2002).

[6] U.S. Environmental Protection Agency. 2008. Reducing urban heat islands: Compendium of strategies. Draft https://www.epa.gov/heat-islands/heat-island-compendium.

[7] "Windbreak, Shelterbelt Calculation", TreePlantation.com, available at https://treeplantation.com/windbreak-calculator.html#:~:text=Shelterbelts%20And%20Climate%20Change&text=The%20shape%20of%20these%20wind,of%20a%20naturally%20prevailing%20wind., accessed 03/01/2024.

million in energy savings and intercept more than 122 million gallons of storm water annually, easing the burden on water treatment facilities and acting as an important filtration system for communities that rely on well water.[8] Additionally, they sequester nearly 9.5 million pounds of carbon and remove over 20 metric tons of pollutants from the air yearly. With the increase in wildfires and related smoke, urban forests are even more critical in improving air quality. UCFs also help stabilize banks in the event of flooding.

In addition to threat of removal, Montana's UCFs are generally old and lack the diversity to withstand major threats from invasive insects and disease. Many of the most valuable community trees were planted around statehood and are reaching the end of their life cycle. Just three species (ash, maple, and crabapple) comprise nearly 42% of the total UCF tree population, making a significant portion of UCFs vulnerable to species-specific threats.

### ESTIMATE OF GHG EMISSION REDUCTIONS

| Priority Measure | Cumulative GHG Emission Reductions (MMT $CO_2e$) | |
|---|---|---|
| | By 2030 | By 2050 |
| Expand healthy urban and community forests | .010 | 0.72 |

*Quantification tool(s) utilized: i-tree Eco*

### KEY IMPLEMENTING AGENCY OR AGENCIES

MT DNRC, Urban and Community Forestry Program

### IMPLEMENTATION SCHEDULE AND MILESTONES

The project would cover a 5-year period along with long-term measurable results. Deliverables include proactive tree planting initiatives, increasing canopy cover percentages, increase diversity, climate-adapted and high-performing trees. Goals include increased shade, mitigate heat island effects, improve community forest health.

- Year 1-2 will focus on building and staffing up urban forestry programs, conduct the canopy analysis, develop tree initiatives, plan and set goals, workforce capacity efforts, and initiating the subaward programs.
- Years 2-5 will further build from the establishment of the expanded program, with more subgrant opportunities and awards cycles, continued workforce development, implementation of projects.

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[8] State of Community Trees in Montana, Montana DNRC, 2017.[State-of-Community-Trees-in-Montana-2017reduced.pdf (mt.gov)]

**<u>GEOGRAPHIC SCOPE</u>**
Statewide.

**<u>METRICS FOR TRACKING PROGRESS</u>**
Tree inventories conducted and updated, Statewide Canopy Cover Assessment, Tree Equity Analysis, nurseries created or expanded, trees planted, canopy cover change, diversity of trees expanded.

The canopy assessment will establish baseline information for tracking canopy change over time, and drive efforts towards improving shade equity and economy of scale in disadvantaged communities.

A number of calculations could be made in order to quantify several environmental services. These include energy conservation, air quality, water quality, storm water runoff and carbon sequestration. In terms of this analysis, we were able to calculate urban forest benefits within the study area and quantify them within each discreet benefit area.

The scenario shown in **Figure 2** provides a snapshot of land use where strategic programming can influence change on a macro scale. It reflects what remaining status quo provides in benefits compared to a basic program investment. In the images below, changing from reds and oranges to the yellows and greens equates to increasing canopy, thus increasing livability and quality of life.

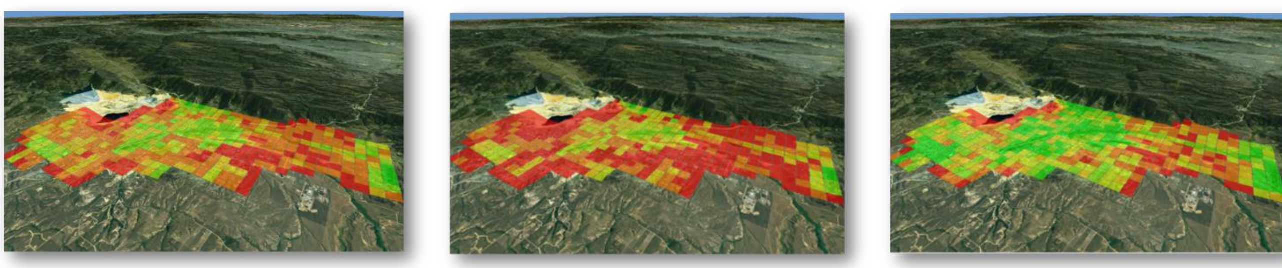

**Figure 2. Example Scenario Showing Vegetative Land Cover with and Without Investment. From Left: Image 1 shows current conditions of green infrastructure land cover in Butte, MT. Image 2 shows projected 2051 cover with a 'business as usual' budget (no investment). Note the loss in overall canopy and vegetation. Image 3 shows projected 2051 with 'sustainable investment' budget.**

**<u>FUNDING</u>**
Total cost estimate for implementation: $10.5 million total

- Analyze and assess - $1.5M
    - Statewide Canopy Cover Assessment, Equity Analysis Project.
- Build capacity and workforce development - $3.5M
    - Funds for DNRC UCF Foresters
    - Staff to assist UCF program’s work in geospatial services and needs.
- Funding projects - $5.5M

- Develop an IRA Subaward Program intended for CPRG grants projects. Standards will be created to verify the projects provide qualitative data, climate-based measurements, and benefits. Example projects: green infrastructure like bioswales, structural soils, converting hardscapes into greenscapes, and large-scale tree plantings.

#### INTERSECTION WITH OTHER FUNDING

UCF will expand land cover analysis through the canopy assessments into the Wildland Urban Interface whenever possible. This will create new collaborative management for landscapes in the WUI and assist in the development of planning and decision-making tools.

School climate-strategy landscape funding: The DNRC UCF Program will bring funding opportunities to tie into the other priority measures, specifically efforts for school building improvements with a climate-based tree planting and landscape design.

#### IMPACTS ON LOW-INCOME AND DISADVANTAGED COMMUNITIES

Urban greening projects can offer low-income urban residents many physical and social benefits. Improving and expanding green spaces in urban areas results in residents spending more time interacting with the outdoors and engaging in recreational activities like biking, running, and walking. These spaces may also serve as meeting grounds, encouraging stronger social ties and social cohesion within a community, providing a host of social and emotional benefits. Appropriate foresight and planning can help prevent “eco-gentrification,” which can occur when improved green spaces drive up property values and push out low-income residents.

*Urban canopy planning, mapping, and data:* The urgency to deliver tree equity is imperative as there are gaps in community canopy near low-income and disadvantaged neighborhoods. Canopy data and tree inventories will identify high-need areas in terms of urban heat islands, canopy coverage, health issues, and lack of ecosystem benefits. A full canopy analysis will allow for strategic, focused planting and maintenance that aligns with critical carbon and GHG reduction goals.

*Impacts of climate change:* Urban and community forestry is an essential program to address the impacts of climate change. Urban forest cover is a key mediating variable between climate change impacts and particularly vulnerable population demographics. These populations often suffer disproportionate negative impacts from the multiple health hazards associated with climate change, especially when located near freeways, industry, rivers, landfills, and other areas with little green space.

#### AUTHORITY TO IMPLEMENT

Montana Code Annotated: State Fire Policy- 76-13-115(7). The legislature finds and declares that: sound forest management activities to reduce fire risk, such as thinning, prescribed burning, and insect and disease treatments, improve the overall diversity and vigor of forested landscapes and improve the condition of related water, wildlife, recreation, and aesthetic resources.

Montana Code Annotated: 76-13-701.The legislature declares that it is the policy of this state to promote the sustainable use of all public forests within the state through sound management and collaboration with local, state, and federal entities.

## Measure 3. Mitigate and Extinguish Coal Seam Fires

This measure proposes to leverage local efforts to identify and map burning coals seams by building on existing data and expertise, such as through collaborative mapping initiatives. Bolster funding available to support the specialized equipment, techniques, and projects necessary to mitigate and extinguish actively burning coal seams in eastern Montana.

Burning coal seams pose a significant threat to Montana's environment, public safety, and climate planning efforts. Burning coal seams can ignite wildfires, burn beneath buildings, roadways and the surface releasing deadly gases and lead to subsidence.
These underground fires act as uncontrolled point sources of harmful greenhouse gases, including carbon dioxide, methane, and nitrous oxide. The detrimental impacts of burning coal seam fires extend beyond greenhouse gas emissions. They also:

- Degrade air quality: Releasing harmful pollutants like sulfur dioxide, mercury, and particulate matter, impacting public health, and contributing to smog formation.
- Endanger firefighters and communities: Creating hazardous conditions and flare-ups that threaten first responders and nearby residents.
- Destroy valuable ecosystems: Degrading forests, grasslands, and waterways crucial for biodiversity and carbon sequestration.

Increasing drought and dry conditions allow the seams to easily catch fire and then continue burning underground. In 2021, it was estimated that 60% of Rosebud County's roughly 70 wildland fires were ignited by coal seams.[9] According to the Bureau of Indian Affairs, 80 active coal seams at Northern Cheyenne have caused, on average, five wildfires per year.

Montana's DNRC recorded an increase in coal seam fires from 14 to at least 685, verified by site visits across seven counties, between 2000 and 2021. The Northern Cheyenne Reservation recorded 74 fires in 2021, and in August of 2021, the largest-known coal seam caused wildfire burned 170,000 surface acres in Rosebud County and the Northern Cheyenne Reservation.[10]

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[9] Custer County DES is currently conducting a study with John Hopkins University of the composition of the emissions from coal seam vents to better quantify the associated health risks. Results were not available at the time of this report.
[10] Austyn Gaffney, "The Fires Below," *High Country News*. Issue 2022_08_01. Page 31.

Several Montana communities have taken proactive steps to map and identify burning coal seams within their jurisdictions. Additional funding could leverage these local efforts by building upon existing data and expertise. Collaborative mapping initiatives can ensure a comprehensive understanding of the scope and impact of these fires. Funding would also go towards mitigating and extinguishing actively burning coal seams, which often requires specialized equipment and techniques, making them cost-prohibitive for many communities.

### ESTIMATE OF GHG EMISSION REDUCTIONS

| Priority Measure | Cumulative GHG Emission Reductions (MMT $CO_2e$) | |
|---|---|---|
| | By 2030 | By 2050 |
| Mitigate and extinguish coal seam fires | 4 | 20 |

*Quantification tool(s) utilized: EPA 2023 GHG emission factors hub and USGS coal resource classification system.*[11]

As each coal seam fire is extinguished, measures of the thickness of the seam and an estimate of its historical course will be made to provide a final, semi-quantitative value of emission reduction, using the sources cited above.

Also, it should be noted that the emission reduction numbers for this priority measure do not include the $CO_2$ emission savings of forest and range fires prevented.

### KEY IMPLEMENTING AGENCY OR AGENCIES

MT DNRC's Conservation Resource Development Division would act as the lead, working cooperatively with County, State (DNRC Forestry/Lands Division), Federal (BLM/USFS) and Northern Cheyenne Tribe to contract the engineering and specialized equipment contactors necessary to extinguish coal seam fires.

The County and Tribal Governments are key players as the local entity serving as the hub that connects landowners, with active coal seam fires on their property, to the state contracted engineers and construction contractors that will perform extinguishment.

### IMPLEMENTATION SCHEDULE AND MILESTONES

Implement a one-year effort to 1) communicate program availability to cooperating governmental entities, 2) award grants with cooperating entities to do initial site examinations, site characterization, bid package development and cost estimates, 3) provide further grant

[11] EPA, *2023 GHG Emission Factors Hub*, September 2023. https://www.epa.gov/climateleadership/ghg-emission-factors-hub. USGS, *Coal Resource Classification System of the U.S. Geological Survey*, 1983. https://pubs.usgs.gov/publication/cir891.

monies to fund characterized coal fire suppression projects, and 5) inventory and prioritize known and suspected coal fires for future characterization and mitigation.

In following years, program focus would be an annual increase in the number coal fires mitigated.

**GEOGRAPHIC SCOPE**

Eastern Montana, particularly in the Powder River Basin, which is home to the world's largest known coal reserve, and where coal seams are a major cause of wildfires in the region.

**METRICS FOR TRACKING PROGRESS**

Numbers of grants awarded for, characterization, fire mitigation, completed mitigation and number of new fires identified annually. Also, a semi-quantitative measure of CO2 emission reduction will be performed based on the coal seam thickness and estimated historical run will be made by the contractor performing the extinguishment. These will be tracked by the state and provided to EPA during quarterly federal reporting periods.

**FUNDING**

$10 million

Outcrop coal fires are variable in size and shape, with accessibility often an issue. The amount of overburden removal needed to access the burning coal varies from one foot to high wall scale operations. All of these concerns lead to widely varying costs per project. Also, there are certain seasons and weather conditions where excavation of burning coal seams is not a great idea. Examples are during the summer fire season, high wind (red flag days), and in the spring when the ground thaws and soils turn to soft clay, burying equipment.

This variability, combined with the unknown total number of fires, makes estimating a total program cost difficult. DNRC requests a *not-to-exceed amount of $10 million.* With this level of funding prioritization for accessible coal seam fires will maximize both the # of fires extinguished, and $CO_2$ emissions reduced.

Costs and $CO_2$ reductions realized will be reported in the quarterly federal reporting period.

**IMPACTS ON LOW-INCOME AND DISADVANTAGED COMMUNITIES**

For the period 2017-2021, the National Institute of Health lists Median Household Income (MHI) in Montana at $60,560, ranking it 40th of 51 (including Washington D.C.). Within Montana, the area of greatest concentration of coal seam fires occurs in south central/southeastern Montana. The five counties within this area all rank below the Montana Median as follows: Rosebud ($59,339), Powder River ($55,833), Custer ($55,426), Treasure ($55,313), and Big Horn ($49,640). The lowest figure in this group is Big Horn County, the majority of which is Northern Cheyenne Tribal Territory.

The residents of this region are at constant risk of spontaneously ignited wildfires from coal seams and the deleterious effects of wildfire smoke and the increased health risks associated with coal seam emissions.[12]
Successful extinguishment of a majority of the accessible coal seam fires will improve air quality and better protection of people's homes and ranches. Further, this grant will provide job opportunities for local residents, generate local economic benefits from the purchase of goods and services needed for fire mitigation work and prevent the loss of range that is so vital for the cow/calf operations that are the cornerstone of the local economy.

#### AUTHORITY TO IMPLEMENT

The authority to implement the program comes from a combination of local landowners granting private property access coupled with the expertise and firefighting resources of federal, state, county, and tribal governments whose authorities and duties include firefighting.

## SUSTAINABLE 21ST CENTURY SCHOOLS

Many Montana school districts struggle to upgrade their aging infrastructure. With inflation and increasing energy rates, property taxes, and student numbers eating into school budgets, it is more important than ever to reduce operational costs for our schools. This suite of measures proposes to deliver critical federal funds to perform badly needed infrastructure upgrades while simultaneously reducing school GHG emissions.

This focus area is a good fit for the CPRG program for several reasons. First, a 2021 report from the New Building Institute explains that the annual GHG emissions per sq. foot of schools in Montana is 11th highest in the nation, at approximately 7,049 metric tons.[13] A school retrofit program would be a strong fit with DEQ's Energy Bureau, given its history of working with schools on multiple related fronts (building retrofits, school buses, Energy Performance Contracting, and solar). For example, DEQ's Smart Schools program, which offers small grants to schools for resource conservation projects, provides an existing structure that could significantly scale up with CPRG funds.

### Measure 1: Incentivize School Energy Performance Measures

Bolster funding for an opt-in energy performance program for Montana schools. The program would provide funds for capital investments in facility retrofits and beneficial electrification, including but not limited to upgrading or replacing heating, ventilation and air conditioning systems, improving insulation levels, reducing air leakage, and upgrading lighting systems.

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[12] Custer County DES is currently conducting a study with John Hopkins University of the composition of the emissions from coal seam vents to better quantify the associated health risks. Results were not available at the time of this drafting.

[13] In Montana, the annual greenhouse gas (GHG) emissions of the operation of public K-12 buildings are estimated at just over 200,000 metric tons (MTCO2e). This puts Montana 11th highest in the nation for GHG emissions per square foot of school building, at around 7,000 MTCO2e per sq. foot. Source: "Why K-12 Should Feature in America's National Climate Strategy," New Buildings Institute, April 2021. https://newbuildings.org/wp-content/uploads/2021/04/Schools_WhitePaper_202104.pdf (accessed 1/4/2024).

Funding would also be available to support deployment of on-site renewable energy generation paired with back-up energy storage system.

The primary objective of a Montana "School Sustainability Suite" would be to provide opt-in funding opportunities for Montana school districts interested in transitioning their buildings to reliable, emissions-free electricity or implementing significant efficiency upgrades, resulting in long-term energy savings. The funding would support capital investments in building retrofits, energy efficiency upgrades, electrification, low- and no-emission buses, and renewable energy infrastructure. This initiative would be open to all Montana K-12 schools, including tribal schools, while prioritizing high-need schools such as those in low-income and disadvantaged areas as well as Title 1 schools.

Funding under this measure may also support enabling projects such as energy sector workforce development or development and maintenance of an information hub for school administrators.

**ESTIMATE OF GHG EMISSION REDUCTIONS**

| Priority Measure | Cumulative GHG Emission Reductions (MMT $CO_2e$) | |
|---|---|---|
| | By 2030 | By 2050 |
| School Energy Performance Incentives<br>(5) Schools with varying energy measures; $2M average cost per school, total hypothetical project budget of $10M | 0.00774 | 0.038 |

*Quantification tool(s) utilized: Investment Grade Audits for MT Schools; EPA AVERT Tool*

**KEY IMPLEMENTING AGENCY OR AGENCIES**

To be determined but may include the Montana Department of Environmental Quality's Energy Bureau, which currently administers the Montana SMART Schools Program, provides oversight of Energy Performance Contracting for schools, and provides technical assistance to schools seeking to improve the efficiency and energy performance of their facilities. Administration of a CPRG funded school energy performance incentive program by DEQ's Energy Bureau would be consistent with Energy Bureau's role implementing similar federally funded, pass through energy incentive measures.

**IMPLEMENTATION SCHEDULE AND MILESTONES**

To be determined depending on implementing agency.

**GEOGRAPHIC SCOPE**

Statewide with priority for schools in low-income and disadvantaged communities.

**METRICS FOR TRACKING PROGRESS**

Metrics would vary depending on the type of projects implemented through this measure, but could include the following:

- Number of schools served;
- Square footage and number of pupils in schools served;
- Type and number of energy performance measures implemented (e.g., lighting upgrades, roof insulation, boiler replacement, etc.);
- Climate resilience measures implemented (e.g., air conditioning, improved air filtration, backup power source, etc.)
- Lifetime energy savings (kilowatt hours (kWh) and British Thermal Units (BTUs) and operational cost savings;
- GHG emission reductions; and,
- Matching funds leveraged.

**FUNDING**

Minimum anticipated funding required to implement this measure would be $10 million to $75 million. CPRG funding would complement and could leverage several other existing federal funding opportunities, multiplying the impacts:

- IIJA 40109, State Energy Program
- IIJA 40541, Grants for Energy Efficiency and Renewable Energy Improvements as Public-School Facilities
- IIJA 71101, Clean School Bus Program
- IIJA Division J, Title VI, Pollution Prevention Grants
- IRA 60101, Clean Heavy-Duty Vehicles
- IRA 60106, Funding to Address Air Pollution at Schools
- IRA 60501, Neighborhood Access and Equity Grant Program

**IMPACTS ON LOW-INCOME AND DISADVANTAGED COMMUNITIES**

This measure would be designed to benefit all Montana communities by investing federal funding in school infrastructure that otherwise may require local or state dollars. DEQ proposes to prioritize high-need schools that serve low-income and disadvantaged communities, tribal schools, and Title 1 schools that serve low-income students. This would ensure that the highest need communities receive much-needed funds.

In addition to the general LIDAC benefits associated with measures (see the LIDAC Analysis section of this Priority Plan), other potential benefits unique to this measure include:

- Reduced level of air pollution ($NO_x$, VOCs, $NH_3$)
- Lower cost of maintenance and cost of charging, compared to maintenance and cost of fuel for diesel/gasoline school buses
- Reduced noise pollution

**AUTHORITY TO IMPLEMENT**

Implementation of this measure by DEQ would be consistent with similar pass-through funding programs administered by DEQ's Energy Bureau. DEQ's Energy Bureau is the federally recognized State Energy Office for Montana and administers State Energy Program funds allocated by the U.S. Department of Energy, including funding for SMART Schools projects.

School energy saving projects conducted as part of this measure could be implemented as energy performance contracts pursuant to Title 90, Chapter 4, Part 11, MCA. Legislative findings and policy for Montana's Energy Performance Contracting statute include the finding that, "conserving energy in public buildings and vehicles will have a beneficial effect on the overall supply of energy and can result in cost savings for taxpayers." (90-4-1101, MCA)

## INNOVATIVE AGRICULTURAL PRACTICES & WORKING LANDS

Agriculture plays a pivotal role in Montana's economy. As shown by the GHG inventory, agriculture is also a significant contributor to Montana's emissions, with practices such as livestock rearing, fertilizer application, and general land management all contributing.

Ag producers experience firsthand the impacts of a changing climate and are critical stewards of Montana's lands for future generations. The majority of Montana's agriculture production is exported out of state for further processing resulting in a large carbon footprint. Montana is uniquely positioned to invest in emerging technologies that reduce greenhouse gas emissions and create value by upcycling resources now being wasted or underutilized. Healthy soils play a big role in capturing and storing carbon and mitigating the impacts of climate change. Improving soil health can increase carbon sequestration while also supporting higher-profitability operations.

The following measures include projects that support the research, development, and practice of sustainable agriculture through soil management, water conservation, and waste (manure) management – all of which have the potential to reduce greenhouse gases by thousands to millions of tons.

### Measure 1: Fertilizer Use Innovation for Improved Soil Health

Precision agriculture has progressed over the last few decades into a management approach for inputs like Nitrogen (N) fertilizer that account for spatial variation at relatively high resolution across fields.[14] Increasing the efficiency of agricultural inputs, including N fertilizer, is a key step in transitioning modern agriculture towards sustainability.[15]

"Low nitrogen use efficiency (NUE) is ubiquitous in agricultural systems, with mounting global scale consequences for both atmospheric aspects of climate and downstream ecosystems."[16]

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[14] Bullock DS, Boerngen M, Tao H, Maxwell B, Luck JD, Shiratsuchi L, Puntel L, Martin NF (2019) The data-intensive farm management project: changing agronomic research through on-farm precision experimentation. Agron J 111(6):2736–2746. https://doi.org/10.2134/agronj2019.03.0165.

[15] Gliessman S (2016) Transforming food systems with agroecology. Agroecol Sustain Food Syst 40(3):187–189. https://doi.org/10.1080/21683565.2015.1130765.

[16] Hegedus, P.B., Ewing, S.A., Jones, C. *et al.* Using spatially variable nitrogen application and crop responses to evaluate crop nitrogen use efficiency. *Nutr Cycl Agroecosyst* **126**, 1–20 (2023). https://doi.org/10.1007/s10705-023-10263-3.

Montana State University-Bozeman has conducted research on two organic farms that have the variable seeding rates and combine mounted yield monitor technology to create profit maximizing and N-loss minimizing (optimum) seeding rates. The research is part of the regenerative agriculture movement to increase soil health that will capture more carbon in the soil as well as reduce N fertilizer use through the use of cover crops.

CPRG funds could be used to increase the number of farms demonstrating the use of on-field precision experiments (OFPE) to identify optimum cover-crop seeding rates.

The share of acres receiving N in Montana in 2022 were: 80% of winter wheat, 96% of spring wheat and 97% of durum wheat. MSU's research has shown significant reductions in N use on Montana fields where they quantified N rates that would maximize return on investment in the fertilizer used on rain-fed winter wheat over the last 9 years. The technology makes for an easily quantifiable reduction of NO2 from the common overuse of N fertilizer.

The next step is to increase recruitment of farmers to conduct the OFPE by creating recruitment meetings around the state and regional demonstration farms beyond the eight MSU is already working with. Funding could be used to pay farmers to participate.

#### Estimate of GHG Emission Reductions

| Priority Measure | Cumulative GHG emission reductions (MMT $CO_2e$) | |
|---|---|---|
| | By 2030 | By 2050 |
| Reduced nitrogen fertilizer volatilization in MMT (per 100,000 acres) | 0.25 | 1.24 |

*Quantification tool(s) utilized: SIT Ag Module Methodology; "Using spatially variable nitrogen application and crop responses to evaluate crop nitrogen use efficiency" Hegedus et al. 2023*

#### Key Implementing Agency or Agencies

MT Department of Agriculture

#### Implementation Schedule and Milestones

Year 1: hire and deploy agent to conduct outreach and educational activities.
Years 2-5: continue recruitment efforts and increase the number of Montana farms using precision agriculture.

**GEOGRAPHIC SCOPE**

Statewide with emphasis on dryland small-grain agroecosystems in Montana, where low NUE has been linked to elevated nitrate levels in drinking water, acidification of agricultural soils, and substantial loss to denitrification with associated production of the greenhouse gas $N_2O$.[17]

**METRICS FOR TRACKING PROGRESS**

Number of producer contacts.
Number of acres enrolled in nitrogen efficiency programs (minimum 100,00 acre 5-year target)

**FUNDING**

$1 million requested over 5 years to partner with fertilizer industry representatives to deploy education and outreach campaigns.

*Intersection with Other Funding:* Estimated industry-driven capital investment in the design and deployment of applications to measure and verify fertilizer application and land management decision-making exceeds $5 million.

**IMPACTS ON LOW-INCOME AND DISADVANTAGED COMMUNITIES**

The environmental impact of food production is significant, and this can be especially concerning for those in low-income and disadvantaged communities who have historically faced a greater burden of the adverse effects of air, water, and soil pollution. Over the past several years, we have established trusting and mutually beneficial relationships with various tribal government groups, NGOs, and other entities in and around Montana that will be readily engaged in our effort to benefit their tribal members and communities.

By implementing innovative operational practices and embracing emerging technologies, the agriculture sector can reduce its greenhouse gas footprint. Practices such as those proposed here - precision farming and improved livestock management – can enhance efficiency and mitigate emissions. Adopting these advancements not only promotes sustainability but also addresses the disproportionate effects of emissions on vulnerable communities.

**AUTHORITY TO IMPLEMENT**

**Montana Code Annotated 80-1-102. Duties of department.** The department shall encourage and promote the interests of agriculture, including horticulture and apiculture, and all other allied industries.

## Measure 2. Ranchland Stewardship Program

Expansion and increased use of technology to improve grazing management planning and adaptive strategies that improve soil health.

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[17] Sigler, W.A., Ewing, S.A., Wankel, S.D. *et al.* Isotopic signals in an agricultural watershed suggest denitrification is locally intensive in riparian areas but extensive in upland soils. *Biogeochemistry* **158**, 251–268 (2022). https://doi.org/10.1007/s10533-022-00898-9.

The project leverages data-driven adaptive management decision-making tools that lead to increased carbon storage in the soil.  Outcomes will increase soil carbon sequestration on Montana's expansive and diverse grasslands.

The entire Western United States has an opportunity to positively impact climate change by sequestering carbon in the soil through improved grazing practices. Montana alone has over 8.75 million acres of rangeland, most of which is in fair to poor condition. This means that most of those soils may contain less than 1% soil carbon, whereas historically they were more like 8-12%. To return to these levels, ranchers must bunch cattle more densely, for shorter periods of time, on smaller plots of land; followed by longer recovery periods for plants to grow both above and below ground (sequestering carbon).

Regenerative Grazing is a planned, adaptive approach to managing livestock that puts the animal, vegetation, and soil into a reciprocal, mutually beneficial relationship, closely mimicking the synergistic relationship between grazers and grasslands that has evolved over millennia prior to human involvement.

Montana has already established itself as a leader in the adoption of regenerative management practices with an increasing focus of its many non-profit ag organizations, industry groups, state and federal agency supporters, and university experiment stations and extension offices.

Key Principles:

1. Prioritizing adequate rest/recovery periods that create ground cover (plant litter in contact with soil surface) to help reduce erosion potential, retain moisture, cushion against compaction, and allow plants to generate seed on a regular basis
2. Committing to shorter graze periods with high stock density (non-selective grazing, avoided grazing of regrowth, trampling uneaten plant material, uniform distribution of manure, urine)
3. Grazing forage up during the growing season (rather than down); plants grazed quickly by large herds of moving animals experience stimulated growth if allowed to fully recover following the grazing activity
4. Planning and adaptive management, which relies on observation, adapting/evolving practices, and monitoring.

Many ranchers know this type of grazing will prove beneficial to their operation as well as the environment, yet too often they lack the resources and tools to implement the appropriate practices. Responding to this need, the Western Sustainability Exchange and many of its partners have created a beta version of a software tool that combines a good ranch pasture map with graphical analyses of past grazing management that empowers ranchers to make confident decisions to achieve the above objectives.

Once the plan is implemented, actual grazing events can be tracked to generate a record of progress achieved going forward. In this way critical metrics such as stocking density, pasture size, graze period, recovery period, and others can be measured over time to allow for goal setting and achievement as well as greater sharing amongst peers. Up to this point, a similar planning and documentation tool has not been available. Several of the most innovative ranch operators have been advising and testing this tool and are very happy with its function and results. Funding for this measure will be used, in part, to launch and build-out the software in the following ways: enhance and expand functionality, add new features and mapping capabilities, incorporate range and ecosystem monitoring metrics, provide training and user support, and other benefits to grazing systems management.

## ESTIMATE OF GHG EMISSION REDUCTIONS

| Priority Measure/Project | Cumulative GHG emission reductions (MMT $CO_2e$) | |
|---|---|---|
| | By 2030 | By 2050 |
| Soil carbon sequestration | 0.60 | 6.0 |

*Quantification tool(s) utilized:* SNAP-graze, COMET

Assumption: 0.5 tons CO2 per year is a conservative average given a progressive grazing system prioritizing rest, implemented on degraded rangelands in the West

## KEY IMPLEMENTING AGENCY OR AGENCIES

MT Department of Agriculture

## IMPLEMENTATION SCHEDULE AND MILESTONES

Year 1: hire and deploy agent to conduct outreach and implementation activities.
Years 2-5: continue recruitment efforts and increase the number of Montana acres utilizing regenerative management practices to increase soil carbon sequestration

## GEOGRAPHIC SCOPE

Statewide.

## METRICS FOR TRACKING PROGRESS

Number of acres under monitored management.
Progress measured by participating ranches as reported by key rangeland health metrics, including increased stocking density, decreased pasture size, decreased graze period length, increased number of pastures, greater water source availability, longer recovery periods, etc.

## FUNDING

$10M Data Driven Ranchland Stewardship Program

- Launch a map-based web application tool to support the implementation of regenerative ranching practices.
- Software functionality build-out and user onboarding, training, and technical support.

- On-the-ground practice training and support; peer networking
- Infrastructure planning and build-out (water wells, pipelines, tanks; fence replacement, improvement; virtual fence; labor needs for infrastructure as well as stock management)

Intersection with Other Funding*:* Estimated private capital investment, donations, and user fees to aid in the development, design, and deployment of software monitoring tool and user outreach and onboarding is estimated to exceed $20 million.

**IMPACTS ON LOW-INCOME AND DISADVANTAGED COMMUNITIES**

See discussion under Measure 3.

**AUTHORITY TO IMPLEMENT**

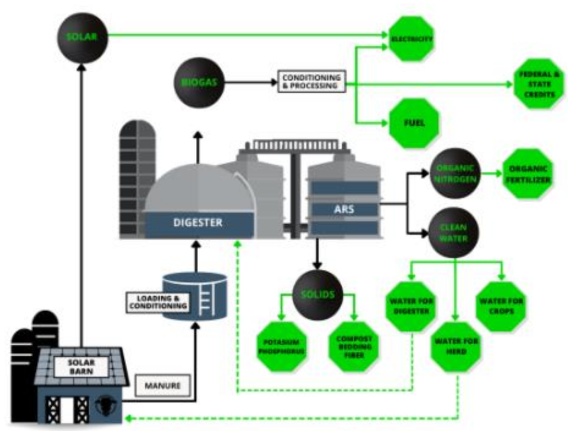
**80-1-102. Duties of department.** The department shall encourage and promote the interests of agriculture, including horticulture and apiculture, and all other allied industries.

## Measure 3. Incentivize Innovation in the Cattle & Beef Industry

This measure would leverage private investment in pilot project upgrades in the beef industry to achieve higher industry standards in the supply chain as a model for locations across Montana and in other states across the west.

The project includes equipment upgrades and use of web-based planning and documentation tools to improve efficiency and reduce the environmental impacts of the beef supply chain through capture and reuse of methane gas, implementation of renewable energy systems, processing and marketing of organic fertilizer by-products to cut waste and augment the health of the soil.

Manure and composted agri-food wastes can play an important role in carbon sequestration when properly applied to the landscape, as well as offsetting other GHG emissions in the agri-food system. Digesters, an example of which is seen on the right, and scaled composting could play a role in diverting GHG-emitting wastes from landfills from meat and food processing enterprises, as rendering opportunities in Montana are non-existent.




Opportunities exist within current manure management best practices for animal feeding operations (AFOs) to a) utilize manure and compost for beneficial agronomic use and carbon sequestration with greater efficiencies, b) through composting, drying, and solid separation, reduce the volume of manure stored and fractionate nutrients to improve transportation and use efficiencies, and c) incentivize voluntary strategic manure management and planning on smaller AFOs.

While there are overarching principles, manure nutrient management practices are best deployed in a strategic site- or operation-specific manner. In some cases, application of raw manure harvested from the AFO is advisable, particularly to preserve nitrogen. In other cases, composting or drying may be advisable to reduce weight and volume of the manure and concentrate phosphorus. Manure management and processing practices can be catered to support diverse uses on the landscape beyond crop production such as remediation and reclamation, green industry and turf farming, and erosion and sediment control.

In general, strategies for manure use and transformation processes depend on access to information, appropriate consulting, and necessary infrastructure and equipment. Technical assistance, manure handling facilities, and equipment should be fundable. Strategic manure management, even with traditional technologies can improve soil quality/health by sequestering carbon, reduce transportation costs and emissions for certain commercial fertilizers, support strategic and economic use of commercial fertilizers in concert with manure, and support closed loops of nutrient and carbon cycling with fewer losses to the environment.

Since EPA's first implementation of manure anaerobic digester incentives (EPA AgSTAR), technologies have improved to make deployment of digesters feasible for a broader set of agri-food waste management applications. Manure, animal mortalities, and offal and butchering wastes are examples of organic waste streams that can be managed by digester technologies. Incentives to design and deploy the right digester technology for an enterprise can address specific waste management needs and costs, reduce GHG emissions, and recover energy.

Manure management strategies and technologies can:

- Support addition of manure- and food-waste based carbon to the soil.
- Improve efficiencies of transportation and land application.
- Fractionate phosphorus and nitrogen for more strategic uses and transportation efficiencies.
- Reduce or offset GHG emissions from the crop and soil fertility supply chain.
- Integrate with strategic use of commercial fertilizers.
- Improve water quality and climate outcomes simultaneously.

**<u>ESTIMATE OF GHG EMISSION REDUCTIONS</u>**

| Priority Measure/Project | Cumulative GHG emission reductions ($MMT\ CO_2e$) | |
|---|---|---|
| | By 2030 | By 2050 |
| Methane gas capture technology or feed efficiency improvements* | 0.07 | 0.42 |
| Renewable energy systems (Source: DOE Annual Technology Baseline) | 0.0031 | 0.0155 |
| Organic fertilizer production (per 100,000 acres) | 0.10 | 0.60 |
| **TOTAL** | **0.1731** | **0.6575** |

*Quantification tool(s) utilized: See table; see Appendix B for discussion of assumptions.*

**<u>KEY IMPLEMENTING AGENCY OR AGENCIES</u>**

MT Department of Agriculture

**<u>IMPLEMENTATION SCHEDULE AND MILESTONES</u>**

Year 1: Develop grant program and possibly hire third party
Year 2: Deploy grant funding
Year 3: Conduct Monitoring and Reporting Activities
Year 4: Deploy remaining grant funding
Year 5: Conduct Monitoring and Reporting Activities

**<u>GEOGRAPHIC SCOPE</u>**

Statewide.

**<u>METRICS FOR TRACKING PROGRESS</u>**

Increase in number of reduced-emission cattle feeding operations in MT
Increase in the number of cattle fed in reduced-emission environments in MT
Increase in digesters and other innovative technological measures utilized
Reduced transportation costs and emissions from cattle exports and fertilizer imports
Increase in strategic and economic use of commercial fertilizers in concert with manure

**<u>FUNDING</u>**

$10M Livestock Emissions Reduction Program

- Grants for equipment and infrastructure that increases livestock production on animal feed operations leveraging reduced emissions technology
- Opportunity to adopt innovative cattle feed model
- Other funding: Yes. 50% cost share (1:1 match requirement)

This measure intends to serve as a complementary source of funding to those streams that already exist to aid in methane abatement and anaerobic digestion installation. Federal funding sources such as USDA REAP, USDA NRCS EQIP, and ARRA Section 1603 all exist to fund installation of anaerobic digestion, while this measure intends to fund installation of pollution and odor controls, as well as permitting and grant staff capacity. Identified as hurdles to implementation of methane abatement technology and installation, community concerns around odor, pollution, and water runoff issues can be a primary prohibitor in large-scale implementation of methane abatement strategies.

Estimated private industry-driven capital investment in the planning, design and installation of critical infrastructure development is estimated to exceed $50 million.

**IMPACTS ON LOW-INCOME AND DISADVANTAGED COMMUNITIES**

*For Agricultural Measures 2 & 3:*

The environmental impact of food production is significant, and this can be especially concerning for those in low-income and disadvantaged communities who have historically faced a greater burden of the adverse effects of air, water, and soil pollution.

The state of MT has working relationships with several local and regional tribal government agencies, NGOs, and other entities interested in pursuing similar climate-related interests. This will enable us to readily engage these partners to build programming that will be beneficial to their members and communities as well.

By implementing innovative operational practices and embracing emerging technologies, the agriculture sector can reduce its greenhouse gas footprint. Practices such as those proposed here - precision farming and improved livestock management – can enhance efficiency and mitigate emissions. Advanced waste treatment minimizes environmental impacts by capturing resources before they become pollution, producing renewable energy, clean water, and precision low-carbon and organic fertilizers.

Adopting these advancements not only promotes sustainability but also addresses the disproportionate effects of emissions on vulnerable communities.

**AUTHORITY TO IMPLEMENT**

**80-1-102. Duties of department.** The department shall encourage and promote the interests of agriculture, including horticulture and apiculture, and all other allied industries.

## Measure 4. Reduce Nonpoint Sources of Pollution and Associated Algal Blooms

This measure proposes to support local efforts to sustainably reduce the prevalence of algal blooms, thereby reducing their associated greenhouse gas emissions, by increasing funding available to implement nutrient pollution reduction projects. Such projects may include septic system improvement programs; floodplain, wetland, and riparian restoration; and grazing management planning.

Climate change, algal blooms, nutrient pollution, and greenhouse gas emissions are caught in an intensifying loop. Montana's growing seasons are becoming longer and warmer, creating more favorable conditions for toxic or excessive algal growth in lakes and rivers. Besides the harm to aquatic life, recreation, agriculture, and drinking water that algal blooms create, studies estimate that freshwater cyanobacteria contribute 1.5% of the global anthropogenic $CO_2$-equivalent emissions,[18] a magnitude equivalent to 20% of fossil fuel emissions.[19]

Nonpoint sources of pollution are the largest cause of water quality impairments in Montana.[20] Sustainably reducing the prevalence of algal blooms, thereby reducing their associated greenhouse gas emissions, requires reducing nutrient pollution. This has the co-benefit of also reducing the energy and associated emissions required to treat drinking and wastewater.

### Estimate of GHG Emission Reductions

The paradigm of addressing nonpoint source pollution and associated climate change requires remedying multiple dispersed small pollution sources to result in a cumulative impact.

Emission reduction estimates below are quantified using the nutrient load reductions that are already reported under the §319 Nonpoint Source Grant Program and extrapolating those values to greenhouse gas emission reductions using existing literature values.[21] Emission estimates in the table below are based off nine recently completed projects. These calculations focus on emissions from water surface. In the future, Montana would like include the climate benefits of the terrestrial component of projects where woody vegetation on riparian floodplains are restored.

| Priority Measure | Cumulative GHG Emission Reductions ($MMT\ CO_2e$) | |
|---|---|---|
| | By 2030 | By 2050 |
| Reduce nonpoint source nutrient pollution | $4x10^{-9}$ | $2x10^{-8}$ |

*Quantification tool(s) utilized: https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator#results*

### Key Implementing Agency or Agencies

DEQ Nonpoint Source and Wetlands Program and their local government and nonprofit partners.

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[18] *B Deemer et al. (2016). [Greenhouse Gas Emissions from Reservoir Water Surfaces: A New Global Synthesis](https://doi.org/10.1093/biosci/biw117)*, BioScience, *66* https://doi.org/10.1093/biosci/biw117

[19] *T DelSontro et al. (2018). Greenhouse gas emissions from lakes and impoundments: Upscaling in the face of global change. Limnol Oceanogr Lett, 3: 64-75.* https://doi.org/10.1002/lol2.10073

[20] Watershed Protection Section. 2017. Montana Nonpoint Source Management Plan. Helena, MT: Montana Dept. of Environmental Quality.

[21] J Beaulieu et al. (2019). "Eutrophication will increase methane emissions from lakes and impoundments during the 21st century," Nat Commun, **10**(1375), available from https://doi.org/10.1038/s41467-019-09100-5.

DEQ's Nonpoint Source and Wetlands Section has a decades long history of leading nonpoint source pollution reduction and wetland conservation. Examples of nutrient pollution reduction projects that the Nonpoint Source and Wetlands Section funds include septic system improvement programs; floodplain, wetland and riparian restoration; and grazing management planning. Climate Pollution Reduction Grant funded will be passed through from DEQ to local governments and non-profits to implement nonpoint source pollution reduction projects.

#### IMPLEMENTATION SCHEDULE AND MILESTONES

Calls for applications for nutrient reduction projects would be issued January 2025 and 2026 and contracts awarded under those calls would conclude by 07/31/2029.

#### GEOGRAPHIC SCOPE

Projects funded by the Nonpoint Source and Wetlands Section traditionally are located in watersheds with a DEQ-approved Watershed Restoration Plan.[22] This program also provides technical and financial support statewide to develop Watershed Restoration Plans.

Available funding under each Call for Applications is typically split between "Focus Watersheds" and all other eligible projects.[23]

#### METRICS FOR TRACKING PROGRESS

- Number of projects implemented
- Amount of match funding leveraged
- Nitrogen and phosphorus load reductions
- Miles of stream/acres of wetlands restored
- Number of people reached through E&O efforts

#### FUNDING

Cost estimates for implementation - $1 million/year ($5 million)

The existing nonpoint source pollution reduction grant program is primarily funded with Federal §319 dollars. This funding requires a 40% non-federal match, and our partners are accustomed to providing this through in-kind, cash, state grants, or foundational support. During the 2023 legislative session, House Bill 6 provided $1,000,000 to DNRC for nonpoint source pollution reduction projects, and this has been passed on to the DEQ Nonpoint Source and Wetland Program. These funds can be used to help meet the Federal 40% match requirement or reduce the overall amount of match required (see our most recent Call for more information). Any unspent funds resulting from our current Call for Applications will be available under our 2025

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[22] View a map of watersheds with DEQ-approved Watershed Restoration Plans at: https://gis.mtdeq.us/portal/apps/webappviewer/index.html?id=b8bd98aca20040048850803c46873b3c.

[23] As an example, DEQ's most recent call for applications can be viewed online here: https://deq.mt.gov/files/Water/WQPB/Nonpoint/2024-Round2/CALLFORAPPLICATIONS_2024R2.pdf.

Call. DEQ and DNRC will advocate for this same infusion of state dollars during the 2025 legislative session.

#### Impacts on Low-Income and Disadvantaged Communities

Combining CPRG funding with §319 Nonpoint Source funding enables better targeting this resource to communities experiencing environmental injustice because both programs have a shared environmental justice initiative.

Through watershed-based planning, community and stakeholder engagement has long been a cornerstone of these §319 projects, ensuring that those affected have a voice in the process. Priority will be given to projects in the state, regardless of geographic location, that benefit disadvantaged communities.

#### Authority to Implement

§319 of the Federal Clean Water Act and the Montana Water Quality Act (MCA 75-5).

## Clean, Reliable Transportation

Montana is the fourth largest state in the U.S., yet it is also the third least densely populated state, averaging about 7 people per square mile. Much of the eastern third of the state has on average, less than one resident per square mile. Given Montana's size and sparse population spread, it makes sense that the transportation sector accounts for nearly 8 million metric tons of GHG emissions per year, or about 15% of the state's total in 2019 (DEQ's baseline year).

According to the MT Department of Transportation's (MDT) Carbon Reduction Strategy (CRS), transportation-related CO2 emissions can be significantly reduced through a variety of strategies aimed at reducing congestion, increasing non-motorized infrastructure investments, expanding public transportation, increasing truck parking, pursuing fleet electrification, supporting the use of zero-emission construction equipment and sustainable materials, and improving energy efficiency.

### Measure 1: Strategic Conversion of Fleet Vehicles to Cleaner Alternatives

This measure proposes to leverage private and public sector investments in cleaner vehicle fleets with voluntary, non-regulatory, incentive-based financing or rebate programs. This measure would provide financing or matching grant funds for strategic conversion or replacement of fleet vehicles with alternative fueled or electric power models, including but not limited to school and transit buses and vans, delivery vehicles, local government fleet vehicles, and utility service equipment. Replacement or upgrades of locomotive engines to more efficient and cleaner technology would also be eligible. Eligible projects may also include funding for fleet charging or fueling infrastructure, with priority given to managed charging or grid-integrated charging systems that improve grid resiliency, and technical assistance to support vehicle replacement projects to ensure well-planned and executed vehicle replacements, and to maximize the cost savings of participating entities.

This measure would augment private and public sector investment in cleaner vehicle technology. Existing incentive programs include EPA's Clean School Bus Program, and DEQ's Clean Transportation Program, which historically has provided pass-through EPA Diesel Emissions Reduction Act and Volkswagen Settlement funding to public and private entities for the replacement of older diesel vehicles and equipment with alternative fuel, cleaner diesel, and electric models. Existing programs have demonstrated the suitability of alternative fuel and electric transit bus, school bus, and airport equipment replacements under a variety of use cases and have shown the value in providing technical assistance to maximize cost savings of participating entities, and to ensure the effective deployment of electric models. This measure encompasses inventive financing for vehicle replacements or conversions, paired with charging/fueling infrastructure, and technical assistance to support the early-stage adoption of cleaner fuel and electric vehicle replacements.

### ESTIMATE OF GHG EMISSION REDUCTIONS

Emissions impacts would vary depending on the number and type of vehicles replaced.

| Priority Measure | Cumulative GHG Emission Reductions (MMT $CO_2e$) | |
|---|---|---|
| | By 2030 | By 2050 |
| Strategic Conversion of Fleet Vehicles to Cleaner Alternatives (Life-cycle petroleum GHGs vs. WECC) | | |
| School Buses (per 10) | 0.0010 | 0.006 |
| Transit Buses (per 10) | 0.0043 | 0.025 |
| Refuse Trucks (per 10) | 0.0065 | 0.036 |
| Delivery Vans/Light Commercial Truck (per 10) | 0.0008 | 0.004 |
| Sedan (per 10) | 0.0002 | 0.0009 |
| 1/4-ton Pickup (per 10) | 0.0002 | 0.0012 |
| Switcher Locomotive Engine (per 1) | 0.0009 | 0.0046 |
| **Total** | **0.014** | **0.077** |

*Tools: Argonne National Lab AFLEET Tool*

### KEY IMPLEMENTING AGENCY OR AGENCIES

To be determined but may include the Montana Department of Environmental Quality's Energy Bureau, which is currently implementing the State's allocation of Volkswagen Settlement Funding, providing technical assistance for deployment of electric school buses, and managing EPA Diesel Emissions Reduction Act funding for the state.

### IMPLEMENTATION SCHEDULE AND MILESTONES

To be determined depending on implementing agency.

### GEOGRAPHIC SCOPE

Statewide with priority for investments in low-income and disadvantaged communities.

#### Metrics for Tracking Progress

Metrics would vary depending on the type of projects implemented through this measure, but could include the following:

- Number and type of vehicles deployed with CPRG funding;
- Operational cost savings for participating entities;
- Reduction in GHG emissions;
- Reduction in criteria air pollutants; and,
- Matching funds leveraged.

#### Funding

Minimum anticipated funding required to implement this measure would be $5 million to $25 million. CPRG funding would complement the existing $12.6 million Volkswagen Settlement funding administered by DEQ's Energy Bureau, and the $5 billion EPA Clean School Bus Program. Demand for vehicle replacement funds is expected to significantly outstrip the funding currently available to Montana entities.

#### Impacts on Low-Income and Disadvantaged Communities

Prioritization of vehicle replacements and conversions in low income and disadvantaged communities will have the benefit of reducing local air quality impacts from the transportation sector, including the direct exposure of bus passengers to diesel exhaust. Implementation of this measure would also facilitate the deployment of innovative transportation technologies in low-income and disadvantaged communities, including associated operation and maintenance jobs.

#### Authority to Implement

Montana's transportation energy policy (90-4-1010, MCA) promotes "actions that encourage the conservation of energy through the environmentally responsible management and planning of efficient transportation systems." Montana's alternative fuels policy (90-4-1011, MCA), "encourages the use of alternative fuels and fuel blends to the extent that doing so produces environmental and economic benefits to the citizens of Montana."

Implementation of this measure by DEQ would be consistent with similar pass-through funding programs administered by DEQ's Energy Bureau. DEQ is designated as the lead agency to administer the Volkswagen Environmental Mitigation Settlement. Additionally, DEQ administers the Diesel Emission Reduction Act (DERA) State funding allocation from EPA.

## Industrial & Power Sector Innovation

Montana businesses are stewards of a healthy environment and often drive creative solutions to big issues. Historic levels of federal funding may open the doors to innovative, cutting-edge technologies that improve business processes while also improving air quality in our communities. Businesses in the power sector seek to improve reliability of the electric grid and reduce customer outages. Measures in this focus area propose to support innovative projects that increase industrial efficiency, support communities, and reduce pollution.

The industrial sector includes a diverse range of sources, including cement plants, refineries, manufacturers, oil and gas producers, mining operations, metal fabricators, and food processors. The industrial sector leads Montana's end-use energy consumption, accounting for about 30% of the state's total.[24]

Decarbonizing industrial facilities will benefit low-income and disadvantaged communities where many of the industrial facilities are located. Achieving this goal will primarily depend upon replacing or reducing existing fossil fuel use with a mix of electrification, solar thermal heat, biomethane, low- or zero-carbon hydrogen, and other low-carbon energy to provide energy for heat and reduce combustion emissions. Emissions also can be reduced by implementing energy efficiency measures and using substitute raw materials that can reduce energy demand and some process emissions.

## Measure 1. Investment and Improvement in Electric Grid Technology

This measure includes projects that increase transmission and distribution system efficiency, that provide transmission service for new renewable energy generation, and improve integration and management of variable renewable energy supplies, including through the deployment of innovative energy storage systems, microgrids, or other technology.

This measure would support investments in innovative grid technology that improve the reliability and resiliency of the transmission and distribution system in the face of extreme weather events, growing demand for electricity, and increased development of variable renewable energy supplies.

Implementation of this measure could be in the form of voluntary matching grant funds to utilities, transmission operators, and others to support investments in innovative electric grid technology solutions that improve the reliability and resiliency of the transmission and distribution system, while simultaneously reducing power sector emissions. This measure would augment the existing Grid Resilience and Reliability Grants Program, funded by the U.S. Department of Energy (DOE) and administered by DEQ's Energy Bureau. Projects eligible for funding would include but not be limited to investments in electric grid technology, including measures that increase transmission system efficiency, that provides transmission service for new renewable energy generation, and improves integration and management of variable renewable energy supplies, including through the deployment of innovative energy storage systems, microgrids, or other technology.

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[24] *Montana State Profile and Energy Estimates, U.S. Energy Information Administration, April 20, 2023,* *https://www.eia.gov/state/analysis.php?sid=MT#:~:text=The%20industrial%20sector%20leads%20Montana's,commercial%20sector%20accounts%20for%2019%25.*

### Estimate of GHG Emission Reductions

| Priority Measure | Cumulative GHG Emission Reductions (MMT $CO_2e$) | |
|---|---|---|
| | By 2030 | By 2050 |
| Investment and Improvement in Electric Grid Technology | 5% - 33% efficiency per GW-mi (see text in Appendix B) | |
| *Enables increased renewable energy development (e.g., via storage systems):* | | |
| Utility-Scale Solar PV (100 MW) | 0.7 | 3.4 |
| Utility-Scale Wind (100 MW) | 0.8 | 3.6 |
| **TOTAL** | **1.49** | **7.02** |

*Tools: EPA AVERT Tool*

Emissions impacts would vary depending on the type of measures implemented. Examples of grid technology measures that would deliver emissions reductions include transmission reconductoring or other efficiency improvements that reduce line losses; and, technology deployment, including energy storage systems, that enables the reliable integration of more renewable energy integration throughout the transmission system. These measures would reduce emissions by increasing the reliable integration of renewable energy generation, and by reducing total energy generation necessary to meet demand.

### Key Implementing Agency or Agencies

To be determined but may include the Montana Department of Environmental Quality's Energy Bureau, which is currently implementing the State's allocation of formula funding awarded through the U.S. Department of Energy's Preventing Outages and Enhancing the Resilience of the Electric Grid Formula Grant Program. CPRG-funded grid resiliency measures could be funded by DEQ in parallel with the DOE-funded program, or by another agency or eligible entity.

### Implementation Schedule and Milestones

To be determined depending on implementing agency.

### Geographic Scope

Statewide with priority for investments in low-income and disadvantaged communities most vulnerable to grid outages.

### Metrics for Tracking Progress

Metrics would vary depending on the type of projects implemented through this measure, but could include the following:

- Improvements in electricity sector reliability, including reduced customer outages.
- Megawatt hours (MWh) of electricity saved and tons of GHG emissions avoided through transmission efficiency upgrades.

- Megawatt (MW) and MWh capacity of energy storage systems deployed and associated net reduction of GHG emissions from emitting sources.
- MW of renewable energy generating capacity implemented through transmission expansion or integration measures deployed and associated net reduction of GHG emissions from emitting sources.
- Matching funds leveraged.

#### FUNDING

Minimum anticipated funding required to implement this measure would be $5 million to $25 million. CPRG funding would complement the existing $35 million Grid Resilience Grant program administered by DEQ's Energy Bureau. Demand for grid resilience measure funding is expected to significantly outstrip the DOE funding awarded to Montana to-date.

#### IMPACTS ON LOW-INCOME AND DISADVANTAGED COMMUNITIES

Low income and disadvantaged communities are among those most vulnerable to power outages. The projects supported through this measure would not only improve the reliability and resilience of Montana's electric grid but will also provide the opportunity to stimulate investments in Montana communities and create good paying jobs for Montanans. Further, projects implemented under this measure can bring benefits to communities that are in need of additional infrastructure investment such as Montana's most rural and remote communities or those serving low-income communities.

#### AUTHORITY TO IMPLEMENT

Implementation of this funding by the DEQ's Energy Bureau would be consistent with similar pass-through funding programs administered by the office. DEQ has been designated by Governor Gianforte as the lead agency to administer the DOE-funded Grid Resilience and Reliability Grant Program.

The program could be administered under the authority provided to DEQ in 90-4-1005, MCA, to provide an energy development and demonstration grant program.

### Measure 2: Incentivize Industrial Process Efficiencies

This measure includes potential projects to support or incentivize GHG reductions in industrial energy use and industrial processes, by encouraging deployment of energy efficiency, fuel-switching, and innovative technologies and strategies to reduce industrial emissions. This measure could fund industrial decarbonization efforts across Montana's manufacturing sector, including chemicals, metals, food and beverages, and nonmetallic minerals, such as cement, glass, electronics, pharmaceuticals, and related support facilities. **Figure 3**, on the following page, shows the top manufacturing sectors in Montana.

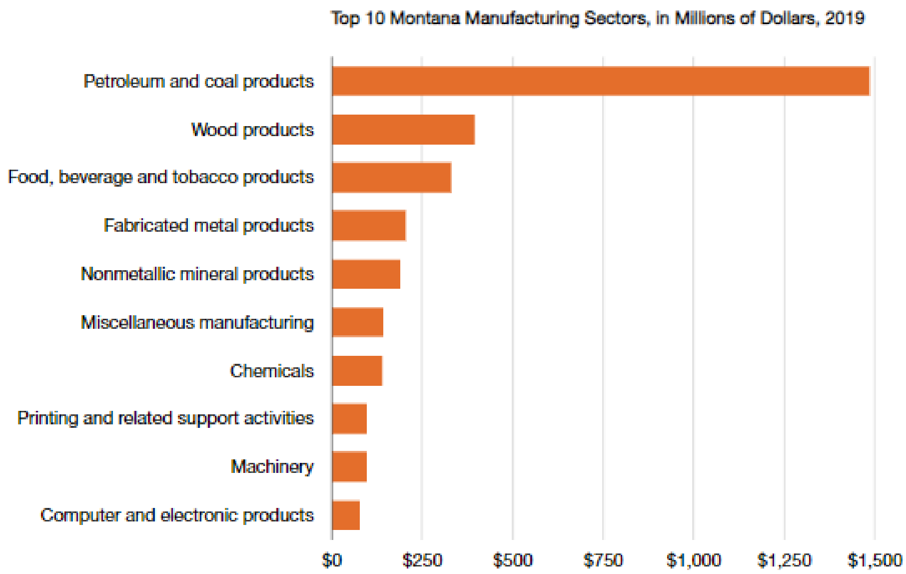


**Figure 3. Montana's Top 10 Manufacturing Sectors, in Millions of Dollars, 2019**[25]

While the decarbonization technologies and practices supported by this measure would vary, they could include – but are not limited to - renewable energy generation, energy efficiency, and load, or demand, flexibility. Funding could be used to provide financial incentives for energy audits and efficiency improvements, as well as electrification of process heat equipment.

With CPRG funding, new projects could accelerate the decarbonization of Montana's industry; ensure substantial and lasting GHG reductions; provide reliability benefits to local electricity grid operations; and reduce air pollution, particularly for low-income. Last Best PACE, the State's C-PACE program, is an innovative clean energy financing tool that provides 100% upfront capital to property owners who want to upgrade their buildings with energy efficiency, renewable energy, and water management systems. While designed primarily for commercial buildings, C-PACE could be applied to industrial facilities. C-PACE is also discussed in more detail in the next section.

The following example actions are illustrative and not intended to be exhaustive of all actions that could be used to implement this measure:

- Provide financing (such as C-PACE) to help property owners upgrade buildings with energy efficiency, renewable energy, and water management systems.
- Support fuel switching including electrification of common end uses, electrification of industrial processes, and use of low-carbon fuels (e.g., hydrogen, RNG) for hard-to electrify processes.

[25] Montana Manufacturing Facts, National Association of Manufacturers, accessed 02/21/2024, available at https://nam.org/state-manufacturing-data/2021-montana-manufacturing-facts/

- Expand incentive programs to encourage energy efficiency and/or emissions reductions measures through financial incentives as well as services such as energy audits and related site assessments and project development services.

#### Estimate of GHG Emission Reductions

To be calculated by eligible entities that wish to apply for implementation funding.

#### Key Implementing Agency or Agencies

Eligible entities that wish to apply for implementation funding.

#### Implementation Schedule and Milestones

To be determined by eligible entities that wish to apply for implementation funding.

#### Geographic Scope

To be determined by eligible entities that wish to apply for implementation funding.

#### Metrics for Tracking Progress

Potential metrics to measure progress under this measure could include the following:

- Changes in carbon intensity per unit output/product produced.
- Financing/incentives used.
- GHG emissions of large point sources over time (e.g., are reported through the EPA Greenhouse Gas Reporting Program)

#### Funding

Cost is dependent on location and scope of project and will thus be determined by eligible entities that wish to apply for implementation funding.

Additional funding sources identified to date for actions under this measure include the following:

- Commercial Property Assessed Clean Energy (C-PACE) Program: Montana's C-PACE Program is authorized by the Montana PACE Authority. C-PACE provides 100% upfront capital to property owners who want to upgrade their buildings with energy efficiency, renewable energy, and water management systems.
- EPA National Clean Investment fund and the Clean Communities Investment Accelerator: This funding will provide competitive grants to non-profit organizations to provide accessible, affordable financing for clean technology projects across the country, particularly for LIDAC communities.

#### Impacts on Low-Income and Disadvantaged Communities

Expanding and incentivizing innovation will help Montana's industrial sector adapt as demand for lower carbon materials continues to grow. Innovation will yield to the creation of manufacturing jobs that will once again ensure disadvantaged communities have increased access to high quality, good paying career opportunities. This enhanced economic benefit is coupled with tangible environmental and public health benefits that come from implementing production methods that result in lower emissions of carbon dioxide and co-pollutants.

**Authority to Implement**

To be determined by eligible entities that wish to apply for implementation funding.

## High Performance Homes & Businesses

Montana's temperature extremes and small population contribute to the state's residential sector having the highest per capita energy consumption of any state.[26] Montana's residential sector makes up 23% of the state's energy use.[27] Historic funding opportunities are available for home and business owners to retrofit and improve the efficiency of their buildings. Energy efficiency improvements cut out-of-pocket costs at a time when inflation and other pressures are stressing small businesses and making it increasingly difficult to afford housing. Such measures are a fit for CPRG because they also reduce the GHG emissions associated with the residential and industrial sectors.

Measures in this package would build on existing opt-in grant, loan, and rebate programs across state government to increase the funding available and reduce barriers to Montanans seeking to access the funds. CPRG funds could be used to boost funding in areas where it is most needed to improve the lives of Montanans. For example, DEQ already contracts with local air pollution control agencies and could increase funding for strictly voluntary woodstove replacements to improve indoor air quality and reduce emissions in low income and rural communities in Montana's western valleys, where wintertime inversions trap emissions and degrade air quality.

### Measure 1. Improve Efficiency of Government, Nonprofit, and Commercial Buildings and Operations

This measure focuses on incentivizing the adoption of energy efficiency measures in government-owned, commercial, and nonprofit buildings and operations. Specific projects could include the deployment of on-site renewable energy generation paired with back-up energy storage systems, energy audits, strategic energy management, and equipment upgrades.

One project to advance energy efficiency efforts in Montana is proposed by 'Last Best PACE,' Montana's Commercial Property Assessed Capital Enhancements (C-PACE) program.

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[26] U.S. Energy Information Administration, Montana State Energy Profile, https://www.eia.gov/state/print.php?sid=MT, April 20, 2023.

[27] U.S. EIA, State Energy Data System, Table C11, Total Energy Consumption Estimates by End-Use Sector, Ranked by State, 2020.

To be eligible for the C-PACE program, property owners must have an Energy Audit completed for their energy efficiency improvements and/or utilize renewable energy solutions projects, followed by Independent Third-Party Reviews (ITPR). These can be cost-prohibitive to many Montana businesses. The Department of Commerce's Montana Facility Finance Authority (MFFA), the administrator of the MT C-PACE program, would use CPRG funds to help cover the costs of those required Energy Audits and ITPRs for eligible properties. Specific requirements will be developed outlining the use of the funds to align with CPRG, and support CPRG program goals. The C-PACE program would also develop and follow any required monitoring and reporting required by the CPRG program.

### Estimate of GHG Emission Reductions

| Priority Measure | Cumulative GHG Emission Reductions (MMT $CO_2e$) | |
|---|---|---|
| | By 2030 | By 2050 |
| Improve Efficiency of Government, Nonprofit, and Commercial Buildings and Operations | Variable (see text in Appendix B) | |

*Tools: Energy Star Portfolio Manager; EPA AVERT Tool*

Energy audits play a crucial role in improving the performance and sustainability of infrastructure, by informing businesses and individuals how to achieve better energy performance. The audits themselves do not directly result in GHG emissions, however, so quantification is not provided for this enabling measure.

Emission reductions from other efforts under this measure will be calculated by eligible entities that wish to apply for implementation funding.

### Key Implementing Agency or Agencies

The MT C-PACE program, which launched in 2022, is administered by MFFA. MFFA was created in 1983 by the Montana Legislature. MFFA will utilize and expand its existing partnerships with organizations such as Certified Regional Development Corporations (CRDCs), Economic Development Organization (EDOs), Chambers, Business Improvement Districts, etc., to market and implement this opportunity.

Other governmental entities may wish to also apply for implementation funding to carry out other projects under this measure.

### Implementation Schedule and Milestones

The Energy Audits and ITPRs for the C-PACE program will require little ramp up time before funds can be utilized. The program expects to produce 15 Energy Audits and 20 ITPRs per year for each of the five years of the award time period.

Additional schedules and milestone for other projects will be determined by governmental entities that wish to apply for implementation funding.

#### Geographic Scope

The Energy Audits and ITPRs for the C-PACE program will be made available to eligible businesses in cities and counties in Montana that have established a C-PACE District. A map of current districts can be found here: https://lastbestpace.com/Program-Details/Map. An estimated 60% of commercial building stock is in a C-PACE-eligible area with additional local governments pursuing the adoption of C-PACE Districts.

The geographic scope of other efforts will be established by governmental entities that wish to apply for implementation funding for additional projects.

#### Metrics for Tracking Progress

C-PACE: Increase in number of Energy Audits and Independent Third-Party Reviews.

Additional metrics for other projects under this measure will be established by governmental entities that wish to apply for implementation funding.

#### Funding

Estimated breakdown of costs to cover required Energy Audits and ITPRs for the MT-CPACE program:

• Energy Audits: 15 projects per year at $20,000 for 5 years
• Independent Third-Party Reviews (ITPR): 20 projects per year at $5,000 for 5 years

Funding for additional projects under this measure needs to be established by governmental entities that wish to apply for implementation funding for other projects under this measure.

#### Impacts on Low-Income and Disadvantaged Communities

The C-PACE program is available to Montana businesses like farms and ranches, commercial office buildings, nonprofit organizations, and even multi-tenant buildings of 4 units or more. This program provides much-needed access to capital for critical building upgrades, which in turn provides improved access to jobs and career advancements.

Based on the specific energy conservation measures and/or renewable energy systems the property owner plans to install, the required Energy Audit costs can range from $5,000 to $30,000. In addition, MT C-PACE requires an ITPR to verify the information in the Energy Audit. A basic "desk ITPR" can cost approx. $1,500 to $3,500, with a more involved ITPR costing as much as $10,000. These initial costs can be prohibitive to the small business owner in Montana wanting to make energy-efficient improvements to their property utilizing the MT C-PACE program.

Furthermore, the program is tax neutral with no financial exposure to local governments. Finally, energy efficiency investments promote local jobs.

The EPA estimates that 30% of energy used in commercial and industrial buildings is wasted. This can be greater for small businesses renting space in older, poorly maintained buildings. Single owner, multi-family residential buildings face this same issue. The impact is that small businesses and families spend more money just to keep their places livable. Energy upgrades directly benefit low-income residents and small businesses by reducing energy consumption, resulting in decreased electric bills.

As buildings are improved, it is possible that property values will be reassessed, and property tax liability may increase. Eco-gentrification is also a possibility when investment in low-income areas increases the desirability of the area. Caution must be taken to avoid landlords increasing rents for current residents which will offset the saving realized from electrification upgrades. The economic benefit of increased employment opportunities will only stay within these communities if local residents are able to be hired for the work performed. The Montana C-PACE statute, MCA 90-4-1305, requires a preference for Montana labor in any skilled labor contracts. Training and apprenticeship programs should be supported and possibly also funded by CPRG.

#### AUTHORITY TO IMPLEMENT

The Montana State Legislature enabled C-PACE in 2021, under Title 90, Part 4, Chapter 13 of the Montana Code Annotated, which authorized the creation of a Commercial Property-Assessed Capital Enhancements (C-PACE) program to be administered by the Montana Facility Finance Authority. This C-PACE program, now known as the Last Best PACE Program, went into effect January 1, 2022. Local governments, following the appropriate municipal process, must authorize participation in MT C-PACE. This is a simple, one-time process typically done at the county level, though cities can move forward with the process as well. Once the program is established at the local level, eligible property owners can begin applying to participate.

## Measure 2. Low-Emission Home Heating Incentives

This measure would support voluntary city or county-managed programs to provide funding for low emission heating sources that will complement or replace inefficient wood burning stoves, especially in areas with compromised air quality.

The purpose of this measure is to provide practical GHG reduction measures in what are primarily low income/environmental justice communities across Montana. In much of rural Montana, a significant if not primary source of GHG emissions, as well as other criteria pollutants, are wood-burning stoves, which provide a relatively inexpensive source of heat during the winter months. Wood burning stoves are often utilized in rural parts of Montana where alternative, more efficient, sources of heat are not readily available or affordable. This grant opportunity would provide funding for cities or counties to implement residential burning stove supplement and/or change out programs, with low emission heat pumps or other low emission heat sources. In addition to GHG reductions, this measure would provide significant reductions to criteria pollutants such as PM2.5 and NOx.

This measure would align with DEQ implementation of the U.S. Department of Energy-funded High-Efficiency Electric Home Rebate (HEEHRA) program and provide focus/support to counties with compromised air quality.

## Estimate of GHG Emission Reductions

| Priority Measure | Cumulative GHG Emission Reductions ($MMT\ CO_2e$) | |
|---|---|---|
| | By 2030 | By 2050 |
| Low Emission Home Heating (Woodstove Change Out) per 50 stove/ASHP replacements | 0.018 | 0.093 |
| Low Emission Home Heating (Supplemental Heating: 90% ASHP; 10% Stove) per 50 stove/ASHP supplementation | 0.014 | 0.073 |
| Low Emission Home Heating (Supplemental Heating: 80% ASHP; 20% Stove) per 50 stove/ASHP supplementation | 0.010 | 0.054 |

*Tools: CARB Quantification Methodology Woodsmoke Reduction Program; EPA AVERT Tool*

## Key Implementing Agency or Agencies

Interested eligible entities, including the DEQ's Air Quality Bureau.

## Implementation Schedule and Milestones

Implementing entities will have 12-18 months for changeout program development and then 42-48 months of program implementation. Assessments for active low emission heating programs will be performed annually.

## Geographic Scope

Program is available to all communities in Montana. Counties and cities need to establish community potential for GHG and criteria pollutant reductions by quantifying reduction potential and demonstrating the economic need for supplemental funding. These criteria are to be established within the Implementation Grant Application.

## Metrics for Tracking Progress

Metrics for tracking progress include:

- Number heat pumps (or low emission heat sources) installed.
- Number of wood stoves removed.
- Number of wood stoves heat sources supplemented, with wood stove usage reduction estimates.

## Funding

Montana DEQ may request funding under EPA's CPRG Implementation Grant Application. Funding amounts and budget details will be included in the grant application. Funding requested would be used to administer contracts to eligible local governments and to pay for point-of-sale rebates, as detailed in an application.

Eligible entities, other than the state, may also apply for implementation grant funding. Funding amount will depend on location and scope of the project.

**IMPACTS ON LOW-INCOME AND DISADVANTAGED COMMUNITIES**

Funding will be prioritized to low-income and disadvantaged communities.

Low emission residential heat sources that supplement or replace wood stoves can reduce airshed air quality impacts and indoor air quality impacts of wood stoves. Certain heating technologies (e.g., high-efficiency ground source or air source heat pumps) also provide efficient air conditioning during summer heat waves, improving household comfort, especially for medically vulnerable populations in areas prone to inundation by wildfire smoke. Any program implemented under this measure that supports wood stove replacement or supplementation with an alternate heat source would need to be designed to accurately disclose any impacts to household heating costs.

In addition to the general LIDAC benefits associated with measures, potential benefits unique to this measure include:

- Reduced level of NOx and particulate matter
- Directly improved indoor air quality and reduced criteria pollutants, so heat pumps can have direct health benefits in LIDAC communities that typically have higher rates of asthma and other respiratory illnesses

**AUTHORITY TO IMPLEMENT**

Montana Code Annotated 75-2-112 provides DEQ the authority to accept, receive, and administer grants or other funds for the purpose of carrying out air quality programs within Montana.

## Measure 3. Residential, Small Business, and Ag Energy Performance Incentives

This measure proposes to leverage private investment in small business, agricultural, and residential (including multi-family housing) energy efficiency and on-site energy systems by expanding access to low-cost financing and rebates. This measure could build on established private and/or public sector loan and rebate programs, with an emphasis on supporting investments that reduce energy costs and improve residential and small business comfort and energy performance.

Eligible actions would include but not be limited to energy performance audits, insulation, high efficiency electric heating and cooling systems, ventilation and heat recovery systems, and on-site renewable generation, including systems paired with energy storage.

Funding may also support enabling measures such as electrical upgrades and asbestos mitigation, as well as energy sector workforce development. Workforce development measures would be geared to complement existing contractor training programs, including through partnerships with the private sector, university system or advancement of internship, apprenticeship, or national service programs.

**ESTIMATE OF GHG EMISSION REDUCTIONS**

To be estimated by eligible entities that wish to apply for implementation funding.

| Priority Measure | Cumulative GHG Emission Reductions ($MMT\ CO_2e$) | |
|---|---|---|
| | By 2030 | By 2050 |
| Residential, Small Business, and Agricultural Energy Performance Incentives | Variable (see text in Appendix) | |

*Tools: NREL ResStock; EPA AVERT Tool*

**KEY IMPLEMENTING AGENCY OR AGENCIES**

Interested eligible entities.

**IMPLEMENTATION SCHEDULE AND MILESTONES**

To be established by eligible entities that wish to apply for implementation funding.

**GEOGRAPHIC SCOPE**

Statewide

**METRICS FOR TRACKING PROGRESS**

To be determined by eligible entities that wish to apply for implementation funding.

**FUNDING**

Cost is dependent on location and scope of the projects and will thus be determined by eligible entities that wish to apply for implementation funding.

**IMPACTS ON LOW-INCOME AND DISADVANTAGED COMMUNITIES**

Providing funds for renewable electric generation such as residential solar panels will benefit low-income homeowners and renters by reducing energy costs, providing a sustainable power source, and creating job opportunities in the renewable energy sector. This can contribute to economic empowerment and environmental sustainability for residents. Homeowners may benefit from increased value of their properties providing a valuable investment and wealth building opportunity.

Building weatherization can reduce GHG emissions due to the resulting improvements in energy efficiency and reduction in energy required to heat and cool the properties. These projects will also lower energy costs for low-income residents and the work performed will provide quality jobs and development of practical, transferable work skills within these communities.

As homes are improved, it is possible that property values will be reassessed, and property tax liability will increase. Training and apprenticeship programs could be supported and possibly also funded by CPRG, as the economic benefit of increased employment opportunities will only stay within these communities if local residents are able to be hired for the work performed.

#### AUTHORITY TO IMPLEMENT

Authority to implement will depend on implementing entity but could include Montana's Alternative Energy Revolving Loan Program (75-25-101, *et seq.*, MCA), which is managed by DEQ. The existing loan program is capitalized by a combination of state and federal funding sources and may accept funding from any other source. The program provides low interest loans to individuals, small businesses and other entities for installation of alternative energy systems and energy conservation measures.

## WASTE REDUCTION OR DIVERSION

According to EPA's State Inventory Tool, in 2019, municipal waste contributed to approximately 1% of Montana's GHG emissions. Solid waste contributes to GHG emissions through the generation of methane from the anaerobic decay of waste in landfills, the emission of nitrous oxide from solid waste combustion facilities, and emissions of carbon dioxide from waste hauling vehicles. Additional emissions come from energy use associated with the upstream production of materials.

Recycling programs can play a role in helping meet GHG emission reduction goals by reducing emissions generated due to waste disposal, extraction of raw materials, and manufacturing of new products. Collecting and processing secondary materials, manufacturing recycled content products, and then purchasing recycled products creates a closed loop that ensures the overall success and value of recycling.

According to the EPA, over a third of the food produced in the US is wasted. In fact, food is the most common organic material sent to the landfill, comprising 24% of municipal solid waste.[28] In Montana, there is a strong interest in diverting food waste from landfills, but cities and counties currently lack the funding to purchase the equipment and finance the infrastructure build-out necessary to compost food waste.

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[28] EPA, *From Farm to Kitchen: The Environmental Impacts of U.S. Food Waste*, November 2021. https://www.epa.gov/system/files/documents/2021-11/from-farm-to-kitchen-the-environmental-impacts-of-u.s.-food-waste_508-tagged.pdf.

Funding from CPRG could be used for grants to build or expand infrastructure as associated with anaerobic digestors and compost facilities such as materials handling, processing, odor abatement, or electricity generating equipment. CPRG funds could also be used to support smaller-scale infrastructure, including in underserved communities, to encourage localized collection of food waste for composting that supports local food production.

Reducing GHGs from the food system also has the following co-benefits:

- Preventing food from being wasted can increase the amount of nutritious, fresh food available and lower costs.
- Increase in the collection of food waste means that less organic material will end up in a landfill, thus reducing methane emissions.
- Increase in anaerobic digesters means more methane will be collected and used to produce renewable fuel or electricity.
- Increase in composting means an increase availability of compost to farmers and residents, which produces healthier soils and lowers use of chemical fertilizers.

## Measure 1. Develop or Expand Local Recycling and Composting Capacity

This measure supports the development or expansion of local recycling and composting programs through infrastructure investments and equipment purchases. Eligible projects support waste reduction, diversion, and/or reuse and may include enabling measures such as capacity building and education and outreach.

### ESTIMATE OF GHG EMISSION REDUCTIONS

For every 1,000 tons (907 metric tons) of food waste landfilled, an estimated 34 metric tons of fugitive methane emissions (838 MMT $CO_2e$) are released.[29] Specific reduction calculations will be made by eligible entities that apply for implementation funding.

### KEY IMPLEMENTING AGENCY OR AGENCIES

State and local governmental entities, possibly in partnership with recycling and composting facilities

### IMPLEMENTATION SCHEDULE AND MILESTONES

To be established by eligible entities that wish to apply for implementation funding.

### GEOGRAPHIC SCOPE

Cities and counties in Montana with an interest in and commitment to increase their jurisdiction's waste diversion efforts.

[29] EPA, "Food Waste Management Quantifying Methane Emissions from Landfilled Food Waste," October 2023, available at https://www.epa.gov/system/files/documents/2023-10/food-waste-landfill-methane-10-8-23-final_508-compliant.pdf.

### Metrics for Tracking Progress
Increase in tons of waste diverted annually from the landfill, through recycling and/or composting of organic materials.

### Funding
Cost is dependent on location and scope of the projects and will thus be determined by eligible entities that wish to apply for implementation funding.

### Impacts on Low-Income and Disadvantaged Communities
Programs focused on reducing food waste in Montana can benefit low-income families by reducing food costs. On average, households could save about $370 per person annually or nearly $1,500 for a family of four by optimizing personal food resources. Furthermore, safe and wholesome food that is often thrown away by restaurants, schools, and businesses could help feed hungry people and reduce food insecurity. Well-fed children have consistent school attendance and tend to perform better at school. Adults with access to secure and healthy meals also take fewer sick days and are more productive at work and home.

Expanding the infrastructure for recycling and food waste recovery could create additional jobs in the collection and management of recyclables and food waste through composting and digestion. Many of these industries are located in rural and underserved communities.

Residents on fixed incomes in low-income and disadvantaged communities are disproportionally impacted by rising rates of waste services and trash pickup. Therefore, any program addressing waste management should be careful not to result in substantial local increases to rates for waste management and trash services.

Siting waste or composting facilities should include all stakeholders, recognizing that LIDACs have received a disproportionate amount of this burden and the pollutants that come with it.

### Authority to Implement
To be determined by eligible entities that wish to apply for implementation funding.

# LOW-INCOME AND DISADVANTAGED COMMUNITY BENEFITS ANALYSIS

Implementation of the measures included in this plan is anticipated to provide significant benefits to Montana's low-income and disadvantaged communities (LIDAC). The potential benefits of each measure were outlined in the previous chapter. This section identifies the LIDAC in Montana, discusses how the DEQ meaningfully engaged with LIDAC in the development of this plan, and how Montana will continue to engage into the future.

More than one-third (98) of Montana's 271 census tracts are considered "disadvantaged" according to the federal Climate & Economic Justice Screening Tool (CEJST) developed by the Council on Environmental Quality. For the purposes of the tool and planning efforts under the CPRG program, "disadvantaged" communities are located within Census tracts that are overburdened and underserved. These are areas that experience significant economic, health, and/or environmental burdens.

Census tracts that meet EPA's criteria defining LIDAC were identified using EPA's Environmental Justice Screening and Mapping (https://ejscreen.epa.gov/mapper/). The map below, **Figure 4**, shows these communities (in yellow) and their location throughout Montana. See Appendix A for a list of the LIDAC census tracts in Montana.

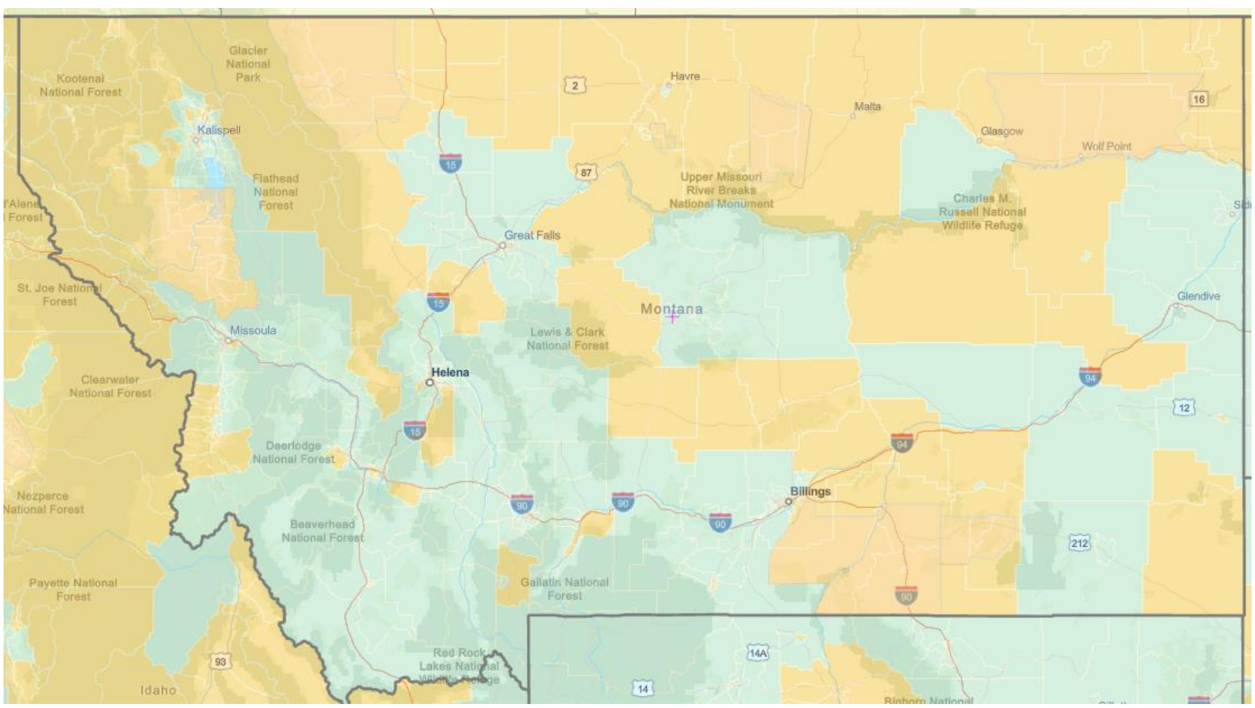


**Figure 4. Map of Low-Income and Disadvantaged Areas in Montana**

As the map illustrates, low-income and disadvantaged communities are spread widely across the state. Much of the northern part of the state is identified as LIDAC, with multiple communities identified in the central and eastern portions of the state as well. Land located within the boundaries of Montana's federally recognized tribes is considered disadvantaged for the purposes of the CEJST.

Because LIDAC communities are located throughout the state and in both rural and urban areas, DEQ's approach for meaningful engagement with these communities was encompassed by the general approach for outreach throughout the state. Engagement and outreach activities included providing the resources listed in the Coordination and Outreach section of this plan. DEQ specifically reached out to municipalities, non-profit groups, other state government agencies, tribal governments, and the public to inform Montana communities about planning efforts and solicit project ideas for inclusion in this plan.

DEQ's strategies for engagement with MT LIDACs are summarized below:

- Online resources:
  - DEQ's CPRG webpage
  - Email list (244 signed up, as of Feb. 22, 2024)
  - Social media
  - Portal for submitting emission reduction measure ideas
- Virtual community meetings to reduce the need for travel
- Targeted outreach to known community-based organizations
- Public comment period on the draft plan

# CONCLUSION & NEXT STEPS

The preceding chapters laid out Montana's priority measures that will leverage federal investments to accelerate our state's emissions reduction efforts—for a vibrant, healthy environment, for thriving communities, and for a more sustainable and resilient future.

The plan reflects Montana values in prioritizing incentive-based, market-driven solutions. It is flexible and tailored to Montana's unique resources and capacity. It covers a mix of key sectors that contribute to both the emission and capture of greenhouse gases, and it leaves the door open for a variety of entities to implement innovative projects that move the state forward. If implemented, the measures outlined in this plan would make a meaningful impact on our state and on Montana's ability to serve as a leader in cutting harmful air pollution and reversing trends that have made our lands and forests net emitters of greenhouse gases when they should instead be serving the country as significant carbon sinks.

The plan is non-regulatory in nature and the measures contained herein constitute a list of voluntary actions available to Montana communities for CPRG implementation. No new regulatory authority is given by CPRG nor is new authority sought by this plan for CPRG implementation. The multiple state agencies that contributed to this plan have reviewed their existing statutory and regulatory authorities to implement each measure contained in this plan. As described in the preceding chapters, the agencies have the existing authority to apply for, administer, and subaward federal grants, which is sufficient authority for the voluntary implementation of CPRG projects by Montana communities.

## NEXT STEPS

DEQ, along with other executive branch-level agencies, municipalities, and tribes are eligible to participate in the general competition for CPRG implementation grants. Nationally, $4.3 billion in implementation funding is available through individual grants ranging from $2 million to $500 million each.[30] Projects proposed to be implemented with CPRG funding must be covered by the priority measures outlined in this plan. Implementation grant applications must be submitted to EPA by April 1, 2024, with awards anticipated in the fall of 2024.

As the lead organization for CPRG planning deliverables, DEQ is also responsible for developing a Comprehensive Climate Action Plan (CCAP) by mid-2025 and a Status Report due in 2027. The CCAP requires that the state build on this plan to further identify all significant greenhouse gas sources and sinks within the state, establish reduction and mitigation goals, and provide strategies and measures to achieve these goals.

To meet EPA requirements as a part of the grant, the CCAP must include:

- A comprehensive greenhouse gas inventory – identifying emission sources and sinks.
- Greenhouse gas emissions projections.
- Greenhouse gas reduction or mitigation goals based upon community solutions.
- Quantifiable greenhouse gas reduction measures.

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[30] US EPA. "CPRG Implementation Grants." October 23, 2023. https://www.epa.gov/inflation-reduction-act/cprg-implementation-grants.

- A benefits analysis for Montana.
- A low income and disadvantaged communities' benefits analysis.
- A review of the authority to implement.
- A plan to leverage other federal funding.
- A workforce planning analysis.

To meet EPA requirements as a part of the grant, the final status report will include:

- The implementation status of greenhouse gas reduction measures including in the comprehensive action plan.
- Relevant updated analyses or projections which support the comprehensive action plan implementation.
- Next steps and future needs to continue to support the comprehensive action plan.

DEQ will continue to meaningfully engage with stakeholders, including other state agencies, industry, community organizations, local governments, tribes, and the public throughout the development of the CCAP and in the implementation of climate pollution reduction actions throughout Montana.

# APPENDIX A. LOW-INCOME AND DISADVANTAGED COMMUNITY CENSUS TRACTS BY COUNTY

DEQ used data from the federal Climate and Economic Justice Screening Tool to compile the census tracts for the state of Montana that are identified in the tool as overburdened and underserved.[31] The following table shows a complete list of statewide LIDAC census tracts by county.

| County Name | Census tract ID | County Name | Census tract ID | County Name | Census tract ID |
|---|---|---|---|---|---|
| Beaverhead | 30001000100 | Cascade | 30013010600 | Cascade | 30013010100 |
| Beaverhead | 30001000200 | Cascade | 30013010700 | Cascade | 30013010400 |
| Beaverhead | 30001000300 | Cascade | 30013010800 | Flathead | 30029001700 |
| Big Horn | 30003000100 | Chouteau | 30015010200 | Gallatin | 30031000101 |
| Big Horn | 30003940400 | Chouteau | 30015010300 | Gallatin | 30031000102 |
| Big Horn | 30003940500 | Custer | 30017961300 | Gallatin | 30031000103 |
| Big Horn | 30003940600 | Custer | 30017961500 | Gallatin | 30031000200 |
| Big Horn | 30003940700 | Custer | 30017961600 | Gallatin | 30031000300 |
| Blaine | 30005000100 | Custer | 30017961800 | Gallatin | 30031000400 |
| Blaine | 30005000200 | Custer | 30017961900 | Gallatin | 30031000501 |
| Blaine | 30005940100 | Custer | 30017962000 | Gallatin | 30031000502 |
| Blaine | 30005940200 | Daniels | 30019020300 | Gallatin | 30031000503 |
| Broadwater | 30007000100 | Dawson | 30021000100 | Gallatin | 30031000504 |
| Broadwater | 30007000200 | Dawson | 30021000200 | Gallatin | 30031000600 |
| Carbon | 30009000100 | Dawson | 30021000300 | Gallatin | 30031000701 |
| Carbon | 30009000200 | Deer Lodge | 30023000300 | Gallatin | 30031000702 |
| Carbon | 30009000300 | Deer Lodge | 30023000400 | Gallatin | 30031000800 |
| Carbon | 30009000400 | Deer Lodge | 30023000500 | Gallatin | 30031000900 |
| Carbon | 30009000500 | Fallon | 30025000100 | Gallatin | 30031001001 |
| Carter | 30011000300 | Fergus | 30027030100 | Gallatin | 30031001002 |
| Cascade | 30013000100 | Fergus | 30027030200 | Gallatin | 30031001101 |
| Cascade | 30013000200 | Flathead | 30029000100 | Gallatin | 30031001102 |
| Cascade | 30013000300 | Flathead | 30029000201 | Gallatin | 30031001200 |
| Cascade | 30013000400 | Flathead | 30029000202 | Gallatin | 30031001500 |
| Cascade | 30013000700 | Flathead | 30029000203 | Gallatin | 30031001600 |
| Cascade | 30013000800 | Flathead | 30029000300 | Garfield | 30033000100 |
| Cascade | 30013000900 | Flathead | 30029000401 | Glacier | 30035940200 |
| Cascade | 30013001000 | Flathead | 30029000402 | Glacier | 30035940400 |
| Cascade | 30013001100 | Flathead | 30029000601 | Glacier | 30035976000 |
| Cascade | 30013001200 | Flathead | 30029000602 | Glacier | 30035980000 |

[31] U.S. Council on Environmental Quality, *Climate and Economic Justice Screening Tool*, “Communities list data,” available at https://screeningtool.geoplatform.gov/en/downloads#5/46.73/-110.04

| | | | | | |
|---|---|---|---|---|---|
| Cascade | 30013001600 | Flathead | 30029000700 | Golden Valley | 30037000100 |
| Cascade | 30013001700 | Flathead | 30029000800 | Granite | 30039961700 |
| Cascade | 30013001800 | Flathead | 30029000900 | Hill | 30041040100 |
| Cascade | 30013001900 | Flathead | 30029001000 | Hill | 30041040200 |
| Cascade | 30013002100 | Flathead | 30029001100 | Hill | 30041040300 |
| Cascade | 30013002200 | Flathead | 30029001200 | Hill | 30041040400 |
| Cascade | 30013002300 | Flathead | 30029001301 | Hill | 30041040500 |

| County Name | Census tract ID | County Name | Census tract ID | County Name | Census tract ID |
|---|---|---|---|---|---|
| Hill | 30041940300 | Madison | 30057000200 | Powder River | 30075000100 |
| Jefferson | 30043962201 | Madison | 30057000300 | Powell | 30077000100 |
| Jefferson | 30043962202 | Meagher | 30059000100 | Powell | 30077000200 |
| Jefferson | 30043962300 | Mineral | 30061964500 | Prairie | 30079000100 |
| Judith Basin | 30045000100 | Mineral | 30061964600 | Ravalli | 30081000100 |
| Flathead | 30029001302 | Missoula | 30063000100 | Ravalli | 30081000201 |
| Flathead | 30029001400 | Missoula | 30063000201 | Ravalli | 30081000202 |
| Lake | 30047000100 | Missoula | 30063000202 | Ravalli | 30081000300 |
| Lake | 30047000200 | Missoula | 30063000300 | Ravalli | 30081000401 |
| Lake | 30047940301 | Missoula | 30063000400 | Ravalli | 30081000402 |
| Lake | 30047940303 | Missoula | 30063000500 | Ravalli | 30081000500 |
| Lake | 30047940400 | Missoula | 30063000700 | Ravalli | 30081000600 |
| Lake | 30047940500 | Missoula | 30063000800 | Ravalli | 30081000700 |
| Lake | 30047940600 | Missoula | 30063000901 | Ravalli | 30081000800 |
| Lake | 30047940700 | Missoula | 30063000902 | Richland | 30083070100 |
| Lewis and Clark | 30049000100 | Missoula | 30063001000 | Richland | 30083070200 |
| Lewis and Clark | 30049000200 | Missoula | 30063001100 | Richland | 30083070300 |
| Lewis and Clark | 30049000300 | Missoula | 30063001200 | Richland | 30083070400 |
| Lewis and Clark | 30049000400 | Missoula | 30063001302 | Roosevelt | 30085080100 |
| Lewis and Clark | 30049000501 | Missoula | 30063001303 | Roosevelt | 30085940001 |
| Lewis and Clark | 30049000502 | Missoula | 30063001304 | Roosevelt | 30085940002 |
| Lewis and Clark | 30049000600 | Missoula | 30063001400 | Rosebud | 30087000100 |
| Lewis and Clark | 30049000700 | Missoula | 30063001500 | Rosebud | 30087000200 |
| Lewis and Clark | 30049000800 | Missoula | 30063001600 | Rosebud | 30087000300 |
| Lewis and Clark | 30049000900 | Missoula | 30063001800 | Rosebud | 30087940400 |
| Lewis and Clark | 30049001000 | Musselshell | 30065000100 | Sanders | 30089000100 |
| Lewis and Clark | 30049001100 | Musselshell | 30065000200 | Sanders | 30089000200 |
| Lewis and Clark | 30049001201 | Park | 30067000100 | Sanders | 30089940300 |
| Lewis and Clark | 30049001202 | Park | 30067000200 | Sheridan | 30091090200 |
| Liberty | 30051050100 | Park | 30067000300 | Sheridan | 30091090400 |
| Lincoln | 30053000100 | Park | 30067000400 | Silver Bow | 30093000100 |
| Lincoln | 30053000200 | Park | 30067000500 | Silver Bow | 30093000200 |
| Lincoln | 30053000300 | Park | 30067980600 | Silver Bow | 30093000300 |

| | |
|---|---|
| Lincoln | 30053000400 |
| Lincoln | 30053000500 |
| McCone | 30055954000 |
| Madison | 30057000100 |
| Petroleum | 30069000100 |
| Phillips | 30071060200 |
| Pondera | 30073977000 |
| Pondera | 30073977200 |
| Silver Bow | 30093000400 |
| Silver Bow | 30093000500 |
| Silver Bow | 30093000600 |
| Silver Bow | 30093000700 |

| County Name | Census tract ID |
|---|---|
| Silver Bow | 30093000800 |
| Stillwater | 30095966400 |
| Stillwater | 30095966500 |
| Stillwater | 30095966600 |
| Sweet Grass | 30097967000 |
| Teton | 30099000100 |
| Teton | 30099000200 |
| Teton | 30099000300 |
| Toole | 30101000100 |
| Toole | 30101000200 |
| Toole | 30101980000 |
| Treasure | 30103963500 |
| Valley | 30105100100 |
| Valley | 30105100500 |
| Valley | 30105940600 |
| Wheatland | 30107000100 |
| Wibaux | 30109000100 |
| Yellowstone | 30111000200 |
| Yellowstone | 30111000300 |
| Yellowstone | 30111000401 |
| Yellowstone | 30111000402 |
| Yellowstone | 30111000500 |
| Yellowstone | 30111000600 |
| Yellowstone | 30111000701 |
| Yellowstone | 30111000702 |
| Yellowstone | 30111000704 |
| Yellowstone | 30111000705 |
| Yellowstone | 30111000706 |
| Yellowstone | 30111000800 |
| Yellowstone | 30111000901 |
| Yellowstone | 30111000902 |
| Yellowstone | 30111001000 |
| Yellowstone | 30111001100 |
| Yellowstone | 30111001200 |
| Yellowstone | 30111001300 |
| Yellowstone | 30111001401 |
| Yellowstone | 30111001402 |
| Yellowstone | 30111001501 |
| Yellowstone | 30111001502 |
| Yellowstone | 30111001702 |
| Yellowstone | 30111001703 |
| Yellowstone | 30111001704 |
| Yellowstone | 30111001801 |
| Yellowstone | 30111001802 |
| Yellowstone | 30111001803 |
| Yellowstone | 30111001804 |
| Yellowstone | 30111001901 |
| Yellowstone | 30111001902 |
| Yellowstone | 30111940000 |

# APPENDIX B. TECHNICAL APPENDIX

# Montana Priority Climate Action Plan

## Technical Appendix: Quantitative Assessment of Emission Reductions

## INTRODUCTION

The Technical Appendix (TA) provides a detailed summary of the data inputs, reference sources, and methodologies in quantifying greenhouse gas (GHG) emissions reductions for the State of Montana's priority reduction measures. This is in support of Montana's Priority Climate Action Plan (PCAP) developed for the U.S. Environmental Protection Agency's (EPA) Climate Pollution Reduction Grant (CPRG) program.

The PCAP contains the following priority reduction measures:

Sustainable 21st Century Schools

- Measure 1: Incentivize School Energy Performance Measures

Healthy, Resilient Forests

- Measure 1. Expand Forest Management and Wildfire Mitigation
- Measure 2. Expand Healthy Urban and Community Forests
- Measure 3. Mitigate and Extinguish Coal Seam Fires

Innovative Agriculture & Working Lands

- Measure 1: Fertilizer Use Innovation for Improved Soil Health Industry
- Measure 2: Ranchland Stewardship Program
- Measure 3: Incentivize Innovation in the Cattle & Beef Industry
- Measure 4. Reduce Nonpoint Sources of Pollution and Associated Algal Blooms

Clean, Reliable Transportation

- Measure 1: Strategic Conversion of Fleet Vehicles to Cleaner Alternatives

Industrial & Power Sector Innovation

- Measure 1. Investment and Improvement in Electric Grid Technology
- Measure 2: Incentivize Industrial Process Efficiencies

High Performance Homes & Businesses

- Measure 1. Improve Efficiency of Government, Nonprofit, and Commercial Buildings and Operations
- Measure 2. Low-Emission Home Heating Incentives
- Measure 3. Residential, Small Business, and Agricultural Energy Performance Incentives

Waste Reduction of Diversion

- Measure 1. Develop or Expand Local Recycling and Composting Capacity

The PCAP provides a detailed overview of each measure along with supporting information, such as including key implementing agencies, implementation schedules and milestones, geographic scope, metrics for tracking progress, funding, and impacts on low-income and disadvantaged communities. The primary focus of the TA is the quantification of GHG reductions for each measure through 2030 and 2050; however, additional supporting analysis is included for some measures providing co-pollutant reductions and cost evaluations.

# OVERALL APPROACH AND METHODOLOGY

The GHG emissions reduction potential quantified for each priority measure provides a general framework for future implementation considerations and expansion within the Comprehensive Climate Action Plan (CCAP). For the purposes of the PCAP, an overall unitized approach was evaluated for each measure when measure outputs were not determined. This provides a scalable basis for future reduction and implementation considerations. The reduction potential for each unitized measure may not provide direct, linear scalability due to factors such as the variable carbon intensity of electrical generating sources within electricity markets, however it provides an accurate approximation of the reduction potential available for each measure given the boundaries set within each evaluation. Each unitized evaluation can then be expanded upon for project specifics in CPRG implementation grant applications and to meet the future reduction goals identified in the CCAP.

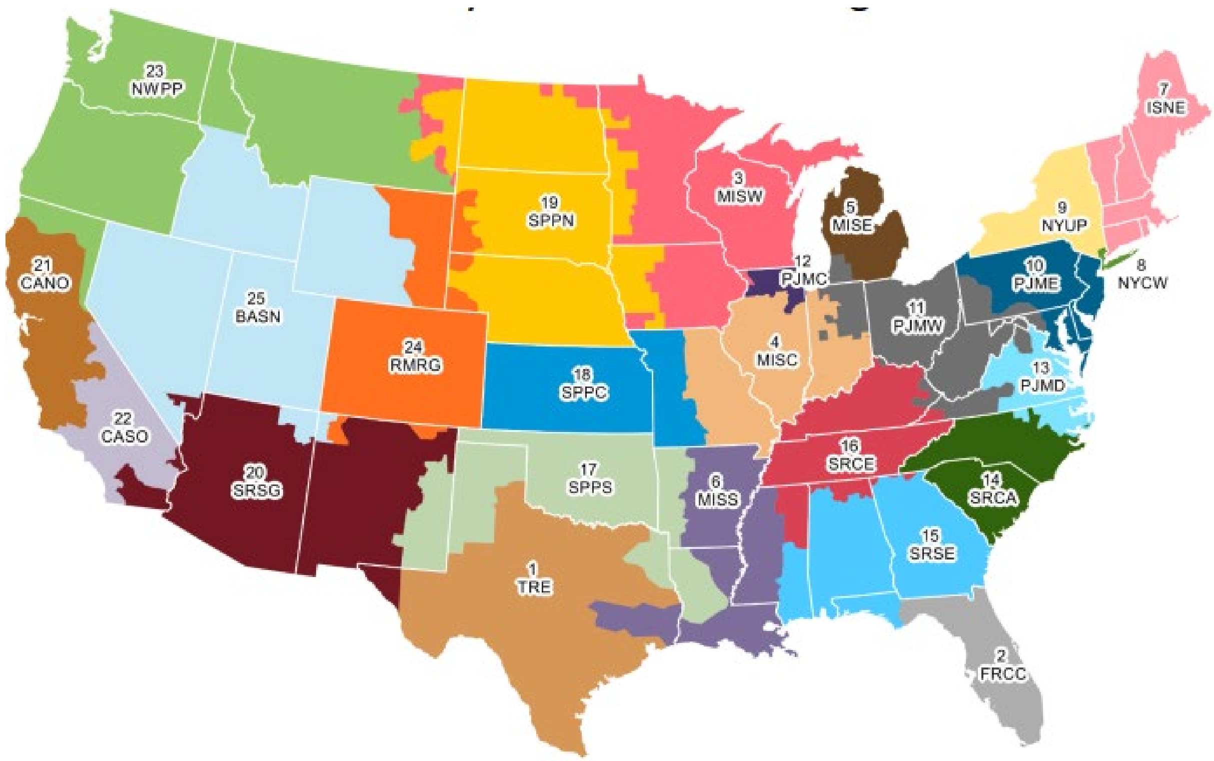
The sectors evaluated within the PCAP exist within a complex and interdependent system where reduction in one sector can change the conditions for evaluating other sectors. This evaluation acknowledges the complexity in those systems but evaluated reduction potential for each measure independently of each other. Although, the evaluation does account for projected grid decarbonization impacts to 2030 and 2050 as described within the following section of the TA. Reduction estimates were evaluated to represent plausible outcomes for each priority measure. In some instances, multiple outputs were quantified when a measure presented varying opportunities for accomplishing GHG reductions.

# PROJECTING EMISSIONS REDUCTION

## Electricity Grid Decarbonization Considerations

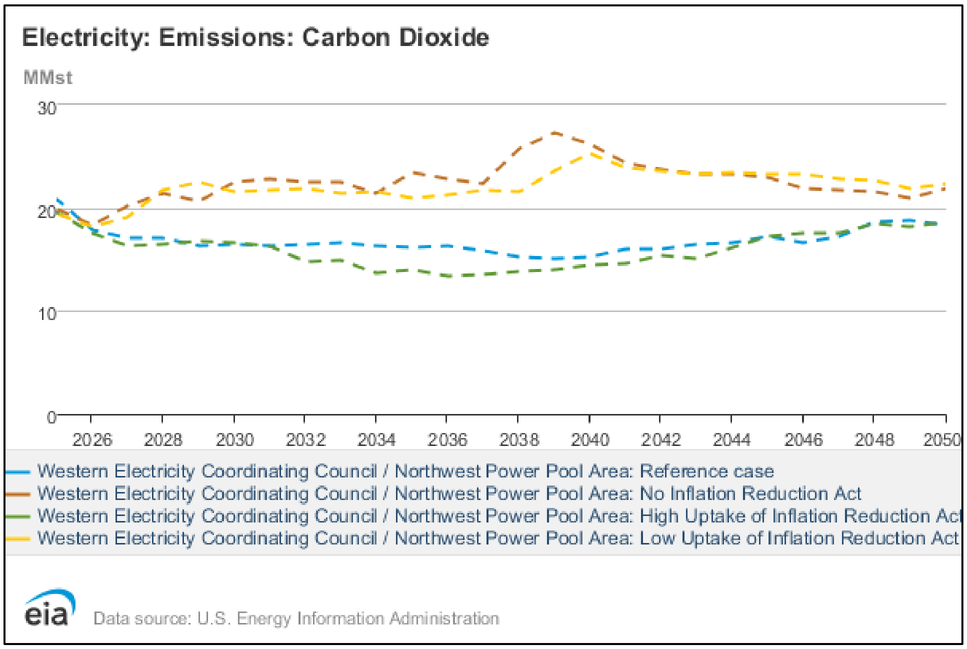
Scaling emissions reduction potential to 2030 and 2050 requires projecting the future carbon intensity of electrical generation. For measures that rely on these considerations, the future carbon intensity of grid-scale electricity production relied on the Annual Energy Outlook 2023 (AEO2023) Issues in Focus: Inflation Reduction Act Cases in the AEO2023 (EIA2023) analysis published by the U.S. Energy Information Administration (EIA). This evaluates potential results of implementing the laws and regulations of the Inflation Reduction Act (IRA) and projects future electricity generation in billions of kilowatt hours (BkWh) and corresponding emissions of carbon dioxide ($CO_2$) in millions of short tons. The trends provided in AEO2023 are scaled and utilized in the analysis to determine the future carbon intensity of electricity use when quantifying emissions reduction totals by 2030 and 2050. In all instances, the emissions reduction for 2025 - 2030 and 2025 - 2050 accounts for reductions effective in first year.

AEO2023 provides datasets by Electricity Market Module Region:

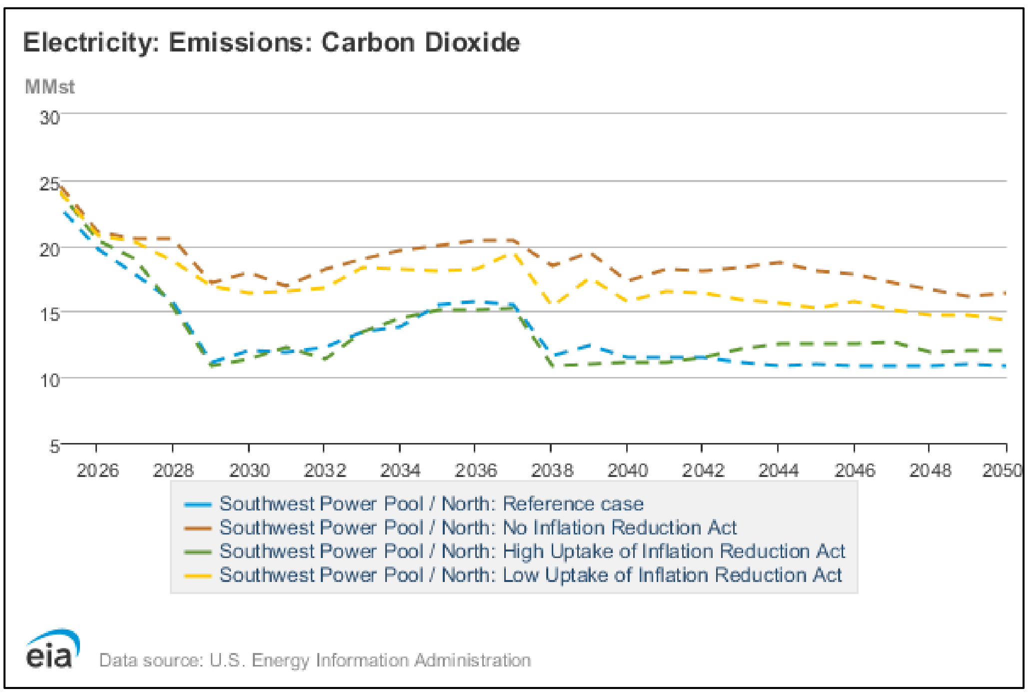



The three regions in Montana were therefore utilized to direct the TA and utilized the IRA reference case emissions reduction scenario evaluated in AEO2023. The trends for each region are illustrated in the following figures.

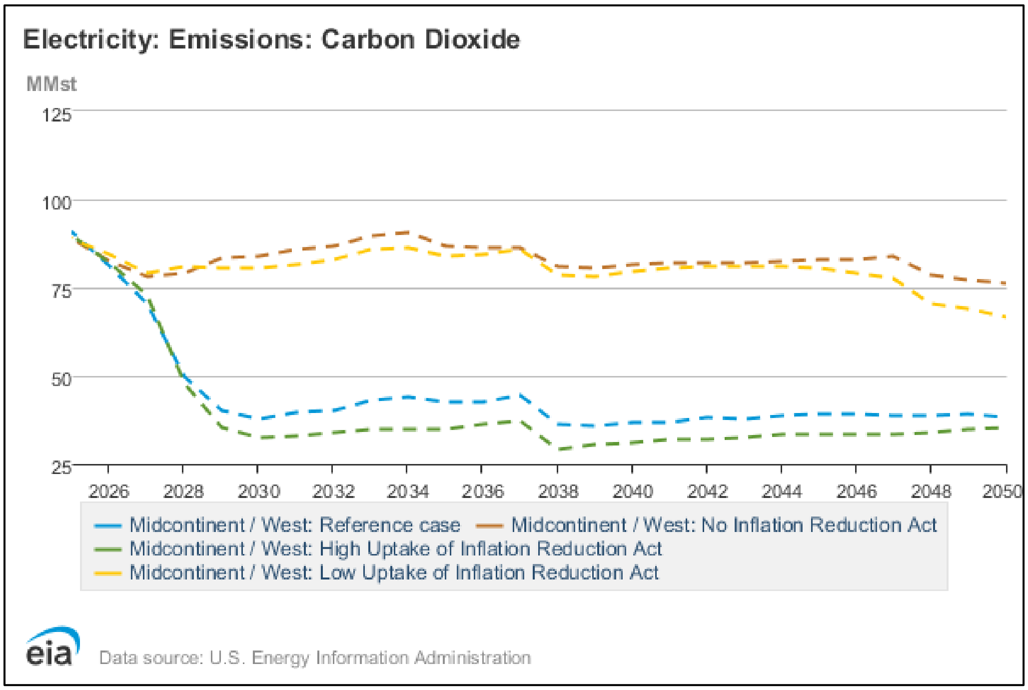
NWPP: WECC/Northwest Power Pool




NPPN: Southwest Power Pool/North



MISW: Midcontinent ISO/West




The anticipated total electricity generation and GHG emissions per year are totaled for the service area and an individual carbon intensity factor is calculated for each year, 2025 to 2050. The carbon intensity factor is then formulated as a percentage of the 2025 carbon intensity. Annualized emissions are calculated for each measure in 2025. Applying the year-specific carbon intensity factor for subsequent years then provides reduction potentials based on the anticipated decarbonization of the electrical grid from 2025 – 2050.

## Renewable Energy Source Degradation Considerations

Similarly, scaling emissions reduction potential to 2030 and 2050 requires accounting for the degradation of renewable energy sources over their equipment lifespan. The TA analysis accounts for published degradation factors for the following renewable energy sources:

Utility-Scale Solar

- Factor: 0.5% average degradation per year
- Reference: NREL 2018

Utility-Scale Onshore Wind

- Factor: 0.63% average degradation per year
- Reference: Astolfi et al. 2022

# SUSTAINABLE 21ST CENTURY SCHOOLS

## Measure 1: Incentivize School Energy Performance Measures

Montana's school buildings are diverse in age, size, student population, geography, and fuel use. It is challenging to predict a specific and comprehensive list of energy conservation measures required to fulfill this measure due to the potential variability of the applicant pool. Therefore, the quantification methodology references recent Investment Grade Audits (IGAs) of Montana K-12 school building stock to provide a realistic summary of building upgrades. The following eight IGAs include school districts of varying student population, geography and climate, and utility providers. This contextualizes the potential applicant pool for the measure and includes additional infrastructure cost considerations with retrofit projects, such as HVAC ventilation mechanical replacements and electrical single phase protection upgrades.

The following table provides results of the IGA review.

| School District | Approx. Student Population | Geography | Climate | Total Building Area (ft$^2$) | EUI (kBtu/ft$^2$) | Fuel Type | Total Project Cost |
|---|---|---|---|---|---|---|---|
| Anaconda | 1000 | West | Humid Continental Mild Summer, Wet All Year | 247,504 | 63.7 | Natural Gas | $1,364,321 |
| Charlo | 240 | Northwest | | 55,778 | 111 | Fuel Oil & Propane | $2,413,000 |
| Kalispell | 6000 | Northwest | | 999,688 | 74.4 | Natural Gas | $922,967 |
| Livingston | 1300 | Central | | 287,075 | 60 | Natural Gas | $ 1,925,740 |
| Havre | 1800 | North Central | Cold Semi-Arid Climate | 407,517 | 70.1 | Natural Gas | $4,085,680 |
| Hinsdale | 60 | Northeast | | 46,557 | 54.3 | Natural Gas | $1,303,270 |
| St. Regis | 200 | Northwest | Humid Continental Climate - Dry Cool Summer | 22,419 | 238.1 | Propane | $ 1,159,240 |

A variety of energy conservation measures (ECMs) were evaluated and selected for each project depending upon the existing condition of the schools and the existing fuel type and utility costs. All projects generally utilized similar technology for lighting upgrades, weatherization, and retro-commissioning. The largest potential variance occurs for HVAC upgrades, so the projects selected to provide and overview of this measure's reduction potential include replacing steam boilers with new condensing heating hot water boilers, installing a condensing boiler with a dedicated outdoor air system, and fuel switching to full electrification with air source heat pumps and electric resistance heating. Projects also considered solar PV installations and EV charging infrastructure. The following table summarizes the ECMs selected for each project evaluated.

| School District | HVAC Upgrades | Lighting Upgrades | Weatherization Upgrades | EV Charging | Solar PV | Annual Energy Conserved (MMBtu) |
|---|---|---|---|---|---|---|
| Anaconda | X | X | X | | | 5280 |
| Charlo | X | X | X | | | 3972 |
| Kalispell | | X | | | | 2530 |
| Livingston | X | X | X | | X | 9219 |
| Havre | X | | X | X | | 2409 |
| Hinsdale | X | | | | | 1085 |
| St. Regis | X | X | | | | 15344 |

Again, the aggregate of existing IGAs for Montana schools provides a realistic identification of ECMs to be addresses through this CPRG measure. Variation of ECMs will occur for each building depending on age, size, location, fuel type, and condition. The aggregation of IGAs accounts for variation in all those categories. The following table sums the total costs and GHG reduction for all of the projects identified above. It then scales the reduction potential to account for $10,000,000 in project funding as a representation of this measure.

| Evaluation Case | Project Costs | Annual Emissions Reduction (MT $CO_2$e) | Emissions Reduction 2025 - 2030 (MT $CO_2$e) | Emissions Reduction 2025 - 2050 (MT $CO_2$e) |
|---|---|---|---|---|
| (7) Existing IGAs | $13,174,218 | 1626 | 8132 | 40660 |
| Scaled Project for Unitization | $10,000,000 | 1235 | 6173 | 30863 |

The measure also identifies on-site power generation as a potential inclusion within projects. Therefore, the analysis also evaluated the reduction potential of including on-site solar PV systems with each energy efficiency upgrade project. The majority utility in Montana provides a net metering opportunity for solar PV systems that are 50-kW or less. Therefore, this analysis considers the measure providing an opportunity to install (1) 50-kW solar PV system at each school. Emissions reduction for solar PV systems were quantified using the EPA Avert Tool. It considered (5) 50-kW solar PV installs.

On-site solar PV reduction potential was evaluated using the EPA AVERT Tool for varying total MW-contributions to the grid. The selected geography was the State of Montana and distributed solar PV total capacity was input.

| 50-kW System Count | Total kW | Total MW | Annual CO2 Reduction (MT/year) | Emissions Reduction 2025 - 2030 (MT $CO_2$e) | Emissions Reduction 2025 - 2030 (MT $CO_2$e) |
|---|---|---|---|---|---|
| 5 | 250 | 0.25 | 318 | 1,572 | 7,462 |

The resulting reduction potential for the measure therefore includes the unitized value of $10,000,000 in energy efficiency improvements and solar PV installations. This is intended to represent the variety of potential improvements available based on existing building audit results. The reduction potential can then be scaled to the appropriate investment amount.

### Reduction Potential for the Measure

| Priority Measure | Cumulative GHG Emission Reductions (MMT $CO_2e$) | |
|---|---|---|
| | By 2030 | By 2050 |
| School Energy Performance Incentives<br>(5) Schools at $10M invested with (1) 50-kW Solar PV install per school | 0.0077 | 0.0383 |

Tools: Investment Grade Audits for MT Schools; EPA AVERT Tool

# HEALTHY, RESILIENT FORESTS

## Measure 1. Expand Forest Management and Wildfire Mitigation

The analysis relies heavily on the publication *"Natural climate solutions for the United States"* (Fargione et al. 2018) and considers mitigation potential strategies based on (4) natural climate solutions (NCS):

1) Reforestation
2) Natural Forest Management
3) Avoided Forest Conversion
4) Fire Management

Mitigation potential is considered for the year 2025 and accounts for human actions taken beyond business-as-usual activities in the land use sector as they are expected to occur in 2025. As evaluated in *"Natural climate solutions for the United States"*, the analysis recognizes that mitigation potential estimates for 2025 will not persist indefinitely and each NCS will eventually saturate due to the finite potential for natural ecosystems to store additional carbon. However, the expected duration for forests to continue to sequester carbon is greater than 100-years. The duration until saturation is identified for each NCS.

Reduction potential is calculated for the year 2025 using a unitized measure of 1000 acres for each NCS. This can then be scaled for implementation applications. For each NCS, the total land available as identified in Fargione et al was divided by the total abatement potential in 2025. This provides a rate of metric tons of $CO_2e$ per year per acre which can be scaled to a 1000-acre target for each NCS.

Cost to implement was also evaluated for this measure based on the research of Fargione et al. A marginal abatement cost (MAC) curve was constructed in Fargione et al for each NCS. The MAC curve represents the monetary cost of achieving one additional ton of sequestered GHGs or avoided GHG emissions and indicates the total quantity of net GHG reductions that can be achieved at price points of USD 10, 50, and 100 Mg / $CO_2e$. Similarly, the total land area available at each cost category was evaluated to calculate an abatement rate. Then a weighted total was developed for each NCS to provide a total cost per 1000 acres.

Each NCS considers 1000-acres of implementation in 2025 and the corresponding reduction potential for that 1000-acres by 2030 and 2050. A stepwise approach can be developed utilizing the same factors to account for implementation area by year over the course of a program and the corresponding accumulating reduction potential.

## Reforestation

This measure accounts for additional carbon sequestration in above- and belowground biomass and soils gained by converting non-forest (<25% tree cover) to forest (>25% tree cover).

Contiguous U.S. (CONUS) Land Available for Reforestation: 62.9 million hectares (Mha)

Duration until saturation: >90 years

<u>CONUS Abatement Potential in 2025</u>

| Area | Category | Tg $CO_2e$ $yr^{-1}$ | Tg $CO_2e$ $yr^{-1}$ per Mha | MT $CO_2e$ $yr^{-1}$ per acre |
|---|---|---|---|---|
| CONUS | Total | 307 | 4.88 | 1.98 |
| MAC USD per MT $CO_2e$ | $100 | *Maximum saturation achieved* | | |
| | $50 | 241 | 3.83 | 1.55 |
| | $10 | 11 | 0.17 | 0.07 |

Maximum achieved at 252 Tg $CO_2e$ $yr^{-1}$ for MAC

<u>Estimated Reduction Potential</u>

| Program Year | Area | 2025 - 2030 Abatement | 2025 - 2050 Abatement |
|---|---|---|---|
| | (Acres) | (MT $CO_2e$) | |
| 2025 | 1000 | 9875.9 | 49379.4 |

Estimated Cost for Abatement

| Program Year | Area | \$10 | \$50 | \$100 | Total Cost |
|---|---|---|---|---|---|
| | (Acres) | per MT $CO_2e$ | | | |
| 2025 | 1000 | \$358.31 | \$39,250.81 | \$0.00 | \$39,609.12 |

## Natural Forest Management

This measure accounts for additional carbon sequestration in above- and below-ground biomass gained through improved management in forests on private lands under non-intensive timber management. The maximum mitigation potential was quantified based on a "harvest hiatus" scenario starting in 2025, in which natural forests are shifted to longer harvest rotations. This could be accomplished with less than 10% reduction in timber supply with new timber supply from thinning treatments for fuel risk reduction until new timber from reforestation is available in 2030.

CONUS Land Available for Reforestation: 123 million hectares (Mha)

Duration until saturation: >25 years

CONUS Abatement Potential in 2025

| Area | Category | Tg $CO_2e$ $yr^{-1}$ | Tg $CO_2e$ $yr^{-1}$ per Mha | MT $CO_2e$ $yr^{-1}$ per acre |
|---|---|---|---|---|
| CONUS | Total | 267 | 2.17 | 0.88 |
| MAC USD per MT $CO_2e$ | \$100 | 38 | 0.31 | 0.13 |
| | \$50 | 165 | 1.34 | 0.54 |
| | \$10 | 64 | 0.52 | 0.21 |

Estimated Reduction Potential

| Program Year | Area | 2025 - 2030 Abatement | 2025 - 2050 Abatement |
|---|---|---|---|
| | (Acres) | (MT $CO_2e$) | |
| 2025 | 1000 | 4392.3 | 21961.6 |

Estimated Cost for Abatement

| Program Year | Area | \$10 | \$50 | \$100 | Total Cost |
|---|---|---|---|---|---|
| | (Acres) | per MT $CO_2e$ | | | |
| 2025 | 1000 | \$2,397.00 | \$30,898.88 | \$14,232.21 | \$47,528.09 |

## Avoided Forest Conversion

This measure accounts for emissions of $CO_2$ avoided by avoiding anthropogenic forest conversion to another land use.

CONUS Land Available for Reforestation: 0.38 Mha

Duration until saturation: >100 years

CONUS Abatement Potential in 2025

| Area | Category | Tg $CO_2e$ $yr^{-1}$ | Tg $CO_2e$ $yr^{-1}$ per Mha | MT $CO_2e$ $yr^{-1}$ per acre |
|---|---|---|---|---|
| CONUS | Total | 38 | 100.00 | 40.47 |
| MAC USD per MT $CO_2e$ | $100 | *Maximum saturation achieved* | | |
| | $50 | 1 | 2.63 | 1.06 |
| | $10 | 37 | 97.37 | 39.40 |

Maximum achieved at 38 Tg $CO_2e$ $yr^{-1}$ for MAC

Estimated Reduction Potential

| Program Year | Area (Acres) | 2025 - 2030 Abatement (MT $CO_2e$) | 2025 - 2050 Abatement (MT $CO_2e$) |
|---|---|---|---|
| 2025 | 1000 | 202343.1 | 1011715.7 |

Estimated Cost for Abatement

| Program Year | Area (Acres) | $10 per MT $CO_2e$ | $50 per MT $CO_2e$ | $100 per MT $CO_2e$ | Total Cost |
|---|---|---|---|---|---|
| 2025 | 1000 | $358.31 | $39,250.81 | $0.00 | $39,609.12 |

## Fire Management

This measure accounts for the use of prescribed fire to reduce the risk of high-intensity wildfire.

CONUS Land Available for Reforestation: 17 Mha

Duration until saturation: >100 years

CONUS Abatement Potential in 2025

| Area | Category | Tg $CO_2e$ $yr^{-1}$ | Tg $CO_2e$ $yr^{-1}$ per Mha | MT $CO_2e$ $yr^{-1}$ per acre |
|---|---|---|---|---|
| CONUS | Total | 13 | 0.76 | 0.31 |
| MAC USD per MT $CO_2e$ | $100 | 3 | 0.18 | 0.07 |
| | $50 | 10 | 0.59 | 0.24 |
| | $10 | 0 | 0.00 | 0.00 |

Estimated Reduction Potential

| Program Year | Area | 2025 - 2030 Abatement | 2025 - 2050 Abatement |
|---|---|---|---|
| | (Acres) | (MT $CO_2e$) | |
| 2025 | 1000 | 1547.3 | 7736.6 |

Estimated Cost for Abatement

| Program Year | Area | $10 | $50 | $100 | Total Cost |
|---|---|---|---|---|---|
| | (Acres) | per MT $CO_2e$ | | | |
| 2025 | 1000 | $0.00 | $38,461.54 | $23,076.92 | $61,538.46 |

### Methodology Uncertainty

The total sequestration potential quantified by Fargione et al accounts for all tree species identified in the USFS yield tables included in *Methods for Calculating Forest Ecosystem and Harvested Carbon with Standard Estimates for Forest Types of the United States* (Smith et al.). Emission reduction estimates within this analysis hold uncertainty in that they are based on the entirety of tree species recognized in Fargione et al, however predominate Montana forests represented in Smith et al only include Douglas-fir, fir-spruce-mountain hemlock, lodgepole pine, and ponderosa pine. Narrowing the reduction potential to those specific species would provide higher accuracy, however they are still represented in the used aggregate. Additionally, the estimated reduction potential does not account for loss from wildfire and associated emissions.

### Reduction Potential for the Measure

| Priority Measure | Cumulative GHG Emission Reductions (MMT $CO_2e$) | |
|---|---|---|
| | By 2030 | By 2050 |
| Expand forest management and wildfire mitigation | | |
| Reforestation (per 1000 acres) | 0.010 | 0.049 |
| Natural Forest Management (per 1000 acres) | 0.0044 | 0.022 |
| Avoided Forest Conversion (per 1000 acres) | 0.20 | 1.012 |
| Fire Management (per 1000 acres) | 0.002 | 0.008 |

Tools: "Natural climate solutions for the United States" Fargione et al. 2018

## Measure 2. Expand Healthy Urban and Community Forests

This measure would incentivize the expansion of urban and community forests by maximizing available grant funding to support the development and maintenance of local urban forestry and green infrastructure programs, particularly in underserved communities

### Reduction Potential for the Measure

| Priority Measure | Cumulative GHG Emission Reductions (MMT $CO_2e$) | |
|---|---|---|
| | By 2030 | By 2050 |
| Expand healthy urban and community forests | .010 | 0.72 |

*Quantification tool(s) utilized: i-tree Eco*

Using Eco benefits model estimates: The standard methodology for calculating urban forest benefits is through million pounds.

- 5-year current estimate of 55.1Mlbs CO2, combining sequestered and avoided.
- 5-year projection increase 20K trees, canopy cover increase of 1% per community: 56Mlbs CO2.
- 25-year status quo estimate of 386.2Mlbs CO2 seq plus avoided.
- 25-year projection increase by 100,000 trees, canopy cover increase of 3% per community: 397.78Mlbs CO2 seq plus avoided.

## Measure 3. Mitigate and Extinguish Coal Seam Fires

This measure proposes to leverage local efforts to identify and map burning coals seams by building on existing data and expertise, such as through collaborative mapping initiatives. Bolster funding available to support the specialized equipment, techniques, and projects necessary to mitigate and extinguish actively burning coal seams in eastern Montana.

### Reduction Potential for the Measure

| Priority Measure | Cumulative GHG Emission Reductions (MMT $CO_2e$) | |
|---|---|---|
| | By 2030 | By 2050 |
| Mitigate and extinguish coal seam fires | 4 | 20 |

*Quantification tool(s) utilized: EPA 2023 GHG emission factors hub and USGS coal resource classification system.*[1]

Estimating the GHG reductions for this measure is extremely difficult. Only 685 of the estimated 1,700+ coal seam fires have been verified with a site visit. Many others have been identified by remote sensing, but the depth to the seam and thickness of the burning seams have not been characterized. Therefore, a conservative estimate of ~4 million metric tons $CO_2$ emission reduction is used for this

[1] EPA, *2023 GHG Emission Factors Hub*, September 2023. https://www.epa.gov/climateleadership/ghg-emission-factors-hub. USGS, *Coal Resource Classification System of the U.S. Geological Survey*, 1983. https://pubs.usgs.gov/publication/cir891.

priority measure. This estimate is based on EPA's GHG Emission Factors Hub for 2023, Lignite Coal listing an emission rate of 1,389 kg $CO_2$ per short ton.

We applied this emission rate to USGS Coal Resource Classification System - Circular 891, Table 2, which gives a weight for Lignite coal of 145.8 short tons per acre inch. The Lignite coal seams burning in eastern Montana vary in thickness from one inch to several feet. However, for the purpose of this estimate, we used a conservative value of 0.1-acre inch per verified event and addressing 200 of 685 known fires.

# INNOVATIVE AGRICULTURE & WORKING LANDS

## Measure 1: Fertilizer Use Innovation for Improved Soil Health Industry

Montana State University (MSU) has researched nitrogen fertilizer (N) use efficiency on Montana (MT) rainfed winter wheat fields across 8 fields in MT over last 8 years. The results have demonstrated that by using On-Field Precision Experimentation (OFPE), farmers can substantially decrease full-field nitrogen application amounts, increase farmer profits, and decrease nitrogen loss to environment by site-specific application of the fertilizer (Hegedus 2023a). OFPE allows agricultural producers to quantify the exact N amounts to apply to each field, which is important because all fields, even adjacent ones, have different optimum N rates (rates that maximize profit and at same time minimize pollution). Therefore, this methodology allows for field specific quantification as a target for all farmers, or more specifically, for all fields. Innovation of variable rate N application fertilizing equipment, driven by GPS, can aid in applying optimum site-specific rates. MSU research has shown 10 - 60% decreases in full-field N amounts using the OFPE framework (Hegedus (2023b).

While developed in dryland winter-wheat systems of Montana, the methods outlined in Hegedus 2023a are applicable to other crops and systems when similar procedures are used to generate information for increasing agronomic input efficiency with simultaneous consideration for profitability. However, since the known efficiencies are specific to winter wheat, the emissions reduction potential is addressed for that specific application until further crop-specific research is conducted.

The evaluation utilized the research of Hegedus et al paired with the direct and indirect emissions calculation methodology used in the State Inventory Tool (SIT) AgModule. While research has shown a 10% - 60% decrease in emissions, this evaluation uses a uniform 35% average reduction potential. The baseline fertilizer application is based on Montana wheat farmers typically apply one uniform N fertilizer application, typically around 75 lbs N ac−1 in spring (March–April) (Hegedus 2023b). The following tables summarize the reduction potential on a per acre basis.

| Use Case | Total Fertilizer Used (lb N) | Total Fertilizer Used (kg N) | Unvolatized N (kg) | Volatized N (kg) |
|---|---|---|---|---|
| Per acre, baseline | 75 | 34 | 31 | 3.40 |
| Per acre, w/ 35% reduction | 48.75 | 22 | 20 | 2.21 |

| Use Case | Direct N2O Emissions (metric tons) | Indirect N2O Emissions (metric tons) | Direct Emissions ($MMTCO_2e$) | Indirect Emissions ($MMTCO_2e$) |
|---|---|---|---|---|
| Per acre fertilizer emissions, baseline | 4.81E-04 | 5.35E-05 | 1.28E-07 | 1.42E-08 |
| Per acre fertilizer emissions, w/ 35% reduction | 3.13E-04 | 3.47E-05 | 8.29E-08 | 9.21E-09 |

### Reduction Potential for the Measure

Combing the above direct and indirect emissions and scaling the value to 100,000 acres provides the following reduction potential.

| Priority Measure | Cumulative GHG emission reductions ($MMT\ CO_2e$) | |
|---|---|---|
| | By 2030 | By 2050 |
| Reduced nitrogen fertilizer volatilization in MMT (per 100,000 acres) | 0.25 | 1.24 |

Tools: SIT AgModule; "Using spatially variable nitrogen application and crop responses to evaluate crop nitrogen use efficiency" Hegedus et al. 2023

## Measure 2. Ranchland Stewardship Program

The project leverages data-driven adaptive management decision-making tools that lead to increased carbon storage in the soil. Outcomes will increase soil carbon sequestration on Montana's expansive and diverse grasslands.

### Reduction Potential for the Measure

| Priority Measure/Project | Cumulative GHG emission reductions ($MMT\ CO_2e$) | |
|---|---|---|
| | 2025–2030 | 2025–2050 |
| Soil carbon sequestration | 0.60 | 6.0 |

Assumption: per most existing models (SNAP-graze, COMET) , verification bodies (Verra, Carbon Trust) and carbon development programs currently operating (Native, Agoro, Kateri, Cultivo, Grassroots Carbon).

Calculations:

- First 5 years: 240,000ac x0.5 tons/ac x 5yrs = 600k tons CO2
- Next 25 years: 480,000ac x 0.5 tons/ac x 25yrs = 6.0Mtons CO2

## Measure 3. Incentivize Innovation in the Cattle & Beef Industry

This measure would leverage private investment in pilot project upgrades in the beef industry to achieve higher industry standards in the supply chain as a model for locations across Montana and in other states across the west.

### Reduction Potential for the Measure

| Priority Measure/Project | Cumulative GHG emission reductions ($MMT\ CO_2e$) | |
|---|---|---|
| | By 2030 | By 2050 |
| Methane gas capture technology or feed efficiency improvements* | 0.07 | 0.42 |
| Renewable energy systems (Source: DOE Annual Technology Baseline) | 0.0031 | 0.0155 |
| Organic fertilizer production (per 100,000 acres) | 0.10 | 0.60 |
| **TOTAL** | **0.1731** | **0.6575** |

*Quantification tool(s) utilized: See table; see Appendix B for discussion of assumptions.*

Methane Gas capture technology or feed efficiency improvements:

A single cow emits 220 pounds of methane per year. If the emissions of 50,000 cows are reduced by 50 percent through methane capture and/or feed advancements,[2] that results in 2,495 metric tons of methane reduced every five years. The methane production potential of manure depends on the specific composition of the manure, which in turn depends on the composition and digestibility of the animal diet. The amount of methane produced during decomposition is influenced by the climate and the manner in which the manure is managed.

Renewable Energy systems calculations. Distributed solar was used as the reference for "renewable energy systems." This will reduce the capacity factor relative to a large commercial facility assumed to be approximately 15%, according to DOE's Annual Technology Baseline (https://atb.nrel.gov/electricity/2021/commercial_pv [atb.nrel.gov]). This assumption is based on 1 MW of PV (at 15% capacity factor) installed in 2025. The only uncertain variable is the CO2e intensity of Montana's existing electricity generation at .472727 metric tons/MWh.

| Installed Solar (MW) | Capacity Factor | Hours in a year | Annual Production (MWh) | Reduction |
|---|---|---|---|---|

[2] Breanna M. Roque, Joan K. Salwen, Rob Kinley, Ermias Kebreab, "Inclusion of Asparagopsis armata in lactating dairy cows' diet reduces enteric methane emission by over 50 percent," Journal of Cleaner Production, Volume 234, 2019, Pages 132-138, ISSN 0959-6526, available at https://www.sciencedirect.com/science/article/pii/S0959652619321559)

| | | | | |
|---|---|---|---|---|
| 1 | 0.15 | 8760 | 1314 | **621.1636** |

| | 2030 | 2050 |
|---|---|---|
| Solar Reduction (MMtons)* | 0.0031058 | 0.0155291 |

- Reduction (621.164)*5/1,000,000
- Reduction (621.164)*25/1,000,000

* CO2e/MWh (metric tons) = 0.472727273
* CO2e numbers are based on 2022 emissions provided by Carnie Melon University
* Metric ton =2200 lbs
* Analysis assumes capacity is installed January 2025.

Organic fertilizer production (per 100,000 acres):

10,000 Metric Tons of CO2 equivalent per 100. These numbers were used based on results from this study, "Comparative analysis of the environmental impact of conventional and precision spring wheat fertilization under various meteorological conditions."[3] "Results obtained over the entire five-year research period indicated that when VRF (variable-rate fertilization) was used, GHG emissions were 9.4% lower than when CF (conventional fertilization) was used."[4] We extrapolated to the 10% figure and applied it to the goal acreage of 100,000 new VRF/precision acres.

## Measure 4. Reduce Nonpoint Sources of Pollution and Associated Algal Blooms

This measure proposes to support local efforts to sustainably reduce the prevalence of algal blooms, thereby reducing their associated greenhouse gas emissions, by increasing funding available to implement nutrient pollution reduction projects. Such projects may include septic system improvement programs; floodplain, wetland, and riparian restoration; and grazing management planning.

### Reduction Potential for the Measure

| Priority Measure | Cumulative GHG Emission Reductions (MMT $CO_2e$) | |
|---|---|---|
| | By 2030 | By 2050 |
| Reduce nonpoint source nutrient pollution | $4x10^{-9}$ | $2x10^{-8}$ |

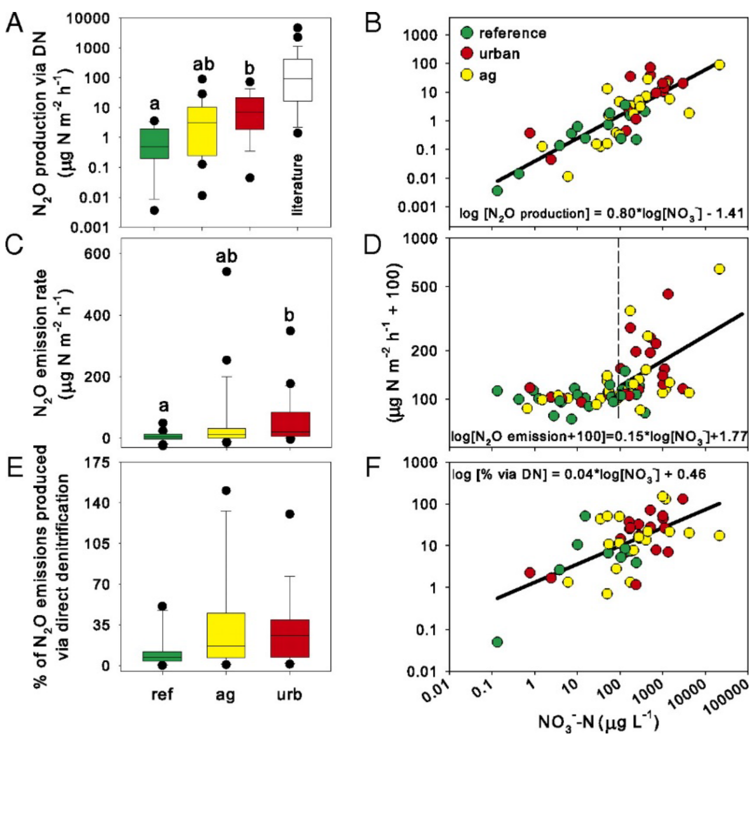
[3] arius Jovarauskas, Dainius Steponavičius, Aurelija Kemzūraitė, Remigijus Zinkevičius, Kęstutis Venslauskas, "Comparative analysis of the environmental impact of conventional and precision spring wheat fertilization under various meteorological conditions," Journal of Environmental Management, Volume 296, 2021, 113150, ISSN 0301-4797,available at https://www.sciencedirect.com/science/article/pii/S0301479721012123).

*Quantification tool(s) utilized: https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator#results*

Emission reduction estimates below are quantified using the nutrient load reductions that are already reported under the §319 Nonpoint Source Grant Program and extrapolating those values to greenhouse gas emission reductions using existing literature values.[5] Emission estimates in the table below are based off nine recently completed projects. These calculations focus on emissions from water surface. In the future, Montana would like include the climate benefits of the terrestrial component of projects where woody vegetation on riparian floodplains are restored.

Literature on the conversion of Nitrate from Nonpoint source pollution to nitrous oxide is limited in scope. We chose the equations to convert the reduction of nonpoint source pollution to a reduction of CO2e based on a combination of different studies documenting this relationship and settled on the analysis done by Beaulieu J. et al. 2010. Beaulieu J. et al. 2010 was used as they were able to demonstrate through tracer studies the conversion of Total Nitrogen concentrations to nitrous oxide 24-hour emission rates with a high degree of accuracy and confidence. This equation allows us to take our load reductions converted to concentrations based on the 14Q5 flow (seasonal low flows) and calculate nitrous oxide emission rates used for CO2 equivalencies reduction reporting.

The figure below, panel D, is an example of some of the literature that provides equations to take concentrations or loads of nutrient in water and convert that into a GHG emission.

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[5] J Beaulieu et al. (2019). "Eutrophication will increase methane emissions from lakes and impoundments during the 21st century," Nat Commun, **10**(1375), available from https://doi.org/10.1038/s41467-019-09100-5.

# CLEAN, RELIABLE TRANSPORTATION

## Measure 1: Strategic Conversion of Fleet Vehicles to Cleaner Alternatives

MDEQ's Energy Bureau has a successful zero emissions vehicle program based on the Volkswagen Diesel Emissions Settlement funding and Diesel Emissions Reduction Act (DERA) funding. Future estimates for an implementation grant are uncertain at the time of the PCAP development so emissions reduction potential is evaluated using a unitized approach for individual vehicle types. The TA evaluated annual reduction potential utilizing the Argonne National Lab - Alternative fuel Life-Cycle Environmental and Economic Transportation (AFLEET) Tool. Default values were selected for vehicle mileage and fuel economy and WECC was selected for the electricity source. The emission reductions quantified for the switcher locomotive engine were calculated using the US EPA's Diesel Emissions Quantifier "Emissions Results and Health Benefits for Project: Switcher Tier 4" guidance.

Projected emissions assume purchase and vehicle delivery occur in year 1 with full vehicle use occurring between 2025 – 2030 or 2025 – 2050. The total emissions reduction accounts for well-to-wheels petroleum use and GHG emissions along with vehicle operation air pollutants. The variables and counts assessed for each vehicle type are included in the following table.

| Vehicle Type | Quantity | Vehicle Mileage (mi/year) | Existing Fuel Type | Replace-ment Type | Fuel Economy (MPDGE) | Annual GHG per ICE vehicle (short tons $CO_2e$) | Annual GHG per EV (short tons $CO_2e$) |
|---|---|---|---|---|---|---|---|
| School Buses | 10 | 15,000 | Diesel | EV | 22.5 | 30 | 10 |
| Transit Buses | 10 | 45,000 | Diesel | EV | 11.2 | 141 | 61 |
| Refuse Truck | 10 | 23,400 | Diesel | EV | 6.2 | 186 | 57 |
| Light Commercial Truck | 10 | 24,000 | Gasoline | EV | 44.6 | 22 | 7 |
| Sedan - Fleet Vehicle | 10 | 12,400 | Gasoline | EV | 118.2 | 5 | 1.4 |
| Pickup (1/4-ton) - Fleet Vehicle | 10 | 11,400 | Gasoline | EV | 73.5 | 6 | 2 |
| Switcher Locomotive Engine | 1 | -- | Diesel | Diesel (Tier 4) | -- | 1,215.0 | 1,012.5 |

### Reduction Potential for the Measure

The emissions reduction potential is included for each vehicle type as well as a comprehensive total.

| Priority Measure | Cumulative GHG Emission Reductions ($MMT\ CO_2e$) | |
|---|---|---|
| | By 2030 | By 2050 |

| Strategic Conversion of Fleet Vehicles to Cleaner Alternatives (Life-cycle petroleum GHGs vs. WECC) | | |
|---|---|---|
| School Buses (per 10) | 0.0010 | 0.006 |
| Transit Buses (per 10) | 0.0043 | 0.025 |
| Refuse Trucks (per 10) | 0.0065 | 0.036 |
| Delivery Vans/Light Commercial Truck (per 10) | 0.0008 | 0.004 |
| Sedan (per 10) | 0.0002 | 0.0009 |
| 1/4-ton Pickup (per 10) | 0.0002 | 0.0012 |
| Switcher Locomotive Engine (per 1) | 0.0009 | 0.0046 |
| Total | 0.014 | 0.077 |

Tools: Argonne National Lab AFLEET Tool, EPA Diesel Emissions Quantifier

# INDUSTRIAL & POWER SECTOR INNOVATION

## Measure 1. Investment and Improvement in Electric Grid Technology

Adding capacity to the existing electrical grid is paramount to connect new renewable energy sources and reduce overall GHGs from all sectors requiring a large increase in electricity demand and usage. Requests to connect to the U.S. transmission grid grew by 40% in 2022, including nearly 2,000 GW of solar and energy storage resources. The amount of solar, wind, and storage in the current interconnect queues exceeds the amount needed to get to 90% of U.S. electricity from zero-carbon resources by 2035 (LBNL 2023).

Expanding grid capacity can be achieved through building out new transmission and distribution (T&D) infrastructure or by implementing efficiencies to the existing grid. Substantial challenges arise with the construction of new transmission infrastructure due to the need for new rights-of-way and the costly processes for land acquisition and permitting. New power lines often take upwards of 10 years to plan, permit, and build.

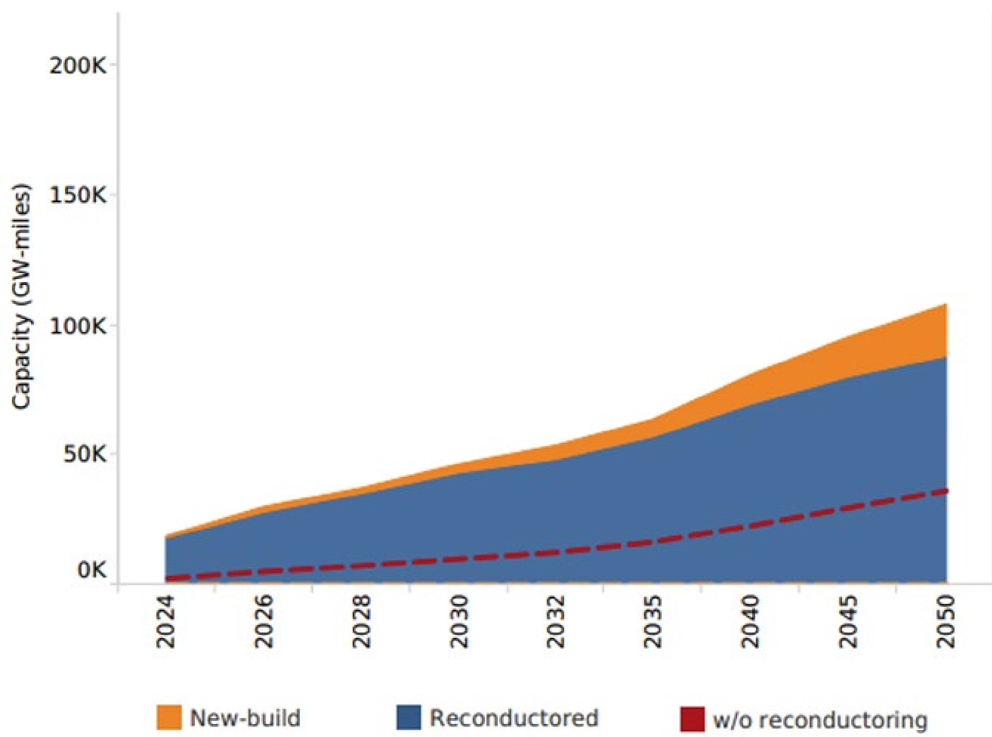
Conversely, the existing grid can be made more efficient through reducing transmission losses and deploying improved technology as outlined in *Opportunities for Energy Efficiency Improvements in the U.S. Electricity Transmission and Distribution System* (ORNL 2015). The Oak Ridge National Laboratory (ORNL) study characterizes improvements to distribution losses, transmission losses, and technology characterization and operational strategies. Notably, reconductoring is identified as a primary focus for the PCAP alongside the other stated improvements in ORNL 2015.

Reconductoring a transmission line implies replacing the existing conductors with newer conductor designs consisting of better properties or design features. For those transmission lines whose transfer capacities are limited by their thermal ratings, reconductoring can be a feasible solution to improve the thermal performance and reduce line loss. Increasing T&D efficiency through reconductoring and other efficiency measures can reduce emissions by minimizing the amount of energy lost during electricity transport from power plants to end-users. The energy lost during T&D is typically in the form of heat generated due to resistance in the transmission lines and transformers. Research out of Carnegie Melon found that electricity is generated versus how much electricity is delivered to the user can produce up to 5% loss in U.S. systems (Janicke et al. 2023). By reducing T&D losses, less energy is wasted, and less energy needs to be generated to meet the same level of demand. An increase in efficiency between 5% and 33% would reduce global median emissions by up to 40%. (Janicke et al. 2023).

The losses in T&D systems are distinguished by technical losses–infrastructure inefficiencies – and nontechnical losses–theft or error. Technical losses can be addressed by investment in newer, high-voltage lines to replace older T&D infrastructure. Non-technical losses can introduce the use of smart meters and greater enforcement of bill payment accountability to reduce loss. Janicke et al considered a cost comparison per ton of carbon dioxide ($CO_2$) abated through different technologies in the U.S. The results showed that smart meters have a median abatement cost of $1,100 per ton of CO2, wind turbines cost $700 per ton, and solar plants cost $1,280 per ton (Janicke et al. 2023).

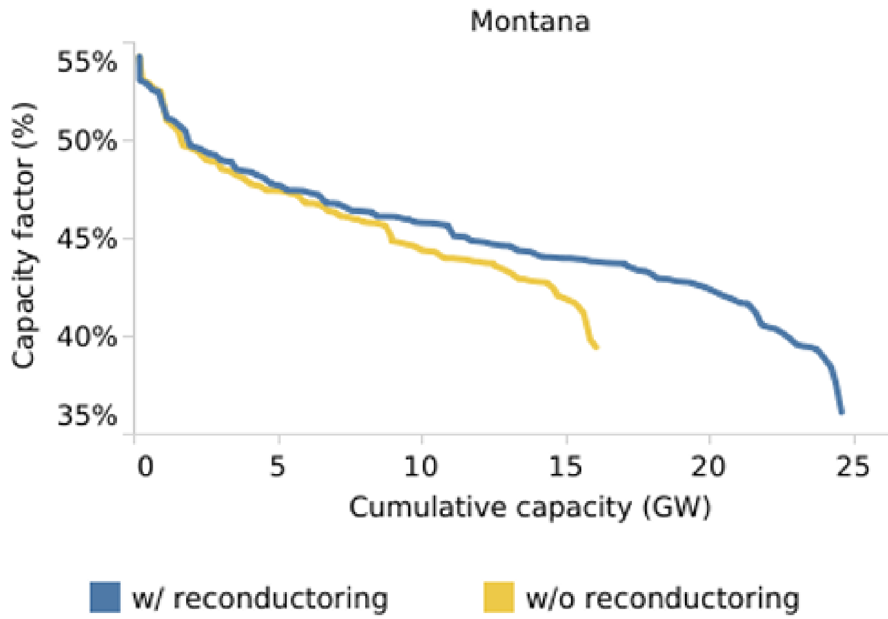
Additionally, ongoing research from UC Berkeley discovered that reconductoring can help meet over 80% of the new interzonal transmission needed to reach over 90% clean electricity by 2035 given restrictions on greenfield transmission build-out. With $180 billion in system cost savings by 2050, reconductoring presents a cost-effective and time-efficient, yet underutilized, opportunity to accelerate transmission expansion. (Chojkiewicz et al 2024). The following chart from Chojkiewicz et al illustrates the potential for added capacity due to reconductoring.

Cumulative Added Capacity: Restricted Build-Out




Chojkiewicz et al also identifies that reconductoring enables more wind capacity to be accessed and evacuated from wind-rich states, as demonstrated by Montana and Nebraska. The following graph indicates the added capacity potential for renewable energy sources in Montana based on reconductoring.

Potential Added Capacity from Wind Energy due to Reconductoring




Given the potential increase in grid capacity unlocked through increased grid efficiency, the analysis also includes increased utility-scale renewable energy generation as a potential reduction opportunity. The EPA AVERT Tool was used to assess emissions reductions from the inclusion of 100-MW of solar PV and 100-MW of wind energy added to the grid.

Emissions Reduction from Utility Scale Renewable Energy Generation

| System Type | Total Capacity (MW) | Estimated Generation (MWh/yr) | Annual CO2 Reduction (MT/year) | Emissions Reduction 2025 - 2030 (MMT $CO_2e$) | Emissions Reduction 2025 - 2030 (MMT $CO_2e$) |
|---|---|---|---|---|---|
| Utility Scale Solar PV | 100 | 229,360 | 145,032 | 0.72 | 3.4 |
| Utility Scale Wind | 100 | 246,610 | 155,628 | 0.77 | 3.6 |

## Reduction Potential for the Measure

| Priority Measure | Cumulative GHG Emission Reductions (MMT $CO_2e$) | |
|---|---|---|
| | By 2030 | By 2050 |
| Investment and Improvement in Electric Grid Technology | 5% - 33% efficiency per GW-mi (see text in Appendix) | |
| *Enables increased renewable energy development:* | | |
| Utility-Scale Solar PV (100 MW) | 0.7 | 3.4 |
| Utility-Scale Wind (100 MW) | 0.8 | 3.6 |

Tools: EPA AVERT Tool

## Measure 2: Incentivize Industrial Process Efficiencies

Given the broad nature of the measure, GHG calculations were not made. Instead, calculations will be made by eligible entities that wish to apply for implementation funding.

# HIGH PERFORMANCE HOMES & BUSINESSES

## Measure 1. Improve Efficiency of Government, Nonprofit, and Commercial Buildings and Operations

This measure provides varied opportunities for governments, commercial entities, and nonprofits to save energy and reduce emissions through energy efficiency measures and on-site power generation. The reduction potential varies greatly depending upon scope and scale of measures along with the size, age, and condition of the building being evaluated. Therefore, the analysis utilizes median energy use intensity (EUI) scores for different building types and tenants. Reduction potential is then evaluated from an energy efficiency percentage and theoretical square footage for each building category with the assumption that it all occurs through reduction in electricity usage.

Second, the analysis identifies emissions reduction potential of installing incremental amounts of 50-kW solar PV systems. The majority utility in Montana provides a net metering opportunity for solar PV systems that are 50-kW or less. Therefore, this analysis considers the measure providing an opportunity to install an incremental number of 50-kW net metered systems throughout Montana.

The quantified analysis indicates the potential emissions reduction available by building type due to implementation of this measure. The EUI scores were provided by the Energy Star Portfolio Manager: U.S. Energy Use Intensity by Property Type (EnergyStar 2023) and the reduction potential from on-site renewable energy was assessed using the AVERT Tool. Emission rates for grid-based electricity were derived using the AVERT Tool, categorized as the power sector only for the Rocky Mountain Region due to changes in Montana. The following tables provide potential reduction opportunities for the measure based on theoretical efficiency projects.

The measure also identifies on-site power generation as a potential inclusion within projects. Therefore, the analysis also evaluated the reduction potential of including a varying number of on-site solar PV systems. The majority utility in Montana provides a net metering opportunity for solar PV systems that are 50-kW or less. Therefore, this analysis considers the measure providing an opportunity to install 50-kW solar PV systems. Emissions reduction for solar PV systems are also included in the following tables.

<u>Energy Efficiency Reduction Potentials</u>

| Energy Star EUI Data | | | Theoretical Efficiency Project | | | | |
|---|---|---|---|---|---|---|---|
| Building Category | Primary Function | Median EUI by Source Type (kBtu/ft$^2$) | Reduc-tion % | Adjusted EUI (kBtu/ft$^2$) | Footprint Area (ft$^2$) | Energy Conserved (kBtu/yr) | Emissions Reduction (MT CO2/yr) |
| Education | Adult Education | 110.4 | 10% | 99.36 | 400,000 | 4,416,000 | 382.96 |

| Energy Star EUI Data | | | Theoretical Efficiency Project | | | | |
|---|---|---|---|---|---|---|---|
| | College/ University | 180.6 | 10% | 162.54 | 800,000 | 14,448,000 | 1,252.95 |
| | Pre-School/ Daycare | 131.5 | 15% | 111.775 | 1,500 | 29,588 | 2.57 |
| | Vocational School | 110.4 | 15% | 93.84 | 120,000 | 1,987,200 | 172.33 |
| Healthcare | Hospital | 426.9 | 5% | 405.555 | 260,000 | 5,549,700 | 481.28 |
| | Clinic | 145.8 | 5% | 138.51 | 80,000 | 583,200 | 50.58 |
| Office | Office | 116.4 | 15% | 98.94 | 25,000 | 436,500 | 37.85 |
| Public Services | Courthouse | 211.4 | 10% | 190.26 | 20,000 | 422,800 | 36.67 |
| | Fire Station | 124.9 | 5% | 118.655 | 18,000 | 112,410 | 9.75 |
| | Library | 143.6 | 10% | 129.24 | 25,000 | 359,000 | 31.13 |
| | Police Station | 124.9 | 5% | 118.655 | 37,500 | 234,188 | 20.31 |
| | Meeting Hall | 109.6 | 15% | 93.16 | 10,000 | 164,400 | 14.26 |

<u>On-Site Solar PV Reduction Potentials</u>

On-site solar PV reduction potential was evaluated using the EPA AVERT Tool for varying total MW-contributions to the grid. The selected geography was the State of Montana and distributed solar PV total capacity was input.

| 50-kW System Count | Total kW | Total MW | Annual CO2 Reduction (MT/year) | Emissions Reduction 2025 - 2030 (MT $CO_2e$) |
|---|---|---|---|---|
| 1 | 50 | 0.05 | 64 | 254 |
| 10 | 500 | 0.5 | 608 | 2431 |
| 50 | 2500 | 2.5 | 3039 | 12156 |
| 100 | 5000 | 5 | 6078 | 24313 |

## Reduction Potential for the Measure

| Priority Measure | Cumulative GHG Emission Reductions (MMT $CO_2e$) | |
|---|---|---|
| | By 2030 | By 2050 |

| | |
|---|---|
| Improve Efficiency of Government, Nonprofit, and Commercial Buildings and Operations | Variable (see text in Appendix) |

Tools: Energy Star Portfolio Manager; EPA AVERT Tool

## Measure 2. Low-Emission Home Heating Incentives

The analysis focuses on western Montana where inversion layers form in mountain valley regions during cold winter months. This creates elevated levels of ambient particulate matter concentrations due to poor dispersion and prevalent use of wood stoves. An individual stove "change-out" is based on the average fuel use assumed for a single-family home in areas representative of Libby and Frenchtown, Montana. Emissions are quantified for various existing stove types and for three implementation scenarios: 1) 80% Air-source heat pump (ASHP) use with 20% wood stove supplementation, 2) 90% ASHP use with 10% wood stove supplementation, and 3) 100% replacement of wood stove by an ASHP.

The overall methodology used for quantifying emissions is based on the California Air Resources Board (CARB) Final FY2021-22 Quantification Methodology Woodsmoke Reduction Program (CARB 2023). The average annual fuel use per home is based on 4 cords of wood to heat a home through the late Fall, Winter, and early Spring months. The heat content of wood used is 17.48 mmBtu/short ton as referenced from the EPA Center for Corporate Climate Leadership Emission Factors for Greenhouse Gas Inventories, Updated Sept. 12, 2023 (EPA 2023). This document was also referenced for GHG emission factors for conventional, noncatalytic, and catalytic wood stoves. The analysis assumed pine would be used for woodstove fuel and a 2.15 tons per cord conversion factor was utilized based on the New Hampshire Department of Revenue timber conversion formulas. Wood stove emission factors and net efficiency was provided by AP-42 Ch. 1.10 Residential Wood Stoves Table 1.10-1 (EPA 1996). Additionally, the recommended burn rate and $PM_{2.5}$ emission speciation factor is referenced in the Residential Wood Combustion – $PM_{2.5}$ Emissions report prepared for the Western States Air Resource Council (WESTAR) Emission Inventory Workshop (WESTAR 1998).

A multi-zone non-ducted ASHP model was selected as the replacement or supplement for wood stoves. The model is eligible for a federal tax credit in order to ensure a high efficiency model is assessed in the program, and also to ensure homeowners would be able to take advantage of additional financial incentives. The model selected is ASHRI # 207517160. Cold climate performance data was gathered from the Northeast Energy Efficiency Partnership (NEEP) Cold Climate Air Source Heat Pump List (NEEP 2023). The ASHP model coefficient of performance (COP) identified at 5°F was then utilized to determine equivalent heat input required by the ASHP. Electricity emission factors are based on the EPA AVERT Tool for the Northwest Regional Fossil Generation Fleet which is representative of the evaluated area.

<u>Wood Stove Emissions</u>

First woodstove emissions were evaluated based on fuel input, burn rate, and stove efficiency.

| Wood Heater Type | Net Efficiency (%) | Stove Specific Energy (mmBtu/yr) | $CO_2$ (MT/year) | $CH_4$ (MT/year) | $N_2O$ (MT/year) | $CO_2e$ (MT/year) |
|---|---|---|---|---|---|---|
| Wood Stoves | | | | | | |
| Conventional | 54% | 278 | 78 | 0.0060 | 0.00301 | 79 |
| Noncatalytic | 68% | 221 | 62 | 0.0048 | 0.00239 | 62 |
| Catalytic | 68% | 221 | 62 | 0.0048 | 0.00239 | 62 |
| Pellet Stoves | | | | | | |
| Certified | 68% | 221 | 51 | - | - | 51 |
| Exempt | 56% | 268 | 77 | - | - | 77 |

Equivalent ASHP Emissions

ASHP emissions were then evaluated based on COP @ 5°F, equivalent energy requirements, and grid emission factors.

| Wood Heater Type | Stove Specific Energy (mmBtu/yr) | Heat Pump Specific Energy (COP @ 5°F) (mmBtu/yr) | $CO_2$ (MT/year) | $CH_4$ (MT/year) | $N_2O$ (MT/year) | $CO_2e$ (MT/year) |
|---|---|---|---|---|---|---|
| Wood Stoves | | | | | | |
| Conventional | 278 | 139 | 10.52 | - | - | 11 |
| Noncatalytic | 221 | 111 | 8.35 | - | - | 8 |
| Catalytic | 221 | 111 | 8.35 | - | - | 8 |
| Pellet Stoves | | | | | | |
| Certified | 221 | 111 | 8.35 | - | - | 8 |
| Exempt | 268 | 134 | 10.14 | - | - | 10 |

Maximum Case Emissions Reduction Per Stove (Prioritize Change Out of Least Efficient Stoves)

Emission reduction potential was then quantified for conventional wood stoves as an implemented program would prioritize the change out or supplementation of least efficient stoves first. Each of the three implementation scenarios were quantified. The following table provides reduction potential on a per stove basis.

| Wood Heater Type | Scenario #1: 80% ASHP; 20% Stove | Scenario #2: 90% ASHP; 10% Stove | Scenario #3: 100% ASHP |
|---|---|---|---|
| | $CO_2e$ (MT/year) | $CO_2e$ (MT/year) | $CO_2e$ (MT/year) |
| Swap out (1) Conventional Wood Stove for ASHP | 39 | 54.0 | 68.8 |

## Reduction Potential for the Measure

Total reduction potential is then evaluated on the basis of replacing 50-stoves for each implementation scenario.

| Priority Measure | Cumulative GHG Emission Reductions ($MMT\ CO_2e$) | |
|---|---|---|
| | By 2030 | By 2050 |
| Low Emission Home Heating (Woodstove Change Out) per 50 stove/ASHP replacements | 0.018 | 0.093 |

| | | |
|---|---|---|
| Low Emission Home Heating (Supplemental Heating: 90% ASHP; 10% Stove) per 50 stove/ASHP supplementation | 0.014 | 0.073 |
| Low Emission Home Heating (Supplemental Heating: 80% ASHP; 20% Stove) per 50 stove/ASHP supplementation | 0.010 | 0.054 |

Tools: CARB Quantification Methodology Woodsmoke Reduction Program; EPA AVERT Tool

## Measure 3. Residential, Small Business, and Agricultural Energy Performance Incentives

This measure provides varied opportunities for homes, small businesses, and agricultural producers to save energy and reduce emissions through energy efficiency measures and on-site power generation. The reduction potential varies greatly depending upon the scope and scale of potentially funded projects; therefore, a wide variety of options has been assessed for reduction potential.

First, this analysis utilizes average home emissions savings based on Montana housing stock as evaluated by the National Renewable Energy Laboratory (NREL) ResStock Tool. Emission reduction potential is sorted by three categories: 1) energy efficiency and electrification upgrade, 2) fuel use, and 3) building type.

Second, the analysis identifies emissions reduction potential of installing incremental amounts of 50-kW solar PV systems. The majority utility in Montana provides a net metering opportunity for solar PV systems that are 50-kW or less. Therefore, this analysis considers the measure providing an opportunity to install an incremental number of 50-kW net metered systems throughout Montana.

Third, the analysis summarizes energy efficiency opportunities for agricultural process.

<u>Residential/Small Business Energy Efficiency Opportunities</u>

The NREL ResStock tool was accessed to provide a basis of emission reduction potential for Montana-specific building stock. The results consider energy efficiency and electrification upgrades that overlap with IRA Home Energy Rebate funding. Additionally, the results consider all fuel-types accounted for in the ResStock database including electricity, natural gas, fuel oil, and propane. The results also detail reduction potentials for single-family detached homes, multi-family units with 2-4 units, and multi-family units with 5 or more units. The results are provided in the following tables.

Note that many of the values provided for emissions savings average from electricity are negative numbers. This indicates an increase in emissions. However, the ResStock tool utilizes an aggregation of all buildings assessed within the program. Therefore, the electrification-based upgrades account for buildings undergoing fuel-switching from natural gas, fuel oil, and propane. Intuitively, this results in a decrease in emissions from fuel-use and an increase in emissions from electricity-use due to the new increase electrical load requirement from beneficial electrification. Due to the distribution of homes accounting for fuel switching, this skews the values provided in the emissions saving average from electricity. The comprehensive building stock portfolio would experience an overall reduction in total emissions as indicated by the "Emission Savings Average" column.

Single-Family Detached Home Reduction Potential

| Energy Efficiency and Electrification Upgrade | Single-Family Detached Home | | | | |
|---|---|---|---|---|---|
| | Emission Saving Avg. ($kgCO_2e/yr$) | Emission Saving Avg. from Electricity ($kgCO_2e/yr$) | Emission Saving Avg. from Fuel Oil ($kgCO_2e/yr$) | Emission Saving Avg. from Nat. Gas ($kgCO_2e/yr$) | Emission Saving Avg. from Propane ($kgCO_2e/yr$) |
| Basic enclosure upgrade | 1,824 | 150 | 31 | 1,316 | 327 |
| Enhanced enclosure upgrade | 232 | 193 | 37 | 1,673 | 420 |
| Minimum efficiency heat pump with existing backup heat | 2,020 | (73) | 44 | 1,554 | 495 |
| High efficiency heat pump with electric backup | 5,389 | (595) | 105 | 4,565 | 1,314 |
| Minimum efficiency whole home electrification | 5,843 | (1,666) | 119 | 5,694 | 1,696 |
| High efficiency whole home electrification | 6,829 | (573) | 109 | 5,204 | 1,550 |
| Heat pump water heater | 504 | (18) | 1 | 391 | 131 |
| Basic enclosure upgrade with heat pump water heater and high efficiency heat pump with electric back up | 6,583 | (204) | 109 | 5,162 | 1,516 |
| Enhanced enclosure upgrade with heat pump water heater & high efficiency heat pump with electric back up | 6,627 | (159) | 109 | 5,162 | 1,516 |
| Basic enclosure upgrade + high efficiency whole home electrification | 6,668 | (194) | 109 | 6,204 | 1,550 |

| Energy Efficiency and Electrification Upgrade | Single-Family Detached Home | | | | |
|---|---|---|---|---|---|
| | Emission Saving Avg. ($kgCO_2e/yr$) | Emission Saving Avg. from Electricity ($kgCO_2e/yr$) | Emission Saving Avg. from Fuel Oil ($kgCO_2e/yr$) | Emission Saving Avg. from Nat. Gas ($kgCO_2e/yr$) | Emission Saving Avg. from Propane ($kgCO_2e/yr$) |
| Enhanced enclosure upgrade + high efficiency whole home electrification | 6,712 | (150) | 109 | 5,204 | 1,550 |

Multi-Family with 2-4 Units Reduction Potential

| Energy Efficiency and Electrification Upgrade | Multi-Family with 2-4 Units | | | | |
|---|---|---|---|---|---|
| | Emission Saving Avg. ($kgCO_2e/yr$) | Emission Saving Avg. from Electricity ($kgCO_2e/yr$) | Emission Saving Avg. from Fuel Oil ($kgCO_2e/yr$) | Emission Saving Avg. from Nat. Gas ($kgCO_2e/yr$) | Emission Saving Avg. from Propane ($kgCO_2e/yr$) |
| Basic enclosure upgrade | 722 | 116 | 24 | 581 | - |
| Enhanced enclosure upgrade | 852 | 148 | 24 | 680 | - |
| Minimum efficiency heat pump with existing backup heat | 883 | 152 | 39 | 692 | - |
| High efficiency heat pump with electric backup | 2,114 | 188 | 51 | 1,875 | 1,314 |
| Minimum efficiency whole home electrification | 2,646 | (568) | 66 | 3,082 | 65 |
| High efficiency whole home electrification | 2,692 | 209 | 51 | 2,382 | 50 |
| Heat pump water heater | 325 | (18) | (2) | 319 | 26 |
| Basic enclosure upgrade with heat pump water heater and high efficiency heat pump with electric back up | 2,736 | 309 | 51 | 2,350 | 26 |

| Energy Efficiency and Electrification Upgrade | Multi-Family with 2-4 Units | | | | |
|---|---|---|---|---|---|
| | Emission Saving Avg. ($kgCO_2e/yr$) | Emission Saving Avg. from Electricity ($kgCO_2e/yr$) | Emission Saving Avg. from Fuel Oil ($kgCO_2e/yr$) | Emission Saving Avg. from Nat. Gas ($kgCO_2e/yr$) | Emission Saving Avg. from Propane ($kgCO_2e/yr$) |
| Enhanced enclosure upgrade with heat pump water heater & high efficiency heat pump with electric back up | 2,756 | 329 | 51 | 2,350 | 26 |
| Basic enclosure upgrade + high efficiency whole home electrification | 2,795 | 312 | 51 | 2,382 | 50 |
| Enhanced enclosure upgrade + high efficiency whole home electrification | 2,851 | 332 | 51 | 2,382 | 50 |

Multi-Family with 5+ Units Reduction Potential

| Energy Efficiency and Electrification Upgrade | Multi-Family with 5+ Units | | | | |
|---|---|---|---|---|---|
| | Emission Saving Avg. ($kgCO_2e/yr$) | Emission Saving Avg. from Electricity ($kgCO_2e/yr$) | Emission Saving Avg. from Fuel Oil ($kgCO_2e/yr$) | Emission Saving Avg. from Nat. Gas ($kgCO_2e/yr$) | Emission Saving Avg. from Propane ($kgCO_2e/yr$) |
| Basic enclosure upgrade | 275 | 98 | - | 178 | - |
| Enhanced enclosure upgrade | 307 | 116 | - | 191 | - |
| Minimum efficiency heat pump with existing backup heat | 415 | 13 | 2 | 300 | 10 |
| High efficiency heat pump with electric backup | 729 | 206 | 2 | 511 | 10 |
| Minimum efficiency whole home electrification | 1,172 | (242) | 3 | 1,307 | 104 |
| High efficiency whole home electrification | 1,268 | 223 | 2 | 966 | 77 |

| Energy Efficiency and Electrification Upgrade | Multi-Family with 5+ Units | | | | |
|---|---|---|---|---|---|
| | Emission Saving Avg. ($kgCO_2e/yr$) | Emission Saving Avg. from Electricity ($kgCO_2e/yr$) | Emission Saving Avg. from Fuel Oil ($kgCO_2e/yr$) | Emission Saving Avg. from Nat. Gas ($kgCO_2e/yr$) | Emission Saving Avg. from Propane ($kgCO_2e/yr$) |
| Heat pump water heater | 350 | (22) | (2) | 335 | 40 |
| Basic enclosure upgrade with heat pump water heater and high efficiency heat pump with electric back up | 1,267 | 272 | 2 | 940 | 53 |
| Enhanced enclosure upgrade with heat pump water heater & high efficiency heat pump with electric back up | 1,275 | 280 | 2 | 940 | 53 |
| Basic enclosure upgrade + high efficiency whole home electrification | 1,320 | 275 | 2 | 966 | 77 |
| Enhanced enclosure upgrade + high efficiency whole home electrification | 1,328 | 283 | 2 | 966 | 77 |

On-Site Solar PV Reduction Potentials

On-site solar PV reduction potential was evaluated using the EPA AVERT Tool for varying total MW-contributions to the grid. The selected geography was the State of Montana and distributed solar PV total capacity was input.

| 50-kW System Count | Total kW | Total MW | Annual CO2 Reduction (MT/year) | Emissions Reduction 2025 - 2030 (MT $CO_2e$) |
|---|---|---|---|---|
| 1 | 50 | 0.05 | 64 | 254 |
| 10 | 500 | 0.5 | 608 | 2431 |
| 50 | 2500 | 2.5 | 3039 | 12156 |
| 100 | 5000 | 5 | 6078 | 24313 |

Agriculture Energy Efficiency Opportunities

Agricultural equipment and operations hold additional opportunities for energy efficiency upgrades. The analysis references efficiency opportunities as outlined in the Bonneville Power Administration (BPA) Agricultural Energy Efficiency Toolkit. Some notable opportunities are summarized below:

*Variable Frequency Drives (VFDs)*

VFPs adjust the motor speed of the water pump to match-flow requirements of an irrigation system. Utilizing a VFD can save 10-20% in energy savings and can help prolong equipment life due to alleviating over- or under-performing systems.

*High-Efficiency Pump Upgrades*

Upgrading old pumps to new, high-efficiency models will reduce energy use along with providing an opportunity to re-size the pump to the irrigation system. New pumps equipped with VFDs provided added efficiency.

*LED Lighting Upgrades*

Energy efficiency LED lighting upgrades and controls can improve working environments and safety as well as providing up to 25 - 50% energy-cost savings. Agricultural facilities may utilize long-standing, high-intensity discharge lamps in outdoor fixtures. Converting these lamps specifically to LEDs can provide high energy-cost savings and fast return on investment.

*Thermostatic Controls*

Various heaters are used in agricultural processes such as livestock waterers and engine block heaters. These can use a lot of electricity when it is not required because they are left on at all times. Thermostatic controls can limit the operation of heaters to freezing days or certain outdoor temperature setpoints.

*Irrigation Pump Tests, Piping Re-Sizing, System Re-Design*

Pump tests and sizing identifies opportunities to allow the pumping and irrigation delivery system to operate more efficiently. Re-sizing piping or designing an updated system can help to reduce friction losses which allows reduced the requirements from the pump motor.

*Anaerobic Digesters*

Agricultural operations can utilize waste products such as livestock manure, waste feed, and food-processing waste to create biofuels. Anaerobic digesters utilize an oxygen-free environment to break down organic feedstocks to create methane. The biogas can be upgraded and utilized in place of fossil fuel-based methane.

### Reduction Potential for the Measure

| Priority Measure | Cumulative GHG Emission Reductions (MMT $CO_2e$) | |
|---|---|---|
| | By 2030 | By 2050 |
| Residential, Small Business, and Agricultural Energy Performance Incentives | Variable (see text in Appendix) | |

Tools: NREL ResStock; EPA AVERT Tool, BPA EE Toolkit

## WASTE REDUCTION OF DIVERSION

### Measure 1. Develop or Expand Local Recycling and Composting Capacity

Given the broad nature of the measure, GHG calculations were not made. Instead, calculations will be made by eligible entities that wish to apply for implementation funding.

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