Miami Valley Region / MVRPC

Comprehensive Climate Action Plan

Technical Report – Final

August, 2025

Prepared for

Miami Valley Regional Planning Commission

Prepared by

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Designed by SSG

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How to Read This Document

This document is a Comprehensive Climate Action Plan (CCAP). It is a roadmap developed by your Miami Valley Region to reduce climate pollution in ways that are measurable, effective and aligned with local priorities. Supported by the United States Environmental Protection Agency's (EPA) Climate Pollution Reduction Grants (CPRG) program, the plan outlines how local communities will reduce greenhouse gas (GHG) emissions, improve air quality, strengthen the local economy and prepare for climate-related risks.

Why This Plan Matters

This plan is part of a nationwide effort to reduce pollution and improve quality of life. It is built on local data, shaped by feedback from interested and affected parties, and designed to ensure that the benefits of GHG emissions reduction measures are widely shared — including in communities that face higher environmental and economic challenges.

What You Will Find in This Document

- **Public Input (Section 2):** How residents, organizations and partners helped shape the priorities and solutions in the plan.
- **Greenhouse Gas Inventory (Section 3):** A summary of where emissions come from (such as vehicles, buildings and industry) and how they have changed over time.
- **Near-Term and Long-Term GHG Reduction Targets (Section 4):** Emissions reduction goals for 2030 and 2050, using the best available data and tools.
- **Future Projections (Sections 5 and 6):** What emissions could look like under a "business-as-usual" scenario, and how things change if the plan is implemented.
- **Reduction Measures (Section 6):** Specific actions proposed to cut emissions — such as expanding public transit or investing in clean energy systems.
- **Implementation Strategies (Section 7):** How measures move from vision to reality with specific entities, funding sources, and timelines defined.
- **Benefits Analysis (Section 8):** How measures will positively impact the community through cleaner air, cost savings, job creation and more, including expected benefits in at-risk and low-income communities.
- **Workforce Planning (Section 9):** A look at the jobs and training needed to carry out the proposed measures.

How to Use This Document

- Start with **"The Community-First Energy Plan"** companion report for a quick overview of the plan's goals and priorities.
- Use the tables, figures and maps to help make the technical data easier to understand.
- Each section builds on the last — read in order for the full context or skip to topics that interest you most.
- Search the glossary and appendices for more detail if you need it.

Who This Plan Is For

This plan is for everyone — residents, governments, businesses, utilities and other partners — who have a role to play in shaping a healthier, more sustainable future. It offers a clear path forward and highlights how local GHG emissions reduction measures can benefit communities now and in the years to come.

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Acronyms and Abbreviations

Acronym	Definition
BAP	Business as Planned
BAU	Business as Usual
BDS	Building development standard
BIPOC	Black, Indigenous, and People of Color
BLS	Bureau of Labor Statistics
CAFE	Corporate Average Fuel Efficiency
CAP	Criteria Air pollutant
CAT	Climate action tracker
CBO	Community-based organization
CCAP	Comprehensive Climate Action Plan
CCS	Carbon capture and storage
CDBG	Community Development Block Grants
CH4	methane
CJEST	Climate and Economic Justice Screening Tool
CMAQ	Congestion Mitigation and Air Quality
CO	carbon monoxide
CO2	carbon dioxide
CO2e	carbon dioxide equivalent
COP	Conference of the Parties (UN meeting on climate change)
CPRG	Climate Pollution Reduction Grant
CRA	Community Reinvestment Area
DMA	Data, Methods and Assumptions
DOC	Department of Commerce
DOE	Department of Energy
DOT	Department of Transportation
EECBG	Energy Efficiency and Conservation Block Grant
EEPOC	Energy Efficiency Program for Ohio Communities

Acronym	Definition
EJScreen	Economic Justice Screening Tool
EPA	Environmental Protection Agency
EPCs	Energy Performance Contracts
EUI	energy use intensity
EV	Electric vehicle
FHA-CRP	Federal Highway Administration's Carbon Reduction Program
FTA	Federal Transit Administration
GDP	Gross domestic product
GDS	green development standards
GED	General Educational Development
GHG	Greenhouse gas
GJ	Gigajoule
GPC	Global Protocol for Community-Scale Greenhouse Gas Emission Inventories
GRMI	Greater Region Mobility Initiative
GWh	gigawatt-hour
GWP	global warming potential
HAP	hazardous air pollutant
HFC	hydrofluorocarbon
HUD	Department of Housing and Urban Development
IPCC	Intergovernmental Panel on Climate Change
IRA	Inflation Reduction Act
IRC	Internal Revenue Code
LC	Low-carbon
MACC	Marginal abatement cost curve
MJ	mega-joule
MMBtu	metric million British thermal unit
MMTCO2e	million metric tons of carbon dioxide equivalent
MVCC	Miami Valley Communications Council
MVRPC	Miami Valley Regional Planning Commission

Acronym	Definition
MW	megawatt
N2O	nitrous oxide
NDC	nationally determined contribution
NF3	nitrogen trifluoride
NGO	Non-governmental organizations
NIST	National Institute of Standards and Technology
NOAA	National Oceanic and Atmospheric Administration
NOx	nitrogen oxides
OAQDA	Ohio Air Quality Development Authority
ODD	Ohio Department of Development
ODJFS	Ohio Department of Job and Family Services
ODOT	Ohio Department of Transportation
OEWS	Occupational Employment and Wage Statistics
ORC	Ohio Revised Code
OTC	Ohio Technical Centers
PACE	property assessed clean energy
PFC	perfluorocarbon
PHEV	plug-in hybrid electric vehicle
PIA	Priority Investment Areas
PM2.5	fine particulate matter smaller than 2.5 micrometers
PPA	power purchase agreement
PUCO	Public Utilities Commission of Ohio
QOFs	Qualified Opportunity Funds
REO	Reentry Employment Opportunities
RLF	revolving loan fund
RNG	renewable natural gas
ROW	right-of-way
SBT	science-based target
SCC	Social cost of carbon

Acronym	Definition
SO2	sulfur dioxide
SOPEC	Sustainable Ohio Public Energy Council
SWMD	Solid Waste Management District
TAC	Technical Advisory Committee
TIF	Tax increment financing
UNFCCC	United Nations Framework Convention on Climate Change
USDA	U.S. Department of Agriculture
VMT	vehicle miles traveled
VOC	volatile organic compound
WESC	Water and Environment Subcommittee
WG	Working group
WIOA	Workforce Innovation and Opportunity Act
WPCLF	Water Pollution Control Loan Fund
WPY	Workforce Pathways for Youth
WWTP	wastewater treatment plant

Key Energy and Emissions Units

GHG Emissions

1 $kTCO_2e$ = 1,000 $MTCO_2e$

Energy

1 MMBtu = 1.055 GJ

1 MJ = 0.0001 GJ

1 TJ = 1,000 GJ

1 PJ = 1,000,000 GJ

1 GJ = 278 kWh

1 MWh = 1,000 kWh

1 GWh = 1,000,000 kWh

1 | Introduction

1.1 CPRG Overview

The Miami Valley Regional Planning Commission (MVRPC) is a recipient of a Climate Pollution Reduction Grant (CPRG) from the United States Environmental Protection Agency (EPA). The CPRG program funds the development of city, regional and state plans to curtail greenhouse gas (GHG) emissions through the Inflation Reduction Act (IRA).

1.2 CCAP Purpose and Scope

The geographic scope of this Comprehensive Climate Action Plan (CCAP) covers the Dayton-Kettering Metropolitan Statistical Area ("Miami Valley Region") in Ohio. The Miami Valley Region includes Greene County, Miami County and Montgomery County (Figure 1.1).

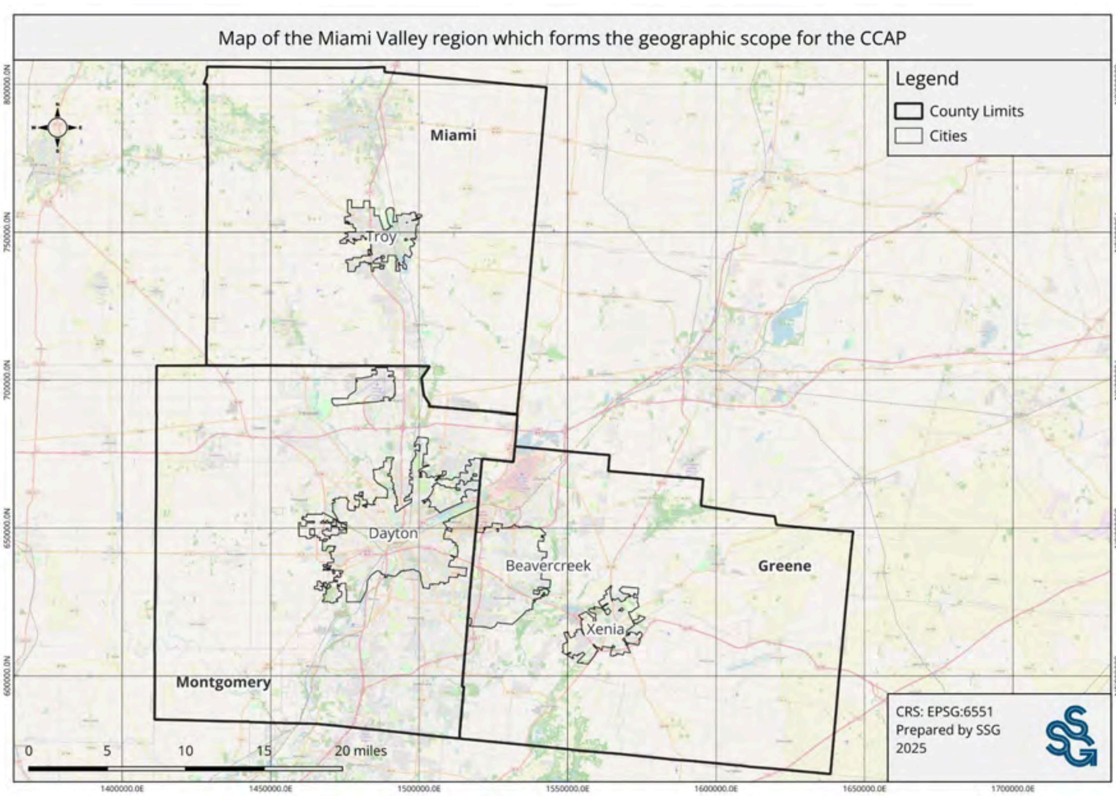

Figure 1.1. Map of the Miami Valley Region (the geographic scope for the CCAP). Source: SSG.

The CCAP identifies actions for the Miami Valley Region to reduce GHG emissions by 54%-55% by 2030 and by 89%-90% by 2050 while achieving other related objectives. These actions are based on both technical analysis and community engagement, and reflect local priorities and challenges. The plan involves a comprehensive assessment of GHGs for all sectors within the region (Table 1.1).

Table 1.1. Sectors included in the GHG emissions scope and their definitions. Source: SSG analysis.

Sector	Definition
Emissions From Energy Use	
Transportation	Emissions from the use of cars, trucks, boats, aviation and non-road vehicles
Electricity Generation	Emissions from the generation and transmission of electricity used within the region, including that produced outside of the region
Residential	Emissions from the use of lighting, appliances, heating and cooling in buildings used as dwellings
Commercial	Emissions from the use of lighting, appliances, heating and cooling in buildings not used as dwellings
Industrial	Emissions from on-site stationary combustion and industrial processes that emit GHGs, such as cement manufacturing or iron and steel production
Other Emissions (Non-Energy Use)	
Agriculture and Forestry	Emissions from agricultural activities such as managing soils, livestock and livestock-related waste, and methane and nitrous oxide emissions from the burning of agricultural residual waste. Emissions from fuel combusted for farm equipment use, such as for the operation of tractors, are included within the transportation sector emissions.
Natural and Working Lands	Sequestration and carbon loss in green and blue infrastructure, including managed and unmanaged forest lands
Solid Waste and Wastewater	Emissions from waste incineration, municipal solid waste and wastewater, and compost in the residential and commercial sectors, as well as industrial waste, industrial landfills, food processing wastewater, pulp and paper, and waste incineration in the industrial sector

The period for assessing GHG emissions for this plan is 2021-2050. The year 2021 is used as the base year since it aligns with the most recent year for which a complete set of data is available.

1.3 Approach to Developing the CCAP

MVRPC developed this CCAP to lower GHGs from community emission sources. The CCAP's strategies and actions for reducing emissions are aligned with other plans and strategies in MVRPC's jurisdiction, including transportation and environmental management plans, as well as the broader community's priorities and goals.

MVRPC's CCAP was developed through two interrelated work streams: technical analysis and engagement (Figure 1.2). The technical team completed background research and analysis, identified constraints and opportunities, and undertook modeling and data analysis to support the plan's development. The engagement team focused on involving key interested and affected parties and the public to ensure the plan is rooted in the local context and to help build public support for the plan.

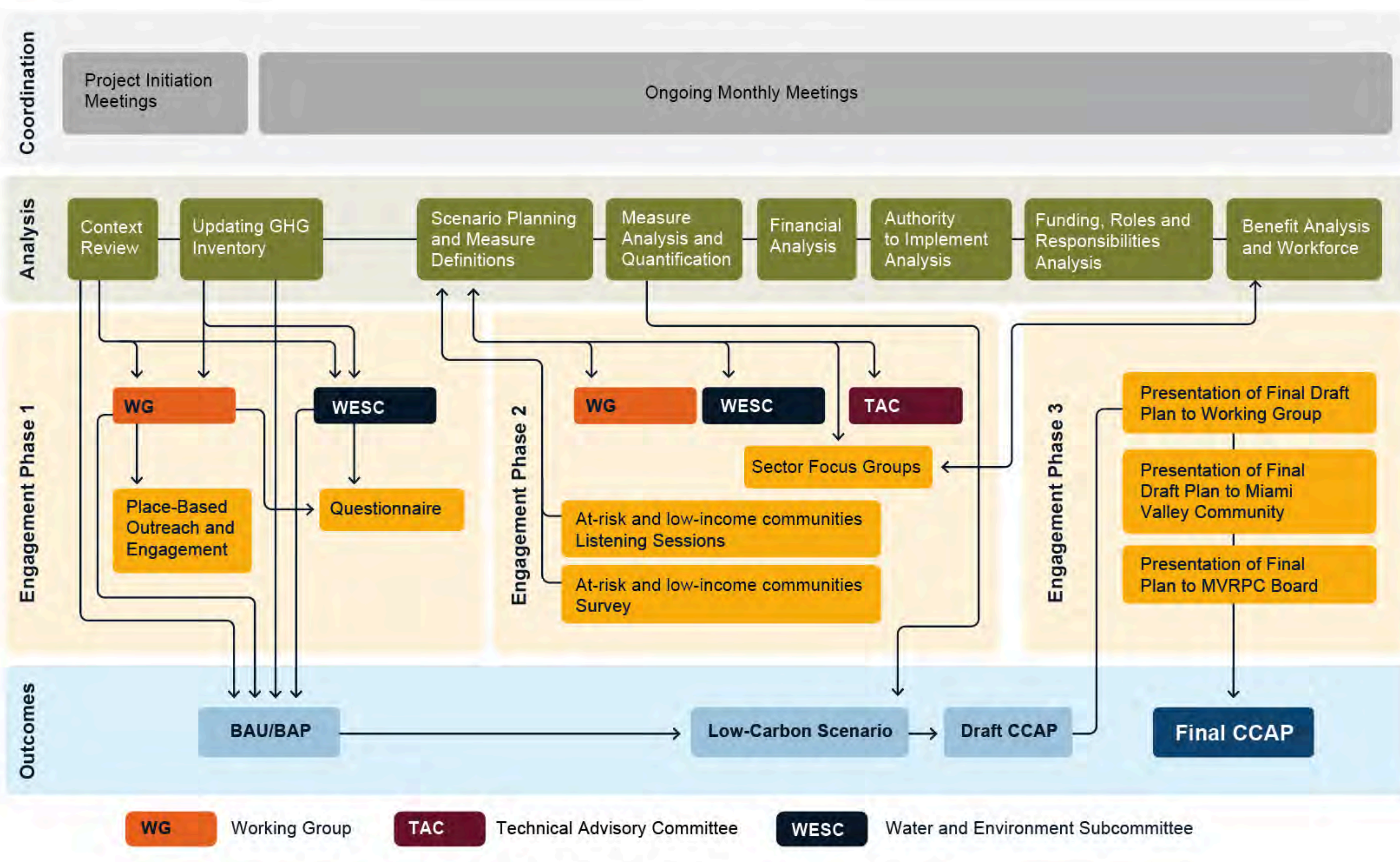

Figure 1.2. CCAP process. Source: SSG elaboration.

2 | Engagement Findings

Public engagement played a key role in the development of the CCAP. Subject matter experts provided input on the technical process, and diverse community members shared perspectives on what measures should be included in the CCAP and how they should be implemented.

This section outlines how interested and affected parties were consulted between May 2024 and July 2025, who participated, and key themes that emerged during the process. This input was distilled into recommendations that informed the technical process and the measures in the CCAP. This section organizes input by key themes and identifies key takeaways for planning. It also identifies aspirations, challenges and solutions for each sector.

2.1 Engagement Strategy

Engagement is any process that involves the public in problem-solving or decision-making and uses input from key internal and external interested or affected groups. At the outset, SSG and New Reach Community Consulting developed an engagement strategy for the CCAP using the International Association of Public Participation (IAP2) methodology. The strategy was based on the specific needs and context of the Miami Valley Region, including communities in Greene, Miami, and Montgomery counties, including at-risk and low-income communities.

The Engagement Strategy aimed to ensure that interested and affected parties had appropriate and useful opportunities to inform and provide feedback at key stages of the CCAP process. Pre-engagement interviews were conducted with key interested and affected parties, leaders and community influencers from several stakeholder groups to hear about how they preferred to be engaged and who should be engaged. These interviews helped SSG and New Reach Community Consulting identify baseline knowledge about climate planning among relevant populations, preferences for engagement, impacted groups that might otherwise be missed, and other potential issues and opportunities for the engagement process. Additionally, the CCAP team collaborated with MVRPC staff to conduct a risk and impact assessment that informed the Engagement Strategy. The team also conducted stakeholder mapping and analysis to identify, categorize and prioritize stakeholder groups for outreach and engagement.

2.1.1 Involved Parties

For the purposes of this process, “the community” refers to any individual, group of individuals, organizations or place within the Miami Valley Region. Similarly, “interested or affected parties” are any person(s), group of individuals, or organization interested in or affected by the CCAP.

Many communities are interested in and affected by GHG emissions reduction measures. Perspectives from each of the groups below were sought through this process, using a range of communication and engagement techniques:

- Boards and commissions
- Business groups and associations
- Civic groups
- Educational institutions
- Nonprofits
- Policy and advocacy organizations
- Public sector agencies

Community Working Group

The mandate of the Working Group (WG) was to provide feedback and advice to the project team regarding preferred approaches, concerns and criteria of proposed measures and other relevant material. The WG did not have formal decision-making powers; however, feedback from WG members was collected to support decision-making by project team staff.

2.2 What Happened

This section outlines the engagement activities that took place, how many people participated, and what each activity involved. Outcomes are described in Section 2.3.

2.2.1 Engagement Activities

Engagement activities were undertaken between May 2024 and June 2025. A range of different techniques were used to communicate information and gather input from people with varied preferences for engagement.

Table 2.1. Summary of engagement activities. Source: SSG analysis.

Activity	Number of Participants	When	Where
WG Meeting 1	10	June 2024	Dayton, Ohio
Climate Actions Questionnaire	191	June-November 2024	Online
Place-Based Outreach and Engagement	Various events	June-September 2024	Greene, Miami and Montgomery counties
WG Workshop/Meeting 2	6-8	September 2024	Dayton, Ohio

Activity	Number of Participants	When	Where
Water and Environment Subcommittee (WESC) Workshop	16-20	September 2024	Dayton, Ohio
Technical Advisory Committee (TAC) Workshop	3	September 2024	Dayton, Ohio
Sector Focus Groups (7)	27	October 2024	Online
At-risk and low-income focused Survey	87	January-May 2025	Online
At-risk and low-income focused listening Sessions (3)	60, approx.	February 2025	Greene, Miami and Montgomery counties
Presentation of Final Draft Plan to WG	9	June 2025	Online
Presentation of Final Draft Plan to Miami Valley Community	29	June 2025	Online
Presentation of Final Plan to MVRPC Board	TBD	August 2025	TBD

Engagement activities were planned in coordination to the overall technical work and divided into three phases with different objectives (described below).

Phase 1: Understanding GHG Emissions

WG Meeting 1

Members for a community WG were recruited among MVRPC's membership, committees and other community-based organizations (CBOs). Representatives from public organizations, businesses, environmental groups, community organizations, post-secondary institutions and individuals reflecting diverse community interests were invited.

The group convened periodically to provide input, feedback, guidance and assistance with the technical analysis, outreach and engagement during the CCAP process. Ten community representatives attended the first WG meeting, where they assessed the impacts of a changing climate their community is experiencing and main greenhouse gas emission sources and identified what types of actions or opportunities exist for them.

Questionnaire

MVRPC launched an anonymous online questionnaire to identify climate pollution reduction goals and explore GHG emissions reduction initiatives tailored to the region. The questionnaire received 191 responses. This input added to feedback from public workshops, focus groups and other activities to help refine the CCAP.

Place-Based Outreach and Engagement

WG members conducted outreach and engagement activities at established venues and events where people regularly gather (e.g., meetings, events). Their goal was to raise awareness of the planning process through discussions about regional conditions and distributing informative materials, while also collecting specific input and feedback from community members. These efforts occurred in various locations throughout Greene, Miami and Montgomery counties.

Phase 2: Action Planning

WG Workshop/Meeting 2

SSG and New Reach Community Consulting updated the WG on CCAP engagement activities and assessed the current and future status of GHG emissions in the Miami Valley Region. The goal was to gather insights into preferred strategies and criteria for emission reduction actions and scenario planning. The workshop/meeting included 6-8 participants.

WESC Workshop

MVRPC's Water and Environment Subcommittee (WESC) received updates on outreach and engagement activities and discussed the scenario parameters for the Business-as-Planned (BAP) and Low-Carbon (LC) Scenarios. The group was asked for their opinions, input and feedback regarding suggestions and modifications on the scenarios. The workshop included 16-20 participants.

TAC Workshop

MVRPC's Technical Advisory Committee (TAC) received updates on outreach and engagement activities and discussed the scenario parameters for the BAP and LC Scenarios. The group was asked for their opinions, input and feedback regarding suggestions and modifications on the scenarios. Three people participated in the workshop.

Sector Focus Groups

Seven virtual focus groups were conducted with a total of 27 participants including CBOs, business and commerce, industries, and MVRPC leadership members. The facilitated discussion centered on transportation (e.g., supply delivery, heavy trucks, last mile), buildings (e.g., retrofitting, energy-efficient actions), and renewable energy adoption (e.g., power purchase agreement [PPA], on-site solar, community) to gather ideas for future policy and program implementation. The groups also identified potential barriers to GHG emissions reduction measures at organizational, sectoral and regional levels.

Two options for focus groups were provided for each external target stakeholder group which MVRPC invited. (MVRPC was the exception because it has a smaller audience that is more readily accessible for internal scheduling.) External target groups included business and commercial organizations (e.g., Chamber of Commerce members, construction firms, real estate, retail, utilities), CBOs (e.g., affordable housing groups, community associations, cycling clubs, labor unions), and industry (e.g., aerospace, manufacturing) in the Miami Valley Region, specifically Greene, Miami and Montgomery counties.

Presentations for the external stakeholder groups were recorded and made available on the project's online microsite. Individuals who were interested but unable to participate received a brief online questionnaire based on the focus group questions.

Phase 3: Final Draft CCAP

Presentation of Final Draft Plan to WG

The WG was provided the opportunity to review the proposed Miami Valley CCAP strategies and share insights to enhance the final version. While certain aspects of the CCAP, such as the adopted targets or modeled action levels, were not subject to change, others were available for consideration. To help reach the target audiences, MVRPC partnered with WG members and other community partners to develop and share social media content for public awareness and engagement in the CCAP final draft (details in Appendix 1).

Presentation of Final Draft Plan to Miami Valley Community

The general public were provided the opportunity to review the Miami Valley CCAP strategies and share insights to enhance the final version. While certain aspects of the CCAP, such as the adopted targets or modeled action levels, were not subject to change, others were available for consideration. Related communications and outreach primarily occur on the MVRPC website, the agency's Facebook, X, and Instagram social media channels, as well as the project microsite (see Appendix 1 for more details).

Presentation of Final Plan to MVRPC Board

MVRPC's Board will be presented with the final version of the Miami Valley CCAP, which will incorporate the WG and public comments for review and formal adoption.

2.2.2 Engagement With At-Risk and Low-Income Communities

SSG and New Reach Community Consulting worked closely with MVRPC to plan and implement the facilitation of meaningful engagement with at-risk and low-income communities and other community members to better understand their priorities and the barriers they face. These communities are mostly concentrated in the City of Dayton and account for about 105,500 people in the Miami Valley Region (about 13.4% in 2023).[1] Members of the WG, MVRPC member organizations, and CBOs provided advice on target audiences and strategies and tactics for disseminating information about outreach and engagement activities throughout the CCAP process.

During outreach and engagement activities, these communities received background information about the CCAP's origins and goals. They were also given access to additional information hosted on the microsite. This included information about regional GHG emissions, resources for individual emissions reduction actions, engagement activities, and other methods to stay informed and actively participate in the CCAP's technical analysis and engagement processes.

This section overviews the outreach and engagement activities conducted specifically for these populations. Subsequent sections of this report detail related findings and how they are integrated into developing GHG reduction strategies that reflect community-driven priorities.

Listening Sessions

Listening sessions were held to listen to community concerns, gather ideas, identify challenges, and prioritize desired policy and program considerations, as well as recommendations for action related to at-risk and low-income communities in the Miami Valley Region. These facilitated discussions centered around emissions reduction planning, focused on "Big Move" categories including Buildings, Circular Economy, Clean Industries and Agriculture, Green Energy, and Transportation.

In total, three sessions were held in person within their communities and hosted by organizations with direct access to these populations, specifically Miami County Public Health, Fairborn FISH Food Pantry (Greene County), and Westwood Right Project CDC (Montgomery County). Attendees received an honorarium of $50, while the host organizations were offered $125. A total of approximately 60 individuals participated in the sessions.

At-Risk and Low-Income Communities Survey

Residents, nonprofits, and community organizations in the Miami Valley Region that work with at-risk and low-income communities, particularly those engaged with these communities in Greene, Miami and Montgomery counties, were invited to complete a brief online survey. The survey aimed to gather ideas for future plan implementation and identify

[1] United States Census Bureau (2023). Table S1701: Poverty Status in the Past 12 Months. American Community Survey. https://data.census.gov/table/ACSST1Y2023.S1701?q=Poverty&g=310XX00US19430

challenges to GHG emissions reduction in the region. The insights and findings aided in developing regional climate reduction policy and program recommendations. A total of 87 respondents completed the survey.

2.3 Overview of Major Findings

The section summarizes the insights gathered during the CCAP engagement process. It categorizes the main topics or issues raised and highlights key points and priorities for detailed action planning. It also identifies areas of consensus and disagreement.

2.1 Overall Themes

Overall themes that emerged through engagement with community members are listed in Table 2.2. The takeaways are important insights that influence aspects of the CCAP, identify specific actions for MVRPC, or represent concerns and opportunities that may require additional conversation with interested and affected parties.

Table 2.2. Summary of major findings for each sector. Source: SSG and New Reach analysis.

Theme	Takeaways for Action Planning
Regional Collaboration and Leadership	• MVRPC and partners should act as conveners to align regional efforts across sectors.
	• Share tools, best practices and policies to empower local implementation.
	• Partner with businesses, CBOs and other governments to unify climate strategies.
Fair Workforce and Economic Opportunities	• Prioritize local hiring and training for clean energy and climate adaptation projects.
	• Develop sustainability certification pathways to incentivize employer participation.
	• Use climate investment to build long-term economic resilience in underserved communities.
Accessible Finance and Incentives	• Expand programs like property assessed clean energy (PACE) to lower financial barriers for households and small businesses.
	• Engage financial and insurance sectors to co-create resilience and investment tools.
	• Increase uptake through education on incentives and low/no-cost options.

Theme	Takeaways for Action Planning
Messaging and Community Engagement	• Tailor climate communication to diverse audiences to overcome political and cultural barriers.
	• Use trusted messengers and regional campaigns to build support and awareness.
	• Collaborate with CBOs to ensure outreach is inclusive, multilingual and community-led.

2.2 Themes by Sector

2.2.1 Businesses, Commerce and Industries

Aspirations:

- Businesses recognize that the knowledge and technology needed for energy efficiency and retrofitting already exist locally, and there is interest in developing real-world business case examples, such as net-zero buildings.
- There is potential for collaboration with federal authorities to support the adoption of alternative fuels.
- Businesses see opportunities in community solar projects and grid greening.
- There is interest in recognition programs (e.g., sustainability certifications) that validate and showcase businesses' environmental leadership.
- Local government partnerships are seen as a pathway for networking, buy-in and coordinated progress.

Challenges:

- High capital costs for retrofitting and clean technology discourage investment, especially when long-term savings are not considered compelling.
- Alternative fuels and regulatory changes have disrupted other processes, sometimes increasing energy use.
- Businesses report unsuccessful or slow partnerships with government entities like the City of Dayton and federal agencies.
- Tight state-level regulations and a lack of familiarity with solar and energy efficiency create further barriers.
- Cultural resistance and a lack of internal knowledge hinder momentum around environmental concerns.

Solutions:

- Develop and share case studies of successful net-zero or energy-efficient buildings to demonstrate real-world feasibility and return on investment.

- Simplify technical and application processes for businesses unfamiliar with retrofitting and clean energy practices.
- Expand incentives for retrofitting, solar installations and alternative fuel adoption, potentially through federal support.
- Encourage community solar programs and promote business participation in local grid greening.
- Establish recognition programs (e.g., sustainability certifications) to motivate participation.
- Facilitate local government collaboration to offer streamlined support and partnership opportunities.

2.2.2 CBOs

Aspirations:

- Residents and grassroots groups aspire to have safer, more connected and community-oriented neighborhoods, supported by better land-use planning and reduced dependence on cars.
- There is a desire to strengthen local workforce capacity so that community members, not outside labor, benefit from new climate-related investments.
- Residents seek more inclusive and accessible outreach, with culturally relevant education and stronger relationships between public offices and the communities they serve.

Challenges:

- Sustainable transportation options are limited due to disconnected cycling infrastructure, car-centric urban design and safety concerns.
- Cultural norms make car dependence difficult to overcome.
- Residents struggle to engage with technical or climate-related education, especially when outreach lacks clarity or cultural relevance.
- Residents see public offices as not as actively engaging with them, leading to mistrust and low participation.

Solutions:

- Expand PACE financing and other incentives, making them easier to access and navigate.
- Advance land-use planning that fosters community-oriented design, improving walkability and neighborhood identity.
- Strengthen education and outreach by partnering with businesses and CBOs to co-deliver information.
- Build local technical capacity by investing in workforce training and ensuring job opportunities stay in the community.

- Explore carbon accountability mechanisms, such as user-based fees or pricing, to promote awareness and behavior change.
- Engage other stakeholder groups, such as insurance companies and other financial stakeholders, in climate preparedness efforts.

MVRPC Leadership

Aspirations:

- MVRPC aspires to continue being a regional convener and collaborator, particularly with local governments and park districts.
- The agency seeks to play a guidance and education role by disseminating best practices, drafting sample policies and advocating for improved state-level policies.
- MVRPC values its role in resiliency, conservation and wellness planning, especially through partnerships with park districts and other public institutions.

Challenges:

- MVRPC faces limited authority to enforce policy or implement regulatory programs.
- Staffing constraints limit the agency's capacity to lead regional efforts or manage partnerships.
- The use of “climate change” language has made outreach and messaging more difficult in certain communities due to perceived political or cultural resistance.

Solutions:

- Continue acting as a regional educator and partner, helping local governments adopt best practices in housing, wellness and energy.
- Develop and distribute model policies to guide local GHG emissions reduction measures.
- Maintain a strong presence in state-level advocacy, pushing for higher standards, increased funding and policy changes.
- Leverage existing relationships, such as those with park districts, to support conservation and resilience goals.
- Use outreach funds strategically to build awareness and support across the region, while refining messaging to resonate with different communities.

2.4 At-Risk and Low-Income Communities Engagement Findings

Key themes from the listening sessions reveal that low-income residents have a strong desire for strategies that align with their experiences. Participants stressed the need for immediate improvements benefiting residents, such as retrofitting homes, enhancing public transit, and increasing access to walkable neighborhoods and green spaces. These priorities shaped the CCAP's GHG reduction measures by directing investments toward improving housing, lowering energy costs and expanding mobility options.

Engagement with at-risk and low-income communities also identified potential barriers. Residents expressed skepticism about certain clean energy technologies, calling for transparency and education to build trust. Thus, the plan emphasizes measures that offer clear local benefits while minimizing disruption, like building upgrades, accessible transport infrastructure, and community recycling and gardening programs. By centering community voices, the CCAP process ensured the plan addresses the urgent need for emissions reductions and improving the quality of life for these residents.

2.4.1 Context

Historic and ongoing disinvestment, discrimination and structural barriers shape the experiences and perspectives of low-income and racially and ethnically marginalized individuals. In the listening sessions, residents described obstacles such as aging housing, limited access to clean energy, gaps in public transportation, and outdated zoning regulations. These issues stem from entrenched patterns that deprive communities of resources and opportunities.

Participants felt previous planning initiatives ignored their needs or failed to implement changes. Many advocated for tangible enhancements like housing renovations, safe sidewalks and improved transit. Their input stresses the need for action to not only cut emissions but also address the long-term effects of neglect to benefit overlooked communities that are often impacted first and worst.

2.4.2 Benefits of GHG Emissions Reduction Actions

Building Upgrades and Retrofitting

Participants in sessions emphasized the importance of improving the existing housing stock, particularly older homes and apartments. They viewed retrofitting as a foundational action that could support and amplify the impact of other emissions reduction strategies. These upgrades — such as insulation, windows, doors and energy efficiency retrofits — were seen as essential for:

- Reducing energy costs

- Addressing housing shortages
- Creating more livable, resilient communities
- Increasing neighborhood pride and long-term community investment
- Benefiting future generations by reducing waste and emissions

Transportation Enhancements

Session participants showed strong support for improved public and active transportation options. These actions were recognized for their ability to reduce emissions while enhancing accessibility and connectivity within communities. Participants identified the following as priorities:

- Expanded bus routes and hybrid buses
- Electric vehicle (EV) charging infrastructure
- Incentives for hybrid or EV adoption
- Improved walkability and safe bike infrastructure
- Electric cargo bike sharing and community bike checkout programs

Circular Economy and Local Resilience

Residents supported initiatives that promote sustainability and reduce waste within the community. These ideas reflect a desire for tangible, community-centered climate solutions that encourage long-term behavioral change. Suggestions included:

- Community gardens, urban agriculture and vertical gardening
- Expanded recycling and composting
- Support for native pollinators through intentional landscaping
- Sustainability education in schools and community settings
- Creating a stronger local economy and encouraging urban foraging

3 | GHG Inventory

3.1 Inventory Methodology

The GHG inventory created for the Miami Valley Region's CCAP used the Global Protocol for Community (GPC) Emissions Basic framework. The complete inventory can be found in Appendix 2.

This framework calculates GHG emissions[2] from the following sources across the project area over the course of a single calendar year:

- **Buildings** — Commercial, residential, industrial/manufacturing and institutional emissions from building systems are often put in a category called Stationary Energy Use, which includes:
  - Use of electricity inside buildings
  - Use of fuel in residential, commercial or industrial furnaces, generators or other stationary combustion equipment
- **Transportation** — This category includes emissions from fuel and energy sources used to move people, freight and equipment within the community. These sources include:
  - On-road passenger travel (including public transportation), freight motor vehicle travel and energy used to move waste
  - Freight
  - Off-road vehicles and equipment
  - Aviation
- **Waste and Materials Management** — This category includes emissions from energy used to treat waste and wastewater and emissions produced during waste decomposition. Examples include:
  - Use of energy in potable water treatment and distribution (through pumping)
  - Solid waste deposited in landfills or composted. The Stony Hollow Landfill (Dayton) is the largest waste sector emissions source in the MSA, according to the U.S. EPA FLIGHT data[3]
  - Energy used in wastewater pumping and treatment processes, including filtering, aeration, chemical, UV and other treatments

[2] Some of these sources are optional according to the GPC framework.
[3] FLIGHT is the Facility Level Information on GreenHouse gases Tool from U.S. EPA.

- **Industrial Emissions** — These are emissions produced through industrial processes. They include:
  - Fugitive emissions, which are gases (most commonly natural gas) that leak out of wells and distribution pipes, directly into the atmosphere
  - Emissions of a number of GHGs that are produced during chemical reactions and processes from industrial facilities
  - The largest industrial emission sources in the Miami Valley Region include Fairborn Cement Company LLC (Fairborn), Cargill Incorporated (Dayton), and Primary Products Ingredients Americas, LLC (Dayton), according to U.S. EPA FLIGHT data

- **Agriculture, Natural and Working Lands** — This category includes energy-based and non-energy-based emissions resulting from agricultural practices, as well as emissions from and sequestration in natural systems:
  - Energy used to run agricultural equipment, machinery and transportation
  - Emissions from livestock, manure, crops and soil
  - Carbon sequestration in forests and other plants and in wetlands

The geographic area included in Miami Valley's CCAP consists of the three counties in the Miami Valley Region: Greene, Miami and Montgomery.

This inventory quantifies the community-wide GHG emissions produced by the project area for the calendar year 2021 (the "base year"). This year was selected because it was the most recent year for which all the required data was available. This inventory is the "baseline inventory," which is now a reference point to which future emissions for the area can be compared.

The GPC GHG inventory is a production-based protocol that is used to report primarily on:

- Emissions released directly from sources within the project area. Examples include emissions from natural gas furnaces or from gas cars driving in the area.

- Emissions that are a result of the activities occurring within the project area but may be produced outside the area. For example, electricity may be generated by a facility outside the community, but the emissions released to produce the amount of electricity that community uses are reported on the community's GPC inventory.

- The most common GHGs, specifically carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O)[4] and sulfur hexafluoride (SF_6).

The GPC protocol **does not** comprehensively include “consumption-based emissions.” These emissions are produced as a result of purchases made inside the area, including emissions from the transportation required to ship goods to the purchaser and inside the community, as well as emissions from production of the goods in their place of origin. Correspondingly, consumption-based emissions are not included in this CCAP.

GHG inventories are also available for seven local jurisdictions as a result of their voluntary participation in a Local Low-Carbon Pathway initiative. The participating jurisdictions are:

- City of Dayton
- City of Kettering
- City of Xenia
- City of Beavercreek
- Beavercreek Township
- Village of Yellow Springs
- Village of West Milton

See Appendix 2 for these inventories.

3.2 Inventory Results

The GHG inventory completed for Miami Valley’s CCAP indicates that in 2021, the project area emitted a total of 10.8 $MMTCO_2e$. Figure 3.1 shows these emissions by sector within the project area.

[4] Industrial GHGs — such as hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and nitrogen trifluoride (NF_3) — are not released in the project area.

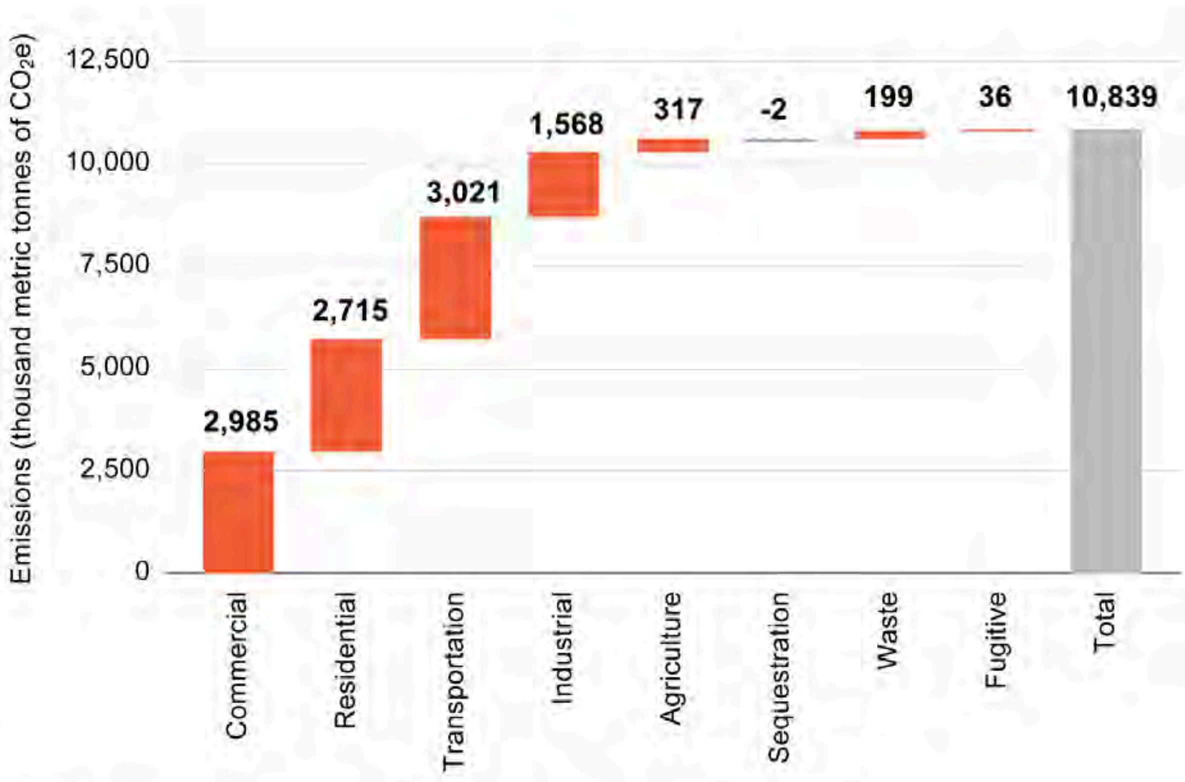

Figure 3.1. GHG emissions by sector within the Miami Valley Region, 2021.
Source: SSG analysis.

These numbers show that the primary sources of GHG emissions in the area are the transportation, commercial and residential sectors. More specifically, Figure 3.2 shows that:

- Emissions from the transportation sector are primarily generated from gasoline and diesel. In 2021, they accounted for 28% of the total GHG emissions from the region.
- Emissions from the residential and commercial sectors come from the energy used to heat and cool buildings, as well as to operate appliances and machinery within buildings. This energy is primarily electricity and natural gas, and the emissions come from the generation of grid electricity and from the combustion of natural gas. In 2021, the commercial sector accounted for 28% of the region's total GHG emissions, while the residential sector accounted for 25%.

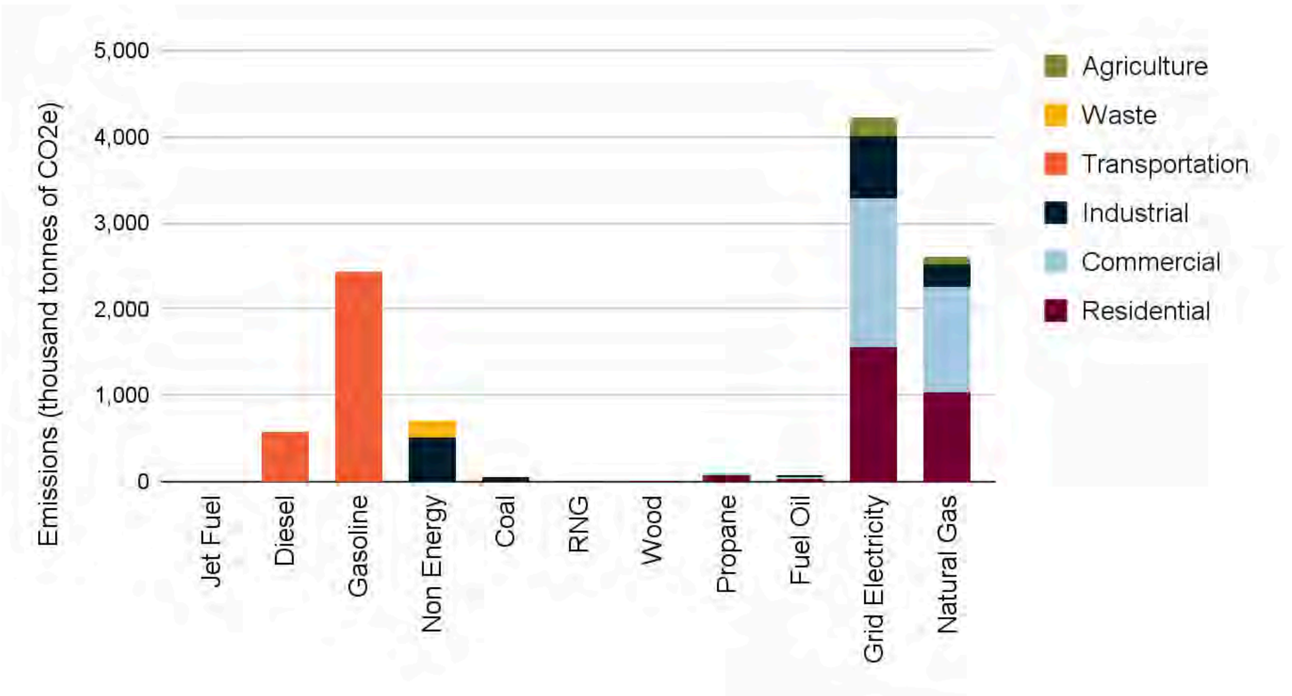

Figure 3.2. GHG emissions by sector and fuel type in the Miami Valley Region, 2021. Source: SSG analysis.

With a population of 801,562, this means that per capita emissions in 2021 were 13.5 $MTCO_2e$/person, which was below the national per capita emissions (14.8 $MTCO_2e$/person) that year.[5]

[5] "Data Page: Per capita CO_2 emissions", part of the following publication: Hannah Ritchie, Pablo Rosado, and Max Roser (2023) - "CO_2 and Greenhouse Gas Emissions". Data adapted from Global Carbon Project, Various sources. Retrieved from https://ourworldindata.org/grapher/co-emissions-per-capita [online resource]

4 | Near-Term and Long-Term GHG Reduction Targets

4.1 Introduction

This analysis describes methods for setting targets and identifies economy-wide and sectoral targets. This analysis will be used to inform the Miami Valley Region's GHG reduction measures and LC Scenarios alongside analysis of the region's current emissions inventory and the projections in the Business-as-Usual (BAU) and BAP Scenarios modeled in this project.

4.1.1 Why Set GHG Reduction Targets?

At a foundational level, GHG reduction targets align policies and investments with a desired outcome, which, in this case, aims to prevent dangerous levels of warming. Current global emissions trends are pushing temperatures toward a 3°C increase, far above the safe 1.5°C (2.7°F) threshold.[6]

GHG reduction targets signal a direction to investors, businesses and residents. Clear targets and pathways drive capital toward sustainable development, technology deployment and infrastructure renewal, creating pathways to a low-carbon economy that aligns with global targets. Targets also enable the development of policies, regulatory instruments and laws that avoid further emissions and provide the policy framework for action implementation.

Targets also provide a reference point against which progress can be measured, enabling policies and strategies to be adjusted or course corrected over time. This enables communities and organizations to address the following questions: Are we on track? If not, why not?

4.1.2 The Basis for Targets

The Paris Agreement is the primary reference point for establishing targets, as it represents a collective global response. Adopted by 196 Parties at the United Nations Climate Change Conference (COP21) in Paris, France, on December 12, 2015, the Agreement's overarching goal is to hold "the increase in the global average temperature to well below 2°C above pre-industrial levels" and pursue efforts "to limit the temperature increase to 1.5°C above

[6] Intergovernmental Panel on Climate Change (IPCC) (2022). Climate Change 2022 Mitigation of Climate Change: Summary for Policy Makers. https://www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC_AR6_WGIII_SummaryForPolicymakers.pdf

pre-industrial levels."[7] The thresholds of 1.5°C (2.7°F) and 2°C (3.6°F) are based on the latest scientific evidence on what will prevent dangerous levels of climate change.[8]

The CPRG program recommends target and base-year alignment with U.S. national targets to enable assessment of program impacts and to provide consistency across sectors and jurisdictions. Targets set by grantees should be consistent with international commitments. In addition to economy-wide targets, the CPRG program encourages short- and long-term sector-specific targets. A full description of EPA CPRG Program Guidance can be found on its website.[9]

Countries set national targets according to a mechanism in the Paris Agreement called the nationally determined contributions (NDCs). Each country determines the target and actions it commits to and submits them to the United Nations. The U.S. NDC set a **target of reducing U.S. GHG emissions by 61%-66% below 2005 levels in 2035[10] and achieving net zero by 2050**.[11]

4.1.3 Alignment With Science

The fundamental test of a GHG reduction target is whether or not it aligns with what the latest science indicates is needed to limit global warming to 1.5°C above pre-industrial levels.

The IPCC indicates that to have a greater than 50% chance of limiting warming to 1.5°C, global GHG emissions must fall 43% by 2030 and 69% by 2040, relative to 2019, and to net zero by 2050.[12]

Many national and sub-national governments have adopted targets that are directly based on the reductions indicated by the IPCC. However, not all jurisdictions have equal capabilities to invest in GHG emissions reductions, which is acknowledged in Article 2 of the Paris Agreement: "The Agreement will be implemented to reflect equity and the principle of common but differentiated responsibilities and respective capabilities, in the light of different national circumstances."[13]

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[7] United Nations Framework Convention on Climate Change (UNFCCC) (2016). The Paris Agreement. Accessed in November 2024, https://unfccc.int/sites/default/files/resource/parisagreement_publication.pdf

[8] IPCC (2021). Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM_final.pdf#page=33

[9] "Program Guidance for States, Municipalities, and Air Pollution Control Agencies," EPA, https://www.epa.gov/system/files/documents/2023-02/EPA%20CPRG%20Planning%20Grants%20Program%20Guidance%20for%20States-Municipalities-Air%20Agencies%2003-01-2023.pdfhttps://www.epa.gov/system/files/documents/2024-07/2024.05.22-ccap-training-presentation.pdf

[10] The United States of America (2024). Nationally Determined Contribution., https://unfccc.int/sites/default/files/2024-12/United%20States%202035%20NDC.pdf

[11] "The Long-term Strategy of the United States: Pathways to Net-Zero Greenhouse Gas Emissions by 2050," U.S. Department of State, https://unfccc.int/sites/default/files/resource/US_accessibleLTS2021.pdf

[12] Core Writing Team, Hoesung Lee and José Romero (eds.) (2023). Summary for Policymakers. In Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. IPCC. Accessed July 21, 2025. https://doi.org/10.59327/ipcc/ar6-9789291691647.001

[13] UNFCCC (2015). The Paris Agreement. https://unfccc.int/files/meetings/paris_nov_2015/application/pdf/paris_agreement_english_.pdf

As a result, when setting targets, governments also need to consider their fair share of global emissions reductions. For example, the Climate Action Tracker (CAT) rates the U.S. 2035 GHG target as "Insufficient," as it does not fully meet the emissions reductions needed based on its historical contributions and economic capacity.[14]

4.1.4 Credibility

For GHG reduction targets to be credible, they should be based on robust analysis that translates economy-wide emissions reduction targets into action in all sectors.

One area of debate is the concept of net-zero emissions. Since 2018, "net zero by 2050" has been the universal benchmark for national, state and local governments worldwide, recognizing that reaching this milestone minimizes the risk of severe climate impacts. As of 2024, 147 countries, including the U.S., have committed to reach net zero by 2050.[15]

Achieving net-zero emissions requires reducing GHG emissions produced by human activity to as close to zero as possible and balancing any remaining emissions with an equivalent amount of carbon removal from the atmosphere (e.g., natural carbon removal through forest or wetland restoration, or technological carbon capture and storage).[16]

The concept of a net-zero target must be approached with caution as the "net" element relies on technologies and approaches that are uncertain in terms of their implementation or ability to scale[17] and have been characterized as wild cards.[18]

4.1.5 Science-Based Targets

The science-based target (SBT) method aims to align GHG reduction targets with science, providing a method to downscale the global objective of limiting warming to 1.5°C or 2°C to a country, state or local government[19] while accounting for fairness and completeness.[20]

Fair-share considerations require jurisdictions to account for their contribution to historical emissions and their socio-economic welfare when setting their emissions reduction targets.

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[14] Climate Action Tracker (November 2024). USA. https://climateactiontracker.org/countries/usa/targets/
[15] Net Zero Tracker. Data Explorer. accessed November 2024, https://zerotracker.net/
[16] Kelly Levin, Taryn Fransen, Clea Schumer, Chantal Davis, Sophie Boehm. "What Does 'Net-Zero Emissions' Mean? 8 Common Questions, Answered." *World Resources Institute* (March 20, 2023). https://www.wri.org/insights/net-zero-ghg-emissions-questions-answered
[17] James Dyke, Robert Watson, Wolfgang Knorr. "Climate scientists: concept of net zero is a dangerous trap." *The Conversation* (April 22, 2021). https://theconversation.com/climate-scientists-concept-of-net-zero-is-a-dangerous-trap-157368
[18] Jason Dion, Anna Kanduth, Jeremy Moorhouse, Dale Beugin (February 2021). Canada's Net-Zero Future: Finding our way in the global transition. Canadian Institute for Climate Choices. https://climatechoices.ca/wp-content/uploads/2021/02/Canadas-Net-Zero-Future_FINAL-2.pdf
[19] CDP. Science-based targets for sub-national governments. https://www.cdp.net/es/disclose/science-based-targets-for-sub-national-governments
[20] Pedro Faria, Tabaré A. Currás, Fernando Rangel, Antoine Jaillet, Andres Chang, Eoin White, Cesar Carreño, Varsha Bangalore (July 2020). Results of the assessment of greenhouse gas emission reduction target setting methodologies for cities. Science Based Targets Network. https://c40.my.salesforce.com/sfc/p/#36000001Enhz/a/1Q000000gRNm/mv_WQOpWyZYubeKGUJytOUA8r60bwnynPcfUv3wOQjs

For example, a government with a high gross domestic product (GDP) per capita and a developed economy would be required to set a target closer to a 70%-75% reduction by 2030.[21]

The principle of completeness requires including emissions from Scope 1 and Scope 2 (and Scope 3 if possible) and considering GHGs beyond CO_2, such as hydrofluorocarbons (HFCs), CH_4 and N_2O. Scope 1 emissions are direct GHG emissions that occur within a jurisdiction's boundary; Scope 2 emissions are from electricity, steam, heating and cooling; and Scope 3 emissions occur outside the jurisdiction's boundary but are a result of the community's activities (e.g., emissions from food production).[22]

The SBT method is the current best practice, but the resulting targets are difficult to achieve because of the depth of emissions reductions required.

4.2 GHG Reduction Targets

4.2.1 Economy-Wide Targets

The GHG reduction targets are based on the LC Scenarios, namely the Community-First and Energy Transition Scenarios, for the Miami Valley Region. The base year of 2021 was selected, as datasets were available, which enabled the development of a comprehensive and reliable GHG inventory for that year. The targets include sequestration of GHG emissions.

The Miami Valley Region will reduce economy-wide GHG emissions by 55% by 2030, 78% by 2040, and 89% by 2050, relative to 2021.

Discussion on Targets

Table 4.1 includes the scenarios modeled to illustrate the source of these targets, as well as the U.S. federal targets and SBTs.

Table 4.1. GHG reductions for scenarios. Source: SSG analysis.

	Baseline, 2021	2025	2030	2035	2040	2045	2050	Cumulative (2025-2050)
Business as Usual								
Total (thousand $MTCO_2e$)	10,839	10,274	9,491	9,120	8,641	8,307	8,021	232,074
% change over 2021		-5%	-12%	-16%	-20%	-23%	-26%	

[21] Science-Based Targets Network (November 2020). Science-based Climate Targets: A Guide for Cities. https://sciencebasedtargetsnetwork.org/wp-content/uploads/2021/04/SBTs-for-cities-guide.pdf
[22] Greenhouse Gas Protocol (2022). Global Protocol for Community-Scale Greenhouse Gas Emission Inventories: Executive Summary. https://ghgprotocol.org/sites/default/files/2022-12/GPC_Executive_Summary_1.pdf

	Baseline, 2021	2025	2030	2035	2040	2045	2050	Cumulative (2025-2050)
Business as Planned								
Total (thousand $MTCO_2e$)	10,839	10,209	9,376	8,876	8,452	8,106	7,814	227,914
% change over 2021		-6%	-13%	-18%	-22%	-25%	-28%	
Community-First								
Total (thousand $MTCO_2e$)	10,839	10,179	4,907	3,482	2,304	1,536	1,203	86,950
% change over 2021		-6%	-55%	-68%	-79%	-86%	-89%	
Per capita ($MTCO_2e$/capita)	13.5	12.7	6.1	4.3	2.9	1.9	1.5	
% change over 2021		-6%	-55%	-68%	-79%	-86%	-89%	
Energy Transition								
Total (thousand $MTCO_2e$)	10,844	10,310	4,906	3,410	2,209	1,530	1,050	85,912
% change over 2021		-5%	-55%	-69%	-80%	-86%	-90%	
Per capita ($MTCO_2e$/capita)		12.9	6.1	4.2	2.9	1.3	1.3	
% change over 2021		-5%	-55%	-69%	-79%	-90%	-90%	
% reduction for US National Targets			-42%	-56%			net zero	
% reduction for Science-Based Targets			-70%			net zero		

The targets identified for the Miami Valley Region align with the **Community-First Pathway modeled** for the region. This pathway meets the U.S. federal GHG reduction targets but falls short of the SBTs (Figure 4.1):

- If the Miami Valley Region were to fully align with the U.S. federal targets, the region would need to reach net zero by 2050.
- If the Miami Valley Region were to align with SBTs that aim to limit global warming to 1.5°C, the region would need to reduce its emissions by an additional 15% (from -55% to -70%) by 2030 and reach net zero by 2045. Based on the region's estimated annual emissions of 10.8 $MMTCO_2e$ in 2021, a 70% reduction would require cutting emissions by approximately 7.6 $MMTCO_2e$ to 3.2 $MMTCO_2e$ by 2030, which exceeds the emissions in the Community-First Pathway by 1.7 $MMTCO_2e$.

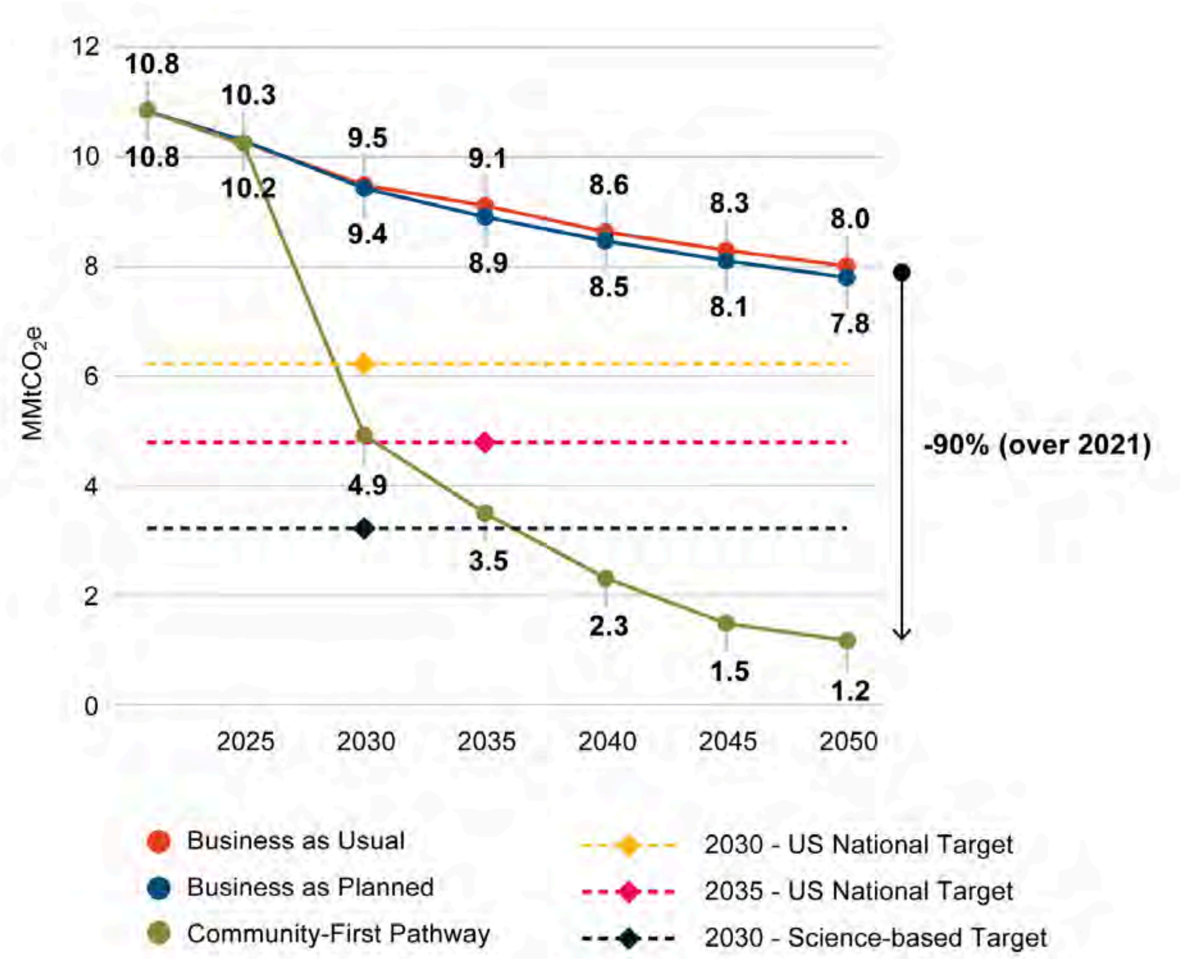


Figure 4.1. Illustration of GHG pathways relative to national and science-based targets. Source: SSG analysis.

To close this gap, the region will seek opportunities (e.g., technology advancements, program developments) to accelerate emissions reductions in subsequent plan updates.

4.2.2 Carbon Budgets

The pathway to achieve net-zero emissions will determine the pace of GHG emissions reductions and have a significant impact on the cumulative total emissions released into the atmosphere (Figure 4.2).

Figure 4.2. Net-zero emissions pathways are determined by the timing of actions and meeting interim targets. The left graph shows fewer cumulative emissions, and the right graph shows larger cumulative emissions. Source: SSG elaboration.

For example, setting more ambitious GHG reduction targets in the near term provides a significant benefit in regards to early reductions in GHG emissions and lower cumulative total GHGs emitted over the timeline. Figure 4.3 illustrates that the cumulative emissions are a function of this trajectory. In turn, the cumulative emissions will determine the level of global temperature rise and whether global warming will remain below the 1.5°C threshold.

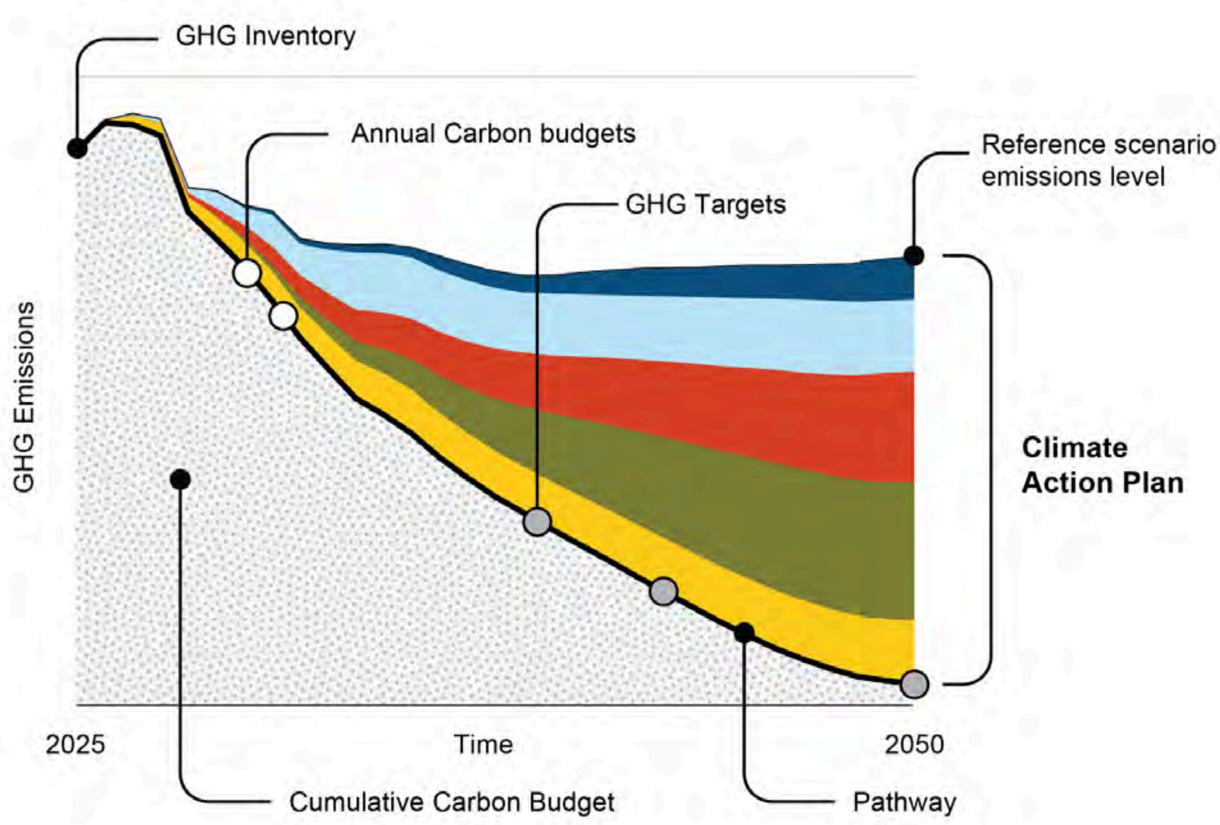


Figure 4.3. Illustration of a carbon budget. Source: SSG elaboration.

A cumulative emissions limit is central to carbon budgeting. While GHG emissions targets are typically put forward in terms of achieving a specified level of annual emissions by some future target year (e.g., 30% below 2010 levels by 2030), it is the cumulative atmospheric emissions over a period of years or decades that determine the degree of global warming that will ensue. This underscores the importance of defining viable pathways in which annual emissions are continually brought down over time, on a pathway that is feasible and that meets the cumulative limit.

The carbon budgeting approach also more effectively enables GHG emissions management. The impacts of investments, projects and plans can be tracked annually and evaluated in an annual carbon budget alongside financial capital and operating budgets.

Figure 4.4 illustrates the alignment between the LC Scenario, annual carbon budgets, the cumulative carbon budget and the economy-wide GHG targets.

The carbon budget for the Miami Valley Region is 87 $MMTCO_2e$, based on the Community-First Scenario. Table 4.2 shows the cumulative GHG emissions from each scenario.

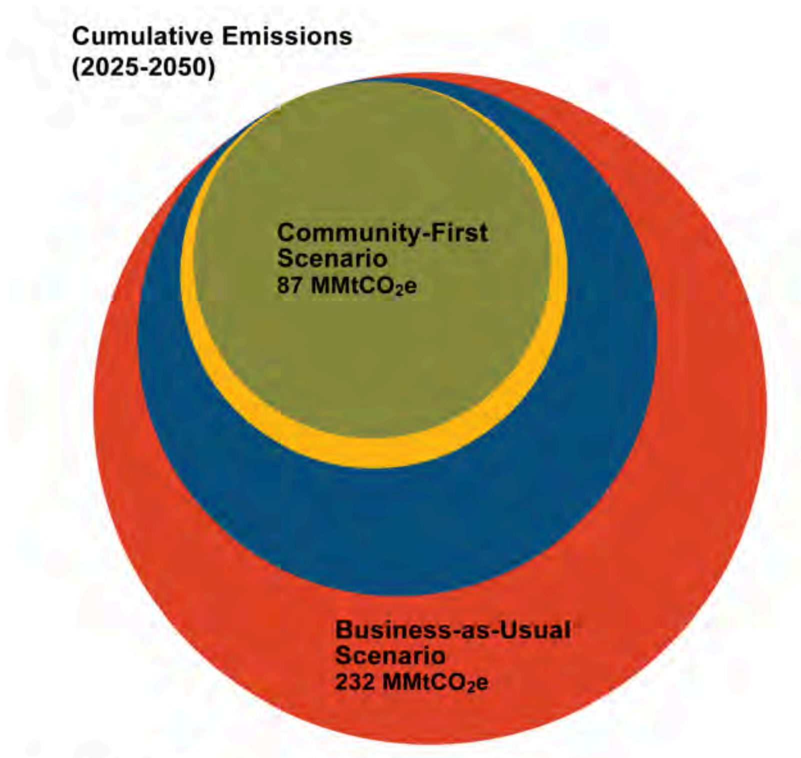


Figure 4.4. Illustration of a carbon budget. Source: SSG analysis.

Table 4.2. Carbon budget relative to cumulative emissions from each scenario. Source: SSG analysis.

Scenario	Million $MTCO_2e$	% reduction relative to BAU
Business as Usual	**232**	
Business as Planned	228	2%
Community-First	**87**	**63%**
Energy Transition	**112**	**52%**

While both scenarios illustrate viable routes to decarbonization, the **Community-First Scenario is the preferred pathway**. While this scenario does not meet the most ambitious SBTs, it aligns with U.S. federal targets and resonates more strongly with community values. Its emphasis on improved indoor air quality, lower energy bills and a cleaner environment reflects the priorities heard during the CCAP's public engagement, making it more likely to gain public support and momentum for implementation.

4.2.3 Sectoral Targets

Sector-specific GHG reduction targets presented in the next sections are based solely on the Community-First Scenario — one of two modeled scenarios for the Miami Valley Region. This scenario emphasizes community benefits and has been identified as the preferred pathway. These targets illustrate how emissions reductions may unfold across key sectors under this scenario, including:

- Energy
- Buildings
- Transportation
- Industry
- Waste
- Sequestration

Energy

Table 4.3 shows the targets of the energy sector in terms of solar renewable energy as rooftop solar photovoltaic (PV), groundmount solar and renewable natural gas (RNG).

Table 4.3. Energy sector, GHG targets. Source: SSG analysis.

Targets	2025-2029	2030-2034	2035-2039	2040-2044	2045-2050
Community First Scenario					
Rooftop solar PV installed (MW)	45	607	978	455	134
Ground-mount solar PV installed (MW)	0	199	0	197	0
Storage installed (MW)	0	101	0	101	0
RNG (GJ)	1,185,215	3,070,525	2,782,896	1,961,775	2,060,213

Buildings

The GHG targets for the building sector set an ambitious trajectory for both residential and commercial emissions. Residential sector emissions are targeted to decrease from 2.72 $MMTCO_2e$ in 2021 to just 22 thousand $MTCO_2e$ by 2050. Similarly, commercial building emissions are targeted to fall from 2.99 $MMTCO_2e$ to near zero by 2050.

Interim targets call for a 35% reduction by 2030 in both sectors, with rapid progress expected through 2040 to mid-century.

Table 4.4. Building sector, GHG targets. Source: SSG analysis.

	2021	2025	2030	2040	2050
Residential ($MTCO_2e$)	2,715,000	2,493,000	925,000	273,000	22,000
% change	-	-8%	-66%	-90%	-99%
Commercial ($MTCO_2e$)	2,985,000	2,890,000	1,037,000	343,000	13,000
% change	-	-3%	-65%	-89%	-100%

To achieve this, the sector must meet secondary targets that support the CCAP's implementation roadmap. Table 4.5 outlines these targets, which range from the number of homes retrofitted to the adoption of heat pumps.

Table 4.5. Building sector, secondary targets. Source: SSG analysis.

Targets	2025	2030	2040	2050
Residential retrofits (#)	10,678	53,326	198,062	346,995
Commercial retrofits (sqf)	0	6,355,380	30,753,470	67,650,412
Residential heat pumps installed (#)	31,018	50,231	171,481	243,394

Transportation

The transportation sector is targeted to reduce emissions from roughly 3 $MMTCO_2e$ in 2021 to 230 thousand $MTCO_2e$ by 2050 — an overall reduction of over 90% (Table 4.6). Interim targets include a 39% reduction by 2030 and a 77% reduction by 2040.

Table 4.6. Transportation sector, GHG targets. Source: SSG analysis.

	2021	2025	2030	2040	2050
Transportation ($MTCO_2e$)	3,021,000	2,679,000	1,833,000	692,000	230,000
% change		-11%	-39%	-77%	-92%

The Community-First Scenario also includes secondary targets related to transportation behavior and technology shifts (Table 4.7). These include increases in active and transit mode share, reductions in vehicle miles traveled (VMT) per capita, and adoption of EVs—in both light- and heavy-duty segments.

Table 4.7. Transportation sector, secondary targets. Source: SSG analysis.

Targets	2025	2030	2040	2050
Active mode share (%)	3%	3%	9%	9%
Transit mode share (%)	1%	1%	14%	14%
VMT per capita (miles/year/person)	7,948.57	8,049.27	6,804.51	7,044.63
Share of light-duty EVs, new vehicle sales (%)	21%	55%	100%	100%

Industry

The industrial sector is targeted to achieve an overall emissions reduction of around 54% by 2050 over the Community-First Scenario. The most ambitious target is by 2030, with emissions cut nearly in half (Table 4.8). Fugitive emissions follow a steeper decline, dropping by 70% by 2050. Secondary targets in terms of clean energy share in the industry sector are shown in Table 4.9.

Table 4.8. Industrial sector, GHG targets. Source: SSG analysis.

	2021	2025	2030	2040	2050
Industrial ($MTCO_2e$)	1,562,000	1,535,000	767,000	715,000	722,000
% change		-2%	-51%	-54%	-54%
Fugitive ($MTCO_2e$)	37,238	36,214	30,608	16,471	11,349
% change		-3%	-18%	-56%	-70%

Table 4.9. Industrial sector, secondary targets. Source: SSG analysis.

Targets	2025	2030	2040	2050
Clean energy share of total energy (%)	2%	4%	28%	47%

Waste

Emissions from the waste sector are targeted to achieve a 30% reduction from 2021 levels by 2050 (Table 4.10). This gradual decrease reflects both the complexity of waste emissions and the long timelines required for systemic changes. The secondary targets to support these reductions are reducing waste generation and increasing diversion rates. Per capita waste generation is targeted to fall from 1.8 to 1.5 tonnes by 2030, while diversion rates should rise steadily, reaching more than 90% by 2050, relative to 2021 levels (Table 4.11).

Table 4.10. Waste sector, GHG targets. Source: SSG analysis.

	2021	2025	2030	2040	2050
Waste ($MTCO_2e$)	206,000	245,000	249,000	205,000	145,000
% change		19%	21%	0%	-30%

Table 4.11. Waste sector, secondary targets. Source: SSG analysis.

Targets	2025	2030	2040	2050
Waste diversion rates (%)	57%	65%	78%	92%

5 | BAU/BAP GHG Emission Projections

MVRPC has developed near-term (2030) and long-term (2050) projections of GHG emissions under four scenarios: two reference scenarios where the measures in this plan are not implemented, and two CCAP Scenarios that project the impact of two different approaches to GHG emission reduction actions.

The first reference scenario — the Business-as-Usual (BAU) Scenario — projects energy use and GHG emissions out to 2050 if no additional GHG reduction plans, policies, programs and projects are implemented. The second reference scenario — the Business-as-Planned (BAP) Scenario — projects energy use and GHG emissions if existing and approved plans, legislations and targets that affect energy use and emissions are implemented with no additional interventions. The two CCAP Scenarios are the Community-First and Energy Transition Scenarios.

This section describes the methods for developing all four scenarios and the projections for the BAU and BAP Scenarios. Section 6 details the CCAP Scenario projections. For more information about the methodology and quality assurance procedures for preparing the projections, refer to the Data, Methods and Assumptions (DMA) Manual in Appendix 3.

Table 5.1 lists base year GHG emissions and near- and long-term GHG emissions projections by sector for the Miami Valley Region under the BAU, BAP and CCAP Scenarios.

Table 5.1. Total GHG emissions (thousand metric tonnes of CO_2e) by scenario and sector. Source: SSG analysis.

		BAU Scenario		BAP Scenario		CCAP Scenario: Community First		CCAP Scenario: Energy Transition	
Sector	**Base Year 2021**	**2030**	**2050**	**2030**	**2050**	**2030**	**2050**	**2030**	**2050**
Agriculture	317	292	235	291	233	71	65	71	65
Commercial	2,985	2,842	2,457	2,793	2,374	1,037	13	1,046	268
Fugitive	37	36	35	35	34	31	11	31	9
Industrial	1,562	1,514	1,388	1,505	1,371	767	722	765	71
Residential	2,715	2,395	1,960	2,335	1,854	925	22	910	285
Sequestration	-5	-5	-5	-5	-5	-5	-5	-5	-5
Transportation	3,021	2,124	1,577	2,127	1,578	1,833	230	1,833	213
Waste	206	294	373	294	373	249	145	249	137
TOTAL	10,839	9,491	8,021	9,376	7,814	4,907	1,203	4,900	1,044
% change over base year		**-12%**	**-26%**	**-13%**	**-28%**	**-55%**	**-89%**	**-55%**	**-90%**

5.1 Scenario Projections Methodology

Four scenarios were developed and modeled to explore the potential futures for the Miami Valley Region out to 2050. These scenarios are not predictions — they are plausible, evidence-based projections on how the future may evolve based on data and assumptions about the key drivers for emissions and critical trends in the area, augmented by feedback from engagement activities.

5.1.1 Modeling Tool

The scenarios were modeled using the consulting team's ScenaCommunity model. ScenaCommunity is an integrated, multi-fuel, multi-sector, partially disaggregated energy systems, emissions and finance model for cities and regions.[23]

5.1.2 Reference Scenario Descriptions

The future scenarios are summarized in Table 5.2. The two reference scenarios — the BAU and BAP Scenarios — provide a baseline for exploring the potential impact actions could have on GHG emissions and the community. The two CCAP Scenarios are compared to the baseline scenarios and one another to understand the potential impacts of different approaches to GHG emissions reduction actions. One of the CCAP Scenarios will be identified as the **preferred** scenario for implementation.

Table 5.2. Descriptions of the four scenarios developed for the Miami Valley Region. Source: SSG analysis.

Scenario Label	Title	Description
BAU	Business-as-Usual	A reference scenario that extrapolates current demographic patterns into the future to illustrate energy use and GHG emissions (and sinks, if applicable) if no additional plans, policies, programs and projects are implemented. This scenario answers the question, "What would happen if no further actions are taken?"

[23] For additional information on the technical modeling process and its inputs and assumptions, see the DMA (Appendix 3).

Scenario Label	Title	Description
BAP	Business-as-Planned	A reference scenario that extrapolates current demographic patterns into the future while taking into account existing and approved plans, legislations and targets that would affect energy use and emissions, and assuming no additional GHG emissions reduction interventions are taken. This scenario answers the question, “What would happen if only current actions, plans and policies are implemented?”
CF	Community-First	A scenario that selects and models actions to dramatically decrease GHG emissions and improve energy use across all sectors, with a target of achieving net-zero emissions by 2050. This scenario explores actions to increase urban intensification with local community hubs (hub and spoke model of development), fairness and access focused investments in decentralized renewables, and an emphasis on household affordability over the long-run. This scenario answers the question, “What would happen if all the actions, policies and programs in this CCAP are successfully implemented with a focus on community development?”
ET	Energy Transition	A scenario that selects and models actions to dramatically decrease GHG emissions and improve energy use across all sectors, with a target of achieving net-zero emissions by 2050. This scenario explores market-driven actions, with large deployment of large-scale renewables, vehicle manufacturing and EV adoption at a moderate pace and focus on clean technology adoption. This scenario also answers the question, “What would happen if all the actions, policies and programs in this CCAP are successfully implemented with a focus on technology implementation and market-driven?”

5.1.3 Modeling the Scenarios

After the baseline inventory was completed, the BAU and BAP Scenarios were modeled to forecast energy use and emissions annually out to the years 2030 and 2050. The ScenaCommunity spatial energy and emissions modeling tool was used to develop these scenarios based on the key assumptions described in Table 5.3.

Table 5.3. Modeling parameters and assumptions for BAU and BAP Scenarios. Source: SSG analysis.

Parameter	BAU Scenario	BAP Scenario
Demographics	From 2021 to 2050, assume: ● 0.12% decline in population ● 12% growth in employment ● 7% growth in the number of households ● 7.5% growth in the number of vehicles	From 2021 to 2050, assume: ● 0.12% decline in population ● 12% growth in employment ● 7% growth in the number of households ● 7.5% growth in the number of vehicles
Building sector	From 2021 to 2050, assume: ● Current building codes are held constant over the 2050 period. ● Heat pumps and heat pump water heaters remain constant since the base year.	From 2021 to 2050, assume: ● On average, the Ohio Energy Code 2024 will lead to improved energy efficiency in new buildings (residential and non-residential) compared to older standards, as it has a stricter standard reference design. ● Heat pumps and heat pump water heaters will be added to all new residential buildings, and heat pumps will be added to all new commercial buildings. ● 1.88% rate of energy retrofits per year (singles, doubles, row) and 10% thermal improvement for existing residential buildings

Parameter	BAU Scenario	BAP Scenario
Transportation sector	From 2021 to 2050, assume: ● 4% growth rate in personal EVs every 3 years; nearly 40% of new vehicles are EVs by 2050	From 2021 to 2050, assume: ● 4% growth rate in personal EVs every 3 years; nearly 40% of new vehicles are EVs by 2050 ● Included electric vehicles (5) of Dayton's municipal fleet (1,200 in total) ● 2%/year improvement in fuel economy for private vehicles (passenger cars and light trucks) from 2028-2031, due to Corporate Average Fuel Economy (CAFE) standard improvements. Assume a 10% increase in fuel efficiency for heavy-duty pick-up vans from 2030-2032, and an 8% increase from 2033-2035.
Waste sector	● City of Dayton residential composting program fully implemented by 2026, including 32 drop-off facilities and 6 in-vessel compost systems	● City of Dayton residential composting program fully implemented by 2026, including 32 drop-off facilities and 6 in-vessel compost systems
Water & wastewater sector	N/A	● Cleaned digester gas and landfill gas from Stony Hollow landfill to be injected into natural gas (NG) pipeline as of 2025
Energy sector	● Projected 254 kg/MWh grid electricity emissions factor by 2050	● Projected 254 kg/MWh grid electricity emissions factor by 2050 ● Assume residential solar PV system install rate of 0.3% per year (approx. 1,041 homes/year) from 2023-2050.

Parameter	BAU Scenario	BAP Scenario
Climate projections	Heating/cooling degree days, changing by 2050 relative to 2021 (following a climate change scenario RCP8.5): ● Heating degree days change (%) by county: Greene: -12% Miami: -13% Montgomery: -14% ● Cooling degree days change (%) by county: Greene: 33% Miami: 42% Montgomery: 38%	Heating/cooling degree days, changing by 2050 relative to 2021 (following a climate change scenario RCP8.5): ● Heating degree days change (%) by county: Greene: -12% Miami: -13% Montgomery: -14% ● Cooling degree days change (%) by county: Greene: 33% Miami: 42% Montgomery: 38%
Industrial sector	N/A	N/A

Sections 5.2 and 5.3 present the results for the BAU and BAP Scenario modeling. For additional information on the modeling process and its inputs and assumptions, see Appendix 3.

5.1.4 Limitations

The methodology and results presented here do not and cannot fully account for all the factors that could shape the future of energy use and GHG emissions in the Miami Valley Region. The resulting projections are intended not to predict the future, but to help us understand how different choices and changes could affect the path forward.

5.2 BAU Projections Results

What would the Miami Valley Region's emissions look like in 2030 and 2050 if no measures are taken? In this BAU Scenario, population remains steady, while the number of households and employment increases over time. Energy sources and consumption trends, transportation modes and patterns, and land-use plans follow the trends described in Table 5.3.

The model shows that without any intervention, emissions would decrease by 12% by 2030, and by 26% by 2050, compared to 2021 emissions (a total decrease from approximately 10.8 to 8 $MMTCO_2e$) (Figure 5.1). Significant decreases in emissions are projected for the largest emitting sectors — namely, transportation (48% decrease in emissions levels by 2050) and commercial and residential buildings (45% decrease by 2050, in total). By contrast, the waste sector is projected to increase considerably (81% increase by 2050); however, this sector only accounts for roughly 2% of baseline emissions, making the impact to total community emissions minimal. Other sector-specific trends will be discussed in greater detail later in this section.

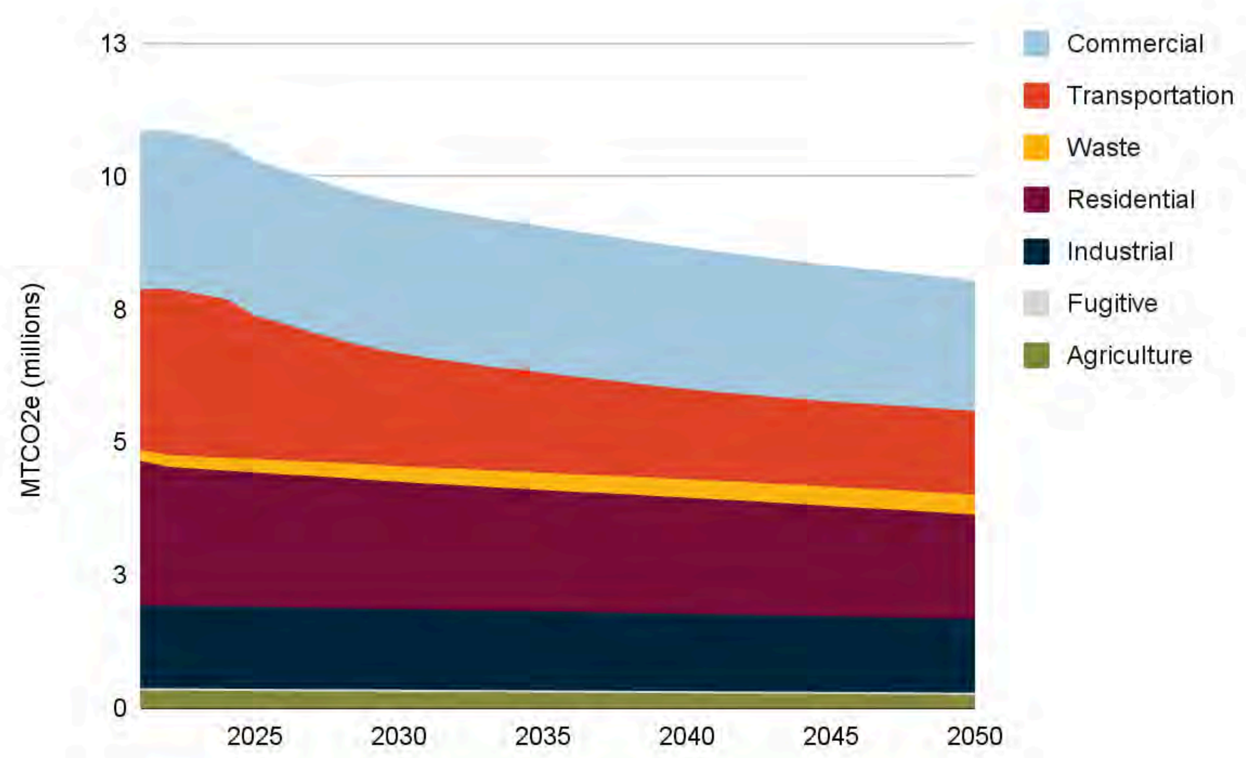


Figure 5.1. Projected total community GHG emissions by sector in the BAU Scenario, 2021-2050. Source: SSG analysis.

5.3 BAP Projections Results

The BAP Scenario illustrates the Miami Valley Region's energy use and emissions trajectory if the community takes no additional action on climate change beyond the activities already underway or planned. This reference scenario accounts for current plans, policies, legislation and regulations at the municipal, state and federal levels, along with changes in population and jobs in the region. It does not account for pledges, promises or ideas that are not yet endorsed, passed through legislation, or budgeted for with committed capital and/or operational funding.

The BAP Scenario results are the baseline against which the measures in the CCAP Scenarios are assessed within the CCAP. Once implementation is underway, the BAP Scenario can be used as a reference for assessing progress toward GHG emissions reductions and the impact of policies, programs and other reduction measures.

5.3.1 BAP Projections for Total Community GHG Emissions

In the BAP Scenario, total annual emissions see a steady decrease from 10.8 $MMTCO_2e$ in 2021 to approximately 9.4 $MMTCO_2e$ in 2030, representing an overall decline of 13% (or roughly 1.4 $MMTCO_2e$), as shown in Figure 5.2. This decline continues after 2030, decreasing by an additional 15% by 2050. The trend in this scenario is similar to the BAU Scenario, as limited policies and programs are in place to tackle GHG emissions, both in the short- and long-term.

At the sector level, the steepest drops in emissions compared to the 2021 baseline are seen in the transportation sector (48% decrease), followed by the residential (32%) and commercial building (21%) sectors — representing a total decline of approximately 2.9 $MMTCO_2e$ (similar to the trends seen in the BAU Scenario).

The waste sector is an exception to this (as in the BAU Scenario), increasing by 81% by 2050 relative to 2021, and reaching 373,000 $MTCO_2e$ from 206,000 $MTCO_2e$. This trend is driven primarily by the waste generated from the commercial sector, which increases slightly due to land-use changes.

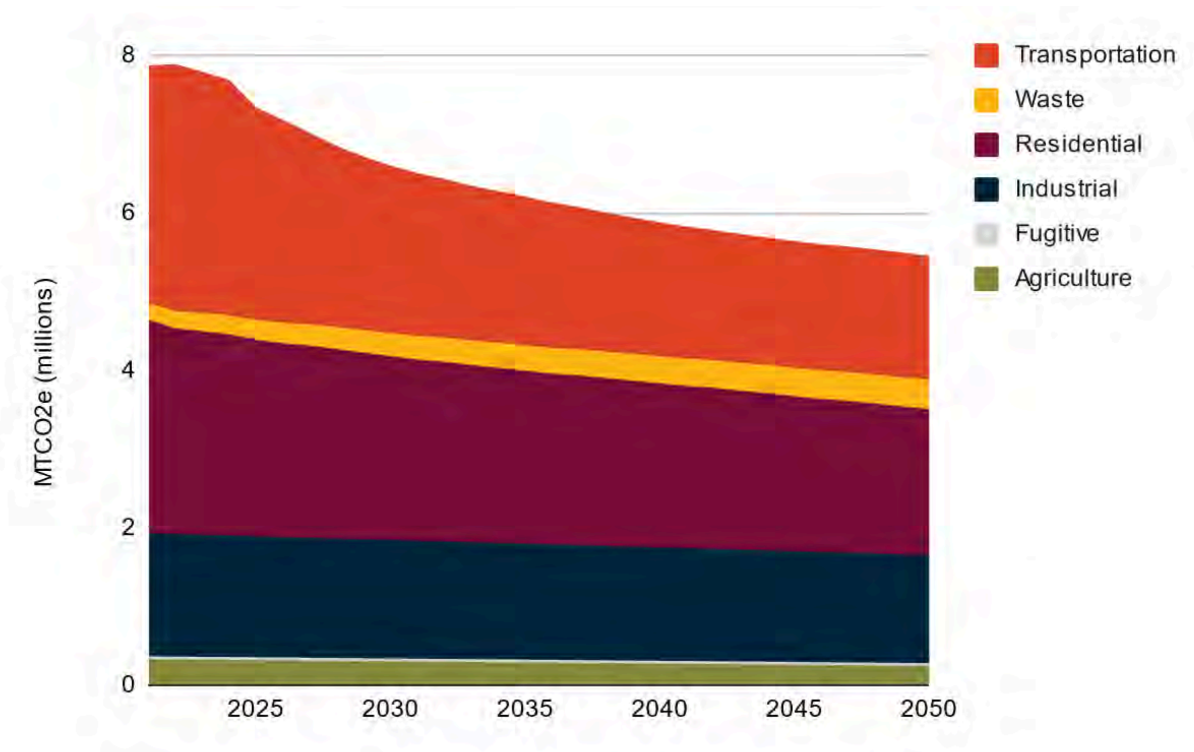


Figure 5.2. Projected total community GHG emissions by sector in the BAP Scenario, 2021-2050. Source: SSG analysis.

Based on 2021 baseline data, grid electricity and natural gas are the greatest contributors to overall emissions (39% and 24% of emissions, respectively), followed closely by gasoline (22%) (Figure 5.3). Over the BAP scenario, a 65% overall drop in emissions from gasoline is a result of low but steady penetration of EVs, while the steepest drop between 2025 and 2030 is mostly driven by the CAFE standards. As there are no current policies or strategies to include renewable energy and electrification of building uses in the region, grid electricity (38%) and natural gas (30%) remain the greatest contributors to the Miami Valley Region's emissions in 2050.

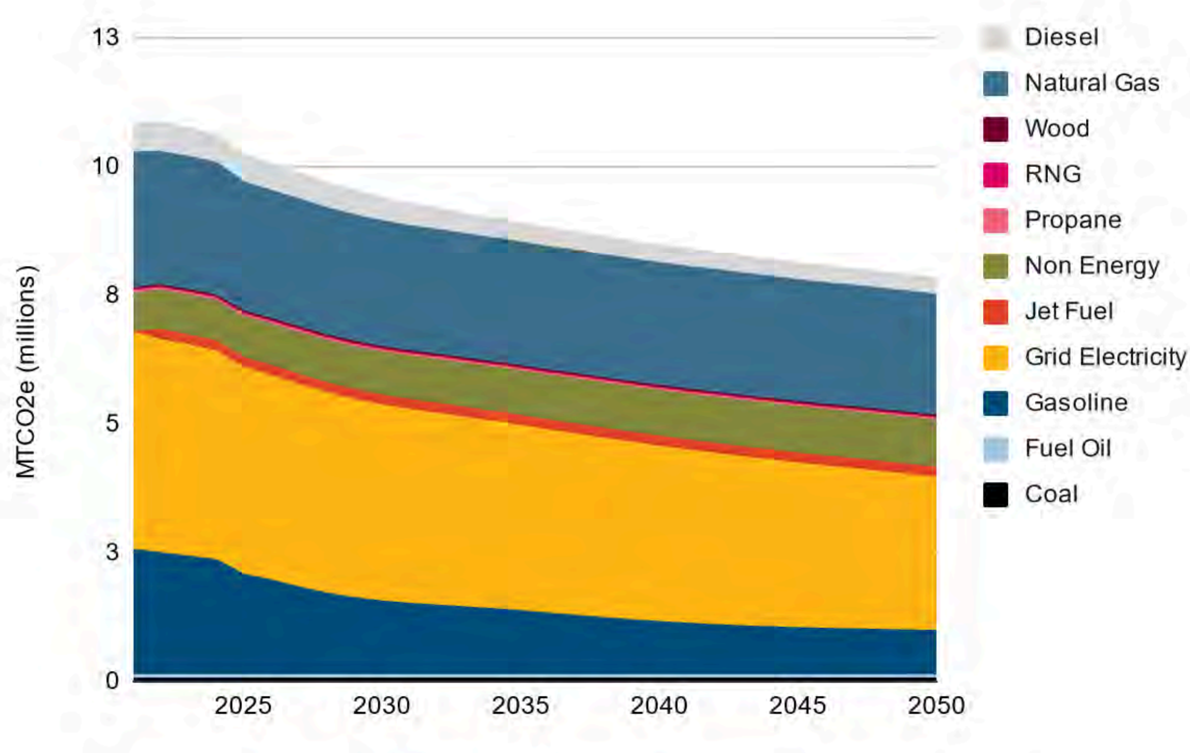


Figure 5.3. Projected total community GHG emissions by fuel source in the BAP Scenario, 2021-2050. Source: SSG analysis.

In the BAP Scenario, per capita emissions decline from 13.5 $MTCO_2e$/person in the baseline year to 9.7 $MTCO_2e$/person in 2050 (-28%), as shown in Figure 5.4.

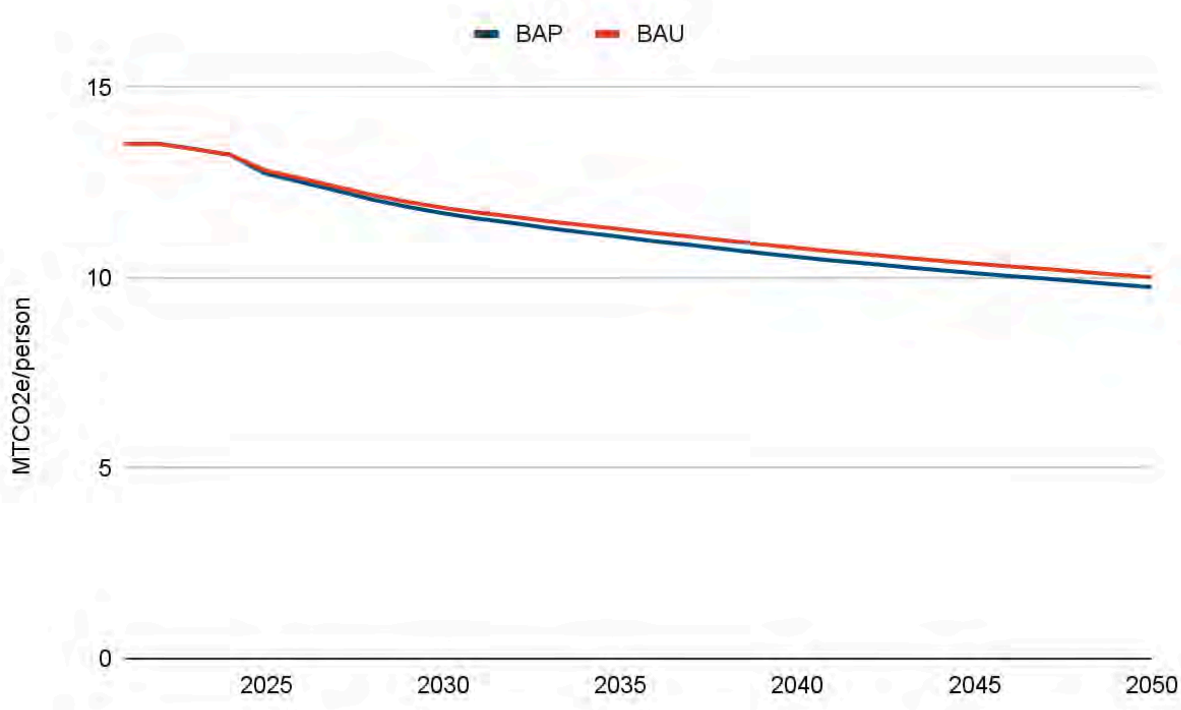


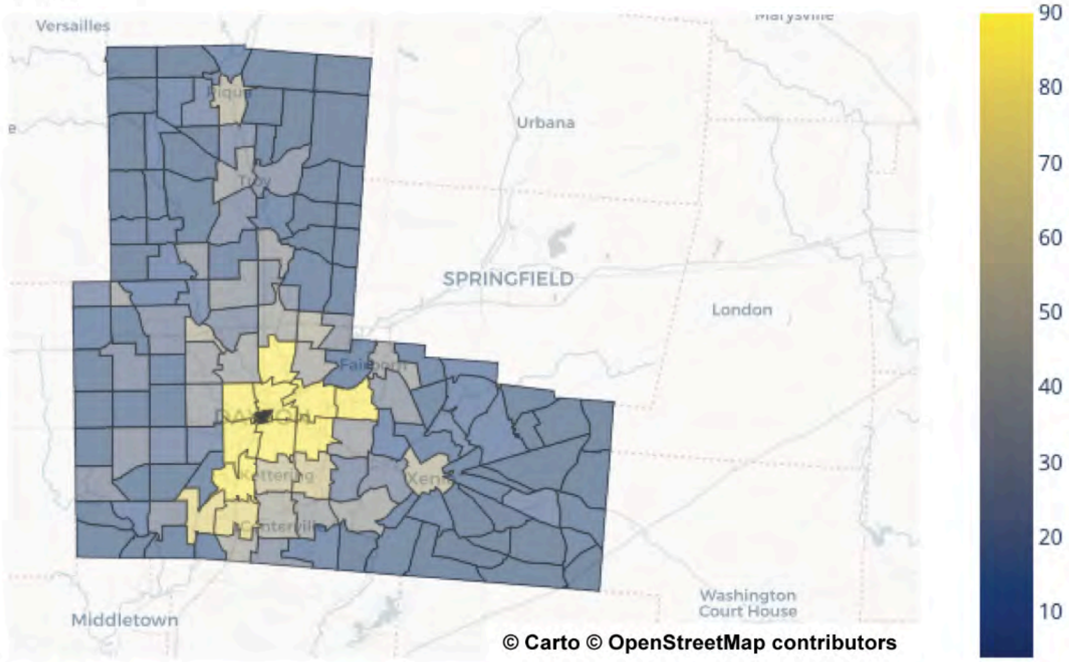
Figure 5.4. Projected total community GHG emissions per capita in the BAP Scenario, 2021-2050. Source: SSG analysis.

For reference, according to the latest recommendations from leading climate science organizations, per capita emissions in cities in wealthy countries need to drop to below 2.9 $MTCO_2e$ per capita by 2030.[24] In the BAP Scenario, per capita emissions drop to 11.8 $MTCO_2e$/person by 2030, which is still four times the recommended target for that year and 3.5 times the 2050 target (9.7 $MTCO_2e$/person).

Emissions density by hectare (Figure 5.5) will also reflect reductions due to the assumptions listed in Table 5.3 — namely, slight increases in building performance resulting from the 2024 Ohio Energy Code, EV penetration, CAFE standards and land-use changes. The city of Dayton is expected to experience the largest emissions density change between 2021 and 2050, mostly related to the concentration of activities in this area (e.g., jobs, transportation, number of buildings).

[24] C40 Cities. 1.5°C Climate Action Plans. https://www.c40.org/what-we-do/raising-climate-ambition/1-5c-climate-action-plans/

2021



2050

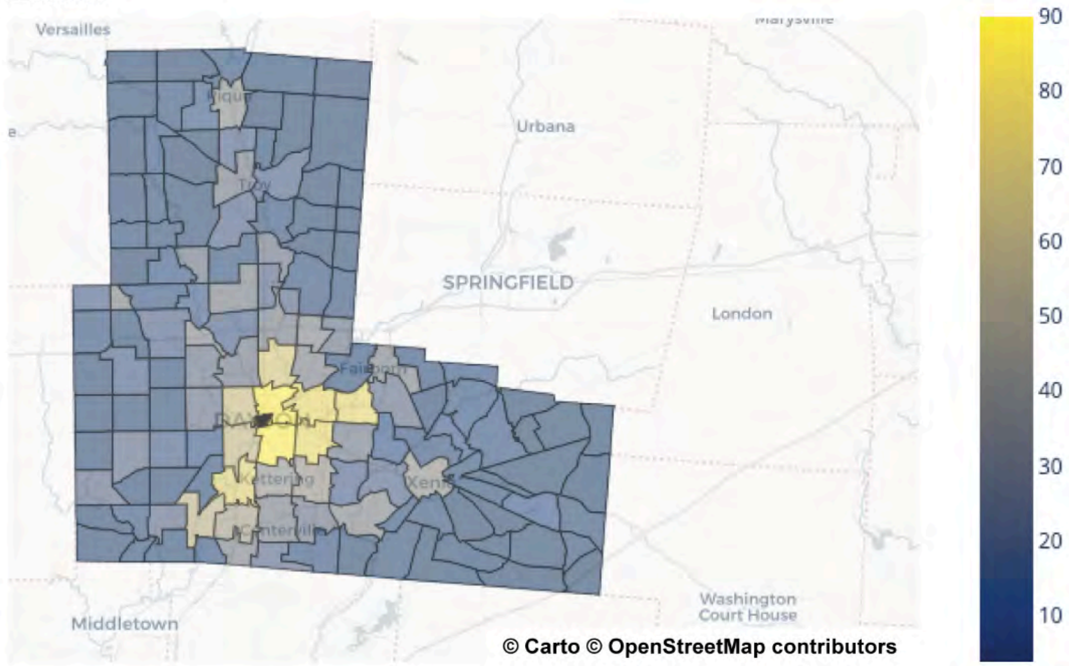


Figure 5.5. Projected community GHG emissions per hectare (MTCO$_2$e/hectare) by Traffic Analysis Zone (TAZ) in the BAP Scenario, 2021 and 2050. Source: SSG analysis.

5.3.2 BAP Outlook by Sector

Building Sector

In line with overall community emissions for the Miami Valley Region, the greatest contributor to emissions in the building sector is grid electricity (4.2 $MMTCO_2e$), followed by natural gas (2.6 $MMTCO_2e$). In the BAP Scenario, emissions across all fuel sources steadily decline from 2021 to 2050 (Figure 5.6) due to improved energy efficiency standards attributed to the new Ohio Energy Code, which applies to residential and commercial buildings.

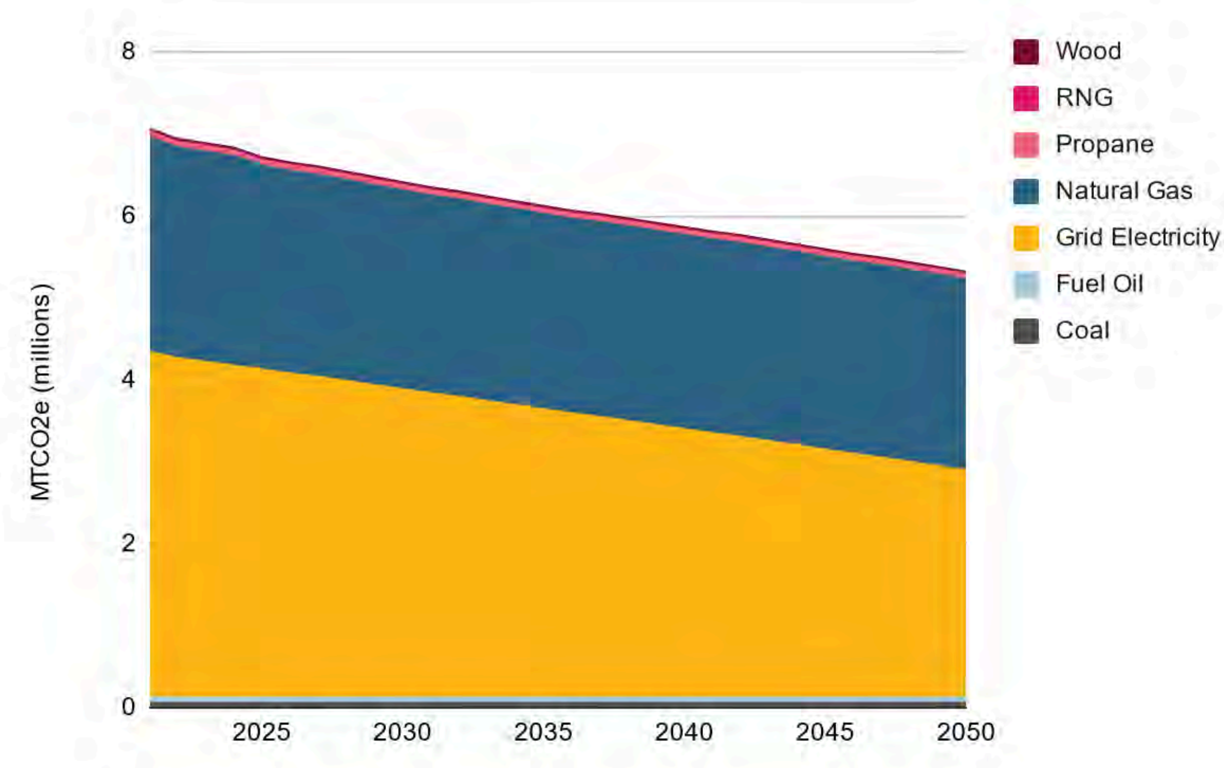


Figure 5.6. Projected building sector GHG emissions by fuel source in the BAP Scenario, 2021-2050. Source: SSG analysis.

Based on 2021 baseline data, space heating is the greatest driver of emissions in this sector, accounting for 40% of total emissions from buildings (Figure 5.7). Industrial processes also account for a meaningful portion (20%) of emissions. Over the course of the BAP Scenario, the percentage contribution of each sub-sector to total building emissions does not change significantly, as all see a decline of 10%-30% by 2050.

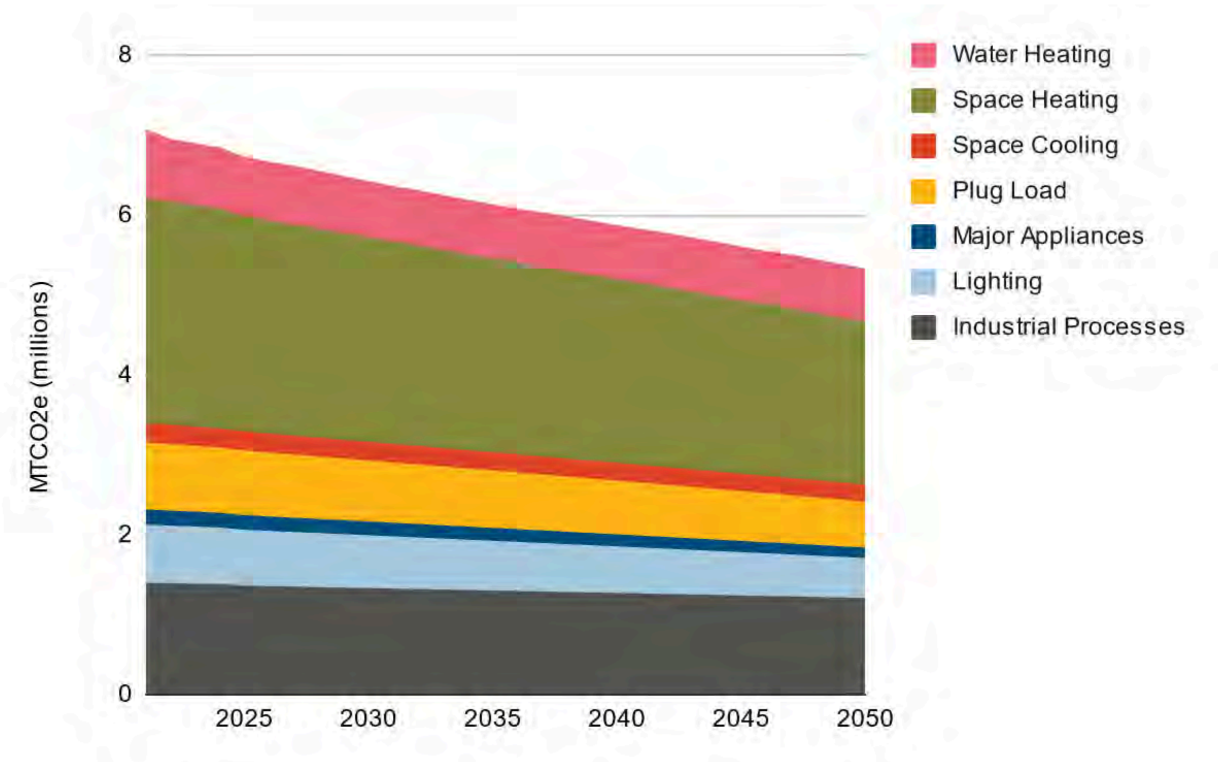


Figure 5.7. Projected building sector GHG emissions by end use in the BAP Scenario, 2021-2050. Source: SSG analysis.

Transportation Sector

Based on 2021 baseline data, the transportation sector represents the largest source of emissions in the Miami Valley Region, reaching nearly one-third of the region's total emissions. Within the sector, personal vehicles account for approximately 65% of transportation emissions, and remain to be the sub-sector with the highest emissions over the course of the BAP Scenario and to 2050 (45% of total sector emissions in 2050).

In the BAP Scenario, transportation emissions are projected to decrease by 48% by 2050, a significant decline compared to overall community emissions (28% decrease) (Figure 5.8). Thus, increases in EV ownership and improvements in fuel economy for cars do result in a sharp decline in emissions in the BAP Scenario, particularly from 2025-2030.

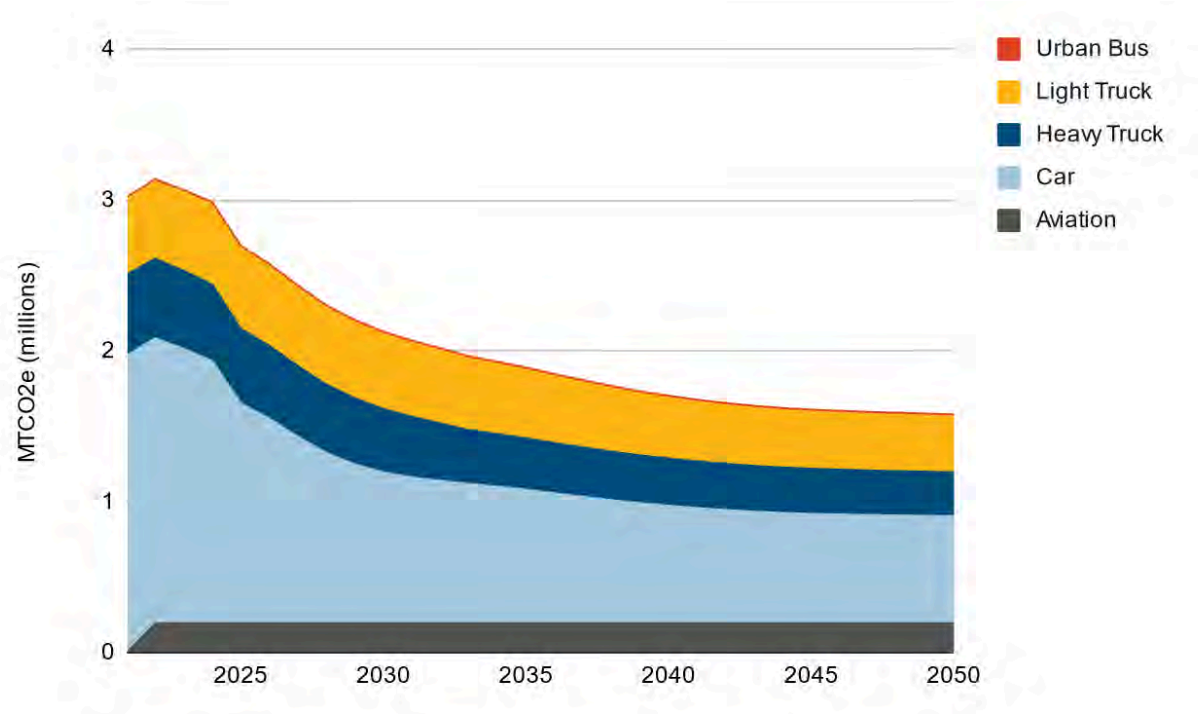


Figure 5.8. Projected transportation sector GHG emissions by vehicle type in the BAP Scenario, 2021-2050. Source: SSG analysis.

With personal vehicles responsible for most emissions in this sector, gasoline accounts for roughly 81% of emissions and diesel for 19%. Diesel emissions do not drastically change over the BAP Scenario; a small decrease occurs due to the CAFE standards applying to heavy-duty trucks. However, EV adoption, although small, represents a large contribution to decreasing emissions from gasoline, and partly contributes to an increase in emissions from the grid, as shown in Figure 5.9.

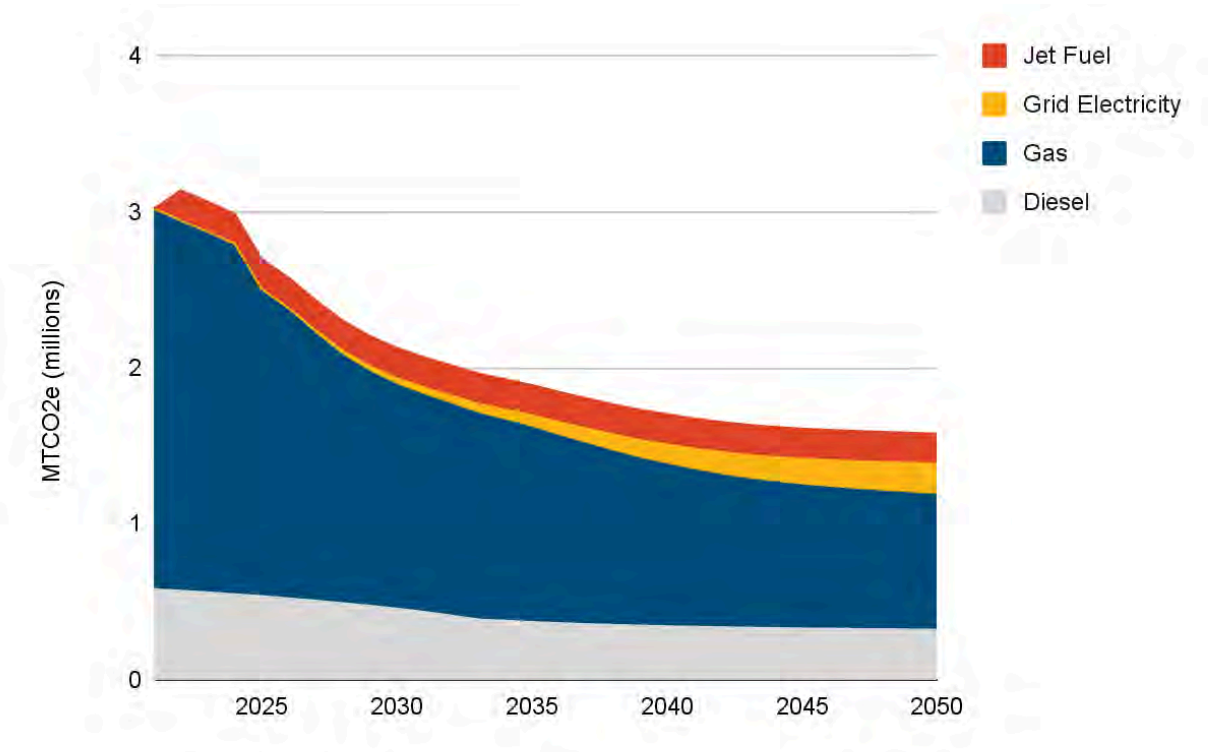


Figure 5.9. Projected transportation sector GHG emissions by fuel source in the BAP Scenario, 2021-2050. Source: SSG analysis.

Waste Sector

Waste emissions accounted for only 2% of emissions in 2021, and increase to only 5% of total emissions in 2050. However, within this sector, emissions rapidly increase by 81% over the BAP Scenario (Figure 5.10), particularly due to cumulative methane emissions and the slow anaerobic decomposition of waste in landfills, where emissions accumulate and increase over time.

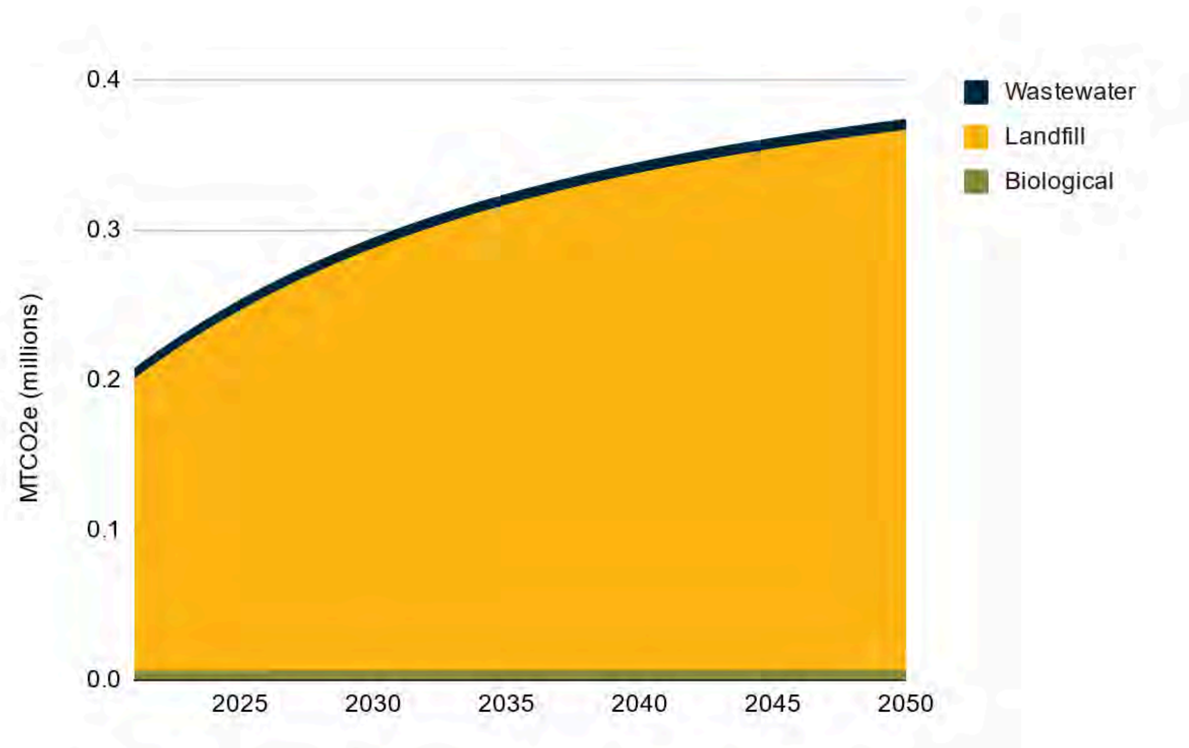


Figure 5.10. Projected waste sector GHG emissions by treatment in the BAP Scenario, 2021-2050. Source: SSG analysis.

Industrial Sector

In the Miami Valley Region, industrial emissions represent a significant and relatively stable portion of overall community emissions, accounting for 14% of the total emissions in 2021. While the absolute emissions from the industrial sector decrease modestly over time under the BAP Scenario (Figure 5.11), the sector's share of total emissions increases, suggesting this sector reduces emissions slowly compared to others. By 2030, emissions decline to 1.50 $MTCO_2e$ (-4% from 2021), with the share rising to 16%. By 2050, they will reach 1.37 $MTCO_2e$, reflecting a 12% reduction over nearly three decades. Notably, the industrial sector's share climbs to 18%, despite the absolute decline in emissions.

Grid electricity is the largest emitting fuel source in this sector, followed closely by non-energy sources, derived from industrial processes, particularly the cement industry in Fairborn. Emissions from grid electricity will decrease due to a cleaner power generation system; however, emissions from natural gas and non-energy will remain almost unchanged over time.

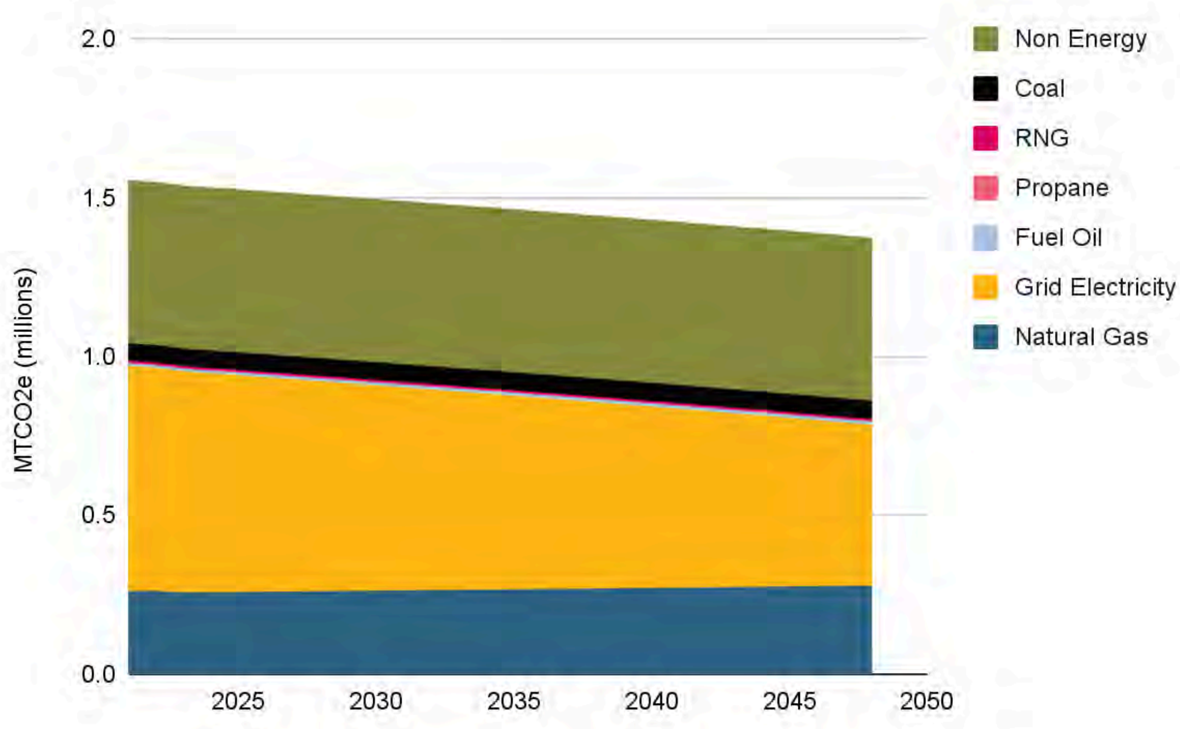


Figure 5.11. Projected industrial sector GHG emissions by fuel type in the BAP Scenario, 2021-2050. Source: SSG analysis.

The Energy System

The Sankey diagrams in Figure 5.12 illustrate the flow of energy in the Miami Valley Region from local and imported sources through to end-use sectors in 2021 and 2050. On the left, the diagram shows energy inputs, including imported electricity and fuels. This energy flows to end-use sectors, illustrated through bars in the middle of the diagram. In 2021, the three most significant energy inputs are grid electricity (approx. 30 million MMBtu), natural gas (49 million MMBtu) and gasoline (33 million MMBtu). These energy sources flow to the right, where they are distributed across major sectors: gasoline is used for transportation, while natural gas and electricity are used in the residential and commercial sectors. Commercial and residential energy use remain relatively constant out to 2050, thanks to improvements in building energy efficiency and decreased conversion losses. Transportation energy use declines as a result of the CAFE standards and increased EV adoption, reducing long-term gasoline imports to 12 million MMBtu. Energy losses — such as those from transmission, conversion inefficiencies or waste heat — are shown on the far right of the diagram; these are projected to decrease by nearly half over three decades.

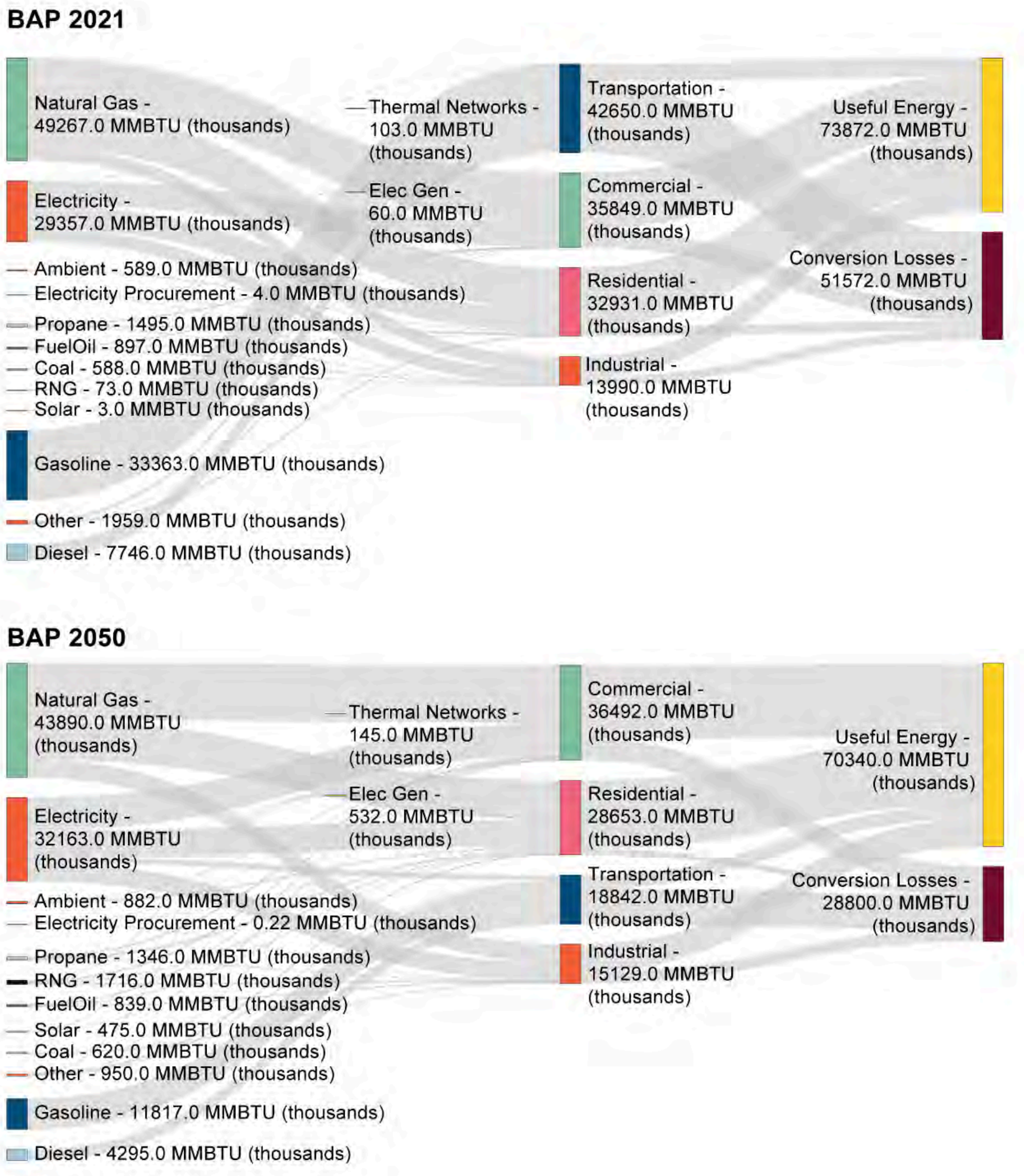


Figure 5.12. Sankey diagram for Miami Valley Region in 2021 (top) and 2050 (bottom), energy flows in million MMBtu. Source: SSG analysis.

6 | Emission Reduction Measures and CCAP Scenario Projections

The BAU and BAP modeling results demonstrate that existing policies, regulations, market trends and efficiency improvements are not enough to reach meaningful emissions reduction ambitions in the Miami Valley Region. To eliminate as many GHG emissions as possible by 2050, comprehensive changes across all sectors are necessary.

In particular, the Miami Valley Region will need to take steps, or “Big Moves,” that span the building, transportation, energy, industry and waste sectors to reduce emissions. These Big Moves include:

1. Develop affordable and sustainable buildings
2. Expand access to clean transportation
3. Transition to clean energy
4. Re-energize clean industrial sectors
5. Foster a circular economy

While the CCAP Scenarios differ in GHG reduction measures, they both address the Big Moves and demonstrate the potential impact of broad GHG reduction measures. When implemented together in a strategic order, the bundle of actions in each CCAP Scenario works to improve overall energy efficiency and reduces emissions associated with energy use and other activities within the Miami Valley Region. Both scenarios reduce total annual average GHG emissions by 4.7 $MMTCO_2e$ by 2050 (Figure 6.1).

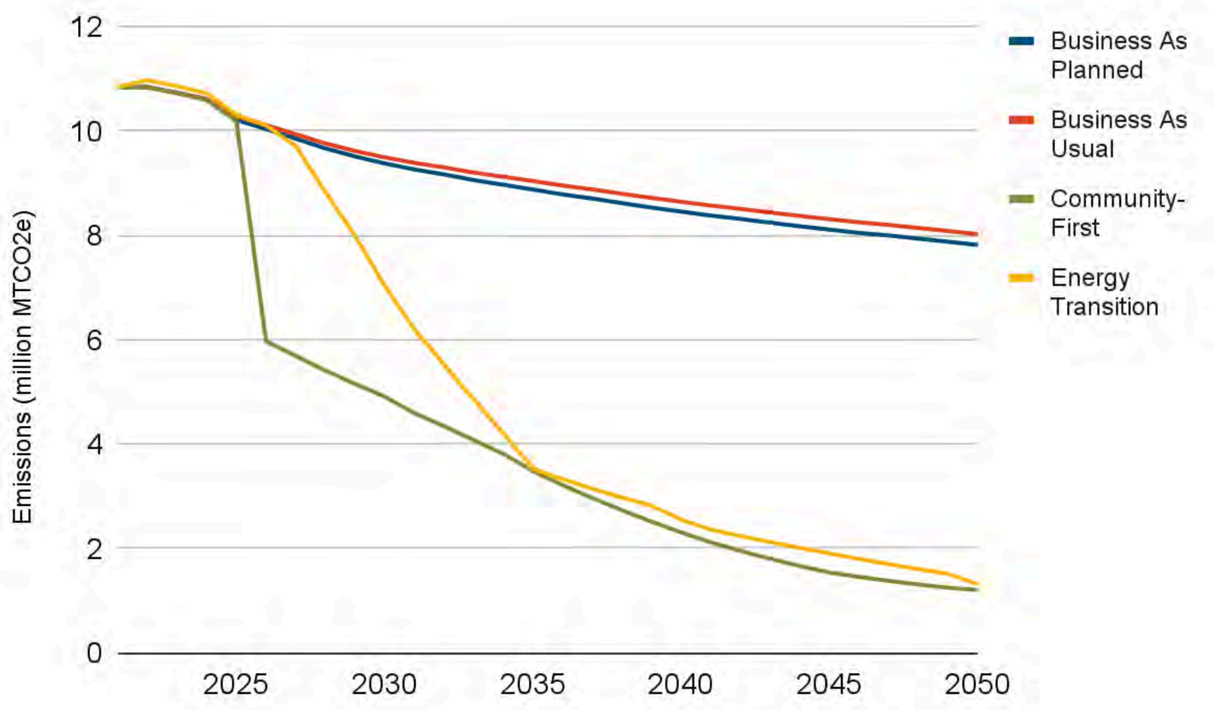


Figure 6.1. Projected total community GHG emissions in the BAU, BAP and CCAP Scenarios, 2021-2050. Source: SSG analysis.

6.1 GHG Emissions Reduction Measures Summary

The CCAP Scenarios build upon the BAP Scenario to show what additional changes need to be made to meet the Miami Valley Region's emissions targets. The modeling assumptions for the CCAP measures, along with the corresponding Big Moves, are described in Table 6.1.

Appendix 3 provides full details of the modeling methodology used.

Table 6.1. Modeled low-carbon actions and corresponding Big Moves.
Source: SSG analysis.

Big Move	Measure	CF Scenario	ET Scenario	Impact
Develop affordable and sustainable buildings	Improve energy efficiency in new buildings	New residential and commercial buildings are constructed to reduce their energy use intensity (EUI) by 30% by 2030 and 50% by 2040, below 2021 levels.	New residential and commercial buildings are constructed to reduce their EUI by 20% by 2030 and 30% by 2040, below 2021 levels.	Avoided/ reduced energy use
	Retrofit existing buildings	All existing residential, commercial and industrial buildings are retrofitted to reduce their EUI per unit of floor area by 50% by 2035 and 60% by 2050.	All residential and commercial buildings are retrofitted to reduce their EUI per unit of floor area by 24% by 2035 and 41% by 2050.	Avoided/ reduced energy use
	Switch new and existing commercial and residential buildings to heat pumps and RNG	All new buildings are equipped with heat pumps by 2035, and 50% of existing buildings by 2045. Natural gas is replaced with RNG in remaining buildings.	Space heating and cooling systems are replaced with heat pumps, with a natural replacement rate to achieve 100% for new buildings and 50% for existing buildings by 2045. Natural gas is replaced with RNG in remaining buildings.	Avoided/ reduced energy use and fuel switching

Big Move	Measure	CF Scenario	ET Scenario	Impact
Develop affordable and sustainable buildings	Electrify water heaters and stoves	All new sales of water heaters and stoves are electric by 2035.	All new sales of water heaters are electric by 2035. No target for electric stoves.	Avoided/ reduced energy use and fuel switching
Expand access to clean transportation	Electrify transportation	50% of light-duty and 30% of heavy-duty vehicle sales are electric by 2030. The municipal transit fleet is 100% electric by 2035. Aviation is 100% carbon-free by 2040. Advances in expanding charging infrastructure are made and charging infrastructure in low-income areas is subsidized to provide fast public charging for EVs.	50% of light-duty and 30% of heavy-duty vehicle sales are electric by 2030. Aviation is 100% carbon-free by 2040.	Fuel switching
	Increase transit and active mode shares	By 2040, at least 20% of trips are made by modes other than driving by car alone (e.g., transit, walking, cycling, carpooling).	No changes to BAP	Avoided/ reduced energy use
Transition to clean energy	Build a zero-emissions grid	Grid provider retires fossil-fuel power generation plants and replaces them with zero-emissions power. Electricity is 100% carbon-free across the community by 2035.	Grid provider retires fossil-fuel power generation plants and replaces them with zero-emissions power.	Fuel switching

Big Move	Measure	CF Scenario	ET Scenario	Impact
Transition to clean energy	Expand solar generation and other renewable energy	100% of buildings with solar potential have solar rooftops.	Large-scale renewable energy projects, including wind and solar, are rapidly deployed by utilities and 100% of new buildings have solar rooftops by 2040.	Fuel switching
	Increase renewable energy used in industrial processes	Industries adopt energy procurements to provide 100% clean electricity.	On-site solar generation covers industrial processes use and renewable energy procurement at local levels.	Fuel switching
	Develop District energy system	100% of district energy is used for space heating, water heating and space cooling, with a capacity of 0.77 MW.	Same as CF	Fuel switching
Re-energize clean industrial sectors	Improve energy efficiency of industrial processes	By 2031, industrial sites reduce their energy intensity by 30% relative to the 2021 baseline.	Same as CF	Avoided/ reduced energy use
	Electrify industrial processes	By 2050, 50% of energy use for industrial processes is electricity.	Same as CF	Fuel switching
	Switch to RNG in wastewater treatment plants (WWTPs)	WWTPs capture 90% of methane to use as RNG by 2030.	No changes to BAP	Fuel switching
	Deploy hydrogen for industrial processes	No changes to BAP	Industries replace the use of coal with hydrogen for industrial processes.	Fuel switching

Big Move	Measure	CF Scenario	ET Scenario	Impact
Re-energize clean industrial sectors	Deploy carbon capture and storage (CCS) technology to capture CO_2 emissions	No changes to BAP	Industries capture 100% of CO_2 emissions by 2050.	Capture/ sequester
Foster a circular economy	Reduce waste generation per capita	By 2050, waste generation per capita is reduced by 30% relative to the 2021 baseline.	Same as CF	Avoided/ reduced energy use
	Divert landfill waste	By 2050, 90% of waste is diverted from landfills, and sent to recycling and community composting facilities.	By 2050, 90% of waste is diverted from landfills, and sent to recycling and anaerobic digestion facilities.	Avoided/ reduced energy use

6.2 CCAP Scenario Projections

6.2.1 CCAP Projections for Total Community GHG Emissions

For the Community-First Scenario, the Miami Valley Region's total annual GHG emissions are projected to drop by 55% by 2030 and 89% by 2050, relative to the 2021 baseline. For the Energy Transition Scenario, total annual GHG emissions are projected to drop by 55% by 2030 and 90% by 2050, relative to 2021. The decrease in emissions over time is a result of all the modeled measures working together and proceeding in a specific order.

Figures 6.2 and 6.3 show the total impact of the CCAP actions for each scenario.

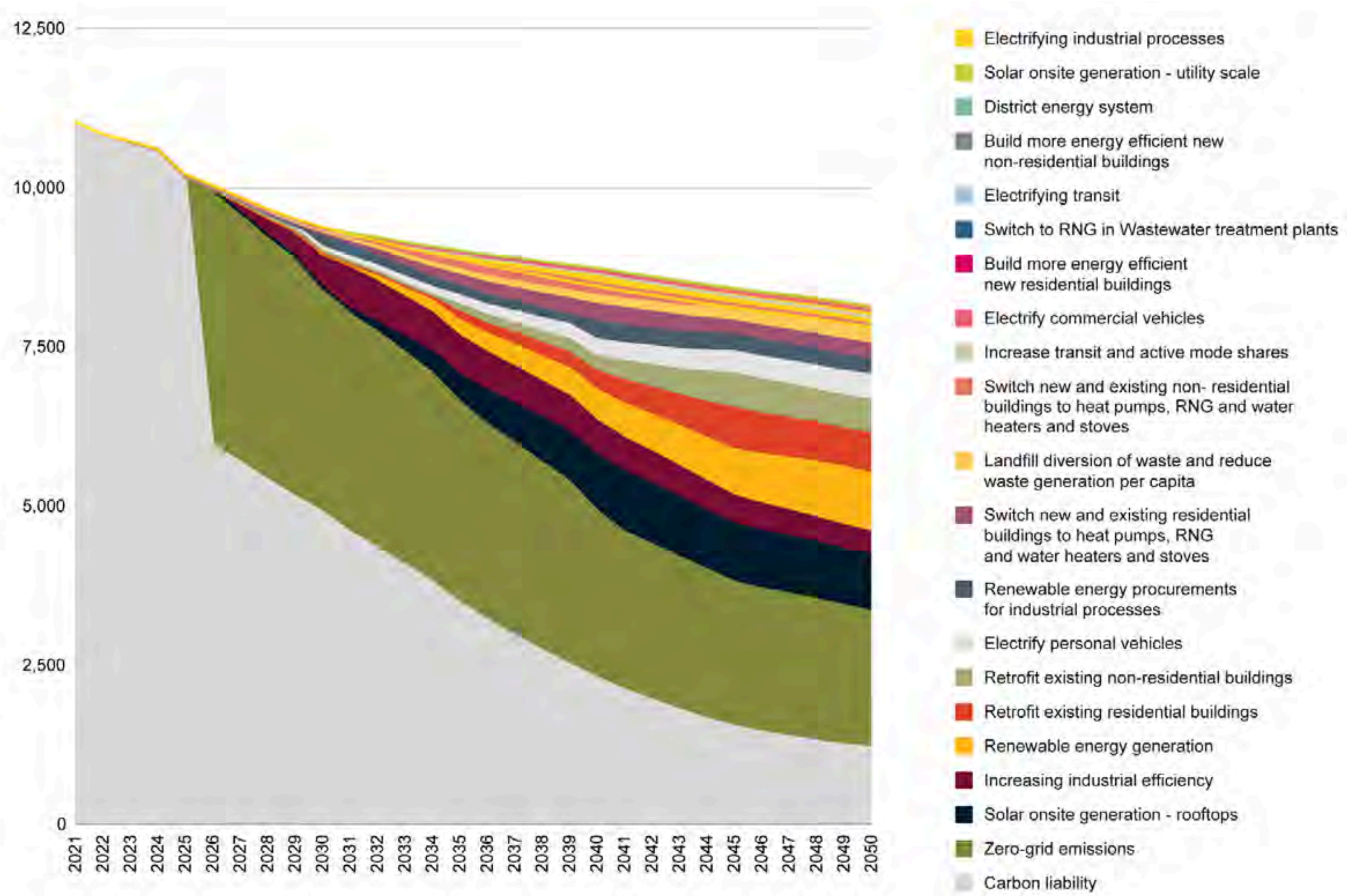


Figure 6.2. Projected emissions reductions by action for the Community-First Scenario, 2021-2050. Source: SSG analysis.

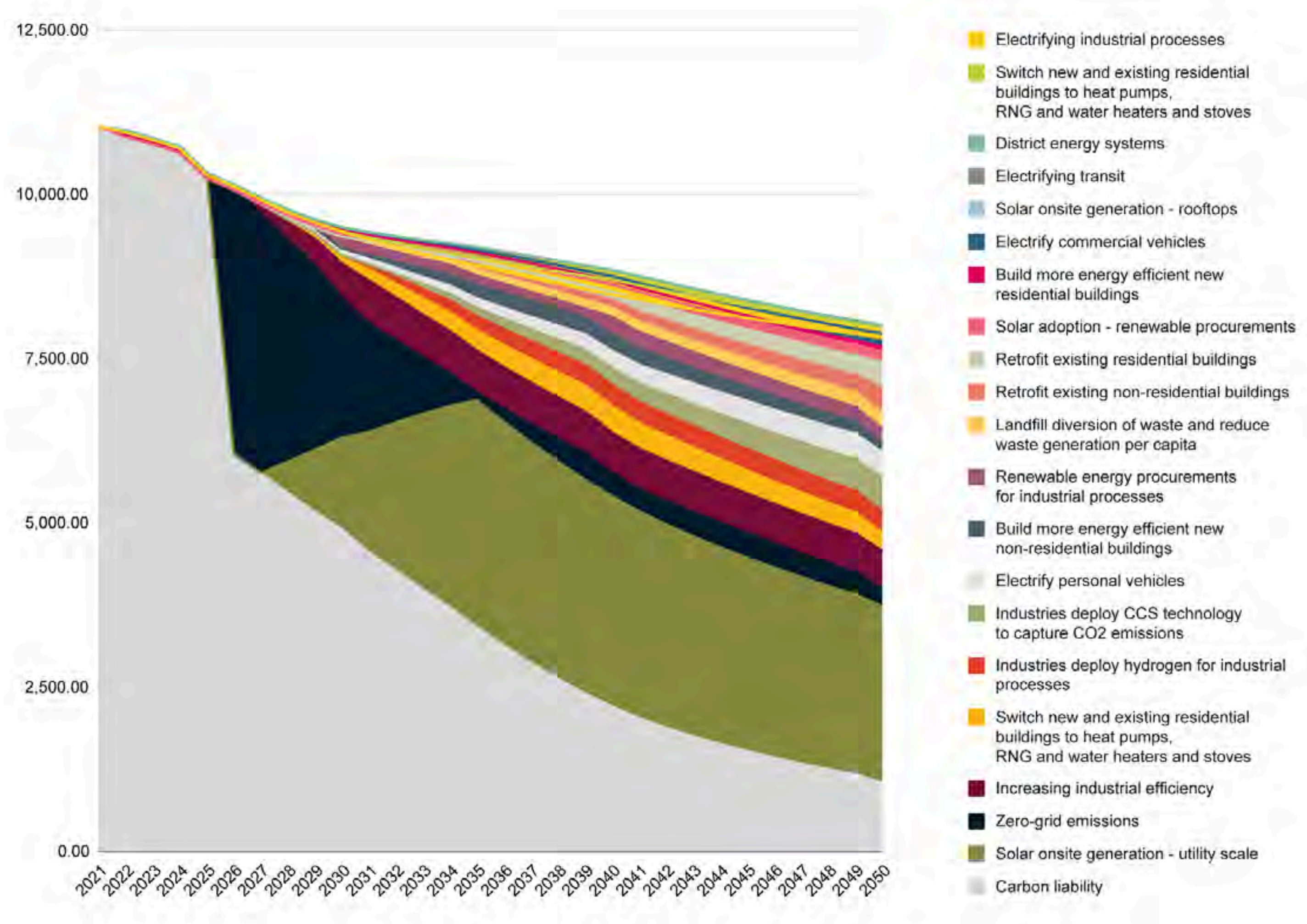


Figure 6.3. Projected emissions reductions by action for the Energy Transition Scenario, 2021-2050. Source: SSG analysis.

The Community-First Scenario shows a gradual (Figure 6.4) but consistent trend toward decarbonization from 2021 to 2050, with notable inflection points, such as those observed by 2030. This shift is largely a result of the installation of rooftop solar PV, which contributes substantially to GHG emissions reductions by supporting a zero-emission electricity supply. In both scenarios, a major shift occurs after 2026, driven by the adoption of renewable generation technologies that displace fossil fuel-based electricity on the grid.

Electrification of transportation, notably personal EVs and commercial EVs, in the Community-First Scenario accelerates emissions reductions in the region. Retrofits and equipment upgrades (e.g., high-efficiency stoves, electric water heaters and heat pumps) in residential and non-residential buildings also ramp up post-2030. Further emissions reductions come along with rising energy efficiency in industrial processes, as well as electrification and fuel switching to cleaner fuels such as RNG.

In the long term, up to 2050, emissions reductions are largely sustained through continued electrification (in buildings and transport), increased distributed renewable generation (rooftop solar PV), and the long-term impact of earlier infrastructure investments, such as retrofits of existing buildings.

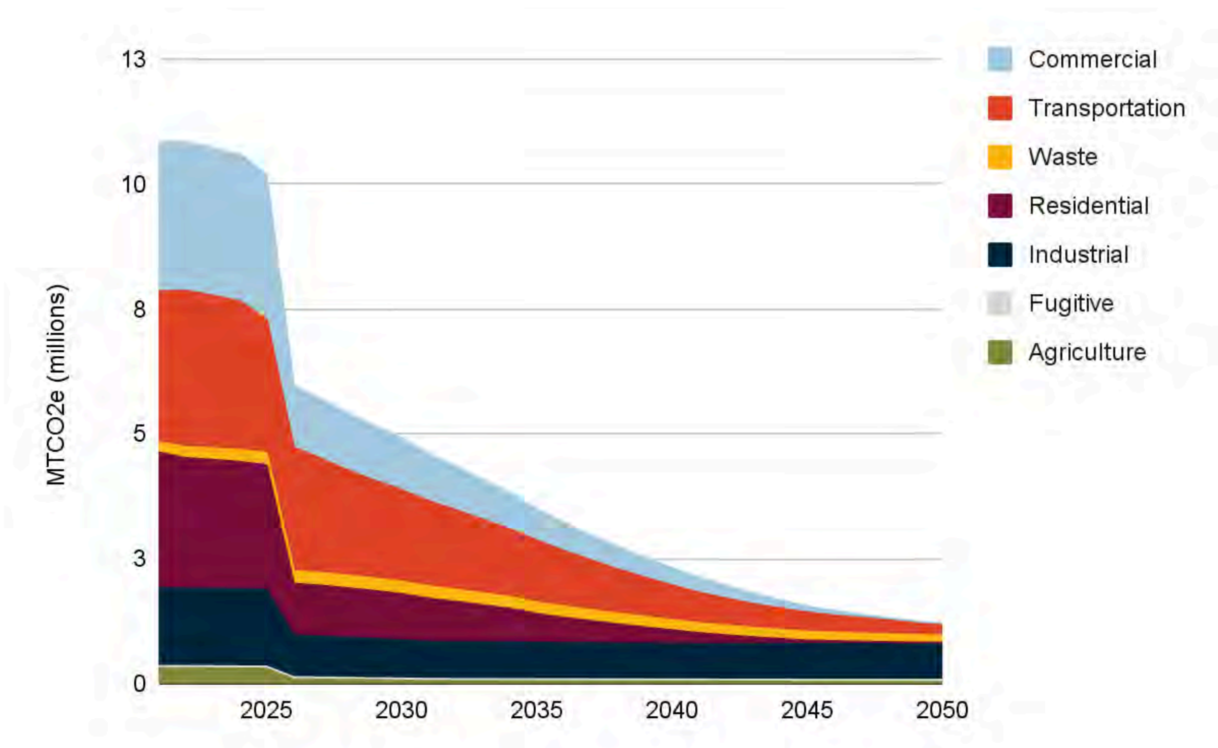


Figure 6.4. Projected total community GHG emissions by sector in the Community-First Scenario, 2021-2050. Source: SSG analysis.

Compared to the previous scenario, the Energy Transition Scenario projects a notably steeper decline in GHG emissions after 2025 (Figure 6.5), continuing steadily through to 2035. This is driven partly by a sharp rise in utility-scale solar starting in 2028, which contributes over 2.9 $MMTCO_2e$ in avoided emissions by 2050. Rooftop solar PV installations also grow steadily, though with a more modest, community-wide increase.

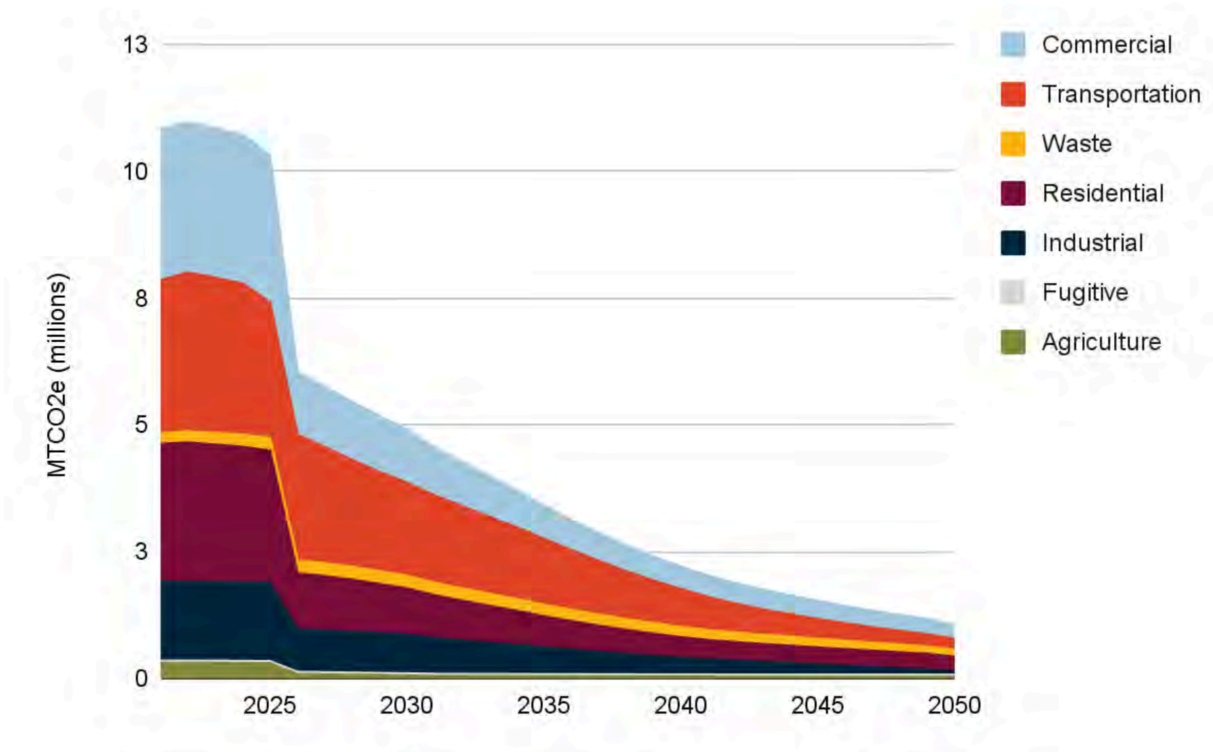


Figure 6.5. Projected total community GHG emissions by sector in the Energy Transition Scenario, 2021-2050. Source: SSG analysis.

The waste, transportation and building sectors follow similar trends as in the first scenario, with differences primarily in timing. In contrast, industrial emissions decline significantly in the Energy Transition Scenario, driven by enhanced energy efficiency and fuel switching. In particular, a major driver of GHG emissions reductions is the displacement of coal with cleaner fuels, along with the adoption of CCS technologies to capture CO_2 emissions from industrial processes.

The sectors with the largest emissions reductions compared to the BAU Scenario are residential and commercial buildings as well as transportation. Industrial emissions also decline significantly by 2050. The agriculture and waste sectors contribute relatively less to overall emissions reductions.

For the Miami Valley Region, key elements in both pathways include reducing the use of natural gas, electrifying vehicles to decrease emissions from gasoline combustion, and reducing the use of grid electricity from more efficient buildings (Figures 6.6 and 6.7). These are complemented with a cleaner grid.

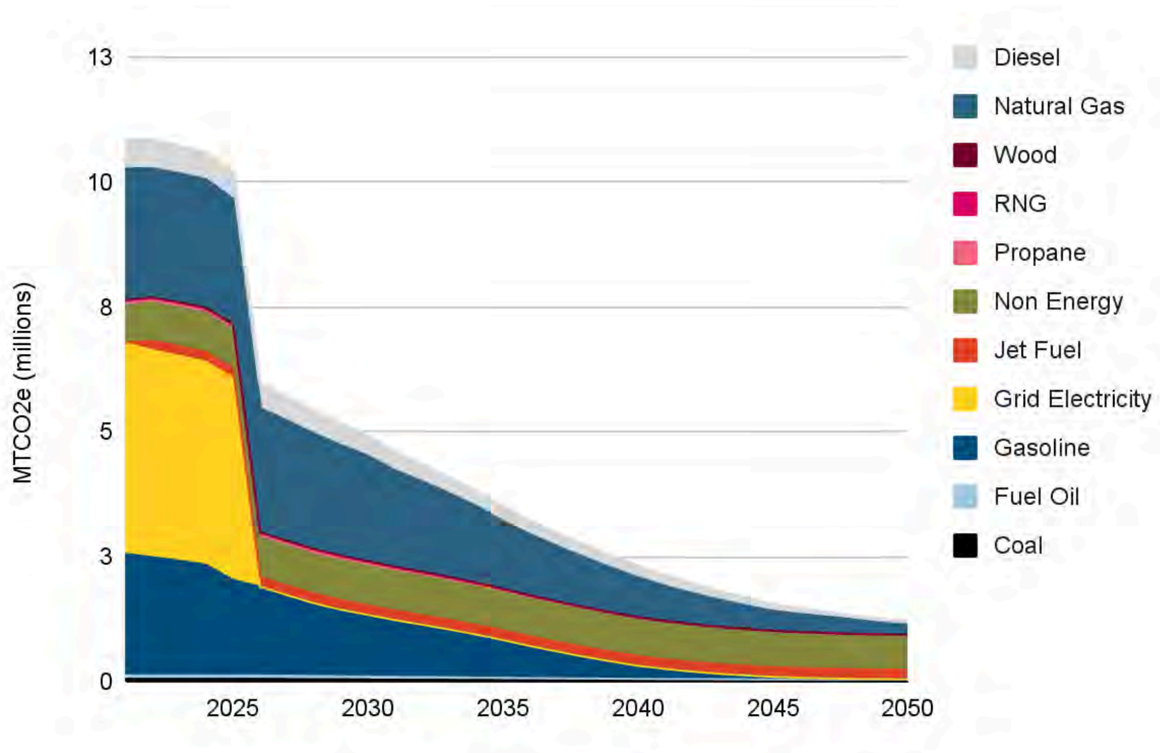


Figure 6.6. Projected total community GHG emissions by fuel source in the Community-First Scenario, 2021-2050. Source: SSG analysis.

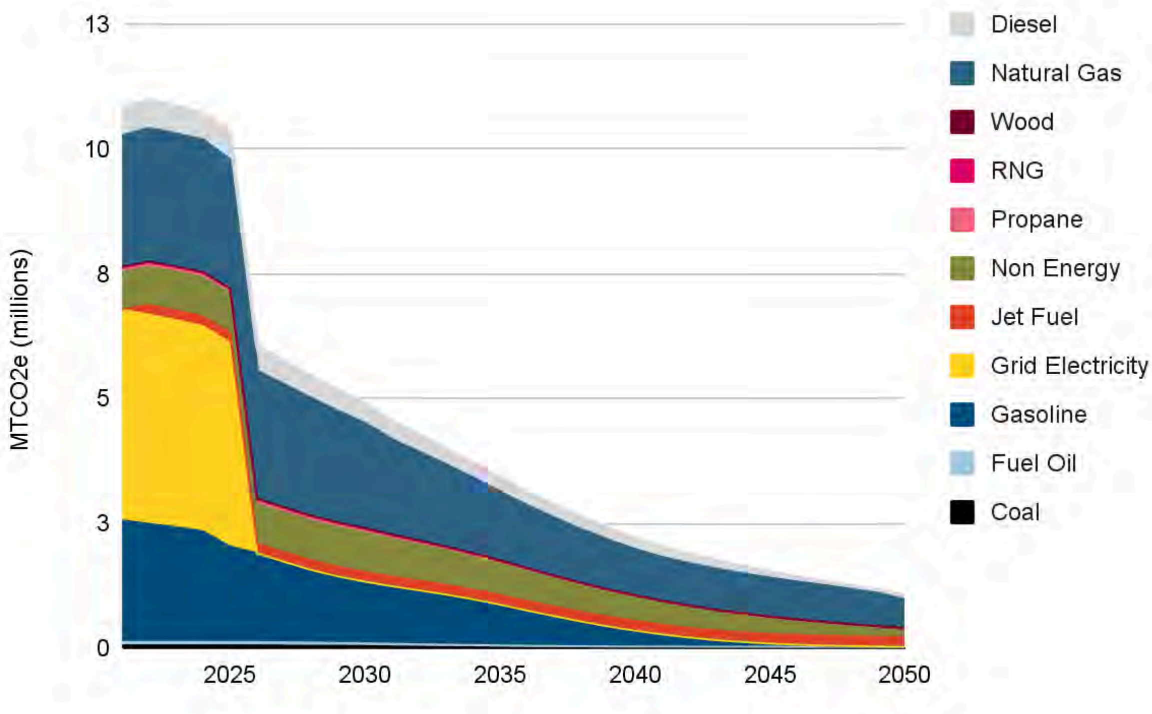


Figure 6.7. Projected total community GHG emissions by fuel source in the Energy Transition Scenario, 2021-2050. Source: SSG analysis.

Relative to 2021, by 2050, per capita emissions are anticipated to decline 89% in the Community-First Scenario (from 13.5 to 1.5 tonnes of CO_2e per person), and -90% by 2050 in the Energy Transition Scenario (Figure 6.8).

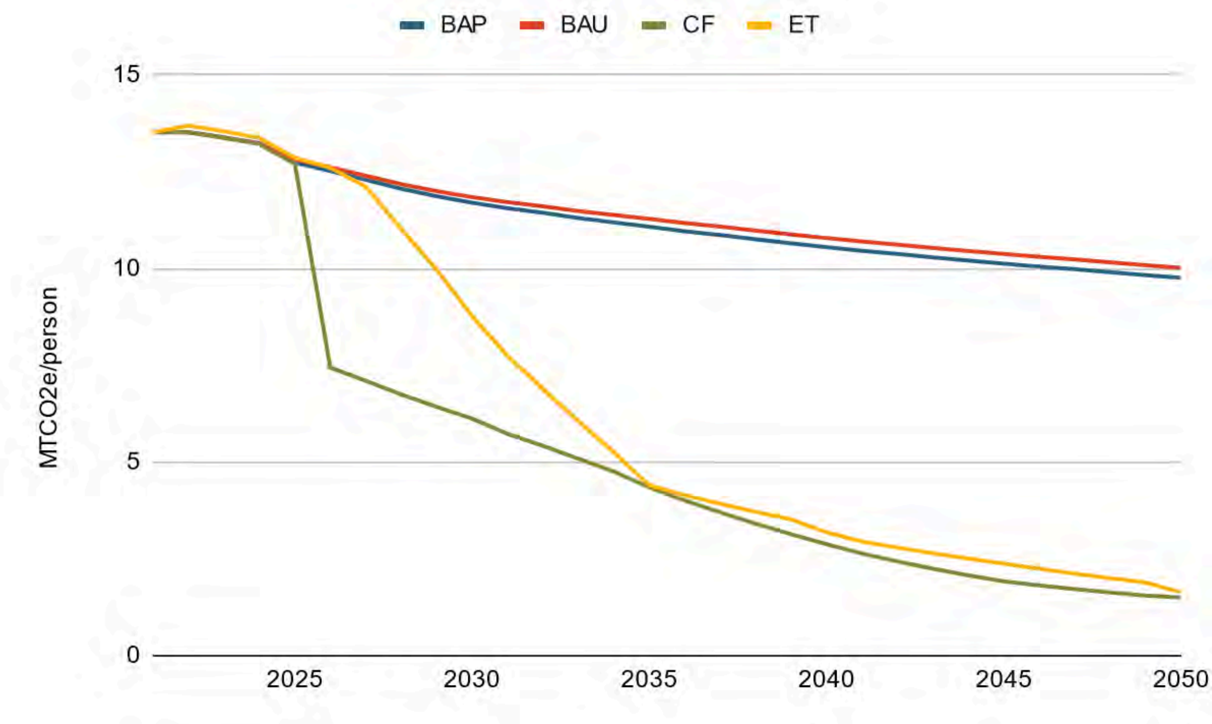


Figure 6.8. Projected total community GHG emissions per capita in the Community-First and Energy Transition Scenarios, 2021-2050. Source: SSG analysis.

6.3 CCAP Outlook by Sector

6.3.1 Building Sector

Emissions in the building sector in both scenarios decrease by about 68% by 2030 and 96% by 2050, relative to 2021 levels. Both the Community-First and Energy Transition Scenarios show substantial reductions in GHG emissions, though the Community-First Scenario achieves greater and faster reductions. In this scenario, emissions drop dramatically from approximately 7.07 $MMTCO_2e$ in 2021 to just 0.308 $MMTCO_2e$ by 2050. The most significant drop occurs in 2026, resulting from a major retrofit milestone that reaches about 20% of total buildings (Figures 6.9 and 6.10).

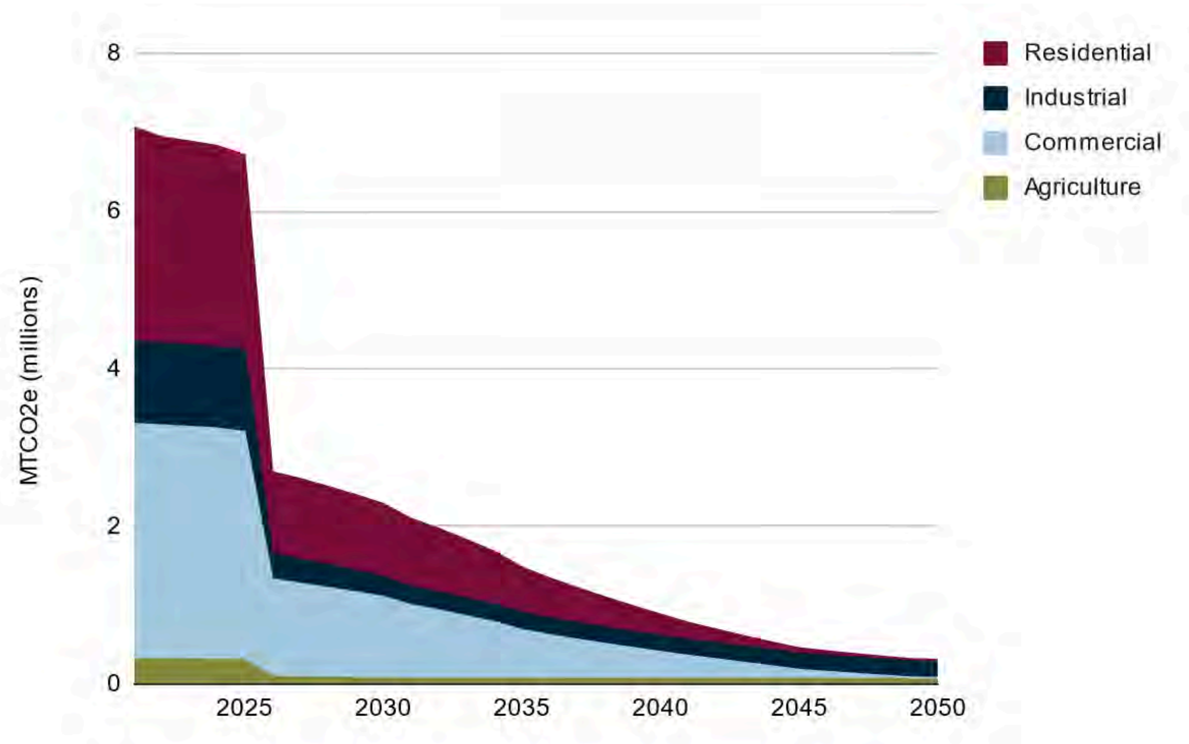


Figure 6.9. Projected building sector GHG emissions by sector in the Community-First Scenario, 2021-2050. Source: SSG analysis.

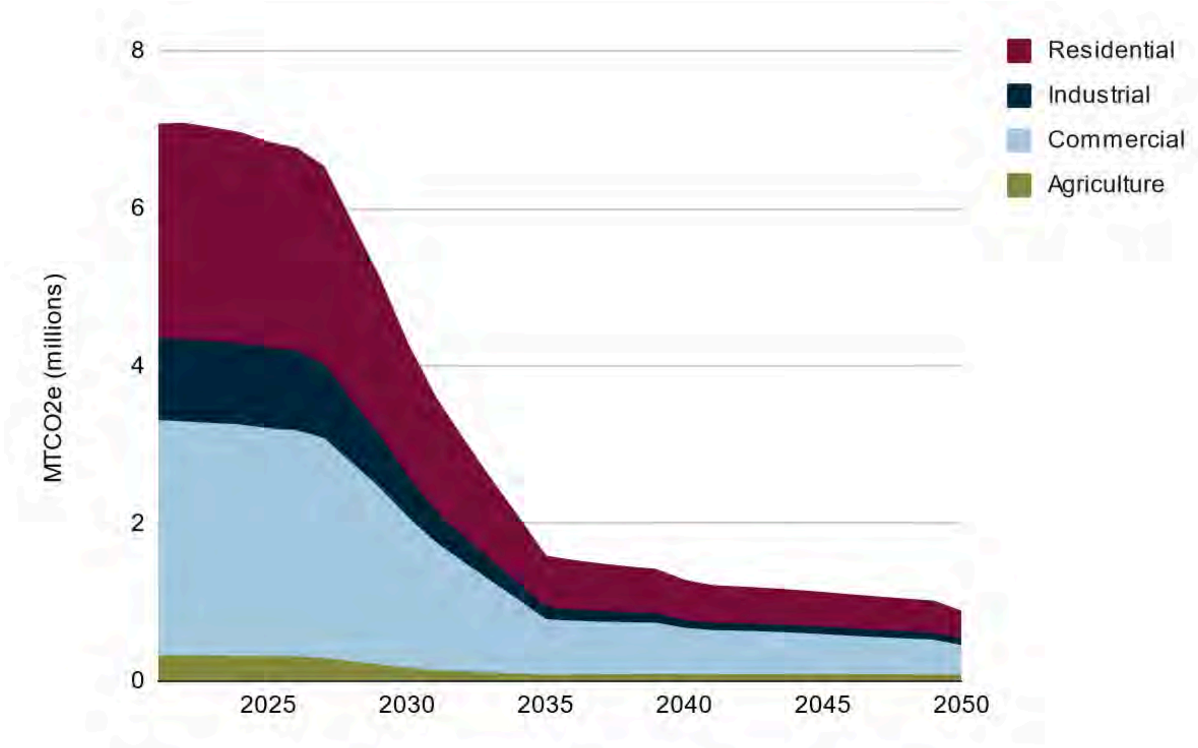


Figure 6.10. Projected building sector GHG emissions by sector in the Energy Transition Scenario, 2021-2050. Source: SSG analysis.

In comparison, the Energy Transition Scenario decreases emissions at a slower pace due to slower retrofit progress. These differences reflect the varying levels of ambition in retrofit strategies — an especially important factor in the Miami Valley Region, where much of the building stock predates the 1980s — and are related to moving away from natural gas (Figures 6.11 and 6.12) and decreasing energy use for space heating by 2050 (Figures 6.13 and 6.14).

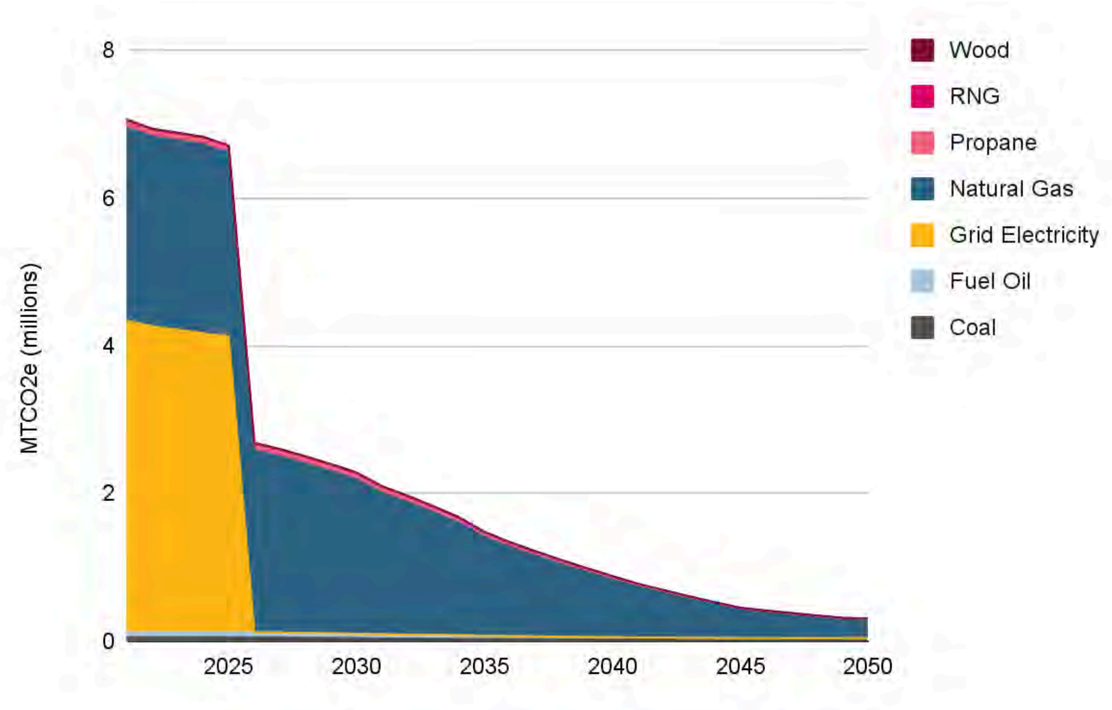


Figure 6.11. Projected building sector GHG emissions by fuel type in the Community-First Scenario, 2021-2050. Source: SSG analysis.

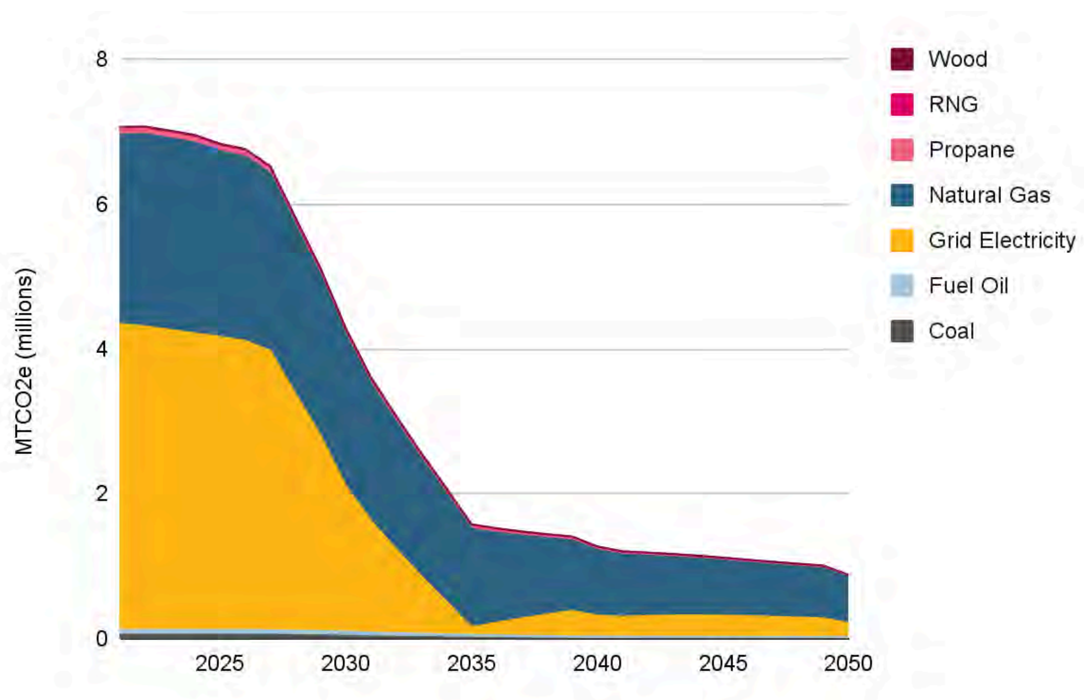


Figure 6.12. Projected building sector GHG emissions by fuel type in the Energy Transition Scenario, 2021-2050. Source: SSG analysis.

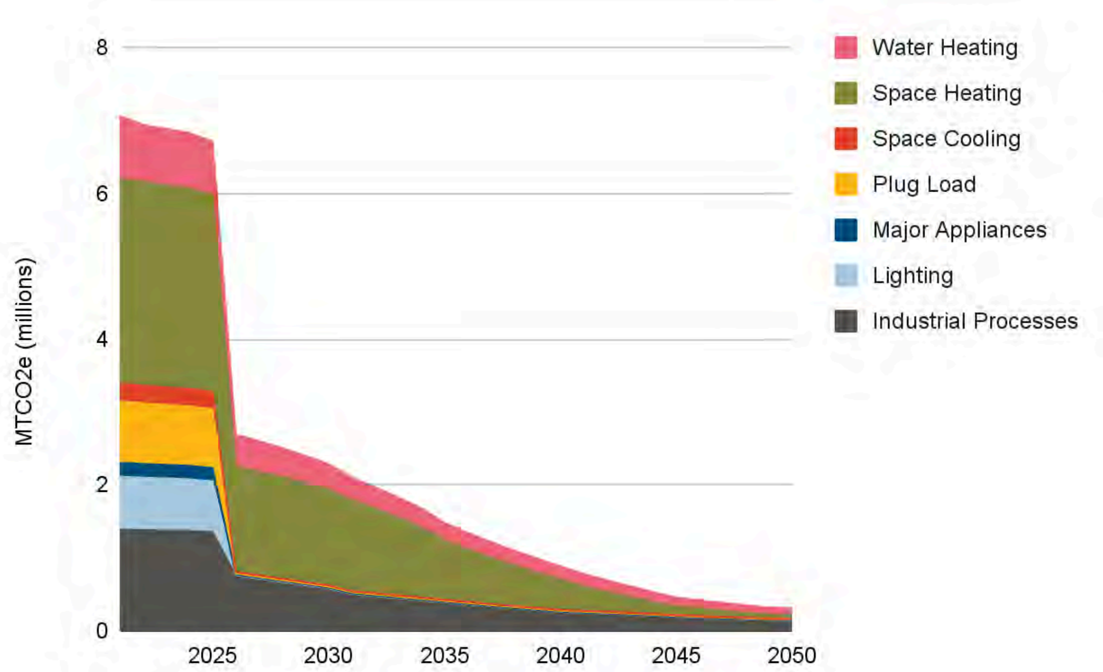


Figure 6.13. Projected building sector GHG emissions by end use in the Community-First Scenario, 2021-2050. Source: SSG analysis.

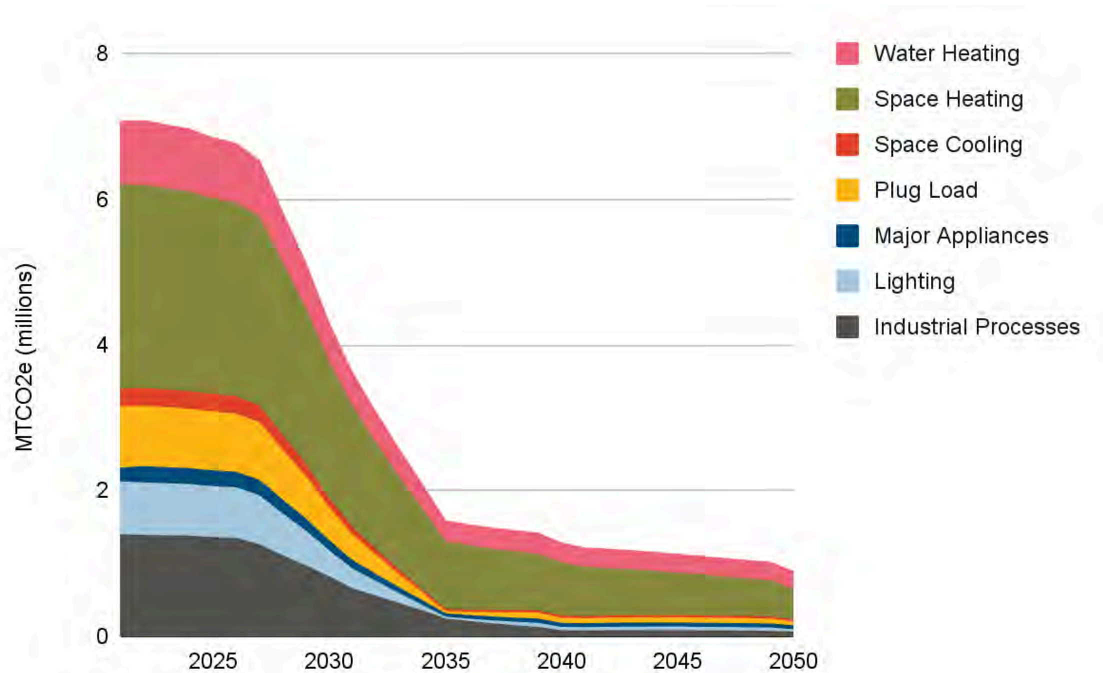


Figure 6.14. Projected building sector GHG emissions by end use in the Energy Transition Scenario, 2021-2050. Source: SSG analysis.

While both scenarios implement energy-efficient new construction and fuel switching through electrification and heat pumps, the Community-First Scenario assumes deeper retrofits and broader deployment of these technologies. Given these results, it is critical to implement policies that target energy efficiency and energy use in existing infrastructure. Various policies and programs can support this transition. For example, local governments can develop building performance standards (BPSs) to enhance home insulation and promote electrification of appliances and heating and cooling systems. Developing a neighborhood retrofit program for deep retrofits could support this effort and achieve 40%-60% energy reductions (both electrical and thermal).

In the CCAP engagement process, housing livability and energy efficiency also emerged as key priorities for communities across the region, as highlighted in the engagement summary.

6.3.2 Transportation Sector

The transportation sector experiences a significant reduction in emissions across all major vehicle types under both the Community-First and Energy Transition Scenarios compared to the BAU Scenario, with a particularly steeper decline in the Community-First Scenario (Figure 6.15). Light-duty cars show the most substantial decline, dropping from nearly 2 $MMTCO_2e$ in 2021 to just under 2,600 by 2050. This reduction is driven by rapid electrification and decreased VMT, supported by active transportation policies and strategies.

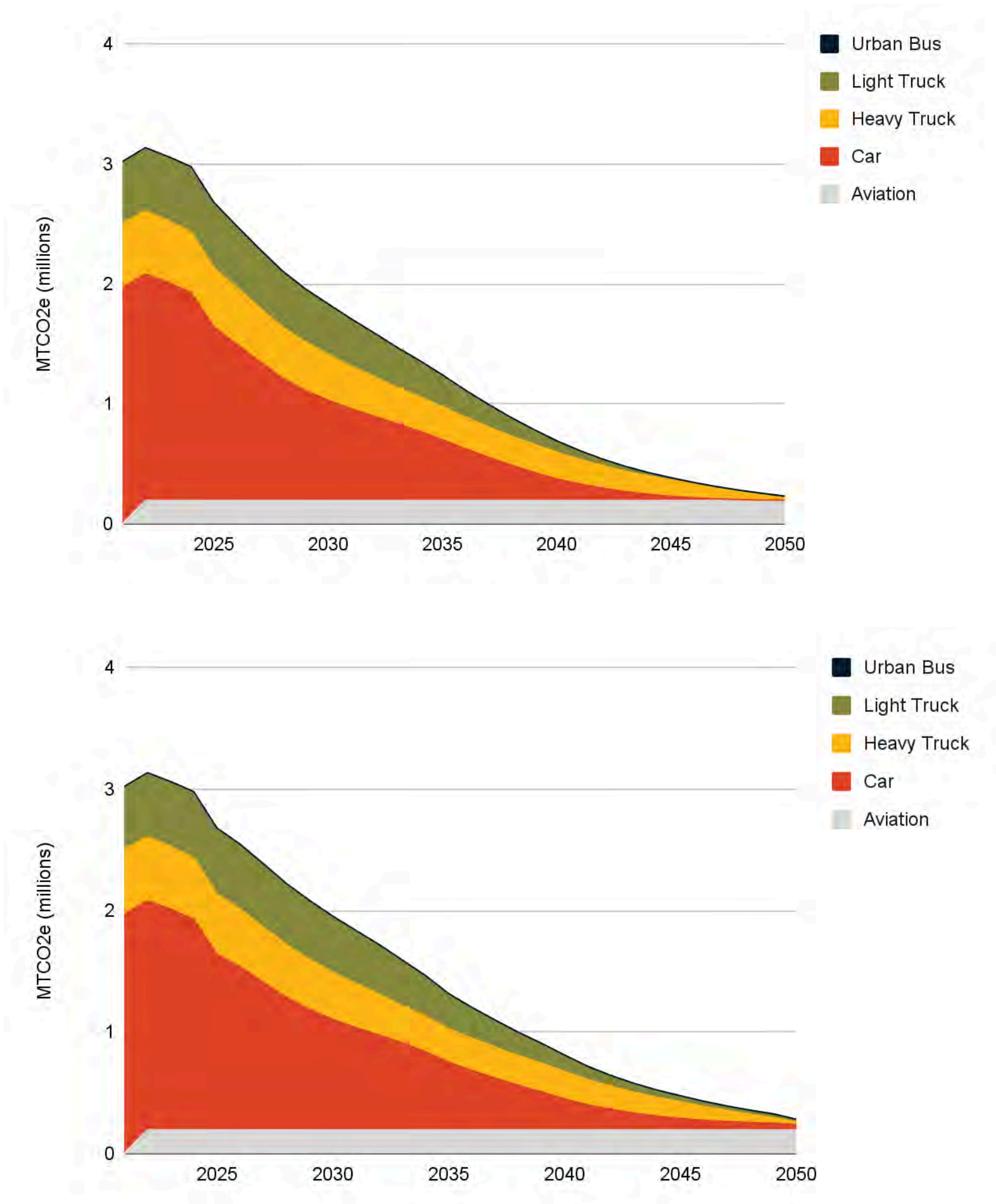


Figure 6.15. Projected transportation sector GHG emissions by vehicle type in the Community-First (top) and Energy Transition (bottom) Scenarios, 2021-2050. Source: SSG analysis.

Gasoline use drops by over 99% in both scenarios (Figure 6.16). At the same time, emissions from grid electricity increase modestly in the short term as more vehicles become electrified, though this growth rapidly switches to decline reflecting ongoing grid decarbonization. Aviation emissions from jet fuel remain constant throughout, although the region will work toward reducing emissions from this sector in the future.

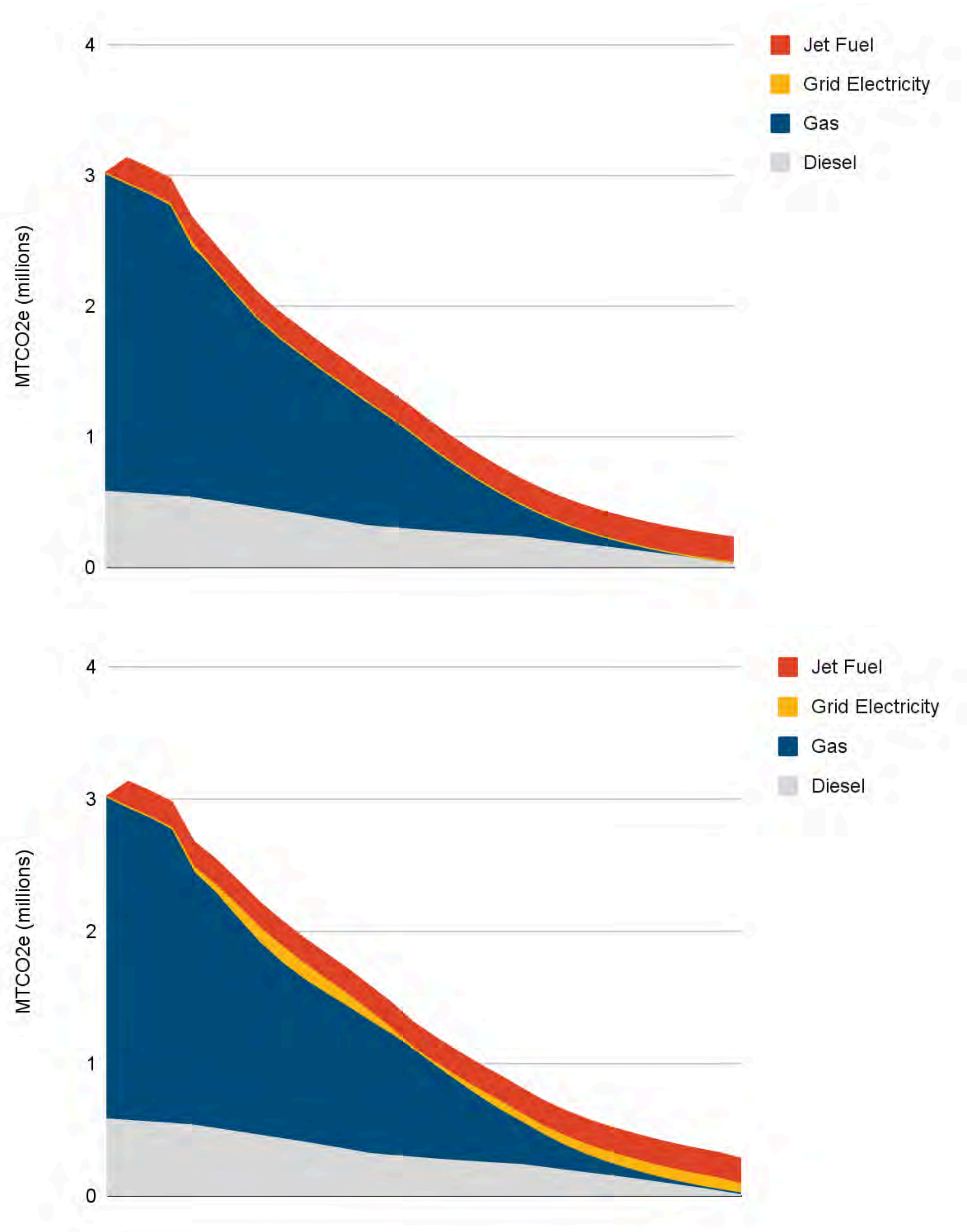


Figure 6.16. Projected transportation sector GHG emissions by fuel source in the Community-First (top) and Energy Transition (bottom) Scenarios, 2021-2050. Source: SSG analysis.

Overall, the CCAP Scenarios support transformative shifts in how people and goods move, which must be backed by strong regional and local coalitions, policies and leadership. The Miami Valley Region should accelerate efforts to expand EV infrastructure and ensure access across all neighborhoods, with financial support and incentives for all, including at-risk and low-income communities — specifically, through programs that help overcome capital barriers, which the community has identified as one of the most significant obstacles to electrification.

In addition to electrifying personal vehicles, the region can accelerate transportation decarbonization by targeting public and municipal fleet procurements. Transitioning transit fleets to electric can be supported by incorporating the social cost of carbon into procurement decisions. This approach allows agencies to evaluate low-carbon alternatives not just by up-front costs, but by their long-term social and economic benefits, ensuring public investments prioritize lower-emitting, socially beneficial options.

Regional authorities should also coordinate with local governments to better understand gaps in transit and active transportation infrastructure. Collaboration should include shared funding administration and joint applications for federal funding on behalf of multiple jurisdictions.

6.3.3 Waste Sector

Emissions in the waste sector increase in both the Community-First and Energy Transition Scenarios by 23% in the near term, by 2030, but decrease by 34% by 2050, relative to 2021 levels (Figure 6.17). The near-term increase is due to methane emissions that will unavoidably be released by 2030 from waste historically sent to landfills. However, long-term waste diversion will lead to emissions reductions, driven by increased composting and anaerobic digestion, as well as a short-term reduction in per capita waste generation to avoid further lock-in of emissions — from 1.8 to 1.5 tonnes of waste per person by 2030.

Despite this, since emissions are projected to rise in the near future, landfill sites must incorporate biogas capture systems. The captured biogas can then be used as a renewable energy source for on-site processes, either as RNG or for electricity generation. To reduce emissions more effectively, local governments in the Miami Valley Region should leverage Montgomery County's experience in waste management by expanding commercial composting collection and increasing residential coverage. Collaboration between counties can support implementation by providing business case examples and exploring disposal pricing mechanisms that can help fund the expansion of composting infrastructure.

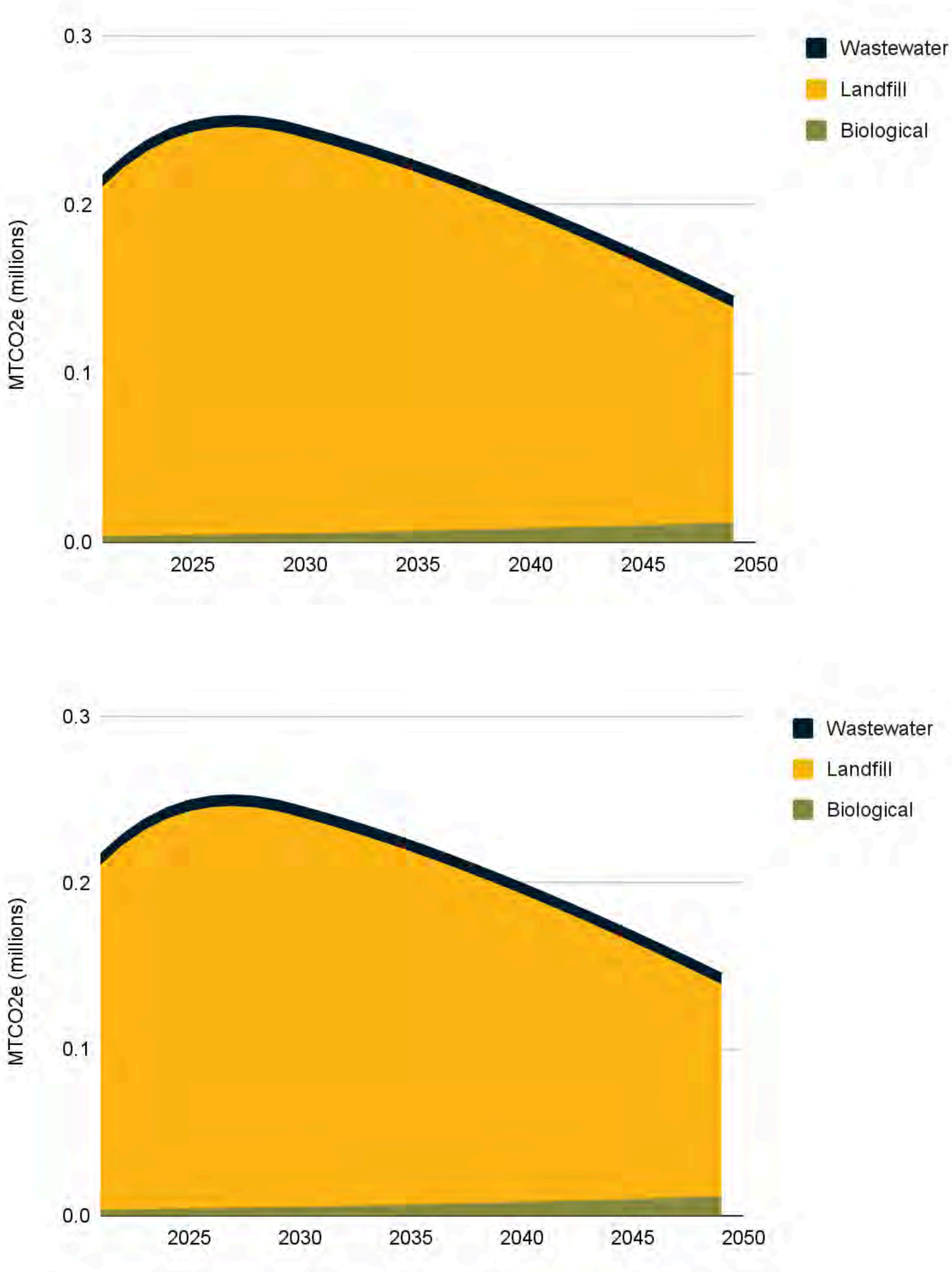


Figure 6.17. Projected waste sector GHG emissions by 2050 in the Community-First (top) and Energy Transition (bottom) Scenarios, 2021-2050. Source: SSG analysis.

6.3.4 Industrial Sector

Between 2021 and 2050, industrial emissions in the region show a declining trend in both scenarios — falling by 50% by 2030 and by 54% by 2050 in the Community-First Scenario, and by 94% by 2050 in the Energy Transition Scenario (Figure 6.18). These reductions are driven by decreased natural gas consumption and increased process efficiency. In the Energy Transition Scenario, emissions from coal fall sharply to zero by 2040 due to its replacement with hydrogen. Emissions from natural gas also drop by over 75% in this scenario, resulting from the electrification of industrial processes.

Historically, the primary fuel source for industrial emissions has been grid electricity, followed by natural gas. However, in the Energy Transition Scenario, electricity emissions drop to zero after 2025, achieved through renewable procurement for industrial processes and on-site generation. Fuel switching, combined with energy efficiency to reduce energy use, are key strategies for achieving a cleaner industrial sector. Also, major differences in non-energy emissions stem from the deployment of carbon capture and storage technologies, which help reduce emissions from hard-to-abate sectors.

Regional and local governments can play a key role in promoting a cleaner industrial sector, starting by supporting energy benchmarking initiatives aligned with federal programs such as the EPA's ENERGY STAR Challenge for Industry. This program is a global call-to-action for industrial sites to reduce their energy intensity by 10% within five years. Any industrial site can participate, and those that achieve this goal receive EPA recognition. Governments can also encourage industries to conduct energy audits — commonly known as "energy hunts" — to identify energy inefficiencies, fugitive emissions and outdated equipment. Leveraging regional networks and partnerships with other industrial hubs in the state, such as Cincinnati or Columbus, can further support the adoption and implementation of these strategies.

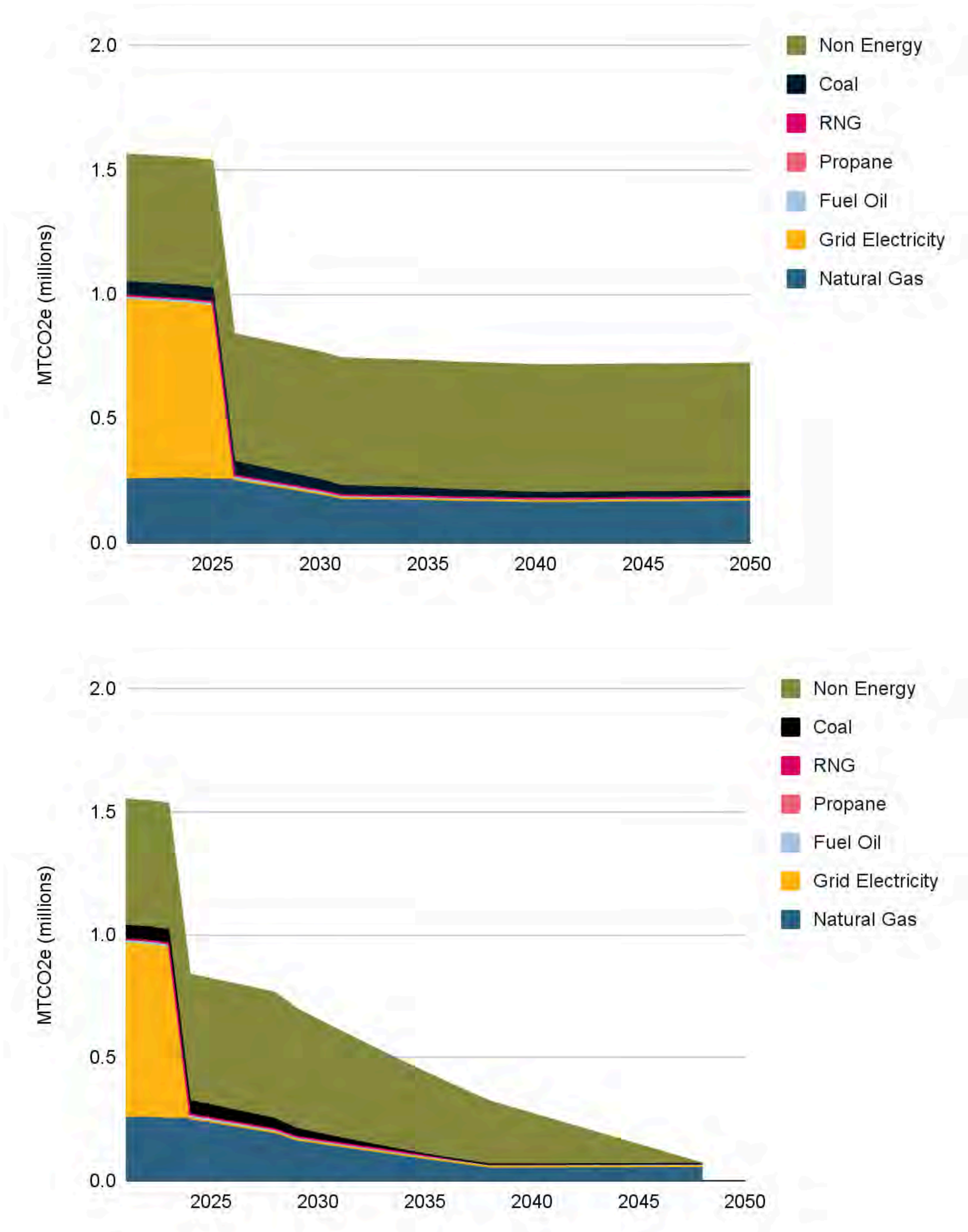


Figure 6.18. Projected industrial sector GHG emissions by fuel type in the Community-First (top) and Energy Transition (bottom) Scenarios, 2021-2050. Source: SSG analysis.

6.3.5 Local Electricity Generation

Under the Community-First Scenario, the energy mix of the Miami Valley Region will shift dramatically from a natural gas-dominated system to a significantly cleaner mix between 2021 and 2050 (Figure 6.19). Local solar generation — through rooftop systems and community solar projects — will drive this transition, providing more than 23% of the region's energy needs. Supported by widespread electrification of appliances, transportation and industry, both solar and grid electricity will play a fundamental role in this shift.

Complementing electrification with energy-efficient technologies for industrial processes and buildings will reduce energy losses by 78% from 2021 levels, with waste accounting for only 20% of total energy use by 2050, compared to 41% in 2021.

This future energy mix not only prioritizes renewable and cleaner sources but also lowers overall energy demand, making the Miami Valley Region more efficient, smarter and more resilient.

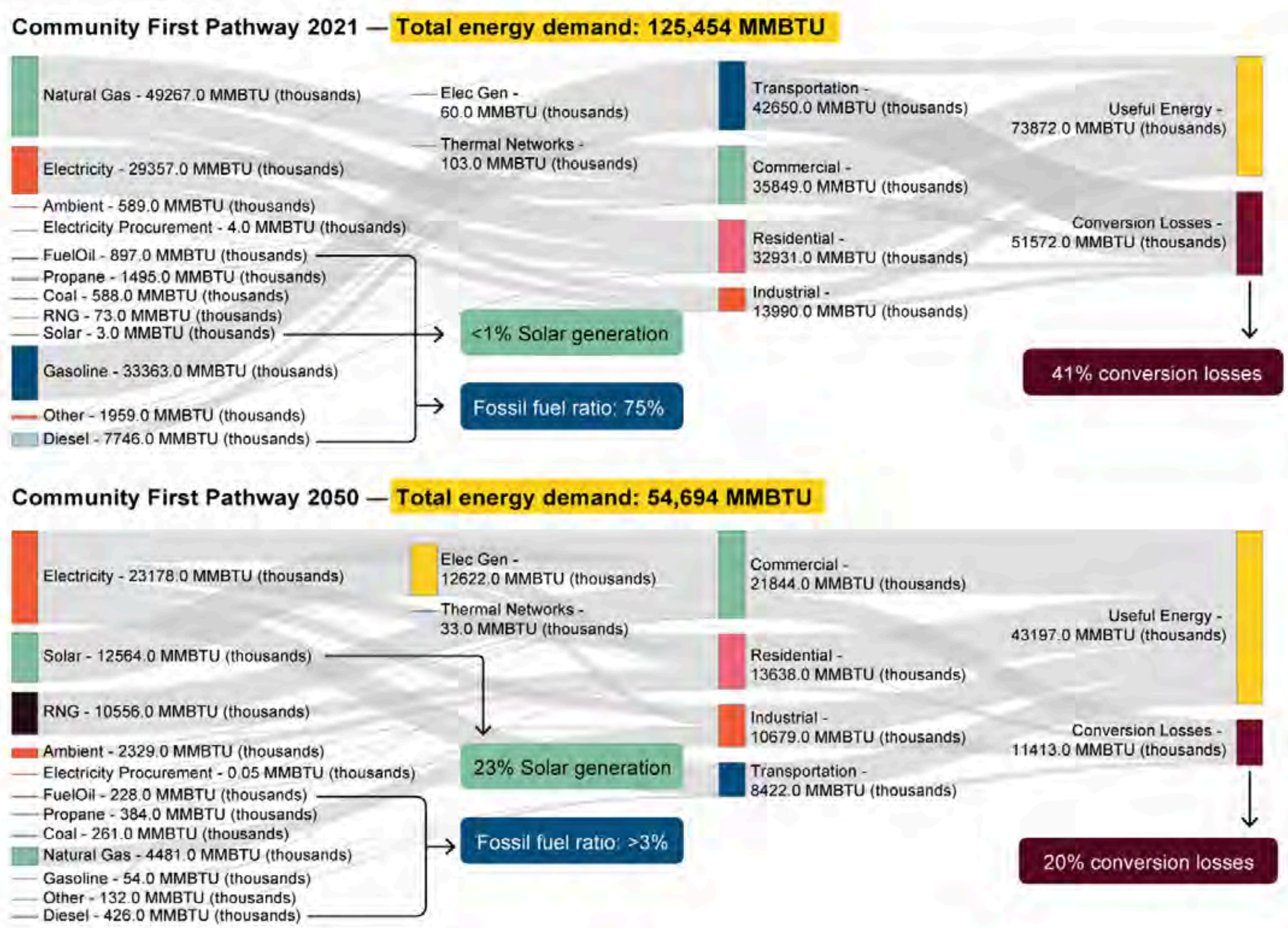


Figure 6.19. Sankey Diagram in the Community-First Scenario, 2021 and 2050. Source: SSG analysis.

6.4 GHG and Pollution Reduction Impacts

GHG emissions, including CO_2, CH_4, N_2O, perfluorocarbons (PFCs) and sulfur hexafluoride (SF_6), are converted into CO_2 equivalents based on their relative global warming potential. Table 6.2 shows the cumulative CO_2e reductions from each of the modeled actions.

Table 6.2. CCAP modeled actions and GHG pollution reduction impacts. Source: SSG analysis.

	GHG Emissions Reductions ($MTCO_2e$) in the Community-First Scenario			GHG Emissions Reductions ($MTCO_2e$) in the Energy Transition Scenario		
	Total		Cumulative	Total		Cumulative
Modeled Actions	**2021-2030**	**2030-2050**	**2021-2050**	**2021-2030**	**2030-2050**	**2021-2050**
Build more energy efficient new buildings	52	915	1,903	812	5,328	6,033
Retrofit existing buildings	133	12,877	25,938	-583	6,041	5,472
Switch new and existing buildings to heat pumps and RNG use for commercial and residential buildings	285	8,183	16,754	-65	-1,508	-1,541
Electrifying water heaters and stoves	89	3,693	7,481	218	5,158	5,277
Electrify transportation	81	11,110	22,333	351	6,984	7,239
Increase transit and active mode shares	0	2,211	4,422	-	-	-
Reach a zero-emissions grid	19,034	57,608	146,260	16,335	11,618	25,825
Expand solar generation	61	13,892	27,870	160	5,642	5,647
Renewable energy procurements for	167	4,486	8,973	253	6,304	6,371

	GHG Emissions Reductions ($MTCO_2e$) in the Community-First Scenario			GHG Emissions Reductions ($MTCO_2e$) in the Energy Transition Scenario		
	Total		Cumulative	Total		Cumulative
Modeled Actions	**2021-2030**	**2030-2050**	**2021-2050**	**2021-2030**	**2030-2050**	**2021-2050**
industrial processes						
Develop district energy systems	0	16	32	0	20	20
Improve industrial sector processes	1,318	10,884	23,358	1,317	18,313	19,107
Electrify industrial processes	0	-4,692	-9,383	0	-3,187	-3,187
Switch to RNG in WWTP	24	59	152	-	-	-
Industries deploy hydrogen for industrial processes	-	-	-	0	5,415	5,415
Industries deploy CCS technology to capture CO_2 emissions	-	-	-	1	5,379	5,379

6.5 Hazardous Air Pollutant and Criteria Air Pollutants

Hazardous air pollutants (HAPs) are toxic air pollutants that are known or suspected to cause serious health effects — including cancer, reproductive effects and birth defects — and adverse environmental impacts. Examples of HAPs are benzene, perchloroethylene and methylene chloride.

Criteria air pollutants (CAPs) are commonly found air pollutants regulated by the EPA and reported as part of air-quality standards. These pollutants are ozone, particulate matter, carbon monoxide (CO), lead, sulfur dioxide (SO_2) and nitrogen dioxide.

Reducing HAPs and CAPs is critical for improving air quality as well as protecting the health of people and the environment.

In this analysis, six specific CAPs were tracked over time: volatile organic compounds (VOCs), fine particulate matter smaller than 2.5 micrometers (PM2.5), particulate matter smaller than 10 micrometers (PM10), nitrogen oxides (NOx), SO_2 and CO. Table 6.3 shows the cumulative reduction of these pollutants.

Table 6.3. CCAP modeled actions and CAP reduction impacts (tonnes). Source: SSG analysis.

	Total Emissions Reductions (tonnes)											
	CO		**NOx**		**PM10**		**PM2.5**		**SO2**		**VOC**	
Action	**2021-2030**	**2031-2050**	**2021-2030**	**2031-2050**	**2021-2030**	**2031-2050**	**2021-2030**	**2031-2050**	**2021-2030**	**2031-2050**	**2021-2030**	**2031-2050**
Build more energy efficient new buildings	39	1,573	30	595	8	251	8	246	39	385	6	228
Retrofit existing buildings	77	9,722	64	6,670	14	1,645	13	1,580	65	5,830	10	1,346
Switch new and existing buildings to heat pumps and RNG use for commercial and residential buildings	7	2,734	18	4,561	2	108	1	93	22	1,189	1	234
Electrify water heaters and stoves	196	11,071	66	2,874	27	1,360	27	1,374	-6	-2,529	28	1,607
Electrify transportation	12,663	225,102	562	9,888	-43	-734	-14	-219	-577	-9,871	1,115	21,635
Increase transit and active mode shares	3	8,982	0	1,064	0	116	0	174	0	1,553	0	845
Achieve a zero-emissions grid	1,762	5,001	10,343	29,352	1,414	4,012	1,230	3,490	19,001	53,922	192	544
Increase solar generation	21	1,681	124	9,867	17	1,349	15	1,173	228	18,126	2	183

	Total Emissions Reductions (tonnes)											
	CO		**NOx**		**PM10**		**PM2.5**		**SO2**		**VOC**	
Action	**2021-2030**	**2031-2050**	**2021-2030**	**2031-2050**	**2021-2030**	**2031-2050**	**2021-2030**	**2031-2050**	**2021-2030**	**2031-2050**	**2021-2030**	**2031-2050**
Renewable energy procurements for industrial processes	146	591	443	224	47	-77	41	-67	621	-1,099	12	34
Divert and reduce landfill waste	0	0	0	0	0	0	0	0	0	0	0	0

6.6 Potential Financial Costs and Savings of Scenarios

This section outlines the financial implications of the preferred scenario: Community-First. While this scenario requires upfront investment (Figure 6.20), it ultimately results in long-term cost savings through reduced energy use, lower operation and maintenance expenses, and decreased fuel costs.

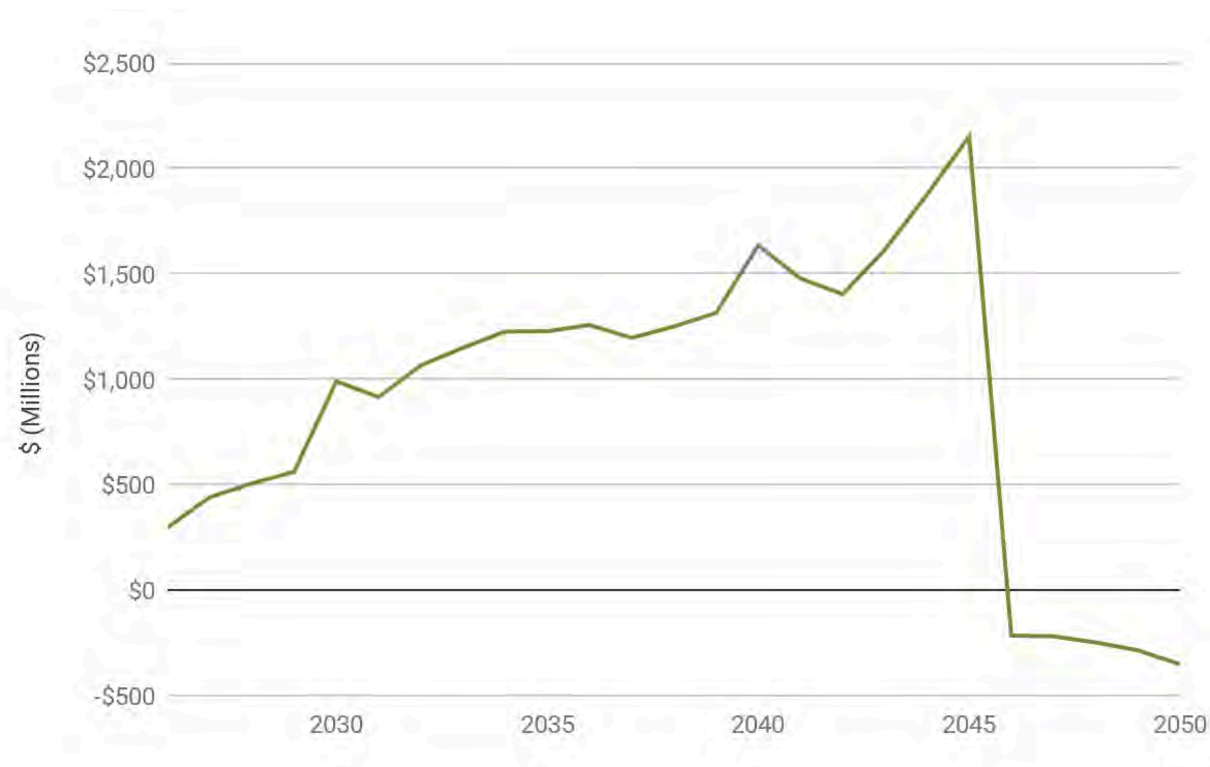


Figure 6.20. Net present value of the Community-First Scenario, 2026-2050. Source: SSG analysis.

Figure 6.21 illustrates the annual net financial performance of the Community-First Scenario from 2026 to 2050. Over time, energy and operations savings accumulate, gradually offsetting upfront costs. Net annual cash flow turns positive in 2046, marking the point when ongoing savings outweigh ongoing capital investments. After this break-even year, the Miami Valley Region starts realizing net positive annual returns.

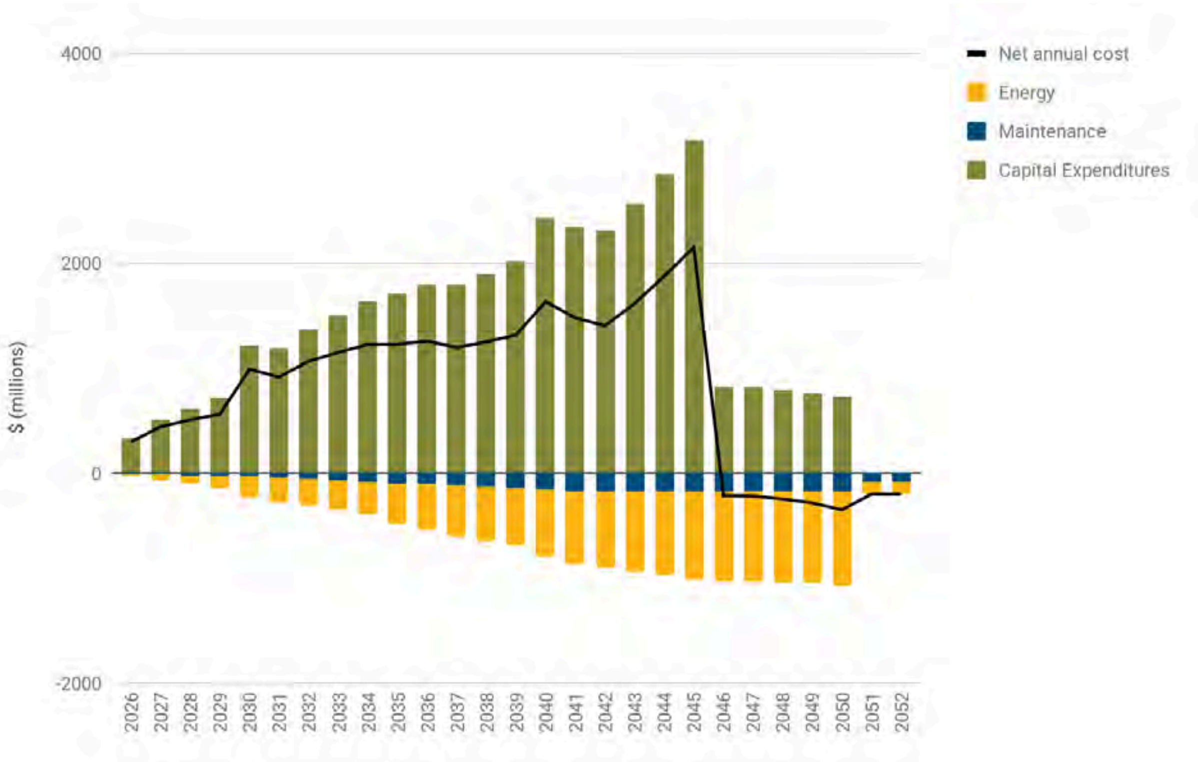


Figure 6.21. Year-over-year investment and returns in the Community-First Scenario. Source: SSG analysis.

In terms of overall costs, the Community-First Scenario needs $25 billion in upfront investment between 2026 and 2050. These investments cover the upfront costs of retrofitting buildings, building more efficient homes, adopting EVs community-wide, expanding transit, and building other infrastructure needed for decarbonization. Approximately, $2 billion could be saved in operations and maintenance costs (shown as a negative expenditure), primarily from reduced maintenance needs for EVs and renewable energy systems. Households, businesses and the public sector save approximately $8 billion on energy costs through reduced consumption from increased energy efficiency. After the 2046 break-even point, savings grow over time as fuel and energy expenditures continue to fall while infrastructure is already in place. Considering these returns, the net investment of the scenario is $16 billion (Figure 6.22).

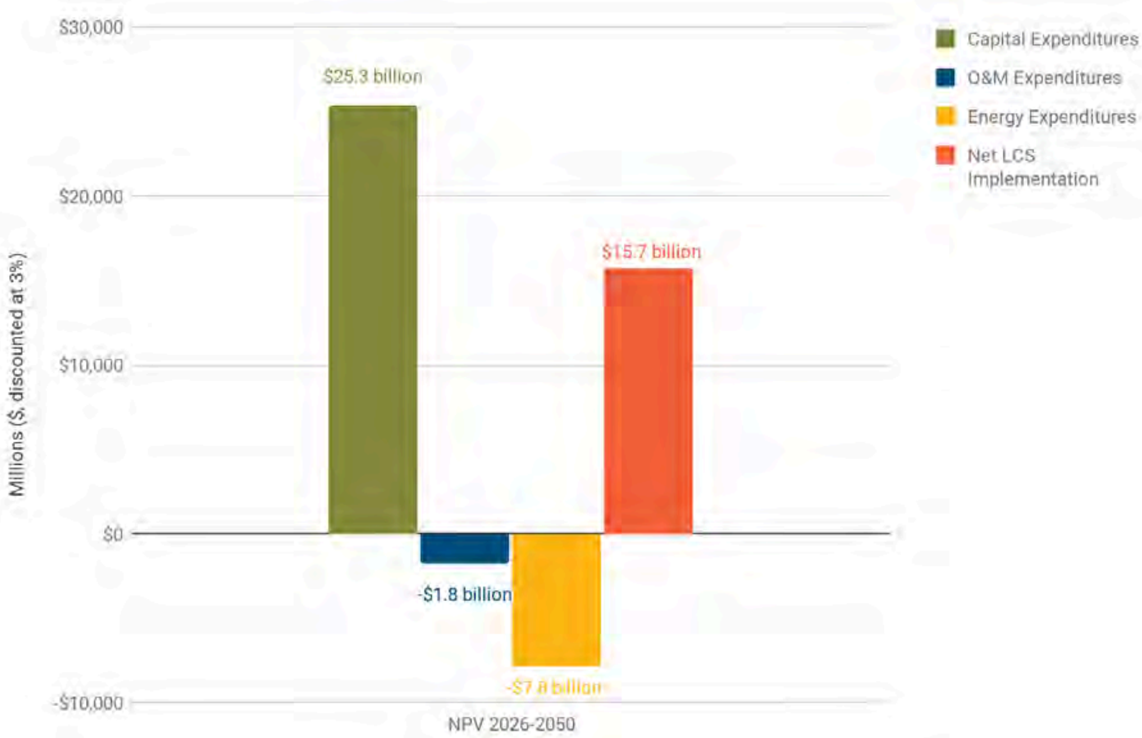


Figure 6.22. Cumulative investment and returns in the Community-First Scenario. Source: SSG analysis.

Regarding cost-effectiveness, the marginal abatement cost curve (MACC) provides a snapshot of the relative costs and potential emissions reductions of all mitigation measures considered in the scenario. Each measure is represented as a bar on the curve, with the width indicating the volume of emissions reduced (in $kTCO_2e$) and the height representing the marginal cost (in $\$/TCO_2e$). The MACC highlights a range of low-cost and cost-saving opportunities—such as active transportation, electrification of transit and personal vehicles, and solar generation—that deliver emissions reductions at negative or near-zero costs due to savings in energy or operating expenses. Higher-cost measures, such as building retrofits, energy efficiency improvements, and the electrification of industrial processes, appear on the right side of the curve and are necessary to achieve deeper decarbonization targets.

Overall, the MACC illustrates that approximately half of the total reductions in the Community-First Scenario can be achieved with net benefits, supporting a strategic, phased approach to investment prioritization (Figure 6.23). Additionally, measures covering 65% of the total reductions have marginal abatement costs lower than the social cost of carbon. This indicates that implementing these measures is less costly than bearing the damages associated with each metric ton of CO_2 emitted into the atmosphere.

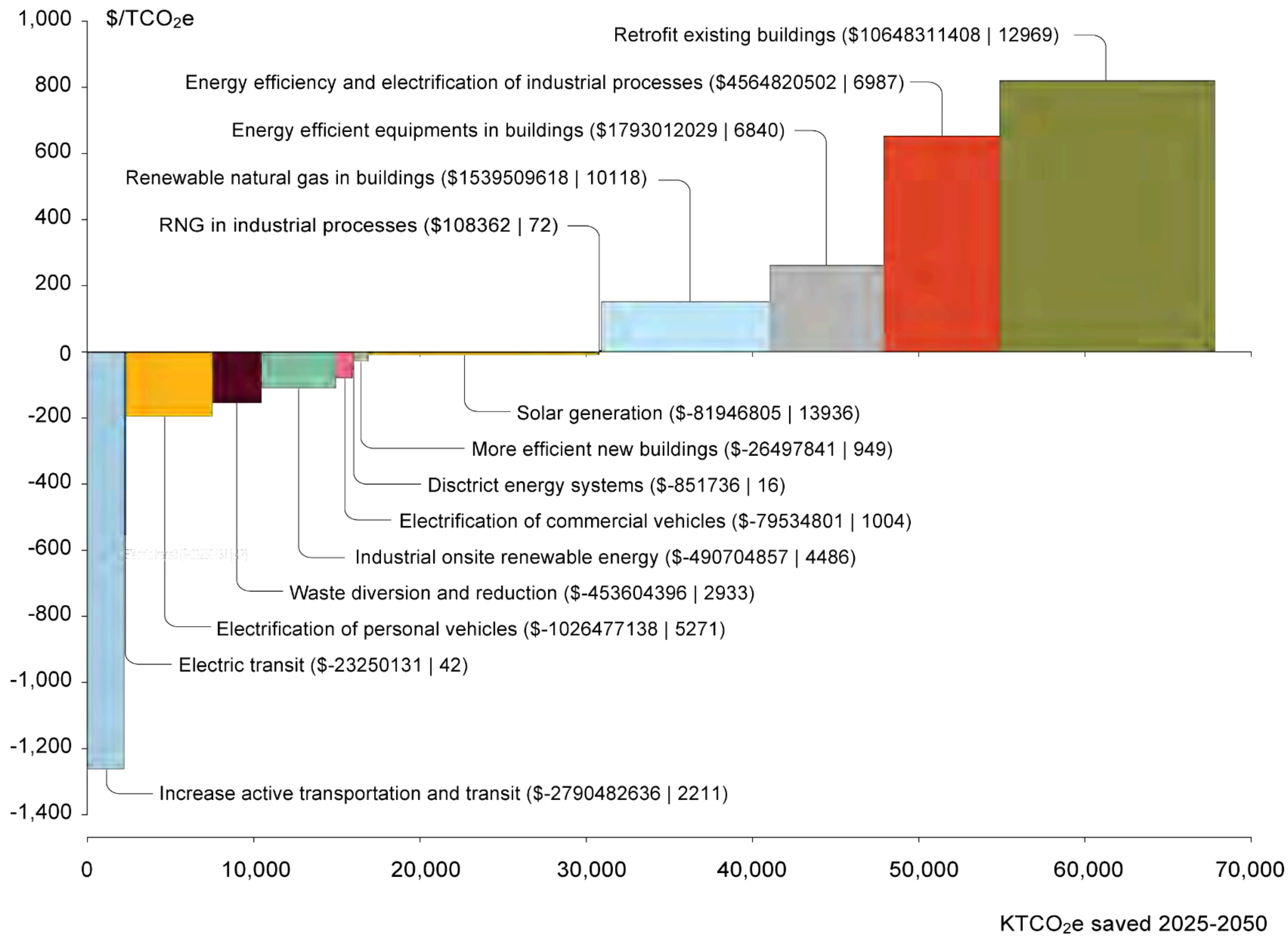


Figure 6.23. Marginal abatement cost curve of the Community-First Scenario, 2026-2050. Source: SSG analysis.

7 | Implementation

This section outlines how the Miami Valley Region will move from vision to action, with a focus on the Community-First Scenario as the preferred scenario and targets for the region. Each measure identified in this scenario requires clear authority, financial resources and practical steps to ensure progress toward implementation. This section also outlines who is responsible, what legal or policy authority they rely on, and how they can secure funding or develop funding mechanisms. Additionally, it describes how progress will be tracked through milestones and metrics. Together, this framework provides the foundation for coordinated, well-resourced and accountable action across the Miami Valley Region.

7.1 Relevant Regulations and Policies

This section details federal, state and local regulations, policies, plans and programs relevant to the implementation of the CCAP.

7.1.1 Federal Government Regulations, Policies and Programs

CPRG Program
Administered by the EPA, the CPRG program is a major federal funding source for planning and implementing GHG reduction strategies across sectors.

Inflation Reduction Act and Bipartisan Infrastructure Law
The IRA and Bipartisan Infrastructure Law are federal laws that offer significant funding to support states and local decarbonization and infrastructure efforts, complementing CPRG-funded initiatives.

7.1.2 State Regulations, Policies and Plans

DriveOhio
The Ohio Department of Transportation (ODOT) initiative "DriveOhio" is focused on advancing smart mobility and EV infrastructure across the state. DriveOhio projects support local implementation of EV charging infrastructure and fleet transition.

Ohio's Resilient and Efficient Codes Implementation Program
Funded by the U.S. Department of Energy, Ohio's Resilient and Efficient Codes Implementation (RECI) program helps local governments statewide to implement updated energy codes that improve building efficiency and climate resilience. The program provides technical assistance, training and resources to accelerate code adoption and enforcement, supporting GHG reductions in the building sector.

Sustainable Ohio Public Energy Council

The Sustainable Ohio Public Energy Council (SOPEC) implements an electric aggregation program allowing municipalities to opt for and purchase power from renewable generation suppliers, and secure electricity rates.

Ohio Energy Efficiency Technical Assistance Programs

Utilities and state agencies offer audits and incentives that industrial facilities can use to upgrade equipment or adopt energy management systems.

Alternative Fuel Corridor Designation

The state has designated corridors for alternative fuels to support the deployment of EV charging infrastructure. The designations preceded the current National Electric Vehicle Infrastructure (NEVI) Formula Program, and the state corridors guide infrastructure development across the state, including charging points along interstates I-75 and I-70crossing the Miami Valley Region.

House Bill 15, Ohio's "Energy Bill"

Ohio House Bill 15 is a comprehensive energy law that includes provisions related to electric generation, energy conservation and renewable energy development. It establishes a process for counties to designate Priority Investment Areas (PIAs) on brownfields and other underutilized lands, allowing energy projects — including renewables — to benefit from streamlined permitting. The bill also addresses consumer protections and regulatory processes to support a more competitive and reliable energy system.

Ohio's Energy Efficient Industries Initiative

The Ohio Department of Development's State Energy Program supports energy efficiency and renewable energy projects across the state. It helps businesses, manufacturers and non-manufacturers, nonprofits, colleges/universities, and local governments by offering funding and technical assistance for facility energy upgrades and renewable installations, support for energy management systems and retrofits, and streamlined processes to access state and federal energy incentives.

7.1.3 Regional Regulations, Plans and Initiatives

Priority Climate Action Plan

Developed by MVRPC under the EPA's CPRG program, the Priority Climate Action Plan (PCAP) outlines near-term priority measures for reducing GHG emissions across the region. It serves as a foundation for implementation funding and long-term planning.

Long-Range Transportation Plan

The Long-Range Transportation Plan integrates sustainability and climate resilience into regional transportation planning. It includes strategies for mode shift, vehicle electrification, infrastructure resilience and emissions reductions aligned with the CCAP.

Greater Region Mobility Initiative

Led by MVRPC, the Greater Region Mobility Initiative (GRMI) aims to improve mobility for all residents — especially underserved populations — through enhanced coordination of transit services, expanded access planning and infrastructure improvements. The initiative supports regional climate goals by promoting low-carbon transportation systems that serve a broad range of community needs.

MVRPC Sustainability Initiatives

MVRPC supports regional climate and sustainability planning through programs such as the Transportation Alternatives Program, which provides technical assistance and funding to local governments for implementing clean transportation, land use and energy strategies. MVRPC recently received SolSmart Bronze designation as a regional organization to expand community solar access and promote solar-ready development. Additional initiatives include efforts toward Charging Smart designation to support EV infrastructure deployment, public fleet electrification, and strategic charging station planning.

Miami Valley Regional Active Transportation Plan

The Miami Valley Regional Active Transportation Plan is a long-range (20-years) strategy and policy program developed to guide the effective investment of public funds in multi-modal transportation facilities. It places focus on expanding cycling and pedestrian infrastructure, as well as enhancing transit access and safety.

7.1.4 Local Regulations, Policies and Plans

Dayton Climate Action Goals

As part of its Climate Emergency declaration, the City of Dayton has set targets for 100% renewable electricity by 2050 and full electrification of the municipal fleet by 2035. These targets guide city-level investment and policy decisions related to emissions reductions.

Yellow Springs Climate Action Plan

The Village of Yellow Springs adopted a climate action plan with targets and actions across energy, waste, transportation and land use. The plan supports village-level decarbonization and resilience, contributing to regional GHG reduction goals.

Local Active Transportation Planning

The City of Dayton's Active Transportation Plan 2040 outlines major investments to expand and improve active transportation infrastructure (i.e., cycling network, shared paths and new sidewalks). The plan sets targets for all transportation modes, guided by "Complete Streets" principles, and includes projects to improve pedestrian and bike infrastructure, transit signage, codes and education.

In addition, the cities of Clayton, Fairborn and Miamisburg, as well as the Village of Yellow Springs, have developed local Active Transportation Plans.

Dayton Solar For All

Funded through the EPA's Greenhouse Gas Reduction Fund, the City of Dayton's Solar For All program expands solar access for low- and moderate-income households. It supports emissions reductions by increasing renewable energy adoption in communities historically and traditionally underserved.

Local Zoning Updates and Building Performance Standards

Municipalities in the region can incorporate sustainability provisions into zoning codes and building standards, such as solar-ready construction and green infrastructure requirements. For example, the City of Dayton is currently developing the Building Performance Standard with support of Ohio's RECI program.

Miami Valley Communications Council's Electric Aggregation Program

Miami Valley Communications Council's (MVCC) Electric Aggregation Program allows participating municipalities in Montgomery County to jointly purchase electricity on behalf of their residents and small businesses. This collective purchasing arrangement can help secure competitive electricity rates and provides a mechanism for communities to pursue cleaner energy options in the future. The program supports CCAP implementation by enabling increased access to affordable electricity and creating a foundation for integrating renewable energy procurement and energy resilience measures at the local level.

County-Level Solid Waste Management District Plans

Solid Waste Management District Plans are developed by counties to assess their current status of solid waste management. These plans outline existing programs, regulatory requirements and projections for waste generation, recycling and disposal. They also provide a framework to guide waste reduction, recycling initiatives and sustainable materials management consistent with regional environmental and climate goals.

7.2 Implementing Entities

This section details federal, state and local implementing entities relevant to the implementation of the CCAP.

7.2.1 Federal Government

Federal agencies derive their authority from Congress, which delegates specific powers to these agencies through legislation. Federal agencies identified as relevant for implementation as part of this CCAP include (but are not limited to) (Table 7.1):

- **U.S. EPA:** The EPA was established by Congress in 1970 through executive reorganization. It operates under the authority granted by numerous environmental statutes, including the Clean Air Act, the Clean Water Act, and the Resource Conservation and Recovery Act. The agency develops and enforces national environmental regulations, issues permits, conducts inspections and provides technical and financial assistance to states, Tribes and local governments. It also manages national programs for pollution control, climate mitigation, environmental justice and research. The EPA's authority comes directly from federal law, with oversight by Congress and the Executive Branch.

- **U.S. Department of Energy (DOE):** The DOE was established by Congress in 1977 through the Department of Energy Organization Act. It operates under the authority granted by a range of federal statutes, including the Energy Policy Act (2005) and the Energy Independence and Security Act (2009). The DOE's responsibilities include setting national energy policies, advancing energy technology research and development, and promoting energy efficiency and renewable energy adoption nation-wide. The agency administers funding programs, technical assistance and regulatory frameworks to support clean energy deployment, grid modernization and climate change mitigation. The DOE's authority derives directly from federal law, with oversight by Congress and the Executive Branch.

- **U.S. Department of Housing and Urban Development (HUD):** HUD was established by Congress in 1965 under the Department of Housing and Urban Development Act. Its authority stems from various federal statutes aimed at improving housing, community development and urban planning, such as the Housing Act and the Fair Housing Act. The agency oversees federal housing assistance programs, enforces fair housing laws, provides funding for community development and affordable housing initiatives, and supports planning efforts to promote sustainable communities. While HUD influences local planning and development through grants and program guidelines, its regulatory powers are generally limited to the housing and community development sectors.

- **U.S. Department of Agriculture (USDA):** USDA was created in 1862 by President Lincoln. It supports agricultural and rural development, environmental and natural resource conservation, renewable energy, and food systems through financial assistance, technical support and research. USDA programs promote sustainable land use, composting, anaerobic digestion and rural infrastructure by funding projects through grants and loans.

- **U.S. Department of Commerce:** The Department of Commerce was established in 1903, by President Roosevelt, to promote economic growth, job creation, and development. It supports U.S. businesses, trade, innovation, and economic data collection through agencies such as the Census Bureau, National Oceanic and Atmospheric Administration (NOAA), and National Institute of Standards and Technology (NIST). DOC programs advance climate resilience, ocean and atmospheric research, coastal management, and support for clean technology and economic development in communities across the country.

Table 7.1. List of federal agencies relevant to implementation of the CCAP. Source: SSG analysis.

Agency	Relevant Sectors	Legal Powers	Enabling Authority	Key Planning and Policy Tools
Environmental Protection Agency (EPA)	Energy, Waste Industry	Promulgation of national regulations Enforcement through inspections, fines and compliance orders Permitting in certain programs Funding power	Authority granted by Congress through major statutes like the Clean Air Act, Clean Water Act, etc.	CPRG grants and Clean Air Act regulations
Department of Energy (DOE)	Energy, Industry, Buildings, Transportation	Provide technical assistance Develop efficiency standards Funding power	Authority granted by Congress through statues such as the Energy Policy Act, Energy Independence and Security Act, etc.	CPRG grants - Section 48C, Better Buildings Program, RECI program

Agency	Relevant Sectors	Legal Powers	Enabling Authority	Key Planning and Policy Tools
Department of Housing and Urban Development (HUD)	Buildings, Energy	Authority to provide grants and funding Develop housing policy standards (not mandatory)	Authority provided by the Housing Act of 1937, National Affordable Housing Act, etc.	CPRG grants, Community Development Block Grants (CDBGs)
Department of Agriculture (USDA)	Waste, Agriculture, Industry	Provide grants, loans and technical assistance Do not regulate directly but incentivize project implementation	Authorized through various statutes including the Farm Bill, Rural Development Act and Food, Conservation and Energy Act	Rural Energy for America Program (REAP), Composting and Food Waste Reduction Cooperative agreements, and Solid Waste Management Grants in rural areas
Department of Commerce	Business and industry, Workforce development	Provides grants, technical assistance, and economic data Does not directly regulate but supports planning, innovation and infrastructure investment	Authorized through statutes including the Department of Commerce Organic Act, Coastal Zone Management Act and National Climate Program Act	Economic Development Administration (EDA) Grants, NOAA Climate and Coastal Resilience Programs, National Climate Assessment, and Census data tools for regional planning

7.2.2 State Government

In Ohio, authority for state agencies is granted by the Ohio General Assembly through enabling statutes codified in the Ohio Revised Code (ORC), and further detailed through administrative rules developed by the agencies. These agencies implement state laws and delegate federal regulations relevant to environmental protection, transportation, economic development and energy. State agencies identified as relevant for CCAP measure implementation include (but are not limited to) (Table 7.2):

- **Ohio Department of Transportation (ODOT):** ODOT is responsible for planning, developing and maintaining the state transportation system, including highways, public transit and active transportation infrastructure. Its authority comes from statutes within the ORC (Chapter 5501) that define transportation planning and funding responsibilities. The agency develops long-range transportation plans, manages federal and state transportation funds, and supports projects that can reduce transportation emissions, increase transit and active modes, and encourage electrification of vehicles.

- **Ohio Environmental Protection Agency (Ohio EPA):** Ohio EPA is the state's primary environmental regulatory agency responsible for air and water quality, waste management, hazardous waste and climate-related initiatives. Its authority is granted by state statutes, including the Ohio Environmental Protection Act, and through delegation agreements with the U.S. EPA to implement federal environmental laws such as the Clean Air Act and Clean Water Act. The agency's powers are also defined in the ORC, primarily in Chapters 3704, 3734 and 3745. Ohio EPA issues permits, enforces compliance through inspections and penalties, and manages statewide environmental monitoring and planning activities.

- **Ohio Department of Development (ODD):** This agency leads statewide economic and community development efforts, including programs supporting energy efficiency, renewable energy and sustainable building practices. Its authority is derived from state laws codified in the ORC (Chapter 122), with additional federal program responsibilities. It administers energy efficiency technical assistance programs, grant funding and economic incentives that help implement energy-related measures, such as building retrofits and clean energy project development.

- **Public Utilities Commission of Ohio (PUCO):** PUCO regulates investor-owned utilities and ensures the provision of safe, reliable and reasonably priced electric, natural gas, water, telecommunications and transportation services across the state. Established in 1911, its authority is codified in the ORC. PUCO plays a central role in utility planning and oversight, including grid reliability, rate design, energy efficiency standards and competitive energy markets. It supports clean energy implementation through integrated resource planning, utility filings, grid modernization efforts and energy efficiency programs approved through rate cases.

Table 7.2. List of state agencies and entities relevant to implementation of the CCAP. Source: SSG analysis.

Agency	Relevant Sectors	Legal Powers	Enabling Authority	Key Planning and Policy Tools
Ohio Department of Transportation (ODOT)	Transportation	Plan, build and maintain the state highways Rulemaking within delegated areas Permit issuance Eminent domain Oversight and enforcement Administer federal transportation funding	Authorized through state transportation laws, the IRA, Bipartisan Infrastructure Law, etc.	DriveOhio, Alternative Fuel Corridor designation
Ohio Environmental Protection Agency (Ohio EPA)	Industry, Waste	Permit issuance Enforcement and fines Rulemaking within delegated areas Oversight and inspections	State law, federal delegation through the Clean Air Act, and others	CPRG grants
Ohio Department of Development (ODD)	Energy, Buildings	Administration of state and federal grants and loans Technical assistance Guidelines for funding allocations	ORC, state statutes on economic development, energy policy and others	Ohio Energy Efficiency Technical Assistance Program
Public Utilities Commision of Ohio (PUCO)	Energy, Transportation	Regulate and oversee state public utilities Provide service standards and enforcement Approve infrastructure investments and programs	ORC, granted by the Ohio Legislature	Approval of Integrated Resource Plans (IRPs)

7.2.3 Local Government and Regional Entities

Local governments adopt charters, ordinances and codes based on state-enabling legislation. Authority is further defined and expanded through county and municipal regulations and administrative rules. In Ohio, local governments act under Ohio home rules granted by the Ohio Constitution, which means that Ohio municipalities — cities and villages, but not always townships — can adopt local ordinances, such as BPSs, zoning for EV infrastructure or waste reduction policies, as long as they do not conflict with state laws.

Other agencies or entities at the regional level have different roles in the implementation of CCAP actions due to different regulatory frameworks that apply to them. Regional entities like MVRPC and others, like MVCC and Solid Waste Management Districts (SWMDs) (i.e., counties), operate under Ohio law to support local governments through planning, coordination and shared service delivery. Although these entities lack **direct** regulatory authority, they enable implementation of initiatives (e.g., transportation and waste initiatives) through intergovernmental collaboration and technical assistance (e.g., SolSmart). Entities identified as relevant for CCAP measure implementation include (but are not limited to) (Table 7.3):

- **MVRPC:** This agency was formed in 1964, under Section 713.21 of the ORC, and has multiple roles serving as a Regional Planning Commission for the Miami Valley Region. It primarily leads transportation planning and funding allocation and other initiatives across Greene, Miami and Montgomery counties. It supports implementation of regional priorities such as EV infrastructure, solar development and active transportation through technical assistance, grant programs and coordination among local governments in six counties. MVRPC does not hold regulatory enforcement powers.

- **MVCC:** The MVCC is a council of governments formed in 1975 according to Chapter 167 of the ORC.[25] It serves its member municipalities in Montgomery county by developing and implementing intergovernmental projects. Its services range from communications infrastructure and public access programming to electric power aggregation.[26] It functions as a policy and administrative body rather than a regulator.

- **SWMDs (Greene, Miami and Montgomery):** These entities are formed under Chapter 3734 of the ORC to develop and implement solid waste management plans at the county or multi-county level. They assess regional solid waste generation, set recycling and landfill diversion targets, and administer public education and grant programs. They play a role in guiding local compliance with waste standards set by the Ohio EPA, by supporting municipal efforts and coordinating regional infrastructure for waste management.

[25] Miami Valley Communications Council. Electric Power Aggregation Operation and Governance Plan. https://vandaliaohio.org/DocumentCenter/View/8959/2-MVCC---Operation-and-Governance-Plan-Electric?bidId=

[26] Serving municipalities: Centerville, Germantown, Kettering, West Carrollton, Trotwood, Brookville, Englewood, Xenia, Miamisburg, Moraine, Huber Heights, Union, Clayton, Riverside, Troy, Eaton Fairborn and Monro.

- **Public housing authorities:** Public housing authorities in Ohio provide affordable housing and related services to low-income individuals and families. They operate under federal authority from HUD and state-enabling statutes found in the ORC (Chapter 3735). These agencies manage public housing developments and programs, and often support energy efficiency, weatherization and healthy housing upgrades. Some authorities also participate in sustainability initiatives, such as building retrofits and renewable energy integration, through federal grants or utility partnerships.

- **Transit agencies:** Transit agencies provide public transportation services at the regional and local levels, supporting mobility, accessibility and environmental goals. These agencies operate under state and local authority, primarily governed by the ORC (Chapter 306), and receive additional funding and regulatory guidance from the Federal Transit Administration (FTA). Transit agencies plan and manage bus and paratransit services, and increasingly play a role in reducing GHG emissions through fleet electrification, facility upgrades and transit-oriented development. They are eligible for federal and state grants that support low-emission technologies and infrastructure improvements.

- **Sewer and wastewater treatment services: These services** are operated by both municipalities and regional sewer districts, with authority established in the ORC (Chapters 6117 and 6119). These entities manage wastewater collection, treatment and discharge to protect public health and water quality. They are regulated by the Ohio EPA and the U.S. EPA under the Clean Water Act. Operators are responsible for infrastructure maintenance and permit compliance, and may also support energy efficiency, biogas recovery and green infrastructure. Funding is often accessed through programs like the Water Pollution Control Loan Fund (WPCLF).

Table 7.3. List of local and regional entities relevant to implementation of the CCAP. Source: SSG analysis.

Agency	Relevant Sectors	Legal Powers	Enabling Authority	Key Planning and Policy Tools
Miami Valley Regional Planning Commission	Transportation, Energy, Buildings	Planning authority Administering federal and state transportation and planning funds	Federal Metropolitan Planning Organization designation, ORC	CCAP and PCAP, LRTP, GRMI, SolSmart and other regional coordination
Miami Valley Communications Council	Energy	Aggregation contract implementation	ORC on governmental aggregation	Electric Power Aggregation Plan

Agency	Relevant Sectors	Legal Powers	Enabling Authority	Key Planning and Policy Tools
Solid Waste Management Districts (Greene, Miami and Montgomery)	Waste	Solid waste regulation, plan enforcement at county-level	ORC 3734, State Solid Waste Management Plan	County Solid Waste Management Plans, landfill diversion programs
Local governments (municipalities)	Buildings, Transportation, Land Use, Energy, Waste	Develop and update zoning ordinances, codes and land use regulation Adopt BPS Building permitting and code enforcement Municipal assets management (e.g., fleets, buildings) and energy procurements	Ohio home rule authority	Zoning updates, Solar for All, Active Transportation Plans, Climate Emergency declarations
Public housing authorities	Buildings, Housing, Energy	Own and manage properties, apply to HUD funds, contract for capital improvements	HUD regulations under the U.S. Housing Act of 1937	Public Housing Capital Fund, Energy Performance Contracts (EPCs), weatherization partnerships
Transit agencies	Transportation	Operate transit systems Provide service routes, fares and schedules	Transit authorities are established under the ORC (Chapter 306) and bylaws establish procedures	Transit plans, implement Long-range transportation plans, provide capital investment for fleet improvements and can issue bonds.

Agency	Relevant Sectors	Legal Powers	Enabling Authority	Key Planning and Policy Tools
Sewer treatment operators (districts and municipalities)	Wastewater	Collect and treat municipal wastewater, set user rates Issue permits and enforce local discharge regulations Own and operate treatment plants	Authorized by ORC (Chapters 6117 and 6119); municipal operators are enabled by home rules	Wastewater plans, capital investment for improvement

7.2.4 Non-Governmental Entities

Non-governmental organizations (NGOs), community foundations, or entities may support CCAP implementation efforts by providing policy advocacy at various levels of government, technical assistance, public education and outreach, as well as effective community engagement (Table 7.4). Many operate as nonprofit organizations regulated by Section 501(c)(3) of the Internal Revenue Code (IRC), while others may work independently supported through diverse streams of funding and partnerships with public agencies. Community foundations also operate under Section 501(c)(3) of the IRC and serve as a bridge between philanthropic resources and community-driven initiatives and actions.

Table 7.4. List of non-governmental entities relevant to implementation of the CCAP. Source: SSG analysis.

Entity	Relevant Sectors	Roles	Enabling Authority	Function
Solar United Neighbors	Energy	Public engagement Facilitation of group solar co-op programs Provide technical assistance	501(c)(3) nonprofit status	Assistance to residents and businesses through the process of installing solar panels, securing group pricing and policy advocacy for renewable energy access
Drive Electric Dayton	Transportation	Education and outreach organization Policy advocacy	N/A	Engaging decision-makers and the public on EV adoption

Entity	Relevant Sectors	Roles	Enabling Authority	Function
Community Foundations	Cross-sectoral	Grantmaking Convening stakeholders and capacity building	501(c)(3) nonprofit status	Support local efforts by funding initiatives, facilitating partnerships and capacity building with grassroot organizations

7.2.5 Utility Service Providers

Utility service providers in Ohio operate within a deregulated energy market established under state legislation in 1999 (Senate Bill 3), which separated electricity generation from distribution. Under this framework, customers can choose their electricity and natural gas suppliers, while regulated utilities such as AES Ohio (electricity provider) and CenterPoint (natural gas providers) remain responsible for maintaining distribution infrastructure and delivering energy. These utilities are regulated by PUCO. The list of relevant entities in the region, their legal powers, authority and functions are described in Table 7.5.

Table 7.5. List of utility service providers relevant to implementation of the CCAP. Source: SSG analysis.

Entity	Relevant Sectors	Legal Powers	Enabling Authority	Function
Electricity utilities	Energy, Buildings	Operate energy infrastructure Implement efficiency and distributed energy system programs Propose tariffs	Regulation by PUCO, under ORC	Energy efficiency programs, grid modernization plans, interconnection rules
Retail energy suppliers	Electricity	Provide generation service to customers via aggregation or direct contracts	Not subject to rate regulation, but authorized by PUCO	Provide PPAs, renewable energy supply options, aggregation contracts
Natural gas utilities	Buildings	Own distribution pipelines Set rates and operate and maintain infrastructure	Authorized by PUCO	Deliver natural gas, provide energy efficiency incentives

7.3 Implementation Mechanisms

This section outlines the core implementation mechanisms that state and local governments, utilities, community organizations and private sector partners can use to execute GHG emissions reduction measures across sectors. These mechanisms span a wide range of tools that can be used by different implementing entities, from financing and policy levers to capacity building and cross-sector partnerships. Together, these mechanisms provide the practical foundation for advancing scalable and sustained solutions.

This section briefly describes how they work, while Section 7.5 provides more details per action.

7.3.1 Financial Incentives and Funding Tools

Grants and rebates: Provide direct financial support to households, businesses, local governments and nonprofits to implement GHG emissions reduction measures. Local governments have the authority to provide incentives, grants and rebates; apply for federal funding; and provide technical assistance. MVRPC has no authority to provide financial support, but has the ability to facilitate cooperation, planning and coordination by creating policy frameworks that support member governments.

Tax incentives: Offer tax credits, deductions or exemptions to reduce upfront costs of eligible technologies and actions. Most tax incentives are state-regulated matters, and local governments can provide informational resources for residents and businesses on how to apply.

Low-interest loans and revolving funds: Provide access to capital for clean energy and energy efficiency projects. MVRPC has no ability to provide funding, but can facilitate cooperation and funding access (e.g., from green financing banks or coalitions).

Performance-based incentives: Link funding to measurable outcomes like GHG reductions or energy savings. Local governments can provide zoning incentives, expedite processes and offer fee reductions or waivers.

7.3.2 Regulatory and Policy Mechanisms

Codes and standards: Update building codes, appliance standards and fuel standards to align with climate goals, and develop green development standards (GDS)[27] or BPSs.[28] In Ohio, mandatory GDS cannot be more stringent than state building codes. However, there are no limitations for BPSs, and municipalities can enforce complementary ordinances such as GHG emissions reduction and energy standards.

Permitting reform: Streamline permitting processes for clean energy and EV infrastructure installations. Municipalities, generally, can issue ordinances to adjust permitting processes and govern local matters under Ohio home rules.

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[27] GDS applies to new projects and buildings.
[28] BPS applies to existing buildings.

Mandates and requirements: Adopt enforceable policies or regulations that set targets and timelines for GHG emissions reduction measures. Local governments have the authority to govern local matters, including planning for such measures, under Ohio home rules.

7.3.3 Planning and Governance

Integrated planning requirements: Require the integration of GHG emissions reduction measures into land-use, transportation, energy and adaptation planning. Local governments in Ohio have the authority to update zoning codes and ordinances, provide incentives, lease land for EV installation, and install municipally owned EV chargers.

Cross-sector coordination: Establish task forces or working groups to align state, local and private-sector efforts. Local governments can establish partnerships and agreements with relevant operators, stakeholders or other municipalities, and may need council approval. MVRPC is a regionwide entity that itself provides cross-jurisdictional coordination.

Engagement with at-risk and low-income communities: Co-develop programs and implementation approaches that address the needs of at-risk and low-income communities in alignment with GHG emissions reduction measures. Local governments can directly engage with local communities in planning processes and through providing outreach and education.

Climate community benefits frameworks: Embed community benefits in all GHG emissions reduction policies and programs. Through ordinances, local governments can update zoning codes, policies and others to include local matters in their own planning.

7.3.4 Technical Assistance and Capacity Building

Guidance and toolkits: Provide resources for local governments and other stakeholders to develop and implement GHG emissions reduction projects. MVRPC has the ability to facilitate regional coordination, including the creation of toolkits, guidance, and application and ordinance drafts and templates.

Community-based support: Offer direct planning support to community organizations in low-income and underserved communities. Any local government can provide technical assistance and support for community development, including assistance with writing grant applications, planning and technical analysis.

Workforce development: Expand training, apprenticeships and job placement programs aligned with the Community-First Scenario measures. Local governments have the authority to set partnerships or agreements with educational institutions, utilities, service providers and others to develop workforce planning and strategies. MVRPC can support collaboration among different stakeholders. Educational institutions, economic development coalitions and others can provide formal training, certifications and education.

7.3.5 Partnerships and Collaboration

Public-private partnerships: Develop collaborations between government and the private sector to deliver public services, infrastructure or innovation. In Ohio, generally, municipalities can set partnerships and agreements (e.g., Memorandum of Understanding, [MOU]) with third parties, and may need council approval.

Demonstration projects: Develop pilot projects with government, industry and educational institutions.

Innovation accelerators: Support early-stage technologies and start-ups through incubators and testbeds.

Utility and/or developer collaboration: Coordinate large-scale deployment with key actors.

7.3.6 Market Development and Procurement

Public procurement standards: Use state purchasing power to catalyze demand for low-carbon products and services. Municipalities have full control over municipal fleet procurements, municipal buildings and operations, and have the ability to allocate budgets accordingly.

Green purchasing requirements: Require low-carbon materials in public construction and operations. As with public procurement standards, municipalities in the region have full control over their own assets and operations, and may need council approval.

Bulk purchasing: Pool purchasing power to reduce costs and expand access. Local governments can provide technical assistance and deliver programs and incentives to residents to apply for funding. They can also assess technology availability in partnership with developers, utilities and nongovernmental organizations, and provide these partners with a list of trusted suppliers and vendors, starting with local suppliers. Municipalities may also engage in joint procurement of products or services to reduce costs and streamline investments for municipal operations.

7.3.7 Monitoring, Evaluation and Transparency

Public reporting: Track and publish implementation, emissions and community outcomes and progress toward goals.

Evaluation frameworks: Build in opportunities for reviewing actions and processes to improve or correct the plan's course.

For both types of mechanisms, local governments and regional entities have the authority to track and monitor progress of their plans, but may need to pass an ordinance for energy use tracking and reporting, which is not mandatory statewide.

7.4 Funding the Plan

Achieving the Miami Valley Region's goals will require sustained and strategic investment across public, private and philanthropic sectors. Implementation will hinge on the ability to mobilize and manage funding effectively. Actions will rely on funding sources and financing mechanisms.

Funding sources are financial resources such as federal grants, state general funds, taxes or private investment. Financing mechanisms are tools to attract and distribute those resources, including revolving loan funds (RLFs), public-private partnerships and on-bill financing.

Understanding and aligning sources and mechanisms will enable the Miami Valley Region to identify viable financing pathways for each action, tailoring implementation strategies to available resources and administrative capacity.

At the federal level, the Infrastructure Investment and Jobs Act (IIJA) and the IRA created significant new funding opportunities. However, the long-term availability of federal climate funds is uncertain. This makes it critical to vary funding and financing, for example, by combining federal opportunities with flexible state and local resources and leveraging private investment where possible.

7.4.1 Funding and Financing Mechanisms

Taxes

Taxes can generate revenue directly from residents through, for example, property taxes, sales taxes, utility charges, vehicle registration fees and fuel taxes. Governments can design or modify these tax structures to target specific sectors or behaviors, incentivize actions that help reduce GHG emissions or generate dedicated revenue streams for climate programs. For example, a local sales tax may be levied to fund public transit expansion projects. In Ohio, most taxes are mandated by state law, such as sales and property taxes and municipalities have limited authority to exempt businesses and residents unless certain conditions are met, such as the designation of Community Reinvestment Areas (CRAs) or Enterprise Zones or following the statutory processes under the "Qualified Energy Project Tax Exemption."

In addition, local governments often require voter approval to institute new taxes or increase existing rates. Some jurisdictions use special assessment districts or tax increment financing (TIF) to capture future increases in property values to fund infrastructure projects today.

Taxes can fund a wide array of GHG emissions reduction measures including public transit expansion, energy efficiency upgrades in public buildings, EV infrastructure, water conservation projects and renewable energy programs. Dedicated taxes can create stable, predictable revenue streams for long-term planning and program delivery.

Fees

Fees are specific charges on activities, services or resources that require regulatory oversight or rely on public infrastructure. Fees are collected directly from the users and can be structured to recover costs (e.g., paying for permitting and inspection) or to incentivize or discourage certain behaviors (e.g., plastic bag fees encourage bringing a reusable bag). While taxes are general revenue-raising tools, fees are usually charged in exchange for a specific service or regulatory function and must comply with state and local legal constraints, especially in terms of their proportionality and use.

Fees can be levied and used by a wide range of actors, from state agencies and local governments to regional authorities and special districts. For example, utility fees can fund renewable energy infrastructure, while vehicle registration fees can support clean vehicle incentives. Ohio's local governments are authorized to impose fees to fund infrastructure improvements and environmental initiatives, particularly for critical infrastructure projects. As MVRPC is an entity that facilitates the development of regional plans, it supports ensuring that local fee structures align with broader regional goals. However, it cannot impose regional fees or mandate them.

Ohio's home rule grants municipalities with the power to own and operate their own utilities, through which several municipalities in the state have implemented utility-based fee mechanisms. This helps with funding upgrades, energy efficiency programs and capital creation for clean energy investments, often involving minimal surcharges that are applied monthly to users.

The types of GHG emissions reduction measures supported by fees are typically infrastructure- or compliance-oriented. These can include clean transportation infrastructure, building electrification compliance programs, renewable energy and energy efficiency. Importantly, fees can serve as a stable, locally controlled revenue stream to fund ongoing CCAP implementation, especially where external funding may be limited. However, implementing authorities should be aware that poorly designed fees can disproportionately impact low-income residents.

Budget Allocations

Budget allocations are one of the most direct and flexible funding sources and mechanisms available to governments. Budget allocations appropriate general fund revenue through a government's budgeting process, directing funds to specific programs, departments or projects.

Local governments in Ohio benefit from home rules, which provide considerable autonomy for budget management and allocation.

Flexible and discretionary budget allocations can support a wide range of GHG emissions reduction measures, including energy efficiency retrofits for public buildings, tree planting programs, community solar installations, electrification of municipal fleets, climate planning studies and public engagement.

Loans

Loans provide upfront capital that is repaid over time, often at low or subsidized interest rates. Loans may come from state RLFs, federal loan programs, green banks or private lenders. Borrowers, including governments, businesses or even households, can use loans as a financing mechanism to implement GHG emissions reduction projects without the need for immediate capital. Loans can be structured with flexible repayment terms, tied to project performance (e.g., energy savings) or even bundled with technical assistance.

Federally funded loan programs available to states include the following:

- The Loan Programs Office is a federal financing program that supports large-scale energy and infrastructure projects. The program is managed and administered by the DOE.[29]
- State Energy Program Funding provides grants to states to assist in designing, developing and implementing renewable energy and energy efficiency programs. The funds are administered through the state's energy office. Funding is authorized through 2026.[30]
- EPA's Clean Water State Revolving Funds provide funding and guidance to states to provide low-cost financing for water quality infrastructure projects. States administer the program, making lending decisions and setting priorities.[31]

State and local governments, utilities, nonprofits and, in some cases, private property owners are eligible to access and administer loan-based programs. For example, an RLF is a capital source that provides loans to eligible projects with the repayments and interest replenishing and growing the fund over time. State and local governments can establish RLFs with seed funding from grants, federal funding, utility surcharges, bonds or budget line items and administer the funds based on eligible uses (e.g., building retrofits, renewable energy installations, clean transportation). This is just one example of how loans work. Criteria and eligibility for RLFs vary. A city might use a state-supported RLF to upgrade municipal buildings with energy efficiency retrofits, while a rural cooperative might use USDA loan support to finance distributed solar or

[29] U.S. Department of Energy. Loan Programs Office. https://www.energy.gov/lpo/loan-programs-office
[30] U.S. Department of Energy. State Energy Program (SEP) Funding. https://afdc.energy.gov/laws/317
[31] U.S. Environmental Protection Agency. Clean Water State Revolving Fund (CWSRF). https://www.epa.gov/cwsrf

composting projects. Ohio administers two primary State Revolving Loan Funds, targeting water supply and pollution control projects.

States can also create their own green banks to administer low-interest loans and loan guarantees for clean energy projects. PACE financing is another example that allows property owners to finance energy efficiency or renewable energy upgrades and repay the loan via a special assessment on their property tax bill. In Ohio, the PACE program can finance up to 100% of energy efficiency improvements (only applicable to commercial buildings), with a repayment period of up to 30 years.

At the state level, Ohio offers the Ohio Energy Loan Fund, administered by the ODD, which provides low-interest financing to businesses, nonprofits and public entities aiming to implement energy efficiency and advanced energy projects. Some eligibility criteria apply; for instance, eligible projects must demonstrate a minimum energy use reduction of 15%.

Loans can fund a wide range of GHG emissions reduction measures including energy efficiency upgrades, renewable energy installations for homes and businesses, EV infrastructure, water conservation retrofits and climate-resilient infrastructure. While loans must be repaid, borrowers can unlock upfront capital and gain long-term savings at every level.

Bonds

State and local governments can use bonds to raise capital for large-scale infrastructure investments. As a funding source, bonds are essentially loans issued by a public entity (like a city, county or state government) to investors, which are repaid with interest over time. As a financing mechanism, bonds allow governments to spread the costs of major projects over many years, making them more affordable and accessible upfront. There are multiple types of bonds, including:

- General obligation bonds are backed by the full faith and credit of the issuing government.
- Revenue bonds are repaid through the income generated by the funded project (e.g., toll roads, water utilities).
- Green bonds are specifically earmarked for environmentally beneficial projects.

Both state and local governments can issue bonds, although the process typically requires voter approval or legislative authorization. Entities such as municipalities, counties, transit authorities, school districts and special districts (e.g., water, flood control or energy districts) frequently use bonds to fund projects with long lifespans and public benefit. For example, a local government might issue general obligation bonds to upgrade public school heating, ventilation and air conditioning (HVAC) systems for energy efficiency or to construct solar-covered parking facilities at civic centers; or a state agency could use revenue bonds to fund new EV charging networks along highways, with repayment linked to fees or utility revenues.

In Ohio, the Ohio Air Quality Development Authority (OAQDA) has implemented a dedicated green bond program aligned with internationally recognized standards, facilitating the financing of air quality facilities that improves the comfort, health, safety and general welfare for all people within the State of Ohio.

Bonds are well suited to fund measures that involve capital-intensive infrastructure, such as renewable energy installations (e.g., solar fields, geothermal plants), public transit modernization, large-scale building retrofits and water efficiency projects. Green bonds are particularly aligned with CCAP measure implementation, as their proceeds are restricted to projects with defined environmental outcomes, and their transparency can build public trust in climate spending. Due to their scale and long-term structure, bonds can play a foundational role in implementing state and local climate plans.

Grants

Grants are a critical tool for implementing small-scale local projects and large-scale regional initiatives. They are especially valuable since they do not typically require repayment. Grants are provided by federal, state, local or philanthropic entities and allocate funding for specific policy objectives or agendas. Grants are typically distributed as competitive awards or formula-based allocations, meaning recipients must either apply through a proposal process or qualify based on predetermined criteria.

Examples of federal grant programs include:

- **Energy Efficiency and Conservation Block Grant (EECBG) Program:**[32] Led by the DOE, this program supports increasing renewable energy capacity, technical knowledge and deployment of energy efficiency projects at the local level.

- **Federal Highway Administration's Carbon Reduction Program (FHA-CRP):**[33] Created under the IRA Bill, this program provides funds for projects designed to reduce transportation emissions, defined as CO_2 emissions from on-road highway sources.

- **Community Development Block Grants (CDBG):**[34] Provided by HUD, the CDBG provides annual grants on a formula basis to states, cities and counties to develop viable urban communities by providing decent housing and a suitable living environment, and by expanding economic opportunities, principally for low- and moderate-income persons.

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[32] U.S. Department of Energy. Frequently Asked Questions on Energy Efficiency and Conservation Block Grant Financing Program Compliance and Reporting. https://www.energy.gov/scep/frequently-asked-questions-energy-efficiency-and-conservation-block-grant-financing-program

[33] United States Department of Transportation Federal Highway Administration. Infrastructure Investment and Jobs Act - Fact Sheets. https://www.fhwa.dot.gov/infrastructure-investment-and-jobs-act/crp_fact_sheet.cfm

[34] U.S. Department of Housing and Urban Development (September 2024). Community Development Block Grant Program. https://www.hud.gov/hud-partners/community-cdbg

At the state level, agencies may create their own grant programs funded by legislative appropriations or revenue. These funds can be used by a wide range of entities, including state and local governments, regional agencies, nonprofits, utilities, universities and community organizations, depending on the specific eligibility criteria.

The State of Ohio developed the Energy Efficiency Program for Ohio Communities (EEPOC) and provides grants to support energy efficiency projects across the state.

Grants can fund a broad range of GHG emissions reduction measures, including renewable energy installation, energy efficiency retrofits, building electrification, EV infrastructure, green jobs training, nature-based solutions and more.

Other

Other state and federal opportunities targeting and increasing alternatives for industries include:

- **DOE's Better Buildings Program:** This program helps public, private and nonprofit organizations to improve energy efficiency in buildings and homes through technical assistance, peer exchanges and support for implementation. Municipalities can participate in becoming Better Buildings Challenge Partners, and local governments can also participate in representation of neighborhoods.
- **Section 48C – Advanced Energy Project Tax Credit (IRA):** Offers a 30% tax credit for investments in clean energy manufacturing or industrial decarbonization technologies. Facilities in Ohio may qualify.

In terms of green finances and green banks, Ohio has not established a statewide green bank, but the region can leverage national entities that have advanced in these matters, such as the Coalition for Green Capital, the Climate United Fund and Power Forward Communities.

7.5 CCAP Measures and Cost estimates

Table 7.6 describes the CCAP implementation actions, associated with the region's measures to reduce GHG emissions, detailing the total costs of implementation community-wide. Savings are shown as negative expenditures or values, while costs are shown as positive values.

Table 7.6. List of measures, implementation mechanisms, monitoring metrics, funding mechanisms and cost-savings. Source: SSG analysis.

Measure	Implementing Mechanisms	Implementation measure (summary description)	Implementation Roles and Responsibilities	Metrics for Tracking Progress	Implementation Timeline and Milestones	Funding Strategies	Cost-savings (million USD)
1. Build more energy-efficient new buildings	1.1 Green Development Standard	Develop a regional approach to a GDS that applies a tiered performance standard supported by incentives for new construction and planning approvals.	MVRPC: Coordinate and develop the program, including incentive options. Municipalities: Implement the GDS. Builders and developers: Identify cost-effective strategies to implement the standard.	# building projects using voluntary GDS % energy use reduction relative baseline $ incentives provided % of GDS projects located in priority or disadvantaged communities	2026 - Create a task force for GDS framework, coordinate with partners (e.g., municipalities, utilities, developers). Create draft of the GDS and design incentive approaches to implementation. 2027 - Consolidate the task force and launch GDS toolkit. 2028 - Municipalities start GDS adoption. 2029 - GDS implementation and incentives are in place.	Leverage federal funding opportunities.	-$26.5

Measure	Implementing Mechanisms	Implementation measure (summary description)	Implementation Roles and Responsibilities	Metrics for Tracking Progress	Implementation Timeline and Milestones	Funding Strategies	Cost-savings (million USD)
2. Retrofit existing buildings	2.1 Retrofit Programs	Implement or coordinate retrofits for three streams of the building stock: (a) public housing, (b) housing in general, and (c) commercial buildings.	MVRPC: Design the program. Municipalities: Participate in the program SOPEC: Possible implementing entity Utilities: Provide incentives.	# buildings retrofitted % energy use reduction relative to baseline % retrofit located in priority or disadvantaged areas	2026 - Establish a retrofit steering committee, leveraging current regional committees (e.g., TAC, WESC). Assess regional needs, identifying target communities, areas or neighborhoods. Explore and define funding mechanisms. 2027 - Secure funding and develop funding application templates (federal, state and green financing mechanisms). Launch the program. Integrate into the Building Performance Standard (BPS) development process. 2028 - Implement the program and start tracking and monitoring. Perform public outreach and campaigns for disadvantaged communities. 2029 - Fully deploy and scale up program deployment. 2030 - Ongoing monitoring and tracking progress	Leverage federal funding opportunities. OAQDA ODD	$10,648.3

Measure	Implementing Mechanisms	Implementation measure (summary description)	Implementation Roles and Responsibilities	Metrics for Tracking Progress	Implementation Timeline and Milestones	Funding Strategies	Cost-savings (million USD)
2. Retrofit existing buildings	2.2 Benchmarking Program	Track and report on building performance to enable people or businesses to select higher-performance buildings, as well as to provide a baseline to establish a retrofit program targetting low performance buildings. Benchmarking is a foundational mechanism to develop a BPS.	MVRPC: Provide technical assistance to adopt benchmarking tools and provide template of ordinance. Municipalities: Pass ordinance to require tracking energy use in buildings and implement benchmarking program. Building developers: Participate in benchmarking program.	% buildings covered by the benchmarking % buildings reporting energy performance # EUI (MMBtu/sqft) % EUI change relative to baseline $ energy savings	2026 - Planning phase to establish a benchmarking framework. Establish partnerships with municipalities and building developers. Engage with homeowners and renters. Create ordinance templates for local governments. Launch an educational campaign. 2027 - Ordinance adoption and launch. Building data collection and tracking, annual reporting.	Leverage federal funding opportunities. OAQDA ODD	

Measure	Implementing Mechanisms	Implementation measure (summary description)	Implementation Roles and Responsibilities	Metrics for Tracking Progress	Implementation Timeline and Milestones	Funding Strategies	Cost-savings (million USD)
2. Retrofit existing buildings	2.3 Building Performance Standard	Develop and implement phased BPSs requiring commercial and residential (single and multifamily) buildings to meet specific GHG reduction targets over time, supported by technical assistance, data transparency tools and joint collaboration across the region.	Dayton: Continue to coordinate the BPS development with other major cities in Ohio. Municipalities: Participate in the program. Utilities: Provide incentives.	% of regional buildings covered by a BPS % emission reduction achieved by the implementation of BPS $ energy savings per household resulting from increased energy efficiency in existing buildings	2025 - BPS design and funding application. Define baseline and building coverage. 2026 - Pass municipal ordinance to adopt BPS and increase workforce capacity. 2027 - Launch the BPS, and provide technical support and financial information. 2028 - Fully deploy the BPS. 2029 - Evaluate BPS compliance and performance.	Leverage federal funds for voluntary BPS at local levels: Coordinate regional applications to federal funds for BPS design and implementation, by providing help for group applications for public buildings or multi-jurisdictional retrofit efforts. Coordinate retrofit financing with the OAQDA and the ODD	

Measure	Implementing Mechanisms	Implementation measure (summary description)	Implementation Roles and Responsibilities	Metrics for Tracking Progress	Implementation Timeline and Milestones	Funding Strategies	Cost-savings (million USD)
3. Switch new and existing buildings to heat pumps and RNG use for commercial and residential buildings	3.1 Air Conditioner Replacement Program	Promote and support the installation of heat pumps for space heating and cooling in buildings through technical assistance, aggregated procurement and access to rebates or tax incentives to reduce upfront costs. Policy mechanisms include a requirement in building condition codes and heat protection codes. The initial priority is social and rental housing to protect vulnerable residents.	MVRPC : Design the program. Municipalities: Participate in the program. SOPEC: Possible implementing entity Utilities: Provide incentives and support installation. Other partners include: University of Dayton's Building Energy Center	$ energy savings per household resulting from heat pump adoption % emissions reduction achieved by heat pump adoption	2026 - Develop the program, including technical resources such as model codes. Identify funding sources for incentives. Create a list of trusted vendors. Create and issue an RFP to set criteria and requirements for vendor selection. Launch an education and outreach campaign for residents and businesses, along with establishing information resources for federal funding. 2028 - Installation and support phase. Design a monitoring and tracking process in collaboration with partners. 2030 - Monitor the program and evaluate progress. 2031 onward - Conduct a program evaluation (metrics, equity, lessons learned and recommendations for expansion).	Primarily, funding sources are federal funding under the IRA bill: Commercial building energy efficiency tax deduction, new energy efficient home credit, investment tax credits, residential energy efficiency improvements and other state funding.	$2,891.8

Measure	Implementing Mechanisms	Implementation measure (summary description)	Implementation Roles and Responsibilities	Metrics for Tracking Progress	Implementation Timeline and Milestones	Funding Strategies	Cost-savings (million USD)
4. Electrify water heaters and stoves	4.1 Home Electrification Program	Provide education on the benefits and challenges of home electrification, including heating, water heating, cooking, technical assistance for municipalities in policy development, procurement aggregation programs and coordination of incentives and grants.	MVRPC: Design and coordinate the program in cooperation with Rewiring America. Municipalities: Participate in the program. SOPEC: Possible implementing entity Utilities: Provide incentives.	$ energy savings per household resulting from electrification % emissions reduction achieved by electrification # homes electrified	Parallel implementation to the BPS development	Leverage federal funds for voluntary BPS at local levels: Coordinate regional applications to federal funds for BPS design and implementation, by providing help for group applications for public buildings or multi-jurisdiction al retrofit efforts.	$440.7

Measure	Implementing Mechanisms	Implementation measure (summary description)	Implementation Roles and Responsibilities	Metrics for Tracking Progress	Implementation Timeline and Milestones	Funding Strategies	Cost-savings (million USD)
5. Electrify transportation	5.1 Clean Fleets	Adopt EVs in municipal fleets through joint procurement and support the provision of technical assistance for municipal electrification strategies. The program can be expanded to private fleets.	Dayton: Design the procurement template and provide guidance for funding applications. Municipalities: Develop procurements for electric fleets. Utilities: Facilitate interconnection mechanisms. Federal entities (DOE and EPA): Provide tools to estimate the environmental impacts of green fleet technologies (AFLEET) and the GHG emissions calculation tool from the EPA (e.g., TCO Calculator).	% EVs in municipal fleet % GHG emission reductions $ savings in operational and fuel use	2026 - Conduct an inventory and assessment of municipal fleets. Plan for fleet upgrades and renewal. 2027 - Develop a joint procurement mechanism (e.g., MOU, procurement cooperative or other strategy). 2028 - Savings and performance monitoring	Budget allocation for transit and public fleet electrification Green bonds for electric fleets through OAQDA	-$1,129.3

Measure	Implementing Mechanisms	Implementation measure (summary description)	Implementation Roles and Responsibilities	Metrics for Tracking Progress	Implementation Timeline and Milestones	Funding Strategies	Cost-savings (million USD)
5. Electrify transportation	5.2 Clean Cars for All	Clean Cars 4 All provides incentives to help lower-income consumers to replace their old higher-polluting vehicles with newer and cleaner transportation. Participants have the option to purchase or lease a new or used hybrid, plug-in hybrid electric vehicles (PHEVs), battery-electric vehicles (BEVs), zero-emission vehicles (ZEVs), or an alternative mobility option such as an e-bike, voucher for public transit or a combination of clean transportation options. Additionally, buyers of PHEVs and BEVs are also eligible for home charger incentives or prepaid charge cards if home charger installation is not an option.	MVRPC: Lead a program to help low-income households adopt EVs and electric bikes, increase transit use or a combination. Municipalities: Deliver the program in partnership or individually. Utilities: Install charging equipment.	VMT by vehicle mode # EVs in the region	2026 - Program development 2027 - Year 1 implementation 2028 - Monitor savings and performance.	Philanthropic funding Federal funding	

Measure	Implementing Mechanisms	Implementation measure (summary description)	Implementation Roles and Responsibilities	Metrics for Tracking Progress	Implementation Timeline and Milestones	Funding Strategies	Cost-savings (million USD)
5. Electrify transportation	5.3 Charging Infrastructure	Promote updates in zoning codes to allow EV chargers, prioritize EV parking with fines and penalties, and adjust right-of-way (ROW) rules to facilitate and expedite charging point installation in curbside areas. Municipalities integrate EV charging targets and strategies into planning processes by updating comprehensive land-use plans, including criteria for EV access in low-income areas.	MVRPC: Provide guidance and technical assistance for policy updates. Drive Electric Dayton: Possible outreach and education entity to drive demand Utilities: Install EV charging and interconnection. Municipalities: Facilitate EV charging installation through ordinances, and identify target neighborhoods for investment and installation of EV chargers.	# EV chargers across the region # EVs in the region	2026 - Develop a regionwide EV infrastructure strategy, identifying target and underserved neighborhoods. Coordinate regional installation on public properties. Update local zoning codes and use of ROW. Application for funding. 2027 - Install EV charging. 2028 - Launch a communication, education and outreach campaign. Monitor and track implementation. 2030 - Scale up based on metrics.	Public-private partnership Federal funding	
5. Electrify transportation	5.4 Clean Freight Strategy	Develop a regionwide clean freight strategy to support clean freight technologies, identify last mile delivery strategies	MVRPC: Develop the strategy. Municipalities: Apply last mile solutions. Private companies: Participate in pilot projects.	Air Quality Index	2026 - Develop the strategy. 2027 - Implement the strategy. 2028- Track progress.	Federal or state funding for air quality Better Utilizing Investments to Leverage Development (BUILD) Grant Program Congestion Mitigation and Air Quality (CMAQ)	

Measure	Implementing Mechanisms	Implementation measure (summary description)	Implementation Roles and Responsibilities	Metrics for Tracking Progress	Implementation Timeline and Milestones	Funding Strategies	Cost-savings (million USD)
6. Increase transit and active mode share	6.1 Regional Planning Initiative	Develop an integrated land-use plan for the Miami Valley Region that identifies the major demographic and economic trends and ensures regional coordination between land-use and transportation to minimize emissions, protect greenspace and enhance livability.	MVRPC: Develop a regional plan that coordinates planning efforts with local municipalities and other entities as required.	Plan developed	2026 - Define scope and secure funding. 2028 - Develop plan.	Federal and membership funding	-$2,790.5
6. Increase transit and active mode share	6.2 Safe Streets for All	Develop infrastructure and policies that increase the safety for walking, cycling and transit in communities across the region.	MVRPC: Continue to implement the Miami Valley Toward Zero Action Plan as a strategy to make streets safe for active transportation modes.	% non-vehicular mode share	2025 - Prepare a regional report card on safe streets with a perspective on at-risk and low-income communities and enhancing health outcomes.	Department of Transportation-Safe Streets and Roads for All (SS4A)	

Measure	Implementing Mechanisms	Implementation measure (summary description)	Implementation Roles and Responsibilities	Metrics for Tracking Progress	Implementation Timeline and Milestones	Funding Strategies	Cost-savings (million USD)
6. Increase transit and active mode share	6.3 Mobility Hubs	Create mobility hubs across the Miami Valley Region, prioritize areas that connect isolated neighborhoods to essential services, and increase access to low-income communities.	MVRPC: Lead integrated mobility hubs across the region. Municipalities: Implement infrastructure and coordinate with partners Transit agencies: Implement and integrate transit operations. Micromobility providers: Deploy bike-share and e-bike sharing programs and operations.	# transit ridership counts # trips made by active transportation mode	2026 - Create a working group with multiple municipalities and local governments, led by the City of Dayton. Identify areas for the implementation of hubs, define funding mechanisms, and identify policy update needs and technical support. Partner with micromobility providers, transit agencies and the ODOT. 2027 - Create templates for a grant application, draft of zoning code amendments at municipal levels, construction permitting approval with active infrastructure criteria. MOUs with partners for implementation. Grant application. 2028 - Award funding. Zoning code amendments and mobility hub project design. 2029 - Mobility hub build-out 2030 - Mobility hub evaluation and scale-up	Project funding supported by federal and state funding, and future expansion of infrastructure in new building projects secured through density bonuses, allowing construction of denser or multifamily units in exchange for including bike lanes and/or contributing to mobility hub improvements Green bonds issued by large projects in coordination with regional goals and supported by MVRPC	

Measure	Implementing Mechanisms	Implementation measure (summary description)	Implementation Roles and Responsibilities	Metrics for Tracking Progress	Implementation Timeline and Milestones	Funding Strategies	Cost-savings (million USD)
6. Increase transit and active mode share	6.4 Healthy Transportation Funding Program	MVRPC implements the Active Transportation Plan. Municipalities access federal and state funding via the Transportation Improvement Program (TIP) and Statewide Transportation Improvement Program (STIP), supporting coordination between multiple municipalities for joint applications and project design for active transportation and micromobility infrastructure.	MVRPC: Provide guidance for funding applications and coordinate municipalities. Municipalities: Access funding and implement the program.	VMT by mode	Ongoing project implementation	Based on federal and state funding	
6. Increase transit and active mode share	6.5 Micromobility	Continue to provide bike and scooter share programs in Dayton and other municipalities.	Dayton: Develop new partnerships; integrate with other programs (Clean Cars 4 All).	Daily trips by bike or scooter	2026 - Renewed project launch	Public-private partnership	

Measure	Implementing Mechanisms	Implementation measure (summary description)	Implementation Roles and Responsibilities	Metrics for Tracking Progress	Implementation Timeline and Milestones	Funding Strategies	Cost-savings (million USD)
7. Reach a zero-emissions grid	7.1 Clean Electricity Aggregation Programs	Continue to advance and innovate on the aggregation model for clean electricity, energy efficiency (bulk retrofits), clean heating (district heating, heat pumps) and clean transportation (car share).	Municipalities: Sign up to an electric aggregation program (e.g., SOPEC, MVCC program). SOPEC, MVCC: Evaluate additional aggregation models for heat and vehicles. PUCO: Provide approval of programs. City of Dayton and Beavercreek: Support municipalities in establishing the program.	% electricity demand covered by Electric Aggregation Programs % GHG emissions reduction from renewable energy electricity	2026 - Continue to expand SOPEC to additional communities. 2026-2027 - Evaluate additional services areas or aggregation possibilities.	No additional funding for expansion Feasibility study funded by philanthropy	NA

Measure	Implementing Mechanisms	Implementation measure (summary description)	Implementation Roles and Responsibilities	Metrics for Tracking Progress	Implementation Timeline and Milestones	Funding Strategies	Cost-savings (million USD)
8. Increase solar generation	8.1 SolSmart Program	Promote and support the installation of solar on rooftops, brownfield sites and agrivoltaics using the SolSmart resources and framework.	MVRPC: Coordinate and promote the program. Municipalities: Implement policies and incentives, and develop solar projects. Private companies: Install solar. Households: Install solar. Utilities: Provide incentives.	# distributed annual solar generation (kWh or MWh) and/or # installed capacity of solar rooftops regionwide (kW or MW)	2025 - MVRPC continues to educate and support the SolSmart program. 2026 - First cohort of municipalities are SolSmart-certified with relevant policies and programs.	For households and utilities: federal tax incentives For municipalities: OAQDA ODD	-$572.7

Measure	Implementing Mechanisms	Implementation measure (summary description)	Implementation Roles and Responsibilities	Metrics for Tracking Progress	Implementation Timeline and Milestones	Funding Strategies	Cost-savings (million USD)
9. Implement a district energy system	9.1 District Energy in Dayton	Develop an ambient district energy system for downtown Dayton that provides locally sourced, zero-emissions, low-cost heating and cooling for existing and new buildings, with major buildings serving as anchor loads.	City of Dayton: Design and implement district energy system in the city. Utilities: Infrastructure coordination Anchor institutions (universities, hospitals, government buildings): Implement district energy system.	% GHG emissions reduction $ energy savings for space heating and cooling	2026 - Establish partnership and planning phase. 2027 - Conduct a feasibility study for the implementation and funding application. 2028 - Procurement for construction and construction phase 2030 - Service initiated to customers 2031 - Ongoing monitoring and evaluate expansion based on performance	State funding, such as Renewable Energy and Grid Resiliency Program funded by the ODD, the EEPOC, the DOE EECBG, supplemented by green bonds and green financing options	-$0.9

Measure	Implementing Mechanisms	Implementation measure (summary description)	Implementation Roles and Responsibilities	Metrics for Tracking Progress	Implementation Timeline and Milestones	Funding Strategies	Cost-savings (million USD)
9. Implement a district energy system	9.2 Waste Energy Strategy	Identify sources of waste energy in the Miami Valley Region. Waste energy can be the basis of zero-emissions heating and a potential revenue source for the generation of the waste heat. Sources can include data centers, wastewater systems and industrial processes.	MVRPC and Dayton can collaborate on a feasibility study.	# of waste heat to energy projects developed	2026 - RFP for study 2027 - Study completed 2028 - Commercialization of opportunities		
10. Adopt renewable energy procurements for industrial processes	10.1 Renewable Energy Champions	Coordinate commercial and industrial sector renewable energy procurement for both electricity and RNG. Develop a brand for industry in the Miami Valley Region as 'renewably powered.'	MVRPC: Provide technical assistance and coordinate with suppliers. Industries: Procure renewable energy-sourced electricity.	MW of clean electricity procured MMBtu of RNG procured	2026 - Planning phase to assess electricity demand, internal energy audit. Prepare RFP for renewable energy electricity suppliers and selection. 2027 - Contract and application to PUCO for approval, utility interconnection and operation	No funding required	NA

Measure	Implementing Mechanisms	Implementation measure (summary description)	Implementation Roles and Responsibilities	Metrics for Tracking Progress	Implementation Timeline and Milestones	Funding Strategies	Cost-savings (million USD)
11. Improve industrial sector processes	11.1 Industrial Energy Innovation Partnership	Develop an Innovation Partnership to identify actions to support industries in reducing GHG emissions and implementation of energy efficiency and electrification measures in industrial processes.	MVRPC: Design the program. Industries and private sector: Participate in the program. Universities and colleges: Provide extension services, including technical and feasibility analysis. Utilities: Provide technical assistance and conduct energy audits (when applicable). State agencies: Provide funding and technical support. Municipalities: Coordinate with local entities to facilitate workforce links.	GHG reductions MMBtu saved	2026 - Identify interested participants and sectors. Map state and federal funding opportunities and convene initial regional working group meeting. 2027 - Launch the Industrial Energy Innovation Partnership. Secure pilot funding opportunities and champion industrial leaders through public recognition. 2028 - Expand partnership to college and educational institutions to facilitate workforce development on energy efficiency areas for industrial processes and energy audits. 2030 - Scale up participation, monitor and track energy and emissions savings.	State and federal funding for implementation, leveraging from existing programs such as Better Plants Program, IRA for industries, Advanced Energy Manufacturing and Recycling Grant Programs	$3,847.8

Measure	Implementing Mechanisms	Implementation measure (summary description)	Implementation Roles and Responsibilities	Metrics for Tracking Progress	Implementation Timeline and Milestones	Funding Strategies	Cost-savings (million USD)
12. Electrify industrial processes	12.1 Industrial Energy Innovation Partnership	Develop an Innovation Partnership to identify actions to support industries in reducing GHG emissions and implementing energy efficiency and electrification measures in industrial processes.	MVRPC: Design the program. Industries and private sector: Participate in the program. Universities and colleges: Provide extension services, including technical and feasibility analysis. Utilities: Provide technical assistance and conduct energy audits (when applicable). State agencies: Provide funding and technical support. Municipalities: Coordinate with local entities to facilitate workforce links.	GHG reductions MMBTU saved	2026 - Identify interested participants and sectors. Map state and federal funding opportunities and convene initial regional working group meeting. 2027 - Launch the Industrial Energy Innovation Partnership. Secure pilot funding opportunities and champion industrial leaders through public recognition. 2028 - Expand partnership to college and educational institutions to facilitate workforce development on energy efficiency areas for industrial processes and energy audits. 2030 - Scale up participation, and monitor and track energy and emissions savings.	State and federal funding for implementation, leveraging from existing programs such as Better Plants Program, IRA for industries, Advanced Energy Manufacturing and Recycling Grant Programs	$717.1

Measure	Implementing Mechanisms	Implementation measure (summary description)	Implementation Roles and Responsibilities	Metrics for Tracking Progress	Implementation Timeline and Milestones	Funding Strategies	Cost-savings (million USD)
13. Switch to RNG in wastewater treatment plants (WWTPs)	13.1 Renewable Natural Gas	Develop a program to support WWTP operators to produce RNG and use it internally in replacement of current energy fuels. The program provides technical assistance, support for joint application of funding, and coordination with utilities and state agencies for regulatory compliance.	MVRPC: Design the program. WWTP operators: Design projects, provide funding, and implement and operate facilities. Federal agencies: Provide funding and technical assistance.	# GHG emissions reduced # energy savings from on-site energy use # RNG annual production (m3/year)	2026 - Program design, partnerships established, funding opportunities 2027 - Launch the program, starting with pilot engineering design and procurement. 2028 - Construct a pilot project. 2030 - Operational launch of pilot project. Evaluate performance and expand program. 2031 - Expand program and monitoring.	Based on available federal funding, including Investment Tax Credit part of IRA that cover WWTPs that involve anaerobic digestion projects, and may apply the Rural Energy for America Program to WWTPs	$0.1

Measure	Implementing Mechanisms	Implementation measure (summary description)	Implementation Roles and Responsibilities	Metrics for Tracking Progress	Implementation Timeline and Milestones	Funding Strategies	Cost-savings (million USD)
14. Residents reduce per capita waste generation	14.1 Zero Waste Campaign	Provide public education and perform outreach through an advisory table for the community and other participatory processes to reduce waste generation, intergovernmental, across the region.	SWMDs: Lead and design the campaign. MVRPC: Support coordination and engagement. Municipalities: Join the campaign and do outreach and public engagement. Schools, educational institutions, businesses, grocery stores and others: Implement zero-waste practices. Nonprofit organizations: Do outreach and public education.	# waste generation per capita	2026 - Design the campaign, establish partnerships, and create a campaign toolkit and launch. 2027 - Perform and participate in community events, outreach and education. 2028 - Continue the campaign and evaluate results. Plan and adjust the strategy for the following years. 2029 - Ongoing campaign. Collect information about waste generation trends and report.	Municipal budget for waste management, SWMDs budget for outreach and education, complemented with federal funding such as Recycling Education and Outreach Grant Program	-$453.6

Measure	Implementing Mechanisms	Implementation measure (summary description)	Implementation Roles and Responsibilities	Metrics for Tracking Progress	Implementation Timeline and Milestones	Funding Strategies	Cost-savings (million USD)
15. Divert landfill waste	15.1 Circular Economy Strategy	A circular economy strategy for the Miami Valley Region would focus on transforming local systems — from industry and infrastructure to households and government — to eliminate waste, keep resources in use longer and regenerate natural systems. Circular strategies here could include: material exchange networks between manufacturers (e.g., using waste from one as input for another), remanufacturing and refurbishment (especially electronics, auto parts and industrial equipment), and additive manufacturing (3D printing) to reduce material waste.	SWMDs: Lead and design the initiative. MVRPC: Support coordination and engagement, and provide technical support and joint application for funding. Municipalities: Join the initiative, facilitate collection process to accommodate new routes, and implement tree planting programs. Composting operators: Implement composting operations. Nonprofit organizations: Do outreach and public education.	# waste sent to composting facilities # waste sent to landfills % waste type sent to landfills	2026 - Start coordination through a working group regionwide. Design the program and identify funding opportunities and partners. Launch the initiative. 2027 - Start organic waste collection and composting pilot projects. 2028 - Evaluate programs and expand across the region. 2029 - Monitor and report results and continue expansion. 2030 - Ongoing initiative	Leveraging federal funding, such as from EPA Solid Waste Infrastructure for Recycling grants, USDA through the Composting and Food Waste Reduction Cooperative Agreements	

Leadership and Democracy

Table 7.7 details the cross-sector implementation mechanisms for successful implementation.

Table 7.7. Cross-sector implementation actions. Source: SSG analysis.

Big Move	Implementing Mechanisms	Implementation measure (summary description)	Implementation Roles and Responsibilities	Metrics for Tracking Progress	Implementation Timeline and Milestones	Funding Strategies
Leadership and Democracy	16.1 Green Bank	Create a task force for green finance for a retrofit and clean energy program, led by MVRPC in coordination with local governments of the Miami Valley Region. The task force should partner with the Green Banks Coalition (e.g., Coalition for Green Capital, Climate United Fund, Power Forward Communities), Public Housing Authorities (e.g., Greater Dayton Premier Management, Greene Metropolitan Housing Authority, Miami Metropolitan Housing Authority), as well as Community Development Financial Institutions (e.g., credit unions, CDFI banks and loan funds).	MVRPC - Leads task force creation and facilitates coordination between financing institutions, local governments and housing developers, and public housing institutions. It also provides technical assistance for municipalities and coordinated communication and engagement strategy. Local governments - Administer funding locally and manage retrofit contracts, promoting program participation and identification of target neighborhoods and buildings. Green Bank Coalition - Provides funding and seed capital, and guides compliance with state and federal finance regulation. State government (ODD, DOE, Ohio EPA, HUD) - Provides oversight to check alignment with statewide housing, weatherization and energy efficiency programs; technical assistance; and regulatory clarity.	# of projects undertaken % annual GHG emissions reduction resulting from the project	2026 - MVRPC collects information and invites participation from local governments (aligned with the BPS process), and identifies housing authorities, financial partners and other relevant nonprofit organizations). Create and launch the task force. 2027 - Consolidate the task force vision, mission, funding opportunities, roles and responsibilities, and priority geographies, creating a Green Financing Strategy. Launch a communication, engagement and outreach campaign. Secure technical assistance and training for participating agencies and partners. 2028 - Initiate the program with an intake of retrofit participants, and track information for reporting and transparency purposes. 2030 - Monitor program implementation, and adjust task force roles and responsibilities.	

Big Move	Implementing Mechanisms	Implementation measure (summary description)	Implementation Roles and Responsibilities	Metrics for Tracking Progress	Implementation Timeline and Milestones	Funding Strategies
			Public Housing Authorities - Collaborate with local governments and CBOs, leverage federal funding, support coordination with vulnerable communities, and manage or own public housing units. Residents and businesses - Responsible for applying to green financing mechanisms and implementing energy efficiency improvements.			
Leadership and Democracy	16.2 Coordinating Philanthropy	The Miami Region Climate Action Commission (supported by MVRPC) leads the development of a philanthropic program in the Miami Valley Region.	MVRPC: Engage with the philanthropic sector on relevant programs and actions. Foundations: Create a climate action program focussed on community engagement and equity.	$ millions raised for equity-based climate action	2026 - MVRPC develops a concept paper: MVRPC engages with the philanthropic sector	The Dayton Foundation, Mathile Family Foundation, CareSource Foundation, Kettering Foundation, Kresge Foundation, JBP Foundation

Big Move	Implementing Mechanisms	Implementation measure (summary description)	Implementation Roles and Responsibilities	Metrics for Tracking Progress	Implementation Timeline and Milestones	Funding Strategies
Leadership and Democracy	16.3 Municipal Leadership Program	The Municipal Leadership Program is a coalition of engaged and motivated municipalities that can lead and coordinate on climate action across the region, building on the local pathways initiative.	MVRPC: Continue to engage with the municipalities that have local pathways. Municipalities: Develop and implement a climate action plan based on the local pathways.	# of municipalities in Miami Valley with a climate action plan	2026 - MVRPC collects information and invites participation from local governments (aligned with the BPS process), and identifies housing authorities, financial partners and other relevant nonprofit organizations). Create and launch the task force. 2027 - Consolidate the task force vision, mission, funding opportunities, roles and responsibilities, and priority geographies, creating a Green Financing Strategy. Launch a communication, engagement and outreach campaign. Secure technical assistance and training for participating agencies and partners. 2028 - Initiate the program with an intake of retrofit participants, and track information for reporting and transparency purposes. 2030 - Monitor program implementation, and adjust task force roles and responsibilities.	Philanthropy

Big Move	Implementing Mechanisms	Implementation measure (summary description)	Implementation Roles and Responsibilities	Metrics for Tracking Progress	Implementation Timeline and Milestones	Funding Strategies
Leadership and Democracy	16.4 Community Energy Planning	Municipalities develop and implement community energy plans alongside their comprehensive plans to ensure coordination between land-use policy, transportation, the energy transition and economic development. The community energy plans can be focused on the municipal or neighborhood scale.	MVRPC: Provide technical assistance. Municipalities: Develop community energy plans. Utilities: Support the development of community energy plans.	# of community energy plans developed in the Miami Valley Region	2025 - MVRPC provides final information for the local pathways. 2026 - MVRP supports the municipalities in developing climate action plans. 2027- Second cohort of local climate action pathways is announced.	Municipal contributions to participate in the local climate planning program
Leadership and Democracy	16.5 Citizens Climate Assembly	A citizens assembly is convened with representative residents to co-design policy priorities. Members are identified at random and supported with an in-depth education program, after which they provide guidance on policy directions. This approach can address political divides.	The process may be led by the City of Dayton as part of its outreach and education efforts.	Annual Citizens Assembly Report	2026 - Design and development of the Citizens Assembly Initiative 2027 - Citizens Assembly Initiative launched 2028 - Report on findings	Philanthropic funding

Big Move	Implementing Mechanisms	Implementation measure (summary description)	Implementation Roles and Responsibilities	Metrics for Tracking Progress	Implementation Timeline and Milestones	Funding Strategies
Leadership and Democracy	16.6 Miami Region Climate Action Commission (MRCAC)	Create an independent oversight body to include municipal officials, representatives of labor, business, utilities, universities, environmental and community groups, and scientists. Its mandate: refine the CCAP, review and revise interim targets, recommend policies, and review performance across the region. The MRCAC will hold public meetings and produce annual reports on climate indicators (e.g., GHG emissions, energy use, job growth).	MVRPC provides the secretariat and operates the MRCAC in parallel to the WESC.	N/A	2025 - MRCAC terms of reference developed and membership solicited 2026 - MRCAC launched, with quarterly meetings	Internal resources
Leadership and Democracy	16.7 Challenge Teams	Convene time-bound working groups on economic development around specific challenges (e.g., clean energy, building decarbonization, agriculture) that include nonprofits, entrepreneurs and citizen experts. These teams will co-create solutions and pilot projects to stimulate community engagement and innovation.	Challenge teams can be created for each sector. The process would be led by economic development agencies such as the City of Dayton Department of Economic Development, Montgomery County Economic Development, Dayton Development Coalition and MVRPC.	# of jobs created # of new businesses created	2025 - Buildings Decarbonization 2026 - Clean Electricity 2027 - Clean Heat 2028 - Clean Transportation 2029 - Waste Management	Philanthropy

Big Move	Implementing Mechanisms	Implementation measure (summary description)	Implementation Roles and Responsibilities	Metrics for Tracking Progress	Implementation Timeline and Milestones	Funding Strategies
Leadership and Democracy	16.8 Annual Report	Report annually on the progress of the Miami Valley Region's CCAP, including key performance indicators and a regional GHG inventory. The report will be released annually on Earth Day.	MVRPC will prepare the annual report	Annual report published	Annually	

7.6 Implementation Timeline

Name of the Measure	Implementation Measure	Implementation Lead	Supporting Entity	2025	2026	2027	2028	2029	2030	2031	2032
Affordable and Sustainable Buildings											
1. Build more energy-efficient new buildings	1.1 Green Development Standard	MVRPC	Municipalities		■	■	■	■			
2. Retrofit existing buildings	2.1 Retrofit Programs	Municipalities			■	■	■	■	■		
2. Retrofit existing buildings	2.2 Benchmarking Program	City of Dayton; program expanded to other communities			■	■					
2. Retrofit existing buildings	2.3 Building Performance Standard	City of Dayton		■	■	■	■	■			
3. Switch new and existing buildings to heat pumps and RNG use for commercial and residential buildings	3.1 Air Conditioner Replacement Program	MVRPC, Municipalities			■	■	■	■	■	■	
4. Electrify water heaters and stoves	4.1 Home Electrification Program	MVRPC, CBOs				■	■	■	■	■	
Clean Transportation for All											
5. Electrify transportation	5.1 Clean Fleets	MVRPC			■	■	■				
5. Electrify transportation	5.2 Clean Cars for All	MVRPC			■	■	■				
5. Electrify transportation	5.3 Charging Infrastructure	MVRPC			■	■	■	■	■		
5. Electrify transportation	5.4 Clean Freight Strategy	MVRPC, DriveOhio	Transit agencies		■	■	■				

Name of the Measure	Implementation Measure	Implementation Lead	Supporting Entity	2025	2026	2027	2028	2029	2030	2031	2032
6. Increase transit and active mode share	6.1 Regional Planning Initiative	MVRPC	Municipalities								
6. Increase transit and active mode share	6.2 Safe Streets for All	MVRPC									
6. Increase transit and active mode share	6.3 Mobility Hubs	MVRPC, transit agencies									
6. Increase transit and active mode share	6.4 Healthy Transportation Funding Program	MVRPC									
6. Increase transit and active mode share	6.5 Micromobility	Municipalities, Private sector									
Clean Energy											
7. Reach a zero-emissions grid	7.1 Clean Electricity Aggregation Programs	SOPEC, MVCC									
8. Increase solar generation	8.1 SolSmart Program	MVRPC									
9. Implement a district energy system	9.1 District Energy in Dayton	City of Dayton									
9. Implement a district energy system	9.2 Waste Energy Strategy	City of Dayton									
Re-energized Clean Industrial Sectors											
10. Adopt renewable energy procurements for industrial processes	10.1 Renewable Energy Champions	Industries, Dayton Development Coalition (DDC)									
11. Improve industrial sector processes	11.1 Industrial Energy Innovation Partnership	DDC									
12. Electrify industrial processes	12.1 Industrial Energy Innovation Partnership	MVRPC									

Name of the Measure	Implementation Measure	Implementation Lead	Supporting Entity	2025	2026	2027	2028	2029	2030	2031	2032
13. Switch to RNG in wastewater treatment plants (WWTPs)	13.1 Renewable Natural Gas	WWTP operators	Municipalities								
Circular Economy											
14. Residents reduce per capita waste generation	14.1 Zero Waste Campaign	SWMDs	Municipalities								
15. Divert landfill waste	15.1 Circular Economy Strategy	SWMDs	Municipalities								
Leadership and Democracy											
All	16.1 Green Bank	MVRPC, Foundations	Municipalities								
All	16.2 Coordinating Philanthropy	MVRPC, Foundations	Municipalities								
All	16.3 Municipal Leadership Program	MVRPC	Municipalities								
All	16.4 Community Energy Planning	MVRPC	Municipalities								
All	16.5 Citizens Climate Assembly	Greater Dayton Partners for the Environment	Municipalities								
All	16.6 Miami Region Climate Action Commission (MRCAC)	Hanley Sustainability Institute	Municipalities								
All	16.7 Challenge Teams	MVRPC	Municipalities								
All	16.8 Annual Report	MVRPC	Municipalities								

8 | Benefits Analysis

8.1 Introduction

Actions that reduce GHG emissions can also advance objectives related to health, economic prosperity, affordability, and climate adaptation and resilience (Figure 8.1). This section draws on research on the broader societal impacts of GHG mitigation actions in the Miami Valley Region's two LC Scenarios: Community-First and Energy Transition.

In many cases, actions that create vibrant cities and towns, improve public health outcomes, reduce municipal and state operating and capital costs, and support innovation are the same as or similar to the actions that reduce GHG emissions in the Miami Valley Region — these are called "no-regrets policies."[35] One review of over a dozen studies on GHG mitigation policies found that the co-benefits of reduced air pollution — a single co-benefit — often equaled or exceeded the benefit of the GHG reduction itself.[36]

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[35] Lamia Kamal-Chaoui and Alexis Robert. "Competitive Cities and Climate Change." *OECD Regional Development Working Papers, No. 2009/02*. (December 15, 2009). http://www.oecd-ilibrary.org/governance/competitive-cities-and-climate-change_218830433146

[36] OECD (2000). Ancillary Benefits and Costs of Greenhouse Gas Mitigation. https://www.oecd.org/content/dam/oecd/en/publications/reports/2000/10/ancillary-benefits-and-costs-of-greenhouse-gas-mitigation_g1gh285a/9789264188129-en.pdf

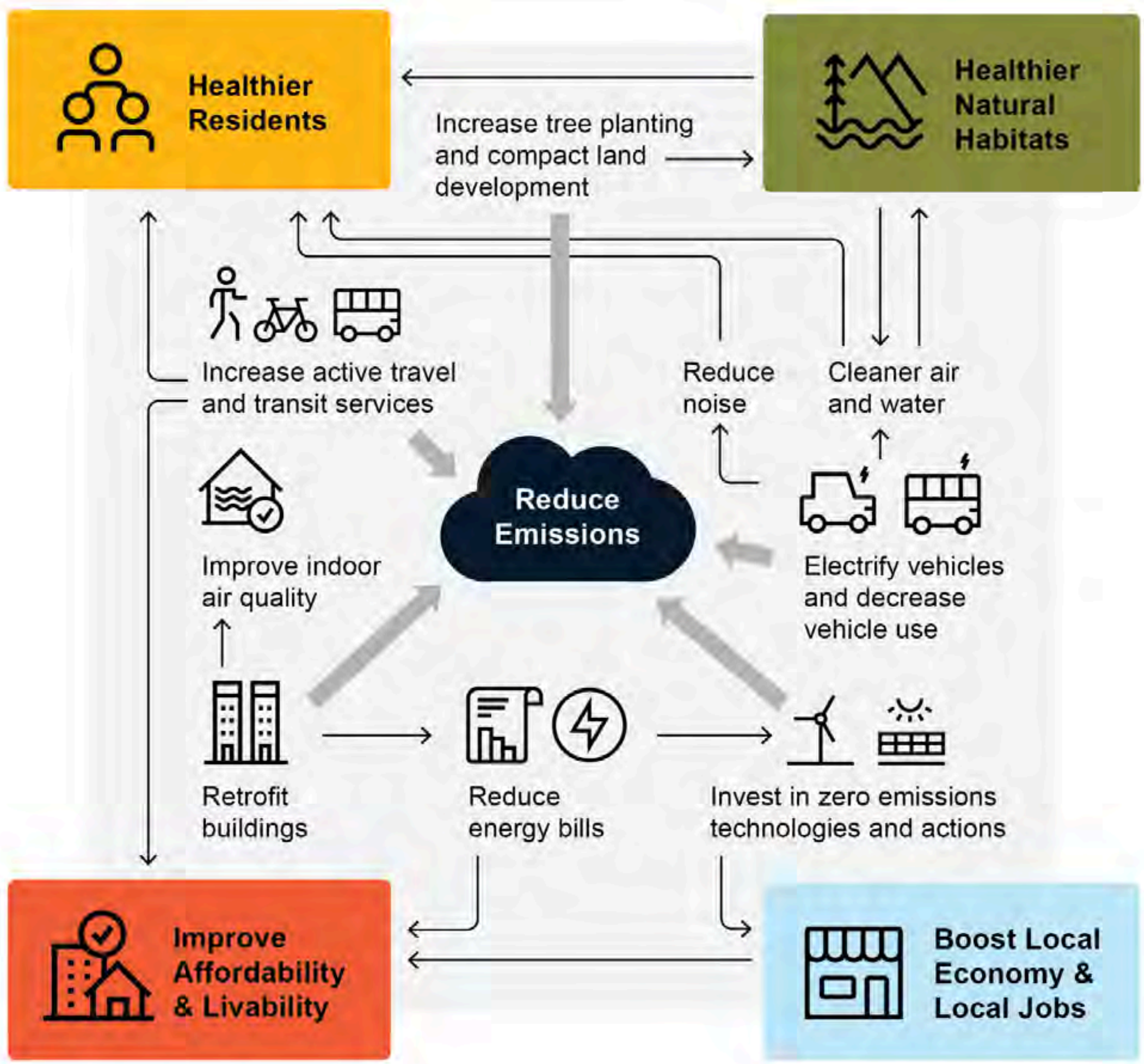

Figure 8.1. Actions that reduce emissions can also support healthier residents and natural habitats, boost local economies, create local jobs and improve affordability and livability. Source: SSG analysis.

8.2 Overview of Co-Benefits and Co-Harms

What Are Co-Benefits and Co-Harms?

The Intergovernmental Panel on Climate Change (IPCC) defines co-benefits as "the positive effects that a policy or measure aimed at one objective might have on other objectives, irrespective of the net effect on overall social welfare."[37] The term co-benefits and its corollary, co-harms, have a variety of synonyms, including "ancillary effects" and "ancillary benefits and costs," and definitions. In this analysis, co-benefits are assumed to be any potential or anticipated benefits of the action in addition to its impact on GHG emissions.

While many GHG reduction measures have positive effects, they can also potentially result in co-harms and the creation of negative feedback cycles.

For example:

- Compact urban development reduces emissions, but without careful design, people could be at risk of exposure to elevated levels of air pollutants as they walk or cycle in close proximity to traffic.
- Infrastructure to reduce emissions requires major investments, and the distributional effects of those investments may favor households with higher incomes at the expense of those with lower incomes.
- Increased costs in urban centers may result in increased lower-cost housing at the edge of cities or outside of their boundaries, leading to an increase in transportation emissions and congestion.

The positive — or negative — effects are often unintentional and specific to local contexts, but governments can intentionally implement actions that reduce emissions in ways that increase positive co-benefits and mitigate or avoid negative ones. This can be achieved through careful policy design that considers and prioritizes GHG emissions alongside health and other impacts.

Not All Co-Benefits or Co-Harms Are Equal

It is helpful to identify and prioritize criteria for evaluating co-benefits, such as:

- **Synergies:** Many low-carbon actions have multiple socio-economic benefits, including improving transit, energy efficiency and compact urban design.

- **Urgency:** Some low-carbon actions, such as conserving wetlands to sequester emissions and promoting compact communities that require less car use, require

[37] Intergovernmental Panel on Climate Change (IPCC). "Glossary." Glossary. In Climate Change 2014 – Impacts, Adaptation and Vulnerability: Part B: Regional Aspects: Working Group II Contribution to the IPCC Fifth Assessment Report, 1757–76. Cambridge: Cambridge University Press, 2014. https://doi.org/10.1017/CBO9781107415386

time to realize their effects, making immediate implementation paramount. These actions must be implemented with a higher degree of urgency in order to avoid loss of inertia on action already taken, lock-in effects,[38] irreversible outcomes or deferred costs that become even more elevated as a result of deferment.

- **Costs:** Taking action earlier is generally cheaper than taking action later, particularly because delayed action involves ongoing investments in infrastructure, activities and utilities that are higher emitting than low-carbon solutions. Examples include investments in renewable energy infrastructure, transit and energy efficiency.
- **Longevity:** Related to urgency, the longevity of investment decisions locks society into their effects for decades, if not centuries.
- **Distribution effects:** Low-carbon actions have varying impacts on different subsets of the population including different income groups, generations (including future generations), neighborhood residents and marginalized populations.

Based on these considerations, decision-makers should prioritize actions that have multiple co-benefits — such as synergies with other priorities, the ability to propel forward momentum, avoiding or reducing future costs, and positive impacts on at-risk and low-income communities.

At-Risk and Low-Income Communities

At-risk and low-income communities were identified by reviewing information about census tracts within the Miami Valley Region using the EPA's Environmental Justice Screening (EJScreen) tool and Climate and Economic Justice Screening Tool (CEJST). For more information about the methodology, see the DMA in Appendix 3.

This section identifies at-risk and low-income communities within the Miami Valley Region. For this project, the CEJST was used to identify census tracts associated with burdens in the following eight categories: climate change, energy, health, housing, legacy pollution, transportation, water and wastewater, and workforce development.[39] This project defines at-risk and low-income communities that meet the income threshold — 65th percentile of low-income — and exceeds one of the burdens within the eight CEJST categories (Figure 8.2). Most at-risk and low-income areas are located within the City of Dayton in Montgomery County.

[38] Lock-in effects describe situations in which the implementation of a strategy or action improves performance of an object or activity in the short term but is prohibitive to future emissions reductions. Lock-in effects may refer to building upgrades or land-use decisions that "lock in" a set level of emissions in the long term. For example, building retrofits that provide limited energy efficiency improvements can create a situation in which no additional improvements in the equipment installed can be expected over the course of its lifetime without considerable additional expense. In this way, lower levels of energy reductions can be locked in for a long period.
[39] Census tracts that exceeded multiple categories and thresholds according to the CEJST.

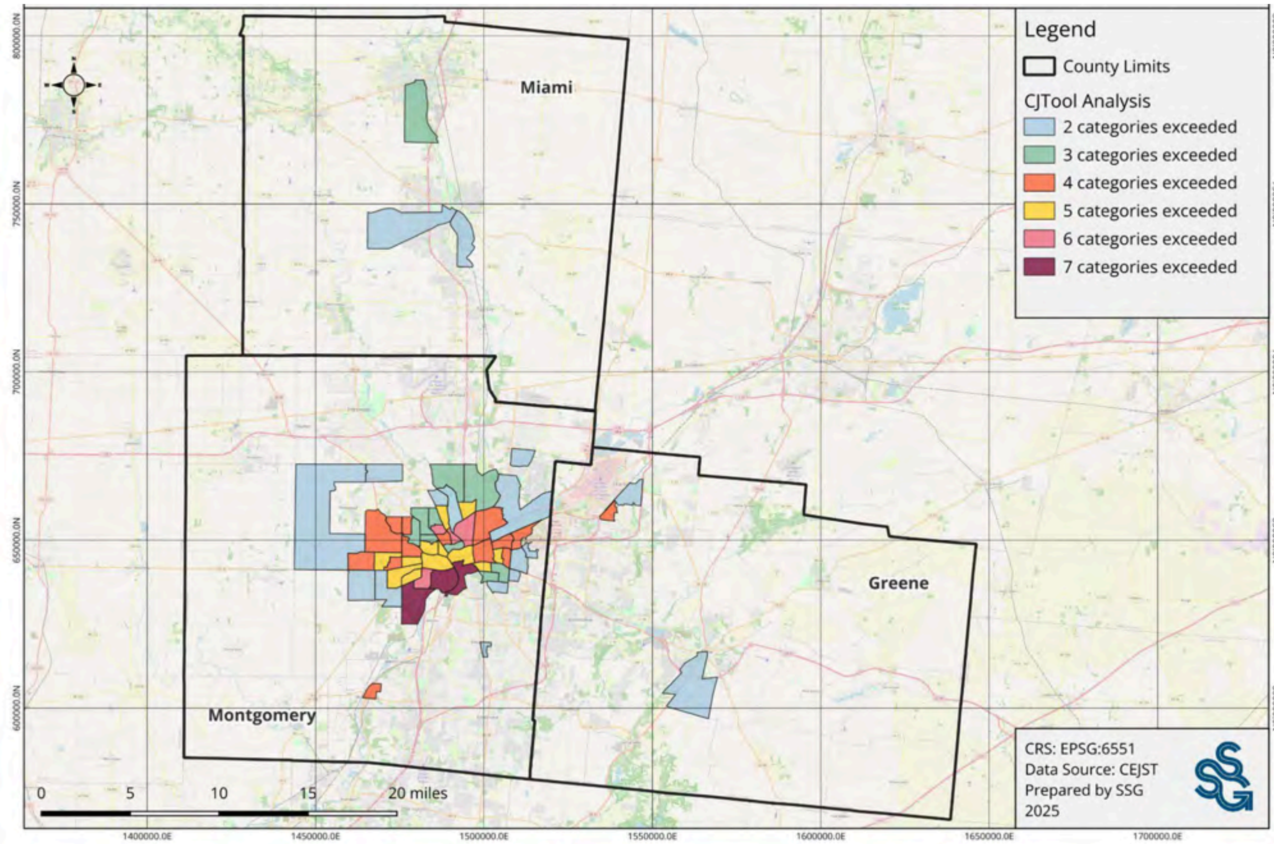

Figure 8.2. Map of at-risk and low-income communities in the Miami Valley Region, identified using the EPA's CEJST/EJScreen tool.[40] Source: Elaborated from the Council on Environmental Quality, 2022.

[40] Council on Environmental Quality (2022). Climate and Economic Justice Screening Tool [Data and Tools]. https://screeningtool.geoplatform.gov/en/#8.84/40.0938/-84.6887

8.3 Co-Benefits in the Miami Valley CCAP

Co-benefits and co-harms were quantified or assessed qualitatively for the Miami Valley Region as a whole for its two pathways, Community-First and Energy Transition. Co-benefits and co-harms for at-risk and low-income communities are woven throughout the assessment. Table 8.1 provides a summary of the assessment and analytical method used. This table constitutes a comprehensive but incomplete list of co-benefits and co-harms resulting from the actions in the Miami Valley CCAP.

Table 8.1. Overview of co-benefit and co-harm categories, specific impacts and indicators, and the analytical method used. Source: SSG analysis.

Category	Impact Overview	Analytical Method
Co-Benefit: Health		
Outdoor air quality	Improved outdoor air quality	• Calculated using air pollutants from modeling inputted into EPA's Co-Benefits Risk Assessment (COBRA) tool
Indoor air quality	Improved air quality inside homes and businesses	• Correlation between use of gas appliances in the home and indoor air quality
Physical and emotional well-being	Increased physical activity; increased mental well-being	• Relationship between VMT and indicators of physical and mental health
Noise	Decreased exposure to noise	• Relationship between noise and health impacts (for urban areas only); impact of EVs on noise levels
Occupant comfort	Improved occupant comfort	• Correlation between retrofits, improved indoor air quality and health and social benefits
Co-Benefit: Economic Prosperity		
Employment	New employment opportunities created; lost existing employment opportunities[41]	• Employment multipliers for every dollar spent on decarbonization
Poverty	Reduced household building and transportation costs due to energy efficiency	• Calculated in the ScenaCommunity model (change in expenditures on transportation and housing)[42]

[41] See the Workforce Analysis section for more details.
[42] See the DMA Manual in Appendix 3 for more information about SSG's ScenaCommunity model.

Category	Impact Overview	Analytical Method
Intergenerational	Reduced damage caused by climate change due to reduced GHG emissions	Calculated in the ScenaCommunity model using the social cost of carbon values by RFF.[43]

8.4 Co-Benefits and Co-Harms: Health

8.4.1 Outdoor Air Quality

Observations

One of the most beneficial and immediate health co-benefits of reducing GHG emissions is improved air quality. Cleaner air reduces the risk of premature death and supports better health outcomes for residents in the Miami Valley Region.

Climate change will increase the likelihood of conditions that exacerbate poor air quality. Burning fossil fuels such as gasoline, diesel and natural gas releases air pollutants in addition to GHGs. These pollutants — including SO_2, NOx, particulate matter, CO, polycyclic aromatic hydrocarbons, mercury and VOCs — have adverse impacts on human health.

One of the key indicators of air pollution is PM2.5. This particulate matter is dangerous because it can enter the blood system by penetrating the lung barrier, causing many health issues. Air pollution can harm human health from prenatal development through old age. It also damages the lungs, heart, brain, skin and other organs, and causes disease, disability and death. Air pollution from fossil fuels has been linked to the development of neurological disorders, including Parkinson's disease, Alzheimer's disease and other dementias; acute bronchitis in children; asthma and other respiratory illnesses; heart disease; stroke; and an increased risk of cancer, among other impacts.

According to World Health Organization (WHO) guidelines, annual average concentrations of PM2.5 should not exceed 5 micrograms per cubic meter.[44] In 2020, Ohio exceeded this target, with an overall average of 7.9 micrograms per cubic meter of PM2.5. All of the state's counties also exceeded this limit, as shown in Figure 8.3. Montgomery, Greene and Miami counties had some of the highest levels of air pollution across Ohio, with 10.3, 9.3 and 8.8 micrograms per cubic meter of PM2.5, respectively.

[43] Brian C. Prest, Kevin Rennert, Richard G. Newell, Jordan Wingenroth. "Social Cost of Carbon Explorer." *Resources for the Future*. (September 1, 2022). https://www.rff.org/publications/data-tools/scc-explorer/
[44] C40 Knowledge Hub (September 2021). WHO air quality guidelines. https://www.c40knowledgehub.org/s/article/WHO-Air-Quality-Guidelines?language=en_US

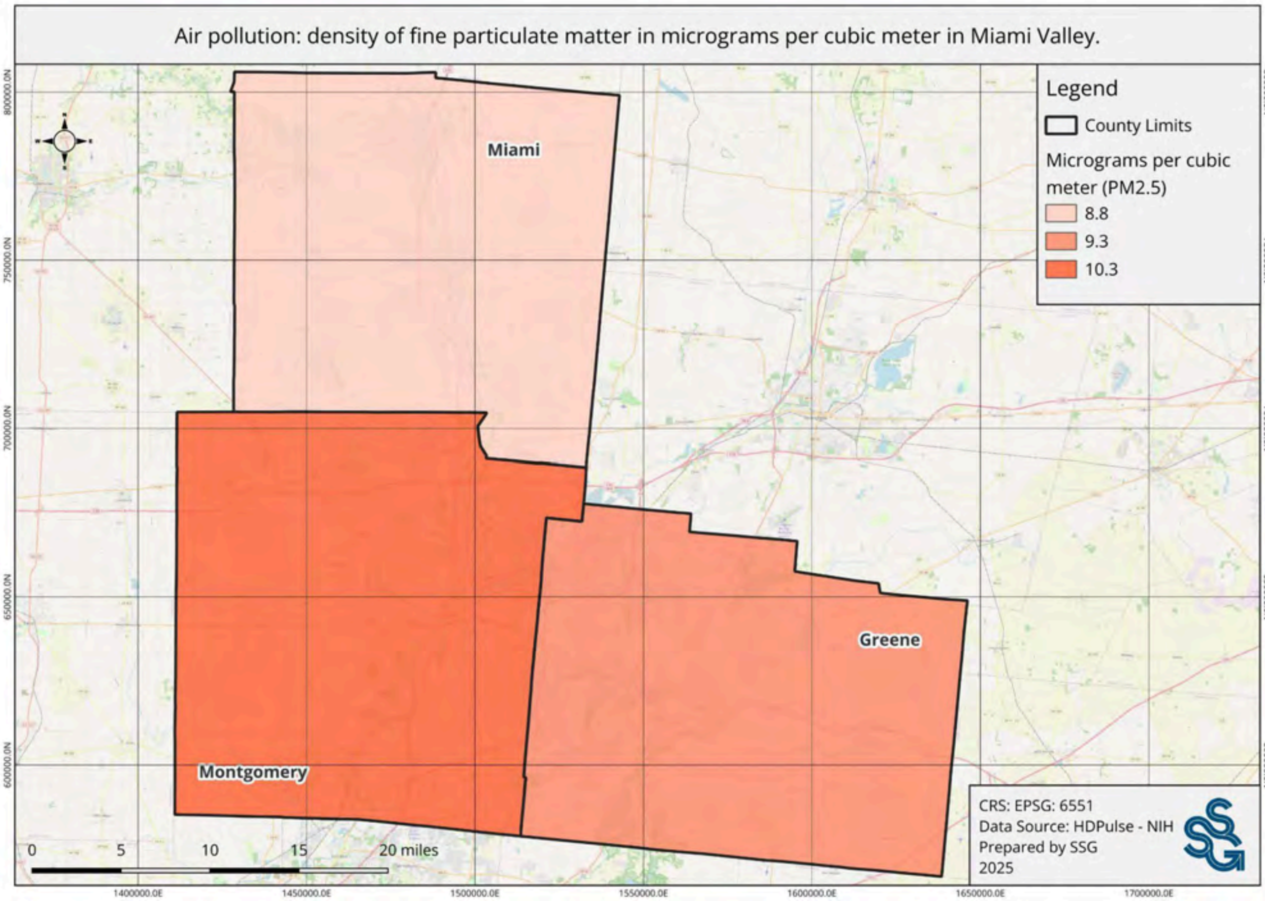

Figure 8.3. Average daily density of PM2.5 in micrograms per cubic meter for Ohio by county, 2020.[45] Source: Elaborated from the Council on Environmental Quality, 2022.

Air pollution does not impact everyone equally. Those with asthma are sensitive to poor air quality; as of 2022, asthma rates among adults in Montgomery, Greene and Miami counties were 11.1%, 10.8%, and 10.7%, respectively.[46] Outdoor workers and farmworker communities are particularly at risk of exposure to air pollutants from transportation and industrial activities, in addition to wildfire smoke and ozone. Air pollution also increases cancer risk.

The EPA's 2020 Air Toxics Screening Assessment assessed which air toxics may pose health risks across the country. Figure 8.4 highlights projected cancer risks by the air

[45] National Environmental Public Health Tracking Network from the CDC. Average daily density of fine particulate matter in micrograms per cubic meter (PM2.5). https://hdpulse.nimhd.nih.gov/data-portal/physical/map
[46] Centers for Disease Control and Prevention (December 2024). PLACES: Local Data for Better Health, County Data 2024 release. https://data.cdc.gov/500-Cities-Places/PLACES-Local-Data-for-Better-Health-County-Data-20/swc5-untb/about_data

pollution source group for the Miami Valley Region.[47] The top sources of air pollution that may cause cancer risk in the counties include non-point sources (e.g., residential wood combustion, solvents), biogenics (e.g., trees and other natural sources), and on-road sources (e.g., vehicles). Point emissions refer to — usually large — fixed sources like factories or power plants. Non-road sources include equipment and vehicles that do not operate on roads, such as from construction, lawn and garden, recreational vehicles, and others. The fire category relates to emissions from events like wildfires or prescribed burns. Non-emissions refer to pollutants not directly released into the air, such as background levels or those formed through chemical reactions in the atmosphere.

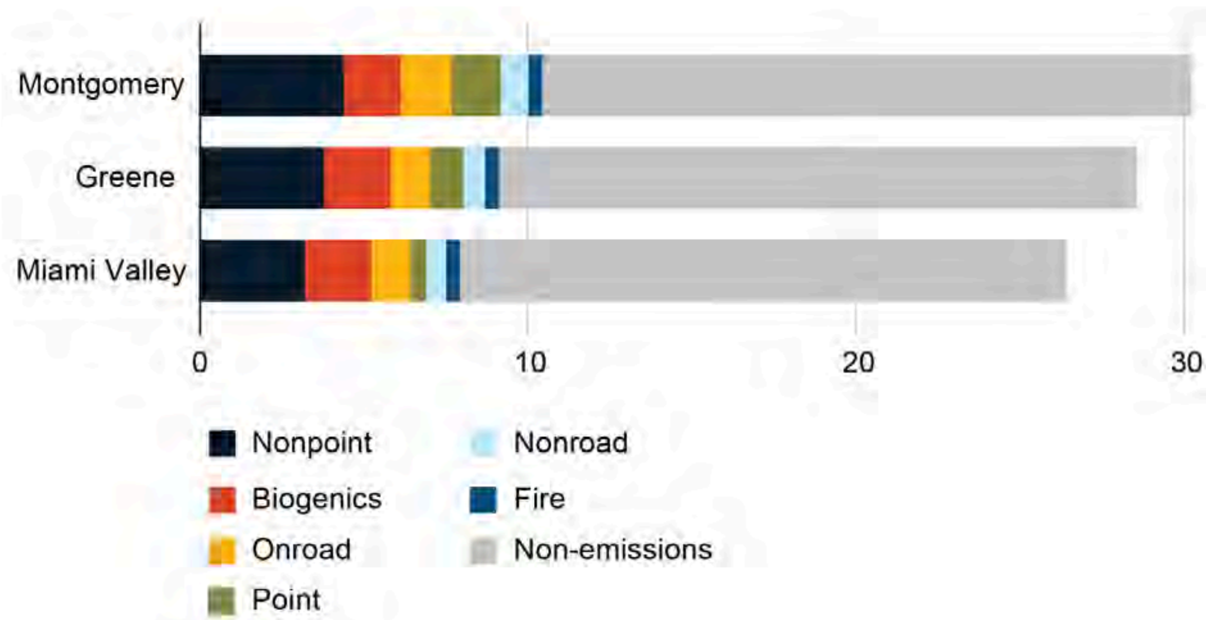

Figure 8.4. Cancer risk (per million) by air pollution source group in the Miami Valley Region. Source: 2020 AirToxScreen Emissions.[48]

High rates of energy burden (costs) and PM2.5 pollution levels are experienced by people living in at-risk and low-income communities in the Miami Valley Region due to air pollution from industrial sources across the region (e.g., cement industry, paper and rubber industries), other manufacturing industries (e.g. food and metal), and energy generation based on natural gas.

Figure 8.5 highlights the distribution of industries and census tracts facing energy burden (e.g., costs) and PM2.5 pollution levels across the region. Due to the nature of the air pollution sources — namely industries and non-point and on-road emissions — urban and

[47] Cancer sources that were not emissions groups, including background and secondary sources, are not included in this figure. Source: U.S. EPA (January 2025). 2020 AirToxScreen: Assessment Results. https://www.epa.gov/AirToxScreen/2020-airtoxscreen-assessment-results
[48] ibid.

suburban areas present higher levels of air pollution and concentrate most of the population experiencing these burdens (i.e., energy burden and PM2.5). The southern region of Montgomery County has the highest concentrations of air pollution.

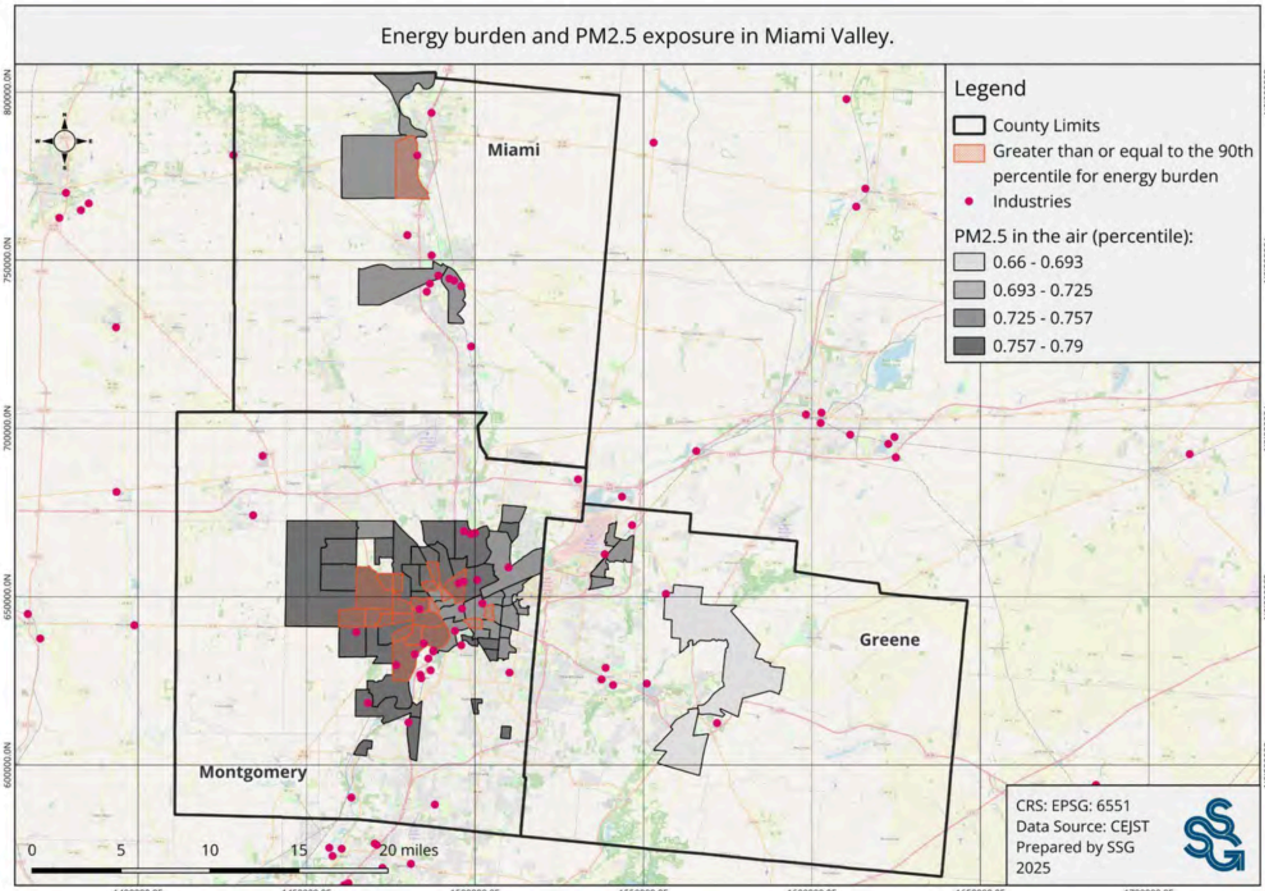

Figure 8.5. Energy burden and PM2.5 exposure in the Miami Valley Region. Source: Elaborated from the Council on Environmental Quality, 2022.

Actions That Reduce Outdoor Air Pollution and GHG Emissions Simultaneously in the Miami Valley Region

Actions in the buildings, energy, waste and transportation sectors (Table 8.2) will help reduce the amount of fossil fuels burned and associated outdoor air pollution in the Miami Valley Region. These include, but are not limited to, fuel switching heating, electrifying vehicles, and increasing energy efficiency in new buildings and industrial processes.

Table 8.2. Overview of GHG emissions reduction measures in the Miami Valley CCAP that will also reduce outdoor air pollution by sector and scenario (CF = Community-First, ET = Energy Transition). Source: SSG analysis.

Sector	Actions	CF	ET
Buildings	- Switch fuel use for heating and cooling	✓	✓
	- Improve energy efficiency in new buildings	✓	✓
	- Electrify water heaters	✓	✓
	- Expand use of high-performance stoves	✓	
Transportation	- Electrify vehicles	✓	✓
	- Increase transit and active modes	✓	
Waste	- Reduce waste generation per capita	✓	✓
Energy	- Increase renewable energy in buildings	✓	✓
	- Increase renewable energy for industrial processes	✓	✓
Industry	- Increase energy efficiency in industrial processes and agriculture	✓	✓
	- Deploy hydrogen for industrial processes		✓
	- Adopt carbon capture and storage		✓
	- Electrify industrial processes	✓	✓

Impacts

These actions are projected to reduce GHG emissions while also reducing other co-pollutants including particulate matter, NOx and VOCs. Table 8.3 highlights the projected co-pollutant released in the BAU, BAP, Community-First and Energy Transition Scenarios. Both LC Scenarios result in a significant reduction of co-pollutants within the region.

Table 8.3. Fossil fuel combustion and related co-pollutants released in the Miami Valley CCAP scenarios. Source: SSG analysis.

Sectors	Base Year	BAU (2050)	BAP (2050)	CF (2050)	ET (2050)
MMBTU fossil fuels combusted (millions)	93.4	65.8	62.8	5.8	12.9
Cumulative MMBTU of fossil fuels combusted (millions)	-	2,234	2,171	1,321	1,407
Particulate matter PM2.5 released (US tons)	786.1	622.2	588.7	97.3	127.6
Particulate matter PM10 released (US tons)	707.2	586.1	551.8	67.7	97.5
NOx released (US tons)	7,894.6	4,644.8	4,527.4	161.9	364.9
SO2 released (US tons)	439.2	428.5	411.2	112.5	149.6
VOCs released (US tons)	2,515.8	2,052.2	2,019.1	88.1	119.9

These reductions in outdoor air pollution will have particular benefits for people living in areas with high traffic volumes. Figure 8.6 illustrates areas with high levels of traffic alongside projected reductions in PM2.5 in the Community-First Scenario. Urban areas in Dayton currently have high levels of traffic. Low-carbon actions, including electrifying vehicles and increasing active transportation, will contribute to air pollution reductions in these urban areas, directly benefiting the residents who live there.

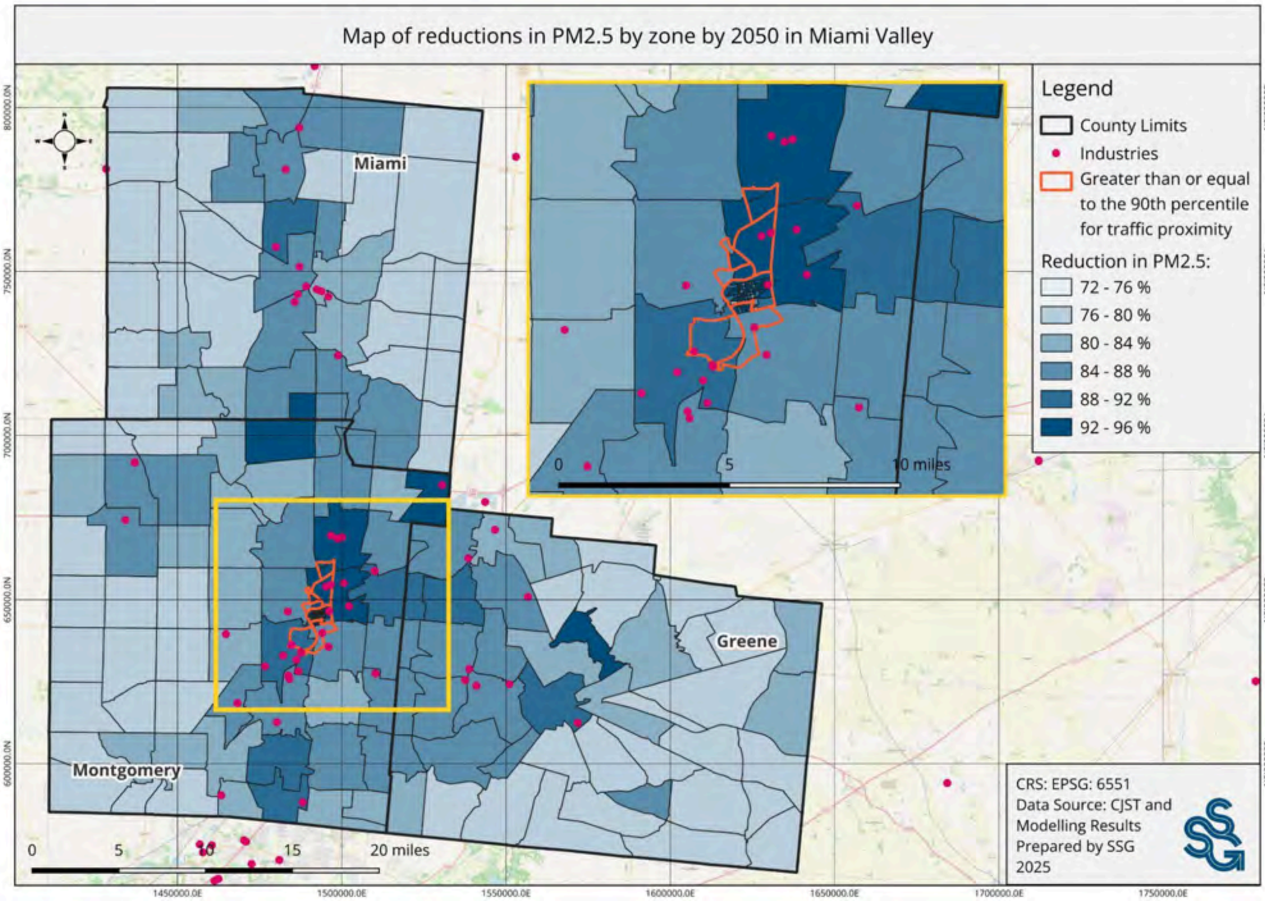

Figure 8.6. Map of reductions in PM2.5 by zone by 2050 in relation to current areas with high levels of traffic proximity in the Miami Valley Region, in the Community-First Scenario. Source: Elaborated from the Council on Environmental Quality, 2022.

Reductions in outdoor air pollution will also have positive health-related economic benefits. Using the EPA's COBRA tool, the cumulative effects of actions across all major energy sectors would result in total health benefits of approximately $464 million annually by 2050, in the Community-First Scenario (Figure 8.7). This indicator incorporates avoided costs and incidences due to reduced air pollution of estimated mortalities for adults and infants, non-fatal heart attacks, hospital admissions for respiratory issues, restricted activity days, work loss days and asthma attacks. The COBRA analysis was conducted on a per county basis for the years 2028 and 2050.

The largest health benefits are due to a decrease in the mortality rate, accounting for more than 98% of the total average savings in the year 2050. Nonfatal heart attacks and reductions in infant mortality save more than $460,000 annually. The main pollutant reductions result from decreasing the burning of natural gas, gasoline and diesel, thereby avoiding the release of NO_2, PM2.5 and VOCs. Gasoline-based light-duty vehicles are major contributors to NO_2 emissions, while SO_2 emissions come primarily from industrial processes, such as the use of coal as fuel and emissions from the cement industry. PM2.5 and VOCs come from a variety of sources, including biogenic emissions, light-duty vehicles, solvent use and off-road equipment.

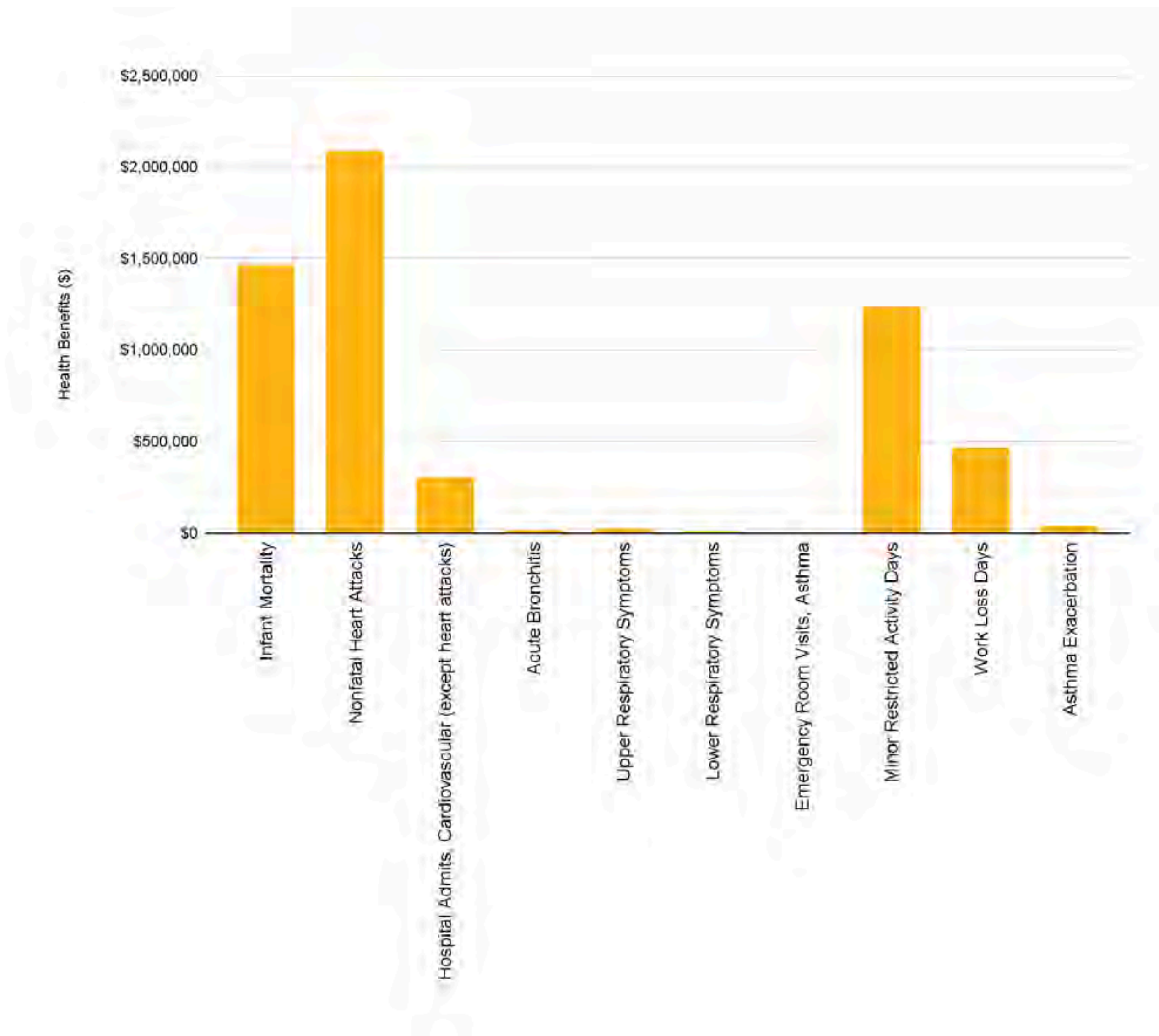

Figure 8.7. Annual health benefits in dollars by health-related indicators in the Community-First Scenario, 2050. Source: Elaborated using EPA's COBRA tool.

8.4.2 Indoor Air Quality

Observations

Americans spend approximately 90% of their lives indoors. Indoor environments can have concentrations of pollutants two to five times higher than typically found outdoors. Those who are most susceptible to the negative effects of air pollution — such as young children and older adults, or those with respiratory and cardiovascular issues — tend to spend even more time indoors, heightening the impact of exposure, particularly from appliances that burn fossil fuels. Cooking appliances can release harmful combustion by-products such as CO and particulate matter directly into the indoor environment. As of 2020, approximately one-third, or 34%, of homes in Ohio were equipped with natural gas stoves for cooking.[49] This is lower than the national average of 38%, and in the Miami Valley Region this trend is even lower, where only 17% of homes use natural gas stoves.

Appliances such as gas heat pumps and hot water heaters can also release chemicals into the immediate environment outside of buildings and homes, which can then get inside buildings through ventilation systems and doors and windows. Each coupling or link of the gas system, from extraction through transmission and distribution, provides an opportunity for gas (methane) to leak as a result of equipment wear and failure or accidental force or puncture. It is estimated that total leaks in the local gas distribution systems in the U.S. are at least five times greater than the amount reported to the EPA.[50]

There is increasing evidence about the health impacts, particularly on children, of using natural gas stoves and fireplaces indoors.[51] Cooking with gas stoves can spike emissions of nitrogen dioxide and CO to levels higher than outdoor standards set by the EPA and some states.[52] According to the Rocky Mountain Institute, homes with gas stoves can have nitrogen dioxide levels that are 50%-400% higher than homes with electric stoves.[53] Even in low concentrations, nitrogen dioxide is a toxic gas that can trigger breathing problems for those who live with asthma or chronic obstructive pulmonary disease (COPD) and increase the risk of respiratory infections, particularly in children. Ongoing exposure can lead to acute or chronic bronchitis.[54,55] A meta-analysis of the effects of nitrogen dioxide found that children who live in homes equipped with gas stoves have about a 20% increased risk of developing a

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[49] U.S. Energy Information Administration. 2020 Residential Energy Consumption Survey. Highlights for appliances in U.S. homes by state, 2020. https://www.eia.gov/consumption/residential/data/2020/state/pdf/State%20Appliances.pdf
[50] Zachary D. Weller, Steven P. Hamburg, Joseph C. von Fischer, "A National Estimate of Methane Leakage from Pipeline Mains in Natural Gas Local Distribution Systems." *Environmental Science & Technology* 54, no. 14 (July 21, 2020): 8958–67. https://doi.org/10.1021/acs.est.0c00437
[51] Brady Seals and Andee Karasner. (2020). Gas Stoves: Health and Air Quality Impacts and Solutions. RMI. https://rmi.org/insight/gas-stoves-pollution-health
[52] ibid.
[53] Brady Seals. "Indoor Air Pollution: The Link between Climate and Health." *RMI*. (May 5, 2020). https://rmi.org/indoor-air-pollution-the-link-between-climate-and-health/
[54] U.S. EPA (May 2025). Nitrogen Dioxide's Impact on Indoor Air Quality. https://www.epa.gov/indoor-air-quality-iaq/nitrogen-dioxides-impact-indoor-air-quality
[55] Weiwei Lin, Bert Brunekreef, Ulrike Gehring. "Meta-Analysis of the Effects of Indoor Nitrogen Dioxide and Gas Cooking on Asthma and Wheeze in Children." *International Journal of Epidemiology* 42, no. 6 (December 1, 2013): 1724–37. https://doi.org/10.1093/ije/dyt150

respiratory illness.[56] Children are particularly susceptible to illnesses associated with air pollution due to having higher breathing rates, greater levels of physical activity, higher lung surface-to-body weight ratios and immature respiratory and immune systems.[57]

Part of the danger of indoor natural gas use stems from undetected leaks at the endpoints of the distribution system, particularly with indoor appliances such as gas stoves. Methane, the main component of natural gas, is odorless, so odorants are added to help detect leaks; however, the level of odorants in the gas distribution can be inconsistent, causing leaks to go undetected. A 2021 study in California found that home cooktops, ovens and broilers emit methane even when they are completely turned off, regardless of the age and price of the appliance.[58] In a Massachusetts study examining samples of unburned natural gas in 69 homes over 16 months, researchers found 21 “air toxics,” hazardous pollutants known or suspected to cause cancer, birth defects or other health effects. These toxics included hexane, toluene, heptane, cyclohexane and benzene, which was found in 95% of the samples.[59] Exposure to benzene can cause drowsiness, dizziness, headaches and eye and skin irritations and can even increase the long-term risk of blood disorders and cancers such as leukemia.[60]

Lower-income households and communities of color may be disproportionately impacted by indoor air pollution, as these groups are more likely to live in older, smaller homes with poor ventilation; share the home with more people (higher occupant density); lack adequate stove top ventilation; and have higher rates of asthma and other respiratory diseases due to other sources of pollutants.[61] In some cases, lower-income households may experience more exposure to pollutants from gas stoves if they are used as a source of heat when other heating systems are broken, inefficient or not working properly.[62]

Figure 8.8 highlights the distribution of homes without adequate indoor plumbing or kitchen facilities and census tracts with communities with high levels of asthma in the Miami Valley Region. Multiple census tracts within Montgomery County have both high levels of asthma and inadequate plumbing or kitchen facilities, suggesting that indoor air pollutants may contribute to high occurrences of asthma in these areas.

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[56] Vic Hasselblad, David M. Eddy, Dennis J. Kotchmar. “Synthesis of Environmental Evidence: Nitrogen Dioxide Epidemiology Studies.” *Journal of the Air & Waste Management Association* 42, no. 5 (May 1, 1992): 662–71. https://doi.org/10.1080/10473289.1992.10467018
[57] Brady Seals and Andee Karasner. “Gas Stoves.”
[58] Eric D. Lebel, Colin J. Finnegan, Zutao Ouyang, Robert B. Jackson. “Methane and NOx Emissions from Natural Gas Stoves, Cooktops, and Ovens in Residential Homes.” *Environmental Science & Technology* 56, no. 4 (February 15, 2022): 2529–39. https://doi.org/10.1021/acs.est.1c04707
[59] Drew R. Michanowicz et al. “Home Is Where the Pipeline Ends: Characterization of Volatile Organic Compounds Present in Natural Gas at the Point of the Residential End User.” *Environmental Science & Technology* 56, no. 14 (July 19, 2022): 10258–68. https://doi.org/10.1021/acs.est.1c08298
[60] Elena Shao. “Gas Piped Into Homes Contains Benzene and Other Risky Chemicals, Study Finds.” *The New York Times*. (June 28, 2022). https://www.nytimes.com/2022/06/28/climate/natural-gas-home-toxic-chemicals.html
[61] Brady Seals and Andee Karasner. “Gas Stoves.”
[62] Brady Seals and Andee Karasner. “Gas Stoves.”

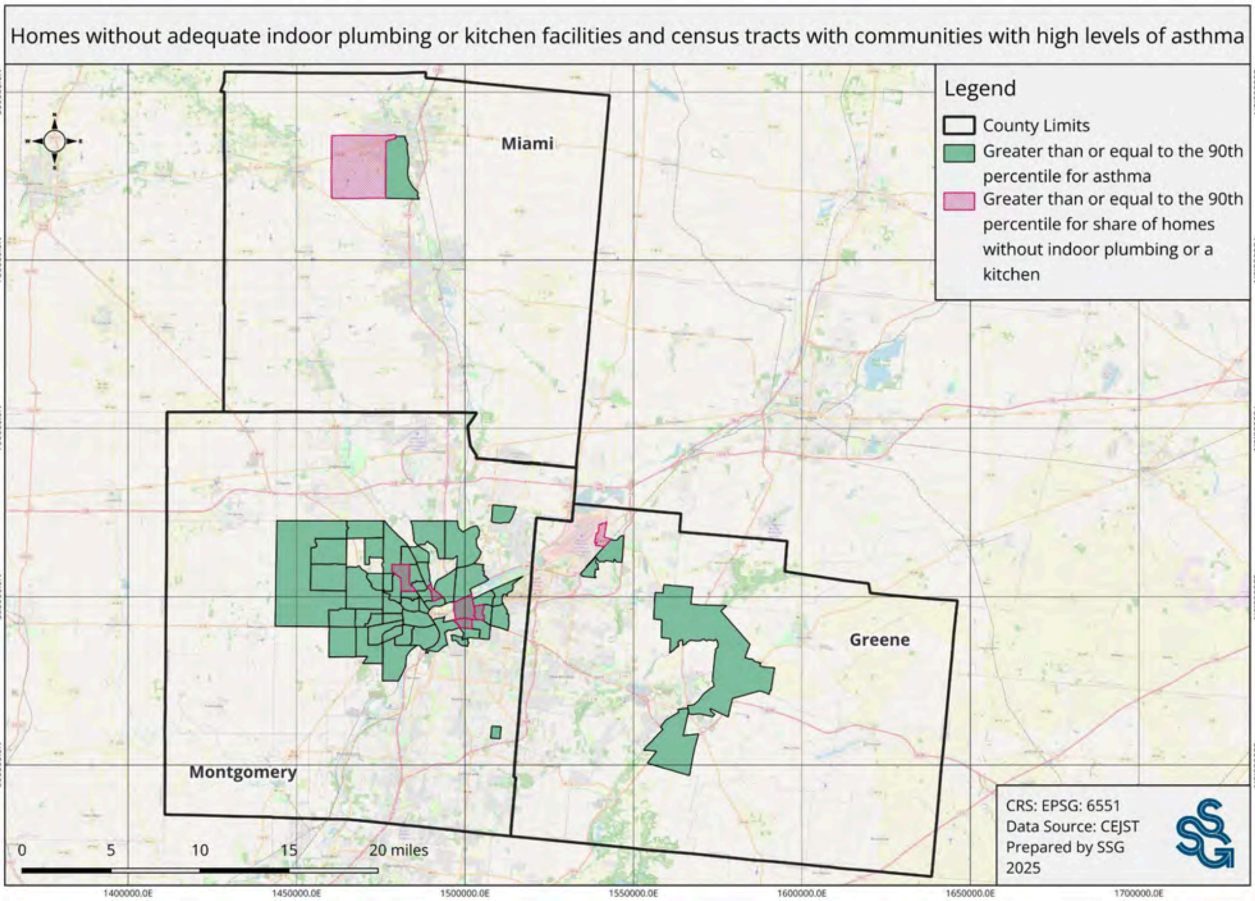

Figure 8.8. Homes without adequate indoor plumbing or kitchen facilities and census tracts with communities with high levels of asthma in the Miami Valley Region. Source: Elaborated from the Council on Environmental Quality, 2022.

Actions That Reduce Indoor Air Pollution and GHG Emissions Simultaneously in the Miami Valley Region

Several actions can be taken in the buildings sector (Table 8.4) to help reduce indoor air pollution while also reducing the amount of fossil fuels burned in the Miami Valley Region.

Table 8.4. Overview of GHG emissions reduction measures in the Miami Valley CCAP that will also reduce indoor air pollution by sector and scenario. Source: SSG analysis.

Sector	Actions	CF	ET
Buildings	- Switch fuel use for heating and cooling	✓	✓
	- Improve energy efficiency in new buildings	✓	✓
	- Electrifying water heaters	✓	✓
	- Expand use of high-performance stoves	✓	

Impacts

Residents of the Miami Valley Region will benefit from reduced exposure to indoor air pollutants as a result of the actions taken in the two LC Scenarios compared to the BAU Scenario (Table 8.5). The amount of natural or RNG used in commercial buildings is expected to decrease by almost 79% in the Energy Transition Scenario compared to the BAP Scenario.

Table 8.5. Energy used (MMBtu) by fuel source in commercial buildings in 2050 in the Miami Valley CCAP scenarios. Source: SSG analysis.

Sectors*	BAU	BAP	CF	ET
Natural Gas or RNG	23,167,168	22,920,972	7,689,746	4,958,991
Local and Grid Electricity	12,891,545	12,802,844	13,540,019	14,282,781
Wood	508	508	195	195
Propane	381409.8	373626.7	157344.4	184,710
Fuel Oil	172136	169822.9	16832.5	44,005
Hydrogen	0	0	0	3,658,825

*Does not include energy from fuel oil, propane, district energy, solar or other sources.

8.4.3 Physical and Emotional Well-Being

Observations

Another health co-benefit of reducing GHG emissions is improving the physical and emotional well-being of residents. According to the University of Wisconsin Population Health Institute's County Health Rankings, Greene and Miami counties tend to have better overall health outcomes compared to the Ohio state average and are comparable to national figures. However, residents of Montgomery County generally have slightly worse outcomes than the state and national average.[63] One key indicator for this is premature death, which measures the years of life lost to deaths of people under age 75, per 100,000 people. Figure 8.9 shows that Miami and Greene counties had lower years of potential life lost per capita than Ohio, while Montgomery residents had noticeably higher levels of premature death.

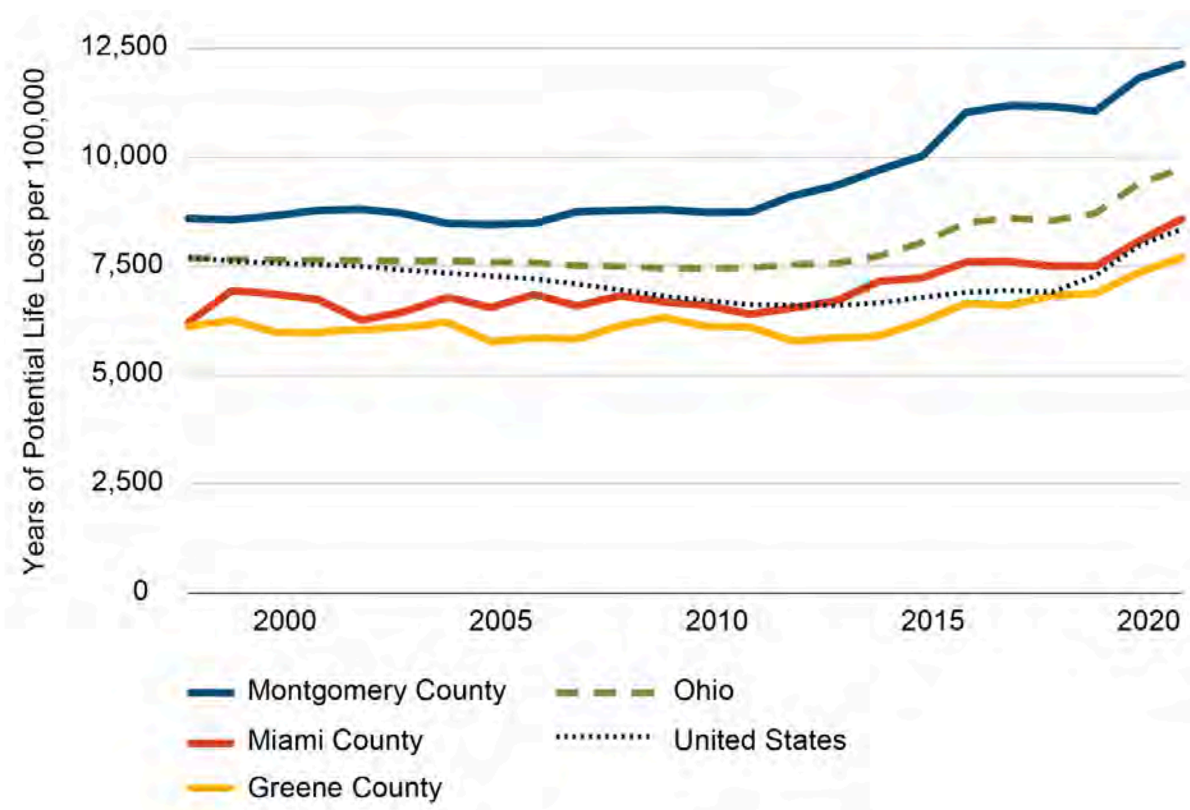

Figure 8.9. Age-adjusted years of potential life list per 100,000 population in the Miami Valley Region, Ohio and the U.S.[64] Source: Adapted from the University of Wisconsin Population Health Institute, 2025.

[63] University of Wisconsin Population Health Institute. (2025). County Health Rankings. Retrieved from: https://www.countyhealthrankings.org/health-data/ohio

[64] University of Wisconsin Population Health Institute. (2025). County Health Rankings. Retrieved from: https://www.countyhealthrankings.org/health-data/ohio

Another indicator of physical well-being is the prevalence of chronic conditions. These include COPD, emphysema or chronic bronchitis, heart disease, diabetes, chronic kidney disease and high BMI. As of 2018, 50%, 44% and 41% of Montgomery, Miami and Greene county residents, respectively, reported having one of these chronic conditions.[65] These conditions can increase the risk of severe illness. They can also lead to more frequent hospitalizations, longer recovery times and higher overall healthcare needs.

Regular physical activity can improve overall health and fitness, reduce the risk of premature mortality and many chronic diseases, and contribute to happiness and reduced anxiety. People living in cities and neighborhoods with more compact urban forms and robust public transportation are less likely to experience hypertension.[66] When people switch from driving to using public transit, their physical activity is likely to increase by eight to 33 minutes per day.[67] Studies have shown that children who walk or bike to school are more fit than those who travel by car or bus.[68]

Getting around on foot or by bike can also reduce the risk of premature death. Studies have shown that the relative risk of premature mortality was 30%-40% less among those who used active transportation compared to those who did not or did not get similar amounts of leisure time exercise.[69,70] Similarly, studies have found that cycling to work also reduced all-cause mortality rates by 40%.[71] Increasing physical activity among Miami Valley Region residents who have, or have experienced, one or more chronic diseases could help improve their overall physical health.[72]

Increasing access to green spaces and parks also increases community levels of physical activity. Residents in neighborhoods with ample green space are three times more likely to be physically active and 40% less likely to be overweight than those in neighborhoods with limited green space.[73] Seniors living in neighborhoods with walkable green spaces nearby may live longer on average.[74]

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[65] ArcGIS Hub (2020). Selected Chronic Conditions by U.S. County, 2018. https://hub.arcgis.com/apps/cdcarcgis::selected-chronic-conditions-by-u-s-county-2018-1/explore
[66] Reid Ewing and Richard Kreutzer (May 2006). Understanding the Relationship Between Public Health and the Built Environment. A Report Prepared for the LEED-ND Core Committee. https://www.usgbc.org/sites/default/files/public-health-built-environment.pdf
[67] Chris Rissel, Nada Curac, Mark Greenaway, Adrian Bauman. "Physical Activity Associated with Public Transport Use—A Review and Modelling of Potential Benefits." *International Journal of Environmental Research and Public Health* 9, no. 7 (2012): 2454–2478. https://doi.org/10.3390/ijerph9072454
[68] Christine Voss and Gavin Sandercock. "Aerobic fitness and mode of travel to school in English schoolchildren." *Medicine & Science in Sports & Exercise* 42, no. 2 (2010):281–7. https://doi.org/10.1249/mss.0b013e3181b11bdc
[69] Lars Bo Andersen, Peter Schnohr, Marianne Schroll, Hans Ole Hein. "All-cause mortality associated with physical activity during leisure time, work, sports, and cycling to work." *Archives of Internal Medicine* 160 (2000):1621–8. https://doi.org/10.1001/archinte.160.11.1621
[70] Charles E. Matthews et al. "Influence of exercise, walking, cycling, and overall nonexercise physical activity on mortality in Chinese women." *American Journal of Epidemiology* 165 (2007):1343-50. https://doi.org/10.1093/aje/kwm088
[71] Lars Bo Andersen et al. "All-Cause Mortality Associated With Physical Activity."
[72] Oregon Health Authority, Public Health Division, Health Promotion and Chronic Disease Prevention section, "Chronic Diseases among Oregon Adults, by County, 2014-2017."
[73] Commission for Architecture and the Built Environment (n.d.). Future Health: Sustainable places for health and well-being. https://www.designcouncil.org.uk/fileadmin/uploads/dc/Documents/future-health-full_1.pdf
[74] R. Bray, C. Vakil, D. Elliot. (2005). Report on Public Health and Urban Sprawl in Ontario: A review of the pertinent literature. Ontario College of Family Physicians.

The COVID-19 pandemic temporarily shifted transportation mode patterns. Many people no longer had to commute long distances by car and could spend more time walking or biking closer to home. These shifts, even if temporary, revealed that latent demand for active transportation modes may be higher than previously assumed.

If such latent demand is met, residents may experience relief or even joy. People who walk and bike to work are happier with their commutes; those who travel by car or transit in heavily congested areas are less happy with their commutes.[75] When done intentionally and for reasons unrelated to affordability, giving up a car is shown to have a positive effect on feelings of life satisfaction and joy, two positive indicators of subjective well-being, for up to three years after the event.[76] Those who spend long periods driving have higher odds of being smokers, getting insufficient physical activity and sleep, and having poor physical and mental health.[77]

Potential Co-Harms

Active travel, through cycling and walking, is beneficial for health due to increased physical activity but may also expose people to higher levels of air pollution. However, a recent study showed that the benefits of physical activity far outweigh risks from air pollution, even under the most extreme levels of active travel.[78] Additionally, planting a tall vegetation barrier along busy roads can significantly mitigate increased exposure to air pollution, as plants can capture air pollution particulates on their leaves.[79,80] Furthermore, the more people who walk and cycle, the more drivers become accustomed to looking out for them — researchers have found that doubling the number of people who walk in a given area would reduce the risk of injury to each individual walker by approximately one-third.[81]

Actions That Increase Physical and Emotional Well-Being and Reduce GHG Emissions Simultaneously in the Miami Valley Region

One action that can simultaneously improve the physical and emotional well-being of residents while decreasing emissions is increasing active transportation modes, as shown in Table 8.6.

[75] Oliver Smith. "Commute Well-Being Differences by Mode: Evidence from Portland, Oregon, USA," *Journal of Transport & Health* 4 (March 1, 2017): 246–54. https://doi.org/10.1016/j.jth.2016.08.005
[76] Ann-Kathrin Hess. "The Relationship between Car Shedding and Subjective Well-Being." *Transportation Research Interdisciplinary Perspectives* 15 (September 1, 2022): 100663. https://doi.org/10.1016/j.trip.2022.100663
[77] Ding Ding et al. "Driving: A Road to Unhealthy Lifestyles and Poor Health Outcomes," *PLOS ONE* 9, no. 6 (June 9, 2014): e94602. https://doi.org/10.1371/journal.pone.0094602
[78] Marko Tainio et al. "Can Air Pollution Negate the Health Benefits of Cycling and Walking?" *Preventive Medicine* 87 (June 2016): 233–36. https://doi.org/10.1016/j.ypmed.2016.02.002
[79] Aysha Khan. "Plants By School Playgrounds Protect Kids From Road Pollution, Study Finds." *Next City*. (August 29, 2022). https://nextcity.org/urbanist-news/plants-by-school-playgrounds-protect-kids-from-road-pollution-study-finds
[80] U.S. EPA (January 2017). Living Close to Roadways: Health Concerns and Mitigation Strategies. https://www.epa.gov/sciencematters/living-close-roadways-health-concerns-and-mitigation-strategies
[81] Paul L. Jacobsen. "Safety in numbers: more walkers and bicyclists, safer walking and bicycling." *Injury Prevention* 9, no. 3 (2003): 205–209. https://doi.org/10.1136/ip.9.3.205

Table 8.6. Overview of GHG emissions reduction measures in the Miami Valley CCAP that will also increase physical and emotional well-being by sector and scenario. Source: SSG analysis.

Sector	Actions	CF	ET
Transportation	- Increase transit and active modes	✓	

Impacts

Residents in the Miami Valley Region will benefit from increased opportunities to walk, bike and use transit as a result of the actions taken in the two LC Scenarios compared to the BAU and BAP Scenarios (Table 8.7). The annual number of hours that residents spend walking and biking in the region is projected to increase by nearly 130% in the Community-First Scenario compared to the BAU and BAP Scenarios.

Table 8.7. Indicators of physical and emotional well-being in the Miami Valley CCAP scenarios. Source: SSG analysis.

Sectors	BAU	BAP	CF	ET
Yearly active miles (2050)	83,756,146	83,756,146	191,854,941	83,756,091
% improvement from BAP	0%	0%	129%	0%
Annual number of hours spent walking	34,898,394	34,898,394	79,939,559	34,898,371
Annual number of hours spent cycling	9,306,238	9,306,238	21,317,216	9,306,232

Figure 8.10 shows areas in the Miami Valley Region with high percentiles of people experiencing diabetes and asthma relative to areas that will experience increased active transportation by 2050. Urban areas in Montgomery County generally have higher levels of diabetes and asthma than the surrounding rural areas. In the Community-First Scenario, these areas are expected to see at least 70% increase in active travel by 2050. Some rural areas are projected to see higher proportionate increases because current active travel modes in these rural areas are lower than in urban parts of the region.

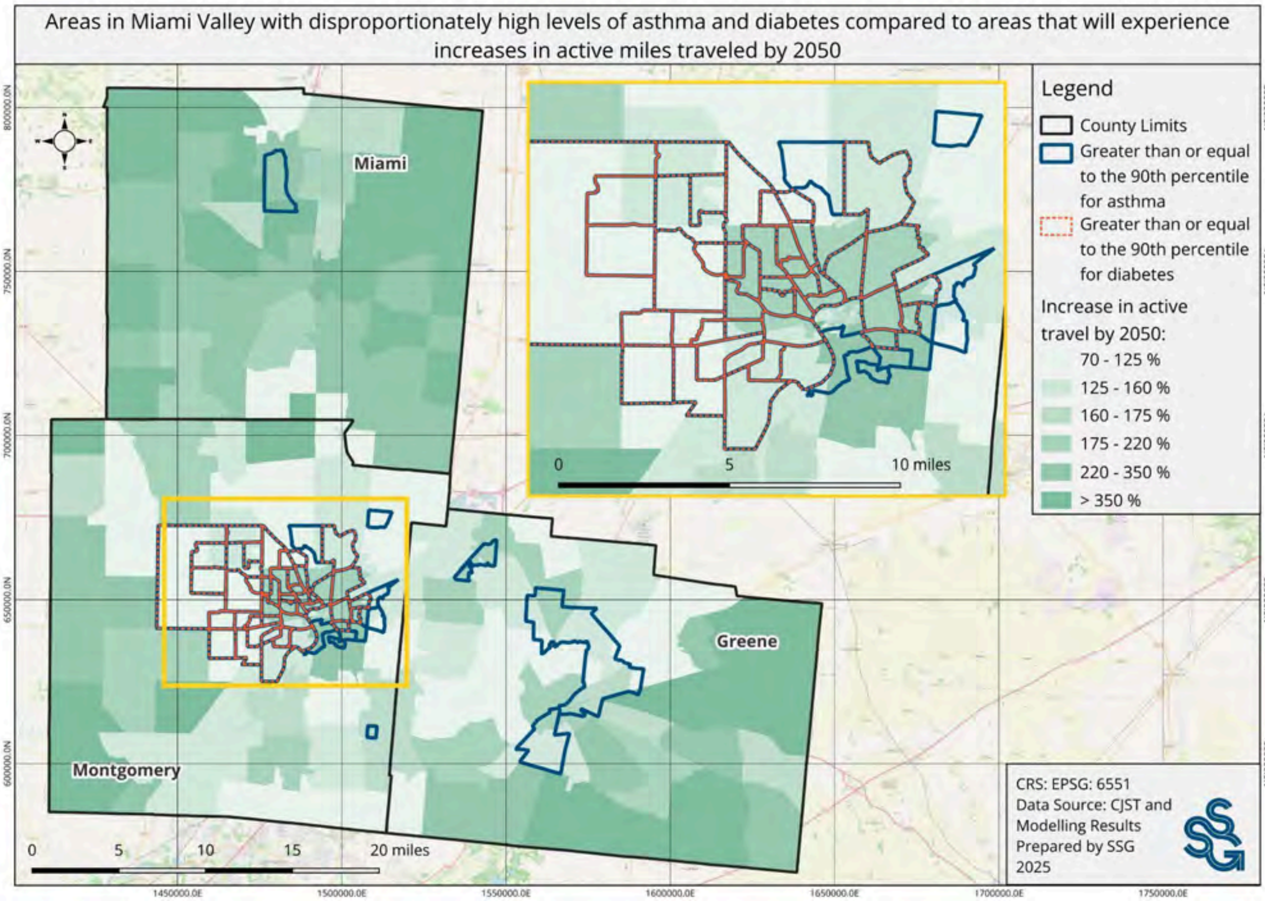

Figure 8.10. Areas in the Miami Valley Region with disproportionately high levels of asthma and diabetes compared to areas that will experience increases in active miles traveled by 2050. Sources: Elaborated from the Council on Environmental Quality, 2022; SSG modeling.

8.4.4 Noise

Observations

Noises caused by cars, trucks, planes and trains are among the most common urban disturbances. According to the U.S. Bureau of Transportation Statistics, nearly the entire U.S. population lives within areas where exposure to noise from planes and highways reaches the noise level of a humming refrigerator (around or below 50 decibels). Figure 8.11 shows average noise levels across the Miami Valley Region, calculated on a typical day in 2020.

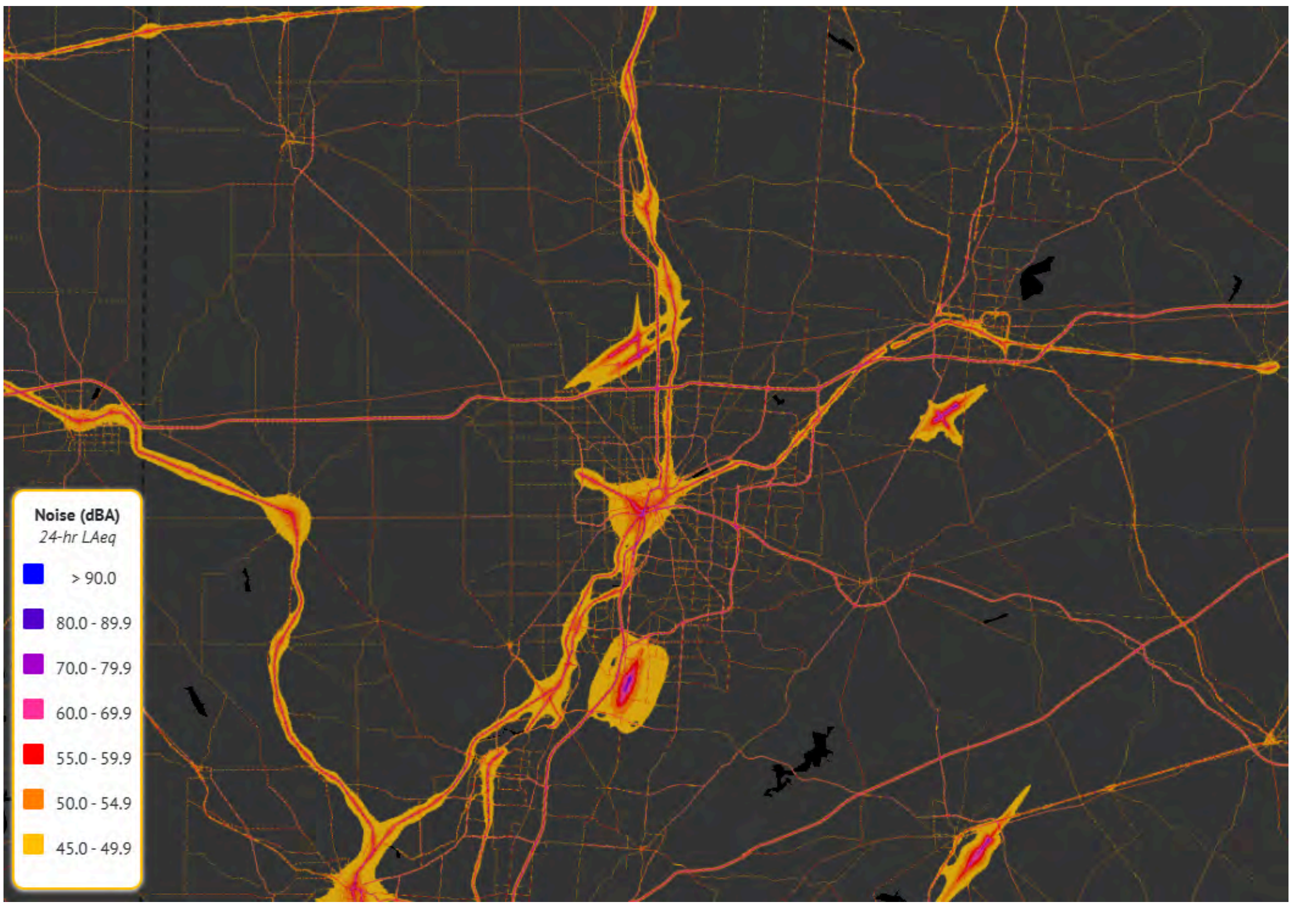

Figure 8.11. Noise levels due to aviation, vehicular travel and railroads in 2020 in the Miami Valley Region. Source: U.S. Department of Transportation (National Transportation Noise Map).

Prolonged sounds above 85 decibels are harmful to human hearing. Table 8.8 shows the relative noise levels in decibels of indoor noises.

Table 8.8. Relative sound pressure levels of indoor noises.[82] Source: Adapted from "Common Outdoor and Indoor Noises," Federal Highway Administration.

Indoor Noises	Sound Pressure Levels (dB)
Rock band or jackhammer	110
Inside subway train (New York)	100
Food blender at 3 ft distance	90
Garbage disposal at 3 ft distance, shouting at 3 ft distance	80
Vacuum cleaner at 9 ft distance	70
Normal speech at 3 ft distance	70
Large business office (occupied)	60
Dishwasher in the next room	50
Small theater, large conference room (background noise)	40
Bedroom at night, quiet concert hall	25
Broadcasting and recording studio	15
Threshold of hearing	5

Cars make a lot of noise, especially when traveling at high speeds on highways and interstates. On average, gas-powered cars moving at 30 mph on local roads produce sound levels ranging from 33 to 69 decibels, while cars traveling around 70 mph produce sound levels ranging up to 89 decibels, regardless of whether they are electric or gasoline powered.[83] In comparison, EVs make so little noise at low speeds that the National Highway Traffic Safety Administration actually requires most hybrid and electric vehicles to emit sounds ranging from 43 to 64 decibels while backing up and moving at speeds below 18 mph.[84] Highway traffic noise levels typically range from 70 to 80 decibels at a distance of

[82] Adapted from Federal Highway Administration, "Common Outdoor and Indoor Noises." https://highways.dot.gov/public-roads/common-outdoor-and-indoor-noises

[83] Erica D. Walker. "If All the Vehicles in the World Were to Convert to Electric, Would It Be Quieter?" *The Conversation*. (August 1, 2022). http://theconversation.com/if-all-the-vehicles-in-the-world-were-to-convert-to-electric-would-it-be-quieter-179359

[84] U.S. Department of Transportation (November 2016). NHTSA Sets "Quiet Car" Safety Standard to Protect Pedestrians. https://www.transportation.gov/briefing-room/nhtsa-sets-%E2%80%9Cquiet-car%E2%80%9D-safety-standard-protect-pedestrians

50 feet from the highway, roughly equivalent to listening to someone shouting from 3 feet away.[85] Sounds at these levels affect most people, causing interruptions in conversations, increasing heart rates and limiting the ability to converse.

Regular exposure to high levels of traffic noise is associated with a number of physical and mental health impacts. These include higher incidences of hearing loss, cardiovascular disease,[86] annoyance,[87] sleep disturbances and heart attacks.[88] Even a 10 dB increase in noise in a working environment can reduce productivity and negatively affect cognitive functions, such as working memory.[89,90] Moderate levels of noise (70 dB) can increase creativity, while high levels of noise (85 dB) hurt creativity by reducing the extent of information processing.[91] Indoor exposure to nearby noise can be mitigated by construction standards. Occupants of newly built Passive House buildings report greatly reduced anxiety as a result of the increased quiet the highly insulated buildings offer, even in loud urban settings such as New York City.[92]

Noise disturbances are not equally experienced. Areas near highways and other sources of noise pollution tend to be less valuable (more affordable) than other types of property. Lower-income households and communities of color tend to be located in areas most polluted by road traffic noise and are less likely to be protected by noise barriers.[93,94] Lower-income communities also tend to have poorer-quality streets, which contributes to traffic noise from cars, regardless of fuel type.[95] Figure 8.12 shows areas in the Miami Valley Region with high levels of traffic proximity, which would increase exposure to noise. These areas are largely concentrated in Dayton in Montgomery County.

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[85] "Living With Noise | FHWA," https://highways.dot.gov/public-roads/julyaugust-2003/living-noise
[86] Jason H. Curran, Helen D. Ward, Mona Shum, Hugh W. Davies. "Reducing cardiovascular health impacts from traffic-related noise and air pollution: intervention strategies." *Environmental Health Review* (August 2013). https://doi.org/10.5864/d2013-011
[87] Henk M. E. Miedema and Caren G. M. Oudshoorn. "Annoyance from Transportation Noise: Relationships with Exposure Metrics DNL and DENL and Their Confidence Intervals." *Environmental Health Perspectives* 109, no. 4 (2001): 409–416. https://doi.org/10.1289/ehp.01109409
[88] Audrey De Nazelle, et al. "Improving health through policies that promote active travel: A review of evidence to support integrated health impact assessment." *Environment International* 37, no. 4 (2011): 766–777. https://doi.org/10.1016/j.envint.2011.02.003
[89] Joshua T. Dean. "Noise, Cognitive Function, and Worker Productivity." *American Economic Journal: Applied Economics* 16, no. 4 (October 2024): 322–60. https://doi.org/10.1257/app.20220532
[90] Simone Romano et al. "The Effect of Noise on Software Engineers' Performance." *ESEM '18: Proceedings of the 12th ACM/IEEE International Symposium on Empirical Software Engineering and Measurement*, no. 9 (2018): 1–10, https://doi.org/10.1145/3239235.3240496
[91] Ravi Mehta, Rui (Juliet) Zhu, Amar Cheema. "Is Noise Always Bad? Exploring the Effects of Ambient Noise on Creative Cognition." *Journal of Consumer Research* 39, no. 4 (December 1, 2012): 784–99. https://doi.org/10.1086/665048
[92] Aliya Uteuova. "'It's a Sanctuary': The Magic of Quiet, Low-Cost, Allergy-Free 'Passive' Homes." *The Guardian*. (February 24, 2022). https://www.theguardian.com/environment/2022/feb/24/passive-building-energy-efficiency-affordable-housing-new-york
[93] Mathieu Carrier, Philippe Apparicio, Anne-Marie Séguin. "Road Traffic Noise in Montreal and Environmental Equity: What Is the Situation for the Most Vulnerable Population Groups?" *Journal of Transport Geography* 51 (February 1, 2016): 1–8. https://doi.org/10.1016/j.jtrangeo.2015.10.020
[94] Stéphanie Potvin, Philippe Apparicio, Anne-Marie Séguin, "The Spatial Distribution of Noise Barriers in Montreal: A Barrier to Achieve Environmental Equity," *Transportation Research Part D: Transport and Environment* 72 (July 1, 2019): 83–97. https://doi.org/10.1016/j.trd.2019.04.011
[95] Erica D. Walker. "If All the Vehicles in the World Were to Convert to Electric, Would It Be Quieter?"

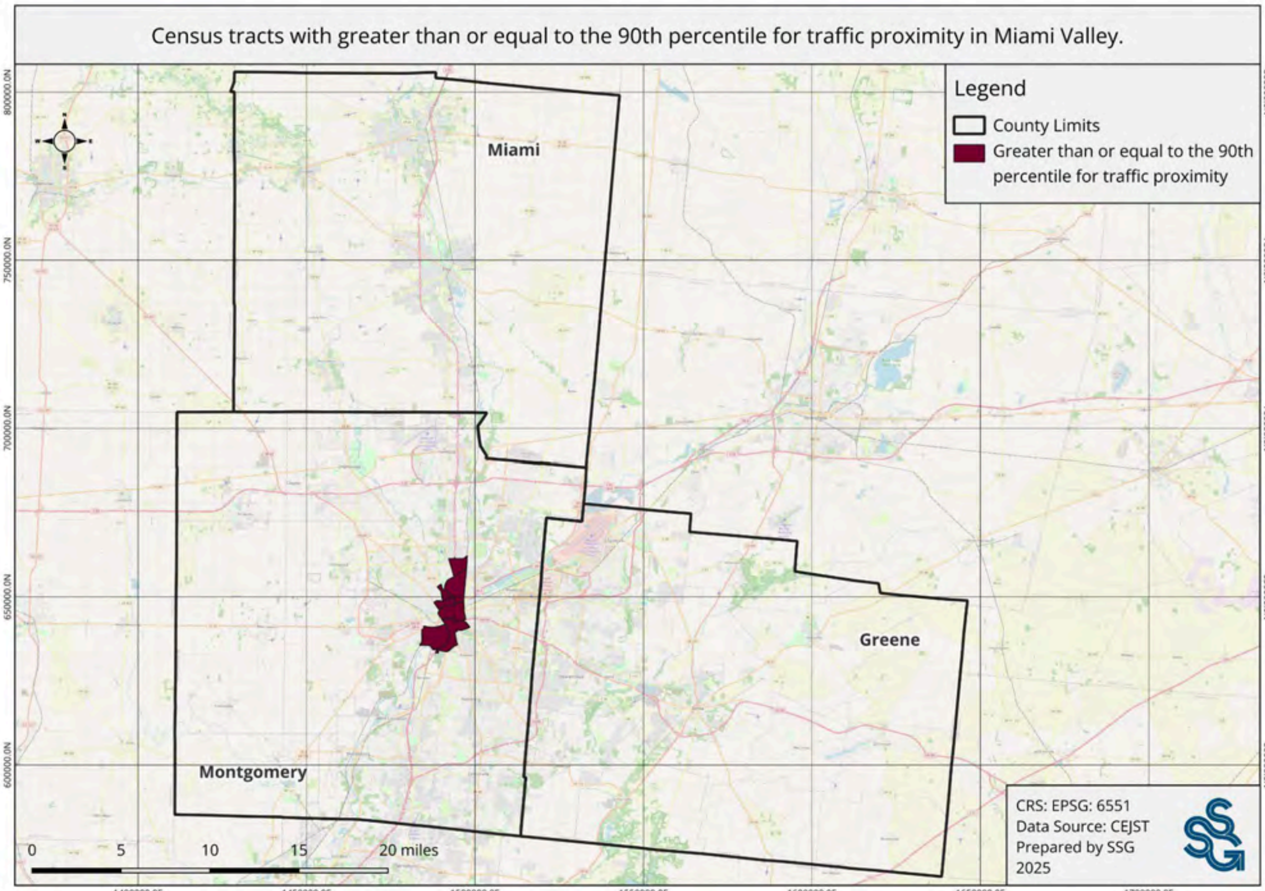

Figure 8.12. Census tracts with greater than or equal to the 90th percentile for traffic proximity in the Miami Valley Region. Source: Elaborated from the Council on Environmental Quality, 2022.

Potential Co-Harms

Increasing the share of EVs may make it harder for pedestrians and cyclists to hear vehicles approaching. In the U.S. and Europe, EVs are being made to incorporate additional sound, but this remains a controversial solution. Creating more compact and dense communities may lead to increased exposure to noise pollution if not mitigated through reduced driving, walls and vegetation barriers, and adequate insulation in buildings. Increasing transit use may increase noise levels, as buses tend to be louder than passenger vehicles, but this may be mitigated by an overall reduction in vehicles on the road as more people use transit.

Actions That Impact Noise and GHG Emissions Simultaneously in the Miami Valley Region

Table 8.9 lists GHG emissions reduction measures that have an impact on noise reduction.

Table 8.9. Overview of GHG emissions reduction measures in the Miami Valley CCAP that will also reduce noise by sector and scenario. Source: SSG analysis.

Sector	Actions	CF	ET
Transportation	- Vehicle electrification	✓	✓
	- Increase transit and active modes	✓	

Impacts

Residents in the Miami Valley Region will benefit from decreased noise levels as a result of vehicle electrification and an increase in active transportation (Table 8.10). Compared to the BAP Scenario, the Community-First Scenario is projected to result in a 17% reduction in annual per capita VMT by 2050. The number of EVs is also projected to increase by 238% in both LC Scenarios compared to the BAP Scenario. Together, these changes will reduce overall traffic congestion and noise levels within the region.

Table 8.10. Indicators of noise in the Miami Valley CCAP scenarios. Source: SSG analysis.

Sectors	BAU	BAP	CF	ET
Decrease in VMT				
Yearly VMT per person (2050)	9,255	9,255	7,670	9,257
% improvement from BAP	0%	0%	-17%	0%
VMT in 2050 (millions)	7,410	7,410	6,141	7,411
Number of EVs				
Number of EVs in 2050	187,266	187,265	633,466	633,463
% improvement from BAP	0%	0%	238%	238%
Share of vehicles that are electric in 2050	29%	29%	99%	99%

8.5.5 Occupant Comfort

Observations

The Miami Valley Region's housing stock is aging and energy inefficient. Roughly two-thirds of the region's 375,000 housing units were built before 1980, with a large portion built between 1950 and 1979 (Figure 8.13).[96] Most (70%) of these are single-family detached homes.[97] The average home in the Miami Valley Region is about 2,300 sqft and uses 28,000 kWh of energy per year, which is two times Ohio's average energy use per household (10,280 kWh) per year.[98] Natural gas is the main heating source in approximately two-thirds (68%) of homes across the region.

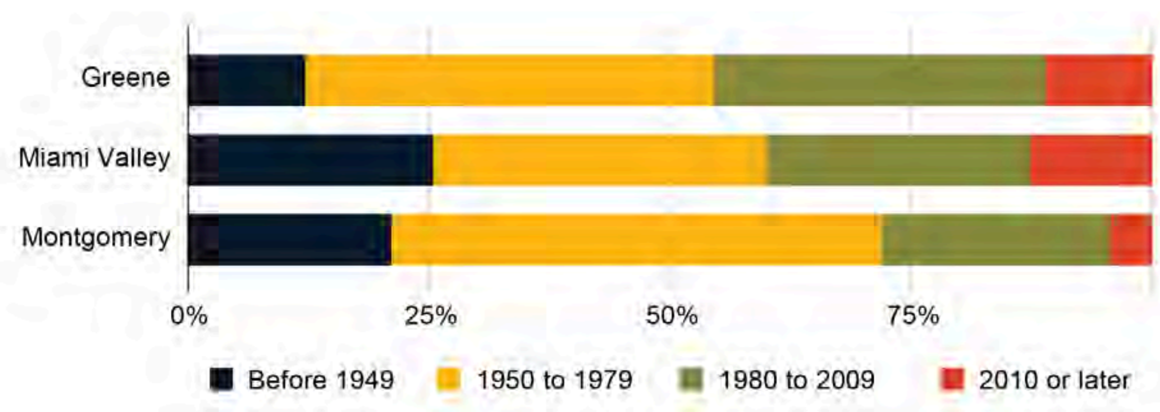

Figure 8.13. Year of construction for residential units in the Miami Valley Region.[99]
Source: Adapted from the U.S. Census Bureau, 2023.

Collectively, the conditions we experience inside buildings are known as "occupant comfort." As we typically spend 90% of our time indoors,[100] indoor health conditions are an important consideration. The phenomenon of "sick building syndrome," prevalent in the 1980s and 1990s and continuing today, as well as the COVID-19 pandemic, helped to identify indoor air quality as a major health-influencing factor. Improvements in ventilation systems and less toxic building materials (e.g., insulation, wall paneling) improve indoor air quality, often while reducing energy use. Improving energy efficiency can also affect health directly by influencing indoor temperatures, energy use and cost (with indirect effects on

[96] U.S. Census Bureau (2023). ACS 2023 1-year, Table 25034: Year Structure Built. https://data.census.gov/table/ACSDT5Y2023.B25034
[97] U.S. Census Bureau (2023). ACS 2023 1-year, Table 25024: Units in Structure. https://data.census.gov/table/ACSDT1Y2023.B25024
[98] U.S. EIA. 2020 Residential Energy Consumption Survey. https://experience.arcgis.com/experience/cbf6875974554a74823232f84f563253

[99] U.S. Census Bureau. ACS 2023 1-year, Table 25034.
[100] U.S. EPA (1989). Report to Congress on Indoor Air Quality — Vol. II: Assessment and Control of Indoor Air Pollution. EPA/400/1-89/001C.

financial choices for low-income families), and the emission of toxic pollutants to the local environment.[101] Buildings with more stable and comfortable indoor environments have been found to reduce the risk of deaths from cold and hot spells and indirectly reduce absenteeism from school in children.[102]

Benefits of improved energy efficiency and tighter building envelopes include reduced mold (which has been found to directly reduce depression, arthritis and rheumatism, injuries and death), allergies and symptoms of respiratory disease.[103] Energy-efficient buildings with opportunities for occupant control, such as windows that open and adjustable blinds, provide an increased sense of control, which reduces stress and depression.[104] Improving occupant comfort and energy efficiency also reduces the likelihood of residents turning to more dangerous sources of heat, such as gas ovens and stoves.

Potential Co-Harms

Meeting global GHG mitigation goals by 2030 could result in the health benefits described above if mechanical ventilation heat recovery systems with particle filtering are installed in retrofitted and new buildings. If such systems are not installed, operated and maintained correctly, buildings could wind up with poor indoor air quality.[105] There may also be trade-offs between preserving historic and heritage buildings and increasing occupant comfort. Reducing the severity of these trade-offs involves documenting current and historic energy use and creating detailed energy models for such buildings.[106]

[101] James Milner, Michael Davies, Paul Wilkinson. “Urban energy, carbon management (low carbon cities) and co-benefits for human health.” *Current Opinion in Environmental Sustainability* 4, vol. 1 (2012): 398–404. https://doi.org/10.1016/j.cosust.2012.09.011
[102] International Energy Agency (2014). Capturing the Multiple Benefits of Energy Efficiency. https://iea.blob.core.windows.net/assets/28f84ed8-4101-4e95-ae51-9536b6436f14/Multiple_Benefits_of_Energy_Efficiency-148x199.pdf
[103] ibid.
[104] Aliya Uteuova. “‘It’s a Sanctuary.’”
[105] Paul Wilkinson et al. “Public health benefits of strategies to reduce greenhouse-gas emissions: household energy.” *Lancet* 374 (2009): 1917–1929. https://doi.org/10.1016/s0140-6736(09)61713-x
[106] Larissa Ide, Michael Gutland, Scott Bucking, Mario Santana Quintero. “Balancing Trade-Offs between Deep Energy Retrofits and Heritage Conservation: A Methodology and Case Study.” *International Journal of Architectural Heritage* 16, no. 1 (2022): 97–116, https://doi.org/10.1080/15583058.2020.1753261

Actions That Increase Occupant Comfort and Reduce GHG Emissions Simultaneously in the Miami Valley Region

Several actions can help reduce the amount of fossil fuels burned while also increasing occupant comfort in the Miami Valley Region (Table 8.11). These include, but are not limited to, retrofitting existing buildings and improving the thermal and energy efficiency of buildings.

Table 8.11. Overview of GHG emissions reduction measures in the Miami Valley CCAP that will also increase occupant comfort by sector and scenario. Source: SSG analysis.

Sector	Actions	CF	ET
Buildings	- Retrofit existing buildings	✓	✓
	- Improve energy efficiency in new buildings	✓	✓
	- Improve thermal efficiency of buildings	✓	✓

Impacts

Table 8.12 highlights the projected number of residential and non-residential retrofits in the BAU, BAP, Community-First and Energy Transition Scenarios. Approximately 347,000 homes and 235,000,000 sqft of commercial space are projected to be retrofitted in the LC Scenarios.

Table 8.12. Indicators of occupant comfort in the Miami Valley CCAP scenarios. Source: SSG analysis.

Sectors	BAU	BAP	CF	ET
Residential retrofits				
Cumulative number of existing homes retrofitted (2021-2050) (thousands)	0	115	347	347
Non-residential retrofits				
Square footage of non-residential building floor space retrofitted (2021-2050)	0	0	235,437,596	235,148,624

8.5 Co-Benefits and Co-Harms: Economic Prosperity

Actions that reduce emissions can also play a major role in helping to revitalize local economies across the Miami Valley Region, and to put the region on a path of economic prosperity for years to come. In addition to direct benefits such as job creation and reduced energy costs, jurisdictions that have a low-emission, low-cost energy supply and supportive policies for reducing GHG emissions will be well positioned to attract new businesses and encourage business expansion.

8.5.1 Employment

Observations

In general, the transition to a low-carbon economy is expected to have four categories of impacts on labor markets:

- Additional jobs will be created in emerging sectors, such as energy generation and building energy efficiency.
- Some employment will be shifted, for example, from fossil fuel production and distribution to renewables.
- Certain jobs will no longer be relevant or necessary, such as vehicle mechanics who specialize in gasoline motors.
- Many existing jobs will be transformed and redefined, with some employment opportunities emerging that are not yet possible to anticipate.[107]

The transition from an energy system based on fossil fuels to one based on renewable energy will require massive investments in infrastructure — from vehicles to district energy, from manufacturing to energy efficiency. This mobilization of public and private finance — of up to $3.2 billion per city in one estimate[108] — requires many new jobs. For example, the International Energy Agency (IEA) estimates that 8 to 27 jobs are created for each 1 million euros invested in energy efficiency.[109] Reducing GHG emissions from the electricity grid through regulation can also result in job creation. In the U.S., the Natural Resources Defense Council projected that stricter emissions standards for electricity generation could net 210,000 national jobs over a seven-year period.[110]

Analyses of recently passed state and federal legislation demonstrate the economic opportunities enabled by decarbonization. Climate and energy investments integrated into the

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[107] Cristina Martinez Fernandez, Carlos Hinojosa, Gabriela Miranda (2010). Greening Jobs and Skills: Labour Market Implications of Addressing Climate Change. *Working Document, OECD*. http://www.oecd.org/regional/leed/44683169.pdf

[108] A. Gouldson et al. (2014) The economic case for low carbon cities. *A New Climate Economy, Stockholm Environment Institute*. http://eprints.whiterose.ac.uk/82868/

[109] International Energy Agency (2014). Capturing the Multiple Benefits of Energy Efficiency. https://iea.blob.core.windows.net/assets/28f84ed8-4101-4e95-ae51-9536b6436f14/Multiple_Benefits_of_Energy_Efficiency-148x199.pdf

[110] Elizabeth A. Stanton et al. (June 2013). Economic Impacts of the NRDC Carbon Standard: Background Report prepared for the Natural Resources Defense Council. https://www.nrdc.org/sites/default/files/ene_13070101a.pdf

recently passed IRA could create more than 9 million job years across the U.S. over the next decade, with more than half of those jobs being created in the electricity, transportation and building sectors.[111]

Investments in active travel and public transit create ample employment opportunities. Implementing policies to increase walking, biking and public transit has been found to increase GDP, total employment and employment in the transportation sector.[112] One assessment estimated that $1 billion dollars of spending on public transportation generated over 36,000 jobs, $3.6 billion dollars of output, and $1.8 billion dollars of GDP annually.[113] Additionally, spending on transit generates 70% more job hours than spending the same amount on highway projects.[114]

Potential Co-Harms

Policy and implementation design are key to realizing the benefits of the new jobs created during the low-carbon transition, as well as mitigating the negative impacts of job losses. Workers in industries that will be phased out need to be provided with the tools and resources necessary to transition into quality new jobs. These could include transition assistance (financial or otherwise), investment in workforce training and economic development assistance. For more details, see the Workforce Analysis section of this report.

At-risk and low-income communities have long been on the front lines of jobs that expose them to toxic pollution and hazardous conditions. Special attention must be given to these workers and communities most likely to be impacted by job losses in the fossil fuel industry and related sectors. Creating well-paying, high-quality jobs should also be a focus to avoid potential economic harms. Currently, one in five utility industry workers are unionized, compared to one in 10 of all American workers.[115] Ensuring an economically just transition includes investing in jobs that support unions and worker organizing, complying with or exceeding mandatory labor standards, and maximizing training and apprenticeship programs.[116] Advancing employment and training opportunities is also key, specifically for those from low-income households and historically marginalized groups, and particularly in areas already experiencing job loss.

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[111] Robert Pollin, Chirag Lala, Shouvik Chakraborty (August 2022). Job Creation Estimates through Proposed Inflation Reduction Act. University of Massachusetts Amherst: Political Economy Research Institute (PERI). https://peri.umass.edu/publication/job-creation-estimates-through-proposed-inflation-reduction-act/

[112] C. Doll and J. Hartwig (2012). Clean, safe and healthy mobility through non-technical measures - Linking individual and public decision levels. Transportation Demand Management - mobil.TUM2012 International Scientific Conference on Mobility and Transport, Munich, Institute of Transportation, Technische Universitaet Muenchen.

[113] Arlee Reno and Glen Weisbrod (2009). Economic Impact of Public Transportation Investment. Transit Cooperative Research Program; Patrick Rérat. “The new demographic growth of cities: The case of reurbanisation in Switzerland.” *Urban Studies* 49, no. 5 (2012): 1107–1125. http://dx.doi.org/10.1177/0042098011408935

[114] SGA (2011). Recent lessons from the stimulus: Transportation Funding and Job Creation, Smart Growth America.

[115] BlueGreen Alliance. Climate Change & the Clean Economy. https://www.bluegreenalliance.org/work-issue/climate-change/

[116] BlueGreen Alliance. Solidarity for Climate Action. http://www.bluegreenalliance.org/wp-content/uploads/2019/07/Solidarity-for-Climate-Action-vFINAL.pdf

Actions That Increase Employment and Reduce GHG Emissions Simultaneously in the Miami Valley Region

Table 8.13 lists GHG emissions reduction measures that have an impact on employment in the Miami Valley Region.

Table 8.13. Overview of GHG emissions reduction measures in the Miami Valley CCAP that will also increase employment by sector and scenario. Source: SSG analysis.

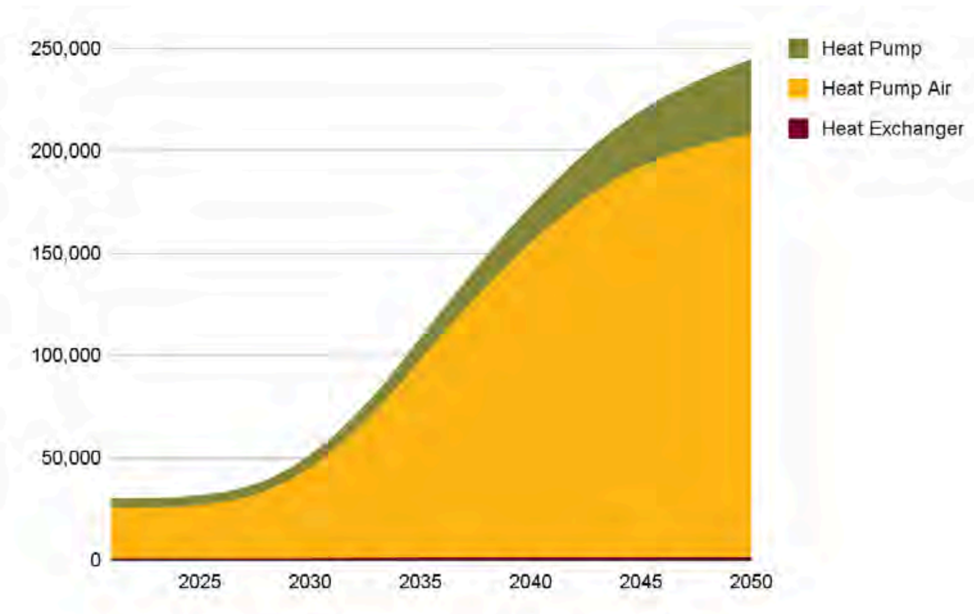
Sector	Actions	CF	ET
Buildings	- Switch fuel use for heating and cooling	✓	✓
	- Retrofit existing buildings	✓	✓
	- Improve energy efficiency in new buildings	✓	✓
	- Improve thermal efficiency of buildings	✓	✓
	- Electrify water heaters	✓	✓
	- Expand use of high-performance stoves	✓	
Transportation	- Vehicle electrification	✓	✓
	- Increase transit and active modes	✓	
Waste	- Expand composting	✓	✓
Energy	- Increased renewable energy in buildings	✓	✓
	- Increased renewable energy for industrial processes	✓	✓
Industry	- Increase energy efficiency in industrial processes and agriculture	✓	✓
	- Electrification of industrial processes	✓	✓

Impacts

Investments in the LC Scenario represent opportunities for existing and new businesses in the Miami Valley Region. These include primary beneficiaries such as contractors, HVAC suppliers, construction companies, appliance manufacturers, renewable energy developers, car dealerships[117] and bike shops, and secondary businesses such as banks and credit unions, engineering firms, architects and designers, and insurance companies.

[117] Car dealerships may benefit from increased EV sales, but may lose revenue due to decreased maintenance needs of EVs.

Figure 8.14 illustrates the number of heat pumps and heat pump water heaters required to decarbonize the Miami Valley Region. These totals essentially constitute sales targets for the HVAC industry in the region. This would create new jobs for individuals to sell, install and maintain heat pumps in the region.



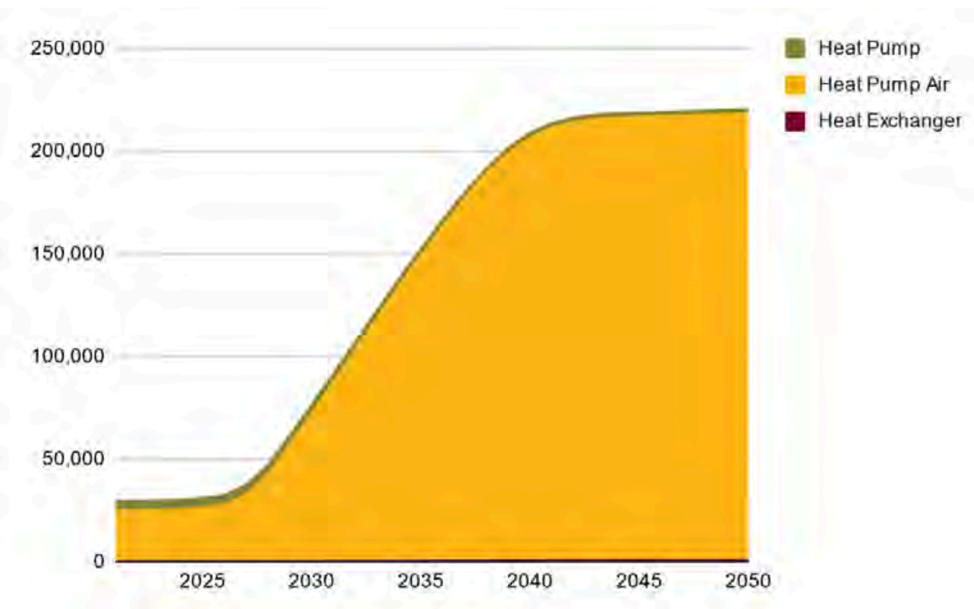
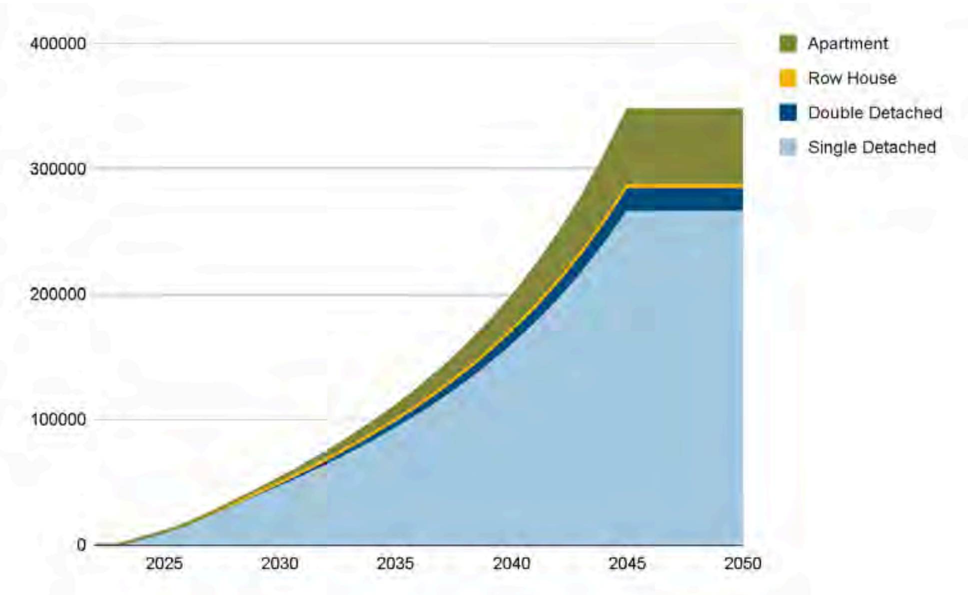


Figure 8.14. Number of heat pumps installed in residential buildings in the Community-First Scenario (top) and Energy Transition (bottom) Scenario, 2021-2050. Source: SSG analysis.

Figure 8.15 illustrates the numbers of homes (by dwelling units) and commercial buildings (by floorspace) that need to be retrofitted to decarbonize the Miami Valley Region. These totals essentially constitute targets for the nonprofits and businesses that provide deep retrofitting services in the region. Figure 8.16 represents the total square footage of commercial buildings to be retrofitted in the region in the two LC scenarios.



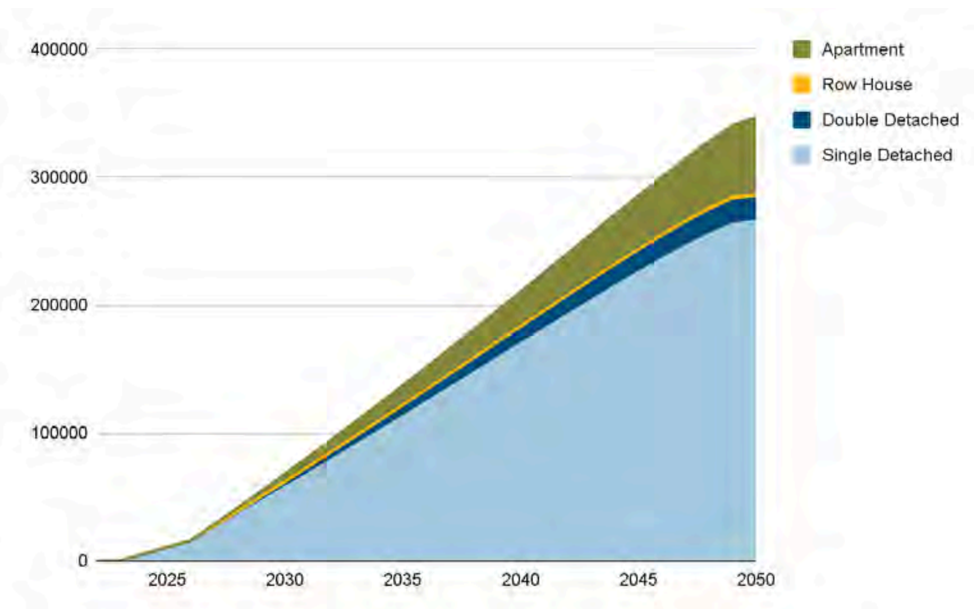


Figure 8.15. Number of residences (by unit) retrofitted in the Community-First (top) and Energy Transition (bottom) Scenarios, 2021-2050. Source: SSG analysis.

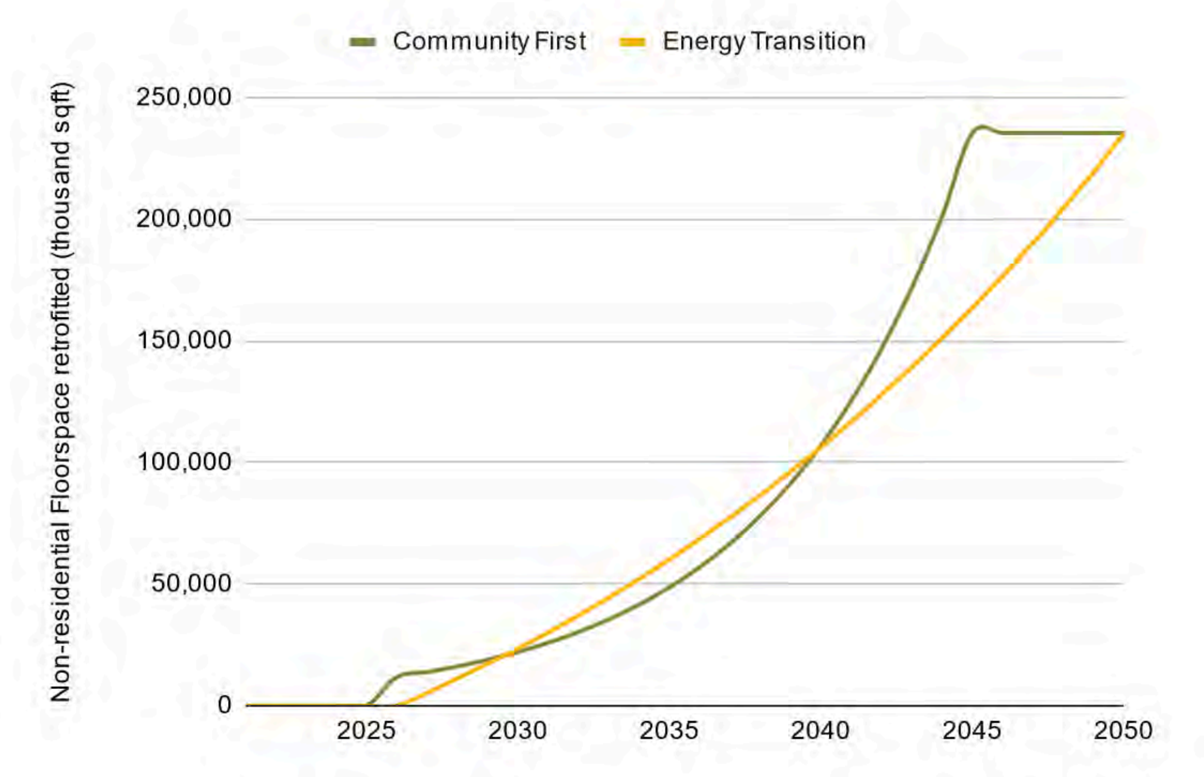


Figure 8.16. Square footage of commercial buildings retrofitted in the LC Scenarios, 2021-2050. Source: SSG analysis.

Figure 8.17 illustrates the number of personal EVs that will need to be purchased to decarbonize the Miami Valley Region in both LC Scenarios. In these scenarios, the purchase of conventional vehicles is phased out in 2035, and all new vehicles are either EVs or PHEVs. These totals essentially constitute targets for car dealerships selling both new and used vehicles in the region.

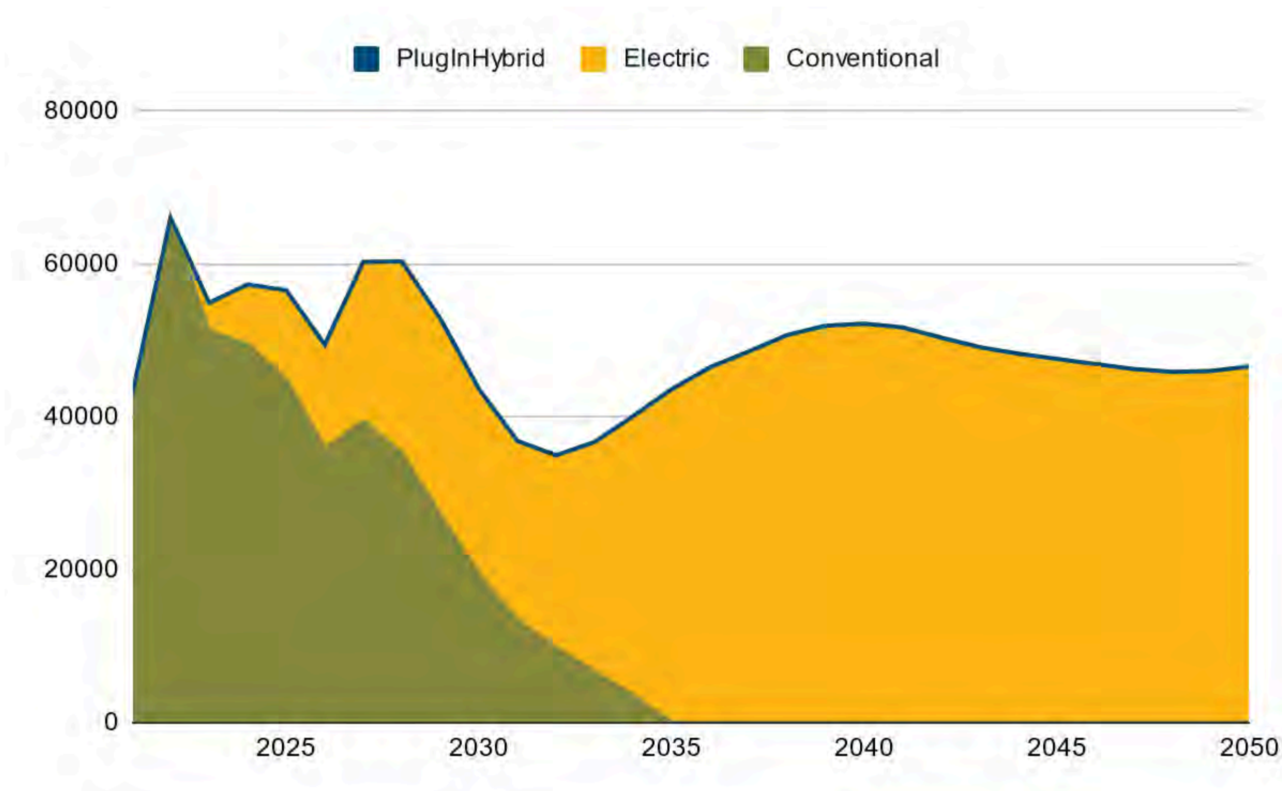


Figure 8.17. Number of EVs purchased in the Miami Valley Region (both Scenarios are the same), 2021-2050. Source: SSG analysis.

8.5.2 Energy Poverty

Building out a renewable energy system will increase the resilience of the Miami Valley Region by allowing residents and businesses to increase their available spending for other needs and to withstand electricity disruptions.

Observations

Energy insecurity can be defined in several ways. The EIA's Residential Energy Consumption Survey includes several indicators of energy insecurity, including whether households have to reduce or forgo food or medicine to pay energy costs, leave their home at an unhealthy temperature, due to inability to afford heating or cooling, receive disconnect or delivery stop notices, or are unable to use heating or air conditioning equipment.[118] As of 2022, roughly 26% of households in the East North Central census region, which includes Ohio, experienced energy insecurity based on at least one of these indicators. Nearly one-fifth of households in the region struggle to pay their energy bills, and have to choose between powering their home and paying for other expenses such as food and medicine.

Low-income households tend to have high energy cost burdens, in part because their homes tend to be draftier and older and have poorer insulation, than those of wealthier households, making them energy inefficient. According to the U.S. DOE, cost-effective energy efficiency measures, such as improving insulation and installing more efficient appliances, have the potential to reduce energy use by 13%-31%.

Potential Co-Harms

The rebound effect — when households use the financial savings resulting from energy efficiency gains to access services that use more energy — is an important negative feedback cycle that can reduce the GHG emissions reductions resulting from a project but may also generate additional well-being co-benefits, particularly for low-income households. For example, a lower-income household could choose to spend savings generated from a home retrofit or reduced electricity bill on an EV, which could potentially increase emissions (if the electricity source is not clean) but could also improve access to jobs and economic mobility.

Increased density can also result in co-harms. For example, if increased density drives up housing prices, lower-cost development may occur on the outskirts of the city or in neighboring municipalities, which can increase emissions from transportation, as well as congestion, vehicle use and other impacts associated with greenfield development.[119]

Actions That Reduce Energy Poverty and GHG Emissions Simultaneously in the Miami Valley Region

Measures to reduce GHG emissions can reduce household energy costs, as they reduce the costs of fuel for transportation, electricity and heating and cooling buildings. For example, transit-oriented urban development can reduce per capita use of automobiles by 50%, reducing household transport expenditures by 20%.[120] The overall result is more disposable incomes.

[118] U.S. EIA (2023). 2020 Residential Energy Consumption Survey. Housing characteristics tables: Household energy insecurity (HC11.1).
https://www.eia.gov/consumption/residential/data/2020/index.php?view=characteristics#household

[119] Carl Gaigné, Stéphane Riou, Jacques-François Thisse. "Are compact cities environmentally friendly?" *Journal of Urban Economics* 72, no. 2 (2012): 123–136. https://doi.org/10.1016/j.jue.2012.04.001

[120] G. B. Arrington and Robert Cervero (2008). TCRP Report 128: Effects of TOD on Housing, Parking, and Travel. National Academies of Sciences, Engineering, and Medicine. https://doi.org/10.17226/14179

Low-carbon actions in the buildings, energy and transportation sectors (Table 8.14) may help reduce energy poverty while also reducing GHG emissions. These actions include, but are not limited to, retrofitting existing buildings, installing high-performance stoves, electrifying vehicles and increasing renewable energy.

Table 8.14. Overview of GHG emissions reduction measures in the Miami Valley CCAP that will also reduce energy poverty by sector and scenario. Source: SSG analysis.

Sector	Actions	CF	ET
Buildings	- Retrofit existing buildings	✓	✓
	- Improve energy efficiency in new buildings	✓	✓
	- Expand use of high-performance stoves	✓	
Transportation	- Vehicle electrification	✓	✓
	- Increase transit and active modes	✓	
Energy	- Increase renewable energy in buildings	✓	✓
	- Increase renewable energy for industrial processes	✓	✓

Impacts

Both Table 8.15 and Figure 8.18 compare household costs associated with energy for buildings and transportation costs in 2021, 2035, and 2050 across the four scenarios. For buildings, this includes energy costs associated with natural gas and electricity. For transportation, this includes energy costs associated with diesel and gasoline.

In the LC Scenarios, household costs associated with energy for buildings and transportation are expected to decrease by roughly half between 2021 and 2035. This translates into a reduction from an average of $4,979 in annual household expenses to $1,428 and $1,761 in the Community-First and Energy Transition Scenarios, respectively.

Table 8.15. Comparison of household energy and travel expenditures in 2050 in the Miami Valley CCAP scenarios. Source: SSG analysis.

	BAU	BAP	CF	ET
Household building energy costs ($/household)				
2021	$2,177	$2,177	$2,177	$2,177
2035	$1,856	$1,891	$1,678	$1,578
2050	$1,780	$1,803	$945	$1,177
Transportation costs ($/household)				
Household total annual travel expenditures (2021)	$2,802	$2,802	$2,802	$2,802
Household total annual travel expenditures (2035)	$1,180	$1,180	$928	$1,008
Household total annual travel expenditures (2050)	$875	$875	$483	$584
Total transportation and energy costs ($/household)				
Household total annual travel and energy expenditures (2021)	$4,979	$4,979	$4,979	$4,979
Household total annual travel and energy expenditures (2035)	$3,037	$3,071	$2,606	$2,586
Household total annual travel and energy expenditures (2050)	$2,655	$2,678	$1,428	$1,761

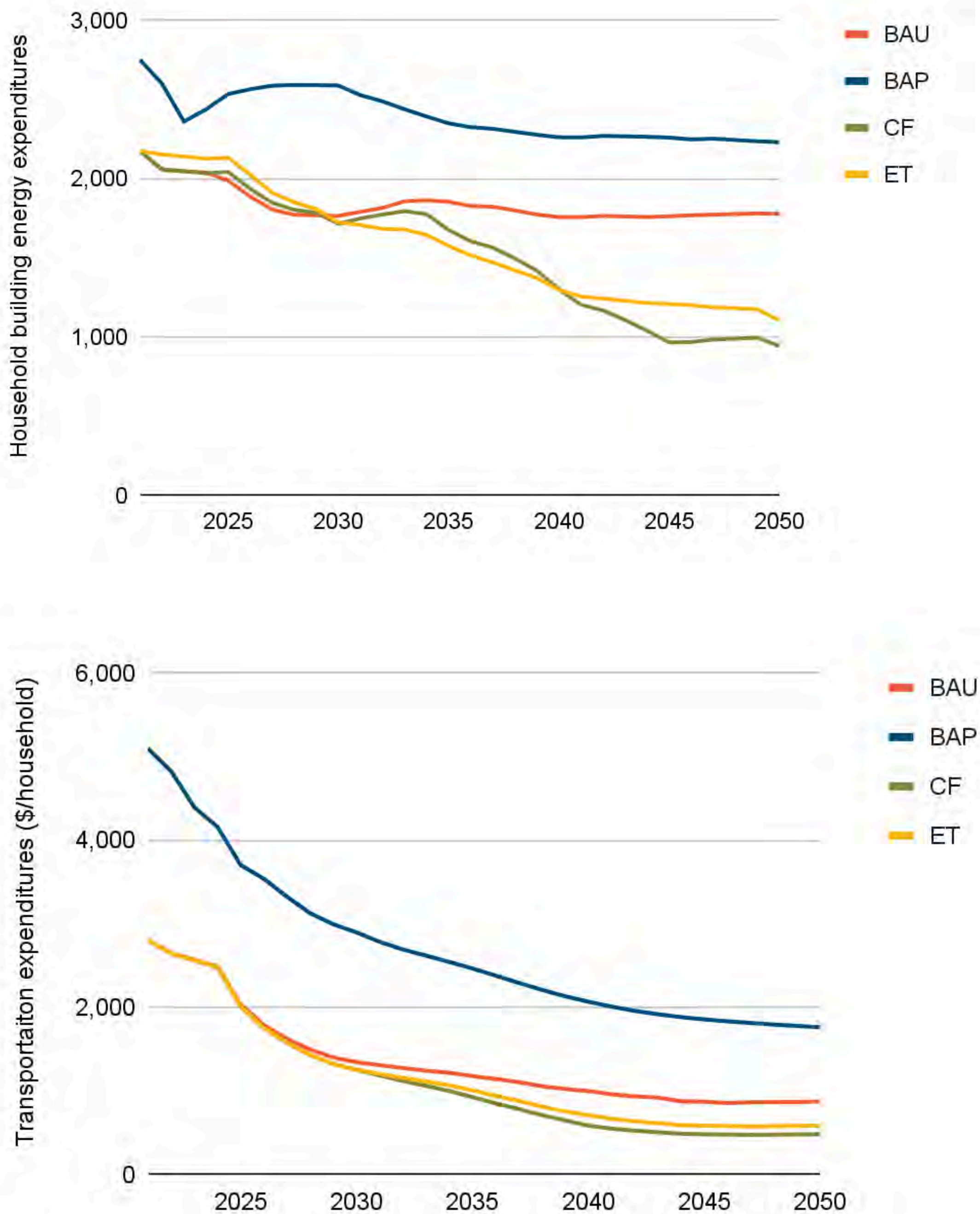


Figure 8.18. Average annual household spending on household building energy costs (top) and household transportation costs (bottom) in the scenarios, 2021-2050. Source: SSG analysis.

8.5.3 Intergenerational Fairness

Observations

Climate change represents a burden on future generations and the complexity of the climatic system means that these impacts are difficult to anticipate. The burden of action increases the longer action is delayed.

The social cost of carbon (SCC) has been used in regulatory processes to reflect the impacts of climate change on society. The SCC attempts to add up the quantifiable costs and benefits of a metric ton of CO_2. While SCC estimates are inherently uncertain due to assumptions about future emissions, climate responses and economic impacts, the SCC remains one of the best available tools for incorporating future climate damages into today's policy and investment decisions. The SCC draws on the results of integrated assessment models and includes assumptions around future conditions and the impact of climate change on those conditions, including: population size, economic growth, rate of climate change, value of changes in net agricultural productivity, human health effects, property damage from increased natural disasters, disruption of energy systems, risk of conflict, environmental migration and the value of ecosystem services.

The discount rate is a significant assumption within the models. Discounting reflects the idea that people would rather have $100 now than $100 in 10 years. From an ethical perspective, a higher discount rate indicates that future generations are worth less than current generations; for this reason the Stern Review[121] recommended a discount rate of 1.4%, well below traditional discount rates: "A 2% pure-time discount rate means that the life of someone born 35 years from now (with given consumption patterns) is deemed half as valuable as that of someone born now (with the same patterns)."[122] A high discount rate also implies that future damages are significantly undervalued — which is not appropriate when referring to climate change, since each tonne of CO_2 emitted into the atmosphere will only increase, and potentially exponentially amplify, future damages.

Impacts

The shape of a community's decarbonization pathway matters. Taking immediate action can result in fewer cumulative emissions compared with delaying action, even if the same targets are still eventually met. Implementing the actions described in the Community-First Scenario will put the Miami Valley Region on a path toward lower overall cumulative emissions by 2050, compared to a scenario in which action is delayed. Full implementation of the Community-First Scenario would result in 140 million $MTCO_2e$ fewer cumulative emissions between 2026 and 2050, compared to taking no additional action (Figure 8.19).

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[121] Nicholas Stern (2006). The Economics of Climate Change: The Stern Review. https://webarchive.nationalarchives.gov.uk/ukgwa/20100407173719/http://www.hm-treasury.gov.uk/sternreview_index.htm
[122] Nicholas Stern. "Economic development, climate and values: making policy." *Proceedings of the Royal Society B* 282, no. 1812 (2015): 20150820. https://doi.org/10.1098/rspb.2015.0820

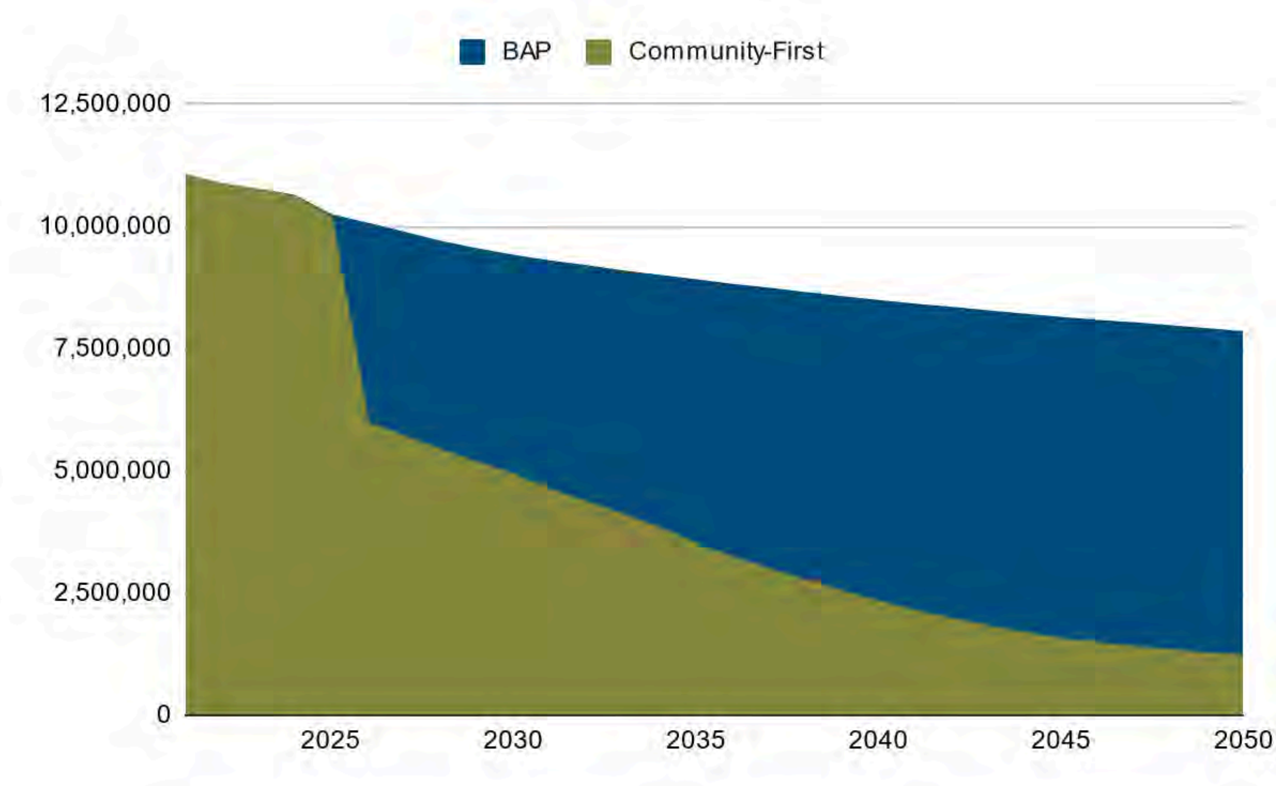

Figure 8.19. Annual and cumulative emissions in the BAP and Community-First Scenarios, 2026-2050. Source: SSG analysis.

Remaining emissions will contribute to climate change on an annual basis. The extent of damage caused by these emissions can be expressed in financial terms using the SCC (Figure 8.20).

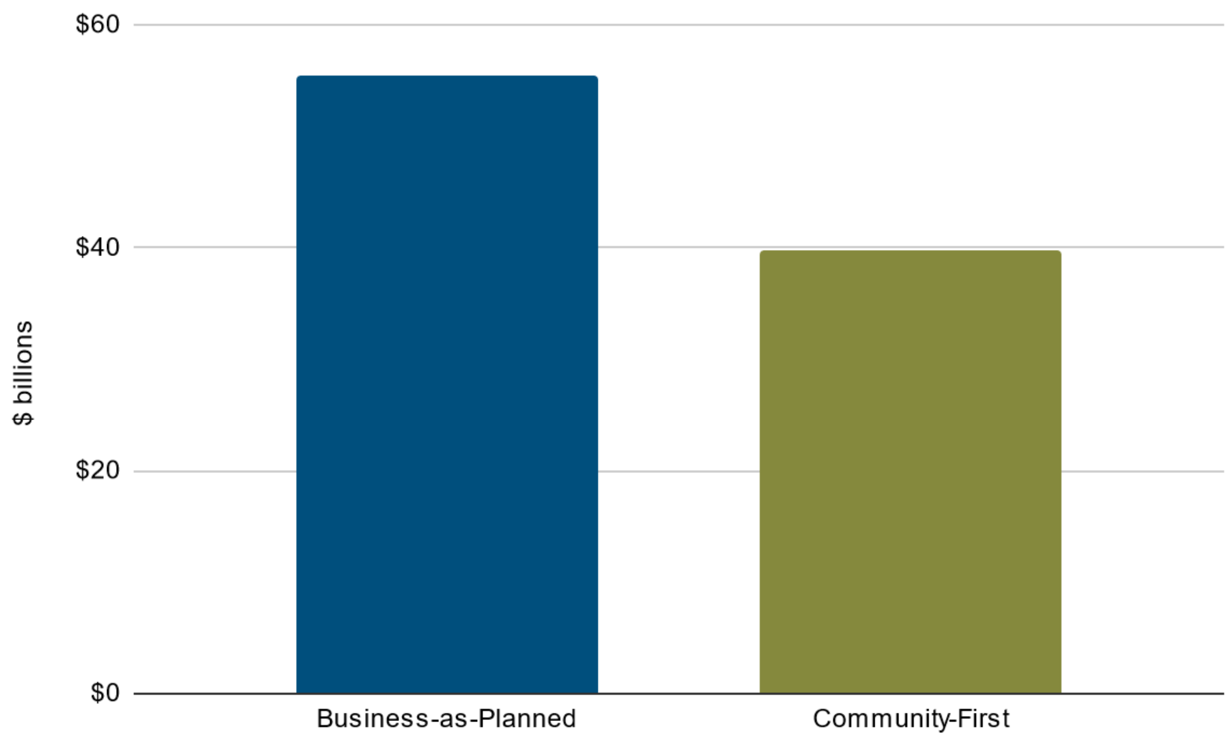

Figure 8.20. Total damages from emissions for the BAP and Community-First Scenarios based on the SCC, 2026-2050. Source: SSG analysis.[123]

If no action is taken to address climate change, damages from cumulative emissions by 2050 could reach more than $55 billion (Figure 8.20). If the Miami Valley Region follows the Community-First Scenario as described in this report, damages could be reduced to $39 billion (or $2 billion annually). Since the impacts of climate change are disproportionately higher for at-risk and low-income communities, reducing cumulative emissions is key to improving positive outcomes for all residents.

[123] Brian C. Prest, Kevin Rennert, Richard G. Newell, Jordan Wingenroth. “Social Cost of Carbon Explorer.” *Resources for the Future*. (September 1, 2022). https://www.rff.org/publications/data-tools/scc-explorer/

9 | Workforce Analysis

9.1 Introduction

The transition to a low-carbon, climate-resilient economy presents both a critical challenge and a transformative opportunity for the Miami Valley Region. To successfully implement the GHG emissions reduction measures planned for the region as part of their CCAP, a capable, available and right-sized workforce is needed. This analysis examines the current state of key industries and occupations in the region that are most relevant to mitigation measures considered in the plan. The analysis is a foundational component of the CCAP, as it serves to identify current labor market capacities, gaps in workforce readiness, and opportunities to build fair pathways toward plan implementation.

The purpose of the analysis is:

- To assess the current workforce in key sectors impacted by the plan, such as energy, transportation, building, waste and industry.
- To identify strategies to align workforce development efforts with the plan's implementation goals.

Thus, this workforce analysis will inform policies and programs that support worker training and career development with a focus on historically underserved at-risk and low-income communities. The analysis directly supports the planning and implementation requirements of the U.S. EPA's CPRG program and guidelines. As a result, this section provides a labor market assessment, outlines strategies to develop and retain a qualified workforce, and identifies mechanisms to ensure fair access to quality employment opportunities.

This document serves to comply with the two main purposes and is organized in two parts: Part 1 provides the minimum information to characterize the current workforce in the Miami Valley Region, while Part 2 is focused on identifying the solutions and strategies for successfully implementing the plan.

9.1.1 Overview of Stakeholder Engagement

Numerous groups have an interest in workforce development in the Miami Valley Region. The overall CCAP engagement process gathered input from a variety of stakeholders regarding workforce needs and gaps in the region. The input summarized here comes from working groups, focus groups, listening sessions and meetings with TAC members (Table 9.1). Efforts to engage stakeholders are ongoing, and broader community engagement has also generated valuable input about workforce issues, as described below.

Table 9.1. Engagement activities used in Workforce Analysis and Planning. Source: SSG analysis.

Engagement Activity	Description	# of Participants
Meetings with utilities	Meetings with relevant utility representatives	5
Working group workshops	Online presentation and discussion with community representatives	6-10
Focus group	Online sessions with industrial and business sector representatives to discuss solutions, plans and actions	9
Listening sessions	In-person activity open to the public	60 approx.

The **major key themes** raised during the planning process are:

- **Local Training and Hiring:** Participants showed a strong interest in building local workforce capacity — especially in low-income communities — to ensure that climate investments benefit residents and help retain technical skills within the region.
- **Green Job Skills:** Engagement input highlighted the need for training in energy efficiency, retrofitting, sustainable construction and emerging clean technologies.
- **Business Readiness:** Businesses face knowledge gaps; simplified processes and targeted education could support greater adoption of clean technologies and practices. Resistance to change is often driven by uncertainty and lack of familiarity.
- **Community Partnerships:** CBOs expressed interest in collaborating on outreach and training efforts that are culturally relevant and accessible.
- **Focus on Fairness:** Across multiple sessions, participants emphasized that workforce strategies must prioritize taking into account the needs of low-income, Black and other marginalized groups.
- **Retrofits and Transit:** Buildings and transportation were identified as key job-creating sectors, with participants highlighting the importance of housing upgrades and investments in sustainable mobility.

9.2 Labor Market Area Characteristics

9.2.1 Current Workforce

In 2023, the total employed population in the Miami Valley Region was 377,035 (out of a total population of 816,546) and the unemployment rate was about 3.4%.[124] Unemployment increased during the COVID-19 pandemic in 2020, which later decreased to pre-pandemic levels with a more steady trend until 2024 (Figure 9.1).

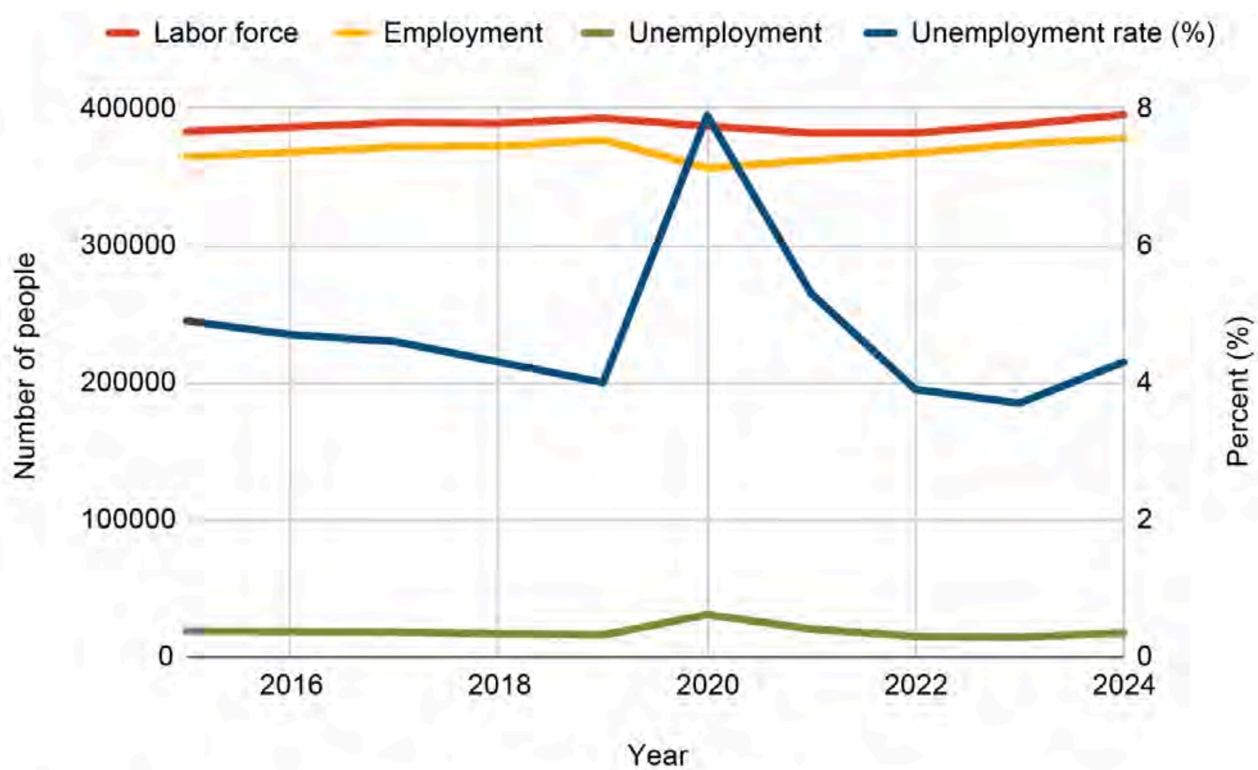

Figure 9.1. Historical labor force data for the Miami Valley Region, 2015-2024. Source: U.S. Bureau of Labor Statistics (BLS).

Figure 9.2 shows the number of jobs and median wages by industry type in 2023. The largest sector is education and health services, followed by trade, transportation and utilities. The sectors with higher wages are financial activities, professional and business services, and information. The fourth and fifth sectors are construction and manufacturing, respectively.

[124] U.S. BLS. BLS Data Finder 1.1. https://data.bls.gov/dataQuery/find?q=unemployment+rate&q=employment+dayton

In 2023, the average annual pay among all industries in the Miami Valley Region was $60,981. The financial activities industry had the highest average annual pay ($82,076), followed by professional and business services ($79,262), and unclassified (or those businesses that did not report a NAICS code) ($78,894).

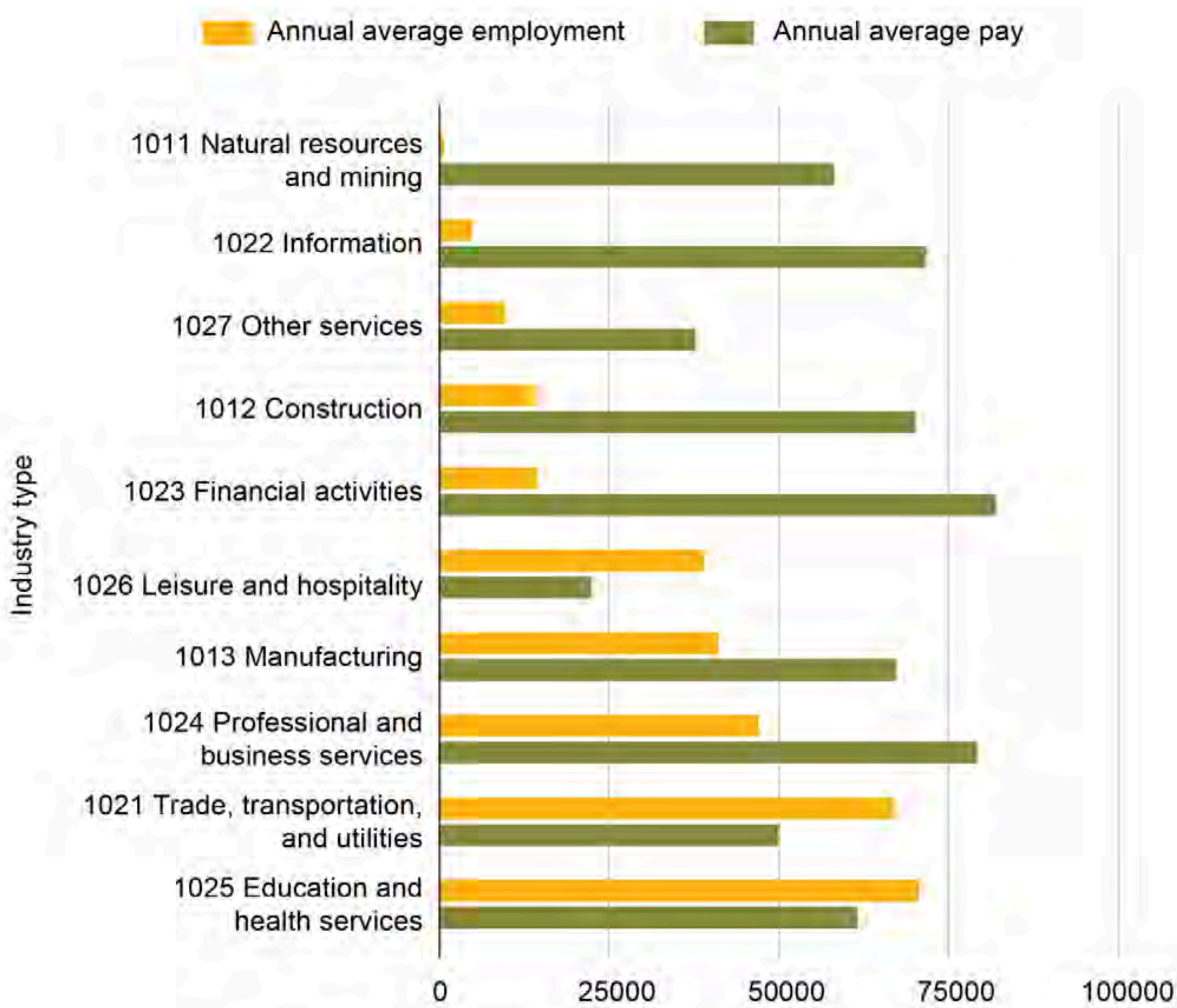

Figure 9.2. Employment and pay in the Miami Valley Region, 2023. Source: Adapted from the BLS Quarterly Census of Employment and Wages (QCEW), 2024.[125]

[125] U.S. BLS (April 2025). Quarterly Census of Employment and Wages. https://www.bls.gov/cew/downloadable-data-files.htm

Education attainment can play a role in determining the readiness and capacity of workers to meet the required technical or specialized skills required in new and emerging industries and jobs. In 2023, 19% of residents in the Miami Valley Region possessed a bachelor's degree, which was 2.8% below the national average (Figure 9.3).

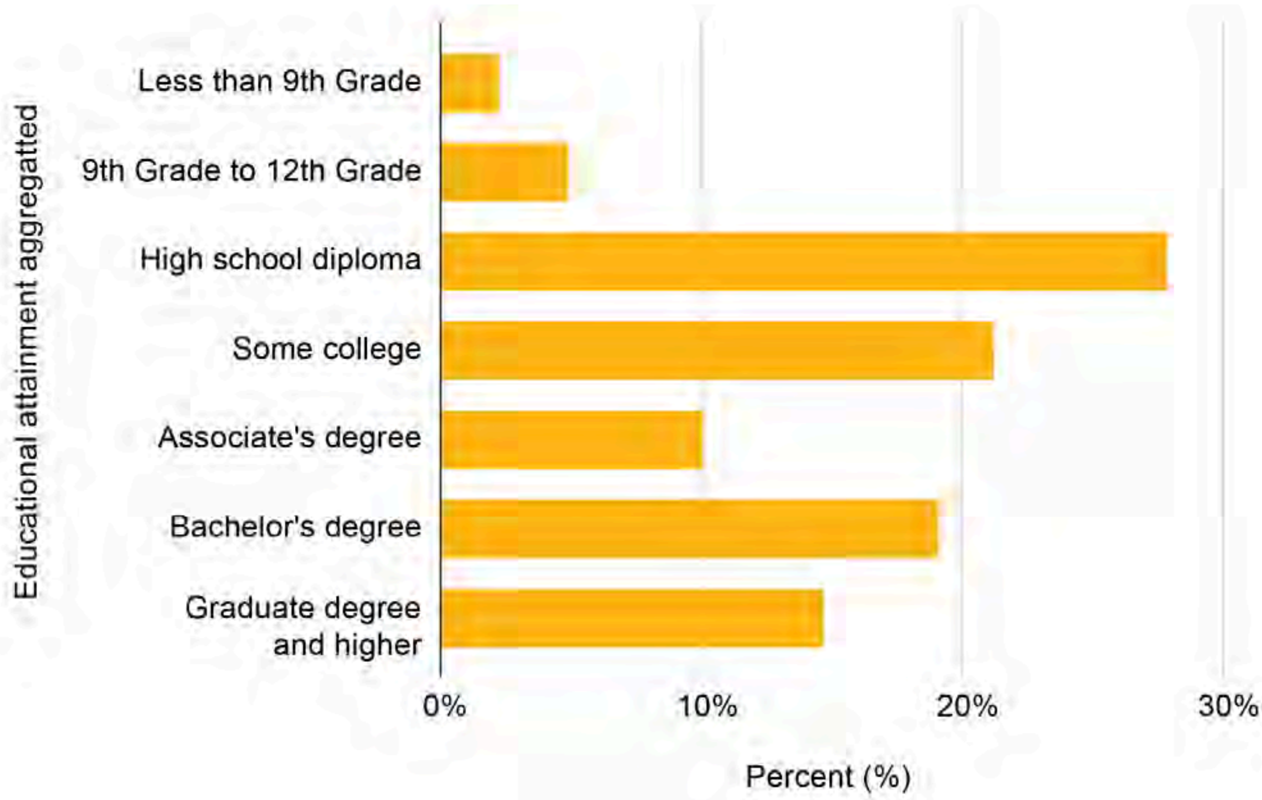

Figure 9.3. Educational attainment in the Miami Valley Region, 2023. Source: American Community Survey (ACS), 2023.

9.2.2 Key Energy Industries

The 2024 U.S. Energy and Employment Report (USEER) from the U.S. DOE found that the three counties of the Miami Valley Region had nearly 8,400 energy workers, accounting for about 2.3% of total employment. In 2023, around 47% of energy jobs in the region were in the motor vehicle industry, followed by the energy efficiency jobs (34%), transmission, distribution and storage (11%), electric power generation (7%) and fuels sectors (2%) (Figure 9.4).

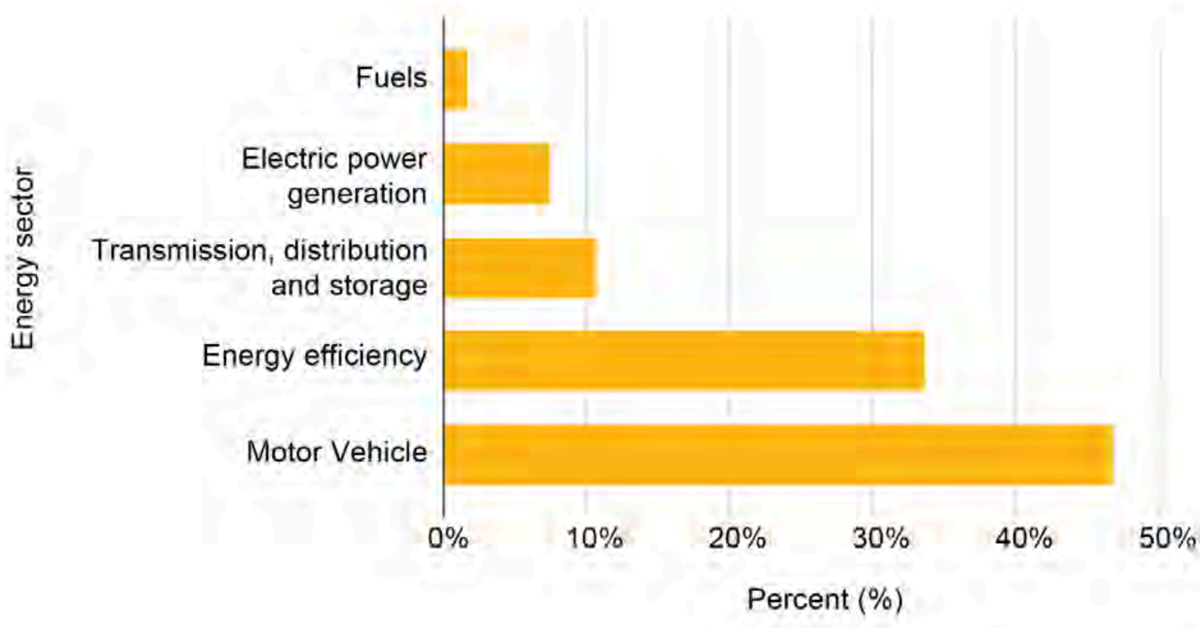

Figure 9.4. Number of energy jobs by sector in the Miami Valley Region, 2023. Source: USEER, 2024.[126]

Montgomery County concentrates the largest share of jobs in the energy sector for any type of category, as shown in Table 9.2.

Table 9.2. Energy employment by county, 2023. Source: USEER, 2024.

County	Electric Power Generation	Transmission, Distribution and Storage	Fuels	Energy Efficiency	Motor Vehicles
Greene	103	116	59	822	536
Miami	100	183	33	604	1,837
Montgomery	964	1,374	184	3,852	4,970

Jobs in the energy efficiency sector account for the largest share of clean energy jobs in the region (Figure 9.5), followed by the vehicle industry in the motor vehicle sector — although the region faces challenges regarding the portfolio of clean jobs, where they comprise only 16% of the motor vehicle industry. In this context, even though the electric power generation sector is small compared to the energy efficiency and motor vehicle sectors, it presents the largest share of jobs in renewable energy (29% out of the total electric power generation sector), leading with solar.

[126] U.S. DOE. 2024 U.S. Energy & Employment Jobs Report (USEER). https://www.energy.gov/policy/us-energy-employment-jobs-report-useer

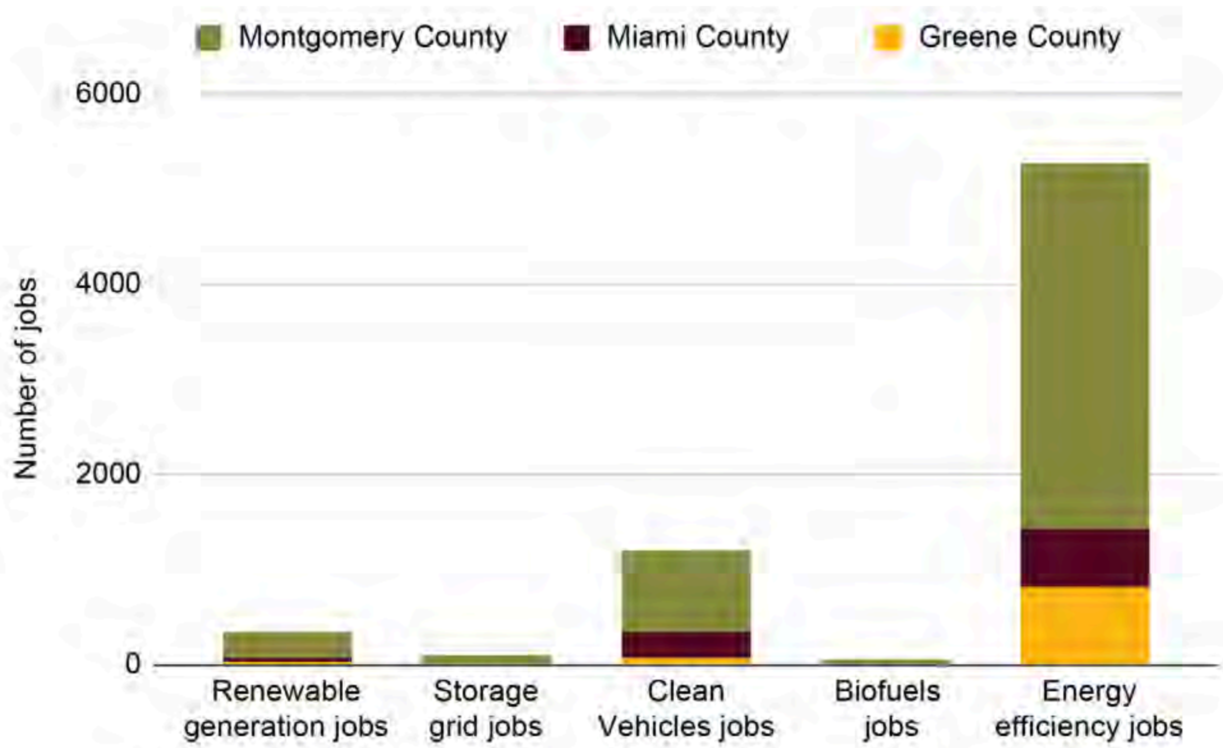

Figure 9.5. Clean energy jobs by county in the Miami Valley Region, 2023.
Source: USEER, 2024.

Overall, the number of clean jobs in these sectors has increased since 2022, with different growth rates by county, adding 312 jobs in the whole region by 2024 compared to 2023. Greene County has seen a growth of only 2.5%, which is considerably lower than Ohio (4.4%), Miami County (6.5%) and Montgomery County (4.8%).

9.2.2.1 Electric Power Generation

The electric power generation sector employed 1,166 workers in the Miami Valley Region in 2023 (Figure 9.6). Almost one-third of total jobs in this sector account for renewable energy, leading with solar generation. Wind power still makes up a small share of power generation employment, except for Greene County which has up to 24 jobs in wind generation, out of 33 total jobs in the renewable energy sector.[127]

[127] According to the 2024 USEER, the Miami Valley Region has 286 coal generation jobs. However, based on known facility closures (e.g., Miami Fort Power Station closed in 2022 and located outside the region), these figures may reflect outdated or misallocated employer survey data.

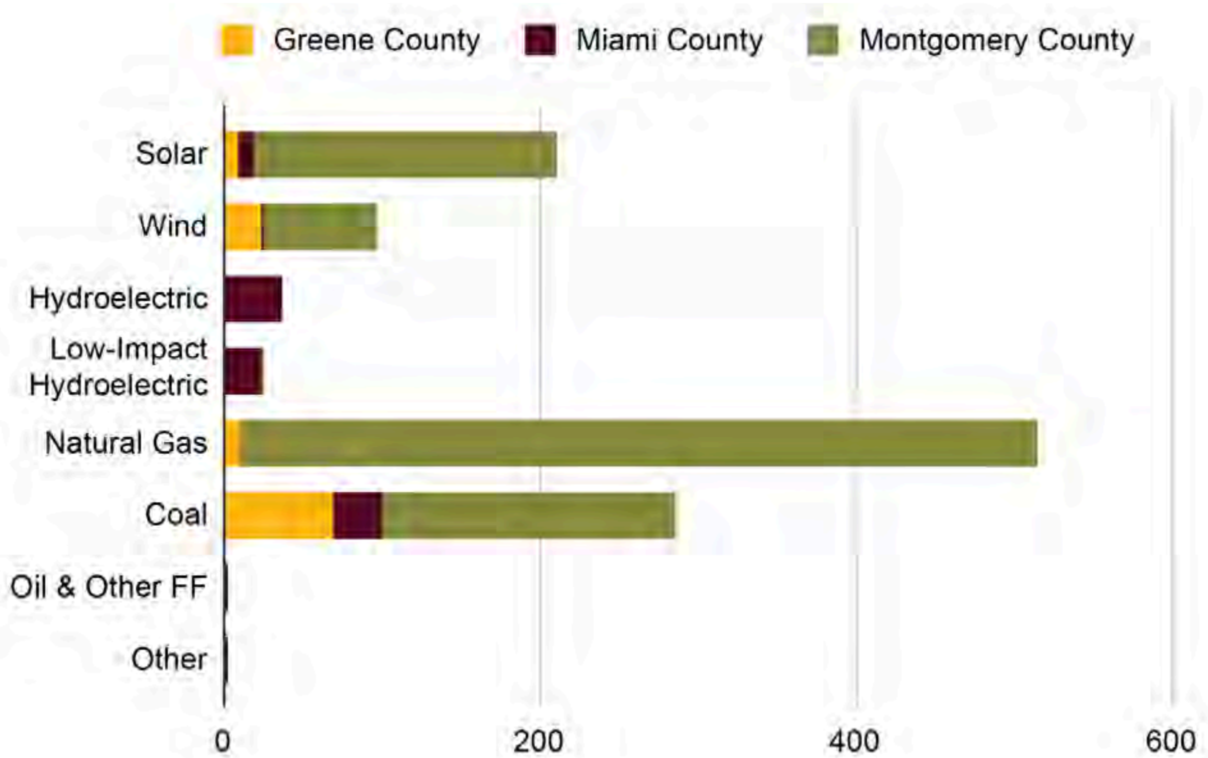

Figure 9.6. Electric power generation jobs by county in the Miami Valley Region, 2023. Source: USEER, 2024.

9.2.2.2 Transmission, Distribution and Storage

The transmission, distribution and storage sector employed 1,673 workers in the Miami Valley Region in 2023 (Figure 9.7). Statewide, clean jobs in this sector decreased 1.8% from 2023 to 2024, compared to the growth of 5.3% in 2023 relative to 2022. In terms of clean jobs, Ohio ranks 16th nationally, with most of the new jobs concentrated in clean storage, followed by grid modernization. However, regional employment is still dominated by traditional transmission, distribution and storage jobs, with limited advancement in clean storage, smart grids, microgrids and other grid modernization activities.

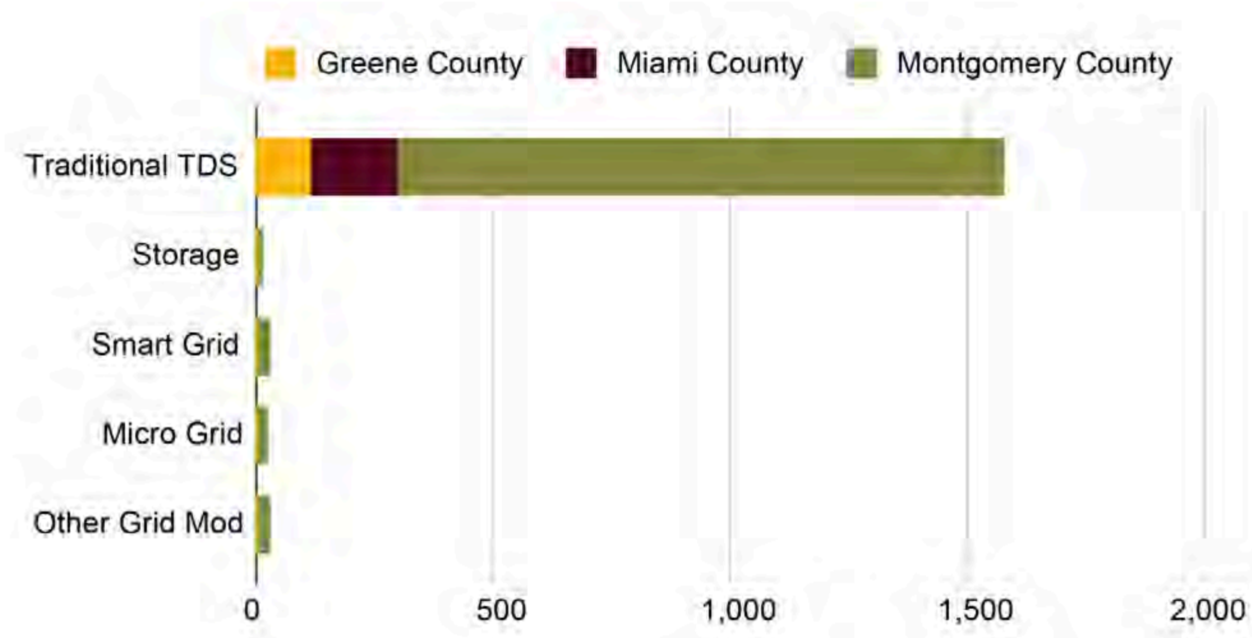

Figure 9.7. Transmission, distribution and storage (TDS) jobs by county in the Miami Valley Region, 2023. Source: USEER, 2024.

9.2.2.3 Fuels

The fuels sector employed 276 workers in the Miami Valley Region in 2023. Statewide, this sector grew 0.2% between 2022 and 2023. Employment in the fuels sector is primarily concentrated in “Oil and Other” jobs, while clean sources account for one-third of jobs (28% of total jobs in this sector).

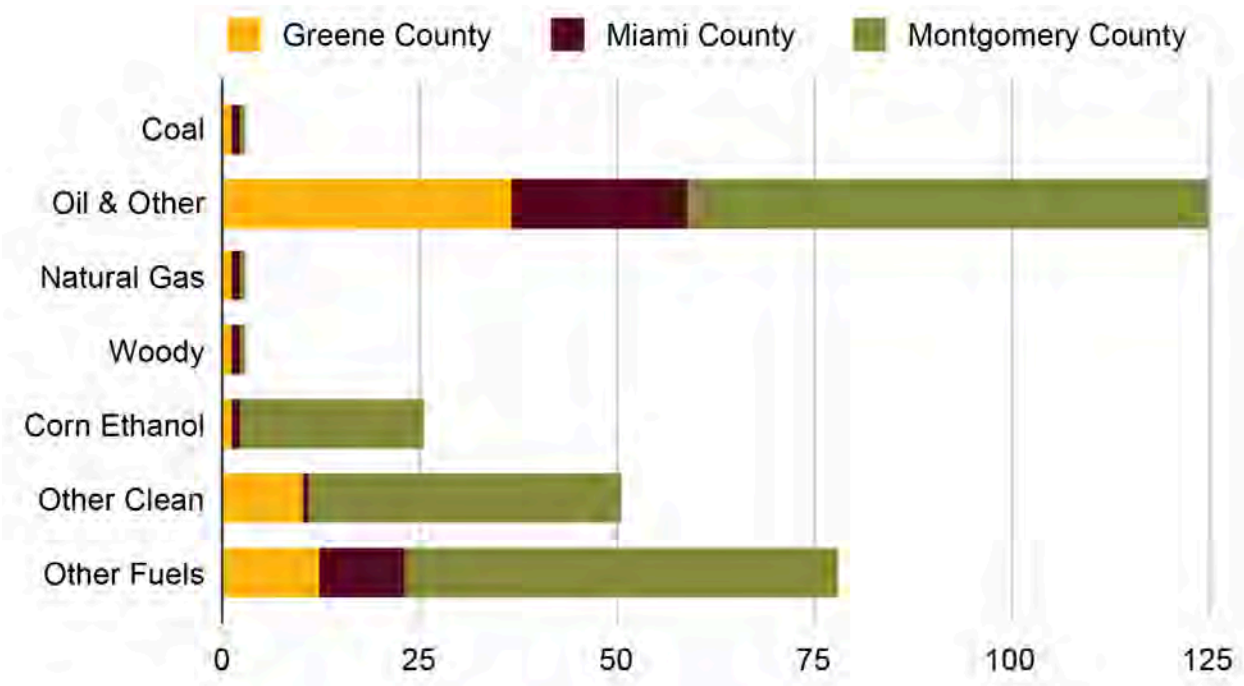

Figure 9.8. Fuels jobs by county in the Miami Valley Region, 2023. Source: USEER, 2024.

9.2.2.4 Energy Efficiency

The energy efficiency sector employed 5,278 workers in the region in 2023. Statewide, this sector increased 3% between 2023 and 2024, below the national growth of 3.4%. Figure 9.9 shows the number of jobs in this sector by county. This sector displays a relatively homogeneous distribution of jobs, only slightly led by the traditional HVAC type, closely followed by advanced materials and insulation.

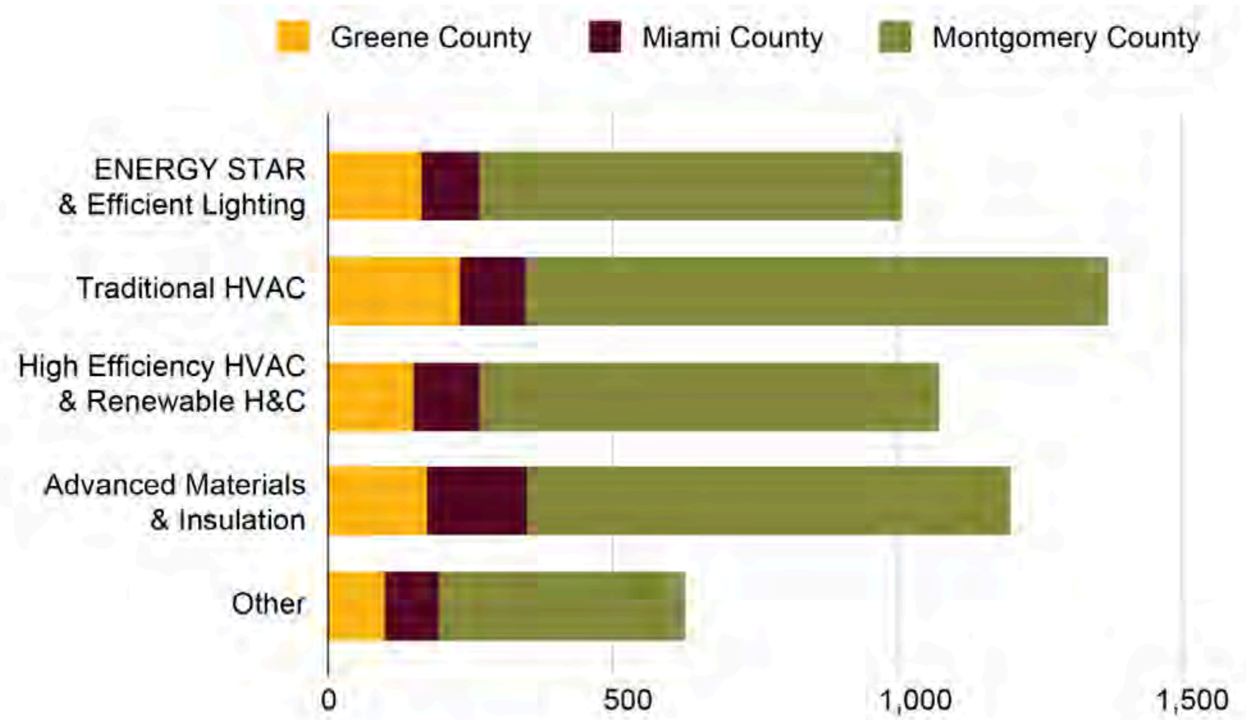

Figure 9.9. Number of jobs in energy efficiency industries by county in the Miami Valley Region, 2023. Source: USEER, 2024.

9.2.2.5 Motor Vehicles

The motor vehicle sector employed 7,344 workers in the region in 2023, of which 1,203 are clean vehicles jobs (considering EVs, hybrid EVs, PHEVs, hydrogen vehicles and fuel-cell vehicles). Statewide, this sector increased 0.8% between 2022 and 2023 overall and ranked 4th nationally with the clean jobs growth between 2023 and 2024 (9.2%).

9.3 Workforce Projections and Future Needs

New and growing jobs in the green economy represent a critical shift in workforce demands for the region as it prepares to implement climate actions. The successful transition to a green economy requires a workforce equipped with the appropriate education, knowledge and skills that will be translated into new training opportunities, expanding workforce development partnerships and initiatives, and targeted upskilling of the labor pool.

The Dayton Region Economic Development Strategy, released in 2022, highlights the emerging industries in the region. They include advanced air mobility and energy production and alternative energy, which may contribute to the creation of a green workforce. Other emerging industries — including logistics and distribution, biosciences and biotechnology, and cyber technology and digital engineering — may support the implementation of the plan by providing more efficient and innovative solutions and support data-driven decision-making. However, these industrial sectors may suggest a gap in industries directly tied to GHG emissions reduction measures.

Of concern is the decreasing population of the 20-30 and 50-60 age groups in the coming years (by 2031). The population of 20-30 year olds is expected to decrease around 2% between 2021 and 2031. A decreasing population poses challenges in terms of the gap it creates in meeting workforce needs. The Miami Valley Region needs to plan strategies to increase the availability of and training for a skilled workforce to address these gaps.

9.3.1 Priority Occupations

This section identifies key occupations in each sector: energy, buildings, transportation, industry, waste, and working and natural lands. Table 9.3 shows the priority occupations required to implement the identified climate measures. However, this is not an exhaustive list and other occupations not shown are likely needed as well for the implementation of GHG emissions reduction measures.

Table 9.3. Priority occupations by sector. Source: O*NET (2024).[128]

Sector	Description	Priority Occupations
Buildings	Occupations involved in energy-efficient building design, construction, retrofitting, HVAC, electrification and weatherization	Civil engineers Construction and building inspectors Electricians Heating and air conditioning mechanics and installers Weatherization installers and technicians

[128] O*Net OnLine. https://www.onetonline.org/

Sector	Description	Priority Occupations
Transportation	Occupations related to vehicles, public transit, logistics and infrastructure	Automotive engineering technicians Bus and truck mechanics and diesel engine specialists Logistics analysts Transportation engineers (e.g., civil engineers) Transportation planners (e.g., urban and regional planners) Electrical and electronic engineers Technologists and technicians
Energy	Occupations related to renewable energy generation and power systems	Construction laborers Solar PV installers Wind turbine service technicians
Industry	Occupations in manufacturing, engineering, production and related operations	Chemical engineers Commercial and industrial designers Electrical engineers Industrial engineers Machinists Manufacturing production technicians
Waste	Occupations focused on recycling, waste removal, landfill gas, composting and wastewater	Environmental engineers Methane/landfill gas generation system technicians Recycling coordinators Water/wastewater engineers

9.3.2 Workforce Supply

The Miami Valley Region has a current labor pool of residents employed in the occupations listed in Table 9.3. Historic changes of these occupations in the region are displayed in Figure 9.10 and with more detail in Table 9.4. Between 2015 and 2024, the region experienced a dramatic increase in the number of jobs in the following occupations: industrial engineers (89%), electricians (44%), logisticians (37%), and water and wastewater treatment plant and system operators (34%). In contrast, occupations that have been decreasing are construction laborers (-18%); environmental engineers (-29%); urban and regional planners (-33%); machinists (-50%); and sales representatives, wholesale and manufacturing, and technical and scientific products (-78%).

Note that limited data is available at the county and regional levels for occupations related to solar, wind and forest conservation. However, according to the latest data, these occupations are projected to increase in the next decade (Table 9.4). Table 9.4 presents projections based on BLS data, and all occupations — except WWTP operators — are expected to increase, with renewable energy occupations showing the largest gains. Employment for WWTP operators is projected to decline by 2033 relative to 2023. This does not imply a reduction in WWTPs, but rather a decrease in the number of employed operators due to several factors including demographic shifts, such as retirements, where vacated positions may not be refilled. Other factors considered in BLS projections include technological advancements and productivity changes, which suggest increased automation and more efficient operations, ultimately resulting in reducing the demand for workers.

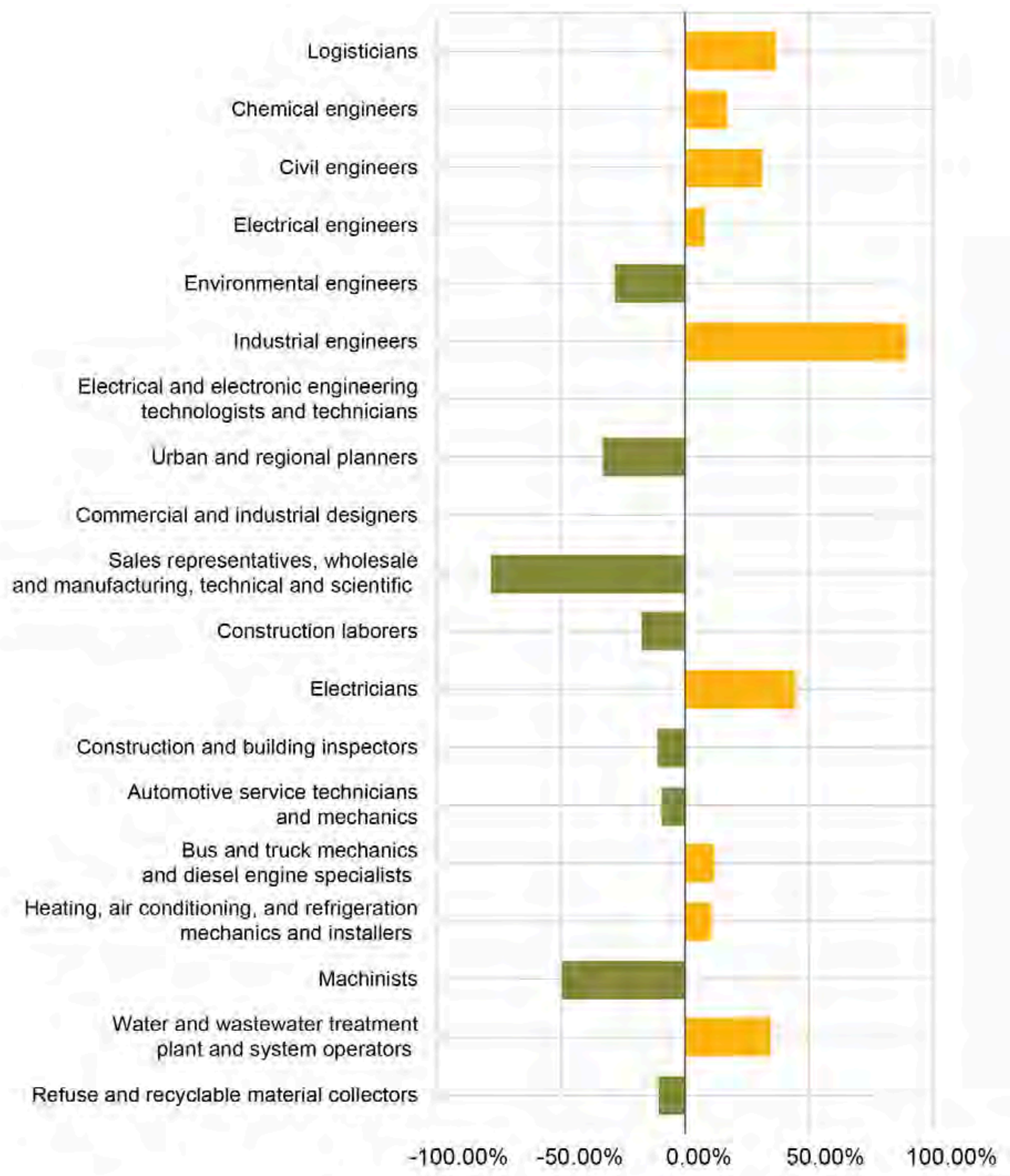

Figure 9.10. Percentage change of number of jobs in selected priority occupations relevant for CCAP implementation, 2015-2024. Source: Adapted from BLS Occupational Employment and Wage Statistics (OEWS), 2024.

Table 9.4. Workforce trends by sector and occupation in 2015 and 2023. Source: Adapted from BLS OEWS, 2024; U.S. Department of Labor State Employment Projections, 2022.

Sector	Occupation	Total Employment 2015	Total Employment 2023	Annual Average Wage 2023	Projected Employment 2033	Projected Growth 2033 (%)
Buildings	Civil Engineers	450	540	$94,230	575	7%
Buildings	Construction Laborers	1,540	1,380	$51,940	1,493	8%
Buildings	Electricians	1,240	1,520	$61,840	1,684	11%
Buildings	Construction and Building Inspectors	180	210	$74,060	210	0%
Buildings	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	940	1,070	$58,610	1,167	9%
Energy	Solar Photovoltaic Installers	No data	200	$40,300	296	48%
Energy	Wind Turbine Service Technicians	No data	95	$70,400	152	60%
Industry	Chemical Engineers	60	70	$114,510	77	10%
Industry	Electrical Engineers	510	570	$106,450	622	9%
Industry	Industrial Engineers	950	1,640	$101,020	1,840	12%
Industry	Commercial and Industrial Designers	90	100	$75,170	103	3%
Industry	Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products	1,250	240	$98,470	247	3%
Industry	Machinists	2,170	1,120	$53,450	1,139	2%
Sequestration	Environmental Engineers	70	70	$106,180	75	7%

Sector	Occupation	Total Employment 2015	Total Employment 2023	Annual Average Wage 2023	Projected Employment 2033	Projected Growth 2033 (%)
Transportation	Logisticians	1,110	1,420	$100,190	1,694	19%
Transportation	Electrical and Electronic Engineering Technologists and Technicians	200	200	$68,320	206	3%
Transportation	Urban and Regional Planners	60	70	$83,360	73	4%
Transportation	Automotive Service Technicians and Mechanics	1,710	1,680	$46,120	1,725	3%
Transportation	Bus and Truck Mechanics and Diesel Engine Specialists	670	640	$57,760	658	3%
Waste and wastewater	Water and Wastewater Treatment Plant and System Operators	320	350	$56,950	329	-6%
Waste and wastewater	Refuse and Recyclable Material Collectors	370	300	$49,450	307	2%

9.3.3 Projected Workforce Demand for Community-First Scenario Implementation

This section outlines the workforce demand for implementing the Community-First Scenario. Table 9.5 lists the number of workers needed by sector to implement actions, relative to BAU employment projections. The sectors with the largest demand for workers or new jobs are buildings, industry and energy. Jobs needed are related to retrofitting existing buildings across the region, installing rooftop solar, and implementing energy efficiency measures in industrial processes. These three sectors account for 97% of the total number of jobs needed cumulatively from 2025 to 2050. These results are partially aligned with the projected growth trends shown in Table 9.4.

The fastest-growing occupations are solar installers and wind turbine technicians, followed by industrial engineers and electricians. Logisticians are also expected to grow significantly, supporting the transition in the transportation sector.

However, the region currently falls short of supplying the workforce needed to implement these actions, particularly in retrofitting existing buildings. By 2033, an estimated 1,400 jobs are projected in construction-related occupations (Table 9.4), but local implementation needs suggest that more than 1,200 additional workers will be required to meet demand in this sector. This gap highlights a major opportunity to invest in local training, apprenticeships and recruitment programs to support the implementation of the plan and create high-quality jobs for Miami Valley residents.

Table 9.5. Estimated workforce needed by measure. Source: SSG analysis.

Action	Number of Jobs Needed 2025-2050
More energy-efficient new buildings are built	848
Existing buildings are retrofitted	74,740
New and existing buildings switch to heat pumps and RNG use for commercial and residential buildings	4,506
Electrifying water heaters and stoves	2,117
Electrify transportation	1,221
Increase transit and active mode shares	797
Zero-emissions grid	N/A
Solar generation	8,211
Renewable energy procurements for industrial processes	N/A
District energy system	-4
Industrial sector processes improvements	15,734

Action	Number of Jobs Needed 2025-2050
Electrifying industrial processes	0
Switch to RNG in WWTPs	0
Residents reduce waste generation per capita	N/A
Landfill diversion of waste	-1,959

Most of the new employment opportunities will be created in the decade 2040-2050 (Figure 9.11). Building retrofits present the largest opportunity for new employment and create opportunities to partner with local education centers to provide job training. This could include expanding programs to teach the skills required to complete deep energy retrofits and install high-efficiency equipment. The waste sector, by contrast, shows a decline in job numbers as communities reduce their per capita waste generation, leading to lower demand for waste treatment. However, composting and anaerobic digestion still contribute to job creation — though the net result is a decrease in overall employment in the waste sector by 2050.

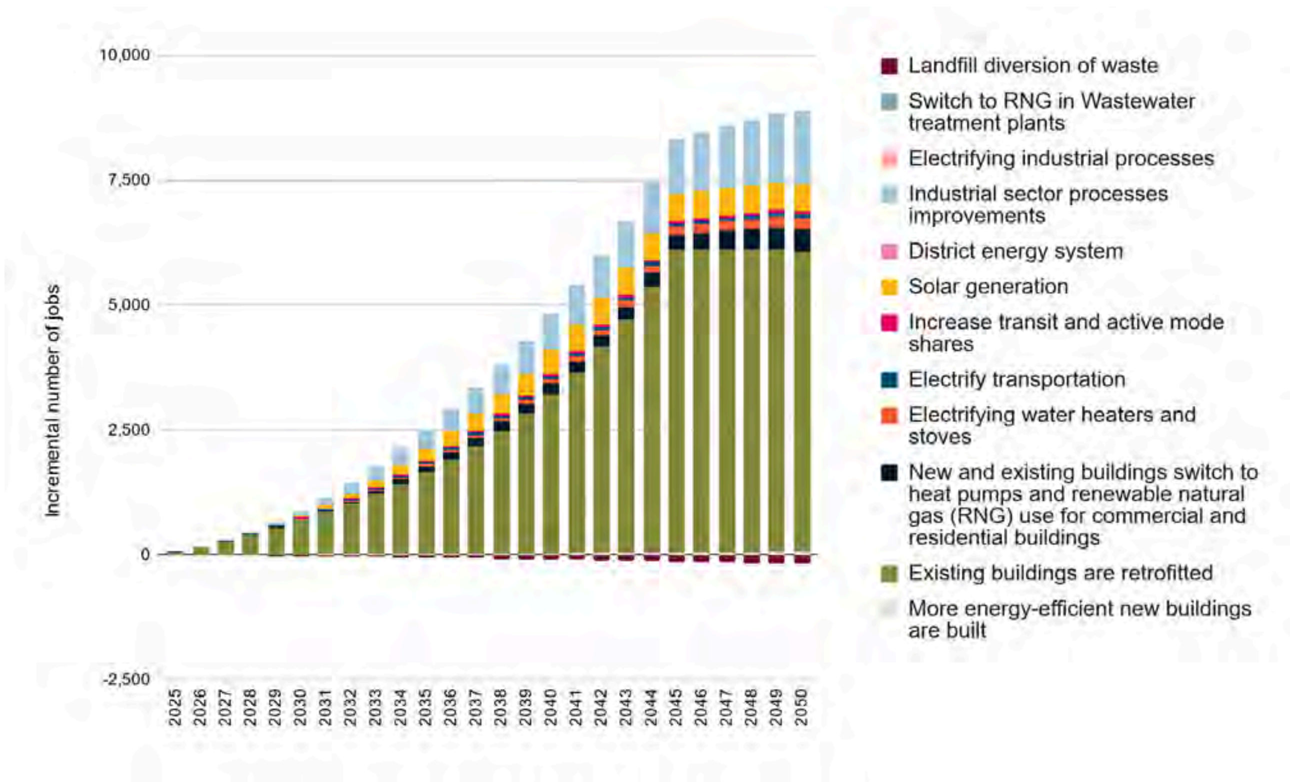

Figure 9.11. Incremental number of jobs created in the Community-First Scenario, relative to the BAU Scenario, 2025-2050. Source: SSG analysis.

9.3.4 Workforce Shortages and Challenges

The main challenges to the implementation of actions and workforce development for the region are the degrowth of wastewater system operators and the limited growth of relevant occupations such as heating, air conditioning and refrigeration mechanics and installers; construction laborers and building inspectors; and refuse and recyclable material collectors. Labor demands in these areas require skilled workers, offering an opportunity to upskill existing workers in advanced energy efficiency technologies, such as heat pump installation, inspection and diagnostics or building insulation.

In the transportation sector, barriers are related to the growth of bus and truck specialists. Although transportation technicians are expected to decrease due to a lower use of vehicles, electrification of vehicles requires upskilling current workers and support for transition to clean technologies. Leveraging local industries and organizations is a key element for transition, for instance, connecting with investment opportunities such as the automotive manufacturing of EV projects in the region and nearby communities (e.g., Honda and LG Energy Solution investment in battery manufacturing plants in Ohio).

Another regional challenge is the low annual average wages for key slow-growing occupations and sectors. Among these, the five occupations with the lowest annual average wages are solar installers, forest and conservation technicians, automotive services and mechanics, refuse and recyclable material collectors, and construction laborers. In addition, jobs in solar generation in Miami and Greene counties are limited, and the region has a strong dependency on the natural gas generation industry. Thus, the region is facing a two-layered challenge with low wages and a limited workforce in this sector.

In terms of educational and training requirements, out of the lowest paid occupations, only recyclable material collectors and construction laborers do not require formal educational credentials, although they require short-term on-the-job training. While educational attainment and access is widespread in the Miami Valley Region, where 92% of the population has graduated high-school, most occupations require a post-secondary degree (Table 9.6).

Table 9.6. Typical education needed for entry by occupation. Source: Adapted from BLS, Occupational Employment Projections Data, 2024.

Occupation	No Formal Educational Credential	High School Diploma or Equivalent	Post-Secondary Non-Degree Award	Associate's Degree	Bachelor's Degree	Master's Degree
Automotive service technicians and mechanics			x			
Bus and truck mechanics and diesel engine specialists		x				
Chemical engineers					x	
Civil engineers					x	
Commercial and industrial designers					x	
Construction and building inspectors		x				
Construction laborers	x					
Electrical and electronic engineering technologists and technicians				x		
Electrical engineers					x	
Electricians		x				
Environmental engineers					x	
Forest and conservation technicians				x		
Heating, air conditioning, and refrigeration mechanics and installers			x			
Industrial engineers					x	
Logisticians					x	

Occupation	No Formal Educational Credential	High School Diploma or Equivalent	Post-Secondary Non-Degree Award	Associate's Degree	Bachelor's Degree	Master's Degree
Machinists		x				
Refuse and recyclable material collectors	x					
Sales representatives, wholesale and manufacturing, technical and scientific products					x	
Solar photovoltaic installers		x				
Urban and regional planners						x
Water and wastewater treatment plant and system operators		x				
Wind turbine service technicians			x			

9.4 Workforce Solutions and Strategies

This section identifies solutions to address workforce shortages, including potential workforce partners and resources that could help address obstacles the Miami Valley Region might face from achieving the CCAP goals. Existing partnerships and resources can also be leveraged to support the achievement of these goals (Table 9.7).

Table 9.7. Potential workforce needs by sector. Source: SSG analysis.

Sector	Job Training	Additional Staffing	Employees With Speciality Certifications	Support for Transitional Workforce	Career Pathway Awareness and Education
Buildings	X		X		X
Energy	X	X		X	X
Transportation	X	X		X	X
Industry	X				X
Waste	X	X			X

9.4.1 Workforce Development Solutions

To close the gaps in workforce needs for CCAP implementation, the Miami Valley Region will focus on a workforce development strategy with three key goals:

1. Good Jobs principles to create high-quality jobs in the region
2. Workforce development benefitting **all** communities and people in the region
3. Closing gaps through partnerships and mobilizing funding

Each of these goals are discussed in more detail below.

9.4.2 Good Jobs Principles

During the planning and implementation of GHG emissions reduction measures, quality jobs should be built into the project planning process. High-quality jobs are those that provide stable pay, job security, safe working conditions and secure benefits to support workers and their families.

Employers should be supported in reducing barriers to accessing high-quality jobs by removing unnecessary hiring requirements, providing reasonable accommodations to individuals with disabilities during the hiring process, recruiting from communities underrepresented in the workforce, and providing transparent pay schedules with equal wages and career ladders.

In 2022, the U.S. Department of Commerce and Department of Labor partnered to define what makes a good job. The “Good Jobs Principles” provide a framework for employers, workers and governments for creating stable, secure jobs with livable wages and safe working conditions. These eight principles are outlined below and can be a guide for developing future workforce development programs, training, job support and recruitment initiatives.

Recruitment and hiring: Qualified applicants are actively recruited. Applicants are free from discrimination, including unequal treatment or application of selection criteria that are unrelated to job performance. Applicants are evaluated with relevant skills-based requirements. Unnecessary credentials and educational and experience requirements are minimized.

Benefits: Full-time and part-time workers are provided benefits that promote economic security and mobility. These include health insurance; a retirement plan; workers’ compensation benefits; work-family benefits, such as paid leave and caregiving support; and others that may arise from engagement with workers. Workers are empowered and encouraged to use these benefits.

Equal opportunity: All workers have equal opportunity. Workers are respected, empowered and treated fairly. Individuals from underserved communities do not face systemic barriers in the workplace. Underserved communities are persons adversely affected by persistent poverty, discrimination or unequal access, including Black, Indigenous, people of color (BIPOC); LGBTQ+ individuals; women; immigrants; veterans; military spouses; individuals with disabilities; individuals in rural communities; individuals without a college degree; individuals with or recovering from substance use disorder; and justice-involved individuals.

Empowerment and representation: Workers can form and join unions. Workers can engage in protected, concerted activity without fear of retaliation. Workers contribute to decisions about their work, how it is performed and organizational direction.

Job security and working conditions: Workers have a safe, healthy and accessible workplace, built on input from workers and their representatives. Workers have job security without arbitrary or discriminatory discipline or dismissal. They have adequate hours and predictable schedules. The use of electronic monitoring, data and algorithms is transparent, fair and carefully deployed with input from workers. Workers are free from harassment, discrimination and retaliation at work. Workers are properly classified under applicable laws. Temporary or contractor labor solutions are minimized.

Organizational culture: All workers belong, are valued, contribute meaningfully to the organization and are engaged and respected, especially by leadership.

Pay: All workers are paid a stable and predictable living wage before overtime, tips and commissions. Workers' pay is fair and transparent. Workers' wages increase with increased skills and experience.

Skills and career advancement: Workers have fair access to opportunities and the tools they need to progress to future good jobs within or outside their organizations. Workers have transparent promotion or advancement opportunities. They also have access to quality employer- or labor-management-provided training and education.

9.4.3 Workforce Development Benefits All Communities

9.4.3.1 Workforce Demographics

In the Miami Valley Region, 92% of the population aged 25 years and over have some form of educational attainment, ranging from a high school diploma to a post-graduate degree. The region has a slightly higher percentage of individuals who have attained a high school diploma (26%) compared to national averages (25%). The share of the population with a Bachelor's degree follows a similar trend, reaching 30% in the Miami Valley Region versus only 21% on average in the U.S.

Figure 9.12 shows percentages of educational attainment by gender, with similar shares holding a Bachelor's degree, as well as comparable trends in the categories of some college, post-graduate degrees and high school diplomas. In both cases, less than 8% of the population has not attained a formal degree.

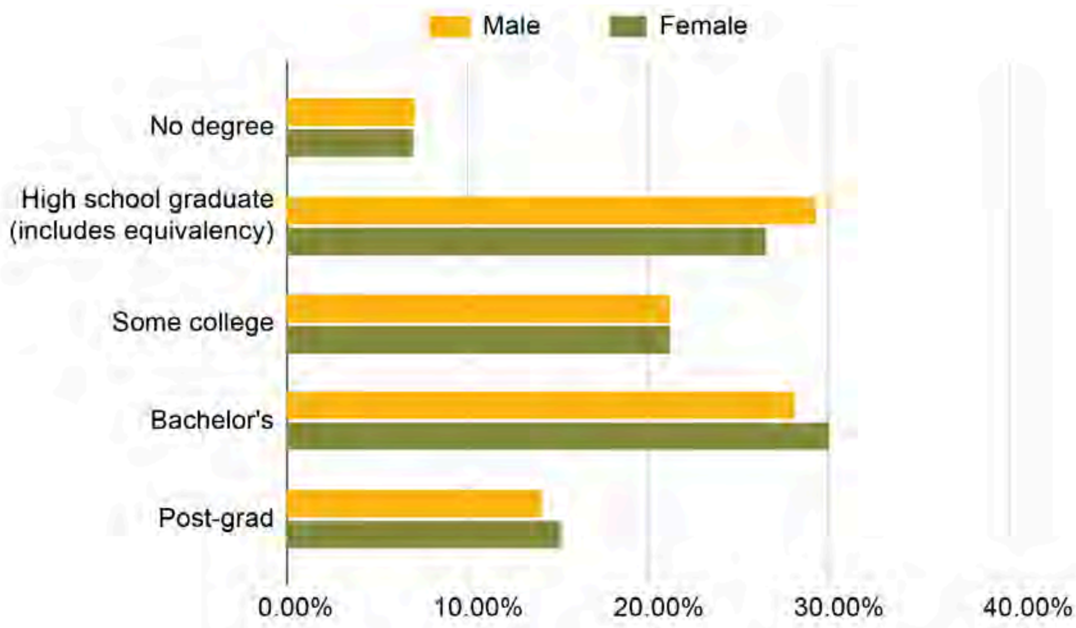

Figure 9.12. Percentage of educational attainment by gender in the Miami Valley Region, 2023. Source: Adapted from Census Reporter, 2024.[129]

The region faces challenges in terms of educational access among different population groups (Figure 9.13). Around 88% of Black individuals have a high school diploma or higher, compared to 94% of the white population. Meanwhile, only 79% of individuals of Hispanic or Latino origin have attained this level of education. When analyzing the share of the population with a Bachelor's degree or higher, 36% of white individuals have this degree, compared to only 23% of the Black population and 25% of the Hispanic or Latino population. These trends reflect a long history of racial segregation in the area, particularly in the City of Dayton.

The City of Dayton's history of racial segregation continues to affect access to education for Black residents — not only in higher education, but also within the K-12 system. Black children predominantly attend public schools in the city, which are largely segregated by race and under-resourced, while white children more often attend suburban schools with greater funding and opportunities.[130]

[129] U.S. Census Bureau (2023). American Community Survey 1-year estimates. Retrieved from Census Reporter Profile page for Dayton-Kettering-Beavercreek, OH Metro Area. https://censusreporter.org/profiles/31000US19430-dayton-kettering-beavercreek-oh-metro-area/
[130] Eileen McClory. "Local schools still deeply segregated 70 years after Brown v. Board." *Dayton Daily News*. (July 11, 2024). https://www.daytondailynews.com/local/local-schools-still-deeply-segregated-70-years-after-brown-v-board/BV6WMOFGE5DDXAYW634TJKMAIM/#:~:text=How%20did%20we%20get%20here,makeup%20of%20who%20lived%20there

Improving educational access and outcomes for historically marginalized communities is a complex challenge rooted in systemic disadvantages. Addressing these disparities requires not only policy changes, but also a collective commitment to fairness, investment and the dismantling of barriers that have persisted for generations.

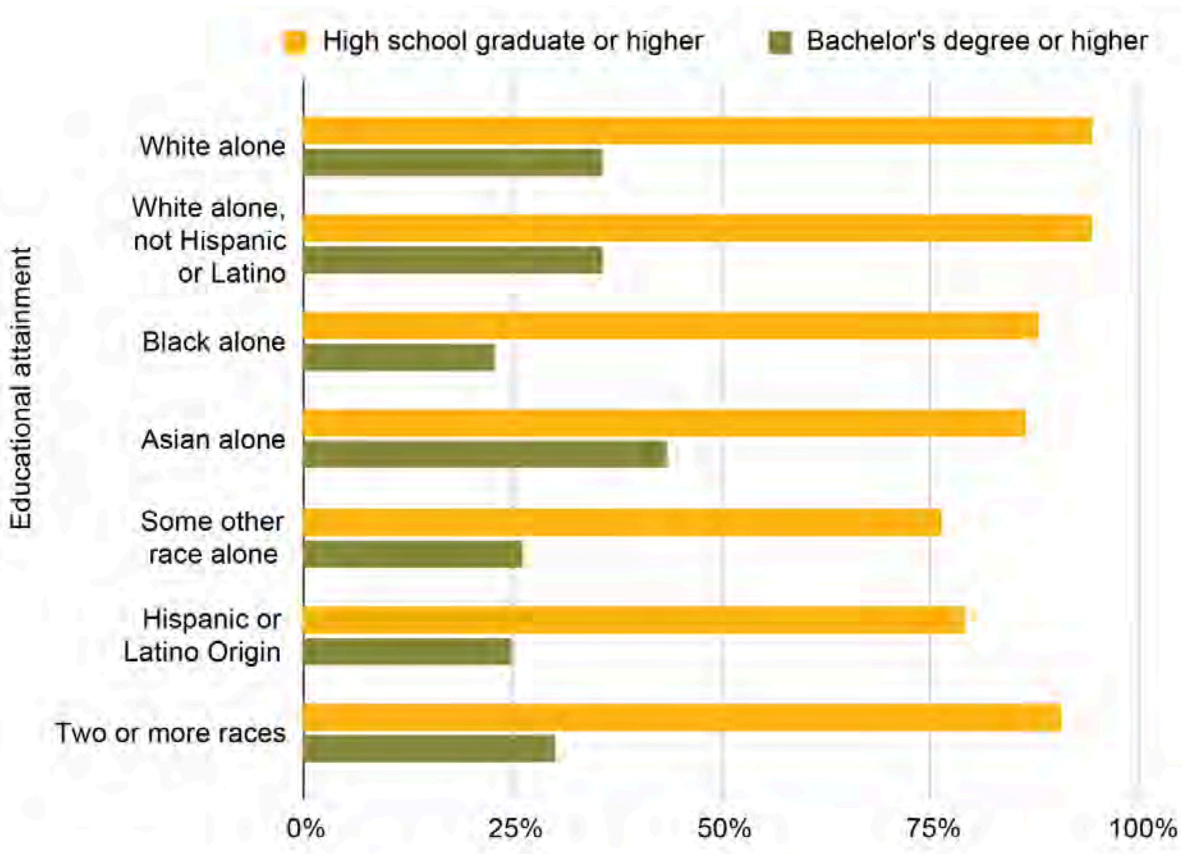

Figure 9.13. Educational attainment[131] by race in the Miami Valley Region, 2024. Source: Adapted from Census Reporter, 2024.[132]

9.4.3.2 Role of At-Risk and Low-Income Communities in Green Workforce Development

The creation of new industries and jobs presents an opportunity to address long-standing inequities related to housing, income and rural-urban disparities — without the pressures of unchecked economic growth. For instance, employment generated through GHG reduction strategies could help lower unemployment rates among marginalized groups and low-income residents.

[131] Note that "High school graduate or higher" includes individuals whose highest level of education is a high school diploma, General Educational Development (GED), some college, associate degree, bachelor's degree, or graduate/professional degree. "Bachelor's degree or higher" is a subset of this group and includes only those with a bachelor's, graduate or professional degree. Categories are based on the highest level of educational attainment reported in the ACS and are mutually exclusive.
[132] U.S. Census Bureau. American Community Survey 1-year estimates.

However, the transition to a green economy also risks magnifying existing disparities in the labor market. Compared to the national average across all occupations, the green jobs workforce tends to be older and predominantly male and white.[133] A 2021 jobs report found that women make up less than 30% of workers in the green energy sector, while Black workers are significantly underrepresented — comprising only 8% of clean energy jobs,[134] a nearly 40% gap relative to their share of the broader labor force. Moreover, while job creation in clean energy has largely benefited wealthier communities and highly paid professionals, lower-wage manual laborers often see only modest improvements in pay, despite requiring additional training and skills to enter the field.[135]

At the same time, lower-paid workers are often at greater risk of job displacement. Labor reallocations in the clean energy transition tend to favor workers with access to higher education, while disproportionately impacting non-college-educated workers. Historically, only a small subset of workers in carbon-intensive industries have successfully transitioned to green jobs; most have instead moved into other carbon-intensive roles, indicating a limited range of available options.[136] These challenges are even more pronounced for workers over the age of 55 and for rural workers in areas with restricted job markets. This adds another layer of complexity in the Miami Valley Region, where the population is aging, which may eventually reduce the overall labor force.

In the Miami Valley Region, low-income households are concentrated primarily in the City of Dayton, as shown in Figure 9.14. These households also face disproportionately high unemployment rates. The City of Xenia, in Greene County, experiences similar employment challenges. Urban areas of Dayton have the highest concentration of Black residents (Figure 9.15), while Asian and Hispanic populations — though smaller in number — are dispersed across the region, with some areas of Dayton showing localized concentrations.

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[133] Mark Muro, Adie Tomer, Ranjitha Shivaram, Joseph Kane (APril 2019). Advancing inclusion through green energy jobs. Brookings Metropolitan Policy Program. https://www.brookings.edu/wp-content/uploads/2019/04/2019.04_metro_Clean-Energy-Jobs_Report_Muro-Tomer-Shivaran-Kane_updated.pdf#page=34

[134] E2 et al. (2021). Help Wanted: Diversity in Clean Energy. https://e2.org/wp-content/uploads/2021/09/E2-ASE-AABE-EEFA-BOSS-Diversity-Report-2021.pdf

[135] David Popp, Francesco Vona, Giovanni Marin, Ziqiao Chen. "The Employment Impact of a Green Fiscal Push: Evidence from the American Recovery and Reinvestment Act." *Brookings Papers on Economic Activity* (2021): 1–49. https://www.jstor.org/stable/27133172

[136] E. Mark Curtis, Layla O'Kane, R. Jisung Park (August 2023). Workers and the Green-Energy Transition: Evidence from 300 Million Job Transitions. Working Paper 31539, National Bureau of Economic Research. https://www.nber.org/system/files/working_papers/w31539/w31539.pdf

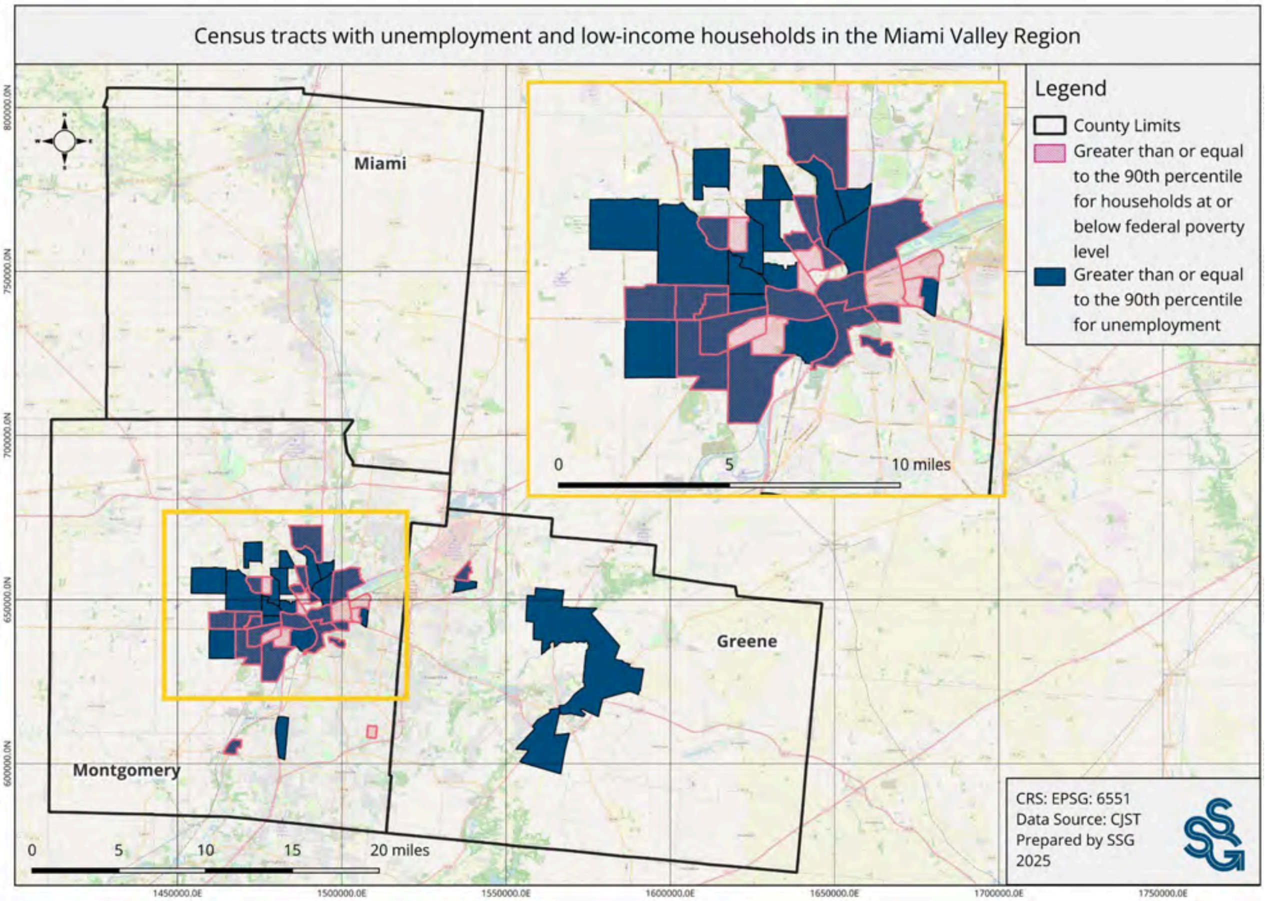

Figure 9.14. Census tracts with unemployment and low-income households in the Miami Valley Region. Source: Elaborated from the Council on Environmental Quality, 2022.

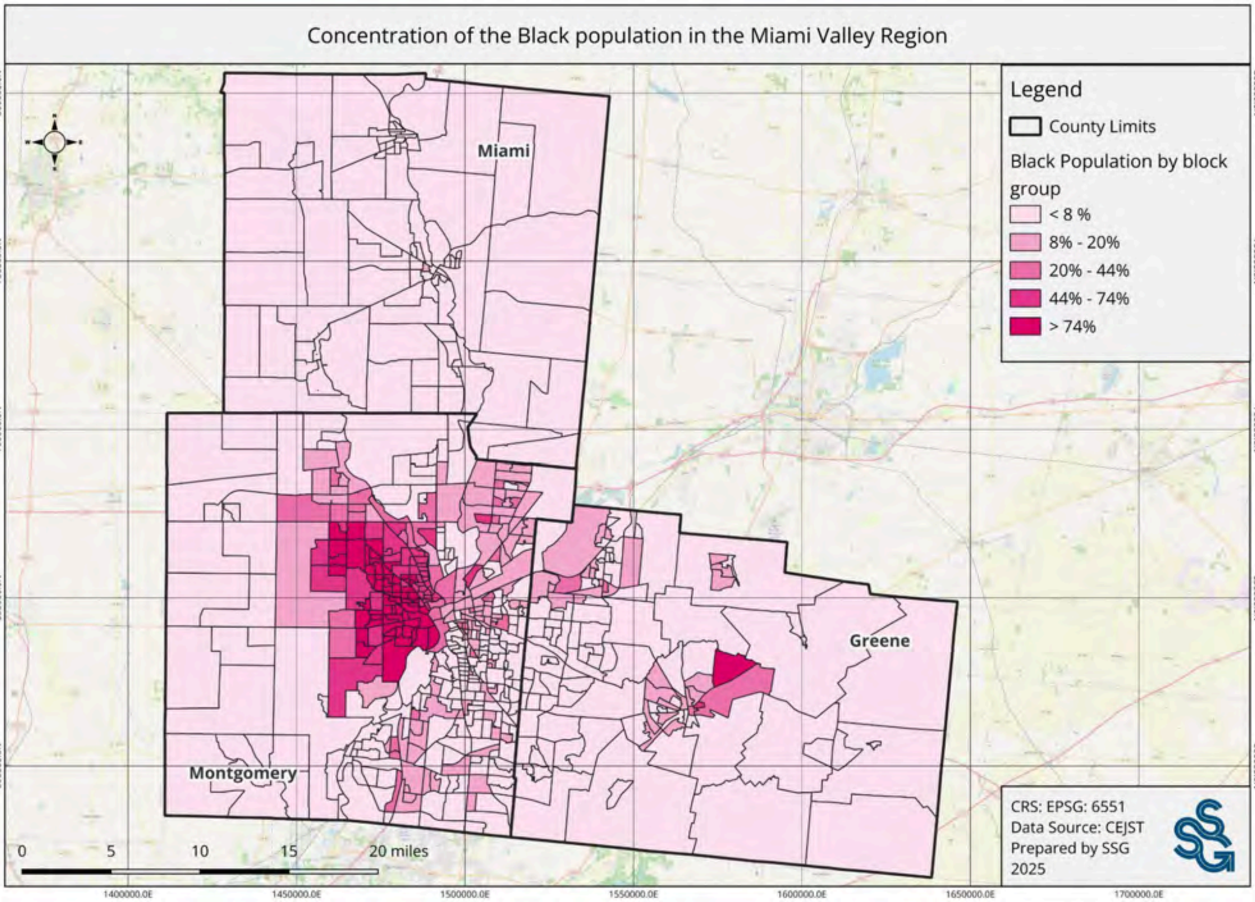

Figure 9.15. Concentration of the Black population in the Miami Valley Region. Source: Elaborated from the Council on Environmental Quality, 2022.

Despite these patterns, targeted job transition strategies that promote training and upskilling can significantly enhance economic opportunities. Workers in the clean energy sector often earn higher wages compared to national averages. Many green jobs also offer competitive pay and low barriers to entry for individuals at the lower end of the income spectrum. Jobs in green construction and renewable energy generation frequently have higher union representation and require less formal education than positions in other industries. Furthermore, long-term investments in the green economy can drive upward social mobility; one study estimates that more than 300 million new green jobs could be created by 2050.

9.4.4 Partnerships and Funding to Address Gaps

To effectively align the CCAP with workforce development, the Miami Valley Region will need to leverage existing partnerships and programs while seeking opportunities to expand them. The following sections outline existing and potential partners, along with mechanisms for workforce development, by sector and action.

9.4.4.1 Partnerships

To increase workforce in the region, local governments can collaborate with different entities, while MVRPC acts as a coordinator among member governments, providing support for collaboration and exploring and providing information about funding and programs available to facilitate the implementation of actions.

In this context, the region can leverage existing partnerships and explore additional ones. Cross-sector partnerships may support multiple goals and actions; these partners may include:

- **Educational institutions:** Due to the range of sectors, educational institutions can support career development in high-skilled areas as well as provide certifications, degrees and other qualifications. For instance, Sinclair Community College offers a Sustainability and Energy Management Technology program that trains students in energy-efficient building systems and technologies.
- **Career centers:** Career centers serve as access points for job seekers to explore training opportunities, apprenticeship connections and employment services. They help match local workforce supply with sector-specific climate and energy job demand. Locally, the Greene County Career Center provides apprenticeship and job placement services, including programs in construction technology.[137]
- **Utilities:** Utilities play a key role in workforce development by offering technical training, internships and partnerships for grid modernization, clean energy deployment and EV infrastructure. Their involvement ensures alignment between labor needs and energy system transformation. For example, AES Ohio offers an internship program focused on electric utility operations and renewable energy projects;[138] although it works statewide, there are opportunities for partnerships locally.
- **Workforce development board or agencies:** These public entities coordinate regional strategies to address workforce gaps, administer state and federal training funds (e.g., Workforce Innovation and Opportunity Act), and collaborate with employers and training providers to align skill-building with climate sector jobs. At the regional level, OhioMeansJobs Miami Valley[139] is one example that administers federally funded workforce training grants that support energy sector jobs, including solar installation training.
- **Industrial partners:** Industries contribute by co-developing training programs, hosting internships and implementing upskilling initiatives for energy efficiency and clean manufacturing. Their participation helps tailor workforce pipelines to meet evolving operational needs. For example, Fairborn Cement Company can collaborate with local educational institutions to develop workforce training

[137] Green County Career Center. Construction Technology. https://www.greeneccc.com/ConstructionTechnology.aspx
[138] AES. Energy4Talent. https://www.aes.com/careers/energy4talent
[139] OhioMeansJobs. https://ohiomeansjobs.ohio.gov/

programs focused on sustainable cement production and energy-efficient manufacturing practices.

- **Local labor unions and trade organizations:** Unions and trade groups provide apprenticeship programs and certified training in construction, retrofitting and renewable energy installation. They ensure high labor standards and a skilled workforce for climate-aligned infrastructure work. Among many local trade organizations and unions, one example is the Plumbers and Pipefitters Local 65 in Dayton, which provides training in HVAC and plumbing systems, including green technologies.[140]
- **Nonprofit and community-based organizations:** These organizations engage underrepresented populations, provide job readiness support and deliver community-focused training. They help ensure climate workforce programs are widely accessible for all, and reach at-risk and low-income communities. In the region, an example is the Miami Valley Housing Opportunities, Inc.[141] that runs weatherization programs, including resident training on energy efficiency and home retrofits.

9.4.4.2 Programs and Resources

The region will also need to leverage existing workforce development programs, which require coordination among multiple government levels, including state and federal agencies. The State of Ohio offers several opportunities, as does the federal government. Moreover, the region has developed some programs that could be expanded to cover the sectors included in this plan, listed in Table 9.8.

[140] Miami Valley Apprenticeship Coordinators Group. Plumbers, Pipefitters and Refrigeration Apprenticeships. https://daytonapprenticeships.org/plumbers-pipefitters/
[141] Miami Valley Housing Opportunities. https://mvho.org/

Table 9.8. Federal, state and local workforce development programs and resources. Source: SSG analysis.

Name	Coordinating Agency	Resource Type	Description
Federal Resources			
Reentry Employment Opportunities (REO) Program	U.S. Department of Labor	Funding	The REO program provides funding for justice-involved youth and young adults and adults who were formerly incarcerated.[142]
Workforce Pathways for Youth (WPY) Program	U.S. Department of Labor	Job Training, Workforce Development	The WPY program expands job training and workforce activities for youth, including soft-skill development, career exploration, job readiness and certification, summer jobs, year-round job opportunities and apprenticeships in out-of-school time organizations nationwide.[143]
Youth Connections Community	U.S. Department of Labor	Online Learning Tool	The Youth Connections Community is an online learning destination for public workforce system staff and partners who serve youth in the Workforce Innovation and Opportunity Act Youth Program.[144]
YouthBuild Community	U.S. Department of Labor	Online Learning Tool, Resources	The YouthBuild Community is a shared electronic space where grantees can support each other in implementing successful programs, sharing tools and fostering partnerships.[145]

[142] U.S. Department of Labor. Reentry Employment Opportunities. https://www.dol.gov/agencies/eta/reentry
[143] U.S. Department of Labor. Workforce Pathways for Youth. https://www.dol.gov/agencies/eta/youth/workforce-pathways-for-youth

[144] U.S. Department of Labor, Employment and Training Administration. Workforce GPS Youth Connections. https://youth.workforcegps.org/
[145] U.S. Department of Labor, Employment and Training Administration. Workforce GPS YouthBuild. https://youthbuild.workforcegps.org/

Name	Coordinating Agency	Resource Type	Description
Career Pathways Community	U.S. Department of Labor	Online Learning Tool, Resources	The Career Pathways Community helps workforce development leaders, practitioners and policymakers expand state and local career pathways efforts currently underway or being planned.[146]
Building Pathways to Infrastructure Jobs	U.S. Department of Labor	Funding	Administered by the Department of Labor's Employment and Training Administration, these grants enable public-private partnerships to develop, implement and scale worker-centered programs that train people for in-demand jobs in advanced manufacturing; information technology; and professional, scientific and technical service occupations.[147]
Map a Career in Clean Energy	U.S. DOE	Interactive Career Mapping Tools	This interactive mapping tool showcases careers in clean energy based on the user's education and experience. The user can explore opportunities in advanced manufacturing, bioenergy, green buildings, hydrogen and fuel cells, hydropower, marine energy, solar and wind.[148]
Better Buildings Accelerators	U.S. DOE	Partner Networks	Better Buildings Accelerators are collaborative peer-to-peer networks designed to facilitate learning and leadership opportunities that result in new strategies and practices in clean energy deployment. Accelerators focus on partner-identified areas that aim to overcome persistent barriers to clean energy options.[149]

[146] U.S. Department of Labor, Employment and Training Administration. Workforce GPS Career Pathways. https://careerpathways.workforcegps.org/
[147] U.S. Department of Labor (May 2024). Department of Labor announces approximately $35M in additional funding available for 2nd round of Building Pathways to Infrastructure Jobs grants. https://www.dol.gov/newsroom/releases/eta/eta20240515
[148] U.S. DOE. Map a Career in Clean Energy. https://www.energy.gov/eere/jobs/map-career-clean-energy
[149] U.S. DOE. Better Building Accelerators. https://betterbuildingssolutioncenter.energy.gov/accelerators.

Name	Coordinating Agency	Resource Type	Description
State Resources			
Workforce Innovation and Opportunity Act (WIOA) Programs	OhioMeansJobs	Federal-State Workforce Program	WIOA programs provide employment and training services for youth, adults and dislocated workers, including support for those entering green jobs sectors. These programs are administered locally through OhioMeansJobs centers.[150]
JobsOhio Workforce Development Initiatives	JobsOhio	State Economic Development Program	These initiatives offer funding and support for workforce development in sectors like advanced manufacturing and information technology, aiding businesses in building skilled teams aligned with climate and innovation goals.[151]
Ohio Technical Centers (OTCs)	Ohio Department of Higher Education	State Education Program	OTCs provide post-secondary career and technical education, preparing learners for certificates and industry-recognized certifications in fields relevant to the green economy.[152]
Ohio Department of Job and Family Services (ODJFS) Programs	ODJFS	State Workforce Services	ODJFS programs provide a range of services including public assistance, workforce development, unemployment compensation and job training programs, supporting individuals entering or transitioning within the workforce.[153]

[150] Governor's Office of Workforce Transformation. Adults Workforce Innovation and Opportunity Act (WIOA). https://workforcesuccess.chrr.ohio-state.edu/wioa-adult
[151] JobsOhio. Incentives. https://www.jobsohio.com/programs-services
[152] Ohio Department of Higher Education. Ohio Technical Centers (OTC). https://highered.ohio.gov/educators/workforce-adult-ed/otc
[153] Ohio Department of Job & Family Services. https://jfs.ohio.gov/

9.5 Green Jobs for All

This section highlights strategies to strengthen and plan for workforce development in the region. It considers key priority sectors (i.e., buildings and energy) and methods for incorporating fairness in the CCAP implementation.

9.5.1 Union-Led Training Centers: Co-Governed With Labor Unions, Community Colleges and Environmental Groups

Objective: Expand and align sector-specific training programs with GHG emissions reduction measures, across all sectors.

Partner with educational institutions (e.g., Sinclair College, University of Dayton), community colleges, labor unions and career centers to scale up programs in HVAC electrification, energy auditing, solar installation, EV infrastructure, the automotive industry and green building construction. Coordinate with current state and federal programs to align capacity building to national funding and resources.

Create climate workforce pathways in primary, secondary and adult education by collaborating with career centers and schools (e.g., Xenia High School, Dayton Public Schools) to embed green trades (e.g., green construction, weatherization, HVAC) into curricula and career days.

Support institutions in incorporating fairness and access considerations into enrollment processes by adopting frameworks that prioritize program slots, stipends and wraparound services for applicants who belong to minority groups, are part of historically marginalized communities, at-risk and low-income neighborhoods, or are BIPOC youth in Dayton. Integrate outreach efforts through trusted community organizations.

9.5.2 Care + Climate Economy Integration

Objective: Integrate Care Economy[154] priorities and support minority-owned and resident-led green start-ups to build an accessible workforce and stimulate fair economic development as part of the green transition across all sectors.

Establish public-private partnerships (e.g., with The Entrepreneurs Center and City of Dayton) to provide technical assistance and information for seed funding application, targeting small and microenterprises in green construction, energy efficiency services, solar panel installations, automotive mechanics and others. Create a streamlined process and outreach campaign to reach Black and minority entrepreneurs from Dayton neighborhoods, with emphasis in areas with historical underinvestment, as well as residents living in census tracts with low-income households and high rates of unemployment.

[154] The Care Economy refers to the paid and unpaid work of providing social and material care. These activities, often not recognized in monetary terms, are essential for maintaining the capability and well-being of individuals, as well as for the functioning of society and the economy.

Leverage opportunity zones to drive inclusive green economic development in at-risk and low-income communities by expanding the strategic use of federal and Ohio Opportunity Zone programs to attract private investment in these areas within the Miami Valley Region. By promoting Qualified Opportunity Funds (QOFs) focused on green infrastructure, energy efficiency retrofits, clean technology start-ups and sustainable development projects, the region can harness tax incentives to stimulate fair economic growth and workforce opportunities. Start by leveraging the City of Dayton's experience[155] with Opportunity Zones and complementing these efforts with partnerships with entities like the Dayton Development Coalition and JobsOhio Inclusion Grant programs to ensure investments benefit underrepresented and underserved populations.

9.5.3. MVRPC Will Establish a Green Jobs Cabinet

Objective: Coordination with multiple relevant actors to advance on fair and collaborative green jobs strategy.

MVRPC will establish a Green Jobs Cabinet, bringing together labor, educators, businesses and city leaders — analogous to Los Angeles's model for creating 300,000 jobs by 2035 — to develop career pathways in solar installation, energy efficiency retrofits, EV maintenance and related fields. Working with colleges and workforce boards, the City of Dayton will fund training and apprenticeships targeted at residents of color, women, and low-income workers traditionally underrepresented in tech trades. The City will conduct a Just Transition Jobs Assessment to ensure that workers in carbon-intensive jobs are retrained or redeployed into equally good jobs in the new economy (as called for in Section 4 of the City's Climate Emergency resolution).

Grants and loans — such as through a local "Community Wealth Fund" — will support small businesses and start-ups in clean industries, especially those led by women and minorities. Community solar and energy co-ops will be promoted so that neighborhoods can share in both ownership and savings.

Across all initiatives, the focus will remain on job quality and fairness — for instance, by requiring prevailing wages on municipal projects and setting local hiring targets, in line with mission contracts that tie public dollars to community benefits.

[155] Dayton Opportunity Zones. https://dashboards.mysidewalk.com/dayton-oh-opportunity-zones-4d3d04b7182d/home-d8862dea349b

9.6 Monitoring Workforce Development

The progress of workforce initiatives will need to be measured and tracked consistently over time to ensure they are meeting their intended audience, providing successful career and training outcomes, and meeting the Good Jobs Principles. The types of metrics tracked will depend on the types of workforce initiatives, the availability of data, and the frequency with which data can be tracked and updated. These metrics can also be supported through the collection of qualitative data from regular meetings with industry leaders, community organizations, policymakers and workers in green industries. This can provide additional insight into workforce initiatives and ensure alignment with workforce goals and needs.

Key performance metrics will need to be refined during the program design and planning process. Metrics will be developed in partnership with workforce development partners to determine what can feasibly be tracked and who will be responsible for tracking, maintaining and sharing the metrics, as needed. Potential key performance metrics are included in Table 9.9.

Table 9.9. Potential key performance metrics for workforce initiative evaluation.
Source: SSG analysis.

Metric Type	Example Key Performance Metrics
Workforce Initiatives	• Number of new workforce initiatives • Number of expanded workforce initiatives • Total number of workforce initiatives
Job Creation	• Number of jobs created annually by sector • Number of jobs created by occupation
Transitional Workforce	• Number of participants with full-time employment completing green job training programs • Number of workers transitioning to clean energy industries • Demographic breakdown of displaced and retrained workers
Job Quality	• Proportion of full-time versus part-time or contract positions • Retention rates within green industries • Availability of career advancement pathways and wage growth potential • Access to professional development and training • Availability of benefits such as health care, retirement plans and paid leave • Median annual wages in green sectors compared to the overall median wage

10| Conclusions

This technical report explores decarbonization pathways for the Miami Valley Region, considering a wide array of actions across all high-emitting sectors. The commercial and residential building sectors are the region's largest sources of emissions, followed closely by transportation. Total GHG emissions in the region reached 10.8 $MMTCO_2e$ in 2021. Major contributors include energy use for heating and cooling (particularly natural gas), diesel and gasoline consumption for moving people and goods, and reliance on a carbon-intensive electricity grid.

Targeting these sectors for reductions will require a comprehensive transformation of the region. This includes retrofitting existing buildings, creating conditions for low-carbon new construction, and transitioning to clean transportation by electrifying vehicles and encouraging sustainable mobility options such as biking, walking and public transit. The industrial sector will also need to transform by reducing the energy intensity of processes, shifting to electrification, and moving away from fossil fuels. Additionally, waste emissions will be addressed by recirculating food nutrients through composting and reducing per capita waste generation.

The implementation of these actions aims to achieve emission reductions aligned with the U.S. 2024 climate targets for 2030 and 2050. The region is projected to reduce emissions by 55% by 2030 (relative to 2021 levels) and will strive to reach net-zero emissions by 2050. Although current actions fall short of this long-term goal (89% reduction), the region is committed to evaluating new technologies and opportunities over time to close the gap.

This community-wide transformation will require collaboration across all levels of government. Local governments and MVRPC will play a central role by facilitating programs that support building retrofits and the adoption of heat pumps, electric water heaters, EVs, rooftop solar and other clean technologies. The region will leverage, expand and create partnerships to coordinate across jurisdictions, improve access to funding, engage communities and grow the local green workforce.

This level of effort is far outweighed by the benefits of the plan. Air pollution — both outdoor and indoor — will decrease significantly, especially improving health outcomes in historically underserved communities and at-risk and low-income communities. Over 100,000 new jobs will be created across sectors as a result of the implementation efforts.

Energy burdens on residents will decline, with transportation and building energy costs projected to decrease by more than 72% by 2050 compared to 2021. These savings will improve comfort, reduce noise and mitigate associated health problems, resulting in meaningful quality-of-life improvements.

The total cost of implementing these actions is estimated at $28.2 billion, with savings reaching $14.6 billion. This equates to $200 per tonne of CO_2 reduced (USD/TCO_2e). Despite this cost, the avoided damages from climate change are estimated at $55 billion — almost double the capital investment.

It is imperative that this report serve as a catalyst for decisive action. The insights and recommendations provided should guide the Miami Valley Region toward a future defined by clean energy use, thriving communities and a flourishing economy. The potential benefits are significant and demand bold, coordinated action.

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