Indiana Priority Climate Action Plan

March 1, 2024

Indiana Department of Environmental Management

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
We Protect Hoosiers and Our Environment.
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March 1, 2024

United States Environmental Protection Agency
Attention CPRG Leadership Team
Climate Pollution Reduction Grant

To whom it may concern,

I am delighted to introduce Indiana's Priority Climate Action Plan, the first deliverable of Phase 1 of the United States Environmental Protection Agency's (U.S. EPA's) Climate Pollution Reduction Grant (CPRG) program. This is an exciting opportunity that aligns with our commitment to environmental stewardship and the well-being of Indiana's communities by providing an area for Indiana to further its efforts in mitigating greenhouse gas (GHG) emissions and addressing climate-related challenges.

Indiana citizens, communities, businesses, industries, and government play a pivotal role in addressing greenhouse gas reductions to secure cleaner air quality and enhanced quality of life for Hoosiers. In this plan, we are addressing emission reductions in the sectors of electric power, industry, transportation, agriculture, residential and commercial buildings, and waste management. With funding for the EPA planning grant, IDEM contracted with ClimeCo, a decarbonization advisory firm, to assist in development of the plan and our teams fulfilled the main components of this grant. We have reached out to communities across Indiana to hold meaningful engagement sessions and to help realize benefits for environmentally and socially overburdened areas. Through these efforts we hope to positively impact communities, increase economic activity, develop Indiana's workforce, and safeguard Indiana's valuable natural resources.

As we continue to work towards implementation of this climate action plan, we plan to work closely with our community and agency partners to put dollars where our communities and the environment need it the most. We are excited to see the potential for projects that reduce emissions in all our important sectors. We look forward to your active engagement in this endeavor and your enthusiasm in securing a sustainable future for all Hoosiers.

Sincerely,

Brian Rockensuess

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EXECUTIVE SUMMARY

In July 2023, the Indiana Department of Environmental Management (IDEM) received a $3 million planning grant as part of the U.S. Environmental Protection Agency's Climate Pollution Reduction Grants (CPRG) program. The CPRG program provides federal funding to state governments, municipalities, tribes, and territories to plan and implement strategies for reducing greenhouse gas (GHG) emissions and other harmful air pollutants.

Through this program, IDEM aims to promote sustainability, enhance Indiana's resiliency to environmental challenges, and safeguard the state's natural resources. This planning grant supports the creation of three key deliverables: 1) a Priority Climate Action Plan (PCAP), 2) a more detailed Comprehensive Climate Action Plan, and 3) a Status Report at the end of the 4-year planning period. Using the EPA planning grant funding, IDEM hired ClimeCo, a decarbonization firm, to provide technical expertise and fulfill key components of these requirements. This climate planning effort represents the first of its kind at the state level for Indiana. However, it builds upon the long-term climate planning efforts of municipalities and organizations throughout the state.

This PCAP identifies near-term, high-priority measures to reduce Indiana's greenhouse gas emissions and other harmful pollutants. These measures were selected through an accelerated and iterative process emphasizing collaboration, stakeholder participation, and the potential for GHG impact and other co-benefits. The PCAP details how measures were selected for inclusion and their estimated potential for impact. The PCAP uses the following structure for communicating these measures:

- **Chapter 1** of this plan lays the foundation for measure selection and communicates Indiana's focus areas for prioritization. Specifically, this section outlines work conducted by the state to quantify and understand its GHG emissions, to identify priority low-income and disadvantaged communities, and to assess the climate risks to these communities.
- **Chapter 2** continues by detailing the approach for many of the assessments completed by the state and the three-step process for selecting PCAP measures. This process began with an initial screening of best practices from across the country, informing a draft list with near-term, high-impact emissions reduction measures. IDEM then launched stakeholder engagement for feedback and revisions through public meetings, surveys, interviews, and email submissions, gathering the input of over 1,500 Hoosiers. Throughout this process, additional consideration was given to the priorities and plans from low-income and disadvantaged communities to help ensure that opinions from these critical stakeholders were reflected in the final plan. Next, IDEM reviewed the revised measures for alignment with municipal climate action plans, as each plan represented additional stakeholder perspectives and local climate priorities. After

prioritizing the measures, IDEM quantified the GHG and co-pollutant reduction benefits and evaluated other potential benefits to low-income and disadvantaged communities.

- **Chapter 3** provides a comprehensive analysis of each priority measure. It begins by assessing the current state of the sector and the measure itself. Next, it summarizes stakeholders' comments and identifies affected communities. Then, it outlines calculated emissions reductions and other expected benefits. This chapter also includes a preliminary analysis of workforce needs and job creation. Finally, it examines the authority to implement and outlines implementation details. This chapter elaborates on the many positive outcomes of the plan, including increased climate resilience, economic growth, and improved air quality in high-priority communities.
- **Chapter 4** outlines future actions that can build on the PCAP. These actions include the pursuit of funding to implement the identified measures. The first step in this process will be Indiana's application for the CPRG Phase 2 Implementation Grants, approximately $4.6 billion in competitive grants to support the implementation of GHG reduction measures.

The measures identified in the plan could reduce Indiana's annual GHG emissions by 28.4 million metric tonnes of carbon dioxide equivalents (MMT CO_2e) by 2030 and 98.9 MMT CO_2e by 2050 compared to a theoretical reference case without intervention. At the same time, these measures could significantly reduce co-pollutants that drive adverse health outcomes. The actions outlined herein will also lead to numerous economic and community benefits, such as reducing air pollution and improving health, reducing energy costs, improving access to transportation, building the resilience of buildings and communities, improving waste management, creating jobs, and reducing climate impacts and risks.

By identifying strategies to address sources of pollution in Indiana, this PCAP aims to reduce greenhouse gas emissions to reduce air pollution, especially for the state's most vulnerable populations. Through efforts to build a more sustainable and resilient future, Indiana will remain a great place to live, work, and play for future generations.

1. INTRODUCTION

1.1 U.S. ENVIRONMENTAL PROTECTION AGENCY'S CLIMATE POLLUTION REDUCTION GRANTS (CPRG)

In 2023, the Indiana Department of Environmental Management (IDEM) received a planning grant under the Climate Pollution Reduction Grants (CPRG) program from the U.S. Environmental Protection Agency (EPA) to create climate action plans for the state. This program provides nearly $5 billion in grants to states, local governments, tribes, and territories to develop and implement ambitious plans for reducing greenhouse gas emissions and other harmful air pollutants. The program provides funds in two phases (U.S. Environmental Protection Agency, 2024):

- **Phase 1 Planning Grants:** $250 million available to states, U.S. territories, municipalities, air pollution control agencies, tribes, and groups to develop plans to reduce greenhouse gas emissions. In this phase, applicants must publish a Priority Climate Action Plan (PCAP), a Comprehensive Climate Action Plan (CCAP), and a Status Report over the 4-year grant period.

- **Phase 2 Implementation Grants:** $4.6 billion for competitive grants to eligible applicants to implement GHG reduction programs, policies, projects, and measures (collectively referred to as "GHG reduction measures" or "measures") identified in a PCAP developed under a CPRG planning grant.

Indiana is one of the 47 states that have received the Phase 1 planning grant. This means Indiana will be eligible to compete for the Phase 2 pool funding for implementing identified greenhouse gas (GHG) reduction measures (U.S. Environmental Protection Agency, 2024). Through these funding opportunities, IDEM aims to promote sustainability, reduce air pollution, enhance Indiana's resiliency to environmental challenges, and safeguard natural resources.

This report represents Indiana's PCAP, the first of the deliverables required in Phase 1. Following this report, IDEM plans to apply for a Phase 2 Implementation Grant on behalf of the state in April 2024. Then, IDEM will build on the foundation created by the PCAP by developing a more detailed Comprehensive Climate Action Plan in 2025.

1.2 INDIANA'S EMISSIONS

IDEM calculated Indiana's baseline emissions for 2021 using the EPA's Greenhouse Gas Inventory Data Explorer. The state used 2021 as a baseline because it is the most recent year of data available; however, it is important to note that this year may be an anomaly due to the

COVID-19 pandemic. Notably, this statewide inventory includes every potential jurisdiction that plans to participate as a grantee in the upcoming implementation grant funding round.

The calculations show that Indiana's emissions totaled 193 million metric tons of carbon dioxide equivalent (MMT CO_2e) in 2021 (U.S. Environmental Protection Agency, 2021). Furthermore, the top-emitting sectors within Indiana were the electric power, industry, and transportation sectors, as shown in Table 1. The top greenhouse gas was carbon dioxide, followed by methane and nitrous oxide, as shown in Table 3.

Table 1. Indiana Statewide 2021 Greenhouse Gas (GHG) Summary – Economic Sector

Economic Sector	Emissions (MMT CO_2e)	Percentage*
Electric power	70.36	36%
Industry	48.27	25%
Transportation	41.34	21%
Agriculture	14.38	7%
Commercial	10.33	5%
Residential	8.99	5%

**Percentages have been rounded to the nearest whole number.*

Table 2. Indiana Statewide 2021 Greenhouse Gas (GHG) Summary – Inventory Sector

Inventory Sector	Emissions (MMT CO_2e)	Percentage*
Energy	165.22	85%
Agriculture	13.13	7%
Industrial processes and product use	11.51	6%
Waste	3.78	2%
Land use, land-use change, and forestry	-5.55	-3%

**Percentages have been rounded to the nearest whole number.*

Table 3. Indiana Statewide 2021 Inventory by Gases

Gas	Emissions (MMT CO_2e)	Percentage*
Carbon dioxide	165.70	85%
Methane	13.64	8%
Nitrous oxide	11.13	6%
Fluorinated gases	3.72	2%
Land use and forestry carbon stock change	-6.10	-3%

**Percentages have been rounded to the nearest whole number.*

Based on Indiana's 2021 GHG baseline, the electric power, industry, and transportation sectors are high-opportunity areas. These three sectors represent over 80% of Indiana's total GHG emissions and have significant potential for statewide reductions, as presented in the PCAP. Indiana has identified a suite of measures that address all key sectors with this first-of-its-kind

statewide effort. More information on these sectors and others included in the analysis is provided below:

- **Electric Power:** The electric power sector is the highest emitting sector, accounting for 35% of total emissions. This sector includes emissions from power plants, including fossil fuel-fired plants, natural gas-fired plants, and other generation facilities. Indiana has high emissions in this sector because it has multiple coal-fired power plants contributing significantly to emissions.

- **Industry:** The industrial sector is the second-largest source of emissions, accounting for 26% of total emissions. This sector includes emissions from manufacturing processes, chemical production, the mineral industry, the coal mining industry, and other minor industrial activities. Industrial activities create direct emissions, which are produced as a result of processes or leaked as fugitives, and indirect emissions, which occur offsite but are associated with industrial emissions.

- **Transportation:** The transportation sector is Indiana's third largest emissions category, accounting for 20% of total emissions. This sector includes emissions from vehicles, including cars, trucks, buses, and other forms of transportation. Transportation plays a large part in Indiana's economic history and is central to the state's identity.

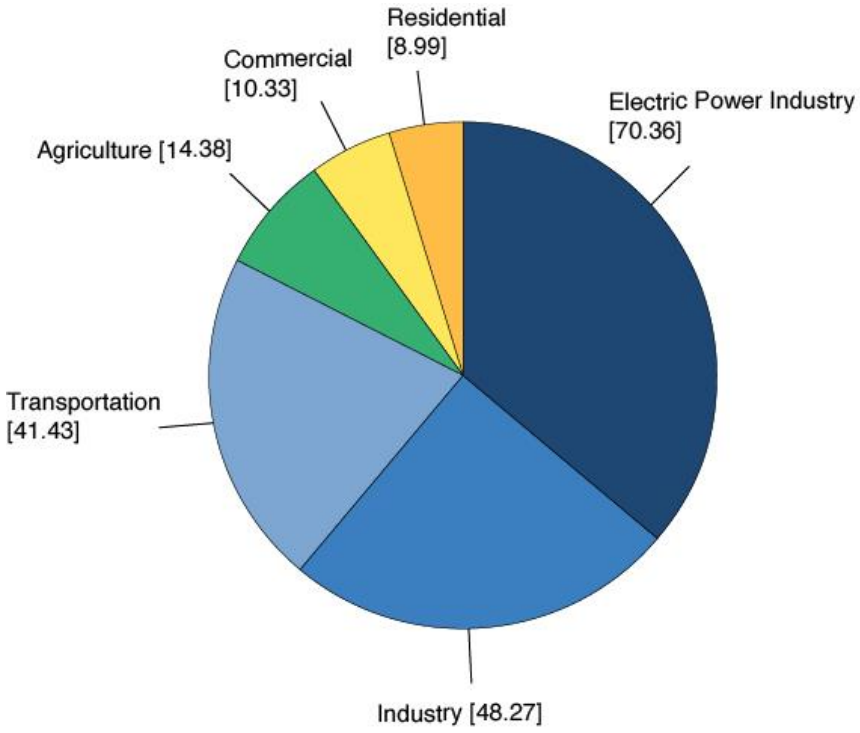
- **Agriculture:** The agriculture sector is Indiana's fourth largest emissions category, accounting for 8% of total emissions. Like Transportation, this sector is another important part of Indiana's economy. Within the sector, crop cultivation is the highest emitting activity and includes tillage operations that release methane, nitrous oxide, and carbon dioxide. Manure and fertilizer application are other sources of sectoral emissions included in crop cultivation.

- **Commercial Buildings:** The commercial buildings sector is the fifth largest emissions category, accounting for 6% of total emissions. Commercial activities that contribute to direct emissions include fossil fuel combustion, management of waste, and refrigerant leakages. This sector also produces indirect emissions from the use of electricity for residential and business applications. However, this sector does not include emissions or sinks from the production of construction materials or the broader built environment related to commercial activities.

- **Residential Buildings:** The residential buildings sector is the lowest-emitting portion of Indiana's emissions, accounting for 5% of total emissions. Fossil fuel combustion is the largest source of emissions within this sector. Still, it is important to note that the use of fluorinated gases has risen significantly since 1990, contributing to an uptick in direct emissions.

Indiana is in the top 10 U.S. states for overall emissions, making the identification of near-term, high-reduction-potential measures key for reaching national climate goals. However, Indiana's emissions have been trending downward, declining by 22.9% from 1990 to 2020 (U.S. Environmental Protection Agency, 2023). The electric power sector has historically been, and still is, the largest emitter of GHGs, although it has decreased its overall emissions by 34.8% since 1990 (U.S. Environmental Protection Agency, 2023).

Figure 1. Indiana GHG Emission by Economic Sector, 2021 **(Emissions in million metric tons of carbon dioxide equivalent)**



Source: (U.S. Environmental Protection Agency, 2021)

1.3 INDIANA'S COMMUNITIES

While climate change can potentially impact all Hoosiers, select communities are particularly vulnerable to climate risks and impacts. Fortunately, these same communities are a key focus of the EPA's CPRG program and can benefit significantly from the actions in the PCAP.

The CPRG program supports the goals of Justice40 to advance environmental justice and spur economic opportunity in the communities that need it most. Justice40 is a whole-of-government effort to deliver at least 40% of the overall benefits from Federal investments in climate and clean energy to disadvantaged communities (Young, Mallory, & McCarthy, 2021). To align with these overarching program objectives, Indiana's climate planning process started by identifying communities that are marginalized, underserved, and overburdened by pollution.

Once these areas were identified, IDEM researched the climate risks facing these specific areas and began reaching out to these communities as part of the planning process. More details on the approach to community engagement are outlined in the following chapter on the PCAP Development Process.

IDENTIFYING PRIORITY COMMUNITIES

Numerous communities in Indiana face significant burdens from high energy costs, legacy pollution, low income, and increasingly, climate change. To identify and engage low-income and disadvantaged communities (LIDAC) in Indiana, IDEM leveraged two tools and guidance from the EPA (U.S. Environmental Protection Agency, 2023). These tools included the Climate and Economic Justice Screening Tool (CEJST) and the Environmental Justice Screening and Mapping Tool (EJScreen).

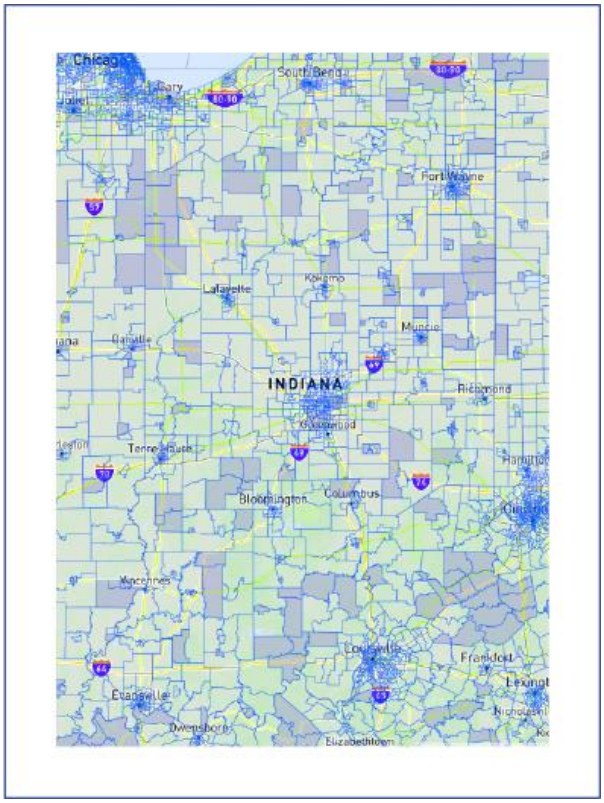
IDEM primarily relied on CEJST for LIDAC identification. The CEJST identifies any community as disadvantaged if it meets or exceeds the threshold for one or more environmental, climate, or other burdens and meets or exceeds the threshold for an associated socioeconomic burden (Council on Environmental Quality, 2021).

According to CEJST, more than 554 census tracts in Indiana fall under the criteria above for low-income and disadvantaged communities, representing 37% of all census tracts in the state. The complete list of identified census tracts can be found in Appendix B. Cities and metro areas with high concentrations of disadvantaged communities include Evansville, Fort Wayne, Gary-Chicago Suburb Area, Indianapolis Metro Area, New Albany-Jeffersonville-Clarksville Area, and South Bend. IDEM targeted these areas for public meetings throughout the engagement process.

Based on identified census tracts, 66 priority zip codes emerged in urban areas with high concentrations of disadvantaged communities. IDEM identified stakeholders from these areas using zip code data provided by survey respondents and public meeting participants. As zip codes encompass multiple census tracts, this approach risked counting non-LIDAC representatives in addition to those from disadvantaged census tracts. While this risk was preferred to missing LIDAC preferences, IDEM considered survey results holistically to balance this risk, using information from public meetings, interviews, and local PCAPs to boost known LIDAC participation. Effectively identifying and engaging members of disadvantaged communities is an ongoing process, and the contributions from community representatives to date are both valued and appreciated.

Figure 2. Climate and Economic Justice Screening Tool Leveraged in PCAP Development

The tool highlights census tracts that experience burdens in blue.



Source: (Council on Environmental Quality, 2021)

CLIMATE RISKS TO COMMUNITIES

Indiana's action to reduce GHG emissions can benefit the communities most exposed to the impacts of a changing climate. An analysis from the EPA shows that the burden of climate change falls "disproportionately upon underserved communities who are least able to prepare for, and recover from, heat waves, poor air quality, flooding, and other impacts" (U.S. Environmental Protection Agency, 2021). The Indiana PCAP acknowledges the need for meaningful climate action to mitigate risks to Hoosiers across the state, especially those in underserved and disadvantaged communities.

The following section outlines potent climate risks facing priority communities, though many of these risks apply to all residents of Indiana:

- **Extreme Weather Events**: Indiana is exposed to various extreme weather events, including severe thunderstorms, tornadoes, and extreme rainfall. The World Health Organization (WHO) reported that extreme weather events disproportionally impact disadvantaged communities due to inadequate resources to prepare for or recover from

severe weather events (World Health Organization, 2003). Additionally, emergency response services, including safe shelters and aid distribution, may not be as effective or prompt in these areas (Fothergill & Peek, 2004). Extreme weather events are expected to become more frequent and severe due to a changing climate (U.S. Environmental Protection Agency, 2021).

- **Extreme Heat and Urban Heat Island Effects**: Urban areas often experience higher temperatures due to the urban heat island effect. This phenomenon occurs because urban landscapes, with concrete and asphalt surfaces, absorb and re-radiate more heat than rural areas. Indiana University's Environmental Resilience Institute estimated that there will be a 400% increase in the total days Hoosiers will need access to cooling by 2080 compared to the previous century (Environmental Resilience Institute, 2021). Extreme heat can lead to health issues, particularly for older adults, children, and those with pre-existing conditions (Centers for Disease Control and Prevention, 2020). Similarly, a Purdue University report found that Indiana is projected to experience an 8-degree increase in the state's hottest annual temperature by mid-century (Widhalm, et al., 2018). Disadvantaged communities often feature aging residential housing and fewer resources to invest in equipment and cooling costs, exacerbating these risks for community members.

- **Flooding**: Indiana's changing climate has led to more frequent and intense rainfall events, increasing the risk of flooding (U.S. Environmental Protection Agency, 2016). Flooding can lead to immediate dangers, such as waterborne diseases, alongside long-term issues like mold in homes, which pose health risks and can be costly to remediate (U.S. Environmental Protection Agency, 2023). First Street Foundation reports that 8.1% of Indiana's properties are at substantial risk of flooding. They project that this number will increase by 4.4% over the next 30 years, affecting approximately 295,000 properties. The cities with the most significant number of properties at risk include Indianapolis, Fort Wayne, Hammond, Gary, and South Bend (First Street Foundation, 2020).

- **Poor Air Quality**: Climate change and the resulting weather pattern alterations will worsen air quality in many parts of the United States (Nolte, et al., 2018). This is particularly concerning, as disadvantaged communities and minorities are disproportionately exposed to greater concentrations of air pollutants, like ozone and particulate matter (U.S. Environmental Protection Agency, 2021; Miranda, Edwards, Keating, & Paul, 2011). According to the State of the Air report by the American Lung Association, the Indianapolis-Carmel-Muncie metropolitan area ranked 10th worst for annual particle pollution out of 200 metropolitan areas (American Lung Association, 2023). Northwest Indiana continues to be highlighted as a hotspot in the U.S. for air pollution (McCormick, 2023). The health effects of this poor air quality are severe and

wide-ranging. A multi-university study ranked Indiana among the top 12 states with the highest potential number of lives saved by reducing critical sources of air emissions and improving air quality (Schwartz, J. Buonocore, Driscoll, Lambert, & Reid, 2014).

- **Agricultural loss:** Agriculture in Indiana faces significant risks from climate change-induced weather extremes. Agricultural loss can increase food prices, leading to economic challenges for all residents (Union of Concerned Scientists, 2019). The Natural Hazards Index Risk from CEJST reveals that 61.7% of Indiana's more than 1,500 census tracts are at the 50th percentile or above for expected agriculture loss rate (Council on Environmental Quality, 2021). Disadvantaged communities make up a significant portion—nearly 30%—of the areas at above-average risk of agricultural loss. In addition, increased severe weather events may also increase runoff from agricultural production if best practices are not implemented (Widhalm, et al., 2018). Runoff can impact local water quality and cause additional GHG emissions, specifically nitrous oxide (U.S. Department of Agriculture, Natural Resources Conservation Service, 2024).

2. PRIORITY CLIMATE ACTION PLAN (PCAP) DEVELOPMENT PROCESS

The PCAP development process began with developing Indiana's GHG inventory at the state level (no county-level emission estimates) to determine the priority sectors that could be targeted through a plan for meaningful emissions reductions. IDEM then followed a multi-step process to identify the emissions reduction measures that form the plan's basis, addressing priority sectors. This process included an initial screening of national best practices to inform a list of ten draft measures. These measures and all identified best practices were shared through a stakeholder engagement process to enable the public to comment on top priorities, suggest new measures, and refine draft measures to meet the needs of Indiana citizens. IDEM reached out to other Indiana municipalities through the engagement process to gauge their priorities and incorporate local Climate Action Plans, as shown in Table 4. IDEM also created an interagency workgroup to promote collaboration, record the priorities of other agencies, and address any public messaging. Through public meetings, survey results, and one-on-one community leader meetings, IDEM revised the ten priority measures to capture Indiana's most important emissions reductions in the PCAP. IDEM will continue to keep the public informed of the process, next steps, and implementation of these measures. This section provides additional details on this process.

2.1 APPROACH TO STAKEHOLDER ENGAGEMENT

Stakeholder engagement is central to creating an effective climate action plan and must continue throughout implementation. Phase one engagement kicked off as soon as planning began in October 2023 and continued through December, including public meetings, surveys, interviews, and a review of local climate plans. Phase two engagement occurred in February with additional public meetings and presentations focused on the draft PCAP in response to earlier feedback from stakeholders. This PCAP would not have been possible without the more than 1,500 Hoosiers who have contributed valuable insights to date. Through further engagement and local champions' support, this number will continue to grow throughout CPRG planning.

INTEGRATION OF LOCAL CLIMATE PLANS

While the Priority Climate Action plan represents the first plan of its kind at the state level in Indiana, many municipalities, universities, communities, and organizations throughout the state have invested significant time and effort to develop local climate plans in the last decade. Most notably, Indiana University's Environmental Resource Institute (ERI) has helped several cities and towns develop plans through the Resilience Cohort program, providing local governments with the tools and expertise to measure and reduce local greenhouse gas emissions (Environmental Resilience Institute, 2024).

The Indiana PCAP does not attempt to replace these efforts but instead seeks to incorporate the insights and priorities outlined in local plans and leverage knowledge gained. Many of these plans represent the priorities and perspectives of local stakeholders gathered through deeper and more extensive engagement processes, from which the Indiana PCAP benefits. For example, community representatives provided feedback for the South Bend Climate Action Plan through interviews and focus groups. At the same time, members of the City of Evansville participated in more than 50 meetings and town hall events (City of Evansville, 2020). Given the importance of prioritizing disadvantaged communities through PCAP development, greater emphasis was placed on plans with higher concentrations of priority census tracts, such as Indianapolis, Fort Wayne, Gary, and Evansville. More details on this approach can be found in Section 2.2 Measure Identification, Revision, and Prioritization.

Table 4. Local Climate Action Plans Considered

Local Climate Action Plans Considered
Carmel Climate Action Plan (2023)
Fort Wayne Climate Action and Adaptation Plan (2023)
Greater Lafayette Climate Action Plan (2023)
Indiana Department of Transportation Carbon Reduction Strategy Draft (2023)
City of Richmond, Indiana Climate Action Plan (2022)
Bloomington Climate Action Plan (2021)
Evansville Climate Action Plan (2021)
City of Gary Climate Action Plan (2021)
City of Goshen Climate Action Plan for Government Operations (2021)
Zionsville Climate Action Plan (2020)
Carbon Neutral 2050, South Bend's Climate Action Plan (2019)

INTERAGENCY COLLABORATION

Building upon municipal engagement, IDEM developed an accelerated five-month plan to gather additional stakeholder feedback before the CPRG deadline.

IDEM engaged in interagency coordination through a working group comprised of the Indiana Department of Natural Resources, the Indiana Department of Transportation, the Indiana Office of Energy Development, the Indiana Department of Agriculture, the Indiana Economic Development Corporation, and the Indiana Health Department. This group has met twice to discuss the grant's public messaging, update other departments on the grant's progress, and gain insights from other departments on the top ten priority measures to be included in the draft PCAP. IDEM also worked closely with the Central Indiana Regional Development Authority (CIRDA), the lead agency responsible for the Indianapolis MSA planning grant, to coordinate any overlap in implementation measures between the two plans. IDEM has continuously met with CIRDA throughout the planning timeline and joined their initial GHG Subcommittee.

PUBLIC MEETINGS

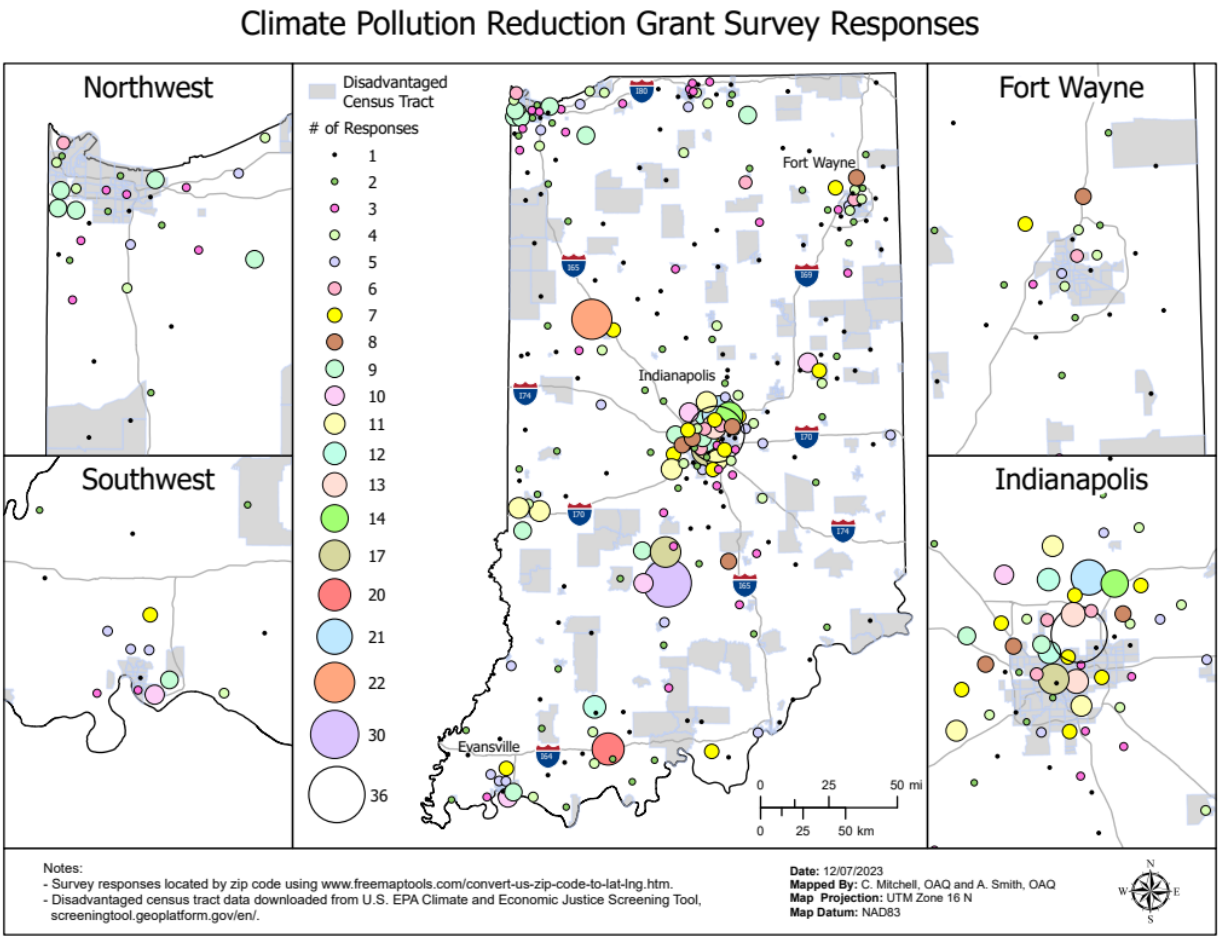
Public engagement around the development of Indiana's PCAP began with an initial phase of four public meetings in October and November of 2023 in Indianapolis, Ferdinand (Southwest Indiana), Fort Wayne, and Portage. These sessions encouraged a live dialogue on PCAP topics while ensuring wider accessibility through live streaming and publication of the presentation to IDEM's website. The recordings of the live events were posted to IDEM's website to provide continuous access throughout the public engagement process. In-person locations were selected based on proximity to a high concentration of disadvantaged communities and areas with larger populations to encourage participation. IDEM publicized these meetings through multiple formats: press releases, social media posts, IDEM's public notice webpage, interested parties' email distribution, and communications with municipal partners. Through these channels, IDEM shared upcoming dates and public meeting agendas. Attendees ranged from smaller groups of 30 to more than 50 participants per meeting.

Public meeting presentations outlined the CPRG program, progress to date, and engagement opportunities over the long term. By describing the emissions actions and program requirements, these presentations helped to promote awareness of opportunities for and benefits of participation, helping address information gaps and empower stakeholders to engage. Following the presentation, a significant portion of each meeting was dedicated to seeking and encouraging public comments, opening the floor to stakeholders' questions, input, and requests.

SURVEY RESPONSES

To gather priority community benefits and actions, and to capture feedback of a broader range of stakeholders, the Indiana Department of Environmental Management (IDEM) released a state-wide survey in English and Spanish requesting input on stakeholder priorities, key benefits, and proposed climate measures. Similar to the public meetings, IDEM publicized the survey through multiple formats: press releases, social media posts, IDEM's public notice webpage, interested parties' email distribution, and communications with municipal and community partners. The survey asked stakeholders for their zip codes to help identify whether they came from disadvantaged areas. Figure 3 visualizes the penetration of the survey through the state of Indiana and survey responses are overlayed with census tracts highlighted as disadvantaged by the Climate and Economic Justice Screening Tool (CEJST). Priority areas are highlighted. For more detail on how priority zip codes were identified, see the prior section, "Identifying Priority Communities." IDEM also partnered with CIRDA to gather feedback from the Indianapolis-specific climate survey guiding Indianapolis' climate action plan.

Figure 3: Indiana CPRG Survey Response with Disadvantaged Census Tracts



Source: Statewide CPRG Survey, 2023

INTERVIEWS AND FOCUS GROUPS

IDEM conducted additional virtual interviews and focus-group meetings to broaden representation in the planning process and gather the advice of subject matter experts. This encompassed over 30 additional meetings (see Appendix C) with community leaders, university directors, environmental justice specialists, and representatives from industry and agriculture. The mix of in-person and virtual approaches to community engagement has been instrumental in shaping more responsive and inclusive measures to include in the PCAP.

INFORMATION SHARING

As feedback was collected, information on the PCAP development process was also disseminated to raise awareness of climate action. IDEM maintained a Climate Pollution Reduction Grants webpage on the agency's website, providing background on the grant, a

timeline of milestones, details on past and upcoming meetings, and periodic progress summaries. IDEM updated the website regularly as new information was available. IDEM initially notified interested groups of the website through multiple channels: press releases, social media posts, IDEM's public notice webpage, interested parties' email distribution, and communications with municipal partners. On this webpage, interested stakeholders signed up for a listserv to receive email updates, used survey links to provide PCAP input, and gained direct access to the IDEM team through an email address. All stakeholders who signed up for the listserv continue to receive regular outreach, including updates on PCAP development and any news posted to the website.

INPUT COLLECTION AND INTEGRATION

Across phase one engagement, more than 1,500 stakeholders provided over 10,000 comments for the PCAP, sharing critical insights into Hoosiers' perspectives, concerns, and recommendations. Over 250 survey respondents came from zip codes with high concentrations of low-income and disadvantaged communities (LIDACs), representing 58 out of the 66 urban zip codes prioritized through the initial census tract identification process. (For more details on the identification process, please see section 1.3.1 Identifying Priority Communities). Additional community representatives shared feedback and priorities live during public meetings, virtual sessions, and through email.

All feedback collected directly influenced the selection of priority measures for the PCAP. Additional emphasis was placed on feedback from LIDAC stakeholders so that their preferences were effectively reflected in the final measure selection, even though these stakeholders represented a smaller number of the total respondents. This feedback highlighted community priorities, shared unique local insights to guide implementation, and helped inform the LIDAC benefits analysis. The identified community benefits and disbenefits relating to each measure can be found in Chapter 3: Summary of Climate Measures.

The results of phase one stakeholder engagement were posted on IDEM's CPRG webpage in January 2024 so that stakeholders could see how their feedback was incorporated. Additional details on how this feedback was factored into priority measure selection can be found in Section 2.2 Measure Identification, Revision, and Prioritization.

ONGOING ENGAGEMENT

Stakeholder engagement around climate planning continues to be an iterative and dynamic process as IDEM continues outreach and stakeholder advocates help spread the word. Engagement will be an ongoing effort throughout the grant period, ensuring that the voices of communities are heard and integrated into the development and implementation of the climate plans.

For example, in response to stakeholder requests during phase one of engagement, IDEM organized additional public meetings and presentations in early 2024 to discuss progress to date and the initial PCAP draft. The two additional public meetings were hosted in Gary and Evansville due to the proximity and concentration of low-income and disadvantaged communities. More than fifty stakeholders attended in person, and these meetings were also live-streamed, allowing for broader engagement from stakeholders across Indiana. Following invitations from collaborators, IDEM also presented on the CPRG program at the Indiana Sustainability and Resilience Conference hosted by Indiana University and at the Indy Health District Public Open House. This continued dialogue and feedback loop are central to developing and implementing a climate action plan that is not only effective but also reflective of the needs of Indiana's most vulnerable communities.

As the state moves into the development of the CCAP, IDEM plans to maintain the CPRG webpage, listserv, and email address as a hub for information and communication. IDEM also plans to host an additional phase of stakeholder engagement with in-person and virtual meetings and a continued focus on low-income and disadvantaged areas.

2.2 MEASURE IDENTIFICATION, REVISION, AND PRIORITIZATION

Development of the Priority Climate Action Plan (PCAP) centers around selecting near-term, high-priority measures to reduce greenhouse gas (GHG) emissions and enhance sinks. These measures outline a plan to deliver on the state’s goals to promote sustainability, enhance resiliency to environmental challenges, and safeguard natural resources. Four steps made up the accelerated process to collaboratively identify state-wide priorities, with input from stakeholders:

1. Initial screening of national best practices
2. Stakeholder engagement phase one
3. Alignment with local climate action plans
4. PCAP measure prioritization

INITIAL SCREENING

To launch PCAP development, the Indiana Department of Environmental Management (IDEM) compiled a list of 59 national best practices for climate pollution reduction through a review of decarbonization strategies employed across the United States. This identification process aimed to keep the initial strategy pool broad by including any strategy found in the 26 climate action plans reviewed, regardless of these strategies’ relevance to Indiana. IDEM then organized the identified GHG reduction pathways per sector into strategies, measures, and actions.

IDEM selected draft priority measures based on GHG emissions data, primarily focusing on attaining substantial GHG reductions while aligning with other relevant planning objectives.

Other relevant planning objectives are listed below and include the reduction of co-pollutants, benefits to low-income and disadvantaged communities (LIDACs), cost-effectiveness, and other economic considerations:

- Frequency of occurrence across climate plans reviewed
- Potential for GHG reduction, based on Indiana's GHG profile and highest-emitting sectors, as well as existing data for each measure
- Timeframe for the impact of reduction actions on GHG emissions with a preference for near-term solutions
- Implementation costs and resources, as well as available funding sources
- Potential impacts on LIDACs
- Potential co-benefits (e.g., economic development, job creation, public health impacts, energy resilience, environmental justice, etc.)

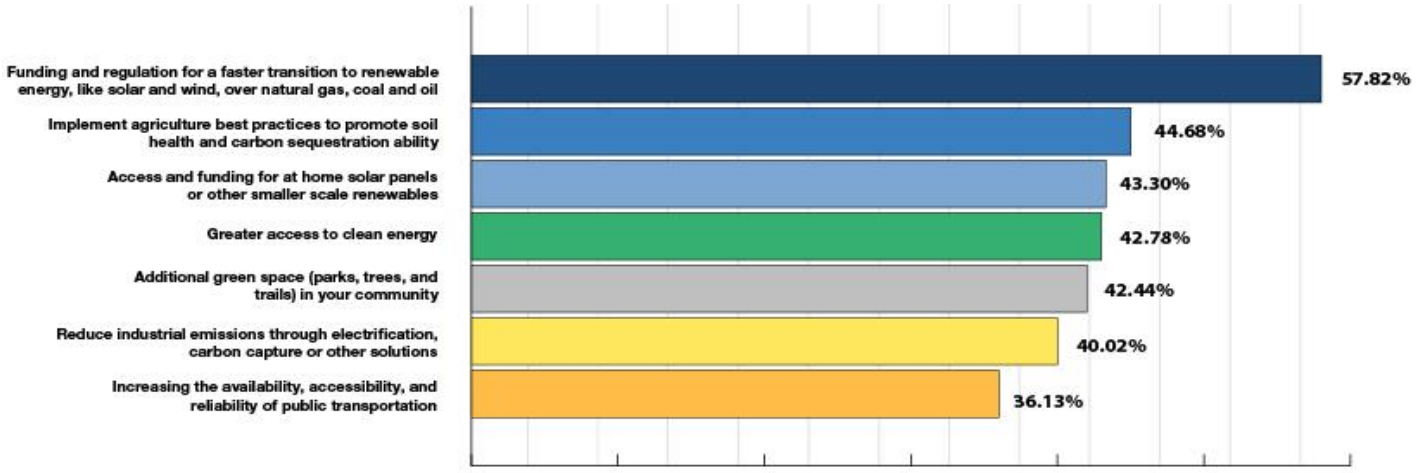
From the list of 59 measures, the screening process identified five Tier 1 and six Tier 2 measures. Tier 1 measures are widely applicable, high-impact decarbonization strategies that are frequently featured in state climate action plans. Tier 2 measures represent additional strategies with significant GHG reduction potential for Indiana based on the state's GHG emissions profile.

REVISIONS FROM STAKEHOLDERS

Following the initial screening process, IDEM shared the draft priority measures and the entire pool of identified strategies for feedback in phase one of stakeholder engagement. Specifically, IDEM disseminated information to stakeholders across the state through summaries published on the IDEM CPRG webpage, a roadshow of public meetings, interviews, and two surveys. Similar to the other stakeholder engagement processes, IDEM publicized the survey through multiple formats: press releases, social media posts, IDEM's public notice webpage, interested parties' email distribution, and communications with municipal and community partners.

Through these same tools, as well as a CPRG-specific email address and a dedicated phone line, IDEM prompted stakeholders to prioritize measures and identify any additional measures they believed should be considered. Figure 4 below outlines the measures voted for the most by survey respondents. Stakeholders also identified overarching benefits that mattered most to their communities and organizations, which informed both measure selection and the benefits analysis. They also highlighted concerns about measures, including disbenefits and implementation barriers.

Figure 4. Top Actions Selected by Respondents in Statewide Survey Question



Source: Statewide CPRG Survey, 2023

In parallel with the above engagement activities, IDEM reviewed local climate action plans from across the state, including those referenced in Table 4. Measures prioritized in local plans provided further input into the state-wide measures, as these plans represent the climate priorities of communities across the state.

Both climate plans and comments from stakeholders in areas identified as low-income or disadvantaged were given additional weight and consideration to ensure that the priorities of these areas were reflected in the final PCAP. By the end of phase one stakeholder engagement, over 10,000 comments informed the final selection of PCAP measures.

Stakeholder support prompted IDEM to add new measures to the priority list, including community solar, expanding green spaces, including the urban tree canopy, and developing bike pathways. In contrast, significant negative feedback caused the removal of carbon capture and storage. While the revised list of priority measures received overwhelming support from stakeholders, various stakeholders also raised concerns about these initiatives, although there are fewer than 30 concerns per initiative. The revised list includes ten priority measures with significant potential to reduce GHG emissions and benefit Hoosiers across the state.

2.3 COMMUNITY BENEFITS ANALYSIS

Through engagement, stakeholders also helped identify co-benefits of the chosen climate measures. Seven benefits rose to the top from survey responses and public meeting comments, with particular emphasis on respondents from low-income and disadvantaged communities:

1) Reducing Air Pollution and Improving Public Health Outcomes

2) Reducing Energy Costs
3) Improving Access to Transportation
4) Enhancing the Resilience of Buildings and Communities
5) Improving Waste Management
6) Creating Jobs
7) Reducing Climate Impacts and Risks

IDEM included these top seven benefits in the community benefits analysis, which featured a review of studies from across the United States to qualitatively assess the potential impacts of PCAP measures on low-income and disadvantaged communities. (For more information on how these communities are identified, please see Section 1.2.1, Identifying Priority Communities). While some key benefits have been highlighted through this initial analysis, the Comprehensive Climate Action Plan will help build a more robust understanding of the potential impacts of climate action in Indiana. The remainder of this section outlines the community benefits for each of the seven categories above.

1) REDUCING AIR POLLUTION AND IMPROVING PUBLIC HEALTH OUTCOMES

As shown above, many sectors contribute to GHG emissions and other air pollutants. These pollutants negatively impact public health. For example, the combustion of fossil fuels generates air pollutants that cause significant health impacts to communities across the United States (Goodkind, Tessum, Coggins, & Marshall, 2019; U.S. Environmental Protection Agency, 2021). Additionally, a recent study by Northwestern University shows that nitrogen dioxide, emitted by vehicles and other sources, has a substantial mortality burden in the U.S. (Camilleri, Hunter, Anenberg, & Horton, 2023). Similarly, the industrial sector represents a primary source of air pollution, such as particulate matter, that causes significant health impacts (Goodkind, Tessum, Coggins, & Marshall, 2019), (U.S. Environmental Protection Agency, 2021). Many of these studies and others have shown that disadvantaged communities are disproportionately exposed to environmental risks and impacts (Schweitzer, 2010).

Measures included in this PCAP reduce the need for fossil fuel combustion and improve public health. For instance, renewable energy and energy efficiency reduce demand for fossil-fuel-based electricity while avoiding harmful co-pollutants. From 2007-2015, one study estimated that transitioning to solar and wind generated an estimated $112.8 billion in benefits to air quality, including up to 12,700 avoided premature deaths (Millstein, Wiser, Bolinger, & Barbose, 2017). Similarly, another study showed that reducing the number of internal combustion vehicles on the road through electrification or alternative transportation options can significantly improve air quality and public health, potentially saving lives (Visa, et al., 2023). However, additional studies on pathways for decarbonization in the U.S. show the importance of ensuring benefits reach the communities that need them most when implementing measures like renewable energy (Goforth & Nock, 2022).

2) REDUCING ENERGY COSTS

Utility costs in Indiana can lead to significant financial strain on households. According to the U.S. Energy Information Administration, the average price of electricity to residential customers is mid-range compared to other U.S. states (U.S. Energy Information Administration, 2022). However, the Department of Energy estimates that the average energy burden for low-income households is three times higher than for non-low-income households, showing the importance of potential cost savings (U.S. Department of Energy, n.d.). The list below details how specific measures can reduce the energy burden:

- Implementing energy efficiency measures in Indiana can lead to substantial savings in electricity consumption and, therefore, household expenses. One analysis showed that implementing cost-effective energy efficiency efforts could save low-income households in Indiana 25-29% on their electricity costs (U.S. Department of Energy, 2018). Energy savings can also help preserve the affordability of low-rent housing (U.S. Environmental Protection Agency, 2018).
- Adding renewable energy options can help households save money in the long term, especially when grant programs support the upfront costs. Utility-scale renewables can also be cost-effective, lowering the cost burden passed on to consumers (U.S. Environmental Protection Agency, 2018).

3) IMPROVING ACCESS TO TRANSPORTATION

According to the U.S. Department of Transportation, low-income families spent 30% of their after-tax income on transportation in 2022 (U.S. Department of Transportation Bureau of Transportation Statistics, 2023). More affordable transportation options, including public and active transit, can help reduce this burden while connecting communities with resources and job opportunities in other areas.

Today, over 60 public transit systems are supported by the Indiana Department of Transportation (INDOT), providing more than 36 million passenger trips annually. INDOT has already developed plans to increase this number (Indiana Department of Transportation, 2024). Many municipal climate plans within the state also aim to enhance public transport and increase bike or pedestrian pathways to better connect residents to nearby resources and job hubs. While access to affordable transportation can bring meaningful benefits to communities, stakeholders emphasized the need for plans to be tailored to each area, focusing on marginalized populations to maximize benefits.

4) ENHANCING RESILIENCE OF BUILDINGS AND COMMUNITIES

Several PCAP measures enhance resiliency. For example, the measures that reduce greenhouse gas emissions can also make buildings more comfortable and communities more resilient in the face of a changing climate. Investments in energy efficiency, such as improving insulation, eliminating leaks, and installing efficient HVAC systems, can help keep housing at a safe temperature, directly benefiting residents. Effectively controlling airflow can also prevent drafts and lower mold-causing moisture, enhancing comfort for residents (U.S. Environmental

Protection Agency, 2018). These investments will become even more critical as heatwaves and severe weather increase in intensity and frequency due to climate change (U.S. Department of Energy, Office of Policy, 2023).

Green spaces can also help communities build climate resilience. The Purdue Climate Change Research Center assesses the wide-ranging benefits of green infrastructure (Indiana Climate Change Impacts Assessment, 2018). Urban trees in Indiana significantly influence the city's microclimate through shade, cooling, and by acting as windbreaks. Notably, they already contribute approximately $157 million in annual savings in residential electricity and heating while helping to prevent 1.3 million tons of carbon dioxide emissions yearly (Nowak, Appleton, Ellis, & Greenfield, 2017). Additionally, urban trees aid in stormwater management, offering an estimated $24 million in benefits annually, and they enhance community well-being through recreational opportunities (Indiana Climate Change Impacts Assessment, 2018).

Furthermore, renewable energy sources can reduce the strain on local electrical grids, enhancing reliability and reducing the potential for outages, especially when paired with energy storage technologies (U.S. Environmental Protection Agency, 2018). The Environmental Resiliency Institute highlights that distributed renewable energy sources can be more resilient in severe weather disruptions than centralized power plants, an essential attribute as severe weather increases due to climate change (Environmental Resilience Institute, 2019).

5) IMPROVING WASTE MANAGEMENT

Measures that reduce landfill emissions also can lead to material recovery and reuse, providing better overall waste management. According to EPA estimates, more than 66 million tons of food were wasted in 2019, most of which were sent to landfills (U.S. Environmental Protection Agency, 2023). Food recovery and donation programs can help enhance local food access, benefiting communities while preventing food from being wasted (Mineo, 2021). For organic waste that needs disposal, such as food scraps or grass clippings, composting provides an alternative to landfilling while generating material to enhance soil health (U.S. Environmental Protection Agency, 2023). Reducing waste sent to landfills also reduces the proliferation of landfills, benefiting nearby communities.

6) CREATING JOBS

Research has documented significant green job creation associated with measures included in the PCAP, such as renewable energy deployment and composting. Under each measure outlined in Chapter 3, the subsection “Workforce Development” highlights the potential for job creation in Indiana, outlines the skillsets required for the workforce, and specifies the actions or tactics necessary for workforce development related to that specific measure. It is critical to emphasize that these actions are suggested as supplementary options for generating new employment opportunities to meet the evolving demand for green jobs in Indiana. They are not intended to replace or displace existing jobs and opportunities.

In collaboration with the identified partners, IDEM will undertake a comprehensive assessment of Indiana's workforce, identifying strengths, weaknesses, and opportunities. This assessment will involve forecasting labor and skill demands and identifying any gaps. It will also pinpoint activities to generate high-quality jobs, aligning with the U.S. Department of Labor's Good Jobs Principles[1].

During public meetings, stakeholders consistently called for job creation in disadvantaged communities, highlighting the importance of this benefit. Creating new jobs and providing workforce training can help improve incomes in areas throughout the state.

7) REDUCING CLIMATE IMPACTS AND RISKS

The primary benefit of the measures included in the PCAP is the ability to reduce greenhouse gas emissions and help combat future climate change. More information on key risks to communities from a changing climate is outlined in the section above titled "Climate Risks to Communities."

2.4 TECHNICAL ASSESSMENTS

IDEM evaluated each priority climate pollution reduction measure for greenhouse gas (GHG) and co-pollutant emissions reductions. This evaluation specifically assessed the following:

- GHGs, including carbon dioxide, methane, nitrous oxide, and various refrigerants such as hydrofluorocarbons (HFCs). All GHG emissions reduction estimates presented in this plan are displayed in millions of metric tonnes of carbon dioxide equivalents (MMT CO_2e). Metric tonnes are defined as 1,000 kilograms and carbon dioxide equivalent is a universal approach to equating the global warming potential (GWP) of different gases.
- Co-pollutants, including NO_x (nitric oxide and nitrogen dioxide), sulfur dioxide, $PM_{2.5}$ (inhalable particulate matter of diameter 2.5 micrometers or smaller), volatile organic compounds, carbon monoxide, and mercury. All co-pollutant emissions reduction estimates are displayed in terms of short tons.

The process for emissions reduction quantification for each measure involved identifying a baseline or current state; determining what activity would be changed by each measure and how this activity relates to emissions reductions; defining ambition scenarios for these activity changes, including key metric projections; and creating logical linkages between baseline data, targeted changes, and emissions reductions. Potential emissions reductions are measured against theoretical reference cases for each sector that assume a continuation of the current state.

[1] Learn more about the Department of Commerce and Department of labor good Jobs Principles here (U.S. Department of Labor, 2022).

The analysis modeled emissions reductions to 2050 for each measure and used the 100-year GWP values from the IPCC's Fourth Assessment Report (AR4), in line with EPA's most recent 2023 GHG Emission Factors Hub (U.S. Environmental Protection Agency, 2023). However, critical assumptions, reference case and scenario data sources, measure-specific methodology, and other pertinent discussions varied and can be found in more detail in each measure's summary. A variety of datasets, tools, resources, research, and assumptions were used to derive GHG and co-pollutant emissions reduction estimates, including:

- National EPA data, including the AP-42 Compilation of Air Emissions Factors from Stationary Sources (U.S. Environmental Protection Agency, 2024), 2020 National Emissions Inventory (NEI) (U.S. Environmental Protection Agency, 2020), and the Motor Vehicle Emission Simulator (MOVES) (U.S. Environmental Protection Agency, 2023). These were used to determine emission factors throughout the analysis.
- Tools and datasets, such as the i-Tree Planting Calculator (i-Tree Planting, n.d.), the USDA Carbon Reduction Potential Evaluation (CaRPE) tool (U.S. Department of Agriculture, 2023), the U.S. Energy Information Administration (EIA) Residential Building (U.S. Energy Information Administration, 2020), Commercial Building (U.S. Energy Information Administration, 2018), and Manufacturing (U.S. Energy Information Administration, 2018) Energy Consumption Surveys, the Landfill Methane Outreach Program database (U.S. Environmental Protection Agency, 2023), the Electric Power Sector Consumption Estimates (U.S. Energy Information Administration, 2021), the EIA's Annual Energy Outlook 2023 (U.S. Energy Information Administration, 2023), and International Energy Agency (IEA) Net Zero Emissions (NZE) models (International Energy Agency, 2023).

IDEM drew Indiana-specific data and strategies from entities within the state, such as INDOT and Purdue University, and direct contact with municipalities to further increase accuracy. Where possible, the analysis considered existing goals and efforts for metrics like renewable energy uptake across Indiana's grid and ongoing public transit projects.

To avoid over-reporting potential reductions, measures use common assumptions where there is overlap. As an example, IDEM used the reduction in Indiana's grid emission factor calculated in the measure to "maintain, develop, and expand utility-scale renewable energy generation" in all the measures relying on grid electricity savings for emissions reductions, such as the measure to "increase residential, municipal, and commercial building energy efficiency." This means the latter energy efficiency measure resulted in lower projections of emissions savings, as the expected increase in renewable energy dictates lower emissions per kilowatt-hour.

All emissions reductions should be viewed as directional indicators of the order of magnitude rather than precise models, as the measures included in this plan have a wide range of potential reductions based on the scenarios chosen. While IDEM aimed to choose realistic scenarios using available data and stakeholder input, the calculations make several assumptions about the

success and breadth of implementation, development of new technologies, future regulations and policies, collaboration with statewide entities, and other unpredictable factors.

2.5 AUTHORITY TO IMPLEMENT

IDEM has reviewed existing statutory and regulatory authority to implement each priority measure included in this plan. This plan includes a list of voluntary actions available to Indiana communities to enable rapid implementation of near-term climate actions in CPRG implementation. CPRG gives no new regulatory authority, nor is new authority sought by this plan for CPRG Implementation. Therefore, there is no implementation timeline to obtain authority for the measures included in this plan. The IDEM commissioner has the existing authority to accept and administer grants or other money or gifts to carry out any air pollution control laws, as described in Indiana Code 13-17-3-9, which is sufficient authority for the voluntary implementation of CPRG projects by Indiana communities.

Including any measures in the PCAP does not add or remove any preexisting regulatory requirements for implementing a project.

3. SUMMARY OF CLIMATE MEASURES

Indiana identified ten climate measures from six distinct sectors. These measures were selected due to stakeholder priorities, sectoral coverage, and emissions impact. The measures and their respective sectors are shown in Table 5 below.

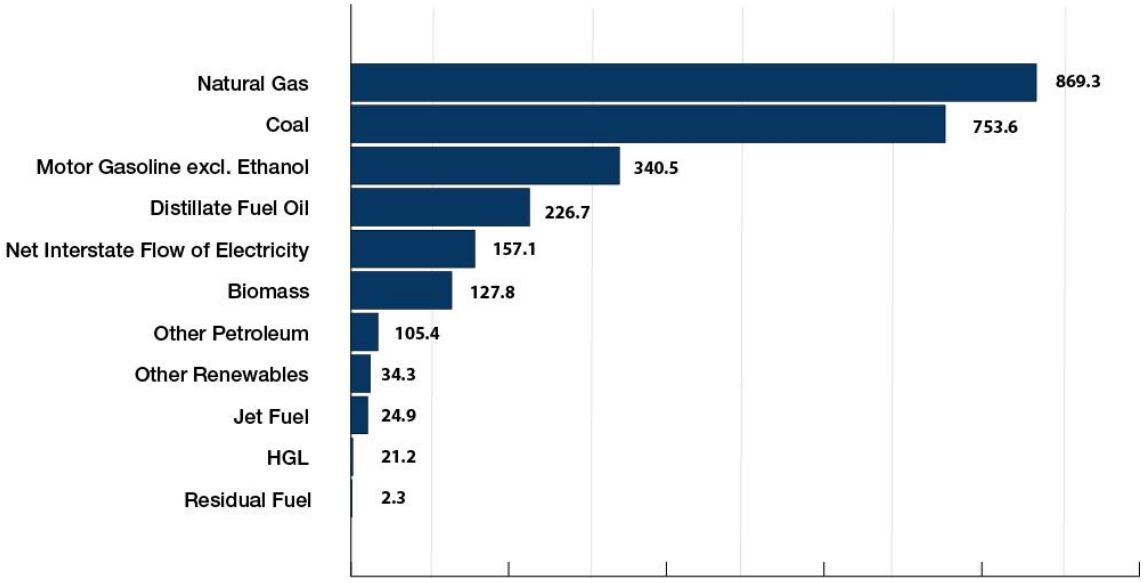
Table 5. Summary of Climate Measures

SECTOR	MEASURES
Electric Generation	1. Maintain, develop, and expand utility-scale renewable energy generation
	2. Expand community and distributed solar generation with battery storage
Residential & **Commercial Buildings**	3. Increase residential, municipal, and commercial building energy efficiency
Transportation	4. Accelerate adoption of light-duty electric vehicles and charging stations
	5. Reduce vehicle miles traveled through expanding options, including public transit and active transportation
Industry	6. Expand the use of electric and green hydrogen industrial processes and technologies
Waste and Materials Management	7. Increase diversion rate of organic waste from landfills
	8. Install and expand landfill gas collection systems and renewable natural gas generation
Agriculture, Natural & Working Lands	9. Expand green spaces and urban tree canopy
	10. Implement agricultural best practices to support carbon sequestration

3.1 ELECTRIC GENERATION SECTOR

As of 2021, Indiana's electric generation sector comprised over one-third (35%) of the state's total emissions, as shown in Section 1.2. These emissions stem from Indiana's electricity mix, which is mainly coal (13.8 GW) and natural gas (7.9 GW). The remaining mix (5.1 GW) includes renewable energy from wind, solar, hydro, and other gas resources (U.S. Energy Information Administration, 2022).

Figure 5. Indiana Energy Consumption Estimates, 2021 (Emission estimates in Trillion Btu)



Source: (U.S. Energy Information Administration, 2022)

Given the significance of emissions in this sector, shifting to cleaner sources of electricity can have a meaningful impact on both the state's greenhouse gas and pollutant footprint as well as the local workforce. However, transitioning to cleaner energy sources will require workforce training, new infrastructure development, and new structures for managing intermittent renewables. Many stakeholders emphasized the need for the state to manage and mitigate these obstacles when implementing selected measures.

Selected Measures

Renewable energy sources like solar and wind have the potential to significantly reduce greenhouse gas emissions in Indiana's power generation sector, given the emissions from this sector. These measures provide additional benefits to public health by reducing other criteria pollutants associated with fossil fuel-based electricity sources. Renewable energy development also creates local jobs, leads to community investments, and can lower the cost of energy.

Given the multitude of benefits from and stakeholder requests for renewable development, the PCAP includes two renewable energy-related measures: (1) expanding utility-scale renewable energy generation and (2) expanding additional solar options.

Sector Overview

To date, Indiana ranks as one of the top 20 states for both wind and solar generation. Both have bolstered the economy through local investments and jobs while reducing emissions. More information on the status of wind and solar are provided below:

- **Wind in Indiana:** According to the American Wind Energy Association (AWEA), Indiana ranks 12th in the nation for installed capacity, generating an estimated $23.4 million in tax payments and $22 million in land lease payments annually.[i] The state is also home to 15 wind manufacturing facilities, further boosting the local economy through high-paying jobs. The National Renewable Energy Laboratory (NREL) estimates that Indiana has the potential to increase its wind capacity up to 148 GW, though further analysis is needed to assess feasibility.[ii]

- **Solar in Indiana:** According to the Solar Energy Industries Association (SEIA), Indiana ranks 16th in installed solar capacity, an upward trend of two spots from the previous year.[iii] The state is also home to almost 4,000 solar jobs and 97 solar companies, including manufacturers and developers. SEIA projects that capacity will continue to increase by over 8 GW in the next five years, further bolstering the workforce and local investment.

Utility Regulatory Structure and Clean Energy Standards

Indiana has a traditionally regulated retail electric market, meaning that customers must purchase electricity from the designated utility in their market (U.S. Environmental Protection Agency, 2023). There are three utility categories: investor-owned utilities (IOUs), rural electric membership cooperatives (REMCs), and municipal utilities. The state has five investor-owned utilities (IOUs), which are regulated by the Indiana Utility Regulatory Commission (IURC) and the state legislature (Indiana Utility Regulatory Commission, 2024). Together, these utilities serve 2.3 million residential, commercial, and industrial customers. Hoosier Energy and Wabash Valley Power are two primary generation cooperative organizations in Indiana with REMC member utilities. Additionally, Indiana has several municipal utilities that are regulated at the local level (Indiana Office of Utility Consumer Counselor, 2020). This means that electric generation is overseen at a number of different levels, which may cause variances in renewable energy generation across the state. In addition, the role of local governments is important in the siting of new energy projects.

Indiana enacted the Voluntary Clean Energy Portfolio Standard Program at the state level in 2012.[iv] Under this program, regulated IOU utilities may receive financial incentives if they integrate a certain proportion of clean energy from solar, wind, biomass, hydro, hydrogen, waste heat, or other qualifying sources into their generation mixes. Table 6 below outlines the targets from the 2012 legislation.

Table 6. Indiana Voluntary Clean Energy Portfolio Program Targets (2013 - 2025)

Years	Voluntary Clean Energy Generation Targets
2013 – 2018	4%
2019 – 2024	7%
2025	10%

With more than 10% of its electricity coming from qualified renewable energy sources in 2021, Indiana has already exceeded its voluntary clean energy generation targets for 2025. There are no publicly available updates beyond 2025 at this time.

MEASURE 1: MAINTAIN, DEVELOP, AND EXPAND UTILITY-SCALE RENEWABLE ENERGY GENERATION

Utility-scale renewable energy generation refers to large-scale energy projects with zero operational greenhouse gas emissions. Generation sources that qualify as renewable energy include wind, solar, hydro, biomass, and geothermal (U.S. Energy Information Administration, 2023). The analysis for this measure focuses on the growth of solar photovoltaic and wind power by 2030 and 2050, as these two renewable energy sources have a high potential for impact on future economic development in Indiana.

CURRENT STATE

Indiana produces most of its renewable energy (solar and wind) from utility-scale projects. For example, according to SEIA, utility-scale has been the dominant solar project type based on capacity in megawatts since 2014 (Solar Energy Industries Association, 2023). Since Indiana has a regulated retail electricity market, utilities are responsible for developing or securing power from new utility-scale projects. Table 7 below provides an overview of notable utility-scale projects in Indiana.

Table 7. Notable Utility-Scale Renewable Energy Projects in Indiana

Project	Capacity	Online Date
Riverstart Solar Park	255 MW	2021
Troy Solar	65 MW	2021
Fowler Ridge Wind Farms	600 MW	2016
Meadow Lake Wind Farm	801 MW	2009

Sources: (Solar Energy Industries Association, 2023; Power Technology, 2023; EDP Renewables, 2024)

Many utilities plan to increase the share of renewable energy in their portfolios, primarily through utility-scale additions. For instance, AES Indiana plans to increase the percentage of renewable energy generation in its portfolio from 8% to 78% in 2042 (AES Indiana, 2022).

Likewise, Duke Energy Indiana plans to add 8 GW of renewables according to its latest Integrated Resource Plan (Duke Energy, 2023).

STAKEHOLDER COMMENTS

Developing utility-scale renewable energy emerged as the highest priority measure from stakeholder feedback collected through surveys, public meetings, interviews, and a review of municipal climate action plans. In the state-wide survey, renewable measures received the most votes of any measure category when respondents were asked to select their top five measures. In particular, 58% of total respondents and 61% of respondents from priority LIDAC zip codes[2] selected the measure for a faster transition to renewable energy. Additionally, increasing renewable energy development was highlighted as a priority across eight municipal climate action plans, including Bloomington, Fort Wayne, and Gary, representing stakeholders' preferences in those areas.

Stakeholders highlighted several areas of concern that the state needs to address during the implementation of this measure. Various stakeholders expressed concern about the use of land for energy generation rather than agricultural purposes, the impact on nearby residents, and the reliability of renewable energy. Respondents stressed the importance of prioritizing low-income and disadvantaged communities as the main benefactors of new renewable energy. They also expressed concerns about the readiness of local codes and regulations to support utility-scale solar. Carefully selecting locations and encouraging voluntary participation in PCAP measures can mitigate some of these core concerns during implementation.

Table 8. Potential Community Benefits of Utility-Scale Renewable Energy

Potential Community Benefits
Reduced climate risks
Reduced air pollution
Improved public health outcomes
Community involvement in the planning and implementation of the measure
Reduce energy cost burden
Reduced climate impacts and risks

COMMUNITIES IMPACTED BY MEASURE

Expanding utility-scale renewable energy generation in Indiana has the potential to positively impact a wide range of communities (see Appendix B for a list of LIDAC census tracts). However, the most significant advantages will be realized in communities where the co-benefits of reduced particulate emissions lead to a substantial decrease in air pollution. As coal-fired power plants retire, these communities stand to benefit not only from a more resilient electric grid but also from improved air quality, promoting a healthier and more sustainable living environment.

[2] See section 1.2.1 Identifying Priority communities for more detail on how these areas were defined.

GREENHOUSE GAS AND CO-POLLUTANT EMISSIONS REDUCTIONS

The analysis modeled two target dates from a 2021 baseline to calculate the potential greenhouse gas and co-pollutant emissions reductions for utility-scale renewable energy:

Target Date 1: Support and develop solar and wind power projects to reach 25% of Indiana's net electricity generation by 2030.

Target Date 2: Support and develop solar and wind power projects to reach 40% of Indiana's net electricity generation by 2050.

Methods and Assumptions

The 2021 baseline was calculated using the electric power sector consumption estimates from the Energy Information Administration (EIA) and emissions factors from the EPA (U.S. Energy Information Administration, 2021). Next, electric power net generation growth was modeled for 2022-2050 using the assumptions described below. Finally, emissions reductions were calculated based on the modeled increases in renewable energy.

Table 9. Emission Reductions Calculation Assumptions for Utility-Scale Renewable Energy Generation

Parameter	Assumption	Source
Annual growth for net generation (2022-2039)	Annual growth is determined by base energy requirements for each year from 2022 to 2039, as described in Purdue's 2021 Forecast.	(Phillips, et al., 2021)
Annual growth for net generation (2040-2050)	Annual growth rate of 0.21 % (average annual growth from Purdue's 2021 Forecast for the 2020-2039 period).	(Phillips, et al., 2021)
Annual growth for solar photovoltaic and wind power	Annual growth is determined by targets set for 2030 and 2050. The growth between target years is evenly distributed, resulting in a constant growth rate year over year.	Integrated Resource Plans (IRPs) and other sources were used to determine reasonable targets for 2030 and 2050.
Annual growth for coal	Replacement of coal-fired power follows the increase in generation from solar and wind.	--
Annual growth for natural gas	Natural gas is used as a transition fuel to fill the gap between the deployment of renewable energy sources and the increase in projected energy demand.	--
Annual growth for other energy sources (e.g., petroleum, hydro, biomass)	Annual growth for each energy source follows the annual growth rate for net generation.	(Phillips, et al., 2021)

Results

Results show that increasing the share of renewables in the state's total net generation to 25% by 2030 generates annual reductions of over 15 MMT CO_2e, and reaching 40% of the total net generation by 2050 doubles the annual reductions to over 30 MMT CO_2e. The table below provides the results for co-pollutants.

Table 10. Greenhouse Gas and Co-Pollutant Emissions Reductions from Utility-Scale Renewable Energy Generation

	GHG emissions reduction (MMT CO_2e)	Co-pollutant emissions reductions (short tons)					
		NO_x	SO_2	$PM_{2.5}$	VOCs	CO	Hg
2030	**15.4**	10,076	11,045	1,539	65	(73)*	0.05
2050	**30.3**	21,293	23,572	3,273	127	(290)*	0.11

GHG and co-pollutant reduction estimate for expanded solar and wind generation at the utility-scale. Values represent the annual emissions reductions in the respective years relative to a 2021 baseline, used as a reference case.

**CO emissions are expected to increase due to the use of natural gas as a transition fuel between the growth of renewable energy and expected demand.*

Limitations and Conclusions

Increasing the share of renewables in Indiana's total net generation by 2030 and 2050 has the potential to yield significant benefits in emission reductions for both GHG and co-pollutants. Although this analysis considers utilities' IRPs, structural constraints on renewable generation for the electrical grid may appear as the state approaches 30% to 40% renewable generation, requiring infrastructure investments to allow for additional renewable capacity. Both the Midcontinent Independent System Operator (MISO) and the National Renewable Energy Laboratory (NREL) estimate a constraint on renewable generation for the electrical grid at up to 40% and 50% renewable generation, respectively (The Nature Conservancy Indiana, 2020).

WORKFORCE DEVELOPMENT ANALYSIS

The workforce development and job creation opportunities from expanding renewable energy generation are already apparent in Indiana and will continue to accelerate with time. In 2022, Indiana had 287,187 energy workers statewide, representing 3.5% of all U.S. energy jobs (U.S. Department of Energy, 2023). Implementing this measure will require a wide range of jobs, skill levels, and training to support a clean energy transition. Between now and 2032, the U.S. Bureau of Labor Statistics anticipates a 45% increase in wind turbine technician jobs and a 22% increase in solar photovoltaic installation jobs (U.S. Bureau of Labor Statistics, 2023). Both specialties will be essential to the growth of utility-scale renewable energy, and various

partnership models with the State Department of Labor, private employers, industry associations, and others will need to be created across Indiana to meet the demand for these positions. Furthermore, incentives or subsidies for individuals pursuing utility-scale renewable energy training and certifications will yield benefits. This can include tuition assistance, grants, or tax incentives for companies that invest in employee training.

Many other specialties will be required across various disciplines. Maintenance technicians and engineers are critical for maintaining the operation and efficiency of existing renewable energy facilities. Electrical engineers and project managers are critical in developing new utility-scale renewable energy projects, from initial planning and design to construction and commissioning. Grid integration specialists are essential for connecting renewable energy systems to the existing power infrastructure, optimizing energy distribution, and ensuring grid stability. Research and development professionals contribute to innovation in renewable energy technologies, driving improvements in efficiency and cost-effectiveness. Environmental scientists and regulatory experts navigate the complex landscape of environmental regulations, permitting, and compliance. Skilled construction workers and laborers are necessary to implement new renewable energy projects. The workforce needed to maintain, develop, and expand utility-scale renewable energy generation in Indiana is multifaceted, offering opportunities in technology, construction, research, and management, ultimately contributing to sustainable economic growth and the transition to clean energy.

IMPLEMENTATION DETAILS

IDEM will coordinate with the Indiana Utility Regulatory Commission, the Office of the Utility Consumer Counselor, and individual utility providers to explore expanding renewable energy generation opportunities, including potential public and private funding/investment options. As opportunities arise, IDEM will continue coordinating with the same entities on timely implementation, including the necessary permitting activities to support various projects.

Funding

The availability of federal funding is essential for the feasibility of utility-scale renewable energy generation in Indiana. Below are possible sources of funding to finance this measure.

Table 11. Federal Funding for Utility-Scale Renewable Energy Generation

Funding Source	Federal Amount	Description
U.S. Department of Energy's Federal Solar Tax Credits for Businesses https://www.energy.gov/eere/solar/federal-solar-tax-credits-businesses	Amount varies	Two tax credits are available for businesses and other entities (nonprofits and local and tribal governments) that purchase solar energy systems.
U.S. Department of Energy's Solar Energy Evolution and Diffusion Studies 4 (Seeds 4) https://www.energy.gov/eere/solar/articles/funding-notice-solar-energy-evolution-and-diffusion-studies-4-seeds-4	$7 million available	This program will award up to $7 million for social science research that generates actionable insights that can improve large-scale solar siting processes and outcomes for host communities- particularly those that are disadvantaged- as well as the solar industry and other stakeholders.
U.S. Department of Agriculture's Renewable Energy for America Program (REAP) https://www.rd.usda.gov/programs-services/energy-programs/rural-energy-america-program-renewable-energy-systems-energy-efficiency-improvement-guaranteed-loans	• Loan guarantees on loans up to 75% of total eligible project costs. • Grants for up to 50% of total eligible project costs. • Combined grant and loan guarantee funding up to 75% of total eligible project costs.	This program provides guaranteed loan financing and grant funding to agricultural producers and rural small businesses for renewable energy systems or to improve energy efficiency. Agricultural producers may also apply for new energy-efficient equipment and system loans for agricultural production and processing.
U.S. Department of Energy's Office of Energy Efficiency & Renewable Energy https://www.energy.gov/eere/renewable-energy-siting-through-technical-engagement-and-planning	$10 million available	This funding and technical assistance program supports the creation of new, or the expansion of existing, state-based programs or initiatives that improve renewable energy siting processes at the state and local levels. The program anticipates awarding five to seven state-based collaboratives up to $2 million each.

MEASURE 2: EXPAND COMMUNITY AND DISTRIBUTED SOLAR GENERATION

Additional solar options encompass distributed solar and community solar. Distributed solar refers to solar plants installed on a residential, commercial, or industrial customer's property behind the meter. This includes solar installations on rooftops, which stakeholders popularly requested. Community solar complements distributed solar by providing access to solar without needing to install a project directly. Through these programs, a customer subscribes to a local

project or supports a utility-owned project. These programs primarily benefit multi-family residents and customers who cannot install rooftop solar for economic or siting reasons.

Priority actions that may support the expansion of additional solar options include providing incentives, such as carving out funding for distributed projects and establishing programs for community solar through regulation. Table 12 below provides an overview of the various options and methods for expanding solar.

Table 12. Additional Solar Option Examples

Option	Description of Option	Example Actions to Support Additional Solar Options
Distributed Solar	< 1 MW of solar sited directly on a customer's property (e.g., rooftop). It is often called "behind-the-meter" solar because it is located on the customer's side of the utility meter. These projects allow customers to benefit from stable electric costs and may offer a return on investment over time.	• Net Metering or alternative compensation, which allows customers to sell excess power back to the grid • Incentives, such as rebates or tax exemptions • Resources, such as lists of qualified contractors • Streamlined permitting processes
Community Solar	Locally sited projects that allow community members to subscribe flexibly to a share of the project at a reduced or fixed rate. These projects allow customers to benefit from stable electric costs and/or reduced costs upfront. Depending on program rules, these projects may be managed by utilities or third-party providers. *Example Program: Illinois Solar for All*	• Developer incentives, which may include carveouts for multifamily residents and/or LIDACs • Program established through legislation or regulatory body • Utility-developed programs

Source: ClimeCo, 2024

Both distributed solar and community solar can increase the accessibility and affordability of energy while having co-benefits, such as increased resiliency and reduced local emissions. Local solar projects can shift generation to clean sources, thereby reducing long-range transport of air emissions, improving local air quality and job prospects, and reducing electric costs.

CURRENT STATE

Indiana has already established some additional solar options. For instance, the state allows for distributed solar and has enacted laws to protect these systems. Additionally, some utilities have implemented green tariff programs. The remainder of the section details the current state of each of the three options highlighted above.

Distributed Solar

As of 2023, over 200 MW of distributed renewable energy have been installed in Indiana (U.S. Energy Information Administration, 2023). To date, Indiana has established several mechanisms to support distributed solar:

- **Solar Access:** Indiana has a state law that prevents planning and zoning authorities from prohibiting solar. Additionally, Indiana adopted a bill in 2022 that prevents homeowners' associations (HOAs) from prohibiting solar panel installations (DSIRE, 2023).

- **Incentives:** In 2022, Indiana enacted an excess distributed generation (EDG) tariff for state-regulated IOUs, compensating customers for any excess power they generate and sell back to the utility (NC Clean Energy Technology Center, 2023). This is a successor to the state's Net Metering program and incentivizes customers to install and generate distributed solar. REMCs and municipal utility incentives vary across the state.

Community Solar

Indiana has not established a community solar program for IOUs. Indiana representatives have proposed adding community solar programs through state legislation; however, the legislation has yet to pass (New Project Media, n.d.). Some co-ops have established their own community solar programs and projects, including Northeastern Rural REMC and Tipmont REMC (Jenny Heeter, 2020).

STAKEHOLDER COMMENTS

Stakeholders identified on-site community and distributed solar programs as well as battery storage as a top priority – leading to this measure's inclusion in the PCAP. In the state-wide survey, renewable measures received the most votes of any measure category when respondents were asked to select their top five measures. In particular, 43% of total respondents and 38% of respondents from priority LIDAC zip codes[3] prioritized the measure for at-home solar panels and distributed renewables. Additionally, six of the municipal climate action plans included additional solar options as a priority, including Lafayette, Gary, and Evansville.

Stakeholders emphasized several barriers to residential solar, including cost implications for low and moderate-income housing. Given these cost constraints, there is a notable desire for incentives or funding to facilitate solar adoption. Despite the challenges, sentiment toward solar

[3] See section 1.2.1 Identifying Priority communities for more detail on how these areas were defined.

initiatives remained largely positive, with many stakeholders expressing interest in having solar installations in schools.

Table 13. Potential Community Benefits of Community and Distributed Solar

Potential Community Benefits
Reduced climate impacts and risks
Reduced air pollution
Improved public health outcomes
Job creation
Reduce energy cost burden
Improved climate resilience

COMMUNITIES IMPACTED BY MEASURE

Expanding solar energy access to communities in Indiana, especially those identified in the LIDAC census tracts (see Appendix B), holds the potential to bring about a range of benefits. Beyond the general reduction in energy costs facilitated by on-site solar generation at schools, the greatest beneficiaries will be communities that extend these savings to taxpayers. By implementing solar power initiatives, residents can contribute to lower energy costs at home and foster a collective effort toward sustainable practices that benefit individual households and the community.

GREENHOUSE GAS AND CO-POLLUTANT EMISSIONS REDUCTIONS

The analysis modeled two target dates from a reference case to calculate the potential greenhouse gas and co-pollutant emission reductions associated with developing community and distributed solar throughout the state:

Target Date 1: Support the development of an additional 500 MW of community or distributed solar statewide by 2030.

Target Date 2: Support the development of an additional 2,000 MW of community or distributed solar statewide by 2050.

Methods and Assumptions

Both the 2021 baseline and projected sector growth follow the same calculation methodology as in Measure 1, where baseline energy generation is calculated from EIA Electric Power Sector Consumption Estimates and is then used to determine baseline GHG emissions using EPA emission factors (U.S. Energy Information Administration, 2021). Growth in the state's overall electricity generation was modeled according to the assumptions outlined in Table 14. For this

measure, the chosen reference case considered interventions laid out in Measure 1 to account for additive effects of community and distributed solar on top of planned utility-scale renewable energy expansion. Grid emissions were calculated based on community and distributed solar expansion in line with modeled targets of 500 MW by 2030 and 2,000 MW by 2050 and compared to this reference case to determine emissions reductions. For the co-pollutant analysis, eGRID emission rates were applied to the projected coal, natural gas, and petroleum generation, and the community and distributed solar scenario was compared to the reference case to identify the reductions attributed to this measure.

Table 14. Emission Reductions Calculation Assumptions for Community and Distributed Solar

Parameter	Assumption	Source
Annual growth for net generation (2022-2039)	Annual growth is determined by base energy requirements for each year from 2022 to 2039, as described in Purdue's 2021 Forecast.	(Phillips, et al., 2021)
Annual growth for net generation (2040-2050)	Annual growth rate of 0.21 % (average annual growth from Purdue's 2021 Forecast for the 2020-2039 period).	(Phillips, et al., 2021)
Annual growth for coal	Replacement of coal-fired power follows the increase in generation from utility-scale solar and wind, as well as community and distributed solar.	--
Annual growth for natural gas	Natural gas is used as a transition fuel to fill the gap between the deployment of renewable energy sources and the increase in projected energy demand.	--
Annual growth for other energy sources (e.g., petroleum, hydro, biomass)	Annual growth for each energy source follows the annual growth rate for net generation.	(Phillips, et al., 2021)
Annual growth for solar photovoltaic and wind power	Annual growth is determined by targets set for 2030 and 2050. The growth between target years is evenly distributed, resulting in a constant growth rate year over year.	Integrated Resource Plans (IRPs) and other sources were used to determine targets for 2030 and 2050.
Photovoltaic Capacity Factor	PV Capacity Factor for Distributed Solar is assumed to be 19%.	(Project Drawdown, n.d.)

Results

The analysis shows that developing community and distributed solar to a capacity of 500 MW by 2030 could result in annual emissions reductions of 0.8 MMT CO_2e. The development of 2,000 MW by 2050 could result in annual emissions reductions of 3.4 MMT CO_2e. The table below summarizes the results for GHG and co-pollutants.

Table 15. Greenhouse Gas and Co-Pollutant Emissions Reductions from Community and Distributed Solar

	GHG emissions reduction (MMT CO_2e)	Co-pollutant emissions reductions (short tons)					
		NO_x	SO_2	$PM_{2.5}$	VOCs	CO	Hg
2030	**0.8**	578	574	85	8	49	0.00
2050	**3.4**	2,314	2,297	341	32	197	0.01

GHG and co-pollutant reduction estimate for community and distributed solar. Values represent the annual emissions reductions in the respective years as compared to the reference case created in Measure 1.

Limitations and Conclusions

The emission reduction potential analyzed here compares to a reference scenario that assumes that Indiana's electricity generation from solar and wind sources will reach 25% by 2030 and 40% by 2050, as outlined in Measure 1. If this level of utility-scale renewable energy generation is not reached, the relative emissions reduction afforded by the modeled community and distributed solar capacity would have a more significant emissions reduction potential, as the grid would have higher emissions due to lower renewable electricity generation. Under the current model, however, developing community and distributed solar has the potential to yield benefits in GHG and co-pollutant reductions while meeting the needs and priorities of stakeholders across the state.

WORKFORCE DEVELOPMENT ANALYSIS

Expanding solar options in Indiana requires a workforce with a diverse skill set across various stages of the solar energy generation lifecycle. Solar installers and technicians are critical for deploying and maintaining solar photovoltaic (PV) systems on residential, commercial, and industrial properties. Electrical engineers and designers are essential for developing efficient solar energy systems, ensuring optimal energy production and integration with existing electrical grids. Sales and marketing professionals specializing in solar energy can promote awareness and drive the adoption of solar technologies. Moreover, solar project managers and construction professionals play vital roles in overseeing the planning and execution of solar

installations. Research and development specialists contribute to the ongoing innovation and improvement of solar technologies.

In order to create these job opportunities, partnerships and training programs will need to be established across the state. The most robust partnerships are possible with educational institutions across Indiana, which have the power to encourage students to pursue learning and careers within the solar industry.

As the solar industry expands in Indiana, job opportunities will likely arise across installation, design, sales, research, and project management sectors, fostering economic growth and supporting the state's transition to clean energy. In October 2023, Governor Eric Holcomb announced plans for a new solar PV cell production facility in Indiana. Canadian Solar's new plant in Jeffersonville, Indiana, which will be the company's second solar module production facility in the U.S., will create approximately 1,200 new jobs over the next several years (Indiana Economic Development Corporation, 2023).

IMPLEMENTATION DETAILS

Through the CPRG planning process, IDEM has established working relationships with several stakeholders actively implementing solar-related projects. IDEM has also engaged with entities that provide technical support to project sponsors and financial institutions that provide low-interest loans for clean energy projects. There are also numerous green banks emerging in Indiana that may be helpful implementation tools for funding projects. IDEM will continue to engage and coordinate with these entities to help move projects along with either grant funding opportunities or low-interest financing.

Funding

The availability of federal funding is essential for the feasibility of expanding the adoption of solar power in Indiana. Below are possible sources of funding to finance this measure.

Table 16. Federal Funding for Community and Distributed Solar

Funding Source	Federal Amount	Description
U.S. Department of Energy's Energy Efficiency and Conservation Block Grant Program https://www.energy.gov/scep/energy-efficiency-and-conservation-block-grant-program	$550 million available	The Energy Efficiency and Conservation Block Grant Program is designed to assist states, local governments, and Tribes in implementing strategies to reduce energy use and fossil fuel emissions and to improve energy efficiency. Eligible applications include solar, wind, fuel cells, and biomass.
USDA's Powering Affordable Clean Energy (PACE) program https://www.rd.usda.gov/inflation-reduction-act	$1 billion available	Under PACE, USDA Rural Development's Rural Utilities Service will forgive up to 60% of loans for renewable energy projects that use wind, solar, hydropower, geothermal, or biomass and for renewable energy storage projects.
U.S. Environmental Protection Agency's Solar for All https://www.epa.gov/greenhouse-gas-reduction-fund/solar-all	$7 billion available	Solar for All will award up to 60 grants to states, territories, Tribal governments, municipalities, and nonprofits to expand the number of low-income and disadvantaged communities primed for residential solar investment.

3.2 RESIDENTIAL AND COMMERCIAL BUILDINGS SECTOR

The residential and commercial buildings sector contributes approximately 11% of the state's emissions. Within this sector, emissions result from the direct burning of fossil fuels for heating and the use of gases for refrigeration and cooling in buildings. The sector's GHG emissions significantly increase when incorporating electricity end-use, primarily due to the significant portion of electricity dedicated to heating, ventilation, air conditioning, lighting, and appliance usage in both commercial and residential contexts.

Enhancing the energy efficiency of residential and commercial buildings in Indiana can substantially reduce greenhouse gas emissions, given the significant contribution of this sector to Indiana's overall emissions profile. Adopting energy-efficient practices reduces energy costs for individuals and businesses, fostering economic savings. Simultaneously, these initiatives contribute to improved air quality and generate job opportunities.

Although the total proportion of emissions from this sector is smaller than the electric generation, industrial, and transportation sectors, energy efficiency brings myriad benefits for both commercial and residential end users. These benefits include reducing air pollution at the

source, reducing energy burden, improving building reliance, and creating new jobs (U.S. Environmental Protection Agency, 2018). In particular, these measures can meaningfully benefit low-income communities: Indiana ranks moderately high in energy costs, and one analysis found that low-income households could reduce their costs by more than 25% through energy efficiency (U.S. Department of Energy, 2018). Implementation will require a multi-faceted approach, such as incentives, education, and implementation support.

Selected Measures

The PCAP includes retrofitting and weatherization of buildings for energy efficiency as a measure for mitigating environmental impact. These targeted interventions aim to enhance energy efficiency in both new and existing buildings. Adopting energy-efficient building practices and undertaking retrofits can optimize energy usage in structures, accomplishing the same functions with reduced energy consumption. Beyond environmental benefits, this measure has the potential to enhance the quality of life for Hoosiers by creating more sustainable and comfortable living spaces.

Sector Overview

Indiana has one of the highest energy burdens in the Midwest, and residents allocate a higher percentage of their gross household income to energy costs than other Midwestern states (Liput, 2023). Enhancing building energy efficiency is an impactful solution that will reduce greenhouse gas emissions and enhance the financial viability of building assets.

MEASURE 3: INCREASE RESIDENTIAL, MUNICIPAL, AND COMMERCIAL BUILDING ENERGY EFFICIENCY

Increasing residential, municipal, and commercial building energy efficiency involves a range of measures that can reduce greenhouse gas emissions by minimizing the reliance on fossil fuels, gases, and electricity. These initiatives encompass enhancements such as improved insulation and building envelope upgrades, the installation of more energy-efficient heating, cooling, ventilation, and refrigeration systems, the adoption of efficient LED lighting, the integration of passive heating and lighting strategies to leverage natural sunlight, the procurement of energy-efficient appliances and electronics, and more.

CURRENT STATE

The Midwest region has dedicated significant resources to building retrofit efforts. Since 2000, 29.9% of all available commercial floor space in Midwest buildings have undergone HVAC equipment upgrades, 34.1% have seen lighting upgrades, and 8.9% of the available floor space has had insulation upgrades (U.S. Energy Information Administration, 2018). Notably, 40.9% of available commercial floor space integrates heating and cooling controlled by a building

automation system, showcasing a substantial adoption of advanced technologies in the pursuit of energy efficiency (U.S. Energy Information Administration, 2018; U.S. Energy Information Administration, 2020).

Indiana currently offers some financial incentives to promote energy efficiency, including the Indiana Finance Authority's Green Project Reserve Revolving Loan fund, the Indiana Department of Local Government and Finance's Guaranteed Energy Savings Contract, and most recently the Indiana Energy Independence Fund (Thrive Indianapolis, 2018). There are two other financial programs from the Indiana Office of Energy Development: the Indiana Energy Efficiency Fund and the Home Energy Rebates. Additionally, the Weatherization Assistance Program, offered by the Department of Energy, aims to make homes for low-income residents more energy-efficient by providing free weatherization services for qualified Indiana residents (Indiana Housing & Community Development Authority, n.d.).

STAKEHOLDER COMMENTS

Stakeholder feedback collected through surveys, public meetings, interviews, and a review of municipal climate action plans identified improving the energy efficiency of buildings through retrofits and weatherization as a top priority – leading to this measure's inclusion in the PCAP. When state survey respondents selected their top five measures, increased energy efficiency in homes and buildings was selected by more than 30% of total respondents as well as those from LIDAC zip codes.[4] Additionally, eight of the municipal climate action plans included building retrofitting and weatherization for energy efficiency improvement, including South Bend, Richmond, and Gary.

Overall, improving the energy efficiency of buildings through retrofits and weatherization was well received. Stakeholders requested expanding certifications for weatherization efforts during implementation.

Table 17. Potential Community Benefits from Increasing Residential, Municipal, and Commercial Building Energy Efficiency

Potential Community Benefits
Reduced climate impacts and risks
Reduce energy cost burden
Enhanced resilience of buildings and communities
Improve housing quality, safety, and comfort
Job creation

[4] See section 1.2.1 Identifying Priority communities for more detail on how these areas were defined.

COMMUNITIES IMPACTED BY MEASURE

Expanding weatherization and building energy efficiency initiatives in Indiana, particularly in communities identified in the LIDAC census tracts (see Appendix B), holds the promise of widespread benefits. Beyond the general reduction in energy costs resulting from efficiency improvements in schools and municipal buildings, the most significant impact will be felt in communities that extend these savings to taxpayers. By prioritizing and implementing energy-efficient measures, residents can contribute to lower energy costs at home and foster a more sustainable and cost-effective living environment for the entire community.

GREENHOUSE GAS AND CO-POLLUTANT EMISSIONS REDUCTIONS

The analysis modeled two target dates from a 2021 baseline to calculate the potential greenhouse gas and co-pollutant emissions reductions for energy-efficient building retrofitting and weatherization:

Target Date 1: Support the implementation of retrofits and weatherization in 25% of Indiana's total residential and commercial buildings that are eligible for interventions by 2030.

Target Date 2: Support the implementation of retrofits and weatherization in 80% of Indiana's total residential and commercial buildings that are eligible for interventions by 2050.

Methods and Assumptions

IDEM defined a reference case forecast of energy consumption and emissions within Indiana for the industrial sector by leveraging EIA State Energy Data System (SEDS) (U.S. Energy Information Administration, 2021) and EPA emission factors. The EIA Commercial Building Energy Consumption Survey (CBECS) (U.S. Energy Information Administration, 2018) and Residential Energy Consumption Survey (RECS) (U.S. Energy Information Administration, 2020) provided data for developing commercial and residential building energy intensity models used in the model. Further data from CBECs and RECs were used to determine the total number of buildings in each sector that have already undergone significant retrofitting and/or weatherization.

Diverse sources were referenced to determine estimated impacts on both natural gas and electricity consumption resulting from the implementation of various abatement interventions. Interventions selected for this analysis included HVAC equipment upgrades, lighting upgrades, insulation upgrades, and heating electrification. The model estimates the net GHG impact of applying these interventions to 80% of eligible buildings by 2050.

For the co-pollutant analysis, the same data sources (SEDS, CBECS, and RECS) and methodology were applied to quantify energy consumption figures that were used as a basis for emissions calculations. Co-pollutants were calculated using emission factors from the EPA AP-42 Compilation of Air Emission Factors (U.S. Environmental Protection Agency, 2024).

Table 18. Emission Reductions Calculation Assumptions for Increasing Residential, Municipal, and Commercial Building Energy Efficiency

Parameter	Assumption	Source
Emission source impacts from building retrofits and weatherization	Only electricity and natural gas emissions are impacted by abatement measures. These represent >90% of the total energy footprint in commercial and residential buildings. Only affecting electricity and natural gas consumption likely results in a more conservative emissions abatement forecast.	EIA SEDS (U.S. Energy Information Administration, 2021)
Abatement measure interventions	It is assumed that implementing the selected abatement interventions has a fixed impact on both electricity and natural gas consumption within commercial and residential buildings. However, energy impacts will vary depending on several factors (site-specific energy consumption profiles, extent of implementation of corresponding measures, age of building/equipment, etc.).	--
Change in grid intensity	Electricity emissions are affected by the projected change in renewable energy contribution to the grid mix as forecasted in the Renewable measure.	--
Heating electrification	It is assumed that natural gas heating systems being replaced by electrification have a medium annual fuel utilization efficiency (AFUE) rating of 80%.	(U.S. Department of Energy, n.d.)

Results

The GHG reduction analysis indicates that if 25% of commercial and residential buildings undergo the abatement interventions specified in the measure by 2030, Indiana's annual GHG footprint could be reduced by roughly 0.3 MMT CO_2e. As participation increases to 80% by 2050, reductions would amount to over 7.7 MMT CO_2e annually. The table below also provides estimated reductions for co-pollutants across the same timeframe.

Table 19. Greenhouse Gas and Co-Pollutant Emissions Reductions from Increasing Residential, Municipal, and Commercial Building Energy Efficiency

	GHG emissions reduction (MMT CO_2e)	Co-pollutant emissions reductions (short tons)					
		NO_x	SO_2	$PM_{2.5}$	VOCs	CO	Hg
2030	**0.3**	3,042	(594)*	3	56	977	0.00
2050	**7.7**	18,332	(823)*	370	342	5,461	0.01

GHG and co-pollutant reduction estimates from building retrofits and weatherization at a state-wide scale. Values represent emissions reductions that occur due to the extent of abatement intervention application by 2030 (25% of buildings undergo specified interventions) and 2050 (80% of buildings undergo specified interventions).
**SO_2 emissions are expected to increase due to the increased usage of electricity for heat pumps replacing gas furnaces.*

Limitations and Conclusions

Enacting upgrades to lighting, insulation, and HVAC equipment, along with the electrification of building heating, holds immense potential to substantially curb GHG emissions and co-pollutants emitted from residential and commercial structures. However, implementing such changes poses financial challenges and potential maintenance needs over time. The estimates in our quantification effort assume that these measures are adopted at a wide scale, which may be beyond current capacity and funding. However, any implementation would bring significant benefits for emissions reduction and improvement in the quality of life for Indiana residents.

WORKFORCE DEVELOPMENT ANALYSIS

The workforce analysis for building retrofitting and weatherization in Indiana reveals a significant demand for diverse skills and job types. The primary focus will be on skilled trades such as carpenters, electricians, plumbers, and HVAC technicians to implement energy-efficient systems and technologies. Energy auditors and building performance analysts will also play a crucial role in assessing structures and recommending suitable retrofitting measures. Given the emphasis on sustainable practices in residential and commercial built spaces, there will be a surge in demand for experts in energy-efficient technologies and construction professionals with expertise in certifications such as Leadership in Energy and Environmental Design (LEED) and the WELL Building Standard. Furthermore, project managers, architects, and engineers specializing in green building design would contribute to the overall success of these initiatives.

To encourage the creation of this workforce, investments must be made in its development. The workforce training efforts should focus on filling technical school, high school, and community college gaps and include support of pre-apprenticeship training and apprenticeship programs.

Workforce development should also include training and continuing education for professional services–including architects, engineers, and lawyers–essential to implementing efficiency and weatherization upgrades and ensuring homeowners optimize state and federal resources.

The scale of the retrofitting and weatherization projects in Indiana could potentially create thousands of jobs, boosting the local economy while addressing critical energy efficiency goals. In 2022, energy efficiency remained the largest source of employment within Indiana's energy sector, with nearly 51,000 Hoosiers employed in the sector (E2, 2023).

IMPLEMENTATION DETAILS

IDEM is actively participating in the Indiana Energy Association's Weatherization and Energy Efficiency Workgroup and will continue to help identify additional funding opportunities to help augment the programs already in place to expand program applicability, particularly in low-income and disadvantaged communities.

Funding

The availability of federal funding is essential for the feasibility of building retrofitting and weatherization for energy efficiency improvements in Indiana. Below are possible sources of funding to finance this measure.

Table 20. Federal Funding for Increasing Residential, Municipal, and Commercial Building Energy Efficiency

Funding Source	Federal Amount	Description
U.S. Department of Energy's Energy Efficiency and Conservation Block Grant Program (EECBG) https://www.energy.gov/scep/energy-efficiency-and-conservation-block-grant-program	$550 million available	The EECBG program is designed to assist states, local governments, and Tribes in implementing strategies to reduce energy use, reduce fossil fuel emissions, and improve energy efficiency.
U.S. Department of Energy's Weatherization Assistance Program (WAP) https://www.energy.gov/scep/wap/weatherization-assistance-program	Amount varies	The Weatherization Assistance Program reduces household energy use by installing cost-effective energy savings measures, which also improve resident health and safety. Common measures include sealing air leaks, adding insulation, and repairing heating and cooling systems.
U.S. Department of Energy's Energy Efficiency Revolving Loan Fund Capitalization Grant Program https://www.energy.gov/scep/energy-efficiency-revolving-loan-fund-capitalization-grant-program	$250 million available	This program provides capitalization grants to states to establish a revolving loan fund under which the state shall provide loans and grants for energy efficiency audits, upgrades, and retrofits to increase energy efficiency.
U.S. Department of Energy's Home Energy Rebate Program https://www.energy.gov/scep/home-energy-rebates-programs	Amount varies	This program is expected to launch initiatives in 2024 to help save money on select home improvement projects.

3.3 TRANSPORTATION SECTOR

Emissions from Transportation comprise approximately one-fifth (20%) of the state's total emissions, as shown in Section 1.2. This makes the transportation sector one of the top three contributors to emissions, following the electric and industrial sectors. The primary source leading to the sector's emissions is the carbon dioxide (CO_2) from vehicle tailpipes, most of which come from light-duty vehicles and light-, medium-, and heavy-duty trucks.

Like the electric generation sector, shifting to new forms of transportation can significantly impact the state's greenhouse gas emissions and workforce. Specific benefits include improving air quality and public health, reducing lifetime vehicle costs, increasing transportation affordability, and creating new jobs (Goodkind, Tessum, Coggins, & Marshall, 2019). These

benefits can have an outsized impact on low-income and disadvantaged communities because these communities often live near heavily trafficked roads and spend higher portions of their income on transportation (U.S. Department of Transportation Bureau of Transportation Statistics, 2023). Implementation of this measure will involve a mixture of incentives, education, and new infrastructure development.

Selected Measures

Given the transportation sector's significant contribution to air pollution, Indiana has identified two priority actions to address transportation-related emissions: (1) electrifying light-duty vehicles and (2) expanding public transit and lower emission transportation options (e.g., high occupancy vehicles, pedestrian walkways, and bike pathways). The remainder of this section outlines the current state of these focus areas, the potential impact of the measures, and the steps for implementation.

Sector Overview

Transportation is central to Indiana's identity: the state's motto is "The Crossroads of America," given its central location in the country. In addition to its interstate location, Indiana has over 96,000 miles of public road, almost 1 million public transit riders, 0.5 million bikers, and almost 2 million pedestrians (Department of Transportation, 2020). The state employs almost 100,000 people to maintain this infrastructure, with an average increase of almost 5% from 2008 to 2018 (Department of Transportation, 2020).

The Indiana Department of Transportation (INDOT) is primarily responsible for building and maintaining transportation infrastructure in the state. This includes overseeing public charging infrastructure for light-duty vehicles and state-level public transit and infrastructure. Municipalities are also responsible for building infrastructure and public transit at the local level.

At the state level, INDOT identified five strategic priorities: (1) safety, (2) mobility, (3) economic competitiveness, (4) customer service, (5) asset sustainability, (6) organization and workforce, (7) innovation and technology (Indiana Department of Transportation, 2019). Within these pillars, INDOT has initiatives to expand connectivity and accessibility, thereby expanding optionality and developing plans to incorporate electric vehicles into its policies and future initiatives (Indiana Department of Transportation, 2019).

MEASURE 4: ELECTRIFY LIGHT-DUTY VEHICLES

This measure captures efforts to encourage the adoption of light-duty electric vehicles, which displace traditional fossil-fuel counterparts. Eliminating fossil fuel combustion in light-duty vehicles reduces tailpipe emissions since electricity from the electric grid or directly from renewable energy sources typically produces fewer emissions (U.S. Environmental Protection

Agency, 2023). This measure also includes expanding charging infrastructure to incentivize electrification.

CURRENT STATE

There are currently over six million registered light-duty vehicles in Indiana. Of these, electric vehicles make up less than 2% of the total as of 2021, showing significant room for increased penetration (U.S. Department of Energy, 2021). In 2022, electric vehicle registration increased by 39%, suggesting that residents are increasingly choosing to electrify their vehicles (Greater Indiana Clean Cities, Inc, 2024). Encouraging additional growth in the light-duty electric vehicle market can result in significant benefits such as improved air quality and job access.

However, there are several barriers to increasing the number of electric vehicles amongst consumers, including high upfront costs, the need for charging infrastructure nearby, and challenges in communicating the benefits of transitioning to an electric vehicle. While some utilities in Indiana have programs to incentivize transitioning to electric vehicles, there are no statewide incentives for light-duty electric vehicles. However, Indiana has a Medium- and Heavy-Duty Vehicles Grant Program, which provides funding for repowering or replacing eligible vehicles with new diesel, alternative fuel, or electric engines (U.S. Department of Energy, 2024).

Indiana has started to reduce barriers and prepare for future light-duty electric vehicle growth by taking action to establish the state's workforce and physical infrastructure:

- **GOEVIN:** The Indiana Department of Environmental Management (IDEM) is developing the foundation for Indiana's light-duty EV charging network across the state. IDEM, along with partners Drive Clean Indiana and the Indiana Utility Group stakeholders (seven of Indiana's major electricity providers), will complete the installation of 61 DC Fast EV chargers on key interstates and highways throughout 2024.

- **Charging the Crossroads:** The Indiana Department of Transportation (INDOT) plans to invest almost $100 million to develop an EV charging network along the state's interstates and highways (Indiana Department of Transportation, 2024)

- **Electric Vehicle Product Commission:** Governor Holcomb signed a bill in 2021 to establish an Electric Vehicle Product Commission (Indiana Economic Development Corporation, 2024). This commission is tasked with evaluating Indiana's electric vehicle production capabilities and identifying opportunities for growth within the industry. The establishment of this commission will prime Indiana for future electric vehicle growth, including in the light-duty space.

Additionally, private companies are expanding electric vehicle manufacturing within the state. For example, two new battery manufacturing facilities are being built in Indiana, one in Kokomo

and another in Terre Haute, that will bring up to $4 billion in investment and over 2,000 jobs (Building Indiana Business, 2023). Similarly, General Motors and Toyota plan to invest hundreds of millions of dollars in Indiana for electric vehicle production and manufacturing (Greater Indiana Clean Cities, Inc, 2024). While manufacturing alone will not incentivize light-duty electrification, it illustrates that both public and private markets anticipate increased consumer demand in Indiana and elsewhere. It also demonstrates the workforce benefits of electrifying light-duty vehicles within the state.

STAKEHOLDER COMMENTS

Stakeholder feedback collected through surveys, public meetings, interviews, and a review of municipal climate action plans identified electrifying light-duty vehicles as a top priority – leading to this measure's inclusion in the PCAP. When survey respondents selected their top five measures, the two measures for vehicle electrification and charging were each prioritized by 12-15% of total respondents and those from LIDAC zip codes.[5] Additionally, nine of the municipal climate action plans included electrifying vehicles as a priority, including South Bend, Richmond, and Gary. Measures for electric vehicles and charging were combined in response to stakeholder priorities, and measures to expand public transportation were also included to better meet the needs expressed by members of disadvantaged communities.

During public comment periods, various stakeholders voiced general concern about the availability of infrastructure to support the adoption of electric vehicles, including charging. Stakeholders also expressed concerns regarding the environmental impact of electric vehicle and battery manufacturing, ongoing reliance on private vehicles, and the local grid mix. Including public transit initiatives, electric vehicle charging efforts, and renewable energy generation in the PCAP helps mitigate some of these primary concerns.

Table 21. Potential Community Benefits from Electrifying Light-Duty Vehicles

Potential Community Benefits
Reduced climate impacts and risks
Reduced air pollution
Improved public health outcomes
Reducing noise pollution

COMMUNITIES IMPACTED BY MEASURE

Expanding light-duty vehicle electrification in Indiana can positively impact many communities (see Appendix B for a list of LIDAC census tracts). While the use of electric light-duty vehicles

[5] See section 1.2.1 Identifying Priority communities for more detail on how these areas were defined.

can benefit any community, the most immediate positive impacts are likely to be observed in urban areas. In these locations, the concentration of reduced vehicle emissions from electrified transportation could potentially enhance local air quality, offering tangible and short-term improvements for the well-being of residents and the overall environmental landscape.

IDEM expects metropolitan counties (population over 50,000) to be the most affected by these measures, which would include the following counties: Allen, Bartholomew, Benton, Boone, Brown, Carroll, Carroll, Clark, Clay, Dear-born, Delaware, Elkhart, Floyd, Franklin, Hamilton, Hancock, Harrison, Hendricks, Howard, Jasper, Johnson, Lake, LaPorte, Madison, Marion, Monroe, Morgan, Newton, Ohio, Owen, Porter, Posey, Shelby, St. Joseph, Sullivan, Tippecanoe, Tipton, Vanderburg, Vermillion, Vigo, Warren, Warrick, Washington, Wells, and Whitley. These metropolitan areas were identified in Rural Indiana Stats (Purdue Center for Regional Development and the Indiana Office of Community and Rural Affairs, 2023). The LIDAC tract IDs for these counties can be found in Appendix B.

GREENHOUSE GAS AND CO-POLLUTANT EMISSIONS REDUCTIONS

The analysis modeled two target dates from a reference case to calculate the potential greenhouse gas and co-pollutant emissions reductions for electrifying light-duty vehicles:

Target Date 1: Electric vehicles' share of light-duty VMT increases to 10% by 2030.

Target Date 2: Electric vehicles' share of light-duty VMT increases to 30% by 2050.

Methods and Assumptions

The 2021 baseline was calculated using the daily vehicle miles traveled (DVMT) by non-commercial vehicles and emissions factors from the EPA (Indiana Department of Transportation, 2023). Next, annual growth in light-duty VMT was modeled for 2022-2050 for each technology type using the assumptions described below. Finally, emissions reductions were calculated based on the modeled increases in electric light-duty vehicles and compared to comparable increases in internal combustion engine vehicles. The assumptions for each step are shown below.

The analysis also assumes that electric vehicle chargers would rely on grid electricity and that net generation from renewables is aligned with the targets stated in Measure 1. Please see the Measure 1 section for details on the approach for quantification.

Table 22. Emission Reductions Calculation Assumptions for Electrifying Light-Duty Vehicles

Parameter	Assumption	Source
Baseline EV penetration rate	Baseline EV penetration is based on the approximate light-duty vehicle registration counts derived by the National Renewable Energy Laboratory with data from Experian Information Solution. Data is available at the U.S. Department of Energy Alternative Fuels Data Center.	(U.S. Department of Energy, 2021)
Baseline vehicle-mile traveled (VMT)	Baseline VMT is based on data from the Indiana Department of Transportation (INDOT), including growth projections of 27% between 2015 and 2045 for all VMT.	(Indiana Department of Transportation, 2023)
Annual changes in light-duty vehicles (LDVs) VMT by technology type	Annual changes in LDVs VMT by technology type are based on projections from the 2023 Annual Energy Outlook by the EIA.	(U.S. Energy Information Administration, 2023)
LDVs fuel efficiency gains by technology type	Changes in LDV fuel efficiency gains by technology type are based on projections from the 2023 Annual Energy Outlook by the EIA.	(U.S. Energy Information Administration, 2023)
GHG and co-pollutant emissions of the grid in Indiana	Emission factors for GHG and co-pollutant emissions are based on projections calculated for the grid in Measure 1.	--

Results

Increasing the penetration of light-duty EVs in the state to 10% in 2030 results in annual emissions reductions of about 2.1 MMT CO_2e between 2025 and 2030, and reaching 30% light-duty EV penetration in 2050 results in annual emissions reductions of about 10.0 MMT CO_2e by 2050. The table below provides the results for greenhouse gas emissions and co-pollutant reductions from electrifying light-duty vehicles.

Table 23. Greenhouse Gas and Co-Pollutant Emissions Reductions from Electrifying Light-Duty Vehicles

	GHG emissions reduction (MMT CO_2e)	Co-pollutant emissions reductions (short tons)					
		NO_x	SO_2	$PM_{2.5}$	VOCs	CO	Hg
2030	**2.1**	2,474	(2,438)*	(213)*	8,390	114,689	0.00
2050	**10.0**	1,005	(18,228)*	(1,453)*	76,684	827,996	0.00

GHG and co-pollutant reduction estimate for increased EV adoption rate for LDVs. Values represent the potential emissions reductions for the 2025-2030 and 2025-2050 periods compared to a reference case where the growth in EV VMT traveled is replaced by ICE vehicles.
**SO_2 and $PM_{2.5}$ emissions are expected to increase due to the increased usage of electricity for the operation of EVs.*

Limitations and Conclusions

Increasing the penetration of light-duty electric vehicles by 2030 and 2050 has the potential to yield significant benefits in emission reductions for both GHG and co-pollutants. Emissions reduction estimates are directly linked to the projected energy mix of Indiana's electricity grid as described in Measure 1. Additional emissions reductions could be achieved by increasing the share of renewables in the state's total net generation. Charging electric vehicles using grid electricity can contribute to an increase in certain co-pollutants associated with electricity generation from fossil fuel combustion. As new energy sources are deployed and additional pollution control systems are installed, this disbenefit will decrease over time.

WORKFORCE DEVELOPMENT ANALYSIS

Electrifying light-duty passenger vehicles across Indiana necessitates a workforce equipped with a diverse range of skills spanning various sectors of the automotive and clean energy industries. The transition to electric vehicles (EVs) demands a surge in skilled electricians, civil engineers, construction workers, and EV charging station technicians capable of installing and maintaining EV charging infrastructure. Engineers specializing in electric power systems and battery technologies are crucial for advancing the development and integration of efficient EV solutions. Moreover, there is a growing need for electric vehicle manufacturing professionals, encompassing roles in battery production, electric drivetrain assembly, and quality control. Training programs for automotive mechanics and technicians to adapt to EV technology will be essential. Additionally, sales and marketing specialists are crucial for promoting and increasing consumer awareness of electric vehicles.

The electrification of light-duty passenger vehicles in Indiana has the potential to generate a substantial number of jobs, fostering economic growth while contributing to the state's sustainability goals. Clean vehicle manufacturers remained at the forefront of growth within all energy sectors, with an increase of nearly 2,000 jobs in 2022, resulting in a total workforce of

over 22,000 employed Hoosiers (E2, 2023). Additionally, since the passage of the federal Creating Helpful Incentives to Produce Semiconductors (CHIPS) and Science Act in August 2022, Indiana has attracted over $7 billion in investments for electric vehicle and battery manufacturing, creating over 2,100 new jobs (Johnson, Campbell, & Elliott, 2023).

IMPLEMENTATION DETAILS

IDEM has a long-standing relationship with the Indiana Office of Energy Development (OED) and its primary Clean Cities Coalition, Drive Clean Indiana. IDEM has a long-term grant agreement with Drive Clean Indiana to implement an education, outreach, and marketing campaign to promote GoEVIN. The focus of this campaign is to promote the transition from fossil-fueled vehicles to electric vehicles and the utilization of the statewide fast charge network that IDEM put in place via the Volkswagen Environmental Mitigation Settlement. In coordination with OED and Drive Clean Indiana, IDEM will continue identifying funding and rebate opportunities to expand and speed up the transition to electric vehicles. The Indiana Department of Transportation will be a key agency for future implementation projects.

Funding

The availability of federal funding is important for the feasibility of electrifying light-duty vehicles in Indiana. Below are possible sources of funding to finance this measure.

Table 24. Federal Funding for Electrifying Light-duty Vehicles

Funding Source	Federal Amount	Description
U.S. Department of Transportation's National Electric Vehicle Infrastructure (NEVI) Formula Program https://www.fhwa.dot.gov/bipartisan-infrastructure-law/nevi_formula_program.cfm	$5 billion available	This program provides funding to states to strategically deploy electric vehicle charging infrastructure and establish an interconnected network to facilitate data collection, access, and reliability.
U.S. Department of Transportation's Carbon Reduction Program (CRP) https://www.fhwa.dot.gov/bipartisan-infrastructure-law/crp_fact_sheet.cfm	$6.4 billion available	The Carbon Reduction Program funds projects designed to reduce transportation emissions, defined as carbon dioxide emissions from on-road highway sources.

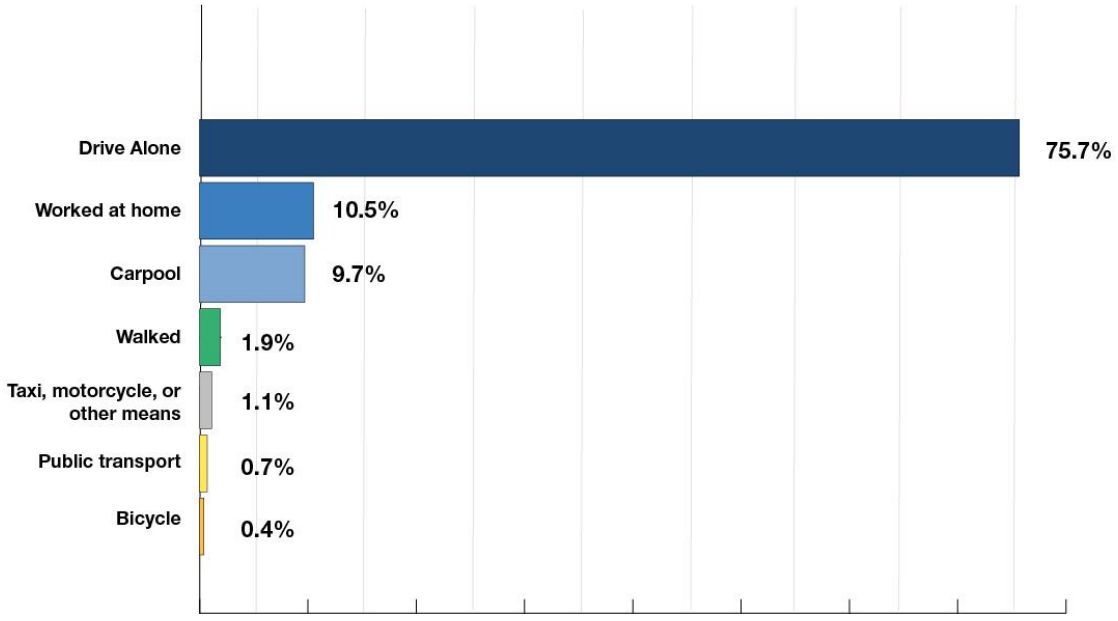
MEASURE 5: REDUCE VEHICLE MILES TRAVELED

Indiana aims to reduce total vehicle miles traveled (VMT) throughout the state by expanding public transit, enhancing high-occupant vehicle travel, and developing pedestrian and bike pathways. Measures that reduce the number of vehicle miles traveled directly correlate to reducing vehicle tailpipe emissions. VMT reduction can occur by transitioning from single-occupancy vehicle rides to high-occupancy rides, opting for active transportation modes (walking, biking, transit), and improving traffic patterns. Strategies may include zoning and development code updates to diversify and improve land use; creation of bicycle and pedestrian infrastructure, including sidewalks, trails, signalized crossing amenities, curb ramps, separated lands, and overpasses; expanding public transit services; and an examination of traffic patterns and congestion mitigation strategies intended to make vehicle travel more efficient.

CURRENT STATE

In 2021, Indiana's transportation energy use per capita (86 million British thermal units (Btus) was higher than the national average (81.5 million Btus per person). In parallel, highway motor fuel use per capita in 2021 was higher for Indiana (435.2 gallons per person) than the national average (388.2 gallons per person). To commute to work in 2022, 75.7% of Indiana residents drove alone, while 9.7% carpooled, 1.9% walked, 0.7% took public transportation, and 0.4% biked (U.S. Department of Transportation, 2024).

Figure 6. How Residents Get to Work 2022 (Percent of Workers Age 16 and Older)



Source: (U.S. Department of Transportation, 2024)

STAKEHOLDER COMMENTS

Stakeholder feedback collected through surveys, public meetings, interviews, and a review of municipal climate action plans identified expanding public transit systems and enhancing high-occupant vehicle travel options as a top priority – leading to this measure's inclusion in the PCAP. When survey respondents selected their top five measures, measures focused on reducing vehicle miles traveled received the second most votes of any measure category. More than a third, or 36%, of total respondents and 42% of respondents from priority LIDAC zip codes[6] selected the measure to increase the availability, accessibility, and reliability of public transportation. Additionally, six of the municipal climate action plans included efforts to expand public transit, including South Bend, Lafayette, and Gary.

While a measure to reduce vehicle miles traveled was frequently requested, a clear priority emerged for Indiana to develop an equitable transportation system, ensuring carbon reduction initiatives align with the needs of vulnerable and historically marginalized communities. Any implementation efforts must be tailored to each community's unique context and requirements to help enable equitable outcomes (Indiana Department of Transportation, 2002).

Table 25. Potential Community Benefits from Reducing Vehicle Miles Traveled

Potential Community Benefits
Reduced climate impacts and risks
Reduced air pollution
Improved public health outcomes
Enhancing connectivity of communities
Improved access to transportation
Job creation

COMMUNITIES IMPACTED BY MEASURE

While any community in Indiana (see Appendix B for a list of LIDAC census tracts) could benefit from reduced vehicle miles traveled, the communities most likely to benefit in the short term are urban areas where the concentration of reduced vehicle emissions will improve local air quality.

IDEM expects metropolitan counties (population over 50,000) to be the most affected by these measures, which would include the following counties: Allen, Bartholomew, Benton, Boone, Brown, Carroll, Carroll, Clark, Clay, Dear-born, Delaware, Elkhart, Floyd, Franklin, Hamilton, Hancock, Harrison, Hendricks, Howard, Jasper, Johnson, Lake, LaPorte, Madison, Marion, Monroe, Morgan, Newton, Ohio, Owen, Porter, Posey, Shelby, St. Joseph, Sullivan, Tippecanoe, Tipton, Vanderburg, Vermillion, Vigo, Warren, Warrick, Washington, Wells, and Whitley. These metropolitan areas were identified using the Rural Indiana Stats website (Purdue Center for

[6] See section 1.2.1 Identifying Priority communities for more detail on how these areas were defined.

Regional Development and the Indiana Office of Community and Rural Affairs, 2023). The LIDAC tract IDs for these counties can be found in Appendix B.

GREENHOUSE GAS AND CO-POLLUTANT EMISSIONS REDUCTIONS

The analysis modeled two target dates from a reference case to calculate the potential greenhouse gas and co-pollutant emissions reductions for expanding public transit and enhancing high-occupant vehicle travel options, pedestrian, and bike pathways:

Target Date 1: 5% reduction in total VMT statewide by 2030 compared to the reference case.

Target Date 2: 20% reduction in total VMT statewide by 2050 compared to the reference case.

Methods and Assumptions

The 2021 baseline was calculated using the daily vehicle miles traveled (DVMT) by non-commercial vehicles and emissions factors from the EPA (Indiana Department of Transportation, 2023). Annual growth in VMT for light-duty vehicles was modeled for 2022-2050 for each technology type using the assumptions described in the table below. Emissions reductions were then calculated based on the VMT reduction targets for 2030 and 2050. The tool for estimating emission reductions for this measure allows for county-level targets to be developed to contribute to statewide VMT reductions. The assumptions for each step are shown below.

Table 26. Emission Reductions Calculation Assumptions for Reducing Vehicle Miles Traveled

Parameter	Assumption	Source
Baseline vehicle miles traveled (VMT)	Baseline VMT is derived from data from the Indiana Department of Transportation (INDOT), including growth projections of 27% between 2015 and 2045 for all VMT.	(Indiana Department of Transportation, 2023)
GHG emission factors for each technology type	GHG emissions are calculated using the EPA's emission factors. For EVs, the calculations follow the methodology provided by the U.S. Department of Energy Alternative Fuels Data Center.	(U.S. Department of Energy, 2023)
Emission factors for co-pollutant emissions	Co-pollutant emissions factors were calculated using EPA's MOtor Vehicle Emission Simulator (MOVES).	(U.S. Environmental Protection Agency, 2023)
Annual GHG and co-pollutant emissions from VMT for each technology type	Annual GHG and co-pollutant emissions from VMT are based on calculations in Measure 4 and its underlying assumptions as described in Table 22.	--
EV penetration rate	The EV penetration rate is based on calculations in Measure 4 and its underlying assumptions, as described in Table 22.	--

Results

Policies and infrastructure projects that support the expansion of public transit, enhancement of high-occupant vehicle travel, and development of pedestrian and bike pathways can reduce GHG emissions by 1.3 MMT CO_2e by 2030 and 5.0 MMT CO_2e by 2050. This measure will also result in co-pollutant reductions, improving air quality for communities in Indiana.

Table 27. Greenhouse Gas and Co-Pollutant Emissions Reductions for Reducing Vehicle Miles Traveled

GHG emissions reduction (MMT CO_2e)		Co-pollutant emissions reductions (short tons)					
		NO_x	SO_2	$PM_{2.5}$	VOCs	CO	Hg
2030	**1.3**	503	35	27	924	606	0.00
2050	**5.0**	979	211	99	2,536	23,247	0.00

GHG and co-pollutant reduction estimate for statewide reductions in VMT associated with expanding public transit, enhancing high-occupant vehicle travel, and developing pedestrian and bike pathways. Values represent annual emissions reductions compared to a reference case based on INDOT VMT growth projections with no reduction in total VMT.

Limitations and Conclusions

Expanding public transit and enhancing high occupancy vehicle travel, pedestrian, and bike pathways can significantly contribute to GHG and co-pollutant emissions reductions in Indiana. Although the total number of VMTs in Indiana is projected to increase by 27% between 2015 and 2045 (Indiana Department of Transportation, 2002), new infrastructure will mitigate the increase in GHG emissions and improve air quality. The current approach for estimating emissions reductions relies on statewide assumptions of the impact of current and future infrastructure projects. Further analysis of the expected impact of infrastructure projects for each county in Indiana will contribute to more detailed results.

WORKFORCE DEVELOPMENT ANALYSIS

Expanding public transit, enhancing high-occupancy vehicle (HOV) travel options, and developing pedestrian and bike pathways in Indiana will necessitate a multidisciplinary workforce with expertise in transportation planning, civil engineering, and urban design. Transportation planners will be crucial in developing comprehensive transit systems, optimizing routes, and integrating various modes of transportation. Civil engineers and construction workers skilled in infrastructure development will be pivotal in building and maintaining efficient public transit networks and pathways. Additionally, transit operators, maintenance personnel, and customer service professionals would be needed to ensure the smooth functioning of expanded public transit services. Urban designers and landscape architects would contribute to creating pedestrian-friendly spaces and bike pathways, enhancing the accessibility and safety of alternative transportation modes.

Moreover, this initiative has the potential to generate jobs across various sectors, including transportation, construction, and design, contributing to economic development and sustainable mobility solutions in Indiana. For example, by 2031, Indiana is expected to see an increase of 28,000 jobs in the broader transportation and materials moving sector (STATS Indiana and Indiana Department of Workforce Development, n.d.). With the proper public-private partnerships and investments in training programs that equip individuals with the necessary skills for building, maintaining, and operating public transit systems, there is potential to fulfill this job growth demand while simultaneously reducing VMT.

IMPLEMENTATION DETAILS

IDEM is a planning partner in local, regional, and statewide transportation planning processes. This involves close coordination of transportation and air quality planning activities among municipalities, metropolitan planning organizations, and the Indiana Department of Transportation (INDOT). IDEM is also a member of the Statewide Congestion Mitigation and Air Quality (CMAQ) project selection committee. IDEM will continue to promote the implementation of projects that reduce vehicle miles traveled within the planning processes and aid its planning partners in securing funding opportunities as they arise.

Funding

The availability of federal funding is essential for reducing VMT through expanding public transit and alternative modes of transportation in Indiana. Below are possible sources of funding to finance this measure.

Table 28. Federal Funding for Reducing Vehicle Miles Traveled

Funding Source	Federal Amount	Description
U.S. Department of Transportation's Rebuilding American Infrastructure with Sustainability and Equity (RAISE) https://www.transportation.gov/RAISEgrants/raise-nofo	$14.3 billion total	This program aims to invest in surface transportation that will have a significant local or regional impact. Examples of eligible project types include public transportation and passenger/ freight rail transportation.
U.S. Department of Transportation's Transportation Alternatives (TA) Program https://www.fhwa.dot.gov/environment/transportation_alternatives/	$7.2 billion total	The Transportation Alternatives program funds smaller-scale transportation projects such as pedestrian and bicycle facilities, recreational trails, and safe routes to school projects.

3.4 INDUSTRIAL SECTOR

In 2021, Indiana's industrial sector accounted for roughly 25% of the state's total direct greenhouse gas emissions at 48.27 MMT CO_2e, as shown in Section 1.2. The industrial sector refers to businesses that produce capital goods used in manufacturing, resource extraction, and construction. These companies manufacture and sell equipment, machinery, and supplies used to produce other goods rather than sold directly to consumers. Indiana is a significant contributor to the industrial sector and is home to some of the top pharmaceutical, automotive, and steelmaking companies (IndustrySelect, 2023). The industrial sector contributed 25.7% of Indiana's GDP in 2022 (U.S. Bureau of Economic Analysis, 2023). Indianapolis ranks #10 in the nation for cities with the most manufacturing jobs (IndustrySelect, 2021).

Like the electric generation and transportation sectors, emissions reductions from the industrial sector can substantially impact the state's overall emissions. In addition to reducing emissions, industrial sector measures can lead to reduced air pollution, increased health benefits, and new jobs (Goodkind, Tessum, Coggins, & Marshall, 2019). Additionally, since Indiana is a leader in manufacturing, reducing emissions from this sector can help the country and corporations meet their climate targets (Bowman, 2023). However, reducing emissions in the industrial sector is challenging, given the complexity of industrial processes and the need for emerging

technologies, such as hydrogen, to mature. Given these challenges, Indiana will need to coordinate efforts with the private sector to ensure successful implementation.

Selected Measures

Indiana selected the following measure based on its potential to reduce emissions: expanding the use of electric and green hydrogen and electrifying industrial processes. Indiana can substantially benefit from electrifying industrial processes compared to other states nationwide (Renewable Thermal Collective, David Gardner and Associates, Global Efficiency Intelligence, 2023).

Sector Overview

Indiana has an approach to energy policy that incorporates both existing and emerging clean energy technologies. This includes advancing the transition to cleaner energy through electrification while supporting emerging technologies like hydrogen. According to a recent study, Indiana can benefit from implementing commercially available electrification technologies in the steel, recycled plastic, milk powder, soybean oil, aluminum, and beverage industries (Renewable Thermal Collective, David Gardner and Associates, Global Efficiency Intelligence, 2023). The same study also found that hydrogen can support the electrification process in those industries. Furthermore, another recent report found that increasing demand for sustainable products will pressure Indiana's industrial sector to decarbonize, emphasizing the importance of these measures (Bowman, 2023).

Status of Sectoral Action in Indiana

Both public and private investments will be required to implement these measures. To date, Indiana has focused its industrial climate efforts on promoting new sectors that will bolster emissions reductions, such as hydrogen development and electric vehicle manufacturing, as noted above. However, Indiana has not yet implemented direct incentives or regulations for implementing industrial-focused decarbonization measures. On the private side, many industrial corporations with operations in Indiana have pledged to reduce their emissions. For example, major automobile manufacturers, like Toyota, Subaru, Honda, Stellantis, and General Motors, have all pledged to be carbon neutral in the future (Johnson, Campbell, & Elliott, 2023).

MEASURE 6: EXPAND THE USE OF ELECTRIC AND GREEN HYDROGEN INDUSTRIAL PROCESSES AND TECHNOLOGIES

Expanding the use of electric and green hydrogen industrial processes and technologies involves electrifying industrial processes, especially low- and medium-heat processes, expanding the use of green hydrogen in high-heat processes, and expanding the use of green hydrogen equipment for all new projects.

Within the industrial landscape, various equipment types such as furnaces, boilers, and gas-fired heaters possess the potential for electrification or can be powered by green hydrogen. Electrifying and converting equipment to green hydrogen holds promise for substantial GHG reduction within industry and offers significant co-benefits, including improved air quality and green job creation. Due to stakeholder feedback, this measure focuses specifically on green hydrogen generated from renewable energy.

CURRENT STATE

Indiana is in the early stages of transitioning its industrial processes to hydrogen and is participating in regional and federal efforts to collaborate and invest in building the hydrogen market.

In September 2022, Indiana Governor Eric J. Holcomb joined the Midwest Hydrogen (M-H2) Coalition, a coalition of seven Midwest Governors, to pursue the acceleration of a robust hydrogen economy. This multi-state collaboration is committed to the investment and development of hydrogen markets, supply chains, and workforce opportunities.

Indiana is also part of the Midwest Hub, one of seven regional hydrogen hubs that will receive funding from the federal government through the Bipartisan Infrastructure Law. The Midwest Hub includes Indiana, Illinois, and Michigan, and each hub will receive part of a $1 billion investment into projects focused on the production, processing, delivery, storage, and end use of clean hydrogen as part of the goal to boost the nation's hydrogen economy. The Midwest Hub will produce hydrogen as fuel for the region's industrial and manufacturing sectors (The White House, 2023).

STAKEHOLDER COMMENTS

Stakeholder feedback collected through surveys, public meetings, interviews, and a review of municipal climate action plans identified electrifying industrial processes as a top priority – leading to this measure's inclusion in the PCAP. When survey respondents selected their top five measures, 40% of total respondents and 42% of those from priority LIDAC zip codes[7] selected the measure to reduce industrial emissions through electrification, carbon capture, or other solutions.

In public meetings, stakeholders also emphasized the need to reduce industrial air pollution to improve local air quality and health outcomes. During public meetings and through survey responses, stakeholders specifically requested a focus on green hydrogen generated from renewables rather than blue hydrogen generated from natural gas. Measures involving electrifying industrial processes were absent from the local climate action plans reviewed.

[7] See section 1.2.1 Identifying Priority communities for more detail on how these areas were defined.

However, the measure was selected due to its high potential to reduce greenhouse gas emissions and co-pollutants – benefits prioritized by stakeholders engaged in PCAP development.

Table 29. Potential Community Benefits from Expanding Use of Electric and Green Hydrogen Industrial Processes and Technologies

Potential Community Benefits
Reduced climate risks
Improved air quality
Improved public health outcomes

COMMUNITIES IMPACTED BY MEASURE

Expanding industrial electrification and green hydrogen in Indiana, particularly in communities identified in the LIDAC census tracts (see Appendix B), holds the potential for significant environmental benefits. While emissions reductions in local industries can benefit any community, the most substantial advantages will be realized in areas where industries exhibit the highest emissions. Targeting industries with high emissions will be a focus of the CCAP. Counties most impacted by these efforts are anticipated to include (but not exhaustive) Lake, Porter, La Porte, Vanderburg, Warrick, and Marion, where industrial electrification can lead to both environmental and health improvements.

GREENHOUSE GAS AND CO-POLLUTANT EMISSIONS REDUCTIONS

The analysis modeled two target dates from a 2021 baseline to calculate the potential greenhouse gas and co-pollutant emissions reductions resulting from the expansion of electric and green hydrogen industrial processes and technologies:

Target Date 1: Achieve decreases in coal and natural gas consumption by 33% and 7%, respectively, across the industrial sector by 2030.

Target Date 2: Achieve decreases in coal and natural gas consumption by 72% and 20%, respectively, across the industrial sector by 2050.

Methods and Assumptions

IDEM defined a reference case forecast of energy consumption and emissions within Indiana for the industrial sector by leveraging EIA State Energy Data System (SEDS) data (U.S. Energy Information Administration, 2021) and EPA emission factors. Further, data from the 2020 National Emissions Inventory (NEI) database was used to identify which industries contribute most to Indiana's industrial footprint (U.S. Environmental Protection Agency, 2020).

According to the 2020 NEI data, the state's most significant driver of emissions by industry is steel mills, representing over 65% of Indiana's industrial emissions. The EIA Manufacturing Energy Consumption Survey (MECS) (U.S. Energy Information Administration, 2018) was employed to model the total amount of coal, natural gas, and electricity consumption attributable to steel mills across the entire industrial sector. Estimated percent changes for these energy types between a baseline year of 2021 and target year of 2050 were then determined using models from the International Energy Agency (IEA) (International Energy Agency, 2023). The IEA models derive a Net Zero Emissions (NZE) scenario, which relies heavily on electrification and green hydrogen applications in addition to other technological and material innovations to drive energy profile changes. Emissions figures supported by the IEA models are then compared against forecasted emissions from the reference case to quantify total GHG abatement potential.

The same data sources and methodologies used to quantify energy consumption figures were used as a basis for the co-pollutant analysis. Co-pollutants were calculated using emission factors from the EPA AP-42 Compilation of Air Emission Factors (U.S. Environmental Protection Agency, 2024).

Table 30. Emission Reductions Calculation Assumptions for Expanding Use of Electric and Green Hydrogen Industrial Processes and Technologies

Parameter	Assumption	Source
IEA models	IEA models rely on a series of assumptions about which abatement interventions will take place specifically in the iron and steel industry and across the industrial sector. It is noted that green hydrogen and electrification will be key drivers of change in the iron and steel industries, while electrification will drive significant change in the industrial sector.	(International Energy Agency, 2023)
Electricity increases	While natural gas and coal consumption is anticipated to decrease precipitously based on the IEA models, process electrification is expected to increase accordingly. This will result in indirect emissions increases that the model conveys.	--
Change in grid intensity	Electricity emissions are affected by the projected change in renewable energy contribution to the grid mix as forecasted in the Renewable measures.	--

Results

The results demonstrate a potential to reduce annual GHG emissions by 0.3 MMT CO_2e if Indiana achieves decreases in coal and natural gas consumption by 33% and 7% respectively across the industrial sector by 2030. If decreases in coal and natural gas consumption of 72% and 20% are achieved by 2050, 15.3 MMT CO_2e could be reduced annually. The table below also provides estimated reductions for co-pollutants across the same timeframe.

Table 31. Greenhouse Gas and Co-Pollutant Emissions Reductions from Expanding Use of Electric and Green Hydrogen Industrial Processes and Technologies

GHG emissions reduction (MMT CO_2e)		Co-pollutant emissions reductions (short tons)					
		NO_x	SO_2	$PM_{2.5}$	VOCs	CO	Hg
2030	**0.3**	16,493	(8,933)*	(114)*	324	5,783	0.00
2050	**15.3**	85,269	(14,691)*	1,018	1,519	25,687	0.05

GHG and co-pollutant reduction estimate for expanding use of electric and green hydrogen industrial processes and technologies. Values represent annual emissions reductions compared to a reference case where energy sources continue to change according to the average annual rate of change from 2010-2021 based on SEDS data.
**SO_2 and $PM_{2.5}$ emissions are expected to increase due to the increased usage of electricity from the electrification of industrial processes.*

Limitations and Conclusions

Enacting decarbonization efforts at various manufacturing and other industrial facilities, with a particular focus on steel mills, holds immense potential in curbing GHG emissions and co-pollutants emitted from the industrial sector. However, implementing such changes poses financial challenges and potential maintenance needs over time. The estimates in our analysis assume widespread adoption of these measures across a broad spectrum of establishments, which may be beyond the capacity of state and federal funding. However, any decarbonization efforts can help reduce emissions and contribute to growing the hydrogen market in Indiana.

WORKFORCE DEVELOPMENT ANALYSIS

Expanding the use of green hydrogen and electrifying industrial processes in Indiana represents a significant transformation that requires a skilled and diverse workforce. Electrical engineers and industrial automation specialists will be instrumental in designing and implementing electrified systems within manufacturing facilities. Skilled electricians and technicians will play a crucial role in installing and maintaining advanced machinery and electrical equipment. Manufacturers must invest in workforce training programs to ensure existing staff can adapt to new technologies and processes.

As the state transitions towards electrification, job opportunities in research and development for innovative technologies and energy storage solutions will likely emerge. The successful electrification of industrial processes in Indiana has the potential to drive economic growth, create new employment opportunities, and position the state as a leader in sustainable manufacturing practices. A practical approach to addressing the growing workforce needs of industrial decarbonization involves prioritizing reskilling individuals from diverse backgrounds and occupations. This approach helps create a pool of skilled green workers instead of solely relying on new graduates. It is essential to support reskilling efforts for those at risk of job displacement, especially in declining industries or where practices could be replaced with cleaner processes.

IMPLEMENTATION DETAILS

IDEM will evaluate existing major source permits to identify potential emissions reduction opportunities within industrial processes. IDEM will coordinate with the applicable industries to explore implementing actions to reduce greenhouse gas emissions and potential funding options.

Funding

The availability of federal funding is important for the feasibility of electrifying industrial processes in Indiana. Below are possible sources of funding to finance this measure.

Table 32. Federal funding for Electric and Green Hydrogen Industrial Processes and Technology

Funding source	Federal amount	Description
Department of Energy's Industrial Efficiency and Decarbonization Office (IEDO) Cross-Sector Technologies Program https://www.energy.gov/eere/iedo/fy24-cross-sector-technologies-funding-opportunity-announcement	$3 million to $5 million available	This funding will aim to advance industrial decarbonization. Technology may include developing combustion systems that enable fuel switching to hydrogen and other low-carbon fuels.
U.S. Department of Energy's Regional Clean Hydrogen Hubs Program https://www.energy.gov/oced/regional-clean-hydrogen-hubs-0	$7 billion available	The regional Clean Hydrogen Hubs Program includes up to $7 billion to establish six to ten regional clean hydrogen hubs across America. Part of a more extensive $8 billion hydrogen hub program funded through the Bipartisan Infrastructure Law, the hubs will form the foundation of a national clean hydrogen network that will contribute substantially to decarbonizing multiple sectors of the economy.

3.5 WASTE AND MATERIALS MANAGEMENT SECTOR

Indiana's waste management sector contributed roughly 2% of the state's total direct greenhouse gas emissions in 2021 at 3.78 MMT CO_2e. Methane accounted for about 87% of these emissions, totaling 3.29 MMT CO_2e (U.S. Environmental Protection Agency, n.d.). Landfills are the primary emitters within the waste management sector, producing 2.80 MMT CO2e in 2021, which represents about 74% of the sector's total emissions (U.S. Environmental Protection Agency, n.d.). Wastewater treatment contributed the second-highest amount, with 0.86 MMT CO_2e, accounting for approximately 23% (U.S. Environmental Protection Agency, n.d.). Composting and anaerobic digestion had comparatively lesser impacts, with composting contributing 0.11 MMT CO_2e or about 3%, and anaerobic digestion contributing 0.003 MMT CO_2e, constituting less than 1% (U.S. Environmental Protection Agency, n.d.).

Tackling emissions from waste can help reduce methane, a potent greenhouse gas, while bringing benefits to the community. These community benefits include local jobs, improved air quality, increased food recovery, and, by extension, food access (Mineo, 2021). While some measures, like renewable natural gas, require relatively little new infrastructure, others pose challenges. For instance, community members voiced concern over the implementation of

waste management measures because they require communities to adopt new waste management practices. However, like other sectors, implementing emissions reduction measures in this sector will require a multifaceted approach, using education, incentives, and new structures.

Selected Measures

Reducing municipal solid waste (MSW) directed to landfills can significantly reduce the methane emitted from landfills. Landfills are a substantial source of human-related methane emissions, contributing approximately 14.3% of methane emissions emitted by the United States in 2021 (U.S. Environmental Protection Agency, 2024). Given methane's high global warming potential, stemming its release from landfills is crucial for climate action. Furthermore, methane released from landfills into the atmosphere is a missed opportunity to harness a substantial energy resource.

To minimize the environmental impacts of organic waste in landfills, particularly methane generation, and tap into the potential for capturing and utilizing methane as an energy source, the PCAP includes two measures for this sector: (1) increase the diversion rate of organic waste from landfills, and (2) install and expand landfill gas collection systems & renewable natural gas generation.

Sector Overview

Indiana's waste and recycling infrastructure for MSW collected approximately 9.4 million tons in 2021. Approximately 75% of this waste was directed to landfills, and about 21% was diverted to recycling (Indiana Department of Environmental Management, n.d.). This recycling rate falls below the national rate of 32%, according to the U.S. EPA, and also falls short of Indiana's goal of achieving a 50% recycling rate (Indiana Department of Environmental Management, n.d.). Coupling diversion strategies with initiatives aimed at decreasing overall MSW generation will help to achieve this recycling objective.

MEASURE 7: INCREASE DIVERSION RATE OF ORGANIC WASTE FROM LANDFILLS

Increasing the diversion of organic waste from landfills involves directing more organic waste into its designated waste stream to avoid it being commingled with municipal solid waste (MSW) destined for landfills. This necessitates that residents and businesses segregate organic waste, similar to the separation process for recyclables. Implementing these changes will also require communities to establish new systems for collecting and processing organic waste.

Diverted organic waste can serve as a valuable feedstock for anaerobic digestion, generating renewable energy, or can be converted into compost for fertilizing crops. When organic waste decomposes in landfills, it emits greenhouse gases. Diverting it for alternative uses mitigates

emissions resulting from landfill decomposition. The act of diverting waste from landfills also facilitates the creation of new jobs while minimizing air and water pollution sources.

CURRENT STATE

In 2021, 3.9% of Indiana's municipal solid waste was composted, and 4.4% was converted into energy (Indiana Department of Environmental Management, 2021). Indiana's solid waste and recycling infrastructure encompasses operations by private waste management companies, solid waste management districts (SWMDs), and cities and towns to service drop-offs, curbside, and commercial accounts.

Current Indiana operations include 34 landfills, 78 transfer stations, 14 material recovery facilities, 116 compost facilities, and a waste-to-energy plant (Indiana Department of Environmental Management, 2021).

To encourage waste diversion, Indiana has several funding opportunities, including the Central Indiana Waste Diversion Pilot Project, which aims to determine the most practical and effective means of diverting recyclable materials from waste streams for commercial reuse; the Community Recycling Grant Program, which offers funding to projects that include education and promotion of recycling, waste reduction, organics management (including yard waste management and composting), or household hazardous waste collection and disposal; and the Indiana Recycling Market Development, a program that offers a limited amount of funding each year for private businesses to invest in equipment purchases to expand or create new recycling enterprises (Indiana Department of Environmental Management, 2021).

STAKEHOLDER COMMENTS

Stakeholder feedback collected through surveys, public meetings, interviews, and a review of municipal climate action plans identified increasing the diversion rate of organic waste from landfills as a top priority, leading to this measure's inclusion in the PCAP. When survey respondents selected their top five measures, about 20% of total respondents and respondents from priority LIDAC zip codes[8] selected the measure to expand composting services. Additionally, improved waste management was the fourth highest benefit prioritized by survey respondents. Multiple local climate action plans included efforts to increase diversion rates, including Bloomington.

Though this measure received significant stakeholder support, various stakeholders raised concerns about the readiness and willingness of communities to adopt new waste management practices and the potential increase in operational costs for waste collection and processing.

[8] See section 1.2.1 Identifying Priority communities for more detail on how these areas were defined.

Several stakeholders also noted there could be a period of adjustment as communities transition from traditional waste disposal methods to more sustainable practices.

Table 33. Potential Community Benefits of Diverting Organic Waste from Landfills

Potential Community Benefits
Reduced climate risks
Improved waste management
Enhance material recovery
Improved food access

COMMUNITIES IMPACTED BY MEASURE

Any community located near a landfill in Indiana (see Appendix B for a list of LIDAC census tracts) could benefit from reducing the need for landfill expansion in their community. Identifying the specific locations of landfills is not a priority for the PCAP and may be a focus for the CCAP.

GREENHOUSE GAS AND CO-POLLUTANT EMISSIONS REDUCTIONS

The analysis modeled two target dates from a 2021 baseline to calculate the potential greenhouse gas and co-pollutant emissions reductions from the increasing diversion of organic waste from landfills:

Target Date 1: Achieve an organic waste diversion rate of 28% and a year-over-year MSW generation growth rate of 3% (relative to a baseline rate of 4%) by 2030.

Target Date 2: Achieve an organic waste diversion rate of 50% and a year-over-year MSW generation growth rate of 0% (relative to a baseline rate of 4%) by 2050.

Methods and Assumptions

IDEM gathered MSW generation data (Indiana Department of Environmental Management, n.d.) and applied national EPA data (U.S. Environmental Protection Agency, 2023) to determine an approximate breakdown of organic waste by waste type within Indiana's landfilled MSW. After aggregating each organic waste type, EPA emission factors were used to quantify the GHG emissions for the baseline year. Then, emissions for a reference case were forecasted between 2021 and 2050 utilizing average MSW generation rates and diversion rates based on historical trends to predict the GHG impact from landfilled organic waste over time. Emissions from this reference case were compared against a modeled abatement case scenario, in which the diversion rate increases to 50% by 2050 and the year-over-year MSW generation growth rate decreases to 0% by 2050, to determine total GHG emissions reductions over time.

For the co-pollutant analysis, IDEM assessed 2020 emissions data from the National Emissions Inventory (NEI) for both landfills and MSW combustors (U.S. Environmental Protection Agency, 2020). An average emissions value per ton of waste for each analyzed co-pollutant was derived using this data such that co-pollutant impacts could be assessed as a function of organic waste generation over time.

Table 34. Emission Reductions Calculation Assumptions for Increased Organic Waste Diversion from Landfill

Parameter	Assumption	Source
Quantity of organic waste within Indiana's landfilled MSW stream	Since state-specific data was not available to determine the share of organic waste that composes Indiana's total landfilled MSW stream, IDEM used EPA average values to fill in this gap.	(U.S. Environmental Protection Agency, 2018)
Organic Waste Diversion	Since emissions differ depending on how diverted organic waste is handled, the following assumptions were made for each organic waste type: Yard trimmings: 75% composted, 25% anaerobically digested Wood: 50% reused, 50% recycled Paper and paperboard: 50% reused, 50% recycled Food: 75% composted, 25% anaerobically digested	--
Out-of-state landfilled MSW	Emissions impacts from Indiana MSW landfilled out of state are not considered in the model.	--
MSW combustors	The impacts of co-pollutant emissions from MSW combustors are considered in the model.	--
NEI landfill data	Data from NEI may underrepresent the total number of landfills across the state. As such, co-pollutant reductions may be slightly underestimated.	

Results

If Indiana reaches the modeled target metrics, the state could achieve GHG emissions reductions of 0.4 MMT CO_2e by 2030 and 4.1 MMT CO_2e by 2050. The table below also provides estimated reductions for co-pollutants across the same timeframe.

Table 35. Greenhouse Gas and Co-Pollutant Emissions Reductions for Increased Organic Waste Diversion from Landfill

	GHG emissions reduction (MMT CO_2e)	Co-pollutant emissions reductions (short tons)					
		NO_x	SO_2	$PM_{2.5}$	VOCs	CO	Hg
2030	**0.4**	9	4	3	7	33	0.00
2050	**4.1**	38	17	12	29	141	0.00

GHG and co-pollutant reduction estimates for increased diversion of organic waste from landfills at a state-wide scale. Values represent total annual emissions reductions compared to a reference case where MSW generation growth rate remains aligned with historical trends and no organic waste is diverted from landfill. The abatement case assumes that Indiana establishes a 50% diversion rate and year-over-year 0% MSW generation growth rate by 2050.

Limitations and Conclusions

Increasing the rate of organic waste diversion from landfills holds the potential to substantially mitigate emissions arising from the decomposition of organic matter at these sites. Further, a reduction in MSW generation will contribute to an even more pronounced decrease in emissions due to the reduced volume of total MSW decomposing in landfills.

However, achieving an enhanced diversion rate of organic waste necessitates the widespread implementation of a state-level organics collection program coupled with dedicated sites for composting or anaerobic digestion. Securing the necessary funding is imperative for the successful execution of this initiative. Additionally, a comprehensive educational effort aimed at instructing Hoosiers and businesses on the proper separation of organics into a distinct waste stream may encounter some resistance but is crucial for the success of this measure.

WORKFORCE DEVELOPMENT ANALYSIS

Increasing the diversion rate of organic waste from landfills in Indiana requires a workforce with expertise in waste management, environmental science, and sustainable practices. For example, waste management professionals, including waste diversion coordinators, will be essential for designing and implementing effective organic waste diversion programs. Compost facility operators and technicians skilled in composting will play a pivotal role in managing organic waste to produce nutrient-rich compost for agricultural use. Additionally, outreach and

education specialists will be needed to raise awareness among businesses, communities, and individuals about the benefits of diverting organic waste and how to properly participate in composting programs. Transport and logistics professionals specializing in organic waste collection and transportation would ensure the efficient flow of materials from generators to composting facilities. Environmental scientists and researchers will contribute to ongoing efforts to optimize composting methods and explore innovative technologies for organic waste management.

Collaborating with vocational schools and community colleges and establishing training programs will be key in equipping these individuals with the skills needed for organic waste collection and composting. If just half of all food scraps landfilled and incinerated were diverted to community composters, over 50,000 new jobs could be created across the United States from composting alone (not including collection) (Institute for Local Self-Reliance, 2023).

IMPLEMENTATION DETAILS

IDEM will coordinate with applicable stakeholders to identify opportunities to divert organic waste from landfills and explore potential funding and investment opportunities to aid implementation. IDEM will rely on its Office of Program Support and pollution prevention staff to support stakeholder coordination, education, and outreach to promote the diversion of organic waste from landfills.

Funding

The availability of federal funding is important for diverting organic waste from Indiana's landfills. Below are possible sources of funding to finance this measure.

Table 36. Federal Funding for Diverting Organic Waste from Landfills

Funding Source	Federal Amount	Description
USDA's Rural Energy for America Program • Renewable Energy Systems https://www.rd.usda.gov/programs-services/energy-programs/rural-energy-america-program-renewable-energy-systems-energy-efficiency-improvement-guaranteed-loans/in	$1 million available per project	This program provides guaranteed loan financing and grant funding to agricultural producers and rural small businesses for renewable energy systems. Funds may be used to purchase and install renewable energy systems, including anaerobic digesters.
USDA's Composting and Food Waste Reduction (CFWR) Cooperative Agreements https://www.usda.gov/topics/urban/coop-agreements	Amount varies by year	Composting and Food Waste Reduction Cooperative Agreements assist local and municipal governments with projects that develop and test strategies for planning and implementing municipal compost and food waste reduction plans.

MEASURE 8: INSTALL AND EXPAND LANDFILL GAS COLLECTION SYSTEMS AND RENEWABLE NATURAL GAS GENERATION (RNG)

Renewable natural gas (RNG) is a biogas made from decomposing organic matter, which can come from landfills, livestock, or wastewater. RNG can replace natural gas for electricity generation, heating, or as fuel for transportation (U.S. Department of Energy, 2024). Capturing landfill gas and generating RNG avoids potent greenhouse gas emissions, primarily methane, from landfills, improving local air quality. Furthermore, RNG can benefit the local economy through investments, and new projects may benefit from incentives.

CURRENT STATE

According to the EPA's Landfill Methane Outreach Program (LMOP) database, Indiana has 21 landfills with operational landfill-to-gas energy projects as of 2023 (U.S. Environmental Protection Agency, 2023). These projects represent 4% of the total number of operational landfill gas collection projects in the US. The Newton County Landfill project generates energy for a business park, reducing local emissions and successfully creating new community jobs to replace previously lost manufacturing jobs (U.S. Environmental Protection Agency, 2023).

In terms of incentives, landfill gas recovery and RNG projects qualify for Indiana's Clean Energy Portfolio Standard, which was detailed in Section 3.1. This standard allows state-regulated utilities to count landfill gas and RNG projects towards their renewable energy portfolios and

qualify for financial incentives if they meet other program requirements. However, as noted above, Indiana utilities have surpassed the program targets, and it is currently unclear if or when the program may be updated. To date, neither the state nor individual utilities have established other incentives for these projects.

STAKEHOLDER COMMENTS

IDEM selected the measure to enhance landfill gas collection and renewable natural gas primarily due to the potential to reduce greenhouse gas emissions. As stakeholders prioritized "reducing climate risks" as a top benefit sought in the climate action plan, this measure still supports stakeholder preferences. In addition, nine municipal climate action plans featured renewable natural gas measures, including Fort Wayne and Gary.

Table 37. Potential Community Benefits from Expanding Landfill Gas Collection Systems and RNG Generation

Potential Community Benefits
Reduced climate risks
Reduced air pollution
Improved waste management
Job creation and workforce development

COMMUNITIES IMPACTED BY MEASURE

Any community located near a landfill in Indiana (see Appendix B for a list of LIDAC census tracts) could benefit from technology that increases the use of landfill gas collection systems if it reduces local air emissions and odor. Identifying the specific locations of candidate landfills is not a priority for the PCAP and may be a focus for the CCAP.

GREENHOUSE GAS AND CO-POLLUTANT EMISSIONS REDUCTIONS

The analysis modeled two target dates from a 2025 baseline to calculate the potential greenhouse gas and co-pollutant emissions reductions as a result of increasing RNG production from landfills or landfill gas (LFG) energy:

Target Date 1: Implement LFG energy projects at 3 landfills with potential for implementation by 2030.

Target Date 2: Implement LFG energy projects at 13 landfills with potential for implementation by 2050.

Methods and Assumptions

Baseline data on LFG energy projects within the state of Indiana was taken from the EPA's LMOP database. The database contains total counts of operational LFG energy projects and landfills that have potential for future installations as of July 2023. In the database, two types of emissions reductions are quantified for landfills that have implemented LFG energy projects:

- **Direct emissions reductions:** Reductions of methane emitted directly from landfills.
- **Avoided emissions reductions:** Averted CO_2 emissions resulting from avoiding the use of conventional fossil fuels.

The model quantifies potential direct and avoided emissions reductions for landfills that have indicated their current project status as "candidate" or "construction." For these landfills, an assumed amount of LFG to be captured and converted to RNG was deduced based on the average quantity of LFG collected per ton of waste at operational landfills. This number was then translated to total direct and avoided emissions reduction values based on methodology embedded within the EPA's LFG Energy Benefits Calculator (U.S. Environmental Protection Agency, 2023).

Since RNG and conventional natural gas have similar co-pollutant impacts when combusted, a co-pollutant analysis was not assessed for this measure. There may be co-pollutant benefits of RNG when compared to traditional natural gas that can be assessed in the future.

Table 38. Emission Reductions Calculation Assumptions for Installing and Expanding Landfill Gas Collection Systems and RNG Generation

Parameter	Assumption	Source
Landfill closure dates	Annual emission reductions for landfills that have anticipated closure dates before 2050 are projected to remain constant once closed. Landfills are assumed to stop accepting waste upon closure.	(U.S. Environmental Protection Agency, 2023)
Assumed project types	Since there is no reliable way of telling what type of projects candidate landfills might pursue, project types for these landfills are assumed.	

Results

If Indiana implements LFG projects at 3 landfills by 2030 and 13 landfills by 2050, GHG emissions reductions could total 0.3 MMT CO_2e and 1.9 MMT CO_2e, respectively.

Table 39. Greenhouse Gas and Co-Pollutant Emissions Reductions for Installing and Expanding Landfill Gas Collection Systems and RNG Generation

	GHG emissions reduction (MMT CO_2e)	Co-pollutant emissions reductions (short tons)*					
		NO_x	SO_2	$PM_{2.5}$	VOCs	CO	Hg
2030	**0.3**	n/a	n/a	n/a	n/a	n/a	n/a
2050	**1.9**	n/a	n/a	n/a	n/a	n/a	n/a

GHG and co-pollutant reduction estimates for Installing and expanding landfill gas collection systems and RNG generation. Values represent total annual emissions reductions of implementing 13 new landfill projects by 2050 as compared to the reference case, where no additional projects are implemented.
**Since RNG and conventional natural gas have similar co-pollutant impacts when combusted, a co-pollutant analysis was not assessed for this measure. Further, co-pollutant impacts are not assessed by the LMOP database.*

Limitations and Conclusions

Increasing the number of LFG energy projects holds the potential to curb otherwise unmitigated direct emissions from landfills in addition to emissions that would be incurred from the use of conventional natural gas. Successful collaboration among several stakeholders, including landfill operators, regulators, and local communities, is required to increase the number of landfill gas collection systems that can be used for RNG production. Having reliable financial support mechanisms is also important, and incentives are available at local and national levels. Furthermore, ensuring that landfills have adequate resources to continue monitoring and maintenance of LFG energy projects over time is critical. While this measure can potentially curb unmitigated landfill emissions, the most successful projects will be located next to pipelines. When projects are not next to pipelines, associated costs may be lower, but emission reductions will likely be lower as well.

WORKFORCE DEVELOPMENT ANALYSIS

The installation and expansion of landfill gas collection systems and renewable natural gas (RNG) generation require a specialized workforce with a blend of engineering, environmental science, and energy expertise. Environmental engineers and technicians are critical for designing, installing, and maintaining landfill gas collection systems, which capture methane emissions from landfills. These professionals ensure that the systems are efficient and compliant with environmental regulations. Renewable energy specialists and electrical engineers are

needed to develop and optimize RNG generation technologies, converting captured landfill gas into a usable and sustainable energy source. Skilled construction and project management professionals play a vital role in the physical implementation of these systems, overseeing the installation process and ensuring projects are completed on time and within budget. Additionally, gas processing and distribution experts are essential for refining and integrating RNG into existing natural gas infrastructure.

Partnerships should be created between energy companies and Indiana universities to educate students on the career paths available in RNG. These partnerships should focus on the many existing sites in Indiana and highlight those in development.

The expansion of landfill gas capture and RNG initiatives in Indiana has the potential to create jobs in engineering, construction, and renewable energy sectors, contributing to the state's environmental sustainability goals. The jobs will likely contribute significantly to rural, low-income regions of Indiana, as sites are often found there. According to research conducted by the International Council on Clean Transportation, the RNG sector could generate as many as 130,000 jobs, both directly and indirectly, in the United States by 2030 (Utilities One, 2023).

IMPLEMENTATION DETAILS

IDEM will coordinate with permitted landfill operations within the state to explore opportunities to reduce landfill emissions. This includes pursuing funding and financing options to aid with implementation. IDEM will make its technical staff available to assist sources in evaluating appropriate control technologies and identifying cost-effective control strategies. IDEM will also review any upcoming EPA regulations to address landfill gas emissions.

Funding

The availability of federal funding is important for the feasibility of widespread adoption of landfill gas collection systems and renewable natural gas generation in Indiana. Below are possible sources of funding to finance this measure.

Table 40. Federal Funding for Landfill Gas Collection Systems and RNG Generation

Funding Source	Federal Amount	Description
U.S. Department of Transportation's Charging and Fueling Infrastructure Discretionary Grant Program https://www.fhwa.dot.gov/environment/cfi/	$2.5 billion available	The Charging and Fueling Infrastructure Discretionary Grant Program deploys funding for alternative fueling infrastructure in urban and rural areas and along designated Alternative Fuel Corridors.
U.S. Internal Revenue Service Alternative Fuel Excise Tax Credit https://afdc.energy.gov/fuels/laws/NG?state=US	$0.50 per gallon	A tax incentive is available for alternative fuel that is sold for use or used as a fuel to operate a motor vehicle. A tax credit in the amount of $0.50 per gallon is available for natural gas.
U.S. Internal Revenue Service Alternative Fuel Infrastructure Tax Credit https://afdc.energy.gov/fuels/laws/NG?state=US	6% of the depreciable costs, up to $100,000 per item, or 30% of the depreciable costs, up to $100,000 per item, if the installation meets U.S. Department of Labor prevailing wage and apprenticeship requirements.	The Alternative Fuel Vehicle Refueling Property Credit is available for qualified AFV fueling properties installed in qualified locations through 2032. Eligible property includes certain fueling equipment for natural gas.

3.6 AGRICULTURE, NATURAL, AND WORKING LANDS SECTOR

Indiana's agricultural sector contributed 8% of the state's total direct greenhouse gas emissions in 2021, as outlined in Section 1.2 Indiana's Emissions. These emissions arise from certain farming practices, such as burning crop residues, converting cropland, and managing livestock and manure (Purdue University, 2021). For example, soil management may require fertilizers and decomposing organic matter, which releases nitrous oxide into the air. However, under certain conditions, working lands and other natural features, like trees, can also act as carbon sinks. These carbon sinks sequester carbon, helping to reduce climate pollution. The measures in this section describe how Indiana can improve its agricultural and urban land management practices for carbon sequestration, particularly given emissions reduction challenges in other sectors.

Notably, improved land management has several benefits beyond emissions reductions: expanded urban spaces can enhance community well-being and resilience (Purdue Climate Change Resources Center, 2018; Zupancic, Westmacott, & Bulthuis, 2015). For instance, green spaces can provide recreational opportunities while offering shade, shelter, and cooling during extreme weather events (Purdue Climate Change Resources Center, 2018). Likewise, improved agricultural practices can help sustain the economic viability of natural resources (U.S. Department of Agriculture National Institute of Food and Agriculture, 2024). Stakeholders

recognized several barriers to implementing measures in this sector, including the challenges of maintaining green spaces and the need to support farmers as they transition their practices.

Selected Measures

To ensure Indiana's agricultural, natural, and working lands provide as many benefits to Hoosier health and the environment as possible, the Preliminary Climate Action Plan (PCAP) includes two measures for this sector: (1) expand green spaces and urban tree canopy, and (2) expanding the implementation of measures with agricultural benefits.

Sector Overview

Both working land and urban green spaces play a key role in Indiana. More than 80% of Indiana's land consists of forests and farms, making them critical contributors to the state's economy (Indiana State Department of Agriculture, 2019). Additionally, the state's largest city by population, Indianapolis, was recognized as one of the top 50 cities for urban green space per capita (Stacker, 2022). More information on the status of these lands is provided below:

- **Agriculture and Working Lands:** Nearly 12 million acres of crops were harvested across Indiana in 2022 (U.S. Department of Agriculture, 2022). The state has made significant strides in implementing measures that expand agricultural benefits through the Environmental Quality Incentives Program (EQIP) and the Conservation Stewardship Program (CSP). In 2023, for instance, farmers planted roughly 1.6 million acres of overwintering living covers, including small grains like wheat and cover crops, a new state record. This overwinter living cover prevented millions of pounds of sediment, nitrogen, and phosphorus from entering the state's waterways. In addition to state programs, recent investments from the federal government are helping the state's farmers adopt more climate-friendly practices.

- **Natural Lands and Green Spaces:** A 2022 survey prepared for Indiana University's Environmental Resilience Institute found that across nine of the state's major cities and counties, there is an existing tree canopy rate of 24%. The study accounted for available tree planting acreage and asserted that attainable tree canopy coverage could be as high as 49% if a concerted effort to reforest is made (Davey Resource Group, 2022). Individual cities manage green spaces within Indiana, but the state offers several assistance programs. The Indiana Department of Natural Resources' (INDNR) Community Urban Forestry Program offers funding for tree planting, and the INDNR website houses several informational resources to assist urban community members' efforts (DNR Indiana Department of Natural Resources, 2024). Indiana has progressed towards expanding green spaces and urban tree canopy, but challenges remain given increasing land development.

MEASURE 9: EXPAND GREEN SPACES AND URBAN TREE CANOPY

Increasing the amount of green space and urban tree canopy can result in many environmental and human health benefits. A robust tree canopy and green space provide carbon sequestration and improved air quality via pollutant absorption (Purdue Climate Change Resources Center, 2018). In addition, these spaces play a crucial role in climate adaptation by reducing the urban heat island effect and improving stormwater management (U.S. Department of Agriculture Forest Service, 2023). Green spaces have also been shown to positively affect mental and physical well-being by offering recreational areas that reduce stress and promote healthier lifestyles (Nowak, Appleton, Ellis, & Greenfield, 2017).

CURRENT STATE

Indiana has made strides in recent years to expand green spaces and urban tree canopies. Ten communities and organizations in Indiana have recently received funding from the Forest Service's Urban and Community Forestry program to improve urban tree canopy, including the City of Bloomington and Indiana University (U.S. Department of Agriculture Forest Service, 2023). Since the pilot program's inception in 2020, 2,000 trees have been planted in Bloomington, and 18,000 trees have been planted in Indianapolis (Indiana University, 2023). Separate initiatives, such as the Thrive Indy plan, are responsible for 30,000 tree plantings in Indianapolis (Sheridan, 2023). The city of South Bend received nearly $2 million for reforestation. South Bend has selected vacant lots, public school yards, and stormwater retention basins suitable for tree plantings to meet the city's goal of planting 100,000 trees by 2050 (The City of South Bend, 2023).

STAKEHOLDER COMMENTS

Stakeholder feedback collected through surveys, public meetings, interviews, and a review of municipal climate action plans identified expanding green spaces and urban tree canopies as a top priority, leading to this measure's inclusion in the PCAP. When survey respondents selected their top five measures, more than 40% of total respondents and those from priority LIDAC zip codes[9] selected the measure to expand green space (parks, trees, and trails). Additionally, six of the municipal climate action plans included expanding green spaces and urban tree canopy as priorities, including Carmel, Evansville, and Gary.

Community members requested that the incorporation of this measure be primarily focused on low-income and disadvantaged communities.

[9] See section 1.2.1 Identifying Priority communities for more detail on how these areas were defined.

Table 41. Potential Community Benefits from Expanding Green Spaces and Urban Tree Canopy

Potential Community Benefits
Reduced climate risks
Improved air quality
Reduce energy cost burden
Improved climate resilience

COMMUNITIES IMPACTED BY MEASURE

Any community in Indiana (see Appendix B for a list of LIDAC census tracts) could benefit from additional green space. Increased access to green areas provides recreational opportunities and enhances well-being, improved mental health, and more climate-resilient communities. The importance of green spaces becomes even more pronounced in urban settings, where the creation of accessible parks can significantly improve the quality of life for residents.

GREENHOUSE GAS AND CO-POLLUTANT EMISSIONS REDUCTIONS

This analysis modeled the potential impact of the expansion of urban tree planting programs in LIDACs across the state on the sequestration, removal, and avoidance of greenhouse gas (GHG) and co-pollutant emissions:

Target Date 1: 500,000 trees planted by 2030 across Indiana in Low-Income and Disadvantaged Communities (LIDAC).

Target Date 2: 2.5 million trees planted by 2050 across Indiana in Low-Income and Disadvantaged Communities (LIDAC).

Methods and Assumptions

For estimating GHG and co-pollutant emissions reductions associated with the expansion of green spaces and urban tree canopy, IDEM selected i-Tree to quantify various environmental benefits. The i-Tree suite is a state-of-the-art, peer-reviewed software suite from the USDA Forest Service that provides urban and rural forestry analysis and benefits assessment tools. The i-Tree tools can help strengthen forest management by quantifying forest structure and trees' environmental benefits (U.S. Department of Agriculture, Forest Service, 2006).

IDEM used the i-Tree Planting Calculator tool to determine the annual environmental benefits of one urban tree. The parameters used to model environmental benefits can be found in the table below. These reductions stem from the following ecosystem services:

- **Carbon sequestration:** A measure of the carbon (in the form of carbon dioxide) that is removed from the atmosphere by trees.

- **Pollution removal:** A measure of air pollution that trees remove from the atmosphere. Pollution removal is calculated for nitrogen dioxide (NO_2), sulfur dioxide (SO_2), ozone (O_3), carbon monoxide (CO), and particulate matter less than 2.5 microns ($PM_{2.5}$).
- **Energy effects:** A measure of the seasonal effects of trees on residential building energy use and consequent emissions from power plants. Energy effects are estimated based on tree distance and direction to residential structures, tree height, and tree condition.

Table 42. Emission Reductions Calculation Assumptions for Expanding Green Spaces and Urban Tree Canopy

Parameter	Assumption	Source
CO_2 and co-pollutant emissions reductions per urban tree planted	i-Tree Planting was used to calculate CO_2 sequestered, co-pollutants removed, and emissions avoided per urban tree planted based on the parameters described below.	(U.S. Department of Agriculture, Forest Service, 2023)
i-Tree Planting calculator parameters used to determine emission factors		
Project location	Indianapolis, IN	-
Electricity emissions factor for avoided emissions	736.75 kg CO_2e per MWh (based on EIA 2021 data for Indiana)	(U.S. Energy Information Administration, 2021)
Fuel emissions factor for avoided emissions	77.25 kg CO_2e per MMBtu (based on EIA 2021 data for Indiana)	(U.S. Energy Information Administration, 2021)
Number of trees in simulation	4,700 (100 trees per species, 47 species)	-
Species composition	List of species based on the "Indiana Native Tree List - Suggested for Urban Landscapes" by Purdue University.	(Purcell & Daniel, 2016)
Project lifetime	24 years: A USDA study indicates that tree life expectancy in urban areas was found to be between 19 and 28 years.	(Roman & Scatena, 2011)
Annual tree mortality rate	2.965% is the default annual mortality rate in i-Tree.	-
Diameter at Breast Height (DBH) at planting	1.5 inches. The 0-3 in. DBH class is considered "recently planted street trees."	(Lesser, 1996)
Health condition	Excellent	-
Distance to nearest building	20 to 39 feet	-
Direction	Varies: 25.5% North, 25.5% East, 25.5% South, 23.4% West	-
Building age	Varies: 51% built 1950-80, 49% built after 1980	-
Climate controls	Varies: 51% heat only, 49% heat and cool	-

Results

Expanding green spaces and urban tree canopy in LIDAC communities could reduce annual GHG emissions by 0.01 MMT CO_2e if 500,000 trees are planted by 2030 and 0.07 MMT CO_2e if 2.5 million trees are planted by 2050. These efforts will also provide additional environmental benefits by removing co-pollutants and avoiding emissions from electricity generation by reducing energy use in buildings. The table below summarizes emissions reductions through sequestration, removal, and avoidance.

Table 43. Greenhouse Gas and Co-Pollutant Emissions Reductions for Expanding Green Spaces and Urban Tree Canopy

	GHG emissions reduction (MMT CO_2e)	Co-pollutant emissions reductions (short tons)					
		NO_x	SO_2	$PM_{2.5}$	VOCs	CO	O_3
2030	**0.01**	6	38	2	0.2	N/A	17
2050	**0.07**	29	191	9	1.1	N/A	84

GHG and co-pollutant reduction estimates for expanding green spaces and urban tree canopy. Values represent the annual quantified emissions reductions for sequestration, removal, and avoidance. Note that O_3 reductions are quantified for this measure.

Limitations and Conclusions

Results are presented as annual emissions reductions from planted urban trees due to CO_2 sequestration, co-pollutant removal, and avoided emissions from reduced energy use from buildings. The current methodology uses the i-Tree Planting Calculator to determine an average annual removal or sequestration rate per tree (e.g., 15 kg CO_2 sequestered per tree per year). This approach results in an overestimation of the benefits of young and recently planted trees and an underestimation of the benefits of mature trees, which provide superior environmental services and benefits to the community. Additional scenarios may be developed to refine these assumptions and provide more granular results.

WORKFORCE DEVELOPMENT ANALYSIS

Expanding green spaces and urban tree canopy across Indiana requires a workforce with expertise in landscape architecture, arboriculture, urban planning, and environmental conservation. Landscape architects play a pivotal role in designing and planning green spaces, ensuring they are aesthetically pleasing, functional, and environmentally sustainable. Arborists and tree care professionals are essential for selecting, planning, and maintaining trees,

contributing to the expansion of the urban tree canopy. This also presents an opportunity to establish programs that engage youth and communities, providing job prospects for young adults and residents interested in tree planting and upkeep. Urban planners and environmental scientists are needed to assess and integrate green infrastructure into city planning, considering factors like biodiversity, stormwater management, and overall community well-being. Construction and maintenance workers skilled in horticulture and landscaping will be critical for implementing planting initiatives and ensuring the ongoing health of green spaces. Community outreach specialists and educators are important for engaging the public, promoting awareness, and encouraging community involvement in green space initiatives.

Over the next decade, about 3,000 openings are projected for foresters and conservation scientists across the U.S. as Indiana and other states implement measures like this (U.S. Bureau of Labor Statistics, 2023). Retaining these jobs within Indiana could provide valuable careers for Hoosiers.

IMPLEMENTATION DETAILS

IDEM will coordinate with the Indiana Department of Natural Resources, non-profits, and municipalities to explore opportunities for expanding green spaces and tree canopies within urban areas, particularly low-income and disadvantaged communities. This will include the pursuit of funding opportunities to enable and augment implementation.

Funding

The availability of federal funding is important for expanding green spaces and urban tree canopy in Indiana. Below are possible sources of funding to finance this measure.

Table 44. Federal Funding for Urban Green Spaces and Tree Canopy

Funding Source	Federal Amount	Description
USDA's Forest Service Urban and Community Forestry Program https://www.fs.usda.gov/managing-land/urban-forests/ucfstry Program	$1.5 billion available	Funding for tree planting and related activities, such as the development of urban green spaces. Indiana was allocated $4.125 million under this program in FY23.
Indiana Department of Natural Resources, Division of Forestry, Community & Urban Forestry Department https://www.in.gov/dnr/forestry/programs/community-and-urban-forestry/grants/	$3.6 million available	Funding is available for urban forestry projects, including workforce development and outreach/education.

MEASURE 10: IMPLEMENT AGRICULTURAL BEST PRACTICES

Agriculture contributes roughly $35.1 billion annually to Indiana's economy from food, fuel, fiber, feed, and forestry products. In 2022, Indiana's agricultural sector production was valued at $18.9 billion, generated by just over 94,000 Hoosier farmers (U.S. Department of Agriculture, National Agricultural Statistics Service, 2023). Indiana is the eighth-largest farming state in the nation and the sixth-largest crop producer. The increased adoption of conservation practices for cropland management can help sequester a portion of the 8.8 million metric tonnes of CO_2e emissions associated with the state's agricultural soil management. (U.S. Environmental Protection Agency, 2023) Agricultural conservation practices involve implementing sustainable cropland management practices that lead to greenhouse gas mitigation and carbon sequestration benefits on farms. Examples of conservation practices include crop rotation, use of cover crops, and tillage management. Cover crops can contribute to carbon sequestration in agricultural soils by increasing annual plant growth and protecting soil carbon without displacing cash crops. Reduced and no-till practices can also sequester soil organic carbon (SOC) by reducing soil disturbance. These actions lead to numerous ecosystem services and on-farm co-benefits, including improved soil health, erosion control, water quality regulation, soil moisture retention, and nutrient management (Bruner, et al., 2021). Nitrous oxide (N_20) represents a potent greenhouse gas that can be emitted when fertilizer is improperly applied to crops. By applying nutrients using the right source, rate, time, and place, these "4R" practices can significantly reduce N_20 emissions and mitigate their impact (The Fertilizer Institute, 2017). Together, these practices can increase the efficiency and productivity of agricultural operations economically, potentially leading to long-term cost savings for farmers. Collectively, these measures represent a holistic approach to transforming agriculture into a more sustainable and environmentally friendly sector, with benefits spanning ecological, economic, and social dimensions.

CURRENT STATE

In geographic scope, farms, forests, and woodlands constitute over 80% of land in Indiana. Fifteen million acres of farmland were tended in 2017, with cover crops planted on 1.5 million acres (Indiana State Department of Agriculture, 2024). To date, the state has several programs to implement agricultural best practices, including:

- In 2022 and 2023, the United States Department of Agriculture's (USDA) Partnerships for Climate-Smart Commodities program invested $3.1 billion in nationwide projects that focus on the greenhouse gas benefits of climate-smart commodity production, and Indiana's agricultural sector has received substantial investment. For example, Fischer Farms Natural Foods, in partnership with Indiana University, received $15 million to measure the greenhouse gas benefits of their products and lower emissions of

commodities brought to market. Similarly, Truterra, LLC was awarded $90 million to expand the adoption of climate-smart practices for grain and dairy production in Indiana, amongst other states, through several methods, including soil management analysis.

- Other projects include $5 million to scale up robotic cover crop planting and verification of soil carbon through automated radiological sensing techniques and $95 million for the National Fish & Wildlife Foundation to facilitate long-term cover crop adoption (with Indiana included in the geographic scope).

STAKEHOLDER COMMENTS

IDEM selected this measure to include the agricultural sector and carbon sequestration options in the PCAP, though stakeholders also supported the measure. When survey respondents selected their top five measures, more than 40% of total respondents and those from priority LIDAC zip codes[10] selected the measure to implement agricultural best practices to promote soil health and carbon sequestration. Additionally, two municipal climate action plans highlighted agricultural best practices: Bloomington and Lafayette.

The main concerns voiced by community members included the need to ensure that proper training is available to farmers across Indiana and, additionally, ensure that farmers receive the support needed for success.

Table 45. Potential Community Benefits from Agriculture Best Practices

Potential Community Benefits
Reduced climate risks
Improved soil health
Improved water quality
Reduced energy use
Provide food and cover habitat for wildlife

COMMUNITIES IMPACTED BY MEASURE

Any community employing agricultural best practices (see Appendix B for a list of LIDAC census tracts) could benefit from this measure. Rural counties could see a more significant local impact on air quality and environmental benefits. Specific communities that may implement agricultural best practices have yet to be identified.

[10] See section 1.2.1 Identifying Priority communities for more detail on how these areas were defined.

GREENHOUSE GAS AND CO-POLLUTANT EMISSIONS REDUCTIONS

This analysis modeled the potential impact of the expanded adoption of agricultural best practices and USDA Natural Resources Conservation Service (NRCS) conservation practices on the sequestration and avoidance of greenhouse gas emissions.

Target Date 1: Increase the adoption of conservation practice standards from the NRCS. All percentages refer to Indiana's total farmland acreage.

- Cover Crop (CPS 340): 20% by 2030
- Conservation Crop Rotation (CPS 328): 100% by 2030
- Residue and Tillage Management – No-till (CPS 329): 30% by 2030
- Residue and Tillage Management – Reduced till (CPS 345): 65% by 2030

Target Date 2: Increase the adoption of conservation practice standards from the NRCS. All percentages refer to Indiana's total farmland acreage.

- Cover Crop (CPS 340): 50% by 2050
- Conservation Crop Rotation (CPS 328): 100% by 2050
- Residue and Tillage Management – No-till (CPS 329): 60% by 2050
- Residue and Tillage Management – Reduced till (CPS 345): 40% by 2050

Methods and Assumptions

For estimating the impact of cropland management practices on GHG emissions, IDEM used the Carbon Reduction Potential Evaluation tool (CaRPE) from the USDA (U.S. Department of Agriculture, 2023). The American Farmland Trust designed the CaRPE tool in collaboration with the USDA-Agriculture Research Service to explore historical and projected GHG mitigation potentials on U.S. agricultural lands resulting from the adoption of conservation practices. The CaRPE Tool scales the emission reduction coefficients (ERCs) extracted from the COMET-Planner (CarbOn Management & Emissions Tool) to the county level by coupling the coefficients with cropland acres from the 2017 Census of Agriculture (U.S. Department of Agriculture, National Agricultural Statistics Service, 2017). The COMET-Planner is a research-based tool developed through a collaboration between Colorado State University and the NRCS that provides estimates of the greenhouse gas impacts of conservation practices at the county level. The ERCs are expressed as tonnes of CO_2e reduction potential per acre per year and reflect the net effect of practice implementation on GHG emissions (mainly N2O) and carbon sequestration relative to reference case conditions (Bruner, et al., 2021). IDEM obtained baseline information regarding average percentages of cover crop acreage and of row crop acreage by tillage method from the Operational Tillage Information System (OpTIS), developed through a partnership between the Conservation Technology Information Center, Regrow, and The Nature Conservancy. The OpTIS dataset was last updated in September 2023 to include croplands in all lower 48 states. The NRCS conservation practices considered for this measure include:

- **Cover Crop (CPS 340):** Grasses, legumes, and forbs planted for seasonal vegetative cover (U.S. Department of Agriculture, Natural Resources Conservation Service, 2014).
- **Conservation Crop Rotation (CPS 328):** A planned sequence of crops grown on the same ground over a period of time (i.e., the rotation cycle) (U.S. Department of Agriculture, Natural Resources Conservation Service, 2014).
- **Residue and Tillage Management – No-till (CPS 329):** Limiting soil disturbance to manage the amount, orientation, and distribution of crop and plant residue on the soil surface year-round (U.S. Department of Agriculture, Natural Resources Conservation Service, 2016).
- **Residue and Tillage Management – Reduced till (CPS 345):** Managing the amount, orientation, and distribution of crop and other plant residue on the soil surface year-round while limiting the soil-disturbing activities used to grow and harvest crops in systems where the field surface is tilled before planting (U.S. Department of Agriculture, Natural Resources Conservation Service, 2016).

In the COMET-Planner, the two GHGs considered for each conservation practice are CO_2 and N_2O. Outputs from the CaRPE tool present results as CO_2e and do not include a co-pollutant analysis. There may be co-pollutant benefits from the expansion of conservation practices that can be assessed in the future.

Table 46. Emission Reductions Calculation Assumptions for Expanding Implementation of Agricultural Best Practices

Parameter	Assumption	Source
Baseline data for planted acreage in Indiana (2018-2022)	14.8 million acres of farmlands in 2021, including 5.4 million planted acres of corn and 5.7 million planted acres of soybeans.	(U.S. Department of Agriculture, National Agricultural Statistics Service, 2023)
Baseline average percentage of cover crop acres	7.0% in 2021	(Conservation Technology Information Center, 2023)
Baseline average percentage of row crops acres by tillage method	2021 statistics: - No-till: 21.1% - Reduced: 48.7% - Conventional: 12.4%	(Conservation Technology Information Center, 2023)
Baseline average percentage of crop rotation	96% in 2021	(The Nature Conservancy Indiana, 2021)

Results

The expanded adoption of NRCS conservation practices can contribute to GHG emissions reductions of 0.8 MMT CO_2e by 2030 and 4.3 MMT CO_2e by 2050 if the key metrics listed above are reached. These reductions are primarily driven by the expanded adoption of cover crop practices in 2030 and the expanded adoption of reduced tillage practices in 2050.

Table 47. Greenhouse Gas and Co-Pollutant Emissions Reductions for Expanding Implementation of Agricultural Best Practices

	GHG emissions reduction (MMT CO_2e)	Co-pollutant emissions reductions (short tons)*					
		NO_2	SO_2	$PM_{2.5}$	VOCs	CO	Hg
2030	**0.8**	n/a	n/a	n/a	n/a	n/a	n/a
2050	**4.3**	n/a	n/a	n/a	n/a	n/a	n/a

GHG and co-pollutant reduction estimates for expanded adoption of agricultural best practices. Values represent the quantified emissions for sequestration and avoidance during the 2025-2030 and 2025-2050 periods.
**Outputs from the CaRPE tool present results as CO2e and do not include a co-pollutant analysis. There may be co-pollutant benefits from the expansion of conservation practices that can be assessed in the future.*

Limitations and Conclusions

Additional conservation practices, including organic nitrogen application (CPS 328), mulching (CPS 484), and grazing land management practices, can be included in future analysis to provide a more comprehensive view of emission reduction potentials for the agricultural sector. Improvements in data collection will also provide more accurate estimates. Currently, OpTIS calculations used to determine cover crop and tillage percentages are performed at the farm-field scale using publicly available data. The data is regularly updated but presents some limitations, as field data accuracy is estimated to be 80% for cover crop data and 60% for tillage.

WORKFORCE DEVELOPMENT ANALYSIS

Expanding the implementation of agriculture best practices in Indiana requires a skilled and diverse workforce spanning various aspects of the agricultural industry. Agronomists and soil scientists are crucial for advising farmers on optimal crop management, soil health, and nutrient utilization. Agricultural engineers are key in developing and implementing sustainable technologies and irrigation systems. Agricultural educators and instructors are essential for disseminating knowledge about best practices and providing ongoing support to farmers. Precision agriculture specialists with technology and data analytics skills are needed to integrate smart farming practices, enhancing efficiency and sustainability. Skilled laborers may be required in order to implement changes, such as cover cropping, conservation tillage, and nutrient management.

With the proper partnerships and research, the expansion of agriculture best practices in Indiana can create jobs in research, education, technology, and field implementation, contributing to increased agricultural sustainability and resilience.

IMPLEMENTATION DETAILS

IDEM will coordinate with the agriculture community via the various associations to explore best practices and emission reduction initiatives. This will include the pursuit of funding opportunities and the provision of technical assistance as needed.

Funding

The availability of federal funding is important for the adoption of agricultural best practices in Indiana. Below are possible sources of funding to finance this measure.

Table 48. Federal Funding for Adopting Agricultural Best Practices

Funding Source	Federal Amount	Description
USDA's Partnerships for Climate-Smart Commodities https://www.usda.gov/climate-solutions/climate-smart-commodities	$3.1 billion available	Funding will help farmers produce climate-smart commodities, which are agricultural commodities produced using farming, ranching, or forestry practices that reduce greenhouse gas emissions or sequester carbon.
USDA's Forest Service Supporting Underserved and Small-Acreage Forest Landowner Participation in Emerging Private Markets https://www.fs.usda.gov/about-agency/state-private-forestry/coop-forestry/ira-forest-landowner-support	$450 million available	This program supports underserved and small-acreage forest landowner participation in emerging private markets for climate mitigation and forest resilience.

4. FUTURE ACTION

The near-term priority measures herein aim to reduce climate pollution and bolster Indiana's economy while enhancing the state's resiliency against environmental challenges. These actions serve as an initial roadmap for the state as it encourages activities that align with national goals, including those of the U.S. EPA's Climate Pollution Reduction Grants (CPRG) program. Through meetings, surveys, and interviews, more than 1,500 Hoosiers aided in the selection of this suite of priority measures, and communities within Indiana will continue to guide the state through its goals for greenhouse gas (GHG) and co-pollutant reduction.

It is essential for Indiana to secure funding for its plans through grants and other investment sources. Various programs and entities throughout Indiana leverage federal funding, and the state will continue to identify programs with aligned objectives to secure additional financial resources. The first step in this process will be Indiana's application for the CPRG Phase 2 Implementation Grants, a $4.6 billion pool of competitive grant funding to be awarded to applicants to fund the implementation of priority GHG reduction measures.

In 2024 and 2025, Indiana will expand upon this Priority Climate Action Plan by developing a Comprehensive Climate Action Plan (CCAP). This plan will include additional measures that Indiana will utilize to improve air quality, as well as statewide GHG emissions projections, a GHG reduction target, expanded community benefits and workforce analyses, and a deeper look into the funding and cost landscape of each GHG reduction measure. The CCAP will be a detailed map for public and private entities to reference for climate pollution reduction planning. Following the release of Indiana's CCAP, a Status Report will be released in 2027, outlining the next steps and updating the various conclusions presented in the CCAP.

APPENDIX A. DEFINITIONS AND ACRONYMS

Central Indiana Regional Development Authority (CIRDA)

Climate Pollution Reduction Grants (CPRG): a program through the U.S. EPA that provides a total of $5 billion in grants to states, local governments, tribes, and territories to develop and implement ambitious plans for reducing greenhouse gas emissions and other harmful air pollutants. See section 1.1 for more details.

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

Environmental Protection Agency (EPA)

Greenhouse Gas (GHG) Inventory: a list of emission sources and sinks as well as the associated emissions quantified using standard methods. The PCAP must include a "simplified" inventory.

Indiana Department of Environmental Management (IDEM)

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

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

APPENDIX B. LOW-INCOME AND DISADVANTAGED COMMUNITY CENSUS TRACT IDENTIFICATION

Source: (Council on Environmental Quality, 2021)

COUNTY	CENSUS TRACT ID
ADAMS COUNTY	18001030200
	18001030500
	18001030600
	18001030700
ALLEN COUNTY	18003000500
	18003000600
	18003000701
	18003000704
	18003000800
	18003000900
	18003001000
	18003001100
	18003001200
	18003001300
	18003001600
	18003001700
	18003002000
	18003002100
	18003002200
	18003002300
	18003002500
	18003002600
	18003002800
	18003002900
	18003003000
	18003003100
	18003003301
	18003003304
	18003003500
	18003003600
	18003003700
	18003004000
	18003004300
	18003004400
	18003010604
	18003011100
	18003011201
	18003011202

	18003011302 18003011303 18003011304 18003011501 18003980002
BARTHOLOMEW COUNTY	18005010100 18005010800 18005011100
BENTON COUNTY	18007100200 18007100300
BLACKFORD COUNTY	18009975100 18009975200 18009975300
CASS COUNTY	18017951200 18017951300 18017951400 18017951500 18017951600
CLARK COUNTY	18019050200 18019050303 18019050306 18019050401 18019050403 18019050504 18019050603 18019050903
CLINTON COUNTY	18023950500 18023950800
CRAWFORD COUNTY	18025951900 18025952000 18025952100
DAVIESS COUNTY	18027954300 18027954500 18027954700 18027954800 18027954900
DEARBORN COUNTY	18029080300
DECATUR COUNTY	18031969100 18031969300
DEKALB COUNTY	18033020800
DELAWARE COUNTY	18035000300 18035000400 18035000600

	18035000902 18035000903 18035001200 18035001300 18035001400 18035001500 18035001600 18035001700 18035002000 18035002100 18035002602 18035002800
DUBOIS COUNTY	18037953800
ELKHART COUNTY	18039000100 18039001501 18039001701 18039001702 18039001901 18039002102 18039002200 18039002300 18039002400 18039002600 18039002700 18039002900
FAYETTE COUNTY	18041954100 18041954300 18041954400 18041954500
FLOYD COUNTY	18043070200 18043070400 18043070500 18043070700 18043070801 18043070902
FOUNTAIN COUNTY	18045957700 18045957900
FRANKLIN COUNTY	18047969700 18047969900
FULTON COUNTY	18049953300
GRANT COUNTY	18053000100 18053000200 18053000400 18053000600

	18053000700 18053000900 18053010300 18053010400 18053010500 18053010600
GREENE COUNTY	18055954702 18055955100 18055955200
HAMILTON COUNTY	18057110700
HANCOCK COUNTY	18059410400 18059410500
HARRISON COUNTY	18061060100
HENRY COUNTY	18065976000 18065976100 18065976300 18065976500 18065976600
HOWARD COUNTY	18067000200 18067000300 18067000400 18067000500 18067000600 18067000900 18067001100 18067001200
HUNTINGTON COUNTY	18069961600 18069961800
JACKSON COUNTY	18071967600 18071967800 18071967901 18071967902
JASPER COUNTY	18073101100
JAY COUNTY	18075962700 18075962800 18075963000 18075963100 18075963200 18075963300
JEFFERSON COUNTY	18077966500 18077966600
JOHNSON COUNTY	18081611300
KNOX COUNTY	18083955000 18083955300 18083955400

	18083955500
KOSCIUSKO COUNTY	18085961900
	18085962700
LAGRANGE COUNTY	18087970100
	18087970401
	18087970402
LAKE COUNTY	18089010201
	18089010203
	18089010205
	18089010302
	18089010304
	18089010400
	18089010500
	18089010600
	18089010900
	18089011000
	18089011100
	18089011200
	18089011300
	18089011400
	18089011500
	18089011600
	18089011700
	18089011800
	18089011900
	18089012000
	18089012100
	18089012200
	18089012300
	18089012400
	18089012500
	18089012600
	18089012700
	18089012800
	18089020300
	18089020400
	18089020500
	18089020600
	18089020700
	18089020800
	18089021000
	18089021100
	18089021400
	18089021700

	18089021800 18089021900 18089022000 18089030100 18089030200 18089030300 18089030400 18089030500 18089030600 18089030700 18089030800 18089030900 18089031000 18089040100 18089040200 18089041100 18089041200 18089041302 18089041400 18089041500 18089041600 18089041700 18089042100
LAPORTE COUNTY	18091040100 18091040300 18091040600 18091040700 18091040800 18091040900 18091041300 18091041400 18091042100 18091042300 18091042400 18091043000
LAWRENCE COUNTY	18093950800 18093950900 18093951100 18093951300
MADISON COUNTY	18095000300 18095000400 18095000500 18095000800 18095000900

	18095001000 18095001200 18095001400 18095001700 18095001800 18095001900 18095002000 18095010200 18095010300 18095010600 18095011600 18095011900 18095012000
MARION COUNTY	18097310305 18097310306 18097310312 18097320108 18097320902 18097320903 18097321001 18097322000 18097322500 18097322600 18097330106 18097330202 18097330500 18097330600 18097330700 18097330803 18097330804 18097330805 18097330806 18097330900 18097331000 18097340102 18097340108 18097340201 18097340202 18097340300 18097340400 18097340500 18097340600 18097340700 18097341100

	18097341200 18097341600 18097341700 18097341903 18097341904 18097342101 18097342200 18097342300 18097342400 18097342500 18097342600 18097350100 18097350300 18097350400 18097350500 18097350600 18097350700 18097350800 18097350900 18097351000 18097351200 18097351500 18097351700 18097351900 18097352100 18097352300 18097352400 18097352500 18097352600 18097352700 18097352800 18097353600 18097354500 18097354700 18097354800 18097354900 18097355000 18097355100 18097355300 18097355400 18097355500 18097355600 18097355700 18097355900

	18097356400 18097356900 18097357000 18097357100 18097357200 18097357300 18097357400 18097357500 18097357600 18097357800 18097357900 18097358000 18097358100 18097360101 18097360102 18097360201 18097360202 18097360301 18097360302 18097360401 18097360402 18097360404 18097360502 18097360601 18097360602 18097360800 18097360900 18097361200 18097361300 18097370201 18097370202 18097380100 18097380200 18097380300 18097380402 18097380501 18097380502 18097380600 18097380700 18097380800 18097381001 18097381203 18097381204 18097390102

	18097390500 18097390700
MARSHALL COUNTY	18099020101 18099020201 18099020302 18099020400 18099020500
MIAMI COUNTY	18103952200 18103952300 18103952400 18103952500 18103952700 18103952900
MONROE COUNTY	18105000100 18105000601 18105000602 18105001101
MONTGOMERY COUNTY	18107957200
MORGAN COUNTY	18109510701 18109510800 18109510900
NEWTON COUNTY	18111100400 18111100500 18111100600 18111100700
NOBLE COUNTY	18113971800
ORANGE COUNTY	18117951300 18117951500 18117951700 18117951800
OWEN COUNTY	18119955500 18119955600 18119955700 18119955800
PARKE COUNTY	18121030300
PERRY COUNTY	18123952600
PIKE COUNTY	18125954200
PORTER COUNTY	18127050503
POSEY COUNTY	18129040700
PULASKI COUNTY	18131959100
RANDOLPH COUNTY	18135951600 18135951800 18135951900
RIPLEY COUNTY	18137968600
RUSH COUNTY	18139974500

SCOTT COUNTY	18143966700 18143966800
SHELBY COUNTY	18145710400 18145710601 18145710602
SPENCER COUNTY	18147953100
ST. JOSEPH COUNTY	18141000100 18141000200 18141000301 18141000302 18141000400 18141000500 18141000600 18141000900 18141001000 18141001100 18141001500 18141001700 18141001900 18141002000 18141002100 18141002200 18141002300 18141002400 18141002500 18141002600 18141002700 18141002800 18141002900 18141003000 18141003300 18141003400 18141003500 18141010100 18141010200 18141010700 18141011100 18141011501 18141011506
STARKE COUNTY	18149953800 18149954000 18149954200
STEUBEN COUNTY	18151971000
SULLIVAN COUNTY	18153050100 18153050300

	18153050400
SWITZERLAND COUNTY	18155965700
	18155965800
	18155965900
TIPPECANOE COUNTY	18157000100
	18157000200
	18157000400
	18157000700
	18157000800
	18157001200
	18157001400
	18157001700
	18157010300
	18157010500
	18157011100
TIPTON COUNTY	18159020400
VANDERBURG COUNTY	18163000100
	18163000800
	18163000900
	18163001000
	18163001100
	18163001200
	18163001300
	18163001400
	18163001500
	18163001700
	18163001800
	18163001900
	18163002000
	18163002100
	18163002300
	18163002400
	18163002500
	18163002600
	18163002800
	18163003200
	18163003300
	18163003600
	18163010100
VERMILLION COUNTY	18165020500
VIGO COUNTY	18167000300
	18167000400
	18167000500
	18167000600
	18167000700

	18167000900 18167001100 18167001200 18167001300 18167001500 18167001700 18167001800 18167001900 18167010202 18167010500 18167011100
WABASH COUNTY	18169102400 18169102600 18169102700 18169102800
WASHINGTON COUNTY	18175967200 18175967300 18175967500
WAYNE COUNTY	18177000200 18177000500 18177000600 18177000900 18177001000 18177010600
WELLS COUNTY	18179040400 18179040600
WHITE COUNTY	18181958200 18181958600
WHITLEY COUNTY	18183050500

APPENDIX C. IDEM STAKEHOLDER ENGAGEMENT

The following table outlines meetings, focus groups, and interviews used to gather feedback and input from stakeholders interested in participating in the planning process. Additional stakeholders provided input through surveys and email, while many other groups received outreach via phone, email, and other formats. Outreach will continue through the development of the Comprehensive Climate Action Plan to expand participation.

Group/Organization	Date	Representation	
City of Bloomington	9-20-2023		ClimeCo
Michiana Area Council of Governments (MACOG)	9-22-2023		ClimeCo
NAACP IN Chapter	9-29-2023	IDEM	ClimeCo
Indianapolis Metropolitan Planning Organization (IMPO) / Central Indiana Regional Development Authority (CIRDA)	Multiple dates	IDEM	ClimeCo
Interagency Workgroup	Multiple dates	IDEM	
Indianapolis Public Meeting	10-10-2023	IDEM	ClimeCo
Fort Wayne Public Meeting	10-24-2023	IDEM	ClimeCo
Hoosier Environmental Council	10-26-2023	IDEM	ClimeCo
Earth Charter	10-30-2023	IDEM	ClimeCo
Indiana University Environmental Resilience Institute (ERI)	10-31-2023	IDEM	ClimeCo
Purdue University	10-31-2023	IDEM	ClimeCo
Portage Public Meeting	11-2-2023	IDEM	ClimeCo
Duke Energy	11-3-2023	IDEM	
Ferdinand Public Meeting	11-8-2023	IDEM	ClimeCo
Indiana Energy Association Environmental Committee	11-10-2023	IDEM	
NAACP	11-13-2023	IDEM	ClimeCo
NiSource	Multiple dates	IDEM	ClimeCo
Indiana University Health	11-16-2023	IDEM	
Indiana Chamber of Commerce, Indiana Manufacturers Association, and Indiana Energy Association	11-16-2023	IDEM	ClimeCo
City of New Albany	11-29-2023	IDEM	ClimeCo
Ahimsa Schools	11-30-2023	IDEM	ClimeCo
Agriculture Sector (Indiana Pork, Indiana Farm Bureau, Purdue University, Indiana Dairy, Indiana Department of Agriculture, and others)	11-30-2023	IDEM	ClimeCo
Gary Ministries	12-1-2024	IDEM	ClimeCo
City of Gary	11-30-2023	IDEM	ClimeCo
City of Carmel	12-4-2023	IDEM	ClimeCo
Greater Lafayette	12-6-2023	IDEM	ClimeCo
Solar United Neighbors	12-7-2023	IDEM	ClimeCo
Fort Wayne Leaders and Ministries	1-4-2024	IDEM	ClimeCo
Indiana Green Bank	1-5-2024	IDEM	
Northwestern Indiana Regional Planning Commission (NIRPC)	1-8-2024	IDEM	
Drive Clean Indiana	1-10-2024	IDEM	
Gary Public Meeting	2-1-2024	IDEM	ClimeCo
Evansville Public Meeting	2-8-2024	IDEM	ClimeCo

APPENDIX D. REFERENCES

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