MARYLAND COMMISSION ON CLIMATE CHANGE

Just Transition Employment and Retraining Working Group Study

Forward

The Maryland legislature enacted critical emissions reductions targets through the Maryland Climate Solutions Now Act of 2022 (CSNA). The CSNA is a Maryland law that requires a combination of stakeholders across industries and agencies to consider the long-term emissions impacts of their policies and efforts. Due requirements set by the CSNA, the Maryland Department of the Environment (MDE) released the Climate Pollution Reduction Plan in 2023, which mapped a viable pathway for achieving these emissions reductions. The Plan was complementary to statewide priorities created by Gubernatorial priorities that fundamentally aimed to "Leave No One Behind."

The MDE has also highlighted the crucial role of distributed energy asset ownership and maintenance in the energy transition, thereby creating new economic opportunities and fostering local community resilience. To this aim, MDE has convened the Maryland Commission on Climate Change (MCCC) and affiliated Just Transition Employment and Retraining Working Group (JTWG) to support clean and renewable energy solutions while championing community economic development opportunities. This study satisfies the requirements established by the CSNA of 2022 and is designed to inform the state's decision-making on how to mitigate burdens imposed by these changes on impacted populations.

This study was completed with the support of the Maryland Commission on Climate Change Just Transition Employment and Retraining Working Group with funding from the U.S. Climate Alliance

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List of Acronyms

BEPS	Building Energy Performance Standards
BEV	Battery Electric Vehicles
CEJST	Climate and Economic Justice Screening Tool
CSNA	Climate Solutions Now Act of 2022
DAC	Disadvantaged Community
DCFC	DC Fast Chargers
ECF	Employment Carbon Footprint
EV	Electric Vehicle
GHGs	Greenhouse Gases
HEV	Hybrid Electric Vehicles
ICEV	Internal Combustion Engines
IRA	U.S. Inflation Reduction Act
JTWG	Just Transition Employment and Retraining Working Group
LCOE	Levelized Cost of Energy
LQ	Location Quotient
L2	Level 2 EV Chargers
MCCC	Maryland Commission on Climate Change
MDE	Maryland Department of the Environment
MEJ	Maryland Environmental Justice
NREL	National Renewable Energy Laboratory
OEM	Original Equipment Manufacturer
PHEV	Plug-in Hybrid Electric Vehicles
PV	Photovoltaic (solar)
RMW	Residential and Multifamily Weatherization
RPS	Renewable Energy Portfolio Standard
SEIF	Strategic Energy Investment Fund
SLOPE	State and Local Planning for Energy
SVI	Social Vulnerability Index
WAP	Weatherization Assistance Program

Executive Summary

The Maryland Department of the Environment (MDE) commissioned a multi-step analysis intended to inform decision-making and recommendations for a just workforce transition that aligns with state policy. Maryland's goals of reducing greenhouse gas emissions by 60% by 2031 and ultimately achieving net-zero emissions by 2045 opens communities to the possibility of energy-transition economic and workforce impacts. Maryland's Climate Solutions Now Act of 2022 (CSNA) required the creation of a Just Transition Employment and Retraining Working Group (JTWG) to identify strategies and make recommendations for the investment of public resources focused on community and workforce development. This JTWG met seven times in 2024 and hosted at least ten presentations and discussions on a variety of programs and topics relevant to just workforce transitions. The working group also drafted three recommendations for the Maryland Commission on Climate Change (MCCC). We partnered with this working group to complete analyses intended to inform the working group's strategy development and satisfy the study requirements established in the CSNA. The first step of this analysis included a statewide community (i.e. counties or cities) survey geared toward selecting prioritized communities for further analysis. This analysis resulted in the calculation of percentile scores indicating vulnerability to the energy transition for each Maryland county and in the prioritization of six counties for further study. The second component of the study modeled opportunities for energy efficiency and decarbonization in counties that had been prioritized in the first task. These scenarios informed potential strategy development for reducing energy costs and meeting Maryland energy goals, including the identification of renewable energy technologies with the greatest generation potential, and energy efficiency measures with the greatest potential for impact across commercial and residential buildings. Finally, the study assessed the economic and workforce impacts of implementing these strategies by analyzing both the supply- and demand-sides of the current and future Maryland workforce. This analysis resulted in the identification of potential economic impacts, including the potential decline in petroleum fuel consumption and increase in electricity demand resulting in both positive and negative economic and workforce impacts.

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Programmatic Summary

This study seeks to assess opportunities and barriers for communities impacted by Maryland's energy transition. It also seeks to provide the Maryland Commission on Climate Change's Just Transition Working Group (JTWG) with relevant information and analysis to support strategic decision-making. The JTWG is tasked with advising the MCCC on equitable workforce development and training and throughout 2024, hosted presentations and discussions relevant to just workforce transitions. The working group also developed seven guiding principles and drafted three recommendations for the Maryland Commission on Climate Change (MCCC).

The study entailed three primary tasks with periodic progress reports made to the JTWG for their input in helping to guide and inform the study's next steps. The first task of the study consisted of a statewide community survey to assess which communities are most vulnerable to the consequences of the energy transition to ascertain potential opportunities for positive impactful intervention. After completion of the first task, a report was made to the MCCC's JTWG with recommendations for next steps, culminating in a selection of priority communities for further analysis.

The second task included a decarbonization opportunity assessment focused on the priority communities identified in task one. This opportunities assessment identified key areas, technologies, or measures where investment or policy could have the greatest impact in reaching Maryland's energy goals.

Finally, the third task entailed development of a career pathways evaluation, informed by the strategies identified in the second task. This analysis assessed both the supply- and demand-side of the Maryland workforce to identify occupational growth opportunities related to Maryland's energy transition, and the necessary workforce initiatives helpful in realizing those opportunities.

Current Landscape

Maryland has been a leader in climate initiatives for some time and has several near- and long-term goals for reducing greenhouse gas (GHG) emissions and improving energy efficiency. In 2022 Maryland enacted the Climate Solutions Now Act (CSNA) that made changes to Maryland's approach to reducing GHG emissions and requires a sixty percent reduction from 2006 levels by 2031 and net-zero emissions by 2045. Among other goals, the CSNA also established Building Energy Performance Standards (BEPS) and requires certain covered buildings to benchmark energy data and reduce GHG emissions.

Among the initiatives undertaken by Maryland to advance their goals are the development of an "Maryland Environmental Justice" screening tool (MEJ) that includes a climate vulnerability score for the state's communities, and a Renewable Energy Portfolio Standard (RPS) that guides the diversification of energy generation technologies and requires that a minimum portion of retail electricity be met through renewable sources. The Working for Accessible Renewable Maryland Thermal Heat (WARMTH) Act passed in 2024 requires Maryland gas companies serving at least 75,000 customers to develop a plan for a pilot thermal energy network system, while the Promoting Offshore Wind Energy Resources (POWER) Act of 2023 and Next Generation Energy Act of 2025 sets a goal for significant offshore wind energy generation by 2031 and provides for new nuclear energy generation initiatives. These laws focused on networked geothermal, nuclear, and offshore wind energy illustrate

Maryland's commitment to utilizing all available renewable energy technologies to meet statewide goals and provide reliable and low-cost heat sources to residents. In 2019, the Maryland General Assembly enacted the Clean Energy Jobs Act (CEJA) that, in addition to raising the RPS target to 50% by 2030, also required the Maryland Power Plant Research Program (PPRP) under the Maryland Department of Natural Resources (DNR) to prepare a study assessing the cost, benefits, and feasibility of increasing the RPS to 100% by 2040 (100% Study). The study was eventually expanded to also assess a 100% Clean Energy Standard (CES). The Regional Greenhouse Gas Initiative (RGGI) is a regional policy that Maryland leads and has provided funding for clean energy projects for many years through the Strategic Energy Investment Fund (SEIF). More information about current Maryland legislation and initiatives can be found in appendix C.

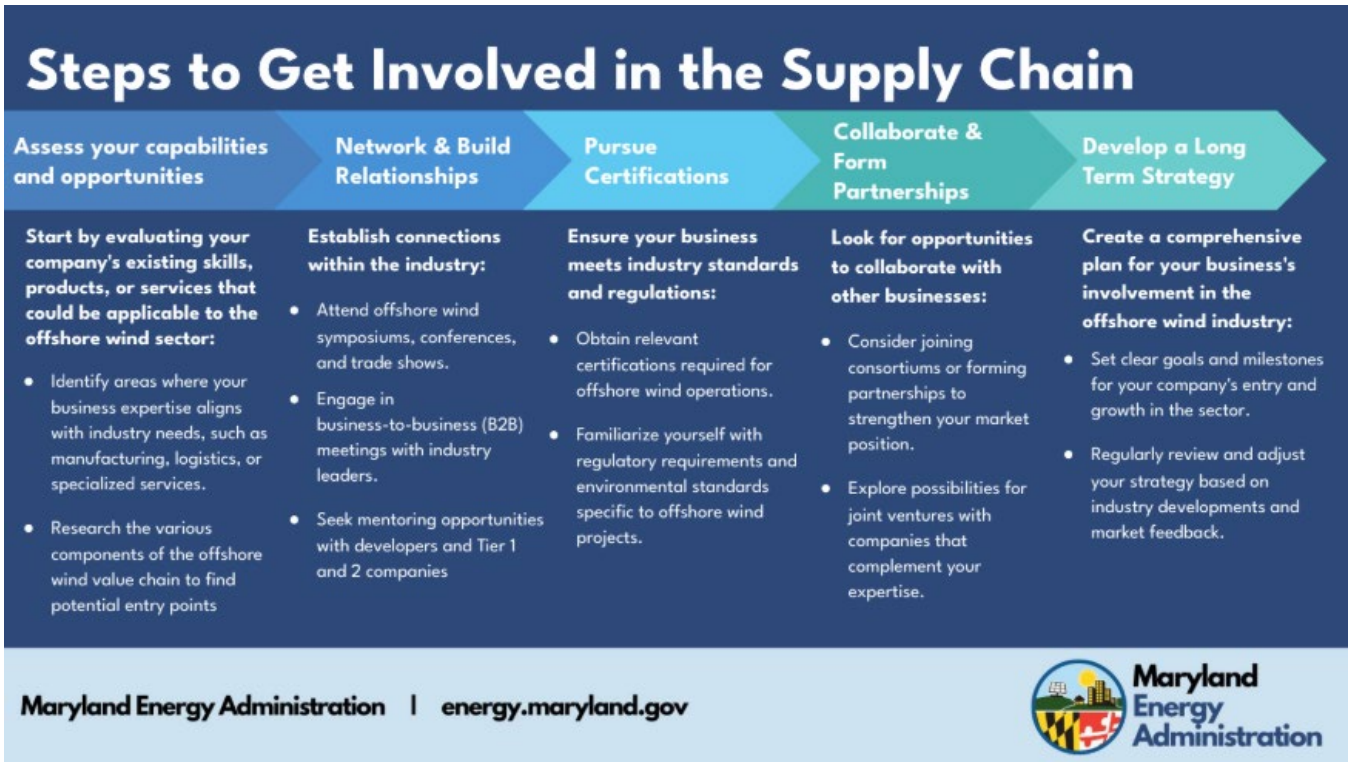

Figure 1. Maryland Energy Administration Supply Chain Graphic

Figure 2. Maryland Energy Administration Workforce Graphic

While legislation such as the CEJA of 2019 and the CSNA of 2022 establish goals for the state, they may require additional planning and discussion to be fully implemented. Plans to achieve these goals include investments in home electrification, electric vehicle incentives, commercial building efficiency, critical infrastructure improvements, and investments in natural working lands such as forest and wetlands management, tree planting and maintenance, and other projects helpful in carbon storage. Many of these legislative acts require various state agencies, such as MDE, to first conduct analysis into potential opportunities, strategies, or impacts. For example, the POWER Act required an analysis of transmission system upgrade and expansion options, while the CSNA required state agencies to consider the long-term climate and equity impacts of their policies. These strategic investments and incentives build upon existing initiatives, such as utility-led energy efficiency programs, and target high-impact measures. This study identifies impacts and opportunities on local workforce within the current and changing landscape and helps provide analysis and information to inform strategic decision-making.

Study Design

In collaboration with MDE, we identified several key considerations for the study to best support the JTWG's goals and priorities. These key considerations formed the basis for the study support strategy and helped determine how certain tasks were undertaken. Key considerations for the study were:

- Prioritization: Identify issues and opportunities specific to energy efficiency and clean energy technologies rather than general workforce and economic development opportunities.

- Industries and Trades: Identify energy-intensive industries and trades not immediately recognized as energy-impacted and assess sector-specific impacts on the workforce.

- Transferrable Skills: Identify avenues to maximize existing skills and expertise in new energy roles and career pathways.

- Education and Training: Provide resources for education and training in skills valuable to clean energy and energy efficiency careers for disadvantaged communities and underrepresented populations.

- Stakeholder Engagement: Develop strategies and resources for engaging with communities and connecting them with resources and opportunities.

The study was also designed to integrate two core principles:

1. to consider "Leave No One Behind" in all tasks, analyses, and strategies; and

2. to utilize the tasks and analyses completed in the initial study to develop a model for prioritization and strategy development that can be expanded across the state.

Study Task 1: Statewide Community Survey

Many of Maryland's policies and programs established to achieve their net-zero emissions goals have resulted in ongoing changes to the energy landscape. These changes impact local economies and provide opportunities for workforce development and new industry career pathways. The first task of this study was a statewide community survey consisting of an emissions intensity analysis and a just transitions analysis with the goal of prioritizing communities for future, more in-depth assessment. This statewide assessment formed the basis for future initiatives or analysis by developing a model which others can use to assess and prioritize communities based on the communities' exposure to energy transitions.

The emissions intensity analysis provided a metric for how closely communities and local economies are tied to fossil-fuel intensive industries. Strong emissions intensity indicates that the local economy is closely linked to energy-intensive industries and may be more vulnerable to energy transition impacts. To build upon this, the just transition analysis combined energy-justice metrics with the emissions intensity outputs to better identify communities most likely to face disruption and to benefit from interventions. The changing energy landscape and transition to renewable energy technologies from fossil-fuels can impact such communities by potentially reducing energy burdens and improving public health outcomes and opening new career pathways within the renewable energy and energy-efficiency industries. These positive outcomes can be most impactful in underserved and overburdened communities, but these same communities are also most vulnerable to adverse experiences throughout the transition.

To ensure healthier and more positive outcomes and mitigate any potential negative effects on communities or local economies, this study considered "just workforce transition plans." Just workforce transition plans are strategies developed to identify and address potential impacts of an energy transition. For example, a just workforce transition plan may identify job loss as a potential impact of the energy transition due to the closure of a coal mine or other fossil-fuel generation site. The just workforce transition plan will then identify career opportunities, transferable skills, and training programs to ensure that communities that face job loss have immediately available resources to transition impacted individuals into a new field.

Methodology

The research team identified publicly available data for use in the study. These publicly available datasets and models provided information on several factors including carbon emissions, employment, population demographics, and other energy-specific datapoints. After identifying the available data, we synthesized a combined dataset for use in the study. This dataset included both the raw datapoints and calculated variables when available. More information on the specific datasets can be found in the data sources section below.

The data models utilized often included a calculated variable or metric based on the raw data, such as disadvantaged community determinations or percentile scores. These calculated scores and variables ranged in their applicability to the study goals and just transition principles. To best assess community vulnerability to energy transition disruption, and to provide the JTWG with a comprehensive analysis to guide their decision-making, three weighted models were developed. Each model included all available datapoints but weighted one factor more heavily than others. This allowed working group members to prioritize certain factors based on their relevance to various working group goals and principles.

Final analysis was completed at the county level and resulted in four calculated percentile scores for each county across the state: One unweighted percentile score and three weighted percentile scores, one for each weighted model.[1] The results of the analysis were presented to the JTWG's members with the goal of determining six priority communities for the remaining study tasks.

Data Sources

Publicly available data was collected to conduct both the emissions intensity and just transition analyses. The study evaluated publicly available datasets and data models for suitability based on the geographic scale of the data and how applicable it was to the study. Five were chosen, all of which were highly applicable to the study and assessed data points at the county or census tract level. All sources were combined to produce a comprehensive dataset for the emissions intensity and just transition analyses. The primary variable of each dataset was:

- *Inflation Reduction Act (IRA) Energy Community*: The IRA defines an energy community as a "statistical area" that has significant employment or revenue related to fossil fuels and has an unemployment rate at or above the national average. Energy communities can also be defined as a community in which a coal mine has closed after 1999; or in which a coal-fired electric generating unit has been retired after 2009.[2]

- *Climate and Economic Justice Screening Tool (CEJST) Disadvantaged Communities (DACs)*: CEJST DACs are communities that meet a minimum threshold for specified burden categories or are located on federally recognized tribal land. Burden categories include climate change risk, energy cost, health outcomes, housing underinvestment, legacy pollution, transportation, water and wastewater, and workforce development factors.[3]

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[1] For this study, "county" refers to all 23 counties in Maryland, plus the city of Baltimore.
[2] At the time of publication, this data set is no longer publicly available
[3] https://dataverse.harvard.edu/dataset.xhtml?persistentId=doi:10.7910/DVN/B6ULET

- *Employment Vulnerability to Energy Transition*: The Employment Carbon Footprint (ECF) is a calculation of metric tonnes carbon dioxide equivalent (CO_2e) per employee. CO_2e is a measurement that compares the impact of different GHGs on the climate. This model assesses how exposed a community is to economic shock or disruption from the elimination of fossil fuels.[4]

- *Maryland Energy Justice (MEJ) Screening Tool*: The MDE's environmental justice screening tool identifies overburdened and underserved communities in Maryland using Maryland-specific legal definitions and models. The tool assesses pollution burden exposure, pollution burden environmental effects, sensitive populations, and socioeconomic or demographic indicators.[5]

- *Social Vulnerability Index (SVI)*: The SVI ranks communities on 15 social factors from four overarching themes. Themes include socioeconomic status, household composition and disability, minority status and language, and housing type and transportation.[6]

Statewide Community Survey: Results

After synthesizing a comprehensive data set from the five selected data sources, we calculated an unweighted percentile score for each county. This score reflected all selected data with no prioritization of variables. These unweighted percentile scores provided an initial assessment of counties across the state that may be vulnerable to disruption due to energy transition or qualify as disadvantaged or underserved. See figure 3 for all unweighted percentile scores.

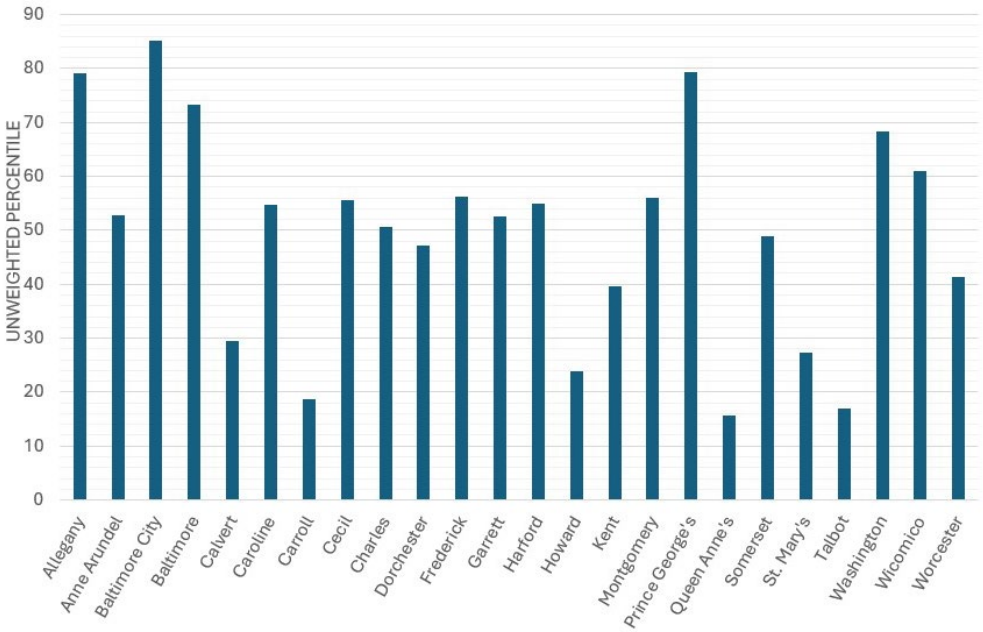

Figure 3. Unweighted percentile scores by county

[4] https://www.pnas.org/doi/10.1073/pnas.2314773121
[5] https://mde.maryland.gov/Environmental_Justice/Pages/EJ-Screening-Tool.aspx
[6] https://maps.nrel.gov/slope/data-viewer?filters=%5B%5D&layer=eej.svi&year=2018&res=county

Weighted data models

Because some datapoints were more relevant to the study goals than others, three weighted models were developed to prioritize certain factors in the overall scoring. This resulted in the calculation of three additional percentile scores for each county. Although IRA energy communities and CEJST DACs are both useful to inform the analysis, these models were both developed to target specific datapoints or serve specific communities. As such, these two data sources were determined to be less relevant to the study goals. A weighted model was developed for each of the three remaining data sources.

- The ECF model is a direct calculation of employment vulnerability to the energy transition. This model is best aligned with just workforce transition goals but relies on national data and utilizes limited socioeconomic variables. A map of percentile scores for the ECF model can be found in the Appendix in figure A-1.

- The SVI assesses the broadest range of social factors of all the data sources. This model does not focus on emissions intensity and relates to energy primarily through energy affordability and public health outcomes. A map of percentile scores for the SVI model can be found in figure A-2.

- The MEJ weighted model utilizes a state-specific data screening tool and focuses on overburdened and underserved communities as defined by Maryland policy and developed for MDE. A map of percentile scores for the MEJ model can be found in figure A-3.

Priority Community Selection

The goal of the statewide community survey was to provide the information and analysis needed to select up to six priority communities for further analysis and strategy development. After calculating the four percentile scores for each Maryland county, the scores were mapped across the state to provide a visual and geographical reference for the analysis results. The JTWG expressed the need for geographic diversity in the results to ensure that the priority community selection was not limited to rural, urban, coastal, or western counties. The top ten counties from each weighted model were calculated and revealed significant overlap. This resulted in a list of eleven counties that had the highest percentile scores across all three weighted models. When these counties were mapped across the state, they showed an appropriate level of geographic diversity as reflected in figure 4.

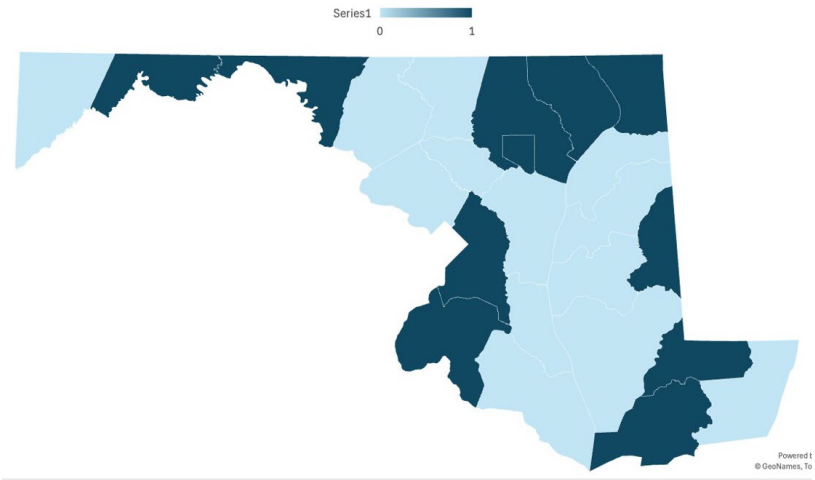

Figure 4. Top counties from each weighted model

As the study called for the selection of only six priority communities for further analysis, this list of eleven counties was further refined to the top six counties in each weighted model. This resulted in a list of seven counties across all three weighted models. These counties, and other study results, were presented to the JTWG in November 2024 to facilitate discussion and selection of up to six counties for further analysis. The top counties and their percentile scores can be found in table 1. Based on the greater propensity of Washington County to be ranked sixth, the rest of the study excluded Caroline County. Instead, it focused analysis on Allegany, Baltimore, Prince George's, Washington, and Wicomico Counties, plus Baltimore City.

Table 1. Top Six Counties

*In the SVI model, Caroline County ranked sixth, while Washington County ranked seventh. In all other models, Washington County ranked sixth and Caroline County fell outside of the top six counties

County	Unweighted Percentile	ECF Percentile	SVI Percentile	MEJ Percentile
Allegany	79.032	79.011	75.282	77.154
Baltimore City	85.087	77.464	83.528	84.558
Prince George's	79.327	71.379	75.627	78.053
Washington*	68.357	65.908	58.664	67.266
Baltimore	73.346	64.639	67.079	72.035
Wicomico	61.011	64.189	68.302	69.213
Caroline*	54.698	60.204	59.691	62.791

Study Task 2: Opportunities Assessment

Building on the results of the statewide community survey, task two utilized the State and Local Planning for Energy (SLOPE) tool to assess energy scenarios in the six counties prioritized through task one. The goal of this task was to understand the opportunities available to Maryland in transportation, energy efficiency, and renewable technology deployment that might inform workforce needs and implications. This task provided a thorough assessment of opportunities to reduce GHG emissions throughout the six prioritized counties in task one and continued to develop a scalable methodology for this study that could be completed across the state. While task two did not directly address workforce transition strategies, the opportunities assessment helped to identify priority industries and needs in the current and future landscape of Maryland with direct implications for Maryland's workforce. Further, the task continued in the down-selection of prioritized communities, to provide the JTWG with a narrowed focus for the final task of the study. This down-selection reduced the number of communities from the six identified in task one to three communities for further workforce analysis, allowing the study to more deeply assess career pathways and needs related to Maryland's energy goals.

Methodology

SLOPE is an accessible online platform that assists energy planners in making data-driven decisions at state and local levels. The tool utilizes two functions, the data viewer and scenario planner, to visualize energy planning scenarios and help communities prioritize initiatives to meet their goals. For this study, the SLOPE tool was utilized to complete a multi-step analysis intended to inform decision-making and

assist the JTWG in identifying recommendations for decarbonization planning and a just workforce transition.

The first step in assessing opportunities for Maryland involved completing business-as-usual reference cases for each of the six counties. This provided a foundation on which to base further analysis. These business-as-usual case references identified energy consumption and CO_2 emissions by industry which were then further analyzed throughout the study. These business-as-usual reference cases also identified key findings from each county, such as counties with the highest commercial energy consumption or highest potential for energy efficiency impact. These findings helped guide the rest of the opportunities assessment by providing research questions for further assessment.

After completing the business-as-usual reference case analyses for each county, five areas for further analysis were identified:

- Broad emissions reduction energy scenarios
- Transportation sector data
- Energy generation technology potential
- Energy efficiency data
- Social data and demographics.

These focus areas were used to develop assessment strategies and research questions for each of the six prioritized counties. The key areas and research questions utilized to guide the analysis were modeled for each of the six counties identified in study task 1. This resulted in several scenarios that illustrated the potential of various initiatives for each county. These scenarios were then refined for the counties with the strongest potential for impact, resulting in study results that highlight both what interventions could be most impactful, as well as where.

Opportunities Assessment: Results

The SLOPE analysis revealed unique characteristics for each of the six counties which were overlayed on a map to illustrate the key findings and implications from each county. This revealed that across the prioritized counties, transportation accounted for the highest share of energy consumption and CO_2 emissions. Further, high-emissions counties like Baltimore and Prince George's were revealed as strong targets for decarbonization programs and investment strategies where such investment may have the most impact. Energy efficiency measures were assessed and the analysis showed that strategies focused on commercial sectors had potential for high impact in Washington, Baltimore, and Wicomico counties.

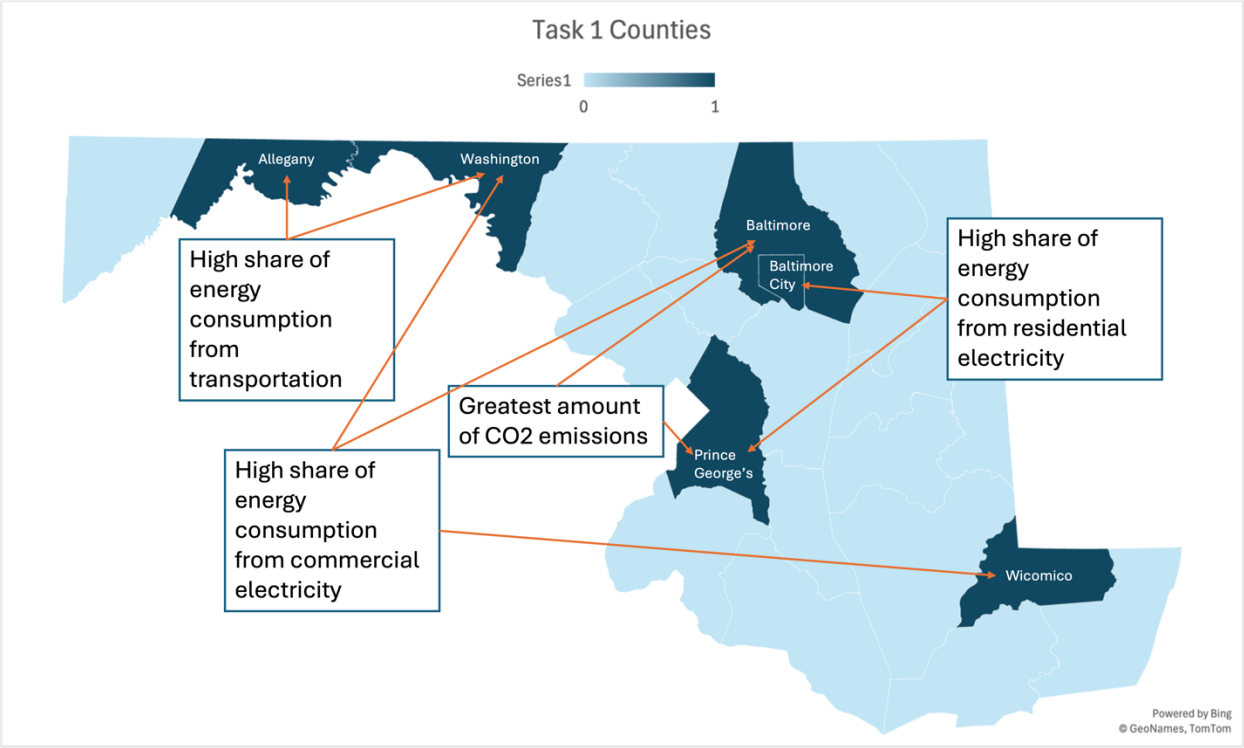

Figure 5. Key findings from each county

To refine the study and demonstrate where various initiatives might have the strongest impact, scenarios were modeled for each county and then further refined for counties showing the greatest impact. Results for these counties in the key areas are as follows.

Transportation

Transportation was quickly identified as the largest sector for energy consumption across the state. As such, this was a key area for potential decarbonization opportunities. Vehicle fuel consumption models can help jurisdictions anticipate the impact of vehicle electrification and electric vehicle infrastructure development. Further, it can help jurisdictions identify pathways for reducing air pollution, traffic, and emissions. Finally, although energy consumption may not decrease through vehicle or transportation electrification, these shifts may help reach emissions reduction goals.

Analysis showed that in a widespread vehicle electrification scenario, Allegany County, which had a high share of energy consumption and emissions from transportation, could cut emissions by 22% when compared to the reference case by 2050.

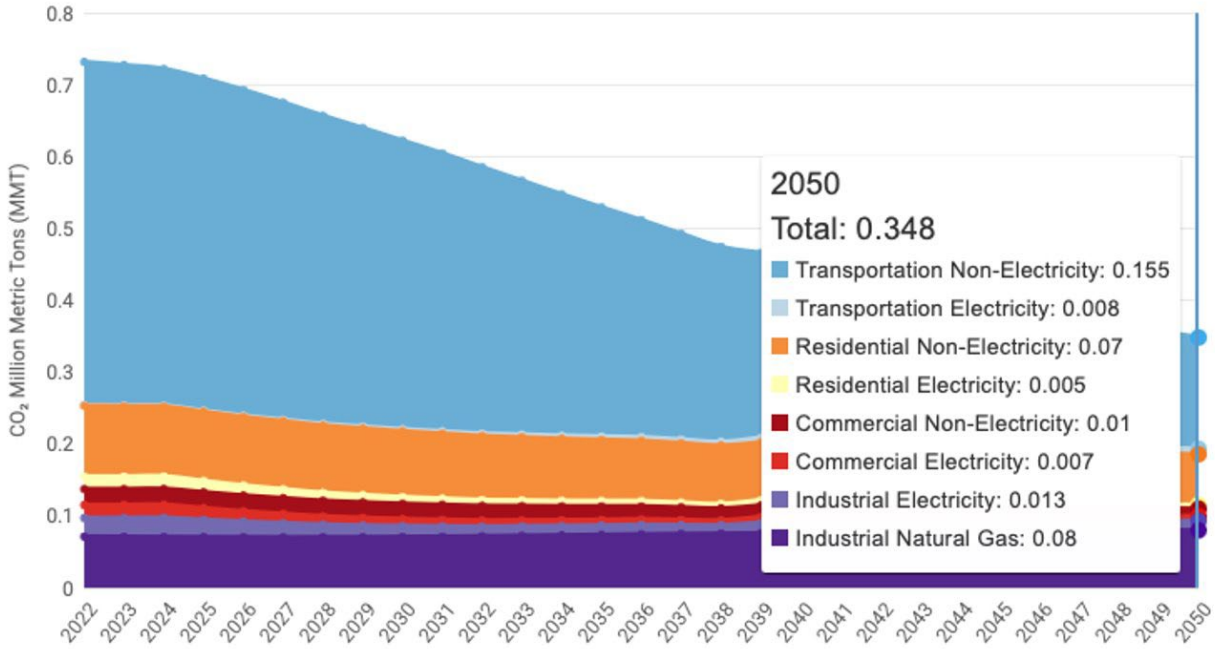

Figure 6. CO2 Emissions and transportation electrification scenario in Allegany County

A high-electrification scenario was modeled for Washington County, which also showed high energy consumption from transportation, and revealed potential reduction of light-duty vehicle gasoline consumption by 72%. In this scenario, light-duty electric vehicle use would increase significantly, and electricity demand would increase by 380 GWh. This scenario indicated that transportation energy consumption is not likely to decrease, but electrification could address the emissions implications of such high energy consumption.

Energy Generation Technology Potential

To meet Maryland's RPS goals, the study assessed the potential of renewable energy technologies to help counties estimate the energy generation potential in their jurisdictions, as well as which technologies show the greatest potential. Another important consideration to energy technology is the levelized cost of energy (LCOE), which can help determine feasibility for a given community. The LCOE measures the lifetime cost of energy and calculates the present value of the total cost of implementing and operating energy technology over its presumed lifetime. This metric helps to compare different energy generation technologies that have varied costs of implementation and maintenance as well as different anticipated sizes and lifespans.

Analysis showed that the renewable energy technologies with the highest generation potential across the six counties, as well as the lowest LCOE were land-based and distributed wind energy and utility-scale solar. Geothermal energy generation was not considered in these scenarios as the dataset did not have sufficient data to provide reliable projections for geothermal energy generation. Recent reports on geothermal energy generation in Baltimore indicate that the thermal state in the Baltimore region is not conducive to cost-effective geothermal energy generation, but more data is needed to assess how new technologies could improve the economic requirements for deep geothermal initiatives (Karimi &

Marsh, 2022). Models of generation potential and LCOE for renewable technologies were repeated across all six counties and some references cases can be seen in figures 7 and 8.

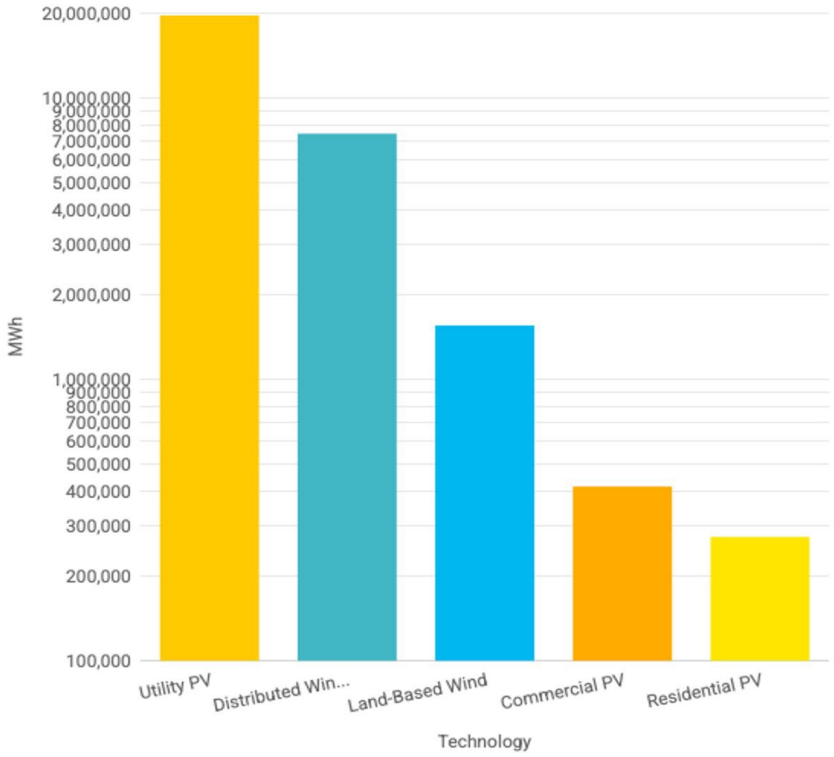

Figure 7. Modeled Annual Technical Generation Potential for Multiple Technologies in Washington County

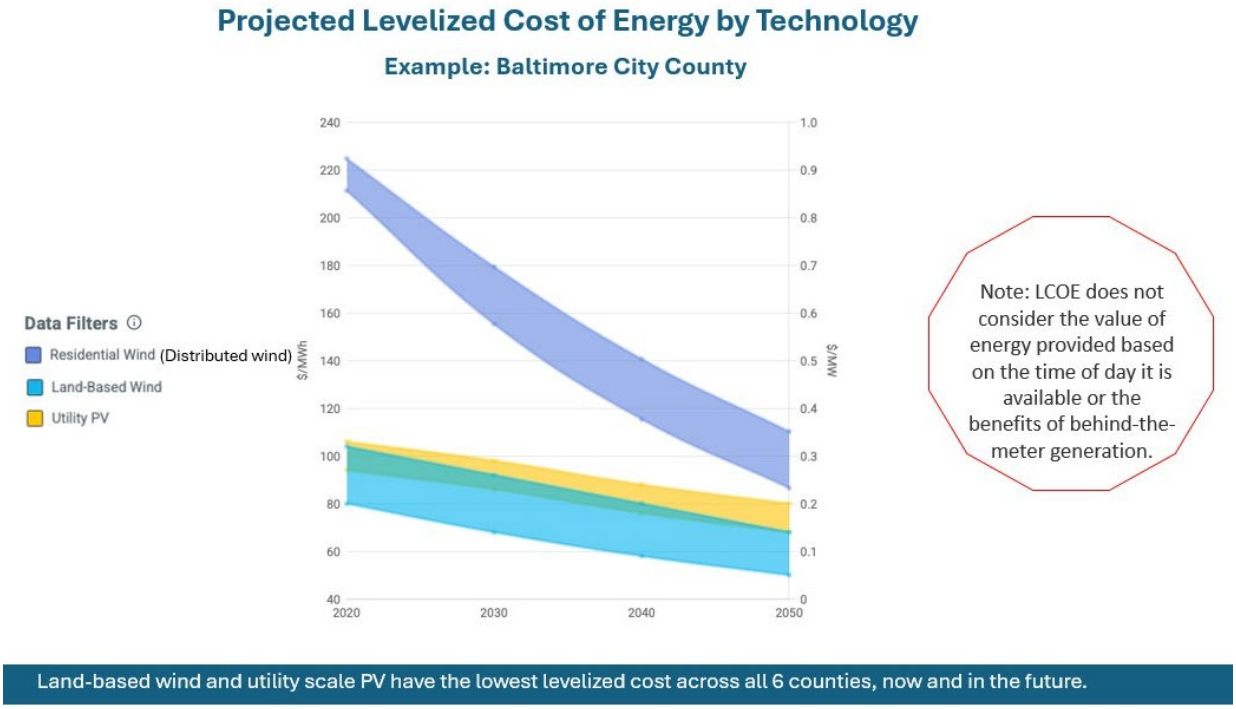

Figure 8. Projected LCOE by Technology for Baltimore City

Energy Efficiency Potential

SLOPE modeling of energy efficiency scenarios was completed to identify strategies and measures that could assist Maryland in reaching building energy performance goals set forth in the CSNA. The scenarios modeled could help counties understand the energy efficiency measures with the greatest potential for impact across all building types. While some identified measures may be utilized in existing programs, the analysis aimed to determine how public or private investment could have the most impact through existing or new programming.

For single-family residential buildings, the greatest potential for electrical savings were identified as electric furnace and baseboard heating upgrades to variable speed and ductless heat pumps, drill and fill wall insulation, and heat pump water heaters. These measures are all Weatherization Assistance Program (WAP) eligible measures, a well-established program with existing processes for identifying and retrofitting homes. With the requisite workforce and funding, WAP program existing infrastructure could assist in implementing these measures across the state.

Building area in the respective counties was modeled to determine what type of commercial buildings should be targeted for energy efficiency measures. This showed that multifamily buildings and industrial buildings had the largest share of commercial building area across the six counties. Statewide scenarios showed that electricity savings potential was greatest for commercial buildings that upgraded interior lighting to LED and added advanced hybrid rooftop units (RTUs) – a type of commercial HVAC system that combines heat pump technology with gas furnace technology allowing for fuel switching depending on conditions.

Social Considerations

The study analyzed social vulnerability, energy burden, and renewable energy job estimates to help Maryland develop strategies to meet future energy workforce needs and target investments in underserved areas. Further, demographic information can help counties plan for decarbonization strategies that benefit vulnerable populations.

While study task one assessed social vulnerability and environmental justice data to assist in the prioritization of six counties across the state, this was further modeled to determine which of the six counties showed highest social vulnerability and energy burden. This modeling was completed to identify where measures described in sections 5.1, 5.2, and 5.3 of this report might have the greatest impact on Maryland residents. Additionally, this served to further refine the prioritization of counties for the study and narrow the focus for study task three down to just three counties rather than the initial six. This down-selection of counties was done to ensure thorough workforce and career pathway analysis could be completed for study task three.

Results of this assessment showed that Baltimore City and Wicomico County ranked the highest in social vulnerability, and household energy burden was highest in Allegany and Wicomico counties. This data could help target programs and investments in areas where households spend a higher percentage of their income on energy and transportation costs.

To address energy burden, the study assessed what portion of low to moderate income (LMI) household electricity could be offset with renewable technologies like distributed solar. Analysis showed the

greatest potential for solar offset in LMI homes across the six counties was in renter occupied homes, either single or multi-family. Potential strategies that focus on renter access to, or multifamily building owner incentives for rooftop solar may be impactful.

Workforce modeling of renewable energy industry scenarios showed that renewable energy jobs are likely to increase, with Solar PV jobs expected to provide the greatest number of renewable energy jobs in Maryland with a projected 9,806 jobs in the state by 2030. Overall employment opportunities in renewable energy sectors could provide 19,986 Maryland jobs by 2030 in an accelerated deployment scenario.

Strategy Development and County Selection

Results of study task two indicated strategies that could have the greatest impact on Maryland's goals and indicated which of the initial six counties could offer the greatest opportunity for impact. The study identified three counties: Allegany, Wicomico, and Baltimore as strong opportunities for both residential and commercial building energy efficiency. Further, these counties were identified as producing higher emissions than other counties and having higher energy costs than the other counties identified in task one. It should be noted that Baltimore County surrounds but does not include Baltimore city. Measures and strategies identified in the opportunities assessment for further analysis were building energy efficiency measures, multifamily housing energy offsets, wind and solar PV growth, and transportation electrification. These measures and strategies were assessed for workforce and local economic impact across the three identified counties.

Study Task 3: Career Pathways Analysis

The implementation of energy saving opportunities identified in the SLOPE analysis across transportation, power generation and building energy efficiency has the potential to create and displace workers in different industries. Hence, it became essential to understand benefits that will be generated in each county and the rest of the state of Maryland, as well as any negative impacts to workforce/businesses and how to address those, especially in terms of transitioning workers to new positions.

For this task, the three counties -Allegany, Baltimore, and Wicomico - were assessed to determine how implementation would impact the local workforce and economy. The study first analyzed the economic impacts of proposed strategies in Maryland and then assessed the demand side of the workforce by determining the skills and occupations required for implementation of new technologies, or demand growth of certain occupations due to increased or incentivized use. Next, the analysis examined the supply-side of the Maryland workforce, identifying training programs, capacities, and reskilling opportunities for occupations that may be negatively impacted by energy or technology transitions.

Methodology

To analyze the economic impacts and demand-side workforce implications, the study combined data from SLOPE's baseline and scenarios to estimate the potential net impacts of each type of intervention in terms of economic, jobs and workforce metrics. These estimates were based on IMPLAN, a widely used economic modeling system for input-output analysis and commonly applied framework for economic impact analysis (Miller and Blair, 2022). Input-output models capture multiplier effects in the local economy that arise from purchases and sales across different supply chains, as well as the

expenditure of wages back in the region. Therefore, IMPLAN's estimates are broken down as direct (immediate economic impact from the change in demand), indirect (from supply chain linkages) and induced (resulting from the spending of wages/salaries by workers) in the region. This analysis includes total temporary and permanent jobs supported, occupations, changes in regional GDP and economic activity, taxes and labor income.

Supply-side workforce analysis was completed by first assessing county workforce data to understand how accessible the workforce was within Allegany, Baltimore, and Wicomico counties and what skills and occupations were represented. A workforce readiness index (Liu et al., forthcoming) was used to assess each county's readiness for decarbonization strategies outlined in study task two. This index is made up of sub-indices, two of which, the workforce availability sub-index and the transportation access sub-index, are technology agnostic. These sub-indices assess the general labor market condition and county transportation infrastructure respectively, while the remaining two sub-indices directly assess information relevant to the specific scenarios outlined in the study. The transferrable skills sub-index looks specifically at occupation lists associated with each decarbonization strategy, while the program availability sub-index considers related education, training, or apprenticeship programs associated with target occupations. This information helps determine which counties may have higher or lower readiness within the workforce to meet new industry needs, or to transition laborers into new occupations. For each of the three counties, the study then analyzed the industry base to determine trends for job gains, losses, and competitive industries. Relatedness of various occupations was scored to determine transition pathways for lost or decreasing roles into in-need occupations – specifically within the green workforce. This workforce can generally be defined as roles within the renewable energy, energy efficiency, sustainable agriculture, or conservation sectors including any roles within the larger supply chain.

Demand-Side Workforce Analysis

Transportation impacts were estimated for vehicle manufacturing, fuels, charging equipment, and vehicle maintenance. Vehicle prices for internal combustion engines (ICEV), hybrid (HEV), plug-in hybrid (PHEV) and battery electric (BEV) vehicles were based on Burnham (2021), and manufacturing costs were broken down for each vehicle type using a similar methodology from a previous study (Jeffers et al., 2022) to account for changes in parts requirements and vehicle battery production. The study assumed that the difference in ICEV not sold in Maryland would be sold outside the state (Figure 9). Because the state does not have any large original equipment manufacturers (OEMs) all impacts were allocated to the rest of the US. Electric vehicle supply equipment (EVSE) requirements were estimated for each county using DOE's EVI-Pro Lite[7] tool and the total number of plug-in vehicles in the area (Figure 10). Installation and equipment costs for level 2 (L2) chargers (residential and public) and DC fast chargers (DCFC) were derived from Borlaug et al. (2020), where EVSE manufacturing was assumed outside the state. Fuel consumption (Figure 11) includes both a decline in purchases of petroleum refined fuels (proxied by gasoline) due to the reduction in ICEV/HEV and an increase in electricity use. The decline in the ICEV fleet reduces demand for gasoline stations, related truck transportation and fuel wholesale in the county (we assumed that unsold fuel in Maryland is sold in other states), while the expansion in the PHEV and BEV fleets increases local electricity consumption. Regional EIA prices were used for fuel and electricity to estimate the economic impacts of this scenario.

[7] https://afdc.energy.gov/evi-x-toolbox#/evi-pro-ports

Finally, vehicle maintenance data from Burnham (2021) and total miles traveled by vehicle type were combined to estimate local net effects of a smaller ICEV fleet and bigger BEV fleet (Figure 12).

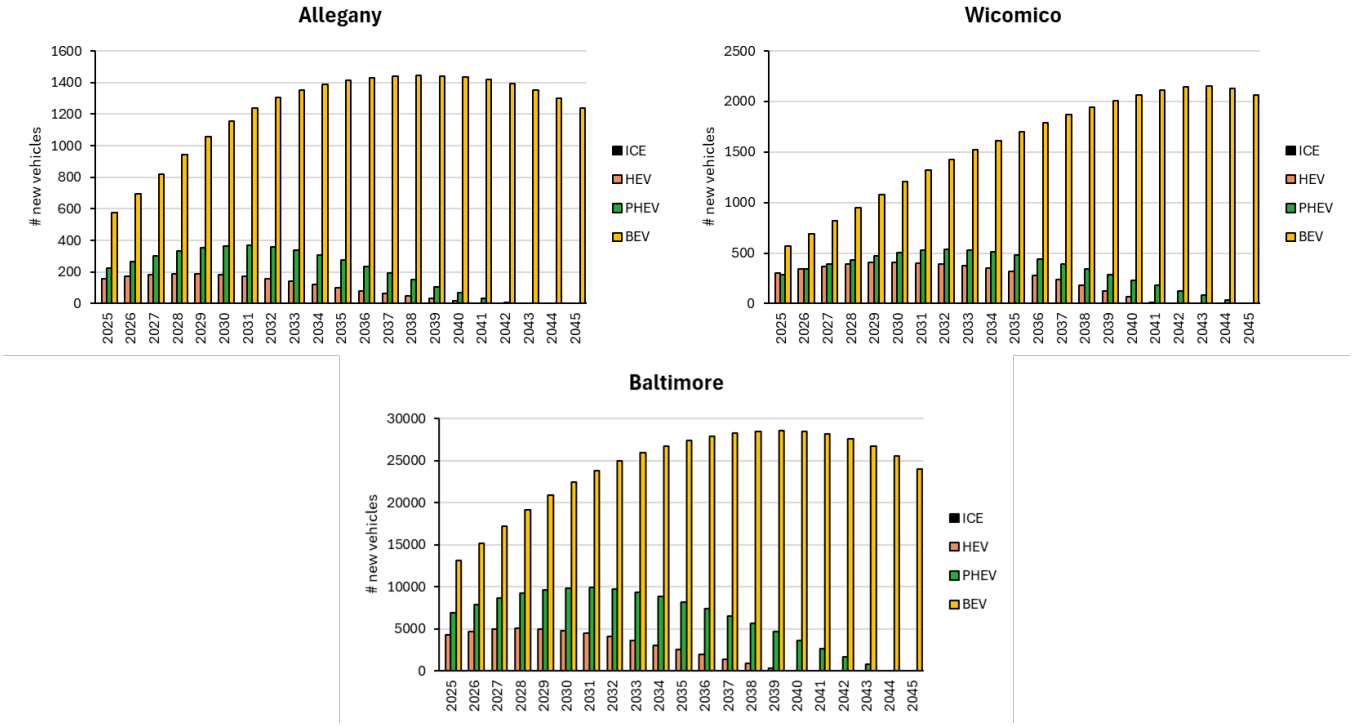

Figure 9. Evolution of new light-duty vehicles by type and county, 2026-2045

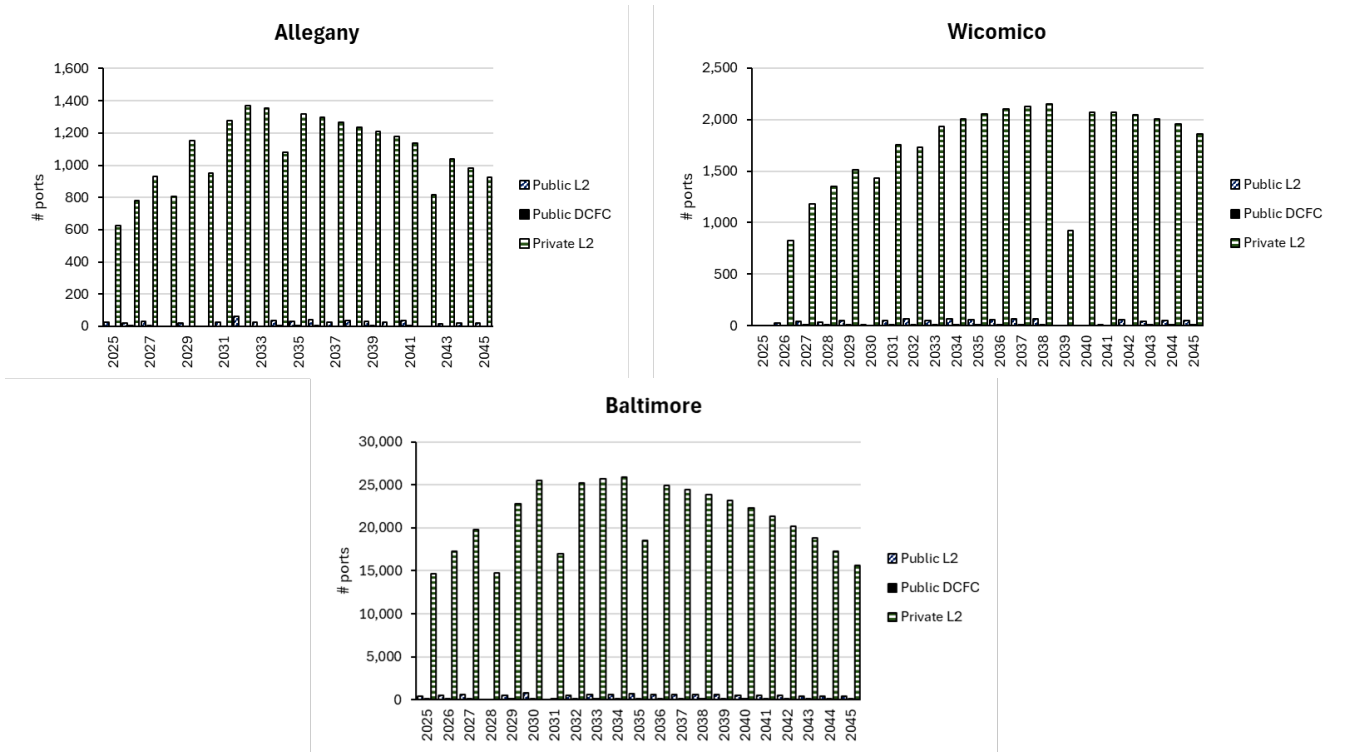

Figure 10. Evolution of EVSE installations by type and county, 2026-2045

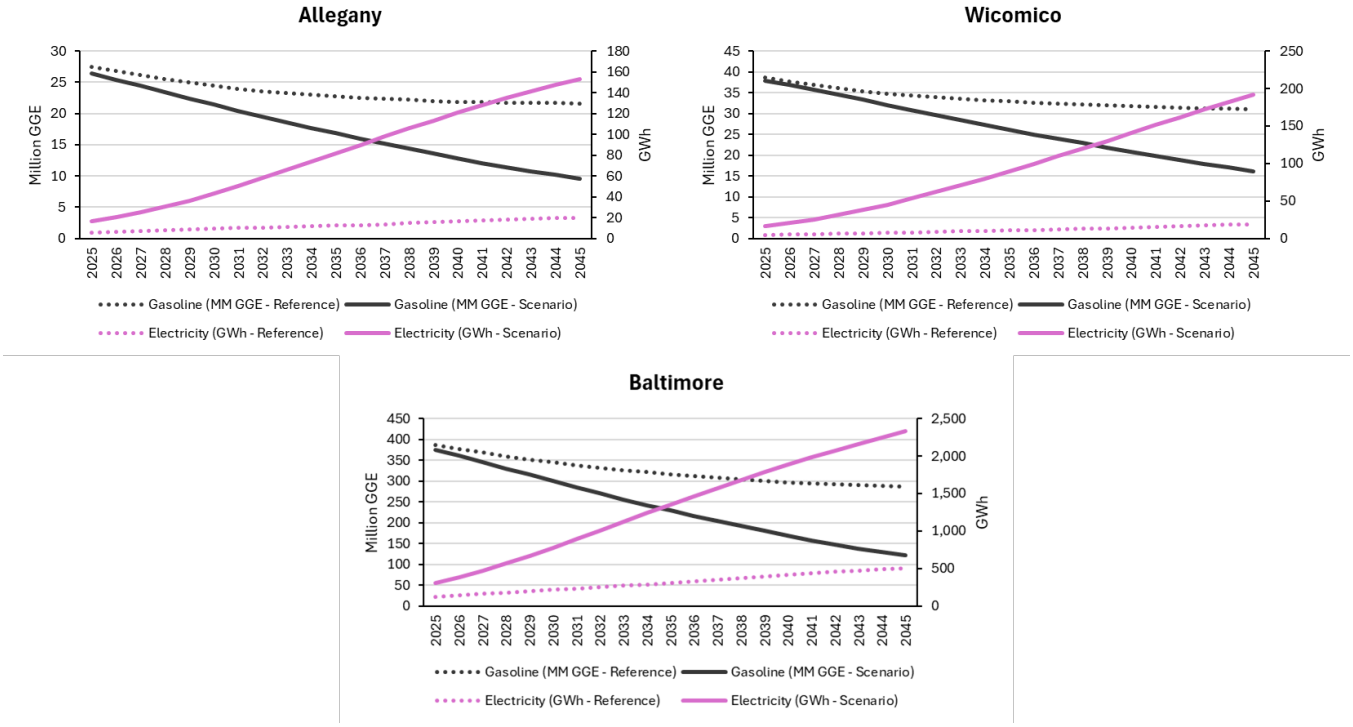

Figure 11. Evolution of gasoline and electricity consumption (vehicle charging) by type and county, 2026-2045

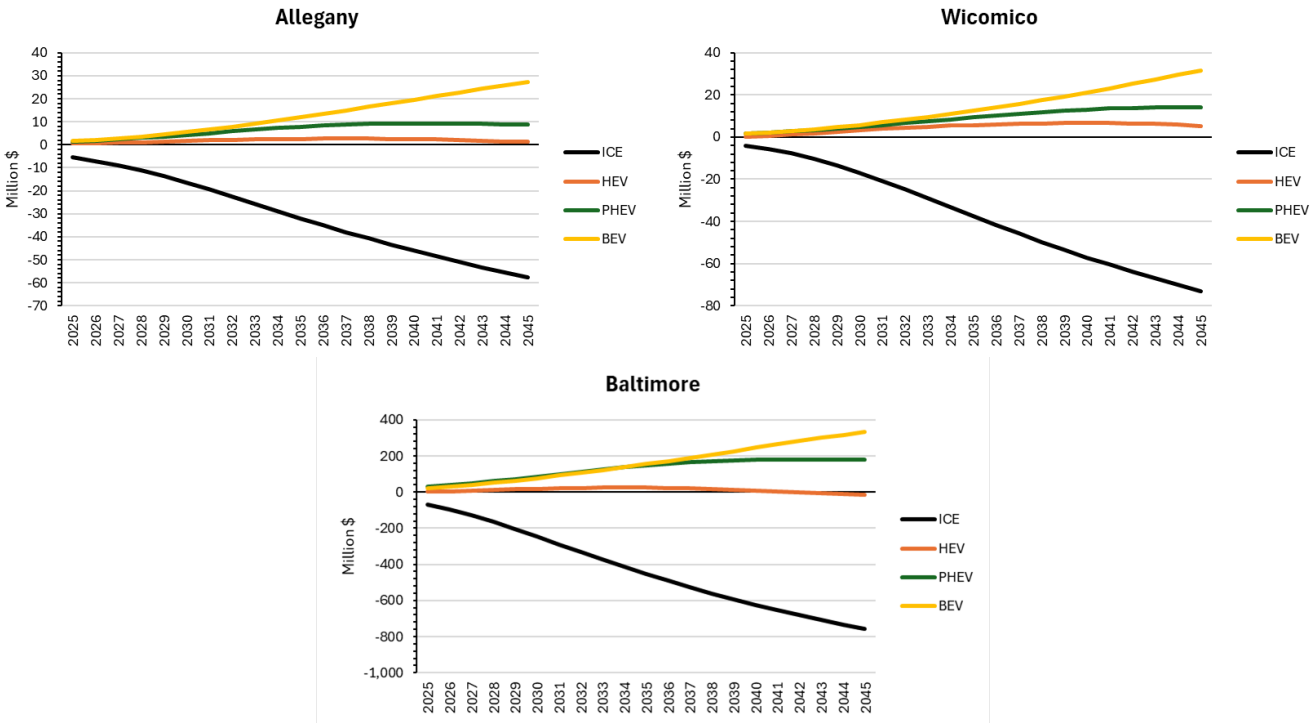

Figure 12. Evolution of vehicle maintenance expenses by type and county, 2026-2045

Power generation impacts were estimated based on the net difference between 2023 ReEDS Standard Scenarios (Mid-Case and Mid-Case with 100% decarbonization by 2035). In these scenarios, only solar capacity is added in the selected Maryland counties between 2026 and 2045 (Figure 13). Construction and operation costs for solar plants were based on data from the JEDI model[8] and Franco-Solis et al. (2024). The impacts were allocated locally using average regional purchase coefficients from IMPLAN.

[8] https://www.nrel.gov/analysis/jedi/models

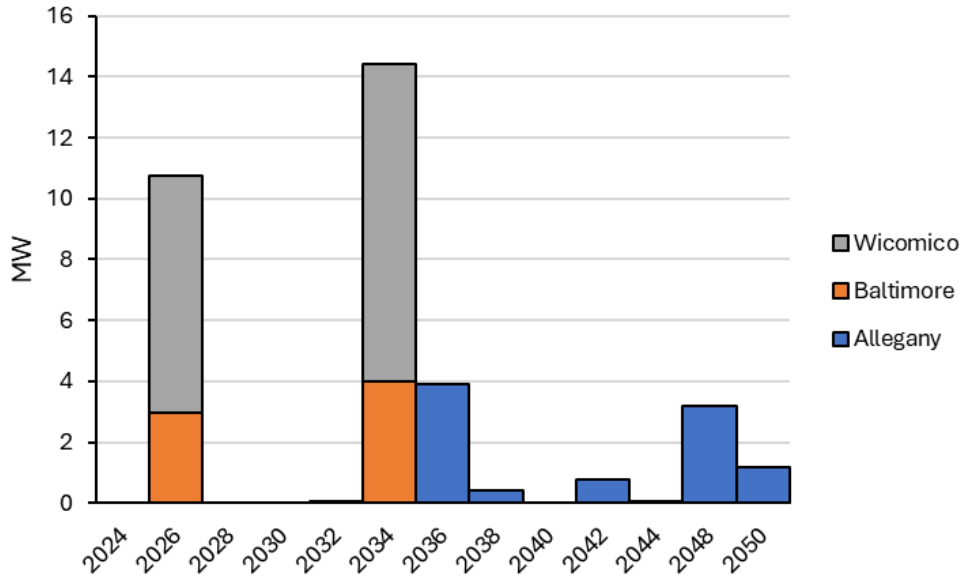

Figure 13. Solar power additions per year and county

The costs of implementing building energy efficiency measures identified in SLOPE were estimated using underlying data from NREL's ComStock model[9]. For this analysis the study focused on commercial buildings only, and on the following measures: interior and external LED light upgrades, advanced hybrid rooftop unit upgrades, rooftop unit direct expansion air conditioner (IEER 17.0) upgrades, wall and roof insulation and window film installation (Figure 14). Equipment and construction costs for each measure were obtained from RSMeans data (Gordian, 2019, 2022, 2023), and all impacts were allocated in the respective county using average regional purchase coefficients from IMPLAN.

[9] https://comstock.nrel.gov/, ComStock Standard Dataset Release 2024 Release 2 - 2018 Weather

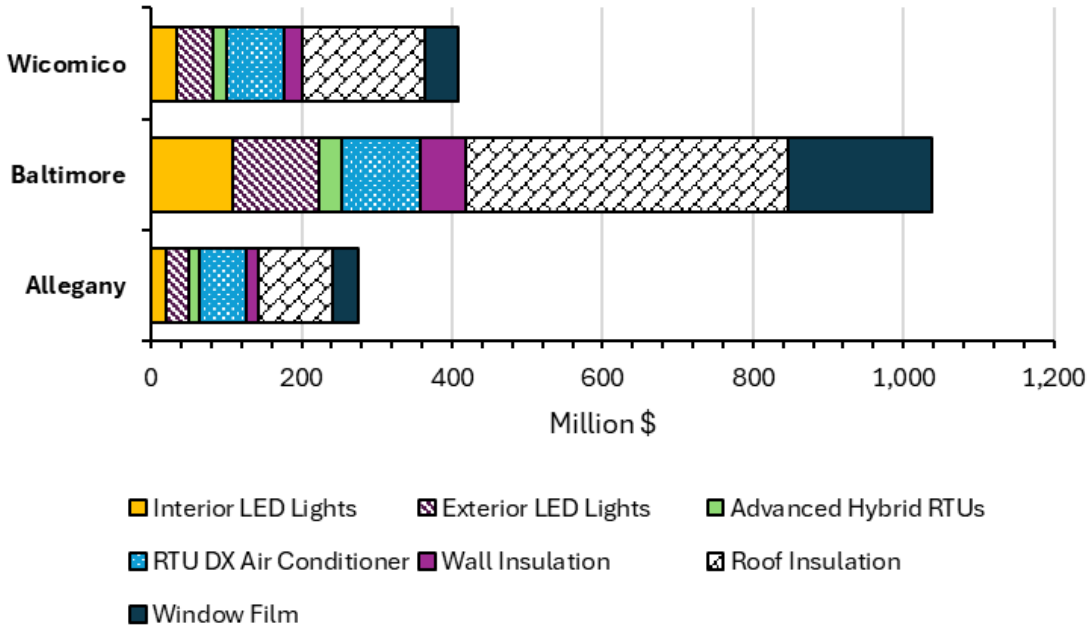

Figure 14. Costs of building upgrades if fully implemented in each county

Results were estimated for each county (Allegany, Baltimore and Wicomico), the rest of Maryland (RoMD) and the rest of the US (RoUS) between 2026-2045. Cumulative results for economic activity (sectoral gross output), labor income, regional GDP and taxes for all opportunities were found. Jobs are reported differently for temporary impacts (e.g., construction, manufacturing) and longer-term impacts (e.g., power plant operation, vehicle maintenance, fuel consumption). For temporary impacts, the analysis shows average jobs supported per year over the period, while for longer-term impacts, it shows total jobs created over the period. Occupations are shown in a similar way. Jobs include both proprietor and wage and salary workers, while occupations only cover wage and salary workers. Outcomes from this analysis provided demand data which informed the workforce supply analysis below and can be found detailed in tables B-4 through B-27.

Important caveats and assumptions: (1) the study did not model the impact of energy savings on households or companies: energy savings through building upgrades, reduced annual vehicle maintenance, savings on fuel demand, etc. create additional income to families and additional cash flow to businesses. The way these economic agents will spend this additional money back into the economy was not accounted for in this analysis; (2) the analysis used a static economic model: it relied on the 2023 Maryland input-output table from IMPLAN to estimate impacts and did not consider any structural changes that may result from these measures being implemented or the expected evolution of the economy by 2045; (3) price effects are not accounted for: any changes to prices are not considered in this model. More result figures can be found in Appendix B.

Supply-Side Workforce Analysis

Percentiles for workforce availability were calculated using a workforce readiness index (Liu et al., forthcoming) which ranks counties across the state by percentile. These percentiles calculate an average workforce availability and accessibility percentile. Workforce availability refers to the number of individuals within the labor market able and willing to fill open positions, while accessibility refers to

the ability of those available workers to access jobs, either through public transit or private auto commutes. The labor market condition is a key pillar of workforce availability – the sub-index that evaluates the current and near-term potential of the general labor supply. Wicomico County ranks at 69.57%, which suggests a relatively strong labor supply potential to support job growth in the decarbonization sector. All three counties analyzed show moderate labor supply percentiles.

Table 2. Workforce Availability State Percentiles

NAME	**Labor Market Condition Pillar**	**Education Demographics Pillar**	**General Education Program Pilar**	**Workforce Availability Sub-index[1]**
Allegany County, Maryland	43.78%	55.94%	27.68%	**42.47%**
Baltimore County, Maryland	57.65%	46.45%	83.89%	**62.66%**
Wicomico County, Maryland	69.57%	50.92%	29.56%	**50.02%**

[1] Percentiles are based on comparing state level data
Data source: ACS 2023 5-year, IPEDS 2023, RAPIDS 2024

The second sub-index assessed labor accessibility – composed of both auto accessibility and transit accessibility measures. Both transportation modes are included to account for transit-dependent populations who rely on public transit for commuting. Baltimore County has strong accessibility for both modes, likely due to being centrally located in an urban or suburban environment. Allegany County appears to rely more on transit, which may reflect some urban design features and previous investments in public transportation. This may present an opportunity for investments that favor public transportation – such as bus electrification. Wicomico County has a balanced, but relatively low, level of transportation accessibility.

Table 3. Labor Accessibility State Percentiles

NAME	Auto Accessibility Pillar	Transit Accessibility Pillar	Labor Accessibility Sub-Index
Allegany County, Maryland	24.82%	56.90%	40.86%
Baltimore County, Maryland	83.81%	80.70%	82.26%

Wicomico County, Maryland	29.66%	28.98%	29.32%

Data source: EPA Smart Location Database 2021

The transferrable skills sub-index is composed of Location Quotients (LQs) for targeted occupations and related occupations for a specific energy sector. LQ is a measure used to compare the concentration of a particular industry or occupation in a region relative to a national average. A LQ greater than 1.0 indicates the occupation is more concentrated in the specific region than it is nationally – a regional specialty. An LQ less than 1.0 indicates the occupation concentration is lower in the region than the national average. This sub-index shows that Baltimore County is well-positioned for growth in all three energy sectors, with a workforce already geared toward supporting solar, weatherization, and EV industries. Allegany County is best suited for growth in solar power generation given its current workforce strengths. Allegany's relatively strong public transit network, combined with near-average EV-related skills also makes it a promising candidate for EV sector development. Wicomico County shows skill levels currently below the national average in all three energy sectors, with investment required to build capacity in these areas. Solar and residential/multifamily weatherization may offer the most accessible entry points for initial development in the three sectors.

Table 4. Transferrable Skills Sub-Index

MSA_TITLE*	Includes Counties	Solar Occupation LQ	Solar Relate Occupation LQ	Residential and Multifamily Weatherization (RMW) Occupation LQ	RMW Relate Occupation LQ	Electric Vehicle (EV) Occupation LQ	EV Relate Occupation LQ
Baltimore-Columbia-Towson, MD	Baltimore County, Maryland	1.24	1.17	1.24	1.22	1.22	1.14
Cumberland, MD-WV	Allegany County, Maryland	1.07	1	0.81	0.82	0.95	0.98
Salisbury, MD-DE	Wicomico County, Maryland	0.98	0.93	0.94	0.97	0.82	0.78

*Data source: OEWS 2023, O*NET 2023, Occupation Map*
**LQ data is only available at the MSA level*

Training and apprenticeship programs can provide necessary upskilling to increase readiness and prepare the workforce for transition. Rather than creating an index, we calculated the number of active apprentices in relation to demand-side occupations. In Allegany County and surrounding areas, there were no apprenticeship programs supplying apprentices for in-demand occupations. For weatherization and building retrofit roles, only five matching programs exist, with a total of five active apprentices. The

number of positions in the weatherization area needed is approximately 1,507, presenting a significant opportunity for capacity growth in those five apprenticeship programs.

In contrast, Baltimore County has robust resources for training and apprenticeships, with four programs supporting a total of 87 active apprentices for solar power generation – well above the current demand in the area. Wicomico County shows a similar trend, with six relevant programs producing 58 apprentices, also exceeding local demand. Wicomico provides a broader variety of programs compared to Baltimore's quantity, effectively addressing the diverse needs of the solar power generation sector. In the weatherization field, Baltimore County has 49 matching programs supporting 398 apprentices, and Wicomico County has 13 programs with 80 apprentices. In all three counties, demand for weatherization-related labor far exceeds what current apprenticeship programs can supply. This gap is also evident in the electrician trade.

To address these findings, all three counties should prioritize the development of apprenticeship programs tailored specifically to the weatherization and building retrofit sectors. This will be particularly challenging for Allegany due to the current lack of relevant programs. Wicomico could benefit from scaling up existing capacity, while Baltimore could benefit from diversifying the types of programs it currently offers. More information on this can be found in table B-1.

Allegany County Industry Base and Transition Pathways

Two major industries – Vocational Rehabilitation Services and Nursing Care Facilities (skilled nursing) are experiencing significant declines in Allegany County, shrinking at a faster rate locally than they are across the state or nation. Both industries offer wages below the county's median, signaling that the local economy may be shifting away from traditional care-related services and occupations. These losses present an opportunity for reskilling and upskilling of the affected workforce toward higher-paying occupations. In contrast to the declining sectors, Allegany County is seeing job growth in several industries that pay above the median wage. Three of the fastest-growing industries are Couriers and Express Delivery Services, Home Health Care Services, and Employment Services (e.g. staffing and temp agencies). These roles have added jobs and offer wages above the county median, which indicates positive wage growth for workers. More industry base data can be found in table B-2, While the table highlights short-term job trends from 2018-2023, Allegany County's manufacturing sector has been in decline for decades – experiencing a 47% drop in employment between 2002-2021.

Figures 15-17 illustrate the relationships between occupations that have experienced job losses and emerging occupations within the green or renewable energy economy. The size of each node on the left reflects the number of jobs lost, while each node represents one of the top 10 occupations for job losses within each of the industries most affected by workforce reductions. Nodes on the right side of the figure represent in-demand occupations within three sectors: Electric vehicles (EV), Solar Power Generation, and Residential and Multifamily Weatherization (RMW). The size of the node represents the present magnitude of demand. Direct transfers are represented by solid lines directly linking a lost occupation to an in-demand occupation, such as the direct transfer between maintenance and repair workers and building maintenance technicians. Indirect transfers are represented by lines connecting through a related occupation, such as the link between maintenance and repair workers through hydroelectric plant technicians, to power plant operators.

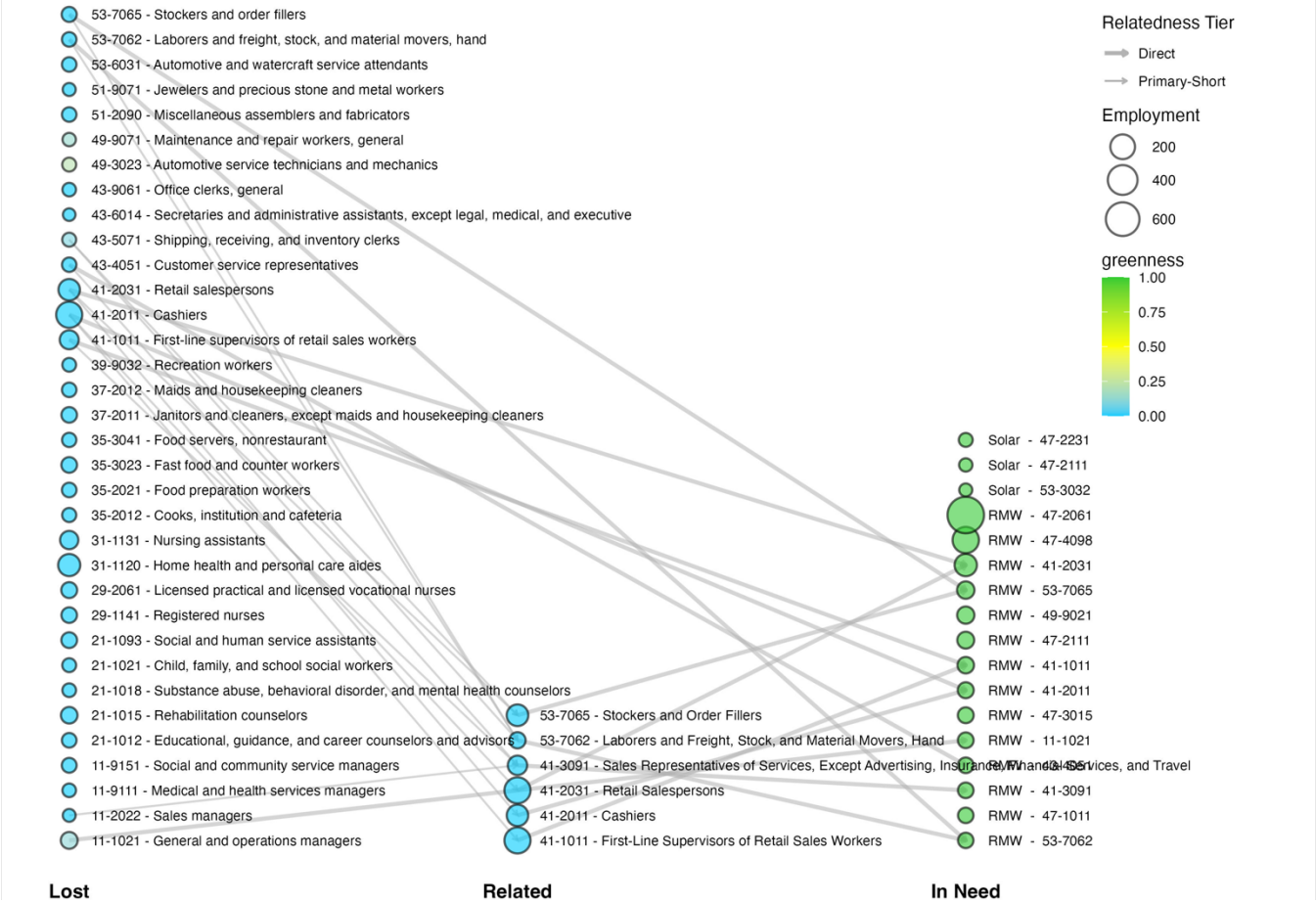

Figure 15. Allegany County Transition Pathways

For Allegany County, none of the three in-demand solar power occupations can be filled through either direct or indirect transfers; however, given the low overall demand, no major workforce-development initiatives are required at this time. By contrast, seven of the fourteen RMW occupations in demand have direct transfer pathways and six offer indirect transfer options. In each case, the pool of displaced workers is sufficient to cover the projected openings. Nonetheless, the two most heavily demanded occupation codes – 47-2061 Construction Laborers and 47-4098 Construction and Related Labor – still exhibit significant skill gaps relative to the available labor force. These results align with the transferrable skills analysis that showed a deficit for Allegany County in weatherization related skills development and apprenticeships.

Baltimore County Industry Base and Transition Pathways

Baltimore's largest job losses in Building Equipment Contractors and Services to Buildings and Dwellings coincide with a broader downturn in some construction-related fields. Most workers in this industry have easily transferrable skills for roles in building retrofit and energy efficiency occupations and re-skilling or up-skilling workers in these areas for energy efficiency and building retrofit jobs could retain a skilled workforce that aligns with sustainability initiatives for the state with relatively little effort. A few key findings show that Baltimore County has larger job gains in certain knowledge-intensive and creative industries which can help broaden and modernize the local economic base. Further, Baltimore County shows a specialization, relative to the rest of the state, in charter bus, retail, and other transit roles. While some of these subsectors pay relatively modest wages, others offer more

competitive compensation. Apprenticeship programs specific to these sectors and subsectors could enhance skill levels within the workforce and raise wages in subsectors of transportation with more modest wages. With the potential electrification of public and private transit within Maryland, these roles would also be considered part of the green workforce. Full industry base tables can be found in Appendix B.

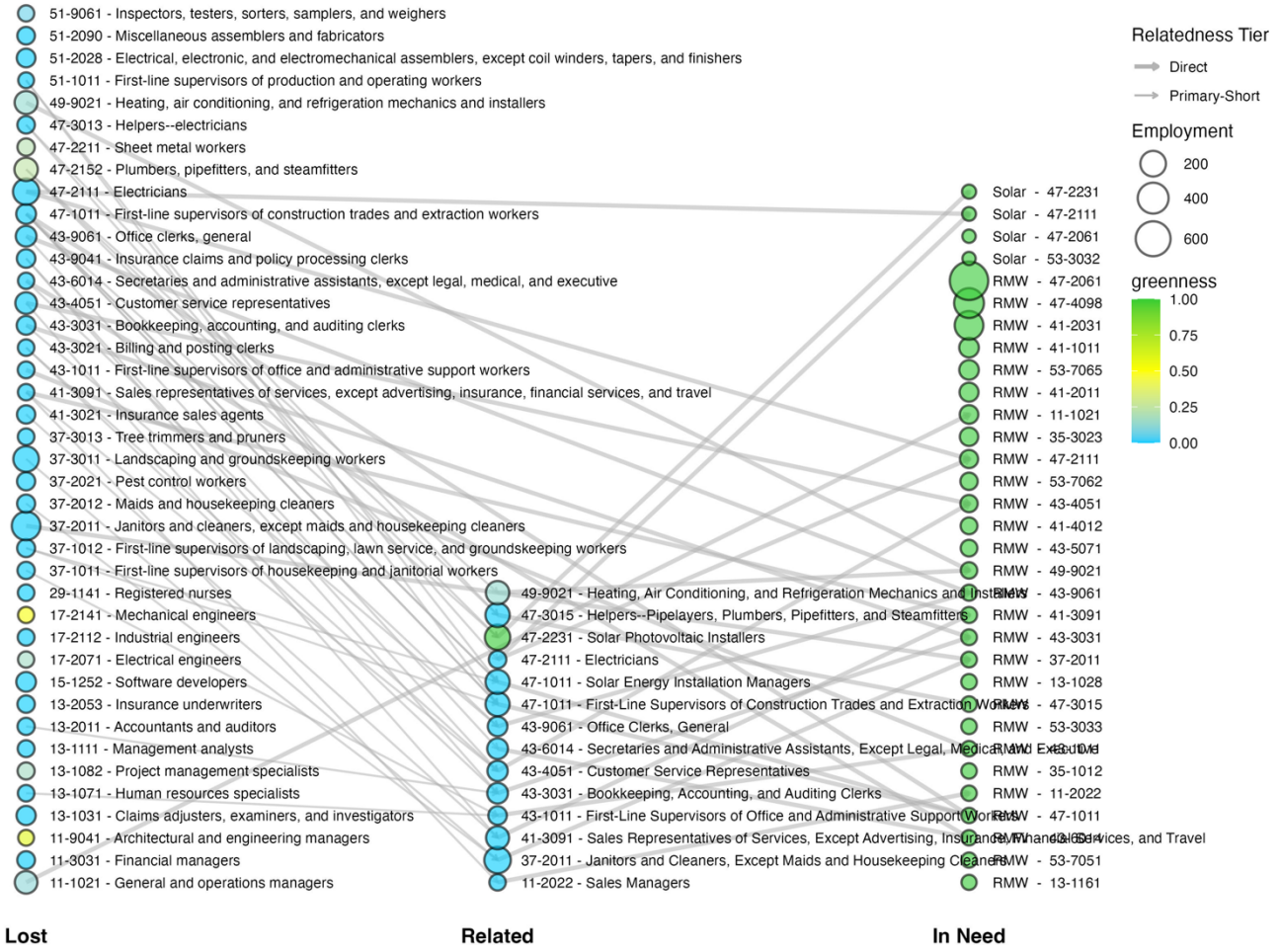

Figure 16. Baltimore County Transition Pathways

For Baltimore County, only one in-demand solar occupation has a direct transfer pathway, while two offer indirect transfer options. Eleven in-demand RMW occupations have direct transfer pathways, and thirteen have indirect options. Similar with Allegany County, the pool of displaced workers appears sufficient or more to meet projected openings; however, the most heavily in-demand occupations will exhibit skill gaps relative to the local labor force. These roles are once again in the RMW sector and could benefit from training and apprenticeship programs directly linked to these roles.

Wicomico County Industry Base and Transition Pathways

Between 2019 and 2023, only one of the top job-gaining industries in Wicomico County – Semiconductor and Other Electronic Component Manufacturing - offered wages significantly above the county median. The remaining growth sectors typically provide lower wages, and while contributing to economic growth, may not offer long-term economic security for workers. The Semiconductor manufacturing industry, however, is experiencing rapid growth, possesses comparative advantages and

holds both state and national significance, indicating a strong opportunity for both workforce and local economic growth if managed effectively. Special attention to occupational transfers into and upskilling or training programs for roles within this industry should be considered. Additionally, the Fuel Dealer industry is a strong local specialization with rapid growth and high wages that could warrant deeper investigation.

Noteworthy job losses within the Electric Power Generation, Transmission, and Distribution sector could have a significant impact on the local economy as this industry had the highest average weekly wage among the analyzed sectors. In the context of a just transition to clean energy opportunities, this sector warrants particular consideration. Job losses in lower-paid sectors such as department stores and elder care facilities may represent an opportunity for retraining newly available workers into more resilient and better-paying sectors with greater long-term career potential.

Figure 17. Wicomico County Transition Pathways

Unlike Allegany or Baltimore, Wicomico County shows a greater alignment between lost jobs and in-demand occupations. Many of the lost jobs can be transferred to these sectors and most jobs in demand can find potential labor supply in displaced workers. The magnitude of need also corresponds. This leads to an easier transition path alongside the broad range of training programs within Wicomico County. The only necessary area of focus is in the highest-demand jobs within the RMW sector. Seven

in-demand solar occupations have direct transfer pathways, while nine have indirect options. For RMW, twelve occupations have direct, and thirteen have indirect transfer pathways.

Indirect Transfer Case Study

Figure 18 provides an example of an indirect transfer. In this example, an individual who lost a job in Automotive and watercraft service attendants likely holds transferrable skills in mechanical repair, troubleshooting, customer service, and equipment maintenance. Another worker who lost a job in the Automotive service technicians and mechanics sector may have transferrable skills such as systems diagnostics, proper tools use, equipment repair and maintenance, and reading schematics. Through a training or apprenticeship program, these individuals could gain HVAC training and certifications, described in the box in the center. This could lead to a role in Heating, Air Conditioning, and Refrigeration Mechanics and Installers which would provide further experience and training opportunities which could eventually lead to an in-demand role as an HVAC technician with solar expertise.

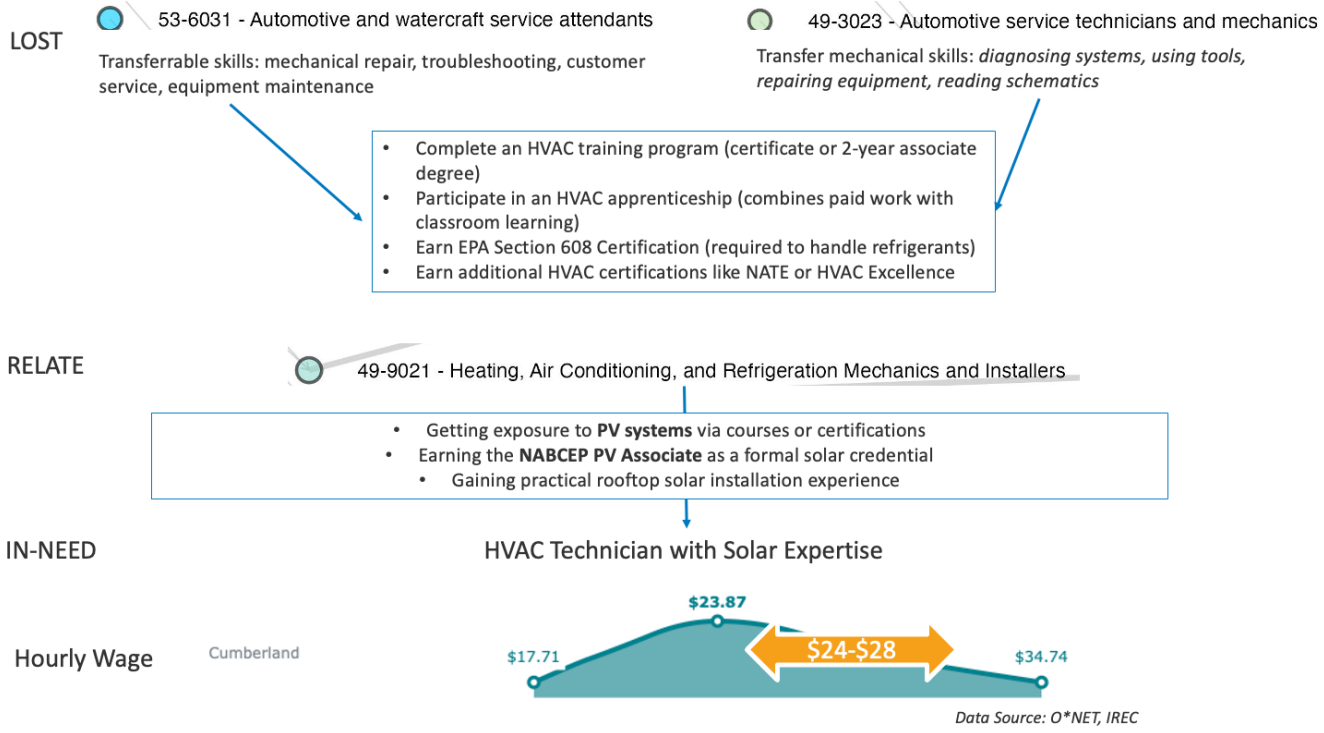

Figure 18. Indirect Transfer Example

Direct Transfer Case Study

In figure 19, a direct transfer example can be found. In this example, an individual with a job loss in the maintenance and repair workers sector could transfer directly to an in-need role as a building maintenance technician within the RMW sector. This transfer could be facilitated by additional exposure to and training in PV systems.

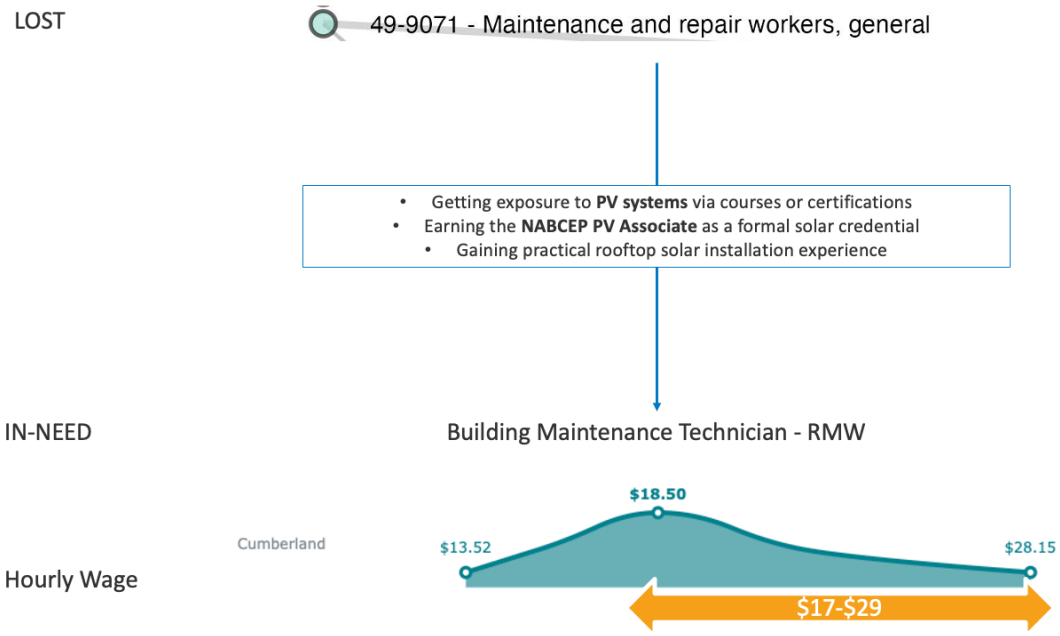

Figure 19. Direct Transfer Example

Career Pathways Analysis Key Findings

For the supply-side of the workforce, key findings and implications for Allegany County include the need to establish workforce development programs. Allegany County faces substantial workforce development challenges due to limited existing apprenticeship programs and declining traditional employment sectors. Allegany County's unique situation revealed a few potential strategies for addressing these needs.

- Develop Apprenticeship Infrastructure
    - Immediately invest in foundational apprenticeship programs in weatherization. Initiate regional collaborations or state-supported pilot programs to rapidly build apprenticeship capacity. Among other decarbonization benefits for the state, this would support ensuring that the state can build an adequate in-state workforce for implementation of building sector programs and regulations.
- Skill Transition Initiatives
    - Capitalize on the local workforce demographic, heavily composed of individuals with high-school diplomas suited for skilled trades. Provide direct reskilling programs transitioning displaced vocational rehabilitation and nursing care workers into growing industries like renewable energy retrofitting roles.
- Economic Diversification through Retraining

- Introduce targeted reskilling initiatives, particularly focused on occupations with indirect or direct transferable skills toward residential/multifamily weatherization (RMW) roles, aligning displaced workers with emerging green job opportunities.

For Baltimore County's unique needs, there is an opportunity to leverage strong workforce foundations and utilize Baltimore County's existing high-ranking workforce readiness, robust apprenticeship system, and high-level accessibility to actively scale up program capacities, particularly for weatherization.

- Diversification of Apprenticeships
    - Introduce apprenticeship and training programs specifically targeting skill gaps in high-demand occupations – such as electricians, HVAC technicians with renewable energy expertise, and building retrofit specialists. This alignment with existing strengths in related construction sectors helps leverage skills from displaced construction workers.
- Expand Transportation Accessibility Programs
    - Continue the investment in- and expansion of public transit networks to support workforce accessibility, especially for lower-income, transit dependent populations.
- Enhanced Green Skills Education
    - Strengthen partnerships with higher education institutions to offer targeted renewable energy certifications (e.g., North American Board of Certified Energy Practitioners PV Associate) and HVAC-related credentials to enhance worker mobility into green sectors.

Wicomico County key findings include the expansion and scaling up of workforce transition initiatives. Wicomico presents a unique opportunity for a balanced workforce transition given the present alignment between recently lost jobs and emerging green sectors.

- Scale Up Apprenticeship Programs
    - Broaden existing training initiatives and apprenticeship programs, emphasizing solar and residential/multifamily weatherization roles. Specifically, increase training availability to address high-demand occupations that currently exhibit significant skill gaps, ensuring that displaced workers from sectors like Electric Power Generation and Transmission can smoothly transition.
- Address Transportation Infrastructure
    - Although currently balanced, Wicomico's transportation accessibility is relatively low. Strategic investment to enhance auto and transit accessibility could help ensure equitable workforce participation and support sustainable growth.

Conclusion

The goal of the study was to provide the information and assessment needed to facilitate the development of strategies that would help Maryland further their energy and climate goals, while

considering a just workforce transition for impacted communities. Further, the methodology utilized to complete the study was designed to provide a template for future analysis. The statewide community survey task not only provided the information to prioritize six counties for further study but also provided results for all counties in the state. The prioritization assessment that resulted in the selection of the initial six counties could be repeated at a future date with updated data, or the existing percentile scores could be used to prioritize additional counties for strategy development in the future.

The opportunities assessment modeled technologies and measures that are likely to have the strongest impact on Maryland's goals. This analysis provided necessary information for the continuation of the study and helped to ensure alignment with Maryland's current activities. Additionally, this assessment identified the counties where energy transition could have the greatest impact on energy costs and emissions and where Maryland could begin the implementation of decarbonization strategies not already addressed through current legislation. Business as usual scenario modeling provided an indication of where Maryland could focus initiatives, depending on state priorities. For example, if the priority were to address transportation emissions, then scenario modeling in task two indicates that Allegany and Washington counties have a high share of energy consumption from transportation. If the priority is to address household energy costs, the study showed that energy burden is highest in Wicomico and Allegany counties. Maryland has several current policies and initiatives establishing goals for the state's energy future, however not all these policies have implementation plans or identified strategies for achieving those goals. Utilizing the information provided through this study, Maryland could develop strategies for addressing these priorities at community levels, such as addressing transportation emissions in Allegany County through electrification and EV infrastructure or developing apprenticeship programs to meet weatherization job demand.

Finally, the study assessed how addressing state priorities and goals may impact local economies and workforce. To continue the example, if Maryland were to prioritize the development of EV infrastructure in Allegany County, local workforce may be impacted by the loss of occupations within the transportation sector, displacing workers with skills that could be transferred to new, high-demand roles that align with Maryland's energy goals. To ensure that this potential negative impact is proactively addressed, the state could implement targeted reskilling programs to ensure any displaced workers have a clear pathway to transition into new roles or occupations. By analyzing both the supply- and demand-sides of the workforce, the study was able to provide not only an assessment of the potential impacts and needs, but also case studies that illustrate how existing or potential programs can be utilized to ensure a just workforce transition.

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Appendix A

Weighted models reflecting the prioritization of various data points resulted in the calculation of several percentile scores for each county. These percentile scores were mapped across the state and are shown in figures A-1, A-2, and A-3. More detail on these weighted models can be found in section 3.1.

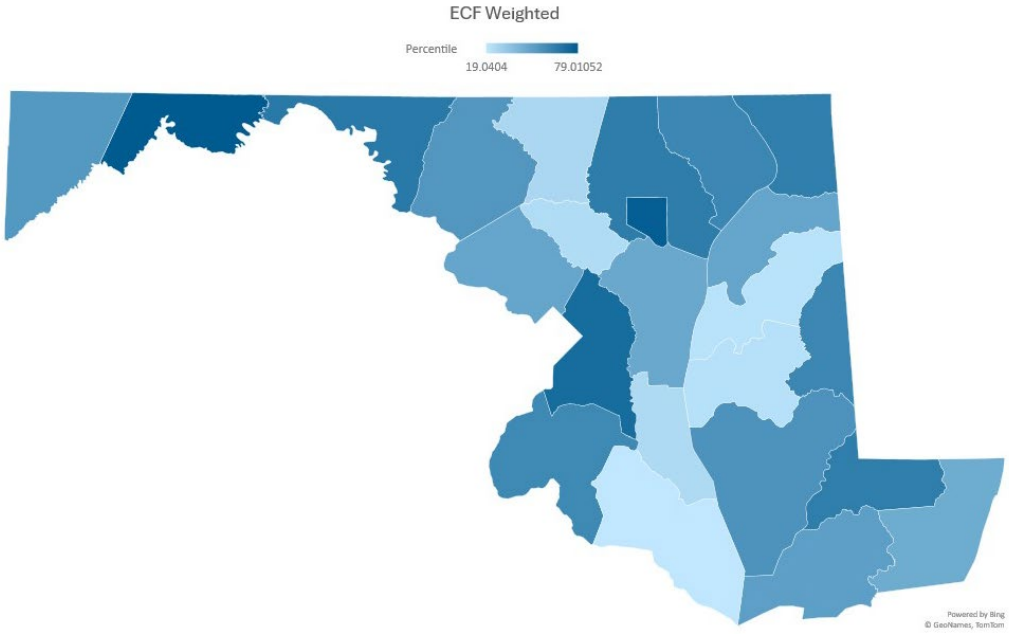

Figure A-1. ECF weighted model map of counties by percentile score

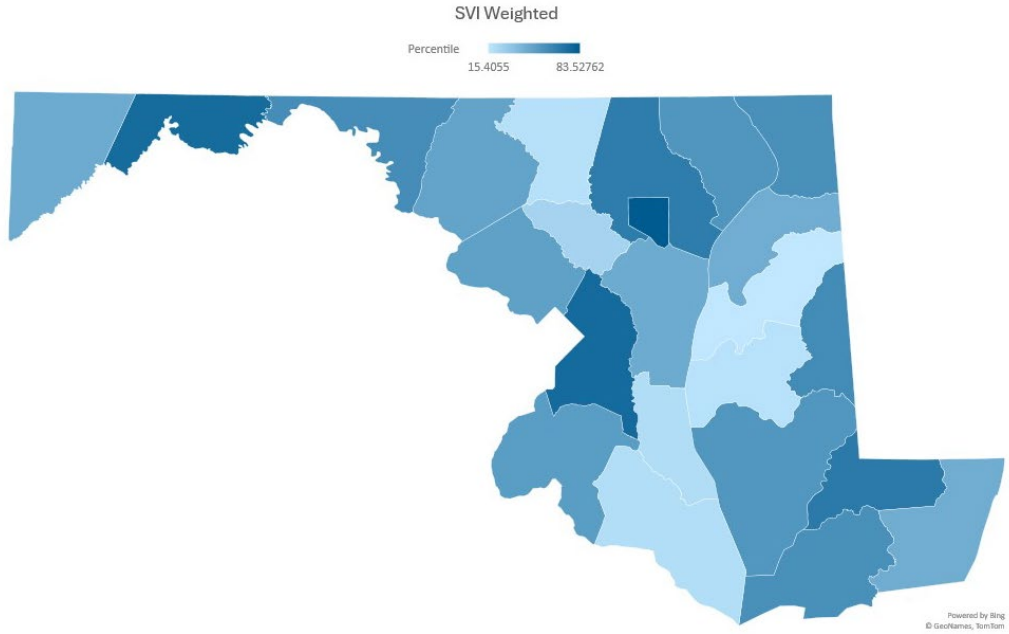

Figure A-2. SVI weighted model map of counties by percentile score

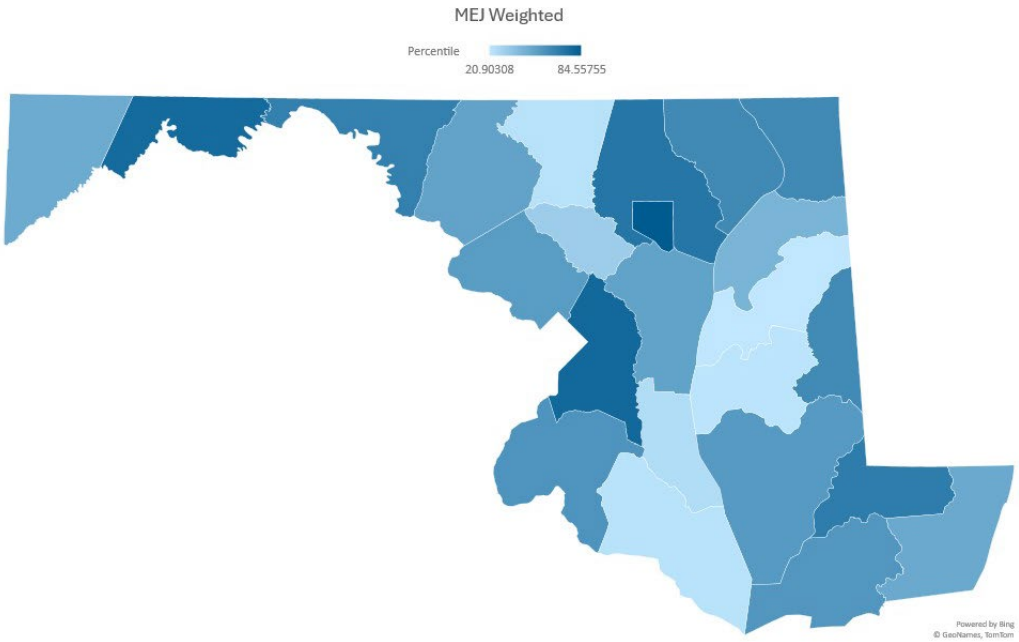

Figure A-3. ECF weighted model map of counties by percentile score

Appendix B

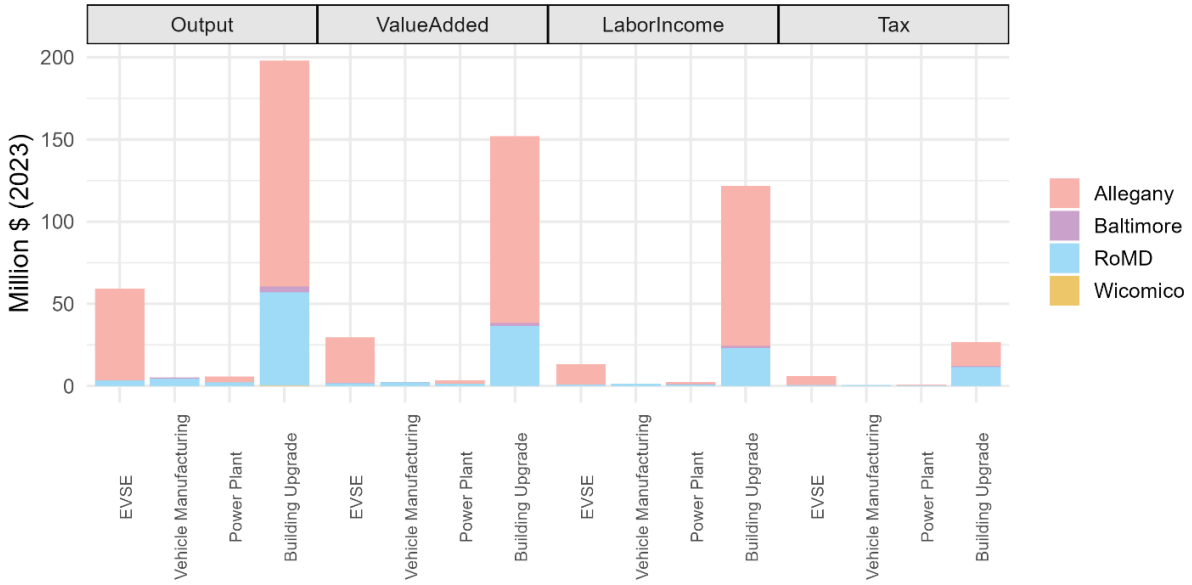

Figure B-1. Total economic impacts due to construction and manufacturing in Allegany County for the 2026-2045 period

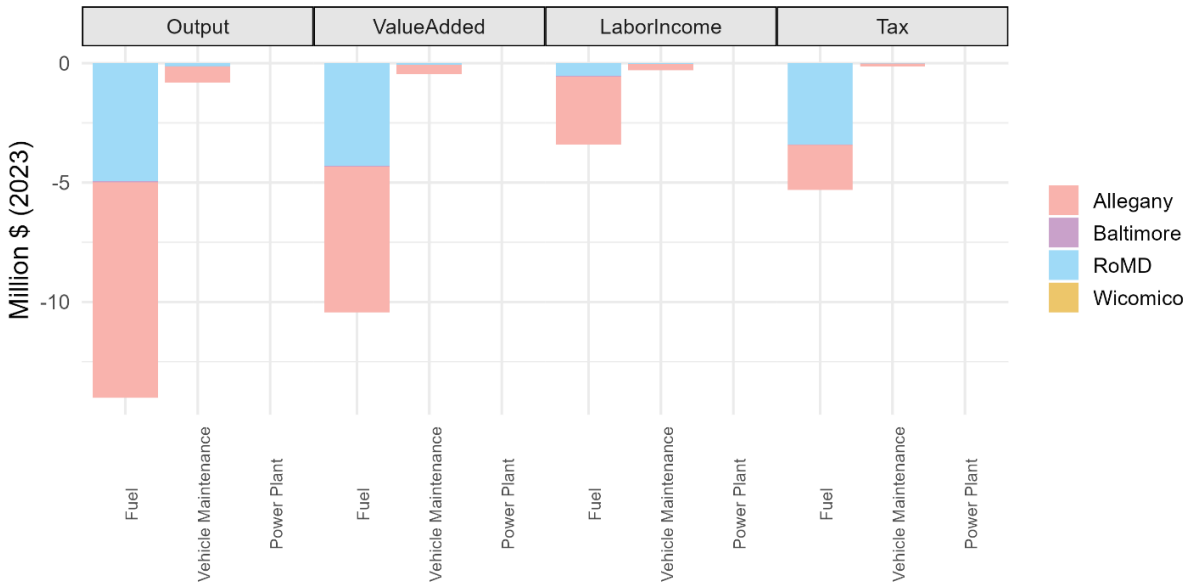

Figure B-2. Total net economic impacts due to fuel consumption, power generation and vehicle maintenance in Allegany County for the 2026-2045 period

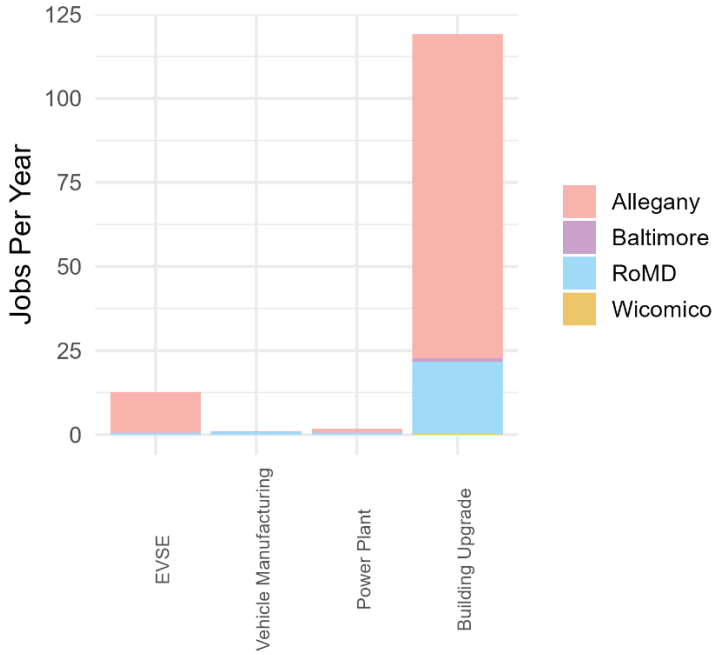

Figure B-3. Average annual jobs supported due to construction and manufacturing in Allegany County for the 2026-2045 period

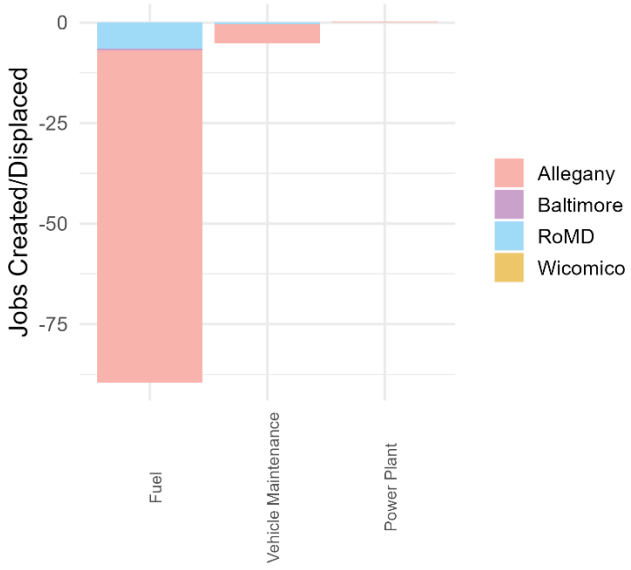

Figure B-4. Total jobs created/displaced supported due to fuel consumption, power generation and vehicle maintenance in Allegany County for the 2026-2045 period

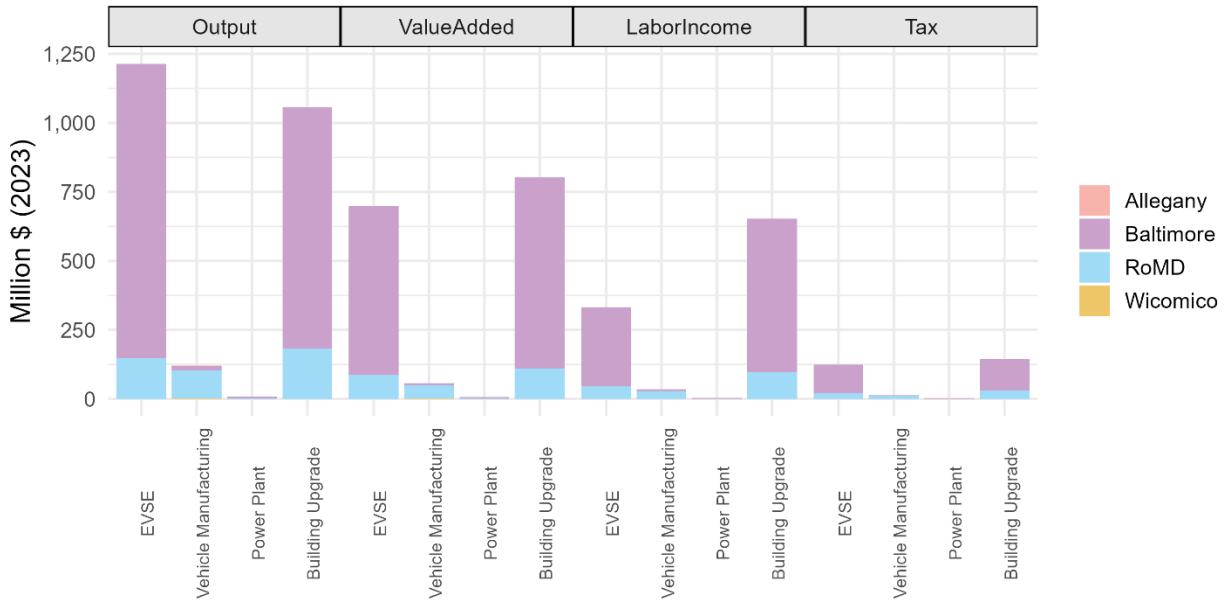

Figure B-5. Total economic impacts due to construction and manufacturing in Baltimore County for the 2026-2045 period

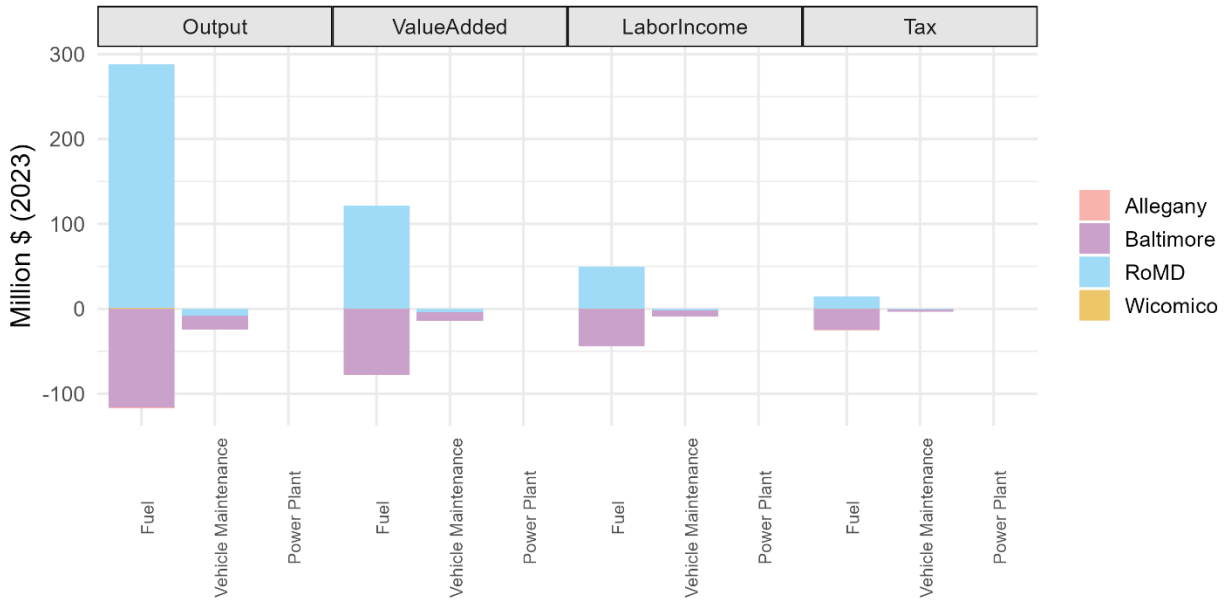

Figure B-6. Total net economic impacts due to fuel consumption, power generation and vehicle maintenance in Baltimore County for the 2026-2045 period

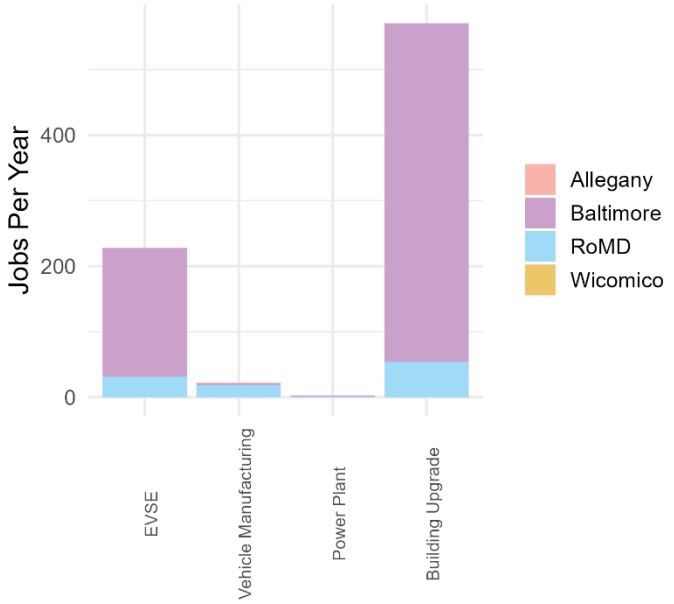

Figure B-7. Average annual jobs supported due to construction and manufacturing in Baltimore County for the 2026-2045 period

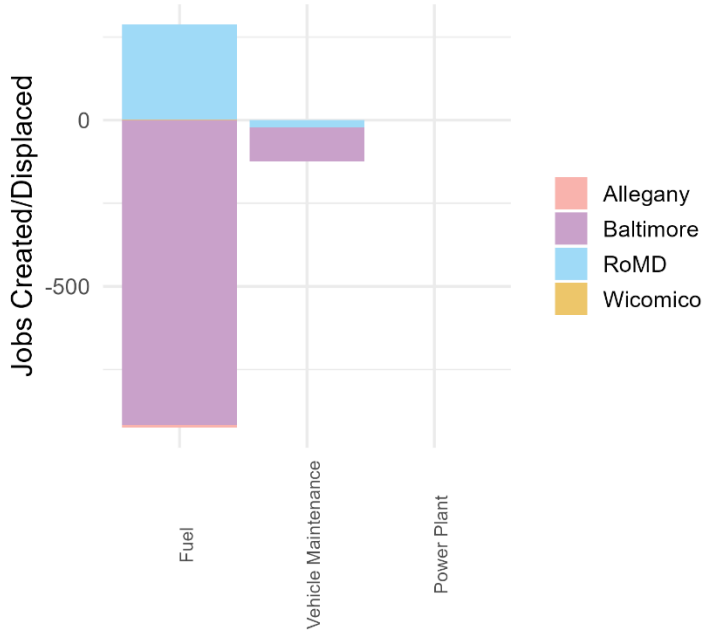

Figure B-8. Total jobs created/displaced supported due to fuel consumption, power generation and vehicle maintenance in Baltimore County for the 2026-2045 period

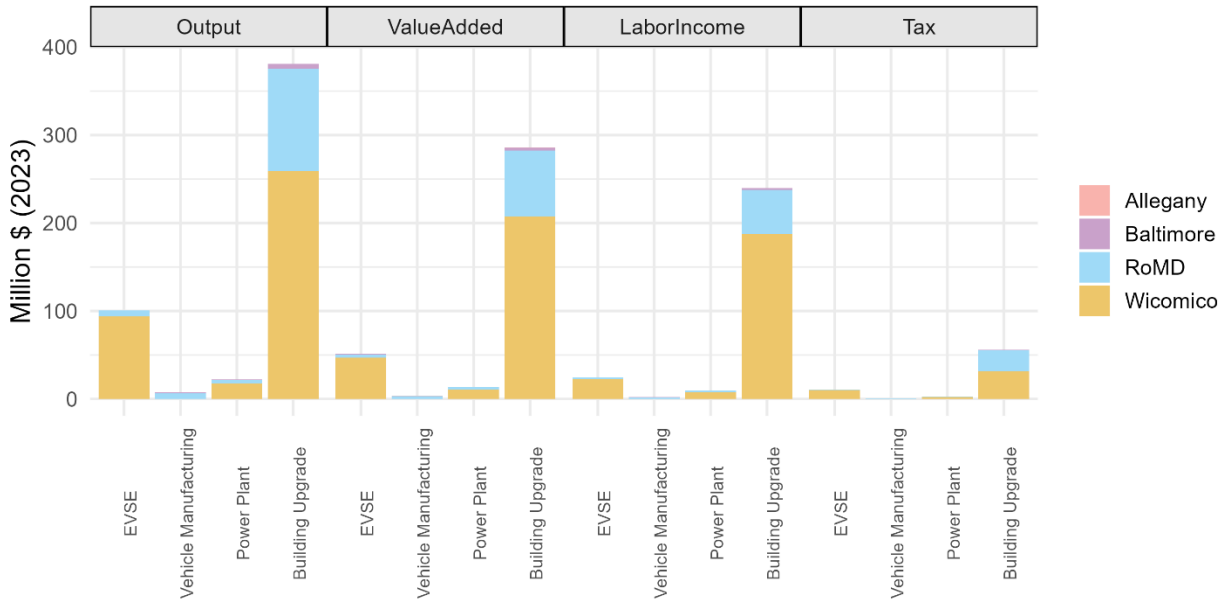

Figure B-9. Total economic impacts due to construction and manufacturing in Wicomico County for the 2026-2045 period

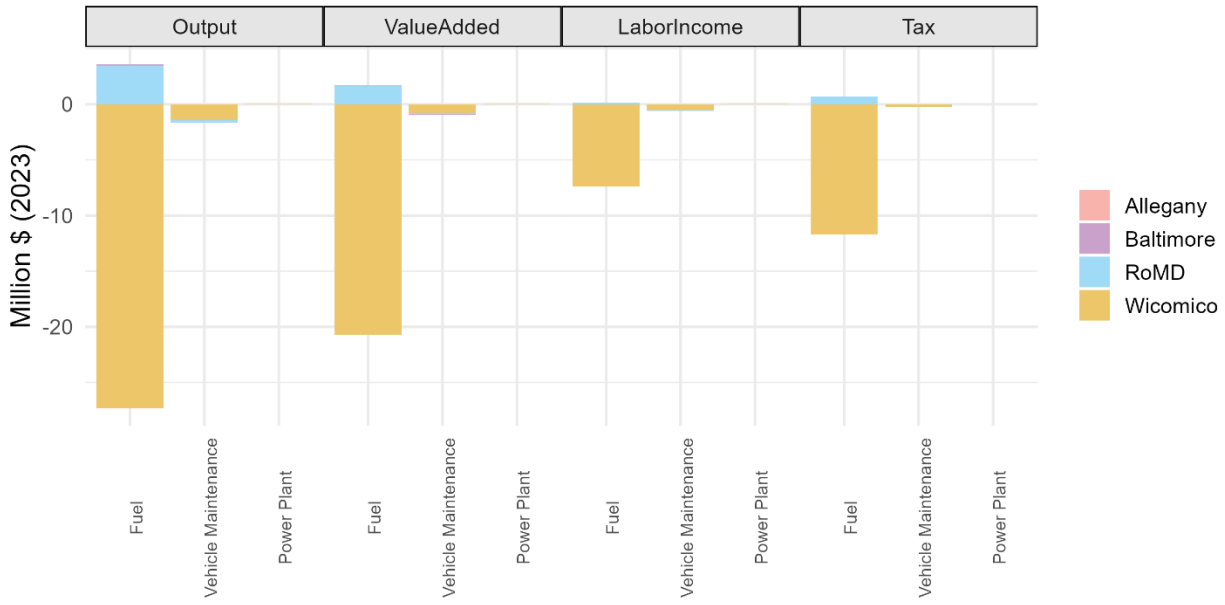

Figure B-10. Total net economic impacts due to fuel consumption, power generation and vehicle maintenance in Wicomico County for the 2026-2045 period

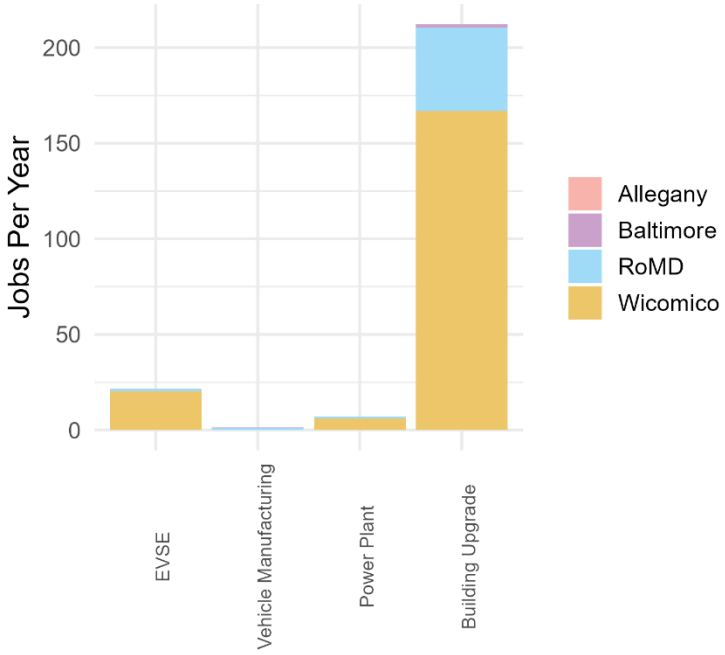

Figure B-11. Average annual jobs supported due to construction and manufacturing in Wicomico County for the 2026-2045 period

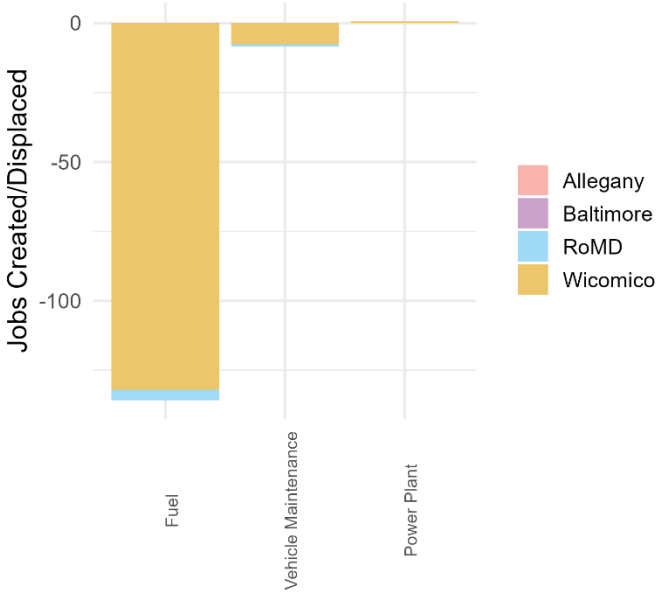

Figure B-12. Total jobs created/displaced supported due to fuel consumption, power generation and vehicle maintenance in Wicomico County for the 2026-2045 period

Table B-1. Program Availability – Total Number of Active Apprentice in Registered Apprenticeship Programs

Demand Sector	Appr. Number	Demand for matching occupations	County
Solar Power Generation	0	0	Allegany
Solar Power Generation	87	10	Baltimore
Solar Power Generation	58	46	Wicomico
Weatherization	5	1507	Allegany
Weatherization	398	8642	Baltimore
Weatherization	80	2683	Wicomico
Electrician	0	29	Allegany
Electrician	73	133	Baltimore
Electrician	33	53	Wicomico

Data Source: Rapids 2024

Table B-2. Allegany County Industry Base

Largest Job Gains from 2018 to 2023

NAICS Code	Industry	Employment Change	% Change in County	% Change in State	% Change in US
5614	Business Support Services	336	n/a	-23.0%	-17.5%
5613	Employment Services	272	n/a	0.9%	-26.3%
4921	Couriers and Express Delivery Services	234	n/a	21.6%	39.9%
6216	Home Health Care Services	225	n/a	22.4%	10.9%
4552	Warehouse Clubs, Supercenters, and Other General M	160	26.4%	11.5%	12.2%

Largest Job Loss from 2018 to 2023

NAICS Code	Industry	Employment Change	% Change in County	% Change in State	% Change in US
4571	Gasoline Stations	-378	-100.0%	-52.6%	4.6%
6243	**Vocational Rehabilitation Services**	**-229**	**-57.4%**	**-27.9%**	**-13.4%**
4551	Department Stores	-157	-55.1%	-17.8%	-17.0%
6231	**Nursing Care Facilities (Skilled Nursing Facilities)**	**-133**	**-16.3%**	**-24.0%**	**-11.8%**
6241	Individual and Family Services	-129	-33.9%	24.5%	18.4%

Industries that have the highest competitive advantage, 2023

NAICS Code	Industry	Employment Change	% Change in County	% Change in State	% Change in US
6211	Offices of Physicians	35	9.9%	6.1%	10.6%
6243	**Vocational Rehabilitation Services**	**-229**	**-57.4%**	**-27.9%**	**-13.4%**
8122	Death Care Services	-3	-3.9%	-6.1%	0.2%
6231	**Nursing Care Facilities (Skilled Nursing Facilities)**	**-133**	**-16.3%**	**-24.0%**	**-11.8%**
6232	Residential Intellectual and Developmental Disability, I	-66	-18.2%	8.8%	-2.6%

Largest Job Gains from 2018 to 2023

NAICS Code	Industry	LQ in 2023	Average Weekly Wage	Relative to County Median Wage
5614	Business Support Services	2.63	$703	-$77.5
5613	Employment Services	0.44	$1,383	$602.5
4921	Couriers and Express Delivery Services	1.51	$1,040	$259.5
6216	Home Health Care Services	0.79	$968	$187.5
4552	Warehouse Clubs, Supercenters, and Other General M	1.96	$503	-$277.5

Largest Job Loss from 2018 to 2023

NAICS Code	Industry	LQ in 2023	Average Weekly Wage	Relative to County Median Wage
4571	Gasoline Stations	2.02	$536	-$244.8
6243	**Vocational Rehabilitation Services**	**3.46**	**$490**	**-$290.5**
4551	Department Stores	0.76	$349	-$431.5
6231	**Nursing Care Facilities (Skilled Nursing Facilities)**	**2.78**	**$828**	$47.5
6241	Individual and Family Services	0.49	$618	-$162.5

Industries that have the highest competitive advantage, 2023

NAICS Code	Industry	LQ in 2023	Average Weekly Wage	Relative to County Median Wage
6211	Offices of Physicians	4.37	$1,897	$1,116.0
6243	**Vocational Rehabilitation Services**	**3.46**	**$490**	-$290.5
8122	Death Care Services	3.12	$755	-$25.5
6231	**Nursing Care Facilities (Skilled Nursing Facilities)**	**2.78**	**$828**	$47.5
6232	Residential Intellectual and Developmental Disability, I	2.70	$779	-$1.5

Table B-3. Baltimore County Industry Base

Largest Job Gains from 2018 to 2023

NAICS Code	Industry	Employment Change	% Change in County	% Change in State	% Change in US
6221	General Medical and Surgical Hospitals	9759	n/a	-3.6%	4.4%
6216	Home Health Care Services	2883	55.5%	22.4%	10.9%
5416	Management, Scientific, and Technical Consulting Services	2006	56.0%	7.3%	25.0%
5161	Radio and Television Broadcasting Stations	931	n/a	25.1%	11.8%
4248	Beer, Wine, and Distilled Alcoholic Beverage Merchant Wholesalers	926	321.5%	12.2%	-46.1%

Largest Job Loss from 2018 to 2023

NAICS Code	Industry	Employment Change	% Change in County	% Change in State	% Change in US
2382	Building Equipment Contractors	-4136.5	-50.7%	-50.6%	13.5%
5617	Services to Buildings and Dwellings	-3301	-53.8%	-4.1%	5.0%
5241	Insurance Carriers	-2109	-42.5%	-23.8%	3.2%
5611	Office Administrative Services	-1956.5	-58.6%	2.3%	19.0%
3345	Navigational, Measuring, Electromedical, and Control Instruments M	-1773	-80.6%	20.5%	2.9%

Industries that have the highest competitive advantage, 2023

NAICS Code	Industry	Employment Change	% Change in County	% Change in State	% Change in US
9231	Administration of Human Resource Programs	-1381.5	-22.4%	2.5%	9.0%
4855	Charter Bus Industry	90	68.7%	-16.5%	-22.9%
4821	Rail Transportation	6	n/a	n/a	161.0%
4859	Other Transit and Ground Passenger Transportation	808	878.3%	2.0%	-3.7%
4854	School and Employee Bus Transportation	166.5	38.5%	-7.7%	-6.7%

Largest Job Gains from 2018 to 2023

NAICS Code	Industry	LQ in 2023	Average Weekly Wage	Relative to County Median Household Income
6221	General Medical and Surgical Hospitals	0.83	$1,382	$160.0
6216	Home Health Care Services	2.07	$663	-$559.0
5416	Management, Scientific, and Technical Consulting Services	1.26	$2,240	$1,018.0
5161	Radio and Television Broadcasting Stations	3.22	$2,731	$1,509.0
4248	Beer, Wine, and Distilled Alcoholic Beverage Merchant Wholesalers	2.35	$1,606	$384.0

Largest Job Loss from 2018 to 2023

NAICS Code	Industry	LQ in 2023	Average Weekly Wage	Relative to County Median Wage
2382	Building Equipment Contractors	0.69	$801	-$421.5
5617	Services to Buildings and Dwellings	0.53	$405	-$817.0
5241	Insurance Carriers	0.99	$2,182	$960.0
5611	Office Administrative Services	0.95	$963	-$259.5
3345	Navigational, Measuring, Electromedical, and Control Instruments M	0.42	$1,769	$547.0

Industries that have the highest competitive advantage, 2023

NAICS Code	Industry	LQ in 2023	Average Weekly Wage	Relative to County Median Wage
9231	Administration of Human Resource Programs	8.68	$1,206	-$16.5
4855	Charter Bus Industry	4.13	$1,103	-$119.0
4821	Rail Transportation	4.08	$1,320	$98.0
4859	Other Transit and Ground Passenger Transportation	3.62	$919	-$303.0
4854	School and Employee Bus Transportation	3.52	$962	-$260.5

Table B-4. Wicomico County Industry Base

Largest Job Gains from 2018 to 2023

NAICS Code	Industry	Employment Change	% Change in	% Change in State	% Change in US
7225	Restaurants and Other Eating Places	455	12.0%	-4.6%	2.2%
6241	Individual and Family Services	440	102.3%	24.5%	18.4%
3344	**Semiconductor and Other Electronic Component Manufacturing**	396	n/a	-0.5%	6.5%
3121	**Beverage Manufacturing**	281	n/a	-40.9%	-38.6%
6231	Nursing Care Facilities (Skilled Nursing Facilities)	210	n/a	-24.0%	-11.8%

Largest Job Loss from 2018 to 2023

NAICS Code	Industry	Employment Change	% Change in	% Change in State	% Change in US
2211	Electric Power Generation, Transmission and Distribution	-496	-100.0%	-48.4%	3.2%
6233	Continuing Care Retirement Communities and Assisted Living Facilities for	-301	-100.0%	0.1%	0.2%
7211	Traveler Accommodation	-223	-46.2%	-10.0%	-7.4%
4551	Department Stores	-205	-33.8%	-17.8%	-17.0%
4413	Automotive Parts, Accessories, and Tire Retailers	-202.3	-100.0%	-5.6%	-0.3%

Industries that have the highest competitive advantage, 2023

NAICS Code	Industry	Employment Change	% Change in	% Change in State	% Change in US
4572	Fuel Dealers	71.7	1667.4%	1207.5%	947.0%
1114	Greenhouse, Nursery, and Floriculture Production	2	1.1%	8.0%	12.5%
3344	Semiconductor and Other Electronic Component Manufacturing	396	n/a	-0.5%	6.5%
4582	Shoe Retailers	-4.3	-2.7%	-15.9%	-19.4%
3121	Beverage Manufacturing	281	n/a	-40.9%	-38.6%

Largest Job Gains from 2018 to 2023

NAICS Code	Industry	LQ in 2023	Average Weekly Wage in 2023	Relative to County Median Wage
7225	Restaurants and Other Eating Places	1.3	$428	-$506.0
6241	Individual and Family Services	1.0	$743	-$191.0
3344	**Semiconductor and Other Electronic Component Manufacturing**	3.4	$1,105	$171.0
3121	**Beverage Manufacturing**	2.9	$901	-$33.0
6231	Nursing Care Facilities (Skilled Nursing Facilities)	0.5	$448	-$486.5

Largest Job Loss from 2018 to 2023

NAICS Code	Industry	LQ in 2023	Average Weekly Wage in 2023	Relative to County Median Wage
2211	Electric Power Generation, Transmission and Distribution	0	$2,052	$1,118.0
6233	Continuing Care Retirement Communities and Assisted Living Facilities for	0	$458	-$476.0
7211	Traveler Accommodation	0.49	$496	-$438.0
4551	Department Stores	1.39	$450	-$484.0
4413	Automotive Parts, Accessories, and Tire Retailers	0	$565	-$369.0

Industries that have the highest competitive advantage, 2023

NAICS Code	Industry	LQ in 2023	Average Weekly Wage in 2023	Relative to County Median Wage
4572	Fuel Dealers	3.58	$1,193	$259.0
1114	Greenhouse, Nursery, and Floriculture Production	3.49	$1,113	$179.0
3344	Semiconductor and Other Electronic Component Manufacturing	3.37	$1,105	$171.0
4582	Shoe Retailers	2.96	$453	-$481.0
3121	Beverage Manufacturing	2.91	$901	-$33.0

Allegany County – Transportation Tables

Table B-5. Top 10 impacted *local* industries due to construction and manufacturing in Allegany County, 2026-2045

Industry	Description	Average Employment (Person/yr)	Labor Income (Million)	Value Added (Million)
54	Construction of other new residential structures	6	6.6	16.5
388	Building material and garden equipment and supplies stores	1	1.0	2.6
51	Construction of other new nonresidential structures	1	1.2	2.1
379	Other durable goods merchant wholesalers	0	0.3	0.6
399	Truck transportation	0	0.3	0.4
429	Other real estate	0	0.0	0.1
454	Employment services	0	0.2	0.3
403	Couriers and messengers	0	0.1	0.1
472	Hospitals	0	0.2	0.2
491	Full-service restaurants	0	0.1	0.1

Table B-6. Top positively impacted *local* industries due to changes in fuel consumption, power generation and vehicle maintenance in Allegany County, 2026-2045

Industry	Description	Additional Employment (Person)	Labor Income (Million)	Value Added (Million)
37	Electric power generation - Solar	4	0.9	1.7

Table B-7. Top 10 negatively impacted *local* industries due to changes in fuel consumption, power generation and vehicle maintenance in Allegany County, 2026-2045

Industry	Description	Displaced Employment (Person)	Labor Income (Million)	Value Added (Million)
391	Gasoline stores	-67	-2.8	-6.3
494	Automotive repair and maintenance, except car washes	-4	-0.2	-0.3
399	Truck transportation	-3	-0.2	-0.3
429	Other real estate	-2	0.0	0.0
403	Couriers and messengers	-1	0.0	-0.1
493	All other food and drinking places	-1	0.0	0.0
384	Wholesale electronic markets and agents and brokers	-1	-0.1	0.0
472	Hospitals	-1	-0.1	-0.1
491	Full-service restaurants	-1	0.0	0.0
492	Limited-service restaurants	-1	0.0	0.0

Allegany County – Building Upgrades

Table B-8. Top 10 impacted *local* occupations due to building upgrades in Allegany County, 2026-2045

Code	Description	Average Employment (Person/yr)
47-2061	Construction Laborers	39
47-4098	Miscellaneous Construction and Related Workers	13
41-2031	Retail Salespersons	7
53-7065	Stockers and Order Fillers	2
49-9021	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	2
47-2111	Electricians	1
41-1011	First-Line Supervisors of Retail Sales Workers	1
41-2011	Cashiers	1
47-3015	Helpers--Pipelayers, Plumbers, Pipefitters, and Steamfitters	1
11-1021	General and Operations Managers	1

Table B-9. Top 10 impacted *local* industries due to building upgrades in Allegany County, 2026-2045

Industry	Description	Average Employment (Person/yr)	Labor Income (Million)	Value Added (Million)
55	Maintenance and repair construction of nonresidential structures	56	72	72
395	Miscellaneous store retailers	16	6.3	9.2
393	Sporting goods, hobby, musical instrument and book stores	7	2.9	6.2
387	Electronics and appliance stores	5	4.4	5.2
386	Furniture and home furnishings stores	5	2.7	8.2
384	Wholesale - Wholesale electronic markets and agents and brokers	1	2.2	0.7
429	Other real estate	1	0.1	0.4
403	Couriers and messengers	0	0.2	0.4
378	Wholesale - Machinery, equipment, and supplies	0	0.6	1.1
399	Truck transportation	0	0.6	0.8

Baltimore County - Transportation

Table B-10. Top 10 impacted *local* occupations due to construction and manufacturing in Baltimore County, 2026-2045

Code	Description	Average Employment (Person/yr)
47-2031	Carpenters	19
47-2061	Construction Laborers	12
47-1011	First-Line Supervisors of Construction Trades and Extraction Workers	8
11-9021	Construction Managers	6
11-1021	General and Operations Managers	6
43-9061	Office Clerks, General	5
41-2031	Retail Salespersons	5
13-1082	Project Management Specialists	4
43-3031	Bookkeeping, Accounting, and Auditing Clerks	3
49-3023	Automotive Service Technicians and Mechanics	3

Table B-11. Top 10 impacted *local* industries due to construction and manufacturing in Baltimore County, 2026-2045

Industry	Description	Average Employment (Person/yr)	Labor Income (Million)	Value Added (Million)
54	Construction of other new residential structures	101	162	377
388	Building material and garden equipment and supplies stores	18	17	42
51	Construction of other new nonresidential structures	17	27	46
429	Other real estate	4	3	8
439	Architectural, engineering, and related services	3	7	8
454	Employment services	3	4	5
379	Other durable goods merchant wholesalers	2	5	10
403	Couriers and messengers	2	1	2
459	Landscape and horticultural services	2	2	3
399	Truck transportation	2	3	3

Table B-12. Top 5 positively impacted *local* industries due to changes in fuel consumption, power generation and vehicle maintenance in Baltimore County, 2026-2045

Industry	Description	Additional Employment (Person)	Labor Income (Million)	Value Added (Million)
36	Electric power generation - Nuclear	3	0.1	0.7
42	Electric power transmission and distribution	2	0.4	1.2
37	Electric power generation - Solar	2	0.3	0.6

35	Electric power generation - Fossil fuel	1	0.1	0.5
20	Oil and gas extraction	1	0.0	-0.1

Table B-13. Top 10 negatively impacted *local* industries due to changes in fuel consumption, power generation and vehicle maintenance in Baltimore County, 2026-2045

Industry	Description	Displaced Employment (Person)	Labor Income (Million)	Value Added (Million)
391	Gasoline stores	-630	-25.1	-52.1
494	Automotive repair and maintenance, except car washes	-80	-5.4	-7.5
404	Warehousing and storage	-46	-2.4	-2.5
384	Wholesale electronic markets and agents and brokers	-32	-5.2	-1.9
429	Other real estate	-29	-0.9	-2.8
399	Truck transportation	-21	-1.5	-2.0
403	Couriers and messengers	-18	-0.4	-0.7
454	Employment services	-10	-0.6	-0.8
493	All other food and drinking places	-8	-0.3	-0.5
458	Services to buildings	-6	-0.3	-0.3

Table B-14. Top 10 positively impacted *RoMD* industries due to changes in fuel consumption, power generation and vehicle maintenance in Baltimore County, 2026-2045

Industry	Description	Additional Employment (Person)	Labor Income (Million)	Value Added (Million)
35	Electric power generation - Fossil fuel	128	31.4	119.5
36	Electric power generation - Nuclear	51	9.9	25.8
42	Electric power transmission and distribution	26	4.3	13.6
454	Employment services	21	1.3	1.8
37	Electric power generation - Solar	11	1.5	3.2
20	Oil and gas extraction	8	0.7	0.4
491	Full-service restaurants	7	0.3	0.4
446	Scientific research and development services	7	0.8	1.0
429	Other real estate	7	0.1	0.6
41	Electric power generation - All other	6	1.3	-0.9

Table B-15. Top 10 negatively impacted *RoMD* industries due to changes in fuel consumption, power generation and vehicle maintenance in Baltimore County, 2026-2045

Industry	Description	Displaced Employment (Person)	Labor Income (Million)	Value Added (Million)
384	Wholesale electronic markets and agents and brokers	-54	-7.2	-2.5
382	Petroleum and petroleum products	-20	-2.3	-56.8

391	Gasoline stores	-17	-0.7	-1.5
399	Truck transportation	-7	-0.5	-0.7
403	Couriers and messengers	-5	-0.1	-0.1
404	Warehousing and storage	-2	-0.1	-0.1
451	Management of companies and enterprises	-1	-0.1	-0.2
335	Other motor vehicle parts manufacturing	-1	-0.1	-0.1
508	Postal service	-1	-0.1	-0.1
463	Junior colleges, colleges, universities, and professional schools	-1	-0.1	-0.1

Baltimore County – Building Upgrades

Table B-16. Top 10 impacted *local* occupations due to building upgrades in Baltimore County, 2026-2045

Code	Description	Average Employment (Person/yr)
47-2061	Construction Laborers	167
47-4098	Miscellaneous Construction and Related Workers	72
41-2031	Retail Salespersons	63
41-1011	First-Line Supervisors of Retail Sales Workers	11
53-7065	Stockers and Order Fillers	11
41-2011	Cashiers	9
11-1021	General and Operations Managers	8
35-3023	Fast Food and Counter Workers	7
47-2111	Electricians	6
53-7062	Laborers and Freight, Stock, and Material Movers, Hand	5

Table B-17. Top 10 impacted *RoMD* occupations due to building upgrades in Baltimore County, 2026-2045

Code	Description	Average Employment (Person/yr)
41-4012	Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	4
11-1021	General and Operations Managers	2
43-4051	Customer Service Representatives	1
41-2031	Retail Salespersons	1
53-7062	Laborers and Freight, Stock, and Material Movers, Hand	1
43-9061	Office Clerks, General	1
35-3023	Fast Food and Counter Workers	1
53-7065	Stockers and Order Fillers	1
29-1141	Registered Nurses	1
31-1121	Home Health and Personal Care Aides	1

Table B-18. Top 10 impacted *local* industries due to building upgrades in Baltimore County, 2026-2045

Industry	Description	Average Employment (Person/yr)	Labor Income (Million)	Value Added (Million)
55	Maintenance and repair construction of nonresidential structures	251	313	314
394	General merchandise stores	79	60.2	102.3
395	Miscellaneous store retailers	66	37.6	50.8
393	Sporting goods, hobby, musical instrument and book stores	22	11.6	22.7
386	Furniture and home furnishings stores	18	17.6	47.3
387	Electronics and appliance stores	14	13.4	15.4
384	Wholesale electronic markets and agents and brokers	10	33.1	11.9
429	Other real estate	7	4.0	12.9
404	Warehousing and storage	5	4.9	5.1
403	Couriers and messengers	4	1.5	2.8

Table B-19. Top 10 impacted *RoMD* industries due to building upgrades in Baltimore County, 2026-2045

Industry	Description	Average Employment (Person/yr)	Labor Income (Million)	Value Added (Million)
384	Wholesale electronic markets and agents and brokers	17	46.2	16.3
451	Management of companies and enterprises	1	3.7	5.6
472	Hospitals	1	2.7	3.3
403	Couriers and messengers	1	0.4	0.7
429	Other real estate	1	0.5	2.1
492	Limited-service restaurants	1	0.8	1.5
491	Full-service restaurants	1	0.9	1.5
378	Wholesale - Machinery, equipment, and supplies	1	2.2	3.9
465	Offices of physicians	1	2.3	2.2
402	Scenic and sightseeing transportation and support activities for transportation	1	1.3	1.0

Wicomico County - Transportation

Table B-20. Top 10 impacted *local* industries due to construction and manufacturing in Wicomico County, 2026-2045

Industry	Description	Average Employment (Person/yr)	Labor Income (Million)	Value Added (Million)
54	Construction of other new residential structures	10	11.1	25.1
51	Construction of other new nonresidential structures	2	2.1	3.5
388	Building material and garden equipment and supplies stores	2	1.8	4.2

Table B-21. Top 10 negatively impacted *local* industries due to changes in fuel consumption, power generation and vehicle maintenance in Wicomico County, 2026-2045

Industry	Description	Displaced Employment (Person)	Labor Income (Million)	Value Added (Million)
391	Gasoline stores	-83	-4.4	-8.2
384	Wholesale electronic markets and agents and brokers	-7	-0.8	-0.3
494	Automotive repair and maintenance, except car washes	-6	-0.4	-0.6
382	Wholesale - Petroleum and petroleum products	-3	-0.3	-9.1
429	Other real estate	-3	0.0	-0.2
399	Truck transportation	-2	-0.2	-0.3
403	Couriers and messengers	-2	-0.1	-0.1
454	Employment services	-2	-0.1	-0.1
491	Full-service restaurants	-1	0.0	-0.1
455	Business support services	-1	-0.1	-0.1

Table B-22. Top 2 positively impacted *RoMD* industries due to changes in fuel consumption, power generation and vehicle maintenance in Wicomico County, 2026-2045

Industry	Description	Additional Employment (Person)	Labor Income (Million)	Value Added (Million)
35	Electric power generation - Fossil fuel	2	0.4	1.6
36	Electric power generation - Nuclear	1	0.1	0.4

Table B-23. Top 2 negatively impacted *RoMD* industries due to changes in fuel consumption, power generation and vehicle maintenance in Wicomico County, 2026-2045

Industry	Description	Displaced Employment (Person)	Labor Income (Million)	Value Added (Million)
384	Wholesale electronic markets and agents and brokers	-2	-0.3	-0.1
429	Other real estate	-1	0.0	-0.1

Wicomico County – Power Generation Capacity Expansion

Table B-24. Top 2 impacted *local* industries due to power plant construction in Wicomico County, 2026-2045

Industry	Description	Average Employment (Person/yr)	Labor Income (Million)	Value Added (Million)
439	Architectural, engineering, and related services	2	2.2	2.8
47	Construction of new power and communication structures	2	1.7	2.7

Wicomico County – Building Upgrades

Table B-25. Top 10 impacted *local* occupations due to building upgrades in Wicomico County, 2026-2045

Code	Description	Average Employment (Person/yr)
47-2061	Construction Laborers	64
47-4098	Miscellaneous Construction and Related Workers	17
41-2031	Retail Salespersons	12
53-7065	Stockers and Order Fillers	3
41-4012	Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	3
47-2111	Electricians	2
41-1011	First-Line Supervisors of Retail Sales Workers	2
49-9021	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	2
11-1021	General and Operations Managers	2
43-4051	Customer Service Representatives	2

Table B-26. Top 10 impacted *RoMD* occupations due to building upgrades in Wicomico County, 2026-2045

Code	Description	Average Employment (Person/yr)
41-2031	Retail Salespersons	12
41-1011	First-Line Supervisors of Retail Sales Workers	2
35-3023	Fast Food and Counter Workers	2
41-2011	Cashiers	2
11-1021	General and Operations Managers	2
41-4012	Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	1
53-7065	Stockers and Order Fillers	1
53-7062	Laborers and Freight, Stock, and Material Movers, Hand	1
43-4051	Customer Service Representatives	1
43-5071	Shipping, Receiving, and Inventory Clerks	1

Table B-27. Top 10 impacted *local* industries due to building upgrades in Wicomico County, 2026-2045

Industry	Description	Average Employment	Labor Income	Value Added

		(Person/yr)	(Million)	(Million)
55	Maintenance and repair construction of nonresidential structures	86	112	112
395	Miscellaneous store retailers	25	11.3	15.8
384	Wholesale electronic markets and agents and brokers	11	23.2	7.9
387	Electronics and appliance stores	11	11.6	13.1
393	Sporting goods, hobby, musical instrument and book stores	10	7.1	13.6
386	Furniture and home furnishings stores	5	3.2	8.6
378	Wholesale - Machinery, equipment, and supplies	3	3.4	6.4
429	Other real estate	2	0.5	1.7
403	Couriers and messengers	1	0.6	1.0
454	Employment services	1	0.5	0.8

Table B-28. Top 10 impacted *RoMD* industries due to building upgrades in Wicomico County, 2026-2045

Industry	Description	Average Employment (Person/yr)	Labor Income (Million)	Value Added (Million)
394	General merchandise stores	24	20.0	33.4
384	Wholesale electronic markets and agents and brokers	4	10.2	3.6
429	Other real estate	1	0.6	2.5
404	Warehousing and storage	1	0.9	1.0
378	Wholesale - Machinery, equipment, and supplies	1	1.7	2.9
403	Couriers and messengers	1	0.2	0.4
395	Miscellaneous store retailers	1	0.3	0.4
472	Hospitals	0	1.0	1.2
491	Full-service restaurants	0	0.3	0.6
492	Limited-service restaurants	0	0.3	0.6

Appendix C

Maryland legislation, policy, and initiatives relating to decarbonization.

- The Maryland Climate Solutions Now Act of 2022 requires reducing greenhouse gas emissions to 60 percent below 2006 levels by 2031 and get on a path to net-zero emissions by 2045.
    - The law sets a 2030 deadline for the Maryland Department of the Environment (MDE) to create a plan laying out how it will achieve its 2045 net-zero carbon goals.
    - The CSNA built upon previous legislation, such as the Greenhouse Gas Reduction Act that called for 50% emissions reductions by 2030, as recommended by the Maryland Commission on Climate Change.
    - Under the CSNA, the Maryland Department of the Environment (MDE) was tasked with developing BEPS for buildings larger than 35,000 square feet. These standards are expected to establish benchmarking requirements as well as energy usage reduction and emissions reduction targets. Covered buildings are required to achieve a 20% reduction in direct greenhouse gas (GHG) emissions by 2030 compared with 2005 baseline levels

- The Maryland Renewable Portfolio Standard (RPS)'s goal is to recognize and develop the benefits associated with a diverse collection of renewable energy supplies. Electricity suppliers are required to meet a prescribed minimum portion of their retail electricity sales with various renewable energy sources. There are yearly carve outs and targets that are managed by the RPS.

- The Regional Greenhouse Gas Initiative (RGGI) is made up of eastern states in the Northeast and mid-Atlantic regions. The participating states have established a regional cap on carbon emissions, which sets a limit on the emissions from regulated power plants within RGGI states.

- The EmPOWER Maryland Energy Efficiency Act of 2008 originally established a goal to reduce per capita electricity usage. Overall, the EmPOWER program aimed to achieve an annual energy savings goal of 2% gross energy sales, which the CSNA increased to 2.25% for 2025-2026 and to 2.5% beginning in 2027, and this later changed in legislation to incorporate a core goal of reducing emissions through utility programs.

- Maryland has passed a wide range of legislation relating to building the next generation workforce in a green economy, while considering energy generation in a safe, reliable, and clean manner. Legislation includes support for energy net metering, energy storage goals, community solar (a permanent community solar program was created due to HB 908 of 2023), electric vehicles and charging infrastructure, energy storage (Maryland has a goal to reach a cumulative storage capacity of 750 MW's by 2027, 1,500 MW's by 2030, and 3,000 MW's by 2033 due to HB 910 of 2023), and offshore wind (goal of reaching 8,500 MW in capacity by 2031).

- Renewable Portfolio Standard (RPS)
  - 52.5% goal by 2030. Carve Outs and yearly targets can be found here
- Clean Vehicles and Electric Vehicles (EVs)
  - ACC (Advanced Clean Cars) 2: 100% sale of passenger car and light trucks starting in 2035
- RGGI
  - The Regional Greenhouse Gas Initiative (RGGI) is a cooperative effort among twelve Eastern states to reduce carbon dioxide (CO2) emissions from power plants within each participating state. Together, the participating states have established a regional cap on CO2 emissions, which sets a limit on the emissions from regulated power plants within the RGGI states
  - Goal to cut power plant emissions 30% below 2020 levels by 2030
- BEPS (Building Energy Performance Standards)
  - Under the CSNA, the Maryland Department of the Environment (MDE) was tasked with developing BEPS for buildings larger than 35,000 square feet. These standards are expected to establish benchmarking requirements as well as energy usage reduction and emissions reduction targets. Covered buildings are required to achieve a 20% reduction in direct greenhouse gas (GHG) emissions by 2030 compared with 2005 baseline levels
- EmPOWER
  - The General Assembly passed the EmPOWER Maryland Energy Efficiency Act of 2008, which established a goal to reduce per capita electricity usage
  - Overall, the EmPOWER program aimed to achieve an annual energy savings goal of 2% gross energy sales, which the CSNA increased to 2.25% for 2025-2026 and to 2.5% beginning in 2027 (updated goals found here)
- Net Metering and Community Solar
  - Both Net Metering and Community Solar are held to the Statewide 3,000 MW cap. As of June 30, 2022 Maryland has 1,033 MW's of installed capacity
  - Permanent Community Solar Program begins in 2025 (2023 HB 908)
- Energy Storage
  - Established in 2023 with HB 910, Maryland has a goal to reach a cumulative storage capacity of 750 MW's by 2027, 1,500 MW's by 2030, and 3,000 MW's by 2033.
  - If these goals cannot be met, the target is to achieve the maximum cost-effective capacity
- Offshore Wind
  - 2,000 MW have already been procured

Appendix D

The Just Transition Employment and Retraining Working Group Recommendations

Voted by the JTWG on August 30th, 2024, and approved by the MCCC in 2024 Report to the Governor and General Assembly

Recommendation 1: The Just Transition Principles are as follows:

- Quality clean job creation
- Occupational training and education
- Promoting investment in clean jobs and impacted communities
- Identifying and eliminating structural barriers to employment
- Hiring and retaining underrepresented workers
- Collaborating with stakeholders, especially emphasizing workers
- Ensuring fossil fuel workers are supported in transitioning into green energy sectors Final Recommendation

Recommendation 2: To successfully support Just Transition Principles in Maryland's new clean energy economy, new infrastructure projects should consider following best practices regarding labor, including but not limited to prevailing wages. This can be done through project labor agreements like the provisions under HB 397 of 2024, which supports Title 17, Subtitle 2 of the Maryland Finance and Procurement Article. This would provide job security and support for new and existing decarbonization construction projects of varying sizes.

Recommendation 3: The JTWG proposes a Green Jobs outreach campaign in 2025 to encourage applications and participation in clean energy-related apprenticeships (including energy audits, LEED certifications, and other relevant training programs) alongside the adoption of clean energy technologies. This two-pronged approach will support job growth in the clean energy sector as well as public adoption of clean energy technologies that job growth is contingent upon. This could include expanded Electrification Pilots across Maryland jurisdictions and other programs that educate consumers about greenhouse gas reduction strategies, which may include residential electrification and decarbonization, as well as provide financial and technical resources to implement decarbonization upgrades. The campaign would partner with pre-apprenticeship, apprenticeship, institutions of education, and other programs that specialize in clean energy workforce development and training to recruit segments of the population who may be underrepresented, including but not limited to person from economically marginalized communities and previously incarcerated persons, in the clean energy workforce.

Recommendation 4:

- The JTWG proposes additional strategic investments into expanding current registered apprenticeship programs that support transferrable skills, such as proven workforce models programs like the Maryland Department of Labor's Employment Advancement Right Now (EARN) Maryland, Registered Apprenticeship, and Maryland Works for Wind (MWW) to address existing and emerging workforce needs in solar, wind, geothermal, electrification, and other clean energy sectors.

- Investments in Registered Apprenticeship will be needed to create a robust clean energy workforce, but additional support for programs and certifications based around specific clean and sustainable occupations will also be needed. An infusion of additional funds in the EARN model will allow the Maryland Department of Labor to support new sector-based efforts to address occupational specific needs. Additionally, investments in workforce ecosystems, like the MWW framework, will allow partners, like unions, to develop curriculum, purchase new equipment, and provide specific training to ensure workers have the right skills to safely work on new clean energy projects, ensuring programming is responsive to emerging clean energy technologies and bolstering the availability of a highly skilled workforce to support these critical projects.