North Carolina Clean Energy Scenarios

Prepared for North Carolina Department of Commerce

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EBP

Contents

Executive Summary

North Carolina is advancing its efforts to address climate change, focusing on reducing greenhouse gas emissions, promoting clean energy, and ensuring equity and affordability. The 2023 Deep Decarbonization Pathways Analysis explores strategies for achieving these climate goals, offering insights into workforce development, business opportunities, and economic impacts associated with clean energy adoption.

North Carolina's economy is poised for steady growth with real GDP projected to increase 2.5% annually through 2050.[1] The state's workforce, at 5.1 million in 2024, is diverse with key sectors such as healthcare, retail trade, and manufacturing driving employment. Educational attainment is rising, with more than half of adults holding some college or higher qualifications.

This report is intended to be a contribution to a larger effort to advance North Carolina's capacity for evaluating the economic impacts of proposed clean energy policies, as it develops and applies an analysis methodology that can be applicable for a range of policy initiatives. To illustrate that approach, this report presents two scenarios: a **Reference Case** and a **Growth Scenario**, which model the adoption of clean energy technologies across four categories – wind, solar, electric vehicles (EVs), and energy efficiency in buildings. The Reference Case reflects current trends showing gradual increases in wind and solar energy and EV adoption. However, a more aggressive action is necessary to meet climate goals, as reflected in the Growth Scenario, which includes stronger adoption rates and a faster transition to net-zero emissions by 2050.

The clean energy scenarios provide detailed assumptions for energy supply and demand. For wind and solar, the Growth Scenario proposes a more rapid expansion compared to the Reference Case. The demand side assumes more aggressive adoption of zero-emissions vehicles and high-efficiency technologies in buildings. Additionally, the Growth Scenario accelerates the transition to electrified, energy-efficient systems in residential and commercial buildings.

This report specifically evaluates the economic impact of clean energy adoption incrementally, meaning the impacts presented reflect **additional** jobs creation and economic activity generated by the more aggressive actions outlined in the Growth Scenario (high) beyond what is projected in the Reference Case (business-as-usual). In other words, the total economic impacts would include the baseline of the Reference Case plus the incremental effects from the Growth Scenario. These incremental impacts include new jobs and economic output generated by the increased adoption of clean energy technologies and the more aggressive decarbonization efforts in the Growth Scenario.

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[1] Moody's forecast

Our analysis of additional impacts encompasses direct, indirect, and induced impacts. Direct impacts include direct jobs and output resulting from clean energy projects; indirect impacts reflect supply chain activities; and induced impacts stem from increased worker income spending. The analysis uses an input-output model to trace the flow of economic activity and estimates the multiplier effects across sectors. This methodology reveals that clean energy advancements will stimulate broad economic growth, creating substantial additional job opportunities reinforcing the state's long-term sustainability goals.

The report provides key insights for policymakers and stakeholders on how clean energy initiatives can drive economic benefits for North Carolina and help the state meet its climate goals while fostering job creation and business development.

Key Policy Findings

- The total employment impact of the Growth's clean energy initiatives in wind, solar, building energy efficiency, and electric vehicles policies between 2024 and 2050 is estimated at close to 9,700 additional annual jobs.
- Increased wind energy generation would create the most significant impact with close to 5,500 additional annual jobs. Energy efficiency in buildings will have the least significant impact creating less than 150 additional annual jobs.
- Clean energy initiatives in North Carolina could attract significant business investment to sectors like (1.) Construction, (2.) Manufacturing, and (3.) Growth, Waste Management, and Remediation Services. One half of all new clean energy employment will come from these three sectors.
- A third of occupations with the largest employment gains from North Carolina's clean energy initiatives earn above the state's average wage of $59,730,[2] including technical roles such as Software Developers, Construction Managers, and Electricians.
- The employment impacts of building efficiency improvements are modest due to existing high energy performance standards in North Carolina, and the fact that the same companies that produce less efficient building materials often also manufacture the high-efficiency alternatives. However, these improvements still offer substantial environmental benefits by reducing energy use and emissions.

[2] BLS May 2023 State Occupational Employment and Wage Estimates

- The employment impacts of electric vehicles (EVs) adoption in North Carolina are most significant for Manufacturing, Utilities, and Wholesale Trade, but the overall economic impact is likely underestimated and remains uncertain due to the nascent stage of the medium- and heavy-duty electric vehicle market.

Introduction

Beginning in 2018, then-Governor, Roy Cooper focused on addressing the climate crisis in North Carolina by setting green-house-gas (GHG) targets, promoting clean energy, and ensuring equity and affordability while creating opportunities for all North Carolinians. Executive Order (E.O.) 246 initiated the Deep Decarbonization Pathways Analysis to guide North Carolina in meeting its climate goals by modeling strategies for reducing GHG emissions and helping policymakers and stakeholders understand key opportunities and tradeoffs in emission-reduction efforts.

In February 2023, Governor Cooper's Office published the Deep Decarbonizations Pathways Analysis providing an understanding of how to achieve deep decarbonization goals across the state's economy and within specific sectors, building on existing statewide efforts.

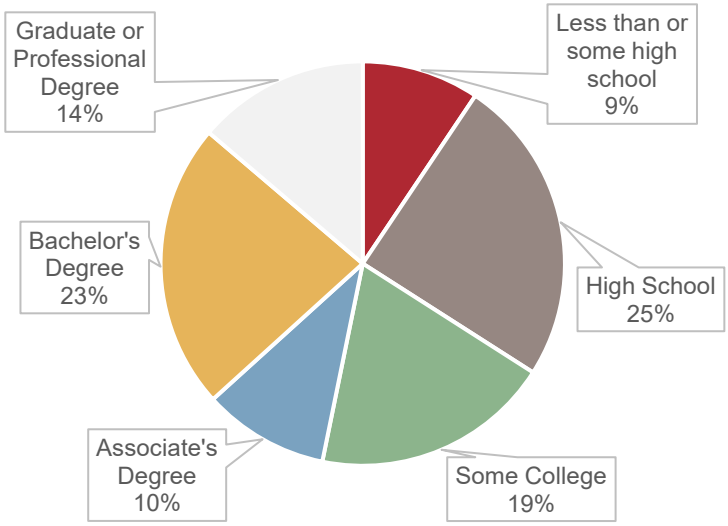
This report provides the state, and specifically, the North Carolina Department of Commerce with information regarding future workforce development needs, business development opportunities, and potential economic impacts associated with adoption of clean energy initiatives described under the Deep Decarbonization Pathways Report as well as future implementation of the policies and goals set out in H951 and E.O.s 218 and 246.

North Carolina State Profile

- North Carolina real GDP in 2023 grew 2.7% year-on-year reaching $625.7 billion.
- Real GDP in North Carolina is projected to grow[3] at an average annual rate of 2.5% through 2050.
- Total jobs[4] in North Carolina in 2024 are averaging 5.1 million (BLS).
- Unemployment rate in July 2024 stood at 3.7% (BLS).
- Total state population in 2022 approached 10.7 million (Census).
- Majority of adult (25 and older) North Carolinians (52%) have more than high school diploma while the rest (48%) have at least high school and some college.

[3] Moody's forecast
[4] Wage and salary employment

Figure 1. North Carolina Educational Attainment Ages 25 Years and Older, 2023



Source: U.S. Census Bureau, 2023 American Community Survey 1-Year Estimates

Ten sectors accounted for more than 81% of all state's employment in 2023. Table 1 summarizes the top ten sectors by employment in North Carolina highlighting the state's diverse economy. Leading the list is Health Care and Social Assistance, employing 665,289 people, reflecting its crucial role in serving a growing population. Retail Trade follows with 531,318 jobs, driven by consumer demand. Manufacturing remains a key sector with 469,461 workers, underscoring North Carolina's industrial strength. Accommodation and Food Services employ 452,898 people, supporting the state's tourism and hospitality industries. Educational Services account for 387,408 jobs, reflecting the importance of education in the state. Professional, Scientific, and Technical Services, along with Administrative Support, Waste Management, and Remediation Services, both contribute significantly with around 331,000 jobs each. The Construction sector provides 261,398 jobs, while Finance and Insurance employs 228,721, supporting both infrastructure development and financial stability. Government jobs, across federal, state, and local levels, employed 254,080 people.

Table 1. Top 10 Sectors in North Carolina by 2023 Employment

Sector	Employment	Share of All Jobs
Health Care and Social Assistance	665,289	14%
Retail Trade	531,318	11%
Manufacturing	469,461	10%
Accommodation and Food Services	452,898	9%
Educational Services	387,408	8%
Administrative, Support, Waste Management and Remediation Services	331,652	7%
Professional, Scientific, and Technical Services	331,548	7%
Construction	261,398	5%
Public Administration	254,080	5%
Finance and Insurance	228,721	5%

Source: North Carolina Department of Commerce Quarterly Census of Employment and Wages (QCEW), 2023

The top ten major occupations accounted for more than 76% of all state's employment in 2023. Table 2 summarizes top ten occupations by employment in North Carolina illustrating the state's employment landscape is shaped by a mix of dominant sectors and a wide range of occupations. Office and Administrative Support Occupations, the common occupation type with 554,240 jobs (12% share), likely support various sectors like Retail Trade, Health Care, and Professional Services, all of which require substantial administrative infrastructure. Retail Trade sector is also reflected in the high number of Sales and Related Occupations (10% share). The Transportation and Material Moving occupations likely supports industries such as Manufacturing and Construction, and Retail, ensuring supply chain continuity. Additionally, Educational Instruction and Library Occupations correspond with the Educational Services 8% share of total state's employment, reflecting the state's emphasis on education and training. Overall, the state's workforce is balanced across sectors and occupations, with a strong presence in healthcare, retail, manufacturing, and administrative roles.

Table 2. Top 10 Major Occupations in North Carolina in 2023

Occupation	Employment	Share of All Jobs
Office and Administrative Support Occupations	554,240	12%
Sales and Related Occupations	488,730	10%
Transportation and Material Moving Occupations	468,220	10%
Food Preparation and Serving Related Occupations	425,680	9%
Production Occupations	329,170	7%
Business and Financial Operations Occupations	323,970	7%
Healthcare Practitioners and Technical Occupations	301,580	6%
Management Occupations	291,400	6%
Educational Instruction and Library Occupations	272,400	6%
Installation, Maintenance, and Repair Occupations	196,380	4%

Source: Bureau of Labor Statistics, Department of Labor Occupational Employment and Wage Statistics (OEWS) Survey

North Carolina is well positioned to navigate potential growth in the identified industries and occupations considering its robust education and workforce systems, affordable post-secondary education, strong public workforce system, and promising practices identified by novel clean energy workforce initiatives.

North Carolina is home to 115 public school districts, 58 community colleges, 16 public universities, and 36 independent colleges and universities, and 20 local workforce development boards. Both locally and at the state level is their strong multi-agency collaboration to better align curricula and create seamless career pathways to support learners over their lifetime. NCcareers.org provides career exploration and planning tools that support students, families, and educators understanding the in-demand career options and education programs across the state.

The state has made significant investments in college affordability through programs such as the NextNC Scholarship, the Longleaf Commitment Grant, Finish Line Grants program, and NC Promise.

Scenarios Development Methodology

Adoption Levels of NC Clean Energy Technologies in Two Scenarios

Our methodology starts with formulation of two scenarios, **the Reference Case** and **the Growth Scenario**. Each scenario is associated with some proposed levels of technology adoption within five different categories. The categories correspond to two renewable energy supply technologies, wind and solar, and three categories of energy demand technologies, electric vehicles, energy efficiency in building structures, and energy efficiency in building operating systems.

The technology adoption levels in the Reference Case are derived from the 2023 Deep Decarbonization Pathways Report. The Reference Case reflects key technology trends and policies in North Carolina such as population growth and customer investments in EVs. The

Reference Case is an important starting point to understanding North Carolina's current emissions path.

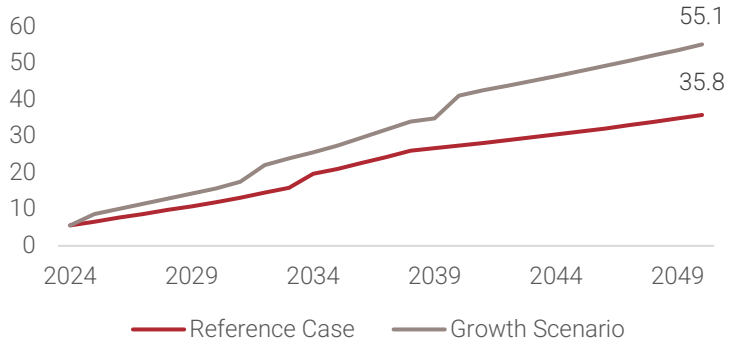
The Reference Case assumes continued future growth of wind and solar energy generation, as well as continued adoption of EVs and energy efficiency in building structures and building operating systems and puts North Carolina on track to reduce emissions over time. However, the scenario demonstrates that more action is needed to achieve the state's climate goals. The Growth Scenario assumes a more aggressive net-zero pathway in future years, with stronger adoption rates of clean energy technologies through 2050.

Clean Energy Supply Assumptions

Figure 2 illustrates two scenarios for wind and solar energy generation in North Carolina through 2050.

- In the Reference Case, 2.4 GW of wind energy is added in 2034 and solar energy generation grows at an average annual rate of 7.4% reaching 33 GW by 2050.
- The Growth Scenario, in line with E.O. 218, assumes 2.8 GW of wind energy is added in 2032 and 8.4 GW (non-cumulative) in 2040, and then grows at 2.9% annual rate through 2050 reaching 11.2 GW. In the case of solar energy generation, the Growth Scenario assumes 33% increase over the Reference Case for total 43.9 GW by 2050.

Figure 2. NC Clean Energy (Wind & Solar) Generation in Two Scenarios, GW



In addition to the supply side of the economy, the model also assumes emerging technologies mix on the demand side of the economy. In other words, the model considers different pathways for consumer demand in transportation for EVs, and in energy efficiency in building structures and building operating systems.

Clean Energy Demand Assumptions

Figure 3 summarizes assumptions about EVs sales between 2019 and 2050 in two scenarios.

- The Reference Case is based on historical data and 2023 Energy Information Administration (EIA) Electric Vehicle Projections.[5]
- The Growth Scenario merges North Carolina's EV needs assessment and the Deep Decarbonization Net Zero Scenario: 50% of new vehicle sales are EV by 2030 and 100% by 2050.

Figure 3. NC Electric Vehicle Sales in Two Scenarios, % Share of Total[6]

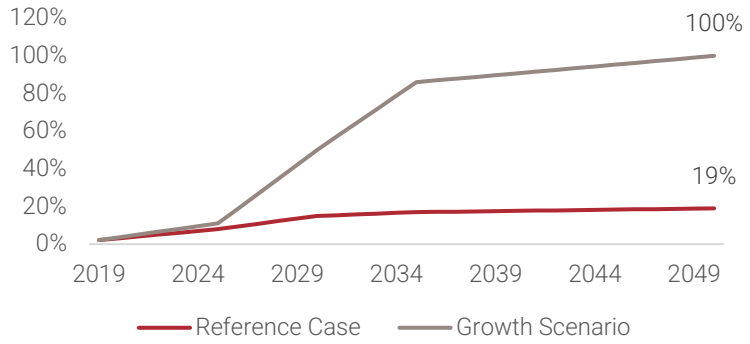
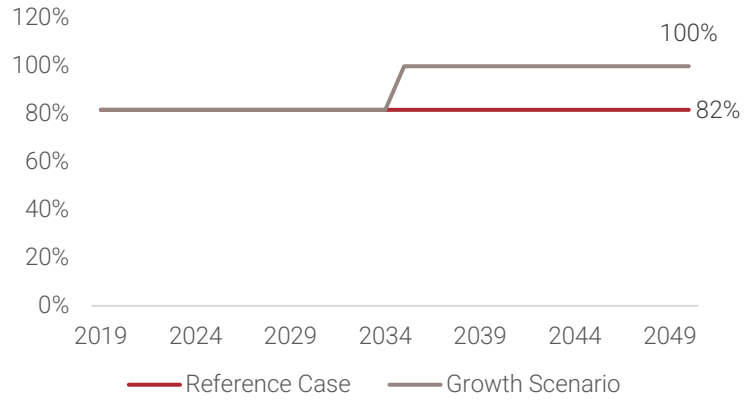


Figure 4 summarizes assumptions about adoption rates of efficient technologies in building construction standards (i.e. building shell materials, windows, insulation, electric-HVAC, etc.) in two scenarios.

- The Reference Case assumes the existing building codes are unchanged for all new construction, i.e. all new construction built to 2015 International Energy Conservation Code (IECC) with amendments.
- The Growth Scenario assumes all new construction is built to the latest IECC building codes in addition to significant expansion of weatherization for existing buildings, all-electric new construction starting in 2035.

5 https://www.eia.gov/outlooks/aeo/pdf/AEO2023_Release_Presentation.pdf
6 Light duty vehicles

Figure 4. NC Efficient Building Construction Standards in Two Scenarios, % Share of Total



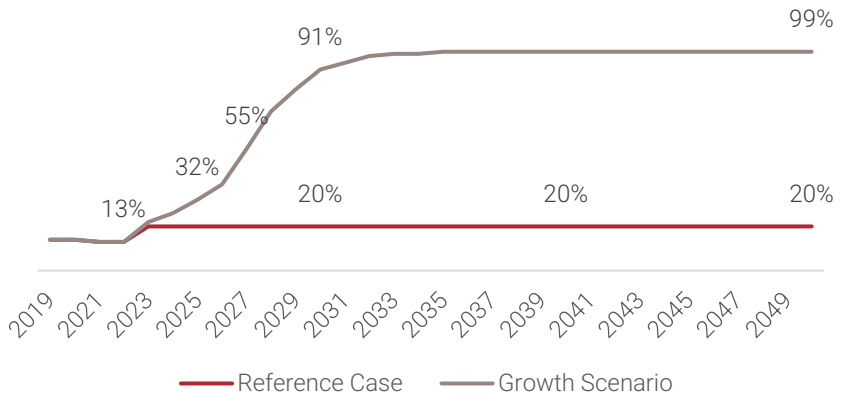
Direct GHG emissions in buildings from on-site combustion of fuels for end-uses like space and water heating account for around 50% of direct GHG emissions from buildings. Relative to many other states with net-zero emissions targets, North Carolina already has a high penetration of electrified devices for space and water heating.[7] Decarbonizing the remaining fossil fuel consumption of these end-uses, and improving the efficiency of building envelopes, are important considerations for achieving the state's GHG targets.

Figure 5 summarizes assumptions about adoption rates of efficient operating systems in Residential & Commercial buildings (i.e. water heating, space heating, other) in two scenarios.

- The Reference Case assumes business-as-usual sales, appliance efficiency improvements are based on projections from the EIA Annual Energy Outlook, and there is a small increase in heat pump sales for space heating based on federal incentives.
- The Growth Scenario assumes a ramp-up in adoption of high efficiency water and space heaters, such as electric heat pump space heaters, heat pump water heaters, etc. All newly sold units are high-efficiency models by 2030. By 2040, 100% of sales are electrified high-efficiency devices for all end-uses.

7 EIA Residential Energy Consumption Survey (RECS)

Figure 5. NC Efficient Building Operating Systems in Two Scenarios, % Share of Total



Direct, Indirect, and Induced Impacts

The total economic impact of improvements in clean energy generation (wind and solar) includes three types of impacts.

Direct impacts refer to immediate effects of clean energy projects on industry output. For example, when a new solar power plant is built, the direct impact includes economic output and jobs from construction, operation, and manufacturing of the equipment. Indirect impacts are the result of the supply chain activity related to the project. Industries that provide goods and services to the clean energy sector, like manufacturing of components, transportation, or raw materials, will see increased demand. For example, a solar panel manufacturer will be purchasing more raw materials, triggering increased production in the sectors supplying those raw materials. Finally, induced impacts stem from increased spending by workers whose income has been boosted by the direct and indirect activities. When workers employed by in the clean energy sector or in its supply chain spend their earnings on housing, food, entertainment, for example, this spending stimulates further economic activity in different sectors of the economy, and we call this the induced impact.

We use an input-output (I-O) model to trace the flow of spending through the economy starting with direct spending in clean energy as the model input. Modeling the supply chain and workforce implications of clean energy generation in North Carolina involves several steps. First, the assumptions about capacity (MW) in Figure 2 are translated into locally sourced economic activity in relevant sectors (measured as $ industry output or direct output impacts) using the latest cost and performance data for renewable energy generation technologies.[8] Once direct spending is established, the I-O model's linkages and multipliers are used to calculate the additional indirect and induced impacts in terms of economic output, income, or employment generated for every dollar of direct spending. This process highlights how clean energy

8 NREL 2024 Electricity Annual Technology Baseline: https://atb.nrel.gov/electricity/2024/changes_in_2024

advancements generate direct economic activity, which then creates ripple effects across industries and through workers' spending, amplifying the overall economic impact. A more detailed discussion of estimation of direct impacts by technology is provided in the Appendix.

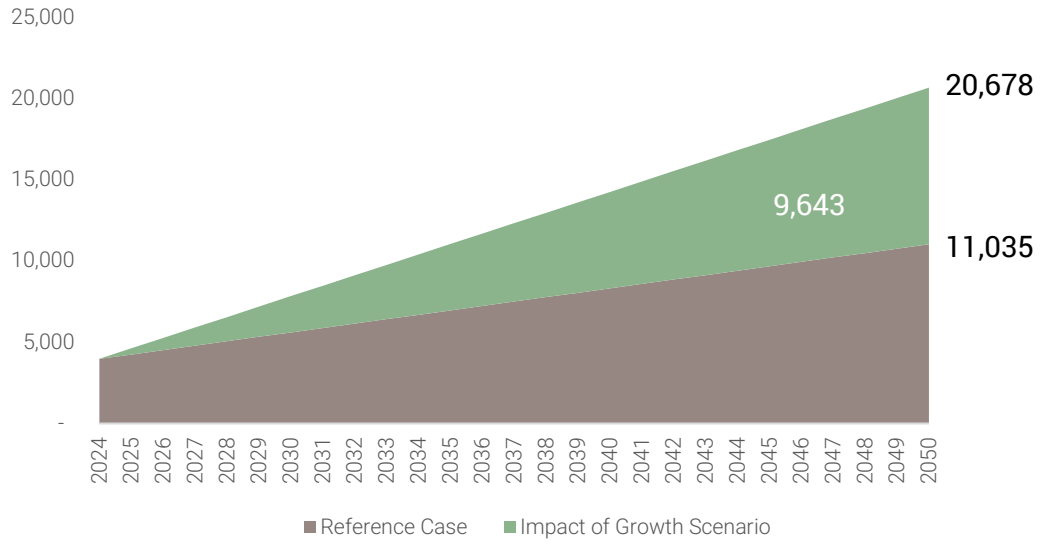
The next section summarizes findings in terms of total employment impacts by North Carolina sector.

Clean Energy Scenarios Total Employment Impacts

In our analysis, the economic impact estimates are incremental and derived by comparing two distinct scenarios: the Reference Case, which represents business as usual, and the Growth Scenario, which reflects a more aggressive approach toward achieving North Carolina's net zero clean energy goals. The economic impacts are calculated based on the difference between these two scenarios, measuring the additional effects that arise from implementing the more ambitious policies and initiatives assumed in the Growth Scenario compared to the status quo. This approach provides a clear assessment of the added benefits associated with enhanced clean energy deployment.

Figure 6 highlights the impact and significance of the Growth Scenario compared to the business-as-usual Reference Case. By 2050, the Reference Case projects total annual employment impacts (expressed as job years) of 11,035. In contrast, the Growth Scenario, driven by additional efforts to achieve net-zero carbon emissions, would generate 20,678 jobs in clean energy industries. This represents a substantial increase of 9,643 additional jobs by the end of the forecast horizon.

Figure 6. Total Annual Employment (Job Years) Impacts in Two Scenarios



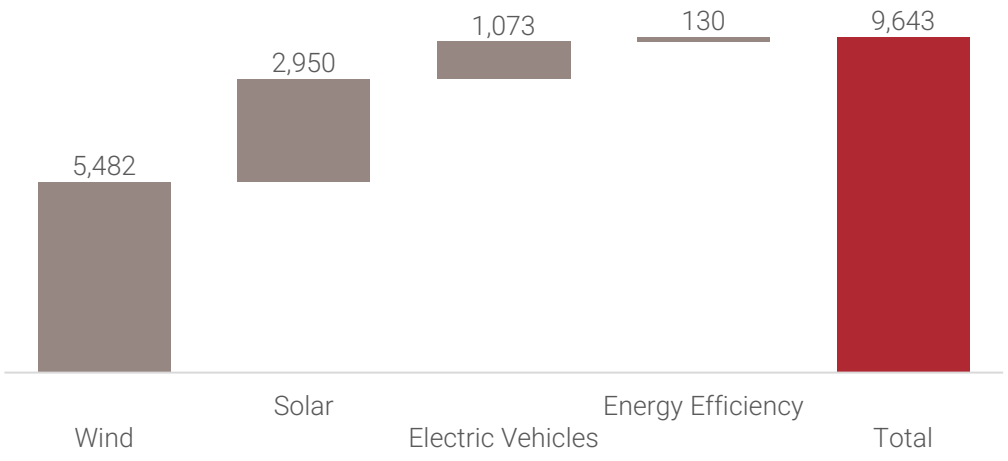
Source: 2022 IMPLAN; NREL; Moody's US Sectors Forecasts; EBP Scenarios Analysis

Figure 7 shows total employment impacts of the clean energy initiatives modeled in the Growth Scenario expressed as total annual jobs created. For example, assume a new automobile manufacturing facility's operations are estimated to support 50 jobs in office and administrative support services in its opening year, and the facility continues to operate for 10 years. Our total employment impact estimate for this scenario would be total employment impact of 50 annual jobs, not 500.

Total jobs impacts in Figure 7 are summarized by program element as we analyze a range of programs considered including wind and solar energy generation, energy efficiency in buildings, and zero carbon emissions electric vehicles. Although solar energy currently leads in job creation, the long-term employment impact from wind energy is expected to be greater due to the growth potential of the sector and the complexity of projects. In addition, wind projects typically involve longer construction times and require more frequent maintenance and technological upgrades than solar. This extended operational phase translates into continuous employment in maintenance and operation over the life of a project, which typically operates for 20 to 30 years.

Our analysis of employment impacts for EVs is based solely on projected future changes specific to North Carolina, while assuming a status quo for all other states. If North Carolina changes were seen as part of a broader effort that would help encourage other states to take the same actions by 2050, then the future clean energy job gains for North Carolina would stand to have larger gains than the impacts estimates presented in this report.

Figure 7. NC Clean Energy Scenarios Additional Employment Impacts[9]



Source: 2022 IMPLAN; NREL; Moody's US Sectors Forecasts; EBP Scenarios Analysis

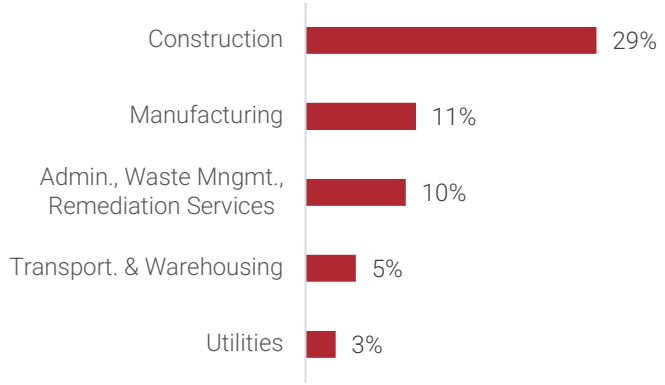
Our model assumes moderate productivity (or output per employee) gains over the long-term horizon (2024-2050). This assumption incorporates potential productivity improvements over

9 Average annual additional employment between 2024-2050 due to the Growth Scenario.

time. The U.S. productivity has fluctuated over time, and digital transformation in recent decades has driven gains in many sectors. Shifts in technology, investment, and economic conditions have driven productivity cycles. The evolution of industries, including clean energy, enables advances in technology, better training, and process efficiencies that enable workers to produce more output with the same or fewer resources. Our model accounts for the possibility that fewer workers may be needed to achieve the same level of output in the future. Moreover, this assumption also allows for the creation of new roles and industries that could emerge due to innovation, shifts in demand, and evolving market conditions, yielding a more accurate estimate of future job growth and economic impacts.

Clean energy initiatives in North Carolina have the potential to attract significant business investment to underrepresented sectors, particularly construction, which currently accounts for 6% of all North Carolina employment. Figure 8 shows Construction is projected to account for 29% of the new additional jobs (~2,000) created by the clean energy initiatives modeled in the Growth Scenario, which would increase the sector's state employment share by more than 1%. Another sector that currently plays a smaller role in the state's economy that stands to benefit significantly from expansion of clean energy projects is Administration, Waste Management and Remediation Services, which is estimated to add close to an additional 1,200 jobs annually. Most of these jobs (84%) will be in office administrative services. However, the construction of renewable energy infrastructure and retrofitting of buildings generate waste that needs to be safely disposed of or recycled. Additionally, decommissioning outdated energy infrastructure and responsibly handling either damaged or end-of-life equipment from solar projects or other energy systems will require specialized waste management services, creating new business opportunities in this field. Similarly, the additional need for remediation services such as reclamation of old industrial sites or brownfields for renewable energy development will attract businesses that specialize in environmental cleanup and soil rehabilitation, further expanding the sector's role in the state's economy: 10% of the newly created jobs will come from this sector compared to current 4% of the state's total employment.

Figure 8. Top Estimated Annual Employment Impacts by Sector, % Share of Total, 2024-2050

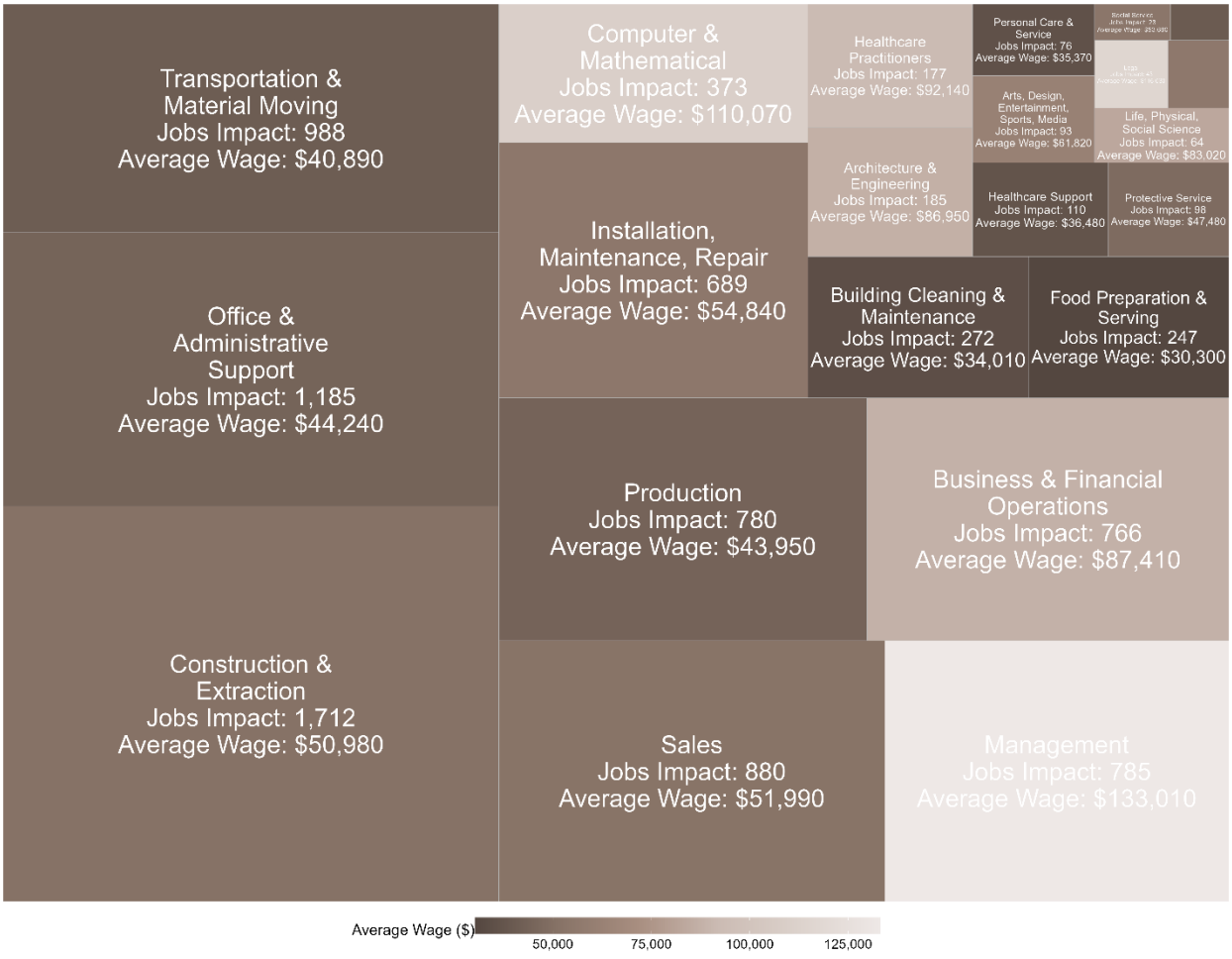


Source: 2022 IMPLAN; NREL; Moody's US Sectors Forecasts; EBP Scenarios Analysis

Table 3 illustrates top ten major occupations with largest employment gains due to the clean energy initiatives, and they account for 90% of total employment gains due to the Growth Scenario. Clean energy projects, particularly in renewable energy generation like wind and solar, require significant labor for building infrastructure, installing turbines, solar panels, and retrofitting buildings for energy efficiency. Workers in these fields are crucial for the construction and maintenance phases of clean energy projects.

As clean energy companies grow, they need robust administrative teams to manage operations, schedule projects, track regulatory compliance, and handle general office duties. This includes support for finance, human resources, and project management functions. Additionally, the clean energy supply chain requires workers to transport raw materials, components, and equipment to manufacturing sites, project locations, and markets. This sector includes drivers, logistics managers, and material handlers, ensuring the smooth delivery of critical infrastructure.

Figure 9. Average Annual Additional Clean Energy Employment Gains and Current Sector Wage by North Carolina Occupation, 2024-2050



Source: 2022 IMPLAN; BLS OEWS May 2023; EBP US analysis

Figure 9 illustrates estimated economic impacts by North Carolina sector and the average state wage associated with each occupation.

Average wage in North Carolina stood at $59,730 in May 2023, according to BLS OEWS. In Table 3, occupations with above-average wage are marked with an asterisk (*). One third of top occupations earn above-average wage and include technical occupations such as Software Developers, Construction Managers, Electricians, Mechanics, Installers, Repairers, Accountants and Auditors.

Table 3. North Carolina Average Wage by Major Occupation

Rank	Occupation	Average Wage	Employment Impacts	Output Impacts ($B)
1	Construction and Extraction	$50,980	1,712	$8.8
2	Office and Administrative Support	$48,220	1,186	$6.1
3	Transportation and Material Moving	$41,130	989	$5.1
4	Sales and Related Occupations	$79,360*	880	$4.5
5	Management Occupations	$143,120*	785	$4.0
6	Production Occupations	$45,260	781	$4.0
7	Business and Financial Operations	$85,620*	767	$3.9
8	Installation, Maintenance, and Repair	$59,280	690	$3.5
9	Computer and Mathematical	$107,570*	374	$1.9
10	Building Cleaning and Maintenance	$38,260	273	$1.4
	All Occupations	$59,730	9,635	$49.3

Source: 2022 IMPLAN; BLS OEWS May 2023; EBP US analysis
Note: Occupations with above-average wage are marked with an asterisk (*)

Clean Energy Supply Economic Impacts

Wind Energy Generation Economic Impacts

Table 4 shows the difference between the Reference Case and the Growth Scenario of the wind energy generation economic impacts expressed in terms of average annual business output (total dollar value of production) and employment between 2024 and 2050.

Table 4. NC Wind Energy Generation Additional Economic Impacts 2024-2050, 2024 dollars

Sector	Total Output ($B)	Additional Average Annual 2024-2050 Clean Energy Jobs Impact	Sector Share of Total 2023 NC Employment
Construction	$11.0	49%	6%
Finance and Insurance	$1.9	7%	5%
Real Estate, Rental, Leasing	$1.6	6%	2%
Prof., Sci., Tech. Services	$1.4	5%	9%
Manufacturing	$1.3	5%	11%
Other	$7.1	27%	67%
Total	$24.2	100% (5,471 additional jobs)	100% (6 M annual jobs in NC)

Source: 2022 IMPLAN; EBP Scenarios Analysis

Solar Energy Generation Economic Impacts

Table 5 shows the difference between the Reference Case and the Growth Scenario of the solar energy generation economic impacts expressed in terms of average annual business output (total dollar value of production) and employment between 2024 and 2050.

The expansion of solar energy generation in North Carolina will impact employment in administrative services as solar installations require significant project coordination, permitting, and staffing support. As the solar energy sector requires the movement of large quantities of solar panels, equipment, and materials to construction sites, demand for jobs in logistics, shipping, and inventory management will be impacted. Similarly, the need for land acquisition, leasing, and management of large tracts of land is crucial for this sector, and therefore, real estate, rental and leasing sector will benefit from the development of solar infrastructure. Lastly, the complexity of solar energy projects will impact demand for engineers, environmental consultants, and scientists to design, implement, and optimize solar energy systems. Therefore, professional and scientific services sector will be impacted as these professions are needed and involved in research and development ensuring that solar installations are efficient and compliant with regulations.

Table 5. NC Solar Energy Generation Additional Economic Impacts 2024-2050, 2024 dollars

Sector	Total Output ($B)	Additional Average Annual 2024-2050 Clean Energy Jobs Impact	Sector Share of Total 2023 NC Employment
Admin., Waste Management and Remediation Services	$1.7	29%	8%
Transport. and Warehousing	$0.9	10%	5%
Real Estate, Rental, Leasing	$0.7	10%	2%
Prof., Sci., Tech. Services	$0.7	8%	9%
Construction	$0.5	7%	6%
Other	$2.91	37%	70%
Total	$7.4	100% (2,940 additional jobs)	100% (6 M annual jobs in NC)

Source: 2022 IMPLAN; EBP Scenarios Analysis

The larger employment impacts for wind energy generation compared to solar through 2050 may stem from several factors. While solar energy generation is currently ahead in North Carolina, wind energy is expected to experience a more rapid growth, particularly as advancements in offshore wind technology increase capacity and deployment potential. Wind energy projects, especially offshore, tend to be larger and more complex, requiring more labor-intensive construction, installation, and ongoing maintenance than solar farms, which often have simpler infrastructure. Additionally, wind energy development involves more specialized manufacturing and logistics for turbines, which can drive job creation across multiple sectors, and therefore, the projected scale of wind energy expansion leads to greater employment impacts relative to solar energy.

Clean Energy Demand Economic Impacts

Energy Efficiency in Buildings

In terms of energy efficiency in building shells, Table 6 shows the difference between the Reference Case and the Growth Scenario economic impacts expressed in terms of average annual business output (total dollar value of production) and employment between 2024 and 2050.

Table 6. Top 5 Sectors: NC Energy Efficiency Economic Impacts 2024-2050, 2024 dollars

Sector	Total Output ($M)	Additional Average Annual 2024-2050 Clean Energy Jobs Impact	Sector Share of Total 2023 NC Employment
Manufacturing	$1,235	67%	11%
Wholesale Trade	$112	6%	5%
Real Estate, Rental, Leasing	$67	4%	2%
Transport. & Warehousing	$56	3%	5%
Finance and Insurance	$51	3%	5%
Other	$307	17%	72%
Total	$1,829	100% (130 additional jobs)	100% (6 M annual jobs in NC)

Source: 2022 IMPLAN; EBP Scenarios Analysis

Employment impacts for clean energy initiatives focused on improving efficiency in building shells may not seem large relative to clean energy supply impacts in the previous section. While retrofitting buildings for better insulation and energy efficiency can require a significant upfront labor investment, these are often infrequent upgrades, such as adding insulation or installing energy-efficient windows and doors. Once completed, ongoing labor demand is minimal compared to other sectors like energy generation, which require continued operation, maintenance, and expansion.

Additionally, the cost differential between the 2018 North Carolina Energy Conservation Code, which is based on the 2015 International Conservation Code, and the more efficient code, which would be based on the most recent International Conservation Code, are minimal, leading to relatively fewer job increases. For example, the Pacific Northwest National Laboratory calculated that moving the North Carolina Energy Conservation Code from the 2015 International Conservation Code to the 2021 International Conservation Code would result in a maximum construction cost increase of $5,070 for a single-family house and an ultimate $6,223 life-cycle cost savings.[10] As a result, the scope of labor-intensive retrofits may be small compared to other clean energy sectors like renewable energy generation, which still has a considerable room for growth.

Lastly, while improvements in building energy efficiency are beneficial, the incremental economic impact is relatively small. This is because the same companies that produce less efficient building materials often also manufacture the high-efficiency alternatives. As a result, the shift to more efficient products doesn't significantly alter the production landscape or create large-scale new economic activity. However, the overall significance of the building materials sector in the

10 https://www.energycodes.gov/sites/default/files/2021-07/NorthCarolinaResidentialCostEffectiveness_2021_0.pdf

state remains large due to its broad role in construction and infrastructure, making it a key component of the state's economy despite the limited incremental impact from efficiency improvements. And not to mention the significant environmental benefits and the role high-efficiency materials play in reducing overall energy consumption in buildings. While the economic impact from shifting to high-efficiency materials in buildings is incremental, the cumulative environmental impact can be substantial as buildings account for a significant portion of energy use and carbon emissions.

Electric Vehicles (EVs)

North Carolina ranks in the top five states for completions in automotive-related degrees. The state houses 110 universities and community colleges conferring over 1,700 bachelor's degrees in mechanical, industrial systems, and electrical engineering, along with 2,500 automotive systems, mechanical, industrial, and electrical engineering technology associate degrees annually. The state's higher education institutions are also creating partnerships to develop curriculum that equip students with skills needed for electric vehicle manufacturers.[11] According to the Transportation Electrification in the Southeast September 2023 report, North Carolina stood only behind Georgia and Tennessee tallying 11,723 EV manufacturing jobs through June 2023, with above national average earnings of approximately 5%.

For North Carolina's EVs demand, Table 7 shows the difference between the Reference Case and the Growth Scenario economic impacts expressed in terms of average annual business output (total dollar value of production) and employment between 2024 and 2050.

The employment impacts of the EVs are most significant for manufacturing, utilities, and wholesale trade due to the broad economic shifts driven by EV adoption. In manufacturing, the sector will experience substantial growth as the shift from internal combustion engines to EVs requires new technologies and workforce skills as well as manufacturing facilities in North Carolina. The utilities sector is also impacted, as increased electricity consumption from EVs drives job growth in electricity generation, grid management, and EV charging infrastructure. Similarly, wholesale trade benefits from the need to distribute specialized EV components and materials, creating new logistics and supply chain demands.

[11] Economic Development Partnership of North Carolina, https://edpnc.com/wp-content/uploads/2024/05/Automotive-EV-Brochure.pdf

Table 7. Top 5 Sectors: NC EVs Additional Economic Impacts 2024-2050, 2024 dollars

Sector	Total Output ($B)	Average Annual 2024-2050 Clean Energy Jobs Impact	Sector Share of Total 2023 NC Employment
Manufacturing	$8.9	58%	11%
Utilities	$2.0	10%	0%
Wholesale Trade	$1.1	7%	5%
Real Estate, Rental, Leasing	$0.6	4%	2%
Finance and Insurance	$0.5	3%	5%
Other	$2.7	18%	77%
Total	$15.7	100% (1,071 additional jobs)	100% (6 M annual jobs in NC)

Source: 2022 IMPLAN; EBP Scenarios Analysis

Our impact estimates are limited to light-duty vehicles and SUVs because the EV industry is still in its early stages, particularly for medium- and heavy-duty vehicles. This nascency introduces a high degree of uncertainty regarding the future direction and market penetration of EVs in these larger vehicle classes. While light-duty EV production has clearer pathways with established demand and technology, the development, manufacturing, and adoption timelines for medium- and heavy-duty EVs remain less predictable. Therefore, since these vehicles are excluded from the analysis, our figures may underestimate the true economic impact of North Carolina's EVs adoption.

The specific launch year of large-scale electric vehicle manufacturing in North Carolina – whether 2026 or 2028 – is less critical to this long-term economic impact analysis, as our focus is on the average annual impacts over a multi-decade horizon. Long-term economic models smooth out short-term fluctuations, such as the peaks in employment during construction and the initial ramp-up phase and any potential troughs due to delays. Moreover, our custom industry framework captures a range of activities beyond vehicle assembly, including battery production, charging infrastructure, and shifts in fuel demand. Over several decades, variations in employment impacts during specific years become less significant, as the overall trend and sustained operations and comprehensive shifts in the supply chain are more important for estimating the broader average effects on job creation, energy demand, and economic output.

The Appendix contains a detailed discussion of our electric vehicles modeling framework.

Employment Impacts by Occupation

Top thirty occupations ranked by total average annual employment gain impacts, shown in Table 8, account for almost 50% of total employment gains from clean energy initiatives and illustrate a diverse workforce needs to support clean energy advancements. These top thirty occupations

represent a broad range of skills spanning from construction, transportation, sales, management to administrative support, and reflect the varied labor demands of clean energy projects.

Average wage in North Carolina is $59,730. In Table 8, occupations with above-average wage are marked with an asterisk (*). A third of top occupations earn above-average wage and include technical occupations such as Software Developers, Construction Managers, Electricians, Mechanics, Installers, Repairers, Accountants and Auditors.

Table 8. Top 30 Occupations Ranked by Average Annual Employment Gains, 2024-2050

Rank	Occupation	Average Wage	Additional Average Annual 2024-2050 Employment Impacts
1	First-Line Supervisors of Construction Trades and Extraction Workers	$69,700*	320
2	Construction Laborers	$40,830	311
3	Laborers and Freight, Stock, and Material Movers, Hand	$35,650	290
4	Customer Service Representatives	$41,120	227
5	Construction Managers	$112,760*	222
6	Heavy and Tractor-Trailer Truck Drivers	$52,980	197
7	Electricians	$53,610	184
8	Office Clerks, General	$39,010	164
9	General and Operations Managers	$132,590*	163
10	Plumbers, Pipefitters, and Steamfitters	$53,140	148
11	Bookkeeping, Accounting, and Auditing Clerks	$46,410	148
12	Maintenance and Repair Workers, General	$56,520	144
13	Carpenters	$46,450	136
14	Operating Engineers and Other Construction Equipment Operators	$48,330	135
15	Software Developers	$130,970*	129
16	Stockers and Order Fillers	$34,700	128
17	Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	$81,920*	124
18	Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	$43,000	122
19	Sales Representatives of Services, Except Advertising, Insurance, Financial Services, and Travel	$79,100*	122
20	Miscellaneous Assemblers and Fabricators	$39,410	120
21	Janitors and Cleaners, Except Maids and Housekeeping Cleaners	$31,310	113
22	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	$52,960	109
23	Accountants and Auditors	$90,870*	104
24	Retail Salespersons	$33,870	100
25	Real Estate Sales Agents	$53,880	98
26	Cashiers	$27,200	93
27	Project Management Specialists	$103,310*	91
28	Light Truck Drivers	$41,590	89
29	First-Line Supervisors of Office and Administrative Support Workers	$62,100*	88

30	First-Line Supervisors of Mechanics, Installers, and Repairers	$74,760*	81

Source: 2022 IMPLAN; BLS OEWS May 2023; EBP US analysis
Note: Occupations with above-average wage are marked with an asterisk (*)

Conclusion

The intent of this analysis is three-fold: (1.) to illustrate the potential policy and investment value of clean energy policies specifically for North Carolina, and its needs for job training to prepare the state to maximize the new job creation potential from those policies; (2.) to show how alternative scenarios can be tested as part of a broader risk analysis ensuring the maximum value of proposed new policies for state residents; and (3.) how this information can be generated via economic analysis software that can be further developed and customized at a state level and be applied to the state of North Carolina.

North Carolina's clean energy initiatives, augmented by the Cooper Administration, present a transformative opportunity to address climate change, drive economic growth, and promote equity and sustainability. The 2023 Deep Decarbonization Pathways Analysis provides a comprehensive evaluation of how accelerated adoption of clean energy technologies—spanning wind, solar, electric vehicles (EVs), and building energy efficiency—can help achieve the state's net-zero emissions goal by 2050. By comparing our Reference Case, reflecting business-as-usual trends, to a Growth Scenario, involving more aggressive clean energy adoption, our analysis reveals significant economic benefits. These include the creation of nearly 10,000 additional annual jobs, significant investment opportunities in sectors like construction, manufacturing, and administrative services, and increased demand for high-wage technical occupations such as software developers, construction managers, and electricians.

The analysis demonstrates how clean energy advancements stimulate direct, indirect, and induced economic impacts, fostering job creation and supply chain activity while enhancing household incomes. We find that while only modest employment gains can be expected in building efficiency improvements due to already high energy performance standards, wind energy emerges as the leading source of job creation, followed by EV adoption, which offers substantial yet uncertain long-term economic potential as the medium- and heavy-duty EV markets mature.

This report equips policymakers and stakeholders with actionable insights into how clean energy strategies can deliver widespread economic and environmental benefits, strengthen key industries, and enhance North Carolina's long-term sustainability. By aligning clean energy policies with workforce development and business opportunities, the state is poised to become a national leader in the clean energy economy, fostering a resilient, equitable, and thriving future for its citizens and industries.

Glossary

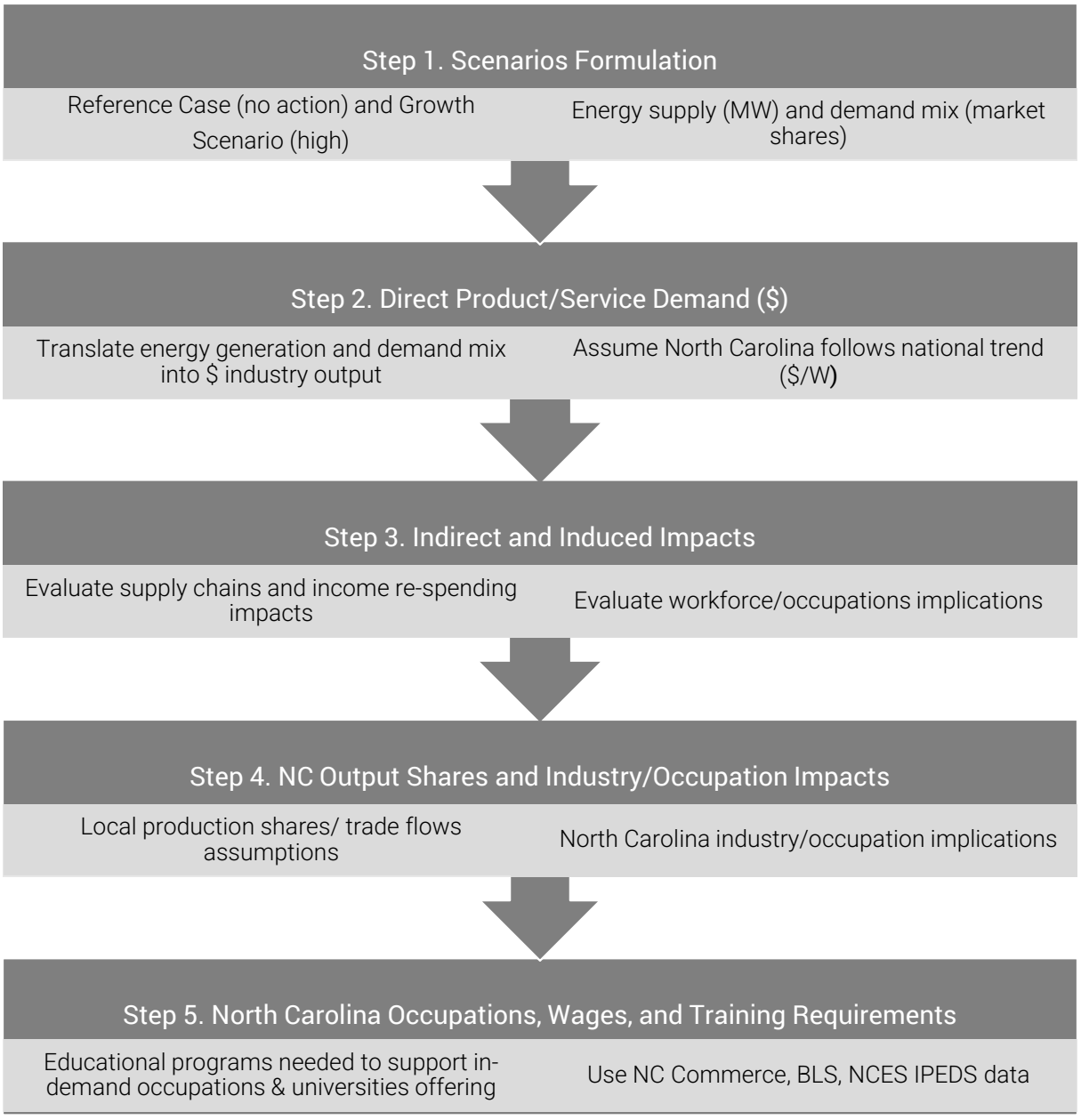
Abbreviation	Definition
ATB	Annual 2024 Electricity Technology Baseline (NREL)
BLS	Bureau of Labor Statistics
OEWS	State Occupational Employment and Wage Statistics (BLS May 2023)
CIP	Classification of Instructional Programs
Direct Impacts	Direct economic output and employment generated by economic activity
EE	Energy Efficiency (in building shells and structures)
EVs	Electric Vehicles
GDP	Gross Domestic Product
GHG	Greenhouse Gas
kWh	Kilowatt Hours
I-D (Degree)	In-Demand (Degree)
Indirect Impacts	Economic activity generated by suppliers' spending on goods and services
Induced Impacts	Consumer spending increases generated by worker income re-spending
IPEDs	Integrated Postsecondary Education Data System
MW	Megawatts
NCES	National Center for Education Statistics
RECS	Residential Energy Consumption Survey (EIA)
SOC	Standard Occupational Classification
W	Watts
ZEVs	Zero emissions vehicles

Appendix

Methodology

This section provides a summary of the methodology for analysis of North Carolina's clean energy scenarios implications and its related projections of workforce and supply chain impacts.

Figure 10. North Carolina Clean Energy Scenarios Methodology Outline



Clean Energy Supply (Wind & Solar)

To model supply chain and workforce implications, we express the energy supply MW values in terms of levels of economic activity ($ output by industry) using the latest cost and performance data for renewable electric generation technologies published by NREL (2024 Electricity Annual Technology Baseline).[12] Table 9 shows energy generation cost assumptions for wind. The percentage of activity sourced from local suppliers (North Carolina) is shown in the last column.

Table 9. North Carolina's Wind Energy Generation, 2024

Spending Type	$/W	% Locally Sourced[13]
Assembly and Installation	$0.25	100%
Electrical Infrastructure	$1.09	100%
Port and Staging, Logistics, Transportation	$0.17	29%
Substructure & Foundation	$1.16	100%
Development & Project Management	$0.10	76%
Financing	$0.22	87%
Insurance	$0.05	94%
Turbine Manufacturing	$1.70	2%
Total	**$4.75**	**61.2%**

Source: 2024 NREL ATB; 2022 IMPLAN

Table 10. North Carolina's Solar Energy Generation, 2024

Spending Type	$/W	% Locally Sourced
Charge controller	$0.07	3%
Wire	$0.02	4%
Racking	$0.09	28%
Inverter only	$0.06	3%
Module	$0.37	2%
Install L & E	$0.09	100%
Developer OH	$0.28	97%
EPC OH	$0.13	98%
Total	**$1.19**	**49.6%**

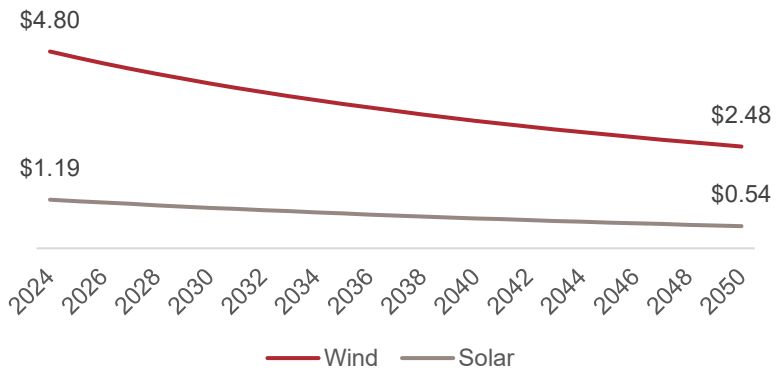
Source: 2024 NREL ATB; 2022 IMPLAN

12 https://atb.nrel.gov/electricity/2024/changes_in_2024

13 2022 IMPLAN model

We use NREL 2024 ATB forecast to project energy generation costs through 2050 shown in Figure 11.

Figure 11. Projected Real $ Cost per Watt of Energy Generated, 2024-2050



Source: EBP Analysis of 2024 NREL ATB

Figure 12 is an example illustrating the steps to convert energy supply expressed in MW into levels of economic activity ($) in North Carolina. The industry output is expressed in real dollars.

Figure 12. NC 2050 Wind Energy $ Industry Ouput Calculation, Reference Case

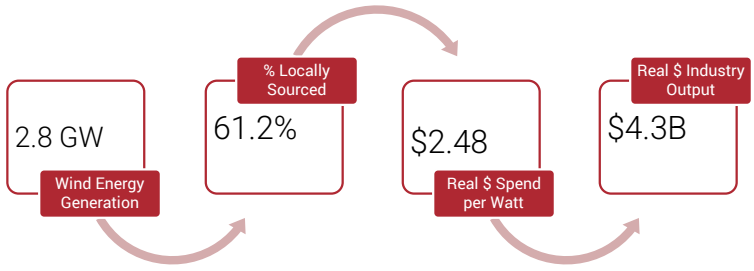


Table 11 shows estimated clean energy industry output in North Carolina in 2050. The Growth Scenario results in $15.5 billion[14] more of clean energy industry output compared to the Reference Case.

Table 11. North Carolina Clean Energy Scenarios Industry Output, 2024 $B

Industry Type	Reference Case	Growth	Difference
Wind & Solar (2024)	$4.4	$4.4	-
Wind & Solar (2050)	$13.2	$28.7	$15.5

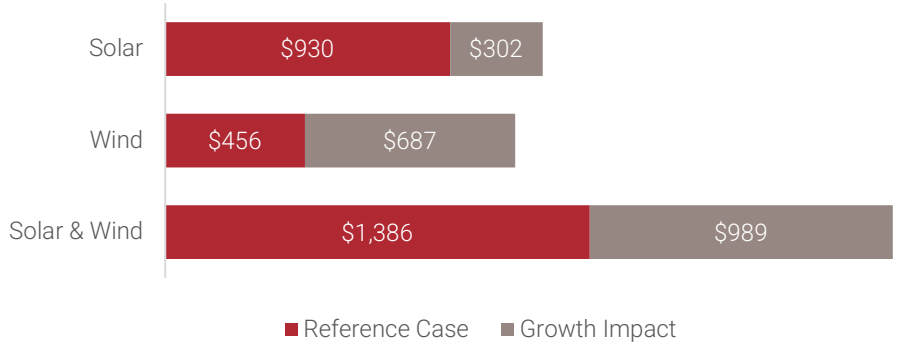
The Reference Case assumes wind will account for 2,816 MW of energy generation by 2050, amounting to $4.3B of industry output. The Growth Scenario assumes almost a four-fold increase in wind energy generation over the Reference Case, or 11,166 MW by 2050, amounting to $16.8B

14 2024 dollars

of industry output. The Reference Case assumes solar will account for 33,012 MW of energy by 2050, amounting to $9.0B of industry output. The Growth Scenario assumes 1.3 times solar generation over the Reference Case, or 43,906 MW by 2050, amounting to $12.0B of industry output.

Figure 13 illustrates the average annual impact of Clean Energy Initiatives in North Carolina between 2024 and 2050 beyond the Reference Case. On average, the State's additional expansion efforts of solar and wind energy generation will yield an additional $302 million of clean solar energy annual output beyond the Reference Case; and an additional $687 million of clean wind energy annual output. This is an additional $989 million annually of direct clean energy economic activity in the Growth Scenario compared to the Reference Case.

Figure 13. Average Annual NC Clean Energy Initiatives Direct Impact, Real 2024 $Millions



Source: EBP Analysis

Clean Energy Demand

While the energy supply-side scenarios are modeled as exogenous changes in the mix of NC-based electricity generation in terms of *output*, the energy demand-side scenarios are modeled as exogenous changes in NC-based *demand*.

In the case of building construction and building operating systems, the crucial aspect of the scenarios is whether the scenarios are (a) changing the level of demand (e.g., adding more insulation or additional equipment) or (b) just changing purchases of the same materials from lower efficiency models to higher efficiency models from the same manufacturers. The latter translates to no change in the NC economy.

Modeling the Economic Impact of Electric Vehicles

Our analysis focuses exclusively on the aggregate (sum) of cars and light truck/utility vehicles, as light trucks now make up the majority of private passenger light-duty vehicle (LDV) sales in the US and NC. This category includes most pickup trucks and sport utility vehicles (SUVs). The analysis excludes medium- and heavy-duty vehicles and buses. Electric vehicles in this analysis includes full battery electric vehicles that cannot run on gasoline (plug-in hybrids are not considered).

Step 1. North Carolina Electric Vehicles Demand (Sales)

The EV demand scenarios used in this analysis are primarily based on changing the assumed NC vehicle fleet mix of EV versus gasoline internal combustion engine vehicles (ICEVs) over time. Table 12 summarizes the NC LDV fleet composition for 2022, and projected fleet composition for 2050 for the Reference Case and Growth Scenario. The Growth Scenario assumes that EVs will account for 100% of all LDV sales in North Carolina by 2050, whereas the Reference Case assumes a sales share of 19%.

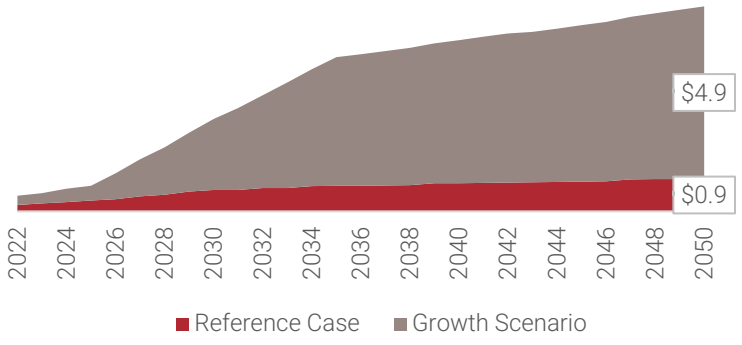
Table 12. North Carolina New LDV Sales, 2022 and 2050

Year	NC new car sales, $B	Reference Case, EV Sales Share	Growth Scenario, EV Sales Share
2022[15]	$3.66	5%	7%
2050	$4.88	19%	100%

Source: EBP Analysis

Next, we calculate the split between EVs and ICEV for new LDV sales using the projection of motor vehicle sales from IMPLAN sector 402 for the full forecast horizon, 2024-2050, for each scenario by applying the EV sales share to the IMPLAN value. The resulting Figure 14 illustrates the impact of the Growth Scenario relative to the Reference Case. The Growth Scenario, with a 100% sales rate in 2050, yields an additional $4.0 billion of annual EV sales beyond the Reference Case.

Figure 14. Projected NC Electric Vehicles Sales, $Billions



Source: EBP Analysis

[15] IMPLAN sector 402 – Retail: Motor Vehicles demand stood at $5.1B in 2022. New cars sales are estimated as 72% of this total. The basis of this estimate is: (a) new cars are 38.6% of all retail car sales per Statistica, and (b) new cars cost 1.87x average used cars per Consumer Reports, so (c) new car $ sales is .386*1.87 = 72% of all retail car sales $.

Step 2. North Carolina Total Vehicle Fleet

Next, we estimate North Carolina's on-road fleet mix by year, as this influences demand for gasoline versus electric charging over time. With an average assumed vehicle age of 13 years, the analysis ages out the existing fleet over time, with a given year's EV fleet share approximately reflecting the average EV sales from the previous 26 years. We also account for the annual growth in North Carolina's LDV fleet size, starting from the current 9,085,500[16] vehicles, assuming growth proportional with the projected NC population.[17] By multiplying the EV share by the total fleet size, we estimate the number of EVs on the road, which helps project future changes in demand for gasoline, charging, and electricity in Step 5. Based on this, the 2024 fleet will be 1% EVs (average of 1999–2024 new car sales), while the 2050 fleet is projected to be 16% EVs in the Reference Scenario and 71% in the Growth Scenario. Intermediate years are interpolated accordingly.

Step 3. Change in Demand for Vehicle Components and Inputs

This step applies various vehicle component demand additions (for EVs) and subtractions (for a decline in ICEV sales), each of which is defined as a percentage of the Step 1 change in the mix of new vehicle sales.

Each year, adjustments in vehicle component demand are made as a percentage of the shift towards electric vehicle sales, reflecting the rising demand for EV-specific parts and the shrinking demand for ICEV-specific components. EV battery demand is projected at 31% of the value of a new EV in 2024, decreasing to 20% by 2050, based on a benchmark battery cost adjusted for anticipated future cost declines and an assumed average battery capacity of 65 kWh. EV motors comprise 8% in 2024, increasing to 11% by 2050, based on the cost of a typical EV motor and evolving EV and component prices (including the battery). The value of lithium used in the battery, comprises 13% of the vehicle value in 2024, decreasing to 8% by 2050 estimated based on an assumed share of the battery price comprised by the cathode and share of cathode price comprised by lithium metal. Offsetting these additions in new vehicle component demand, ICEV engines (12.5% of ICEV value) and other powertrain parts, like transmissions (2.5% of ICEV value), reduce as ICEV sales shrink, as these components are not used in EVs. This reallocation of demand reflects a gradual transformation in the automotive parts industry as EV adoption increases.

Step 4. Change in Demand for Fuel/Power

This step applies corresponding fuel/power adjustments as they related to the Step 2 change in North Carolina's operating fleet.

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16 Alternative Fuels Data Center: https://afdc.energy.gov/vehicle-registration

17 https://www.osbm.nc.gov/facts-figures/population-demographics

Each year, fuel and power demand in North Carolina shifts in response to changes in the vehicle fleet mix. Gasoline demand decreases as EVs comprise a larger share of the on-road fleet, with an estimated annual reduction of $1,477 for each ICEV replaced by an EV, based on average assumed annual vehicle miles traveled and fixed fuel prices.[18] Meanwhile, demand for production of charging stations increases with the EV fleet's growth based on a calculated ratio of required plugs to support an EV fleet from a study on requirements for the national EV fleet in 2030.[19] Each level 3 fast charging port is assumed to cost $84,300 while each standard level 2 charging port is assumed to cost $3,400. Electricity demand for EV charging also rises, estimated at $401 annually per EV, calculated from average yearly usage and electricity prices.[20]

Step 5. Direct Local Impact

This step calculates the direct local impact on the North Carolina economy for each year based on the % Local shown in Table 13 and applied to the Step 1 change in demand for vehicle manufacturing and parts, and Step 2 change in demand for fuel and electricity.

Table 13. North Carolina's Electric Vehicles Sectors and Share of Local Supply Assumptions, 2024-2050

Sector	Description	% Local	Source	Base demand calculation source
333	EV batteries mfg.	11.8%	IMPLAN	Step 1 delta EV sales
330	EV motors mfg.	2.7%	IMPLAN	
347	IC engines mfg.	1.4%	IMPLAN	
347	IC transmission/power train mfg.	1.9%	IMPLAN	
340 (A)	Automobile mfg. – electric (EV)	6.0%	Vinfast*	
340 (B)	Automobile mfg. – ICE	0.0%	None in NC	
34	Lithium mining (from minerals)	33.0%	Future plans**	
154	Gasoline (petroleum refining prod)	1.7%	Almost none in NC	Step 2 EV fleet delta
348	EV charging electrical equipment	9.9%	IMPLAN	
42, 43	Electricity for charging	59.0%	EBP Scenarios (W&S)	

Source: 2022 IMPLAN, EBP Analysis

18 EIA FHWA Highway Statistics
19 https://www.nrel.gov/docs/fy23osti/85654.pdf
20 Edmunds Price of $0.14/kWh

(*) Anticipated Vinfast EV assembly plan in NC starting in 2026' is for 150,000 cars/yr., which is 6% of the 2.5 million EVs now sold annually in the US (per EIA). Default is to assume that share holds as the EV market grows to 2050.
(**) Note: Lithium is a metal extracted from mining of non-metallic minerals. No current production in NC but plans for 2025+ are for it to provide 33% of US demand.

Step 6. Net Economic Impact

Step 5 calculated direct change in local demand, which is used as an input into the IMPLAN model to calculate total of direct, indirect, and induced changes in output, employment, and income gain for NC. Since NC has a higher % local for EV components (batteries, motors, electrical charging equipment), than for ICEV components (combustion engines, transmission, gasoline sales), the net economic impact of a shift to EVs is positive.

Modeling the Economic Impact of Energy Efficiency in Building Construction Standards and Operating Systems

North Carolina has a wide range of manufacturers for various electrical controls/fixtures, HVAC equipment, and building materials (glass and insulation), and the output levels generally trend in line with the employment. It also makes sense to expect relatively modest % local shares for electric equipment and HVAC given the highly specialized nature of these products, but much larger % local shares for the building materials which are more generic. Conversely, all the labor-intensive construction and remodeling is expected at 100%.

In the case of building construction and building operating systems, it is recommended to distinguish whether the scenarios are (a) changing the level of demand (e.g., adding more insulation or additional equipment) or (b) changing purchases of the same materials from lower efficiency models to higher efficiency models from the same manufacturers – similar to what we foresee happening in the demand for appliances case. The latter translates to no change in the NC economy.

Upgrading to a more efficient building shell will usually add more quantity of framing material, more insulation, and more panes or more thickness of windows. Insofar as the NC scenarios increase new home construction building efficiency, the addition is estimated to be a 13-14% increase in demand for wood and insulation (per zeroenergyproject.com).

Table 14. NC Construction Standards and Operating Systems Output, 2022

Industry Type	Industry Output, $M	% Locally Sourced	Direct Output, $M
Fiberglass Insulation	$83.8	93.92%	$10.6
Flat Glass/Windows	$637.7	41.87%	$36.0
Urethane and other foam product	$1,892.5	26.86%	$68.6
Reconstituted Wood Product	$639.0	26.64%	$23.0
Wood Windows/Doors	$732.2	78.81%	$77.9
Prefabricated Wood Building	$155.7	91.65%	$19.3
Total	**$4,141**	**42%**	**$235.4**

Source: 2022 IMPLAN model