TRANSFORMING TRANSPORTATION IN NORTH CAROLINA

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Cover Images: (top) Charlotte skyline at dusk; (bottom left) charging electric vehicle; (bottom middle) GoDurham bus in Downtown Durham - by Christian Laspada; (bottom right) bike route in Chapel Hill - by Shanya Hayes.

We would like to thank Stan Cross from the Southern Alliance for Clean Energy for his contributions to this work.

GLOSSARY

EV	Electric Vehicle
BEV	Battery Electric Vehicle
PHEV	Plug-in Hybrid Vehicle
ICE	Internal Combustion Engine
COBRA	CO-Benefits Risk Assessment Health Impacts Screening and Mapping Tool
EV-REDI	Electric Vehicle Regional Emissions and Demand Impacts Model
EVI-Pro Lite	Electric Vehicle Infrastructure Projection Tool Lite
CO_2	Carbon Dioxide
Level 1	120 V charging from a standard US outlet that is limited to about 1 kW
Level 2	240 V charging from an EV charger that is typically between 6 and 11 kW
DEQ	Department of Environmental Quality
DC Fast Charging	High-powered charging at 50 kW or more
EO	Executive Order
NCEC	North Carolina's Electric Cooperatives
NCUC	North Carolina Utility Commission
DOT	Department of Transportation
LDV	Light-Duty Vehicle
MDV	Medium-Duty Vehicle
HDV	Heavy-Duty Vehicle
NEVI	National Electric Vehicle Infrastructure
IIJA	Infrastructure Investment and Jobs Act
EVSE	Electric Vehicle Supply Equipment
ZEV	Zero Emissions Vehicle
VMT	Vehicle Miles Traveled
EIA	Energy Information Administration

Executive Summary

Governor Cooper's January 2022 Executive Order 246 (EO 246) reaffirms North Carolina's commitment to electrifying the state's transportation sector by setting out ambitious but attainable goals for electric vehicle (EV) adoption.[1] These goals include reaching 1.25 million light-duty EVs on the state's roads by 2030 and for zero emission vehicles (ZEVs) to account for half of all new vehicle sales in the state by 2030. EO 246 also calls for the state to reduce emissions of greenhouse gases (GHGs) by 50 percent below 2005 levels by 2030 and to zero no later than 2050, and requires state agencies to incorporate environmental justice and equity when implementing the Executive Order.[2]

As detailed in this report, the benefits of achieving these goals are massive: North Carolina drivers would keep money in state and save $27 billion in fuel costs through 2050 by switching from internal combustion engine cars to EVs. Reducing tailpipe emissions, particularly in disadvantaged communities, would improve public health by avoiding respiratory ailments and premature deaths, providing North Carolina residents with $58 million in healthcare savings through 2030 and $1.75 billion through 2050. Under EO 246, vehicle-related GHG emissions fall 19 percent in 2030 and 93 percent by 2050, compared to 2005 levels.

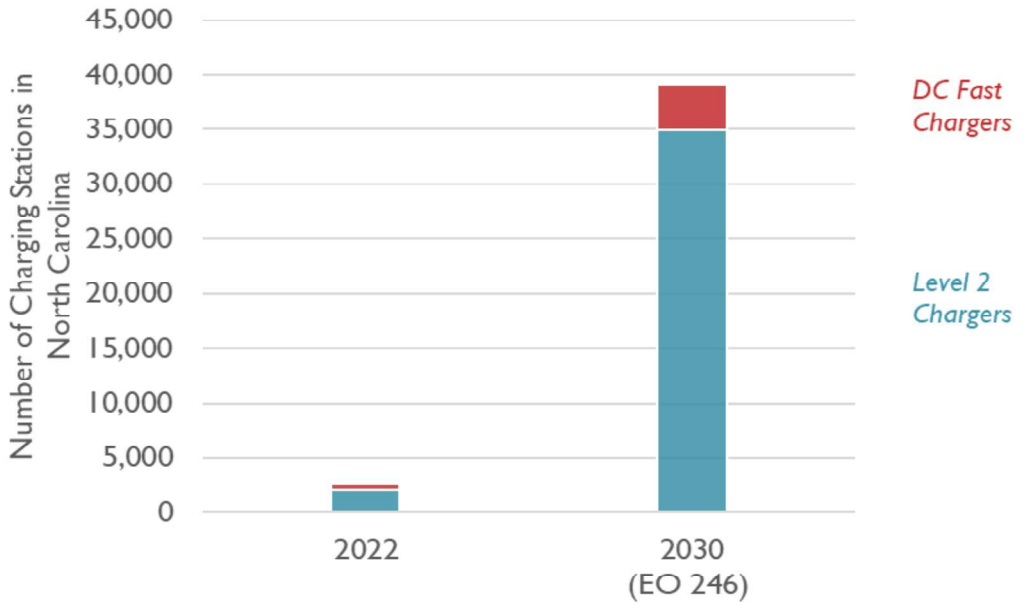
Reaching the electrification goals set out in EO 246, and realizing the benefits that would accrue to North Carolina residents if those goals are met, will require a vast expansion of charging infrastructure in North Carolina. As of 2022, there were only 978 public Level 2 chargers and 568 DC fast chargers in the state.[3] This report demonstrates that to achieve EO 246's electric vehicle adoption goals, North Carolina will likely need 35,000 additional Level 2 chargers and 4,100 additional DC fast chargers located at workplaces or along roadways by 2030 (see Figure 1). **And while North Carolina is due to receive $109 million from the federal infrastructure bill for highway charging infrastructure over the next five years,[4] that is less than one-third of the cost of installing the charging infrastructure the state needs through 2026, and only about one-tenth of the funds required by 2030.**

> In this analysis, the term "EV" includes both full battery electric vehicles (BEVs) and plug-in hybrid vehicles (PHEVs).

Recognizing this EV charging gap and identifying funding sources available to help close that gap is essential to meeting EO 246's EV adoption goals and securing the benefits for North Carolina residents. More work is needed to ensure that the state, the North Carolina Utility Commission, and electric utilities across the state are coordinating efforts, leveraging public and private investment dollars, and centering environmental justice and equity in the process of electrifying North Carolina's transportation sector. Massive and rapid utility-scale investment is needed, as are policies that ensure electric utility rates are designed to spur EV adoption, steer EV charging to times of the day with abundant renewable generation, and give utilities the ability to actively manage EV charging so that they can temporarily constrain EV charging to reduce strain on the grid. Although beyond the scope of this report, achieving the goals of EO 246 will also require a suite of new policies aimed at reducing tailpipe emissions and vehicle miles traveled (VMT), in addition to those aimed at improving EV charging infrastructure. North Carolina's Department of Transportation—along with stakeholders from the Governor's office, state agencies, cities, vehicle manufacturers, EV charging service providers, the conservation community, and others—is examining many of these policies in the ongoing stakeholder meetings that is part of the process of drafting North Carolina's Clean Transportation Plan. There is critical work to be done around adopting California rules for clean cars and trucks, as explained in recent reports by RTI/Environmental Defense Fund and ERM/Natural Resources Defense Council, electrifying public and private vehicle fleets, reducing vehicle miles travelled and increasing public transit ridership.[5]

EXECUTIVE SUMMARY

Figure 1. Number of public Level 2 and DC fast chargers in North Carolina today and required in 2030 under EO 246.



Notes: This figure only includes charging infrastructure required in public places (workplaces, businesses, roadways, etc.). It does not include the charging infrastructure assumed to be available at households. It is also limited to Level 2 Chargers (6 kW to 19 KW) and DC fast chargers (50 kW to 350 kW). Source: U.S. Department of Energy Alternative Fuels Data Center.

On behalf of the Sierra Club, Synapse Energy Economics modeled two scenarios to evaluate the benefits of North Carolina's vehicle electrification goals and the associated demand for charging infrastructure. We analyzed:

- A **Baseline** future, illustrating the likely impacts of a business-as-usual approach with today's policies and expected technological progress; and
- An **EO 246** future, illustrating the comparative benefits of meeting the targets laid out in EO 246. Since we conducted the analysis described in this report, the passage of the Inflation Reduction Act and improved EV offerings have brought future EV sales projections in line with the EO 246 scenario, underscoring its importance for planning purposes.

We then modeled the charging infrastructure, public health, and economic impacts that result from meeting the EO 246 targets. Our analysis had the following major findings:

93% FEWER EMISSIONS

By 2030, motor vehicle carbon dioxide emissions decrease by 19 percent relative to 2005; by 2050, motor vehicle carbon dioxide emissions fall by 93 percent.

$27 BILLION NET FUEL SAVINGS

Reductions in motor gasoline and diesel consumption lead to net cumulative fuel savings from 2022 to 2050 of more than $27 billion.

$1.75 BILLION IN HEALTH BENEFITS

By avoiding premature deaths and other adverse health impacts, an increased number of electric vehicles in North Carolina lead to cumulative public health benefits of $58 million through 2030 and $1.75 billion through 2050.

35,000 LEVEL 2 CHARGERS/ 4,100 DC FAST CHARGERS

The electric vehicles required under EO 246 will need to be powered by a new network of charging infrastructure. In addition to home chargers, we estimate that North Carolina will need 35,000 additional Level 2 chargers and 4,100 additional DC fast chargers located at workplaces or along roadways. While this new infrastructure will not be inexpensive, the benefits to North Carolinians and North Carolina's economy far outweigh the costs. There are also existing funding sources to pay for new chargers throughout the state. However, North Carolina is not currently on track to meet this need, nor does it have processes in place to remedy that.

Executive Summary

Our recommendations:

- The NCUC should work with utilities to plan for the deployment of charging infrastructure in North Carolina. It is essential that the NCUC act now and approve utility programs to plan for the deployment of an EV charging infrastructure network. In addition to planning, the NCUC should approve utility programs to make transmission and distribution system upgrades needed to facilitate EVSE deployment, particularly in more remote locations along highways and where large numbers of 350 kW DC fast chargers will be needed.
    - North Carolina is already moving to claim its allocation of $109 million under the National Electric Vehicle Infrastructure (NEVI) program, which was funded as part of the IIJA. These funds are designated for fast chargers along highway corridors to supply light-duty vehicles. The state should put these funds to best use by implementing parallel programs to fund transmission and distribution upgrades so that NEVI can fund even more DC fast charging stations in North Carolina.
    - Later this year, states can begin applying for $2.5 billion in competitive grants under the IIJA's Charging and Fueling Infrastructure Program. North Carolina agencies should plan ahead to leverage this funding opportunity to target transportation electrification and pollution reduction objectives and advance rural and environmental justice issues.
    - North Carolina Department of Transportation (NCDOT) should work with utilities and the North Carolina Utility Commission (NCUC) to supplement the annual NEVI fund disbursement with additional funding from utilities and third-party charging providers to build the highway charging it will need by 2030. The NEVI funds alone will be insufficient to meet North Carolina's needs, and the state must proactively address ways to ensure that federal, state, private, and utility-scale investments in charging infrastructure are collectively sufficient to support EO 246's EV adoption goals.
- Planning for EO 246 requires other considerations of equity and alternate mobility. North Carolina should identify high-risk communities, monitor air quality in these communities for exposure to pollutants from transportation and other sources, and create and implement strategies to prioritize air quality improvements in these areas. Targeted utility-owned chargers could play a role in improving near-term access to EVs in disadvantaged communities where third party EVSE deployment is slower. Other programs that improve pedestrian, cycling, and public transit infrastructure reduce the need for more electric vehicles. This will decrease the amount of required charging infrastructure and new electricity generation resources.
- North Carolina should immediately start implementing tools to ensure it can meet the goals of EO 246. These tools include, among others, clean car and truck programs, electric vehicle rebates, and smart electric vehicle rate design.

1. Background: North Carolina's Clean Energy Progress

The transition to electric vehicles (EV) is underway nationwide and in North Carolina. According to middle-of-the-road, business-as-usual scenarios, North Carolina is projected to have 35 percent of new light-duty vehicle (LDV) sales be EVs by 2030. This alone represents a new, transformative shift that will bring significant benefits to North Carolina while requiring the development of a robust charging station network.

At the same time, North Carolina has recognized the importance of mitigating the climate crisis and addressing the public health impacts of pollution in overburdened communities. The state is adopting policies aimed at reducing emissions in response to extreme heat waves, sea level rise, increasingly frequent and intense hurricanes, storm surges, and flooding that threatens coastal communities. Simultaneously, the state is seeking to mitigate exacerbated health risks and deaths resulting from worsening air quality and hotter temperatures.

Recently, North Carolina committed to substantial emissions reductions across the entire economy, and to policies that can reduce transportation sector emissions specifically.

EO 80: Statewide carbon dioxide emissions to be reduced by 40 percent by 2025

In 2018, Governor Cooper signed EO No. 80, which outlined North Carolina's commitment to address climate change and transition to a clean energy economy.[6] This order affirmed North Carolina's commitment to supporting the 2015 Paris Agreement goals and honoring the state's commitments to the U.S. Climate Alliance. It also outlined state-level climate and emission targets to accomplish by 2025, including reducing statewide greenhouse gas (GHG) emissions to 40 percent below 2005 levels, increasing the number of registered zero-emission vehicles (ZEV) in the state to at least 80,000, and reducing energy consumption per square foot in state-owned buildings by at least 40 percent from Fiscal Year 2002–2003 levels.

This order also directed the North Carolina Department of Environmental Quality (DEQ) to develop a clean energy plan for North Carolina.

The plan, which was released in 2019, outlined key recommendations to reduce electric power sector GHG emissions by 70 percent below 2005 levels by 2030 and attain carbon neutrality by 2050.

HB 951: Electricity sector carbon dioxide emissions to be reduced by 70 percent by 2030

In 2021, Governor Cooper signed a bill authorizing the NCUC to take all reasonable steps to achieve a 70 percent carbon dioxide (CO_2) emissions reduction from 2005 levels from electric generating facilities by 2030 and carbon neutrality by 2050.[7] This bill instructs the NCUC to develop a plan to achieve the authorized reduction goals by December 31, 2022. The bill also requires review of the plan, and adjustment where needed, every two years.

EO 246: Statewide carbon dioxide emissions to be reduced by 50 percent by 2030, with net-zero emissions by 2050

In 2022, Governor Cooper signed EO No. 246, which further outlined how North Carolina would transform into a clean, equitable economy. The order added goals to those specified in EO No. 80: namely reducing statewide GHG emissions to at least 50 percent below 2005 levels by 2030, achieving net-zero emissions as soon as possible and no later than 2050, increasing the total number of registered ZEVs to at least 1.25 million by 2030, and increasing the sale of ZEVs so that 50 percent of in-state sales of new vehicles are zero-emission by 2030. The order also directs state agencies to incorporate environmental justice and equity considerations and benefits in the implementation of this executive order and EO No. 80.

EO No. 246 includes directives for the North Carolina Department of Transportation (NCDOT) to develop a North Carolina Clean Transportation Plan. This plan will provide actionable strategies for decarbonizing the transportation sector, with a focus on near-team action to transition medium- and heavy-duty vehicles (MDV, HDV) to ZEVs.

North Carolina's progress on vehicle electrification

In 2018, North Carolina's transportation sector was responsible for 36 percent of the state's GHG emissions, making it the highest emitting sector of North Carolina's economy.[8] Because of transportation's high share of state emissions, North Carolina has undertaken several initiatives and projects to increase ZEVs in the state. To support North Carolina's commitments to increasing ZEVs through EO No. 80, NCDOT published the *Zero Emission Vehicle (ZEV) Plan* to guide ZEV adoption in the state.[9] In addition, NCDOT developed a ZEV registration data database that tracks monthly registration data for electric and plug-in hybrid vehicles.[10] NCDOT also recently published a *Vehicle Miles Traveled (VMT) Reduction Study*, which identified strategies to reduce miles traveled in North Carolina.[11] More recently, in 2020, Governor Cooper signed on to a memorandum of understanding with 15 states and the District of Columbia committing to the electrification of MDVs and HDVs.[12]

Where North Carolina needs to go

Despite recent legislative and executive action on vehicle electrification in North Carolina, the state needs to do more to accelerate EV adoption to meet its goals. According to NCDOT's ZEV registration data database, less than 30,000 fully electric vehicles were registered in North Carolina as of March 2022. This is a considerable difference from EO 80's commitment of 80,000 ZEVs by 2025 and EO 246's commitment of 1.25 million ZEVs by 2030.

While the policies implemented to date will help cut into North Carolina's transportation sector climate emissions, our analysis of a business-as-usual future shows that they will not move the needle fast enough to meet long-term commitments. Specifically, North Carolina must develop a comprehensive, multi-agency plan to build the charging infrastructure that it will need to support 1.25 million EVs. A critical focus on this must be on highways. To this end, NCDOT should work with the NCUC to supplement the annual NEVI fund disbursement with additional funding from utilities and third-party charging providers to build the highway charging it will need by 2025.

The NEVI funds alone will be insufficient to meet North Carolina's needs, and the NCUC has thus far failed to authorize utility funding at levels that will be critical to success.

In addition, North Carolina should ensure that its residents have access to the broadest possible set of advanced EV models by adopting Advanced Clean Car and Advanced Clean Truck standards.[13] These standards incentivize automakers to develop, market, and sell EVs that are the most attractive to consumers and most competitive with fossil fuel powered vehicles. The state should take advantage of its authority to adopt these standards and accelerate innovation in the new vehicle market.

2. North Carolina's Charging Infrastructure Need

Building out the charging infrastructure network needed to power millions of new EVs is a big challenge. The following sections estimate the number and cost of new chargers required.

Reaching the EO 246 goal will require 35,000 Level 2 Chargers and 4,100 DC Fast Chargers

As EV adoption in North Carolina grows, demand for chargers will grow as well. The state will need multiple types of EV chargers to provide a selection of charging services including slower, at-home or at-work charging and publicly accessible rapid charging. The latter is particularly important along major transportation corridors for enabling longer distance travel, and for mitigating range anxiety.

Types of EV chargers

- **DC Fast Chargers:** 50 kW to 350 kW chargers that allow for rapid charging during long journeys or for drivers without access to charging at home. 150 kW chargers can provide 150 miles of range in about 20 minutes. 350 kW chargers an provide 350 miles of range in about 20 minutes, for EVs that accept that level of charge.
- **Workplace Level 2 Chargers:** Typically 6 kW to 19 kW chargers that can allow drivers to recharge their vehicles at work. 11 kW chargers can provide 200 miles of range in about 6 hours.
- **Public Level 2 Chargers:** Typically 6 kW to 19 kW chargers that allow drivers to recharge their vehicles opportunistically throughout the day at various locations they drive to. 11 kW chargers can provide 200 miles of range in about 6 hours.

Each of these charger types plays an important role in serving an EV fleet, has different implications for power system planning, and is already present in North Carolina (see Table 1).[14]

Our analysis shows that in order to meet EO 246's 2030 EV adoption goals, the combined number of Level 2 and DC Fast Chargers in North Carolina must increase to 39,000, more than a 1,400 percent increase from today (see Figure 2). With fewer than 2,000 public Level 2 chargers currently installed in North Carolina, the state will need to more than double that amount each year in order to have a sufficient number of chargers in place by 2030. This will mean installing over 4,100 public Level 2 chargers every year through 2030.

Table 1. Number of chargers in North Carolina by type, today and projected for the future

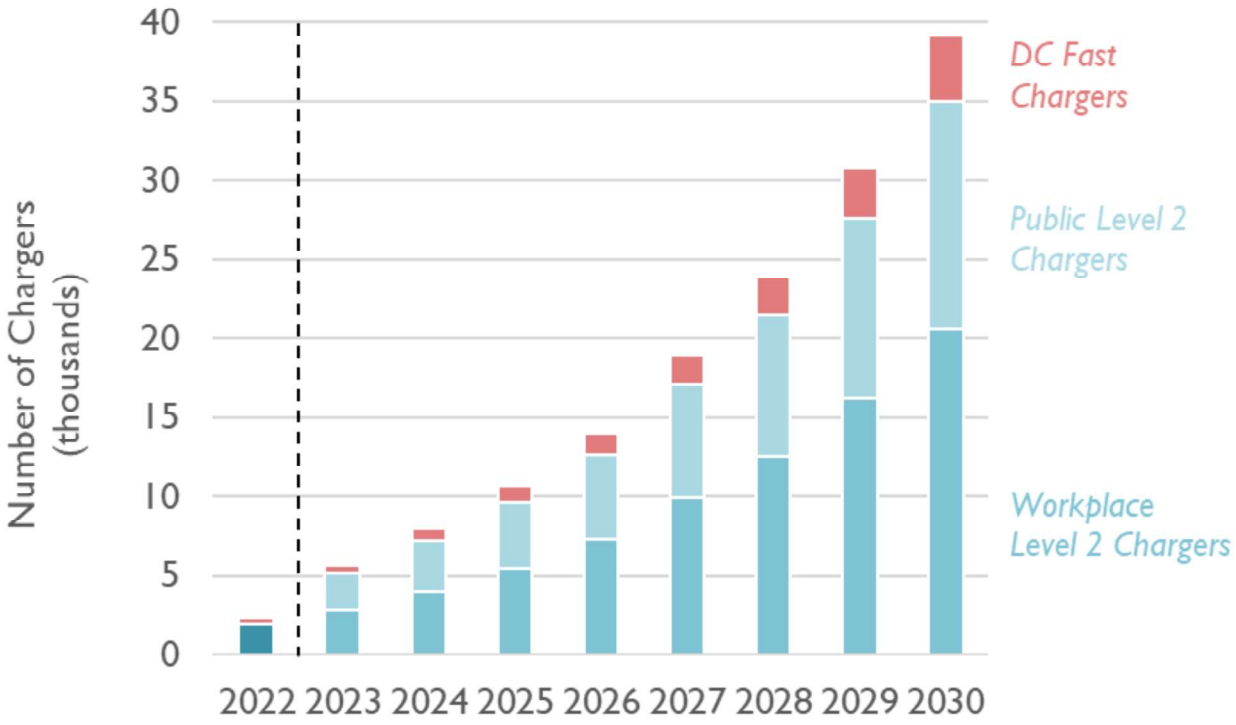
Charger Type	Historical Count (2022)	Projected EO 246 Count (2030)	Estimated Annual Build Needed to Reach EO 246 Goal
Level 2	1,978	35,000	4,100
DC Fast Chargers	568	4,100	440

Source: U.S. Department of Energy Alternative Fuels Data Center

Similarly, for DC fast chargers, the state will need to add approximately 440 chargers per year. Most of the necessary growth is in Level 2 chargers, but DC fast chargers play an important role in meeting consumer preferences for increased charging speed. For the same reason, growth in DC fast chargers will most likely be concentrated at higher capacities between 150 kW and 350 kW. We did not model increases in Level 1 chargers, which require minimal infrastructure changes.

We note that these charging results only account for growth in LDVs. Because the number of MDVs and HDVs will also grow, particularly in the commercial sector, these charging projections should be viewed as a conservative estimate.

Figure 2. Total chargers needed in North Carolina to meet EO 246 EV goal



This analysis also assumes that all owner-occupied housing units in the state (about 66 percent of all housing units) have access to charging at home. For the state to meet EO 246's goal of 50 percent EV sales by 2030, and assuming EV adoption among homeowners proceeds at a rate equal to the statewide average, by 2030, 678,000 households would have EV chargers at home. In reality, it is likely that in the early years of EV adoption, these households will account for an even larger share of EV adoption than average because of their easier access to charging at home.

In addition, consideration should be given to the maintenance and lifespan of EV charging infrastructure. Ensuring that chargers and charging infrastructure are properly maintained will be essential for growing and maintaining consumer confidence that drivers will be able to charge wherever they expect to find a charger. In addition, assuming that outdoor EV chargers have lifespans of ten years or less, many of the chargers that exist today will need to be replaced between now and 2030 to ensure that the total number of chargers shown in Figure 2 for 2030 are online by that year. Increased levels of charger replacement or repair will then continue to happen after 2030.

Methodology for modeling the charging infrastructure need

Our analysis relies on U.S. Department of Energy's EVI-Pro Lite tool to evaluate the charging infrastructure required by various levels of EV deployment. EVI-Pro Lite allows users to customize the model's forecast with a variety of inputs, such as the total number of BEVs and PHEVs, expected EV range, and other parameters. It then outputs the number of DC fast chargers and Level 2 chargers needed. Level 2 charging results are broken into public chargers and workplace-specific chargers. EVI-Pro Lite embeds the number of at-home chargers available into results through an input parameter that requires users to specify a percentage of drivers with access to home charging.

In our analysis, we used BEV and PHEV stock projections from EV-REDI (see Section 3) as inputs to EVI-Pro Lite. We also estimated the share of households with potential access to home chargers as the share of housing units in North Carolina that are owner-occupied, according to U.S. census data.

Cost projections for charging infrastructure

Each type of EV charger has both direct hardware and installation costs and "make-ready" costs related to power distribution upgrades. There is no universally agreed upon definition of make-ready, largely because it is so project- and site-specific; but it generally refers to all necessary electrical infrastructure between a utility grid interconnection and the charger. This infrastructure can include a transformer, electric service panels, feeder, service drop, and other components. These components are generally understood to be between 30 percent and 60 percent of chargers' capital costs, though they can range higher.[15]

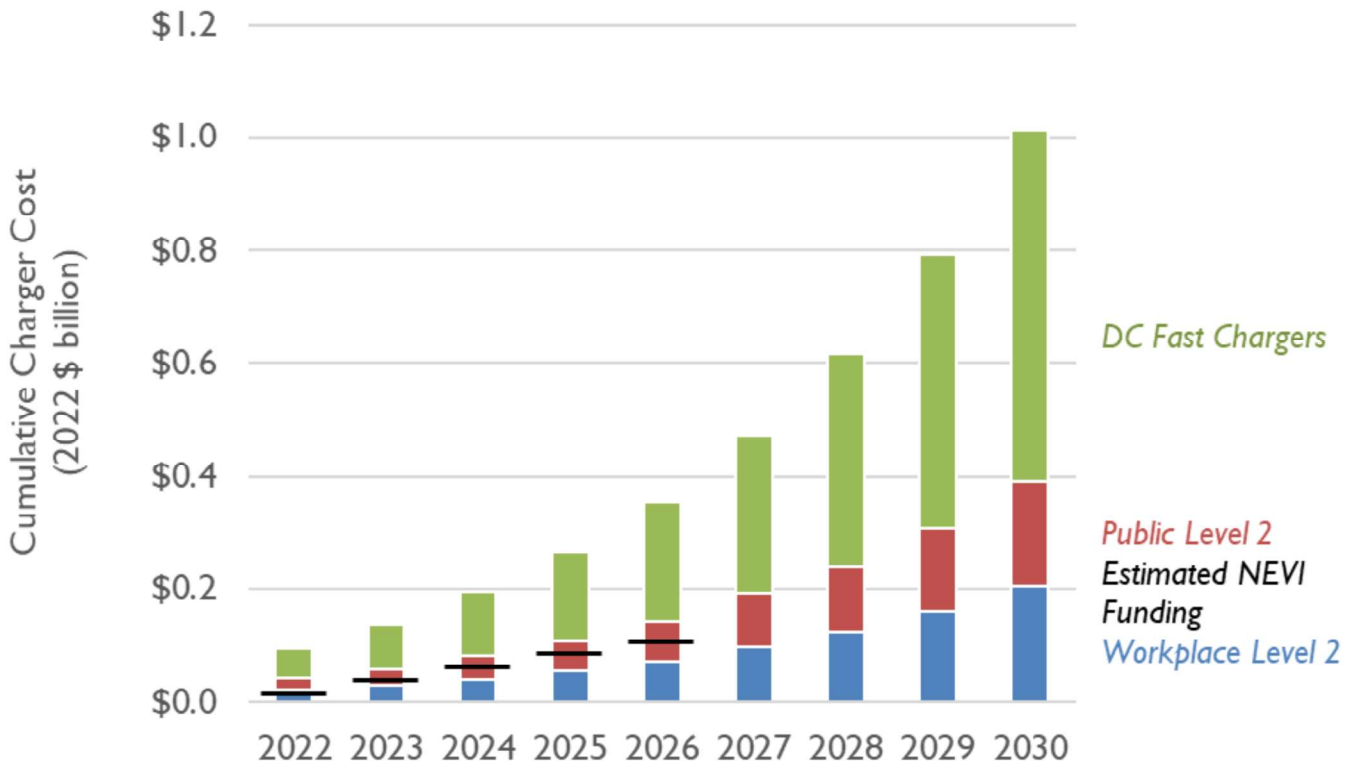
To conservatively account for hardware installation and make-ready costs, our calculations rely on per-charger cost estimates from the International Council on Clean Transportation (ICCT), which include make-ready components (see Table 2). The ICCT also provides information on the percentage of chargers that are networked and non-networked, which we included in our analysis. Networked chargers are more expensive; but they can connect to the internet, bill customers for charging, and monitor usage. Non-networked chargers are more affordable but are unable to connect to the internet or bill customers and do not collect usage data. According to the ICCT, the majority of level 2 chargers are networked. [16] Under EO 246, the investment needed to build out public Level 2 and DC fast chargers will reach $1 billion by 2030 (see Figure 3).

Table 2. Per-charger cost by charger type

Charger Type	Networked Status	Cost (2022 dollars)
Public Level 2	Networked	$13,900
Public Level 2	Non-networked	$9,400
Workplace Level 2	Networked	$11,200
Workplace Level 2	Non-networked	$7,700
DC Fast 150 kW	Networked	$111,100
DC Fast 350 kW	Networked	$192,500

Source: International Council on Clean Transportation.
Note: Values adjusted with ICCT's workplace and public multipliers, adjusted to 2022 dollars, then rounded to the nearest $100.

Figure 3. Cumulative EV charger cost and NEVI Funding, North Carolina



Overall, total charger investment estimates are most sensitive to the number of DC fast chargers needed because DC fast chargers cost substantially more than Level 2 chargers and are disproportionately important for supporting fully electric vehicles, as opposed to plug-in hybrid vehicles. As discussed below, federal funding will soon be available to create a network of DC fast chargers along major transportation corridors throughout the United States. It is essential that North Carolina make good use of available federal funding to build out a highway charging network. In addition, the need for DC fast chargers extends beyond major transportation routes, and, as Figure 3 shows, the funding allocated to North Carolina will meet only a fraction of the state's charging need. Thus, North Carolina will need more planning to deploy an EV charging network that can meet the needs of its residents and businesses. In our analysis, we assume that 50 percent of new DC fast chargers will be 150 kW and 50 percent will be 350 kW. This assumption accounts for the preferences of drivers for increasing charging speeds as they become economic.

Funding available to support EV infrastructure

Federal funding will soon be available for state EV charging infrastructure through the 2021 *Infrastructure Investment and Jobs Act*. Under the law, two charging infrastructure programs will distribute a total of $7.5 billion with the goal of building a nationwide network of 500,000 EV chargers. The first program, the National Electric Vehicle Infrastructure (NEVI) Formula Program, will disburse $5 billion over five years to states to develop a national network of EV-charging corridors for longer distance travel. To qualify for funding, a state must submit an *EV Infrastructure Deployment Plan* to the new Joint Office of Energy and Transportation by August 1, 2022. Assuming North Carolina submits an acceptable plan, its allocation for FY2022 will be over $16 million and its total allocation through 2026 will reach $109 million. [17] [18] An additional $2.5 billion will be distributed across all states through a competitive grant process to support innovative approaches to EV-charger deployment.[19] Other funding sources, such as Electrify America, may also be available to help states invest in charging infrastructure.[20]

There are well established examples for leveraging funding from other third-party private companies, such as ChargePoint, Greenlots and EVGO. Such funding can be combined with the NEVI funds and utility rate-based investments—but only if the NCUC carefully coordinates with NCDOT and other North Carolina agencies to develop a robust plan for EV charging, especially along highway corridors. To some extent, this is already occurring through the NCUC's review of Duke's Phase II EV pilot proposals and make-ready investments. These various funding sources will be important resources for North Carolina as it builds its network of EV charging stations. But by 2030 and beyond, there will still be considerable funding gaps related to infrastructure needed for even business-as-usual EV adoption in the state.

Investing Equitably

To best use funding for EV charging infrastructure, it must be deployed effectively and equitably. Several priority areas stand out. For example, as mentioned above, DC fast charging plays a disproportionate role in enabling long-distance EV travel for people and goods and overcoming driver range anxiety, which is a key barrier to EV adoption. For this reason, development of a network of DC fast chargers along major transportation corridors deserves careful attention. This need is already under discussion and entities like Electrify America have expressly prioritized it; but North Carolina still needs a strategy for allocating funding in a way that creates the greatest benefit for the public. Particular challenges to consider carefully include charging for transit to jobs within the state, for school buses, within environmental justice communities, and in rural areas.

A more difficult challenge is expanding charging infrastructure to areas that may not be served by private charging station companies, but that can yield substantial benefits for the state and improve transportation equity.

Image: Level 2 EV charging station off of Blackwell street in Durham; Shanya Hayes.

The $2.5 billion discretionary grant program recently authorized in addition to NEVI will provide support for first steps; the program requires that at least half of its funding be allocated to rural, low- and moderate-income areas, and communities with few private parking spaces. But the effort to meet this need in North Carolina will likely need additional funding. It will also be important to conduct quality outreach into communities. Doing so can increase access to EVs and help equitably distribute the benefits they provide.

3. Benefits of Transportation Electrification

We modeled two different scenarios: a Baseline case and an EO 246 case (see Table 3). The Baseline case represents a business-as-usual future based on Bloomberg New Energy Finance's (BNEF) EV sales projection but falls short of North Carolina's climate goals.[21] Meanwhile, the EO 246 scenario models compliance with the 2030 EV sales target laid out in the Governor's EO No. 246.

Table 3. Scenario descriptions and assumptions

	Baseline	EO 246
Description	A business-as-usual future that accounts for current policies and expected future technological progress and cost declines.	A more sustainable transportation future that aligns with the goals in EO 246.
EV market share assumptions	EV market share is based on BNEF's national projections, which reach 35% of all new LDV sales in 2030. Among MDVs and HDVs, EVs account for 16% of all new sales in 2030.	EV sales reach 50% of LDVs by 2030. 30% of most new MDVs and HDVs are EVs by 2030, aligning with the Multi-State Medium- and Heavy-duty MOU.[22] 50% of new bus sales are EVs in 2030.
VMT assumptions	VMT per vehicle remains constant in future years.	4% per-vehicle VMT reduction by 2030 and 14% by 2050.

Methodology for estimating EV sales, stock, and impacts

Synapse performed this phase of our analysis using the EV-REDI and COBRA models (we used a third model, EVI-Pro Lite, for the analysis described in *Section 2*.). First, we relied on Synapse's EV-REDI model to analyze vehicle stock turnover and the implications of various policy scenarios.[23] EV-REDI combines a user-specified trajectory of EV sales with state-specific data. The data include total vehicles on the road, vehicle lifetime distributions, vehicle miles traveled (VMT), fuel efficiencies, and emissions rates. Using this information, EV-REDI calculates and reports estimates of future number of EVs on the road, avoided emissions, increased levels of electricity consumption, and other outputs.

Second, we used COBRA, a publicly available model created by the U.S. Environmental Protection Agency.[24] COBRA allows users to compare the public health impacts of two different scenarios. Using our projections of changes in on-road vehicle emissions of particulate matter ($PM_{2.5}$), nitrogen oxides (NO_x), volatile organic compounds, and sulfur dioxide (SO_2) between the two modeled scenarios, we projected how a cleaner transportation sector can lead to improved public health.

EV sales and market share

Figure 4 shows how the EV share of all new LDVs is projected to change through 2050. In the Baseline projection, North Carolina's EV sales share increases steadily from 2.6 percent of new car sales in 2021 to 35 percent of new car sales in 2030. In subsequent years, the rate of change falls and by 2040 the curve begins to flatten as EV technology matures and price declines slow.

In the Baseline scenario, EVs constitute 35 percent of new LDV sales in 2030 and reach nearly 100 percent in the late 2040s. While substantially larger than today, these levels are not enough to reach North Carolina's emissions goals.

In the EO 246 scenario, we modeled a future with both higher levels of EV sales and reduced VMT. The growth in the EV sales share accelerates dramatically in the late 2020s. By 2030, EVs make up 50 percent of all new LDVs sold in North Carolina. By 2040, the sales percentage nears 100 percent.

The story is similar for MDVs and HDVs. The Baseline scenario reaches a level of 16 percent EV sales in 2030, whereas the EO 246 scenario is higher at 32 percent (see Figure 5). The EO 246 scenario nears 100 percent sales by 2040 while the Baseline scenario does not achieve this level until the late 2040s.

VMT Reductions

The EO 246 case assumes that North Carolina is able to achieve a 4 percent per-vehicle VMT reduction by 2030 and a 14 percent per-vehicle VMT reduction by 2050. This assumption is based on *Synapse's Transforming Transportation in New York* report, in which we reviewed studies on the impacts of VMT-reduction policies such as improved public transit, additional bike and pedestrian infrastructure, road pricing, and diversified and dense land uses.[25] Based on that review, we determined that VMT reductions on the order of 5 percent per decade would be both ambitious and achievable. This assumption also aligns with California's goal of reducing light-duty VMT 15 percent below business-as-usual levels by 2050.[26]

Figure 4. EV sales as a percentage of new LDV sales

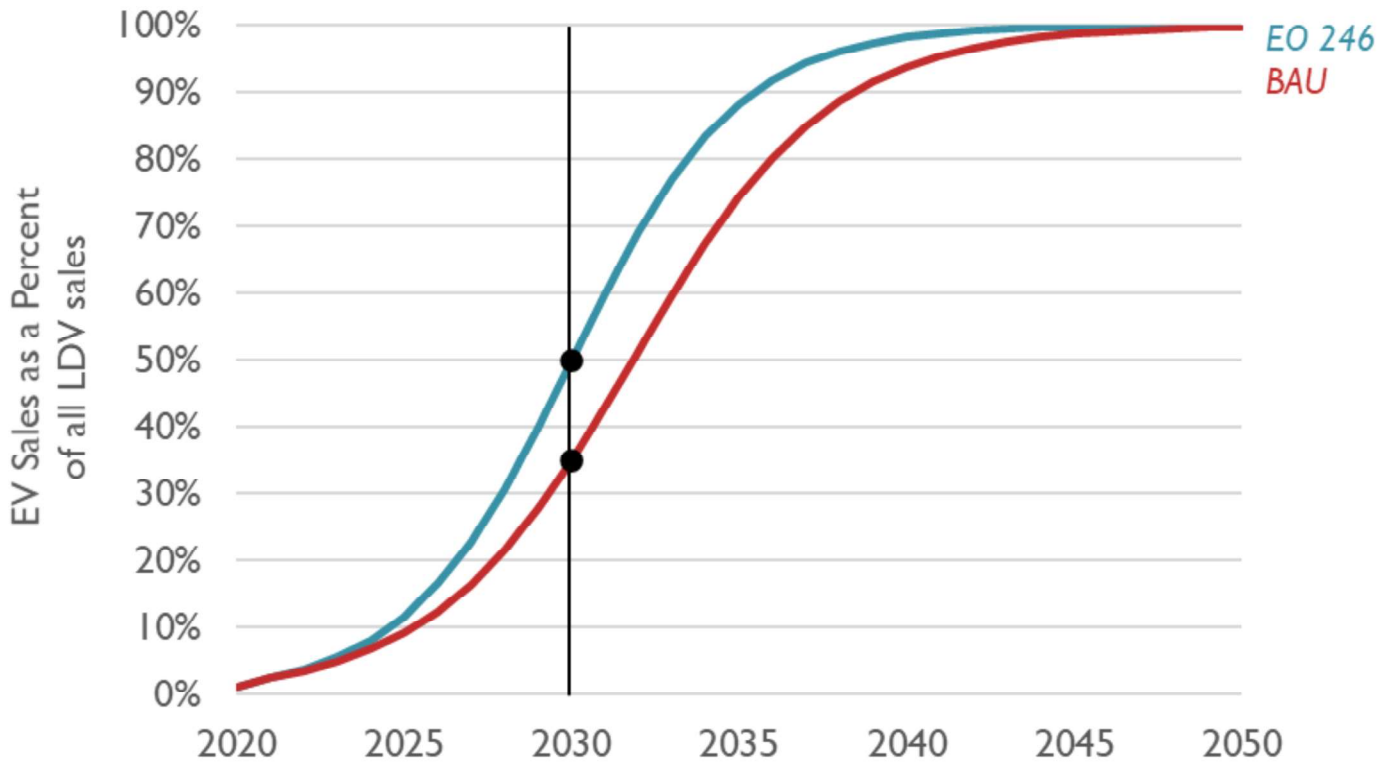
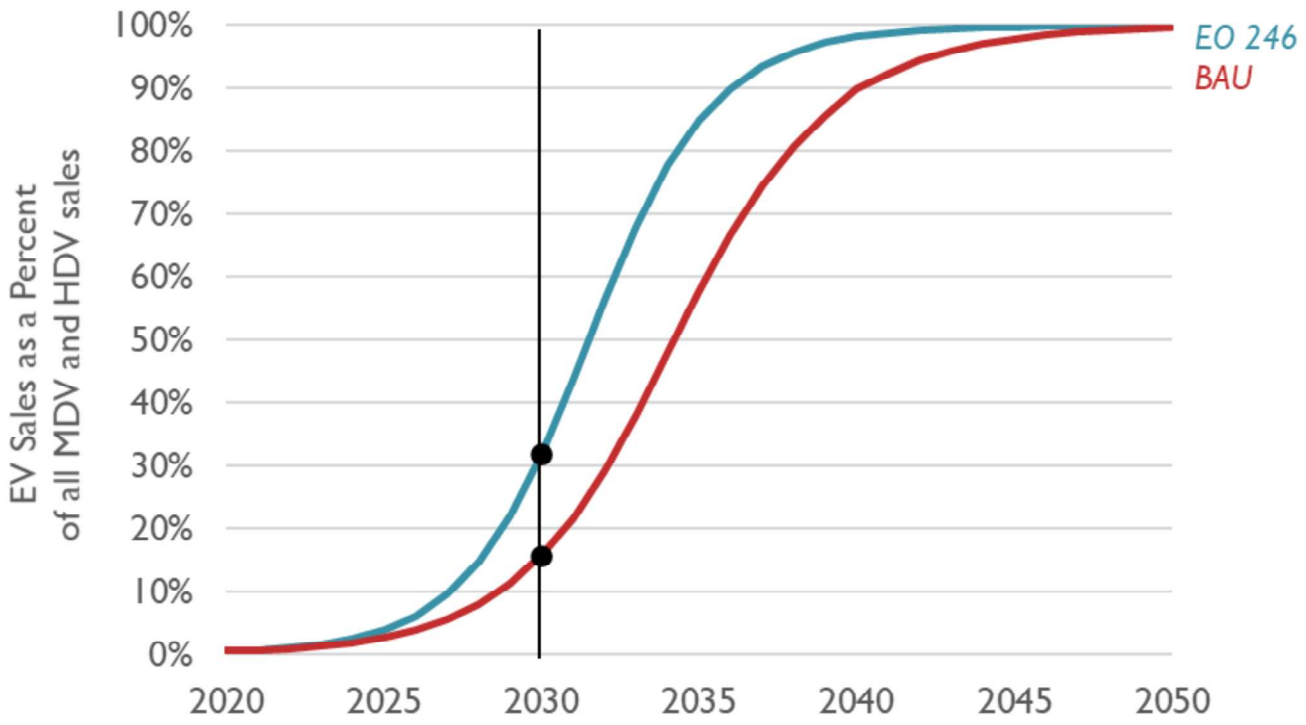


Figure 5. EV sales as a percentage of new MDV and HDV sales



EV stock and vehicles on the road

Even if North Carolina were to achieve a rapid adoption of EVs in terms of new vehicle purchases, slow fleet turnover means that it will take a long time until EVs comprise a substantial portion of the overall LDV fleet (see Figure 6 and Figure 7). In other words, there is a long lag time between when new vehicle sales are predominantly EVs and when the fleet of vehicles on the road is predominantly EVs.

For example, while half of all new LDVs *sold* in 2030 are EVs under the EO 246 scenario, EVs represent 12 percent of all LDVs *on the road* in that same year. In that same scenario, EVs are almost 100 percent of sales in 2040 but make up 57 percent of all LDVs on the road. This is one of the main reasons why EV sales share must increase so dramatically in the near term for North Carolina to reduce GHG emissions. In the EO 246 scenario, 1 million light-duty EVs are on the road in North Carolina in 2030, compared to about 26,000 on the road in 2020.

By 2050, 88 percent of all LDVs are electric. EO 246 targets 1.25 million EVs on the road by 2030, in addition to the 50 percent EV sales target for 2030 that we modeled. In our EO 246 scenario, the state does not reach 1.25 million EVs on the road in 2030. However, this second goal could be achieved either by exceeding the 50 percent sales goal in 2030 or by accelerating EV adoption earlier in the 2020s than we have modeled. Our modeling uses a generic S-shaped technology adoption curve to project EV sales between 2021 and 2030.

Figure 6. Total number of light-duty EVs on the road

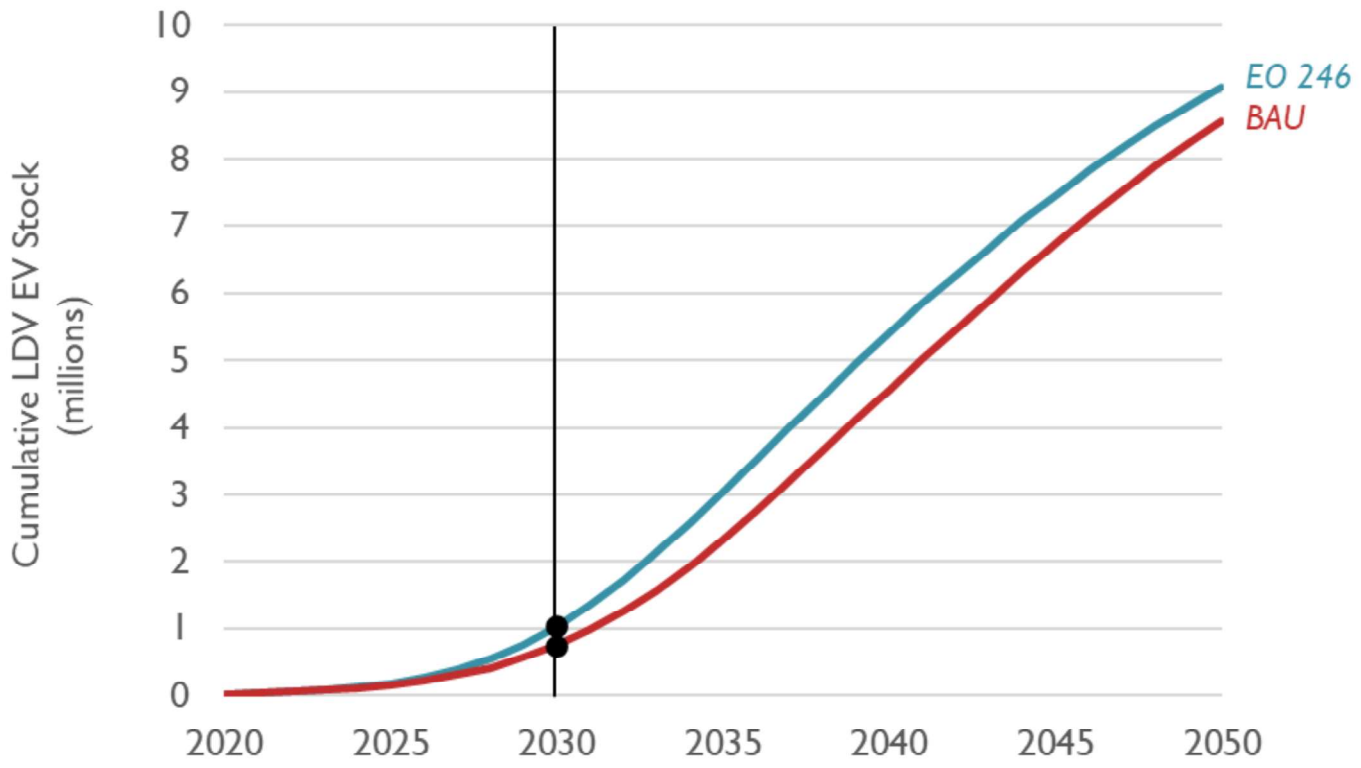


Figure 7. Total number of medium- and heavy-duty EVs on the road

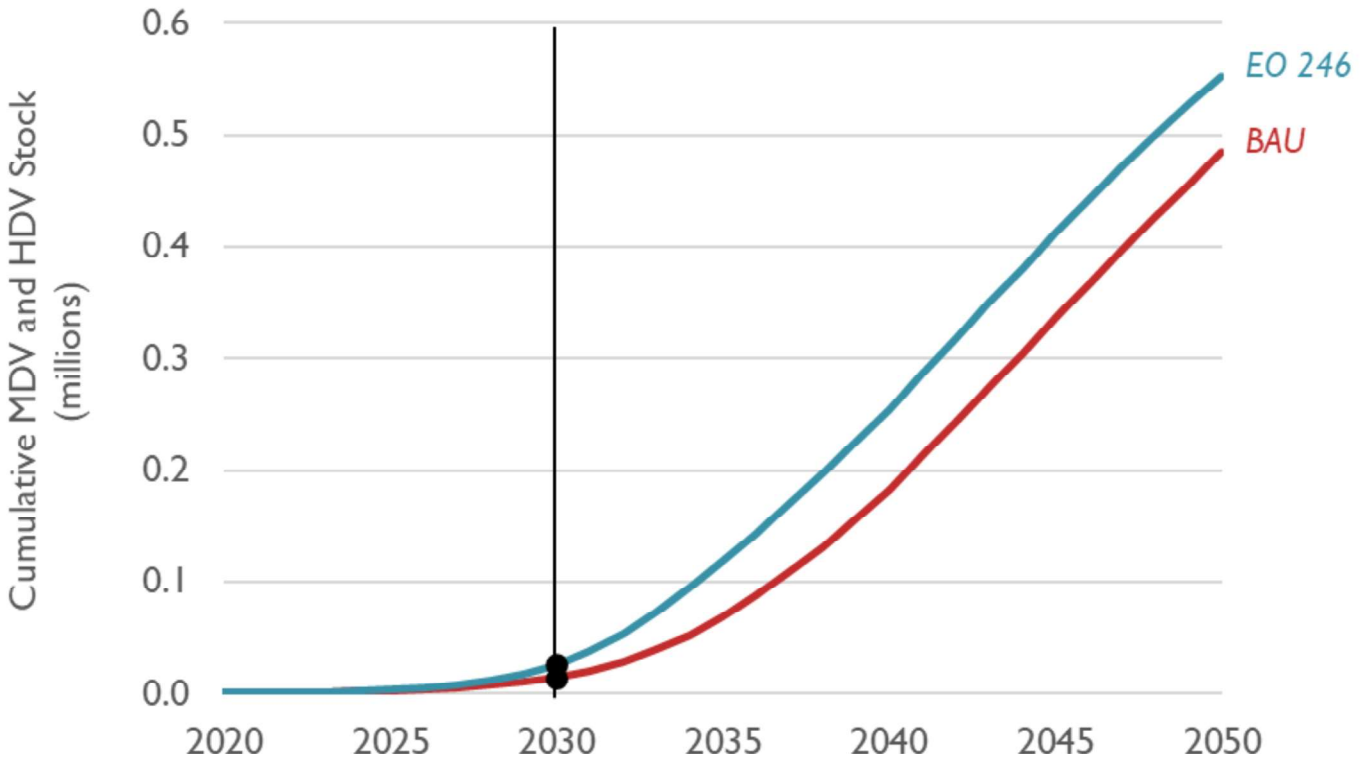
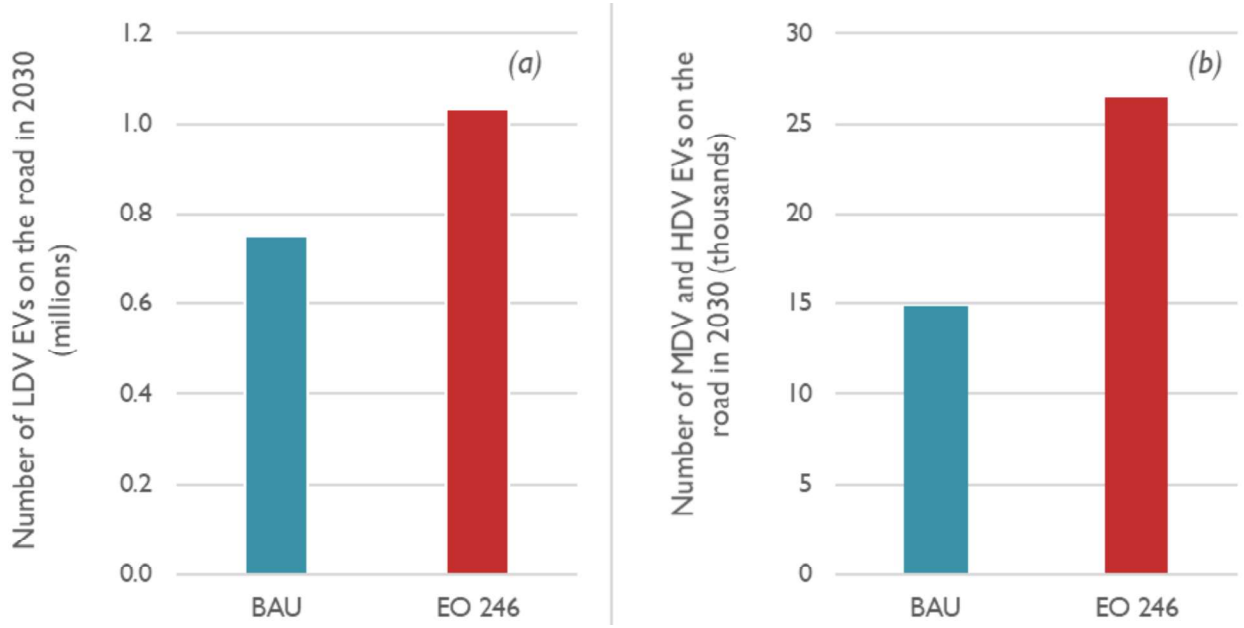


Figure 8. EVs on the road in 2030 (detail)

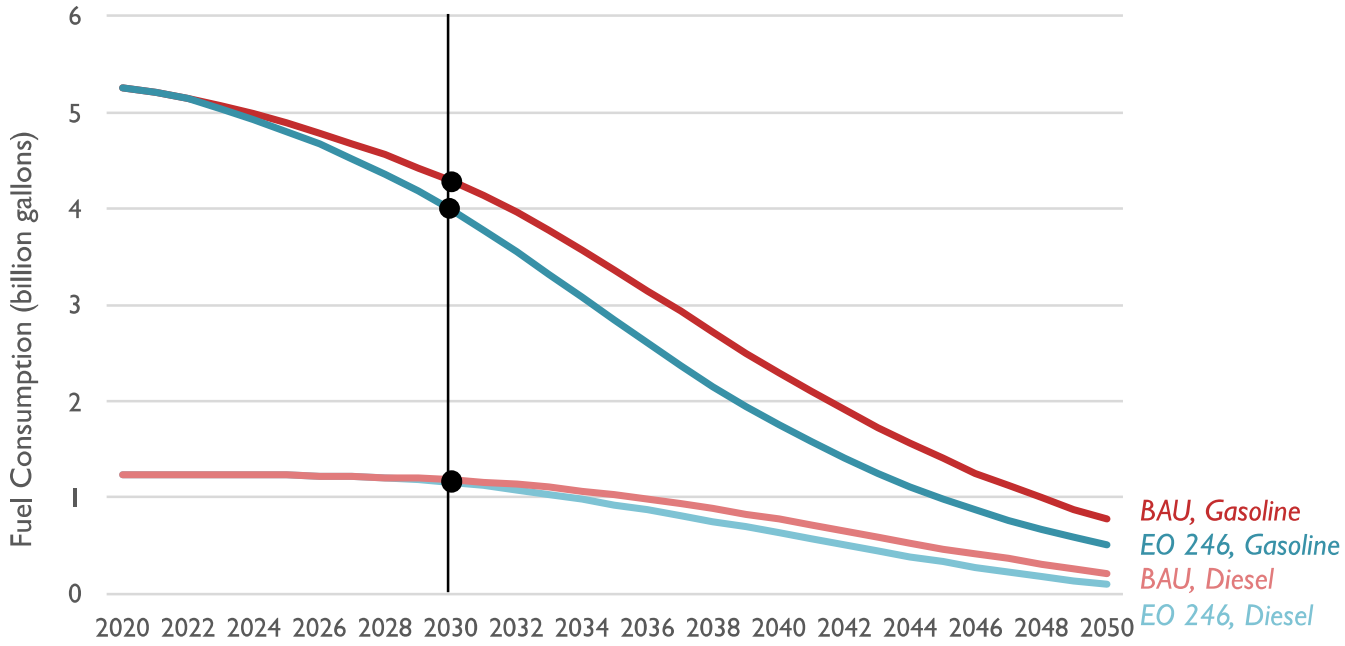


Note: Figure (a) and (b) utilize different y-axis scales.

Gasoline and diesel consumption

One major benefit of meeting the EO 246 targets is a decrease in expenditures on motor gasoline and diesel, resulting in more money kept in North Carolina. North Carolina has no major petroleum extraction industry, meaning that most of the avoided spending on gasoline and diesel would have otherwise flowed out of state. These savings can be achieved by switching from gasoline- and diesel-powered vehicles to those powered by electricity, or by reducing the need for fuel outright through reductions in VMT. These two factors reduce costs for households and businesses. Figure 8 shows the combined effect of these factors.

Figure 9. Reductions in gasoline and diesel consumption



Note: The vast majority of gasoline is consumed by LDVs, while the vast majority of diesel is consumed by MDVs and HDVs.

When multiplied with the anticipated cost of motor gasoline and diesel, these reductions in petroleum consumption produce sizeable economic benefits. Because of the long-term nature of our analysis, our estimates rely on assumptions from the U.S. Energy Information Administration's 2022 *Annual Energy Outlook*, which does not take into account recent increases in fuel prices.[27] In total, we project that nearly $35 billion in fossil fuel expenditures will be avoided in the EO 246 scenario, relative to the Baseline scenario, between 2022 and 2050. Annual savings on gasoline and diesel increase from over $200 million saved in 2025 to $850 million saved in 2030 to $1.9 billion saved in 2040, in constant 2022 dollars. We note that a recent study performed by Southern Alliance for Clean Energy found that North Carolinians spent over $15 billion on motor fuel expenditures in 2019. Only one-third of those fuel expenditures stayed in the state. [28]

Although spending on electricity will increase over time, North Carolina will still see fuel savings because EVs are much more efficient vehicles overall and because VMT reductions decrease all vehicle fuel costs. Using the prices projected for electricity and fossil fuels from the 2022 *Annual Energy Outlook*, we estimate that cumulative net fuel savings between 2022 and 2025 are $0.4 billion, growing to $2.5 billion by 2030, nearly $14 billion by 2040, and exceeding $27 billion in 2050 (see Figure 10 and Table 4). The EO 246 scenario puts billions of dollars back into North Carolinians' pockets.

Figure 10. Cumulative fuel savings

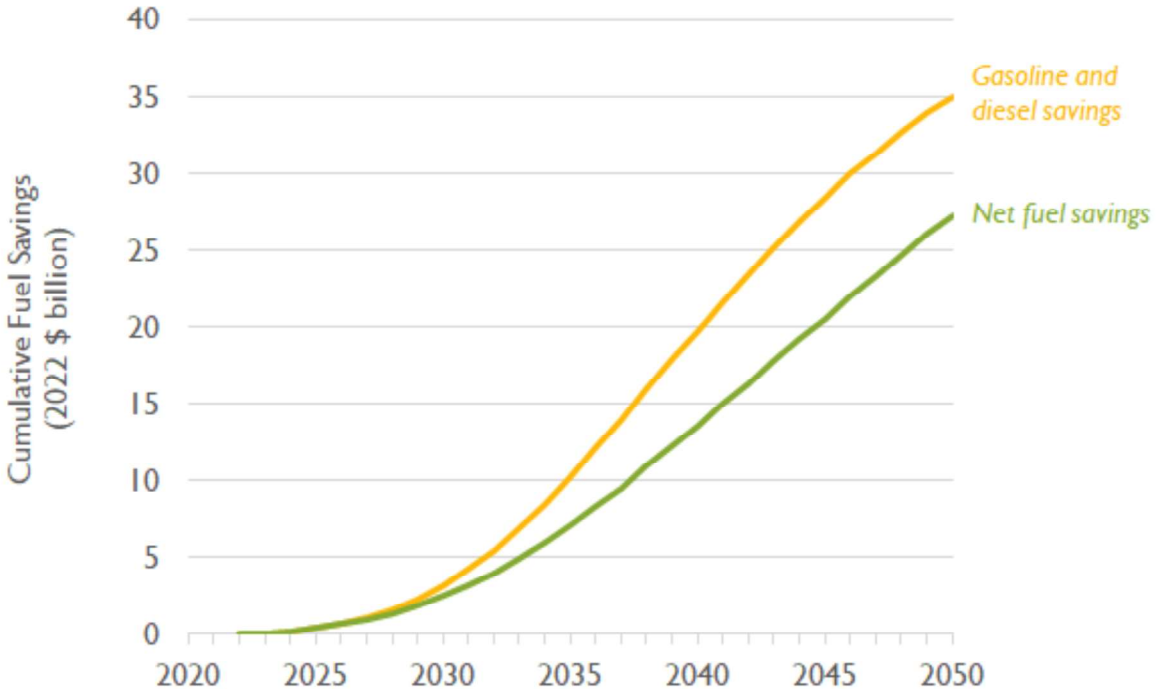


Table 4. Cumulative fuel savings

	2025	2030	2035	2040	2045	2050
Gasoline and diesel savings	$0.4	$3.1	$10.2	$19.8	$28.4	$35.0
Net fuel savings (including charging costs)	$0.4	$2.5	$7.1	$13.6	$20.6	$27.3

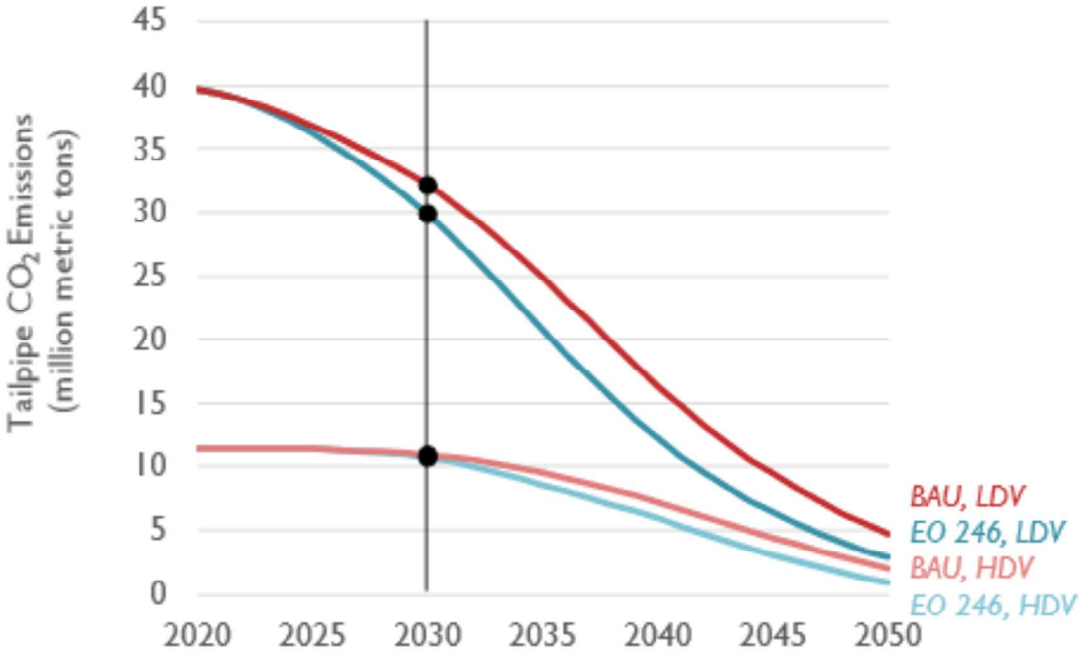
Some households in North Carolina might also decide to keep fewer vehicles in the EO 246 scenario due to the increased availability of alternative transportation modes. These households would see even greater savings by eliminating the high costs of vehicle ownership, maintenance, and insurance; but these savings are not quantified here.

GHG Emissions

Increasing the number of EVs on the road and decreasing light-duty VMT reduces emissions of GHGs from motor vehicle tailpipes (see Figure 11). Even in the Baseline scenario, tailpipe CO_2 emissions decline 17 percent by 2030, relative to 2005 levels. This reduction is a result of anticipated improvements and cost reductions in EV technology, improvements in internal combustion engine efficiency, and existing policies that drive EV adoption.

The EO 246 scenario results in greater emissions reductions, with motor vehicle tailpipe CO_2 emissions falling by approximately 22 percent in 2030 relative to 2005. Further out in the study period, emissions reductions become much greater; the EO 246 scenario reduces CO_2 emissions from motor vehicle tailpipes by 93 percent by 2050. By comparison, in the Baseline scenario, emissions from motor vehicle tailpipes decline 87 percent by 2050. In order to achieve net zero emissions by 2050 economy-wide, motor vehicles will likely need to get as close to zero emissions as possible, given the technological barriers to decarbonizing other sectors. Notably, in both scenarios, MDV and HDV emissions are not projected to see large reductions until the early 2030s, indicating that these sectors may need substantial policy action to ensure achievement of medium- and long-term reductions.

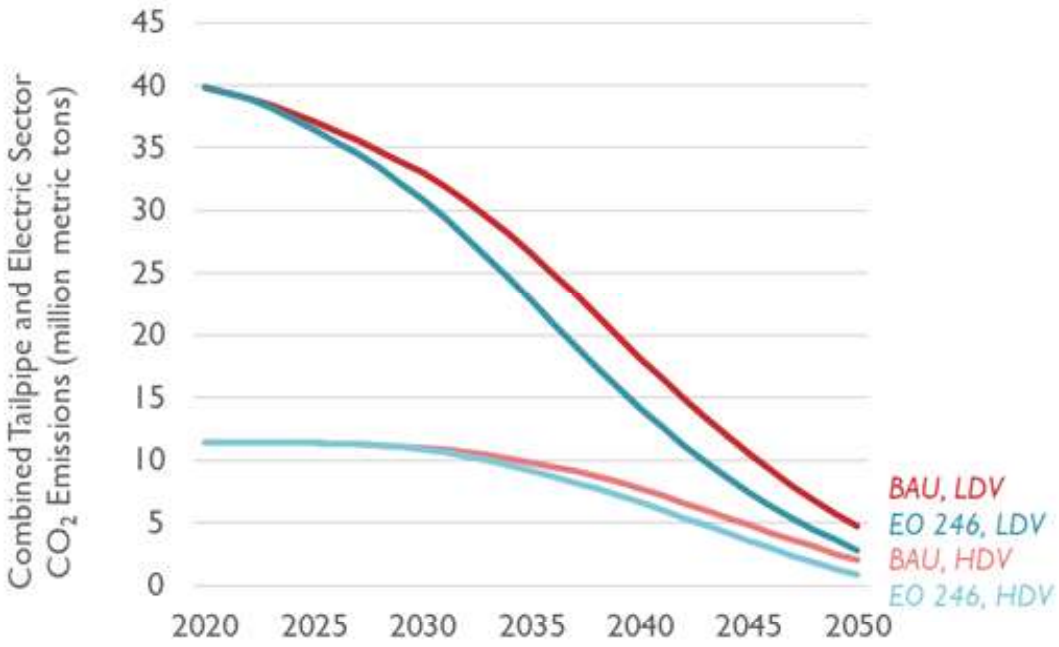
Figure 11. Motor vehicle CO2 emissions (tailpipe only)



Assuming the electricity sector decarbonizes in line with state law (reaching 70 percent clean energy in 2030 and net zero in 2050), the emissions contribution from EV charging would peak in 2038, when it adds between 2 and 3 million metric tons of CO_2 to the motor vehicle sector's total, depending on the scenario. Even accounting for increased grid emissions that result from increased EV adoption, total automobile CO_2 emissions (grid and tailpipe) decrease each year as more EVs replace internal combustion engine vehicles (see Figure 11). In the EO 246 scenario, combined tailpipe and EV charging emissions fall 19 percent by 2030 and 93 percent by 2050, relative to 2005 levels. Decarbonizing the electricity sector even faster than legislated would further mitigate this emissions increase.

Using the federal government's estimate for the social cost of carbon (about $51 per metric ton as of 2020) we can quantify the climate damages that could be avoided in the EO 246 scenario relative to the Baseline scenario.[29] Between 2022 and 2050, the cumulative benefit of reduced GHG emissions is $4.7 billion in 2020 dollars. This is a conservative estimate, as many climate scientists and economists believe the social cost of carbon is higher than the federal government's current estimate.[30] EO 246 directs agencies to use the social cost of carbon promulgated by the federal government, once it is updated.

Figure 12. Motor vehicle CO2 emissions (tailpipe and charging)



Public health impacts

As EVs proliferate, they reduce both CO_2 emissions and emissions of other pollutants that are dangerous to human health. The transportation sector is responsible for over half of total national emissions of nitrogen oxides (NOx), a primary smog precursor.[31] Transportation also contributes to emissions of other harmful pollutants, including carbon monoxide (CO), sulfur dioxide (SO_2), particulate matter (PM), and volatile organic compounds (VOC). Exposure to these pollutants results in increased asthma rates, respiratory illnesses, cardiovascular ailments, lost workdays, and premature death.[32]

Using Synapse's EV-REDI model, we estimated reductions of several air pollutants (SO_2, NOx, PM2.5, and VOCs), resulting from decreased combustion of gasoline and diesel. Using EPA's COBRA model, we can estimate avoided health incidences and associated monetized benefits. We estimate that by 2030 the increased number of EVs and the reduction in VMT in the EO 246 scenario (relative to the Baseline) will cumulatively avoid 5 premature deaths and 348 lost workdays and will result in monetized benefits of $58 million (see Table 5). Further out, we project these benefits to increase to 139 avoided deaths, 10,407 avoided work loss days, and $1.75 billion by 2050.

These estimates only include health benefits linked to reductions in air pollution (specifically reductions to mortality, heart attacks, hospital visits, respiratory ailments such as asthma attacks and bronchitis, restricted active days, and lost workdays). It does not include reductions in deaths and injuries related to motor vehicle collisions. These emissions impacts do not include emission increases associated with increased vehicle charging. These impacts are likely to be modest because by the time most of the EV load has been added, the grid will have gotten much cleaner, as required under state statute.

Table 5. Cumulative statewide health benefits, relative to the Baseline scenario

	Through 2030	Through 2050
Monetized Health Impacts	$58 million	$1.75 billion
Avoided Lost Workdays	348	10,407
Avoided Premature Deaths	5	139

In addition, the numbers described here only quantify the public health benefits achieved as a result of the decreased emissions in the EO 246 scenario relative to the Baseline scenario. In all scenarios, we observe a large amount of pollutant reductions between 2021 and 2050 caused by older, dirty vehicles coming off the road. As newer, cleaner vehicles (EVs or otherwise) replace these vehicles, pollution comprising sulfur dioxide, nitrogen oxides, and particulate matter will decline.

Equity and environmental justice impacts

Providing support for EVs will be critical, if North Carolina wishes to capture the public health benefits that can result from reducing reliance on gasoline and diesel. We estimate that meeting the goals laid out in EO 246 can produce $1.75 billion in cumulative statewide public health benefits with over 40 percent of benefits realized in counties where over 30 percent of the population is non-white.

Distribution of benefits at the county level

Health impacts associated with motor vehicle use are not equally distributed. According to the North Carolina Disease Event Tracking and Epidemiologic Collection Tool (NC DETECT), asthma disproportionately impacts the non-white population in North Carolina. In 2020, the rate of asthma emergency department visits was 238 per 10,000 people for the Black population and 109 for the American Indian population, compared to 90 for the white population.[33] In addition, Medicaid was used to pay for 31 percent of asthma emergency department visits in 2020, compared to 27 percent using private insurance. This indicates income disparities in the prevalence of asthma in North Carolina.

Reducing emissions from motor vehicles—through VMT reductions and electrification—will benefit all communities, but policymakers must be cognizant of how benefits are distributed throughout the state. EVs and alternative modes of transportation can help reduce the disparities in health outcomes for the state's low-income communities and communities of color. Of the $1.75 billion in cumulative statewide monetized health benefits, $740 million of those benefits (42 percent) are realized in counties where over 30 percent of the population is non-white. We did not quantify additional disparities that exist at smaller scales than the county level, though these are also important. Locally undesirable land uses are often clustered in environmental justice communities, further contributing to the inequitable distribution of poor air quality. Major transportation corridors often run through densely populated urban neighborhoods. Freight hubs are also often located near disadvantaged communities. A clean transportation future must prioritize cleaning the air in these neighborhoods starting immediately.

As shown in Table 6 on the following page, almost 50 percent of the population is non-white across the largest five counties in North Carolina. This is compared to 32 percent across the rest of the state. In total, 43 percent of North Carolina's non-white population lives in the five largest counties. These counties, which make up 33 percent of North Carolina's population, experience 45 percent of the cumulative monetized health impacts from the EO 246 scenario. Per-capita impacts are higher in these counties as well compared to the rest of the state, with $142 in annual benefits per resident being realized in the five largest counties, compared to $87 per resident across the rest of the state. This shows that the EO 246 scenario would help to confer public health benefits to much of the state's minority population, who largely live in the five largest counties in North Carolina.

One of the three communities where the EO 246 scenario yields the highest per-capita health benefits is Mecklenburg County, one of North Carolina's two largest counties, where 54 percent of the population is non-white. Mecklenburg County has had a history of non-attainment with *Clean Air Act* standards, but it has been in attainment with the ozone standards since 2015.[34] Nevertheless, air quality in Mecklenburg County is persistently poor. The American Lung Association gave Mecklenburg County an F rating in ozone pollution in its 2022 *State of the Air* report, based on the number of days on which ozone levels are considered unhealthy.[35] Within Mecklenburg County, Charlotte ranked the second most polluted city in the Southeast and the 41st most polluted city in the country for ozone pollution.[36]

Table 6: Cumulative county health benefits relative to Business-as-Usual in the largest 5 counties

County	Population	Percent of Residents Who Identify as Non-White	Cumulative Monetized Health Benefits (million)	Per-Capita Impacts ($/Resident)
Mecklenburg	1,095,170	54%	$192	$175
Wake	1,091,662	41%	$158	$145
Guilford	532,956	50%	$67	$125
Forsyth	378,499	44%	$46	$120
Cumberland	334,562	58%	$25	$73
Total of Five Largest Counties	**3,432,849**	**48%**	**$487**	**$142**
Total of All Other Counties	**6,953,378**	**32%**	**$602**	**$87**

An equity report from Our America ABC found inequity in air pollution risk within Charlotte, where 73 percent of residents of color live in neighborhoods that face the highest cancer risk from air pollutants, compared to 53 percent of white residents.[37] Improving air quality in Mecklenburg County and Charlotte would help reduce these disparities.

Environmental justice policies and priorities

As the transportation sector decarbonizes, principles of equity and justice will again need to guide the transition. While EVs have a large role to play in decarbonizing the transportation sector, North Carolina will have to think more broadly to make the transportation system work for all residents. Frontline communities have borne the brunt of the harmful impacts of the fossil-fuel-intensive transportation system of the past. This system has built highways through low-income communities and communities of color, ruined air quality in densely populated neighborhoods, and failed to provide adequate mobility to disadvantaged communities. North Carolina can begin correcting the mistakes of the past by promoting EV access in historically disadvantaged communities and by addressing two urgent problems with its historical transportation systems: air pollution from fossil-fuel-powered transportation in low-income communities and communities of color, and inequitable access to mobility—including clean transportation options.

Promoting EV accessibility in historically disadvantaged communities

In practice, achieving equitable health outcomes from EVs will depend on the distribution of EV adoption. Policymakers should prioritize solutions, including the installation of charging infrastructure for light-, medium-, and heavy-duty vehicles, that promote EV accessibility in historically disadvantaged communities to ensure that benefits from the state's decarbonization initiatives flow towards those who need them the most. Purchase incentive tools like vouchers, rebates, tax credits, and sales tax incentives can all help lower the cost of EVs, and eligibility for these programs can be based on low-income status.[38] Examples of these types of programs in California include the Clean Vehicle Rebate Project and the Enhanced Fleet Modernization Program Plus-Up. The rebate incentive program provides rebates toward the purchase of BEVs and PHEVs, and eligibility is based on income.[39]

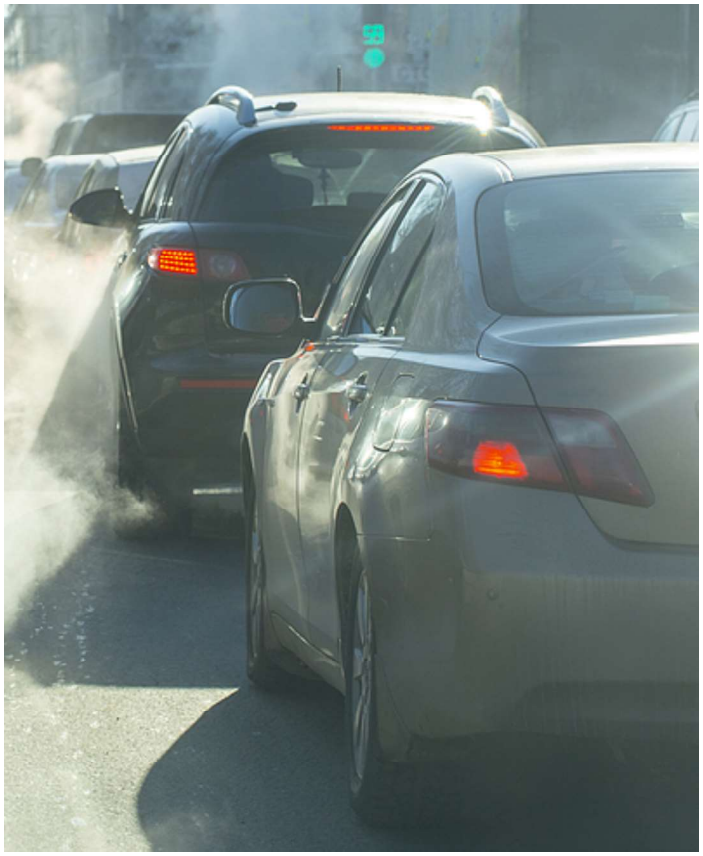
The fleet Plus-Up program, a scrap-and-replace program similar to the federal "Cash For Clunkers" program, provides increasing rebates for lower-income drivers to purchase EVs and remove the dirtiest vehicles from the road earlier than they might otherwise retire. The program also provides rebates for charging equipment.[40]

Beyond struggling with the relatively high upfront costs of EVs today, low-income individuals often lack the credit needed to finance EVs. This can mean higher interest rates and higher monthly payments for these individuals, creating a barrier to owning EVs. Financing assistance programs can allow those without good credit to access affordable loan options. The Greenlining Institute recommends implementing programs like loan loss guarantees for financial institutions and programs that buy down interest rates for consumers. Loan loss guarantees reduce risk for banks to loan money to individuals with low credit scores, and price buy-down vouchers provided by government entities reduce monthly payments on loans for low-income individuals.[41] In California, the Community Housing Development Corporation provides residents of disadvantaged communities with buy-down vouchers for EVs and EV charging equipment.[42]

Another priority is ensuring that charging infrastructure is available to all. Equitable access to charging infrastructure includes deploying public chargers in low-income and minority communities, ensuring affordable access to home charging, and ensuring that workplace charging is available in these communities. Because people in underserved communities disproportionately live in multi-unit dwellings, policies will need to be implemented to encourage deployment of charging infrastructure to multi-family buildings, including those with affordable housing. Fast-charging will be especially important to deploy in areas where access to charging at home is limited. To ensure equitable investment in charging infrastructure among communities in North Carolina, publicly funded EV charger investments should have minimum deployment commitments in disadvantaged communities.[43]

Targeting air pollution in overburdened communities

In conjunction with policies to increase EV adoption, North Carolina can also enact policies that directly target air pollution in overburdened communities to ensure that In conjunction with policies to increase EV adoption, North Carolina can also enact policies that directly target air pollution in overburdened communities to ensure that health benefits are equitably distributed. The many pollutants emitted by fossil-fuel-powered cars and trucks cause cardiac and respiratory diseases, among other illnesses.[44] As described above, moving toward a clean transportation future can reduce monetized public health impacts by $1.75 billion through 2050. Importantly, these health impacts are not uniformly distributed. Low-income communities and communities of color face the worst air quality because of inequitable transportation systems, as well as other sources of pollution.



To target air pollution in overburdened communities, North Carolina could create a community air monitoring program to track progress on diminishing local air pollution. North Carolina should identify high-risk communities, monitor air quality in these communities for exposure to pollutants from transportation and other

sources, and create and implement strategies to improve air quality. These programs can help ensure that policies aimed at achieving significant reductions in emissions are also producing co-benefits for health and equity.

Increasing low-cost mobility options

Transportation systems designed entirely around private vehicles can impose financial hardships on low-income households. North Carolina can provide valuable mobility options at lower costs for low-income households by funding improved transit service and infrastructure, constructing affordable housing in walkable and transit-oriented locations, and providing subsidized electric car-sharing access to supplement transit. In addition, policies discussed earlier that reduce the cost of EVs for low-income households may be especially important for North Carolina's rural communities, where low-carbon transportation alternatives may be more costly or face political obstacles. Many of these policies are being discussed in ongoing stakeholder meetings led by the state as part of the process to draft a North Carolina Clean Transportation plan.

Increased public transit, biking, and walking

Today's transportation system in North Carolina is heavily dependent on private vehicles. NCDOT's Vehicle Miles Traveled Reduction Study reported that only 1.1 percent of commuters in North Carolina used transit, compared to 5 percent nationally.[45] While many households may be able to afford the costs of vehicle ownership, transportation costs are a large burden for low-income households. An auto-centric transportation system leaves low- and moderate-income residents stuck choosing to either pay the high costs of vehicle ownership or go without access to important destinations. Providing access to more affordable transportation modes such as public transportation should be a key goal for the future clean transportation system.

Additionally, walking and biking are among the most energy efficient modes of transportation and should be encouraged as part of a clean energy future. These modes of transportation also have additional health benefits and can improve quality of life relative to reliance on driving and being stuck in traffic.

North Carolina and its communities can promote walking and biking by providing spacious and well-maintained sidewalks, protected bike lanes, bike parking, and intersection designs that prioritize the safety and comfort of pedestrians and cyclists. These interventions importantly also reduce pedestrian and cyclist injuries on the road.

Image: Bike route in Umstead Park, Chapel Hill; Shanya Hayes.

Planning for EV charging and smart EV rate design

As a result of EV charging, both scenarios modeled in this analysis produce modest increases in electricity demand in the near term. By 2030, retail electricity demand from charging nears 5 TWh, representing a 4 percent increase over North Carolina's recent historical electricity sales.[46] The 5 TWh value is within the range of observed swings in recent annual electricity demand resulting from the difference between relatively warm years and cooler years.

By 2050, electricity demand related to vehicle charging in the EO 246 scenario reaches 60 TWh per year (compared to a statewide load of about 134 TWh per year over the past five years). While this is a more substantial addition to electricity demand (averaging about 3 additional TWh per year, every year after 2030), this new charging load is far enough in the future and consistent enough to incorporate into planning.

Grid planners have nearly 10 years before the charging impact of EVs is likely large enough to be noticed outside of normal weather-influenced fluctuations in demand. Planners can use the near term to determine which resources are best (from a reliability, cost, and environmental perspective) to meet the evolving needs of the grid in the 2031 to 2050 timeframe, without necessarily needing to commit to costly investments in grid resources in the very near term.

Utilities can also accelerate EV deployment with rate designs that both lower the costs EV drivers pay for charging and the costs that charging imposes on the grid. Time-of-use (TOU) rates, which charge different amounts for electricity at different times of the day, can help save EV drivers money by encouraging them to charge their EVs at low-cost hours, when it is easier and more efficient for the grid to serve this vehicle-charging load.

Public charging stations offer an additional opportunity for utilities to design rates that encourage EV adoption. High demand charges, which charge customers based on the maximum amount of electricity used at any moment over the course of the month, can be very expensive for charging stations that see only occasional use in the near term (while EV sales are still relatively low). Instead, utilities can develop rates that depend on the amount of energy these stations consume and the hours during which the energy is consumed. Because these kinds of rates help incentivize the use of the electricity grid throughout the day, instead of only during peak hours, they can minimize the per-kWh cost utilities administer for the transmission and distribution component in electricity rates. This lowers the cost of electricity for all households, including those without EVs. TOU rates can also be used to steer EV charging to the times of day with abundant renewable generation, while managed charging can be used to temporarily pause charging and help ease strain on the electricity grid.

Conclusions

Our analysis finds that the targets laid out in EO 246 produce a multitude of benefits for North Carolinians. Achieving the goals under EO 246 requires new policies and investments from the state, utilities, and other parties, particularly for increased investments in public charging infrastructure. Putting policies in place that allow this target to be met will improve public health and the environment, retain billions of dollars in the state's economy, and promote an equitable transformation of the state's transportation sector.

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