MEMORANDUM
Town of Nags Head
Planning & Development Department

To: Planning Board

From: Holly B. White, Principal Planner
Kate Jones, Senior Environmental Planner

Date: April 15, 2022

Subject: Electric Vehicle Action Plan Update

BACKGROUND

The Planning Board initiated discussion of electric vehicle charging stations in June 2019, and Staff prepared a detailed memo the following month to facilitate discussion. These initial discussions led to the inclusion of an Electric Vehicle Action Plan as part of the Planning & Development Department FY2020-2021 Strategic Work Plan, with the general goal being to support the increasing prevalence of electric vehicles. In Fall 2021, Staff began working with Dr. Timothy Johnson and Masters of Environmental Management (MEM) Program students Camila Ospina, Narissa Petchumrus, and Will Price to draft a scope of work that was subsequently reviewed by the Planning Board.

Nags Head Electric Vehicle Action Plan Updates

MEM Program students provided staff with a draft EV Action Plan on March 23, 2022. Staff forwarded the draft Plan to Planning Board Members for review and feedback. Attached is the draft EV Action Plan prepared by the MEM students. A final draft of the plan is anticipated to be received April 22nd. Once received, staff will forward the final version of the plan to the Planning Board for review. Staff would like to briefly discuss the draft plan and determine if there any additional comments or suggestions on the draft prior to plan finalization.

MEM students presented the EV Action Plan draft at the 2022 Duke Spring Master's Project Symposium. Information on the symposium is available HERE. Staff did attend the presentation and felt that the students had a great presentation and represented the Town well.

Staff will be available at the meeting to address any questions.

Attachment:

- Draft EV Action Plan

TOWN OF NAGS HEAD
DRAFT EV ACTION PLAN
March 23rd, 2022

Executive Summary

- Purpose of this report
- Summary of work process
- Results and conclusions

I. Introduction

This Electric Vehicle Action Plan was created for the coastal community of Nags Head, North Carolina, to help the town navigate the anticipated rise of electric vehicle usage in the United States. Moreover, this action plan can serve as a guide for other small towns that are interested in preparing to see more EVs on the roads.

Electric vehicles are becoming increasingly popular, both for consumer car owners and for commercial and municipal vehicle fleets. Electric car sales are growing steadily in the United States. In 2013, only 0.1 million EVs were sold in the U.S. In 2021, 608,000 EVs were sold nationally.[1] From 2018 to 2020, EVs have maintained roughly 2% of the sales shares for new cars in the U.S. The national car market declined 23% overall in 2020 due to COVID, but EV sales declined less than the overall market, maintaining a 2% market share.[2] EV sales in North Carolina have followed this national trend. In December of 2018, roughly 7,000 EVs of all types were registered in the state; by December 2021 that number has grown to 25,000 EVs registered in North Carolina.[3]

Electric vehicles are attractive alternatives to traditional fossil fuel vehicles, both because they are in some ways more convenient, economical, and low-maintenance than gas cars, and because they are better for the environment, due to the fact that they produce less of the pollution that contributes to global warming.[4]

Global warming increases the risk of disasters like hurricanes, droughts, and floods.[5] Carbon dioxide pollution is a major contributor to global warming and reducing carbon dioxide emissions will reduce the rate of global warming.[6] Electric vehicle adoption helps to reduce global warming by replacing traditional gas-powered vehicles with cars and trucks that produce far fewer greenhouse gases to get us from point A to point B.[7]

Developing a cohesive action plan for electric vehicles is an especially important undertaking for Nags Head. Tourism contributes a great deal to the Town's economy. In 2019, Nags Head had a population of 2,900,[8] yet saw roughly 170,000 visitors in 2021.[9] Tourism employs 1/3 of the citizens of Dare County, of which Nags Head is a part.[10] Nags Head is not served by a ferry or bus system, meaning that all tourist traffic must arrive by car. As EVs occupy larger and larger portions of the region's vehicle sales, Nags Head needs a cohesive plan to serve the increasing

number of electric vehicles visiting its shores each vacation season. The purpose of this Action Plan is to create a guiding document with concrete recommendations that Nags Head can utilize so that it is ready to meet the future. Moreover, becoming a leader in EV charging infrastructure could help Nags Head to market itself as the go-to destination for vacationing EV drivers looking for a convenient road trip with their electric car.

This Action Plan will answer two questions: What will be the charging and infrastructure needs of the town as the number of EVs increases, and what steps can the town take to make needed improvements? We will begin with an introduction to the basics of EVs, followed by a report on the general trends of EVs in the market today. The next section will answer this question: why should the Nags Head planning board and local stakeholders be concerned about EVs and meeting their anticipated charging demands? After addressing these preliminary issues, the report will turn to an analysis section. First, we will review existing conditions in Nags Head, potential scenarios for EV growth, and opportunities and constraints for a potential EV plan, including existing and upcoming policies, laws, and regulations. We then survey potential sources of support and funding for EV infrastructure, and best practices gleaned from other EV action plans and case studies. The next section will address the importance of resiliency and equity in enacting this EV action plan. Finally, we provide recommendations for the town based on this research and analysis.

II. Basics of electric vehicles and electric vehicle infrastructure

A) What are electric vehicles?

Electric vehicles are vehicles that are powered by an electric motor instead of a conventional internal combustion engine and have a battery instead of a gasoline tank.[11] Generally, electric vehicles have fewer components than conventional gas or diesel cars. The battery pack stores electricity that powers the vehicle and all its accessories, the charging port allows the vehicle to receive external power to charge the battery pack, and an internal thermal system maintains optimal temperature ranges in the motor, battery, and engine.[12]

Electric vehicles have multiple distinctive characteristics compared to gas or diesel vehicles. The most important feature of electric vehicles is that they do not produce tailpipe emissions. In the United States, 29% of the total emissions of greenhouse gases come from the transportation sector, representing the largest share of GHG in the country.[13] In this regard, one electric vehicle could prevent the emission of 8,500 lb of CO_2 per year compared to a conventional gas vehicle, considering that, on average, a family car is driven 15,000 miles a year in the state of North Carolina.[14] Additionally, electric vehicles have greater energy efficiencies than conventional vehicles. The energy efficiency of a vehicle indicates to the amount of energy coming from the fuel source that is converted into actual energy to move the vehicle. Electric vehicles convert

over 77% of the electrical energy they receive into vehicle movement, while gas powered vehicles only convert approximately 12-30% of the energy stored in gasoline into the vehicle movement.[15]

B) What is electric vehicle infrastructure?

Electric vehicle infrastructure includes the equipment used to charge the vehicles (charger hardware), the wiring, the installation of payment systems such as card readers, the data contracts, and the transformers potentially needed to provide electricity to the charging points. This section provides the description of each of these elements, and an overview of the minimum and maximum costs of each component.

Types of chargers: performance and deployment

Level 1 residential charger

Level 1 chargers have standard 120 V outlets, that is, regular household outlets used to charge cellphones or laptops. They represent the most inexpensive costs regarding installation and supplemental equipment,[16] and generally provide 40 miles of range per 8 hours of charging.[17] As of 2020, Level 1 chargers represented less than 5% of chargers in the United States.[18]

Level 2 residential and commercial charger

Level 2 chargers typically provide electricity through 208 V and 240 V outlets, which are found in typical commercial and residential applications, respectively. The installation of Level 2 chargers requires a certified electrician and an electrical permit, increasing costs in comparison to Level 1 chargers. Level 2 chargers provide 10 to 20 miles of ranger per 1 hour of charging,[19] and are the most common type of charger in the United States, representing over 80% of public ports.[20]

Level 2 chargers installed in residences and workplaces are typically installed on private property and, as such, they are not accessible to renters and tourists who would benefit more from public charging infrastructure.[21] For that reason, although the high deployment of Level 2 chargers is beneficial and the most popular in the United States, it presents challenges of broader accessibility that need to be considered in policies regarding EV infrastructure. A report from the Rocky Mountain Institute recommends that to transition from early adoption to mass market deployment of EVs, policymakers need to focus on a high-coverage public DCFC network.[22]

Direct Current Fast Chargers (DCFC)

DCFC are the fastest chargers available to date and can provide 60 to 80 miles of range per 20 minutes of charging.[23] As of 2020, DCFC chargers represented approximately 15% of chargers in the United States.[24]

DCFC chargers are not standardized, and they serve different vehicles depending on the vehicle charging port. SAE Combined Charging System (CCS) and CHAdeMO fast chargers can be used by virtually all EVs, while Tesla DCFC can only be used by Tesla vehicles, since they have a different charging port. In 2019, Tesla launched an adapter to CCS so Tesla vehicles could use CCS and CHAdeMO DCFC chargers.[25]

Cost of chargers

The costs of charging infrastructure are mainly driven by the power rating of the chargers, that is, at higher power ratings, higher are the costs.[26] Other factors that affect the charger's costs include the location of the charger, which impacts the degree of weatherproofing needed, the mounting style (wall mounted or on a pad), and if they are 'smart' chargers or not.[27] Smart chargers are networked chargers that allow the electric utility to inhibit charging during peak electricity demand hours, when providing power is expensive, and allow charging during low electricity demand hours, when electricity prices are lower. The following table shows minimum and maximum costs per kW of level 2 and DCFC chargers.

CHARGER TYPE	KW RATING	MINIMUM COST/KW	MAXIMUM COST/KW
Level 2: Residential	2.9	$131	
	5.8	$87	$98
	7.7	$52	$90
Level 2: Commercial	7.2	$444	$542
	7.7	$326	$391
	9.6	$396	$448
	14.4	$501	
	16.8	$292	
DCFC	50	$400	$716
	150	$504	$667
	350	$366	$429

lowest cost highest cost

Figure 1. Cost of chargers by type and KW rating. Source: Nelder, C., Rogers, E. (2019). Reducing EV Charging Infrastructure Costs. Rocky Mountain Institute. Retrieved on January 14, 2022 from https://rmi.org/insight/reducing-ev-charging-infrastructure-costs/

Network and Data Contracts

Smart charging stations or networked chargers are connected to a central system via WiFi, the cellular network, or ethernet.[28] These stations can perform two-way communications with the electric utility, or any other entity that can manage the charging station remotely, offer radio-frequency identification (RFID), credit card payments, monitor and analyze use, and facilitate customer support.[29] Networked chargers usually involve ongoing payments for the WiFi, cellular, or ethernet services through a pre-agreed contract.[30] As with any other contract, the contract's length and services provided depend on the supplier. A report from the Rocky Mountain Institute from 2019 suggests that at the current stage of the EV infrastructure market development, it is more beneficial to negotiate shorter contracts. Short contracts allow for flexibility and further negotiation in the near future since data costs are expected to decrease over time.[31] Additionally, the report suggests that whenever possible, contract negotiations should be done across an entire service territory and not on a charger by charger basis.[32] Data contract costs vary between $84/year/charger and $240/year/charger, while network contract costs range from $200/year/charger to $250 /year/charger.[33]

Transformers

The increasing use of EVs can generate higher levels of electricity demand, and a higher probability that a site will require the upgrade of a distribution transformer. It is estimated that with an added energy demand of over 1000 kWh, an upgrade of the distribution transformer will be required.[34] Typically, coastal cities need to bring additional power supplies to support new charging sites.[35] The following figure illustrates the different ranges of grid upgrade costs depending on the additional power required.

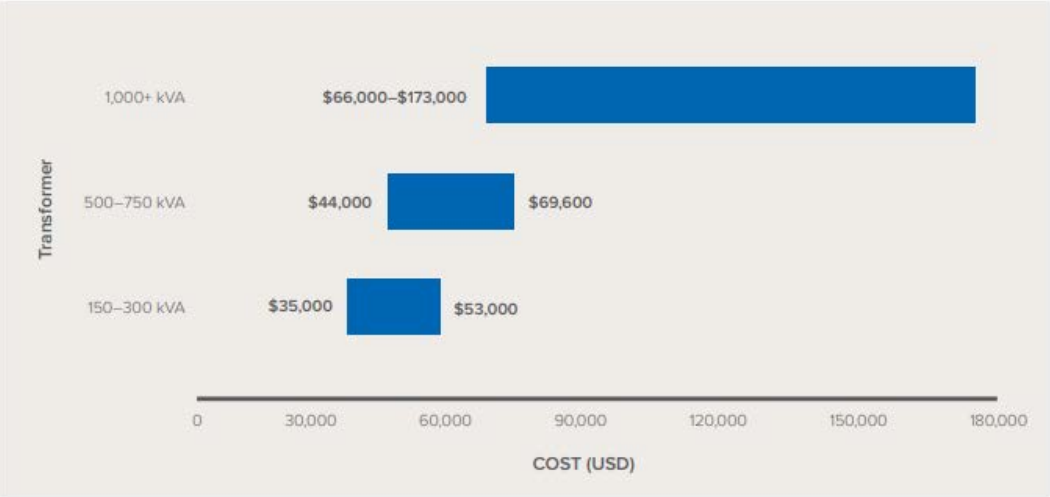

Figure 2. Cost of transformers. Source: Nelder, C., Rogers, E. (2019). Reducing EV Charging Infrastructure Costs. Rocky Mountain Institute. Retrieved on January 14, 2022, from https://rmi.org/insight/reducing-ev-charging-infrastructure-costs/

"Make-ready" infrastructure and physical installation

"Make-ready" infrastructure refers to the necessary electrical infrastructure that connects the electricity grid to the chargers, including conduit and wires, electrical panels, and mounting pads. Typically, the installation of make-ready infrastructure involves interventions such as trenching or boring. It is estimated that the make-ready costs account for 30-40% of the capital costs of the charger's installation.[36] This section briefly describes what the physical installation of make-ready infrastructure involves.

The EVSE (Electric Vehicle Supply Equipment) unit is connected to the electrical service by wires that are enclosed in an electrical conduit. Chargers installed in public spaces, such as a parking lot, require of trenching or boring to create a path for the conduit.[37] The costs drivers of this process include labor costs, distance to be trenched, types of material being dug, and the potential replacement of the material (asphalt or concrete replacement).[38] The cost variability of this processes is very high since they depend on multiple factors.[39] Regarding electric panels, additional installations are needed when there is insufficient capacity on the existing electrical panels for the dedicated circuits. In that scenario, an electrician will need to create additional capacity by replacing or upgrading the panel. In the case there is sufficient capacity on the panel, additional breakers can be added to the panel.[40]

To minimize costs, it is recommended to choose station locations that are relatively close to the available electrical infrastructure.[41] Similarly, to avoid high costs in the future, it is important to consider current and future charging needs to reduce future site preparation costs as the demand for EVs grows.[42]

- Operation and maintenance

Maintenance necessities and costs are less certain than installations costs since the EV market is still developing.[43] General maintenance for charging infrastructure includes site rental or lease, preventative maintenance, and corrective maintenance. Networked units with advanced features and communications systems may require maintenance more frequently than other chargers since they have more components.[44] Naturally, maintenance costs depend on the type of charger.

Typically, Level 1 chargers do not require any maintenance besides keeping the equipment clean. In rare occasions, there may be the need to replace the outlet, which can have cost between $1-$40 depending on whether it is for an indoor or outdoor application, and if it protects against electrical shock.[45] Maintenance of Level 2 chargers includes the replacements of cords because of accidental damage or wear, periodic technical troubleshooting if it is a networked charger, and manual system resets.[46] The replacement or maintenance costs for accidental damage, wear or vandalism are generally covered by the warranty. DCFC chargers require periodic maintenance of the cords and their cooling systems, technical troubleshooting, and manual resets for software malfunction if these are not covered in the data and network fees.[47]

It is important to establish responsibility for periodic maintenance and maintenance costs and determine if the site host, charging network, or installer is responsible to minimize the number of chargers out of service, especially during months of peak tourist visits. While actual maintenance costs vary, station owners should account for maintenance costs of up to $400/year/charger.[48]

- EVSE ownerships models
- Common locations for chargers
- Who Develops and Operates Public Electric Vehicle Charging Stations?

III. Current trends in electric vehicles

General background on EV trends:

Six million electric cars (battery electric and plug-in hybrid) will be shipped in 2022, up from 4 million in 2021, according to a new forecast by Gartner, Inc.[49] The following table below provides a breakdown of the types of EVs for shipment[50]:

	2021 Shipments	2021 Growth (%)	2022 Shipments	2022 Growth (%)
Car	4,473,907	38.3	6,022,147	34.6
Bus	165,551	18.1	198,353	19.8

Van	86,274	56.1	126,607	46.8
Heavy Truck	15,171	41.5	22,663	49.4
Total	4,740,903	37.7	6,369,769	34.4

Figure 3. Global Electric Vehicle Shipments, 2021-2022 (Actual Units). Due to rounding, some figures may not add up to the totals shown. Source: Gartner (January 2022)

EV sales in the US doubled in 2021 compared with 2020, and car buyers in 2022 will have twice as many electric models from which to choose.[51] According to the International Energy Agency (IEA) the expansion of electric car registrations increased in major markets despite Covid-19.[52] Consumers spent $120 billion USD on electric car purchases in 2020, a 50 percent increase from 2019, which breaks down to a 41 percent increase in sales and a 6 percent rise in average prices.[5354]

Regarding pricing trends for EVs according to Kelley Blue Book, the average transaction price for an EV in April 2021 was $51,532, which is more than $11,000 higher than a full-size gas-powered car, and nearly $30,000 more than the average compact car sale.[55] It is also important to note that EV prices are not monolithic as current EV models vary in price. Many currently available models constitute luxury vehicles that can go over $100,000. Cheaper EV models such as the Nissan Leaf start at under $30,000 while the starting price of an electric Mini Cooper is only $7,000 more than its regular gas-powered counterpart.[56] The most expensive cost component behind EVs are their batteries. Around 40 percent of a lithium-ion cell's cost is tied to commodities that have risen over the past year, which could lead to battery price declines stalling for an extended period of time or could even rise for the next few years before decreasing.[57] Battery pack prices will need to drop well below $100/kWh for EVs to reach parity with internal combustion engine (ICE) vehicles but given consumer preferences for higher ranges and heavier vehicles the ideal price resembles $80/kWh in Europe and the U.S., and even lower in some other markets with cheaper vehicles.[58] EVs will be considered cheaper than ICE vehicles when battery pack prices are $60/kWh in all segments and countries.[59] Battery prices are projected to reach $80/kWh in 2026 and $60/kWh in 2029, down from $137/kWh in 2020.[60] "Price parity" refers to the point at which an automaker can theoretically build and sell an EV with the same margin as a comparable combustion vehicle, assuming no subsidies are available.[61]

New data extracted from recent Consumer Reports reliability surveys shows that both battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs) drivers are saving 50 percent on their repair and maintenance costs, when averaged over a typical vehicle lifetime.[62] Based on average driving habits, fuel costs for BEVs were estimated assuming mostly home charging and an estimated six fast-charging sessions required per year for BEVs with a range of 250 miles.[63] Overall, BEVs were estimated to save consumers about 60 percent on fuel costs compared with the average vehicle in their class.[64] Another report from Consumer Reports compared nine of the most popular EVs on the market under $50,000 were compared to (1) the

best-selling, (2) the top-rated, and (3) the most efficient vehicles in their class.[65] For six of the nine EVs analyzed, the first-owner ownership costs are estimated to be lower than those of all three comparable ICE vehicles in their class.[66] For all nine EVs analyzed, the first-owner ownership costs are estimated to be lower for at least one of the three comparable ICE vehicles.[67] In many cases, the EVs matched or exceeded the performance of some of the top-performing ICE vehicles in their class.[68] For all EVs analyzed, the lifetime ownership costs were many thousands of dollars lower than all comparable ICE vehicles' costs, with most EVs offering savings of between $6,000 and $10,000.[69] While new EVs were found to offer significant cost savings over comparable ICE vehicles, the cost savings of 5- to 7-year-old used EVs was found to be two or three times larger on a percentage savings basis.[70] Data also obtained by CR from ALG, a data and analytics subsidiary of automotive pricing and information website TrueCar, shows that when adjusted for federal purchase incentives, both battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs) are expected to depreciate at the same rate as ICE vehicles in the same class over the first five years of ownership.[71]

Installation of publicly accessible chargers increased by 45 percent in 2020, a slower pace than the 85 percent in 2019 likely due to market interruption from the pandemic.[72] Installation of slow chargers in the United States increased by 28 percent in 2020 from the prior year to a total of 82,000 chargers, while faster chargers in the US total 17,000.[73] Slow chargers are generally used in homes, multi-dwelling units, and fleet charging locations where the vehicles have plenty of time to charge and can take around 5-8 hours to fully charge the vehicle.[74] DC fast charging can charge a car's battery back to 80 percent of its capacity within 30 minutes. Despite most EV charging occurring either at home or the workplace, increasing the amount of publicly accessible chargers will be key as more EVs are purchased and therefore more charging demanded.

Despite these trends, a trend that still prevails includes significant barriers to EV adoption. Several barriers that persist include: 1) a lack of accessible charging infrastructure compared to gasoline infrastructure, 2) general perception of the unaffordability of EVs compared to ICE vehicles, 3) concerns with range and charging time, and 3) not enough offerings of EV types. In addition, federal incentives decreased in 2020 due to the federal tax credits for Tesla and General Motors, which account for the majority of electric car registrations, reaching their limit.[75] To help overcome a few of these barriers, 71 percent of EV100 members support more favorable EV procurement tax benefits and 70 percent favor more supportive policies at state, regional and city government levels. EV100 members include global businesses committed to switching their owned and contracted fleets up to 7.5 tones to EVs and installing charging infrastructure for employees and customers by 2030.[76]

How vehicle manufacturers are pivoting to EVs and the place of transportation electrification in broader GHG mitigation goals.

As of January 9, 2021 there are 19 battery-electric vehicle models available in the US and 26 total including model variants.[77] BEV models are offered[78][79] Automakers may be moving to electrify this segment for the following reasons:

- SUVs are the fastest growing market segment in Europe and China, and by far the largest market share in the United States.[80]
- SUVs command higher prices and generally offer higher profit margins than smaller vehicles. This means Original Equipment Manufacturers (OEMs) find it easier to bear the extra costs of electrification for SUVs since the powertrain accounts for a smaller share of the total cost compared with a small car.[81]
- Electrifying the heaviest and most fuel consuming vehicles goes further toward meeting emissions targets than electrifying a small car.[82]

Clearly automakers will be expanding their offerings of EVs in the 2020s. Notably 18 of the 20 largest automakers (in terms of vehicles sold in 2020), which combined accounted for almost 90 percent of all worldwide new car registrations in 2020, have announced intentions to increase the number of available models and boost production of electric light-duty vehicles (LDVs).[83] Some automakers have announced intentions of eventually switching to only EV production. For example, Volvo announced they will only sell electric cars from 2030; Ford will only do electric car sales in Europe from 2030; General Motors plans to offer only electric LDVs by 2035; and Volkswagen aims for 70 percent electric car sales in Europe, and 50 percent in China and the United States by 2030.[84] [85] [86] [87] This transition in shifting production translates to estimated cumulative sales of electric LDVs of $55-$72 million by 2025 and these cumulative sales are aligned with the trajectories of the IEA's Sustainable Development Scenario.[88]

In addition, the pivot for automakers aligns with goals outlined in the current Biden-Harris Electric Vehicle Charging Action Plan that sets an ambitious target of 50 percent of EV sale shares in the U.S. by 2030.[89][90][91][92] North Carolina has also set its own ambitious targets. Governor Roy Cooper built on EO 80 by issuing Executive Order 246 (EO 246) in January 2022. EO 246 increased the statewide greenhouse gas emission reduction goal to 50 percent by 2030. EO 246 also calls for an increase in zero-emission vehicles to 1,250,000 registered vehicles by 2030, and for 50 percent of new vehicle sales in North Carolina to be zero-emission vehicles by 2030. EO 246 further directs the NC Department of Transportation to develop a Clean Transportation Plan.[93]

IV. Why should the Nags Head Planning Board and local stakeholders care about EVs and meeting anticipated EV charging demand?

Given the increased adoption of EVs by automakers and consumers, the Town of Nags Head is situated in a unique position to help lead by example and accelerate the Outer Banks transition

towards accommodating EV drivers and overall transportation electrification. This transition presents both opportunities and challenges that the Town of Nags Head should anticipate.

EVs are highly positioned to become the future of transportation and it is imperative to prepare for this. It is also critical to prepare for potential demand on the grid associated with EV charger installation, expansion, and usage. Transportation to the Town of Nags Head and the Outer Banks from a tourism perspective is solely through personal LDVs. The Town of Nags Head will need to accommodate EV driving tourists so the town is accessible. This can have the impact of increasing tourism revenue as EV tourists will be able to access the Outer Banks. In addition, this can also provide the additional benefit of designating Nags Head as a green destination and set a shining example for all of the Outer Banks. Nags Head can also be cost effective by considering shifting their municipal fleet to electric light and heavy-duty vehicles. Not only will this decarbonize transportation to address climate change concerns, this will also provide lower municipal fleet costs regarding maintenance and energy costs compared to ICE counterparts. This transition though will require training public works staff and first responders about EV cars and charging infrastructure.

To take advantage of the benefits above involves addressing several challenges associated with these opportunities. There are valid concerns regarding how EVs and associated charging infrastructure would fare regarding a harsh marine environment that is susceptible to natural disasters and given that EVs possess a limited range. Nags Head is a marine environment, with corrosive salt spray that poses challenges to infrastructure. Seawater corrosion mixed with pollution are pernicious chemical, physical processes that impair the quality of the environment and the durability of the marine structures and materials.[94] They are aggravated by the discharge into the sea coast of municipal, industrial and agricultural effluents, which contain and produce toxic and highly corrosive components by biological and chemical degradation.[95]

In addition, the entire Outer Banks is extra susceptible to natural disasters exacerbated by climate change, which can have profound implications on all kinds of electrical infrastructure. The Outer Banks are affected by rising sea levels. From 2011 to 2015, sea levels rose up to 5 inches in some locales.[96] These levels are the fastest in the past 2,000 years, and are considered a direct consequence of climate change. Rising sea levels could increase overwash from waves, cause significant erosion, and intensify flooding.[97] In addition, the Outer Banks serve as barrier islands, equipped as natural defense that buffers the inland shore against storms due to their unique formations.[98] However, rising sea levels could disintegrate these islands, and increase storm impact across the state.[99] Rising sea levels along with flooding can continue to damage infrastructure.

In addition, EVs require reliable electricity and if this is disrupted, this could pose severe challenges to EV owners who need to evacuate. Even if electricity is not disrupted during an

evacuation event, there is concern of the grid being overwhelmed by demand. EV models also vary by how much time they take to charge, which would be a massive inconvenience for someone who needs to evacuate immediately. Lastly another issue that makes EV charging different from gas stations where one can drive up and pay on the spot, is the need to set up an account.[100] Most EV charging stations require advance registration, or at least for the driver to register the vehicle at the station and have a credit card number on file. While this has its purpose, it is another impediment to accessing the charging station, and certainly not something that drivers would want to deal with during an emergency evacuation.[101]

This EV Action Plan will detail approaches that will address these challenges so Nags Head can realize the numerous benefits of expanding EV charging infrastructure.

V. Analysis

In this section, we review the available data and resources, focusing on 1) existing conditions in Nags Head, including consideration of infrastructure, policies, and laws and regulations; 2) Stakeholder needs and objectives; and 3) opportunities and constraints for EVs in Nags Head.

Existing Conditions

i. Public infrastructure (existing chargers, locations, capacity to meet demand)

In the past decade, the state of North Carolina has seen a gradual increase in electric vehicle registrations and EV public charging stations, as can be seen in the figure below.[102] The Town of Nags Head has increased registrations from <100 EVs to between 100 and 500 EVs. It is important to note that, although there are multiple chargers installed in the Outer Banks, the number of chargers installed along highway 64, which connects Nags Head with the piedmont region, does not have many chargers installed. This might be an obstacle for tourists and EV drivers who are traveling from the piedmont to get to the coast.

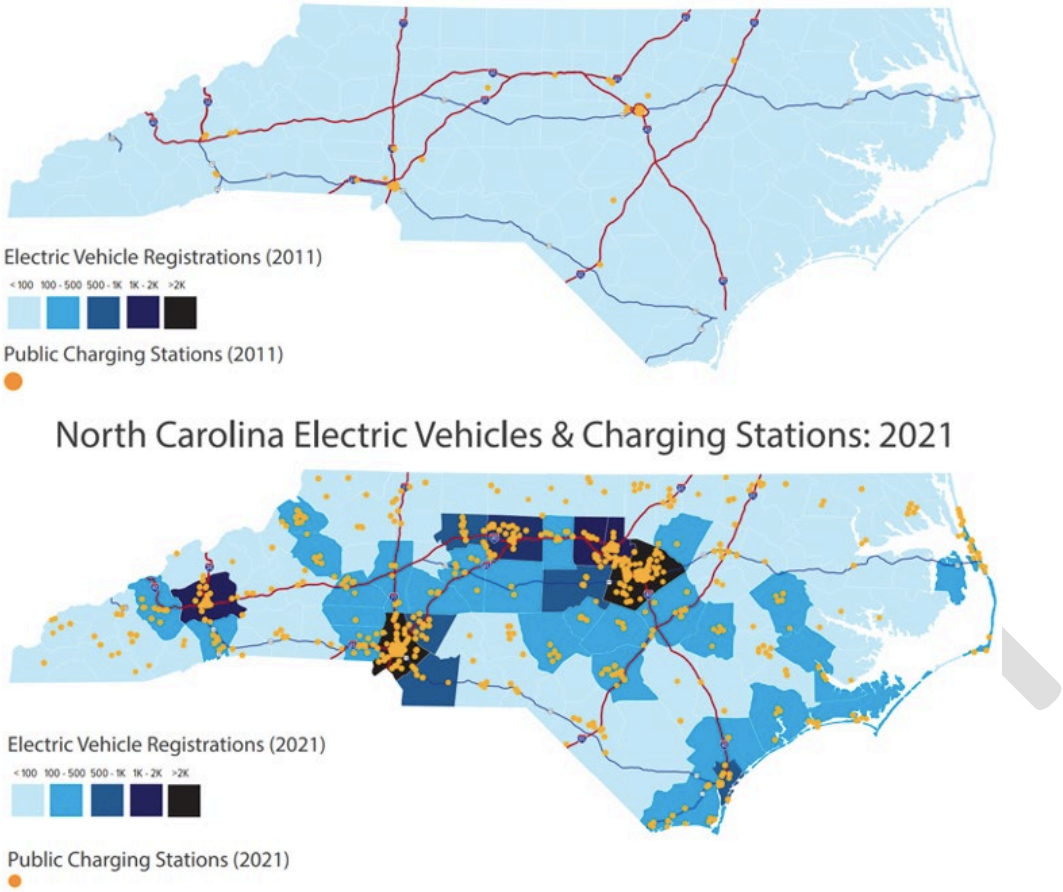

Figure 4. North Carolina's EV registrations and EV charging stations for the years 2011 and 2021. Source: Plug-in NC. (2022). North Carolina Electric Vehicles & Charging Stations: 2011 – 2021. Retrieved on February 28, 2022 from https://pluginnc.com/resource/electric-transportation-in-north-carolina-a-recap-of-2021-and look-at-2022/

As of March 2022, the Town of Nags Head had three charging points: two Level 2 chargers and one Tesla DCFC charger.[103] There is one more Level 2 charger nearby in Roanoke Island, as it is illustrated in the figure below. All the chargers are located next to commercial buildings.

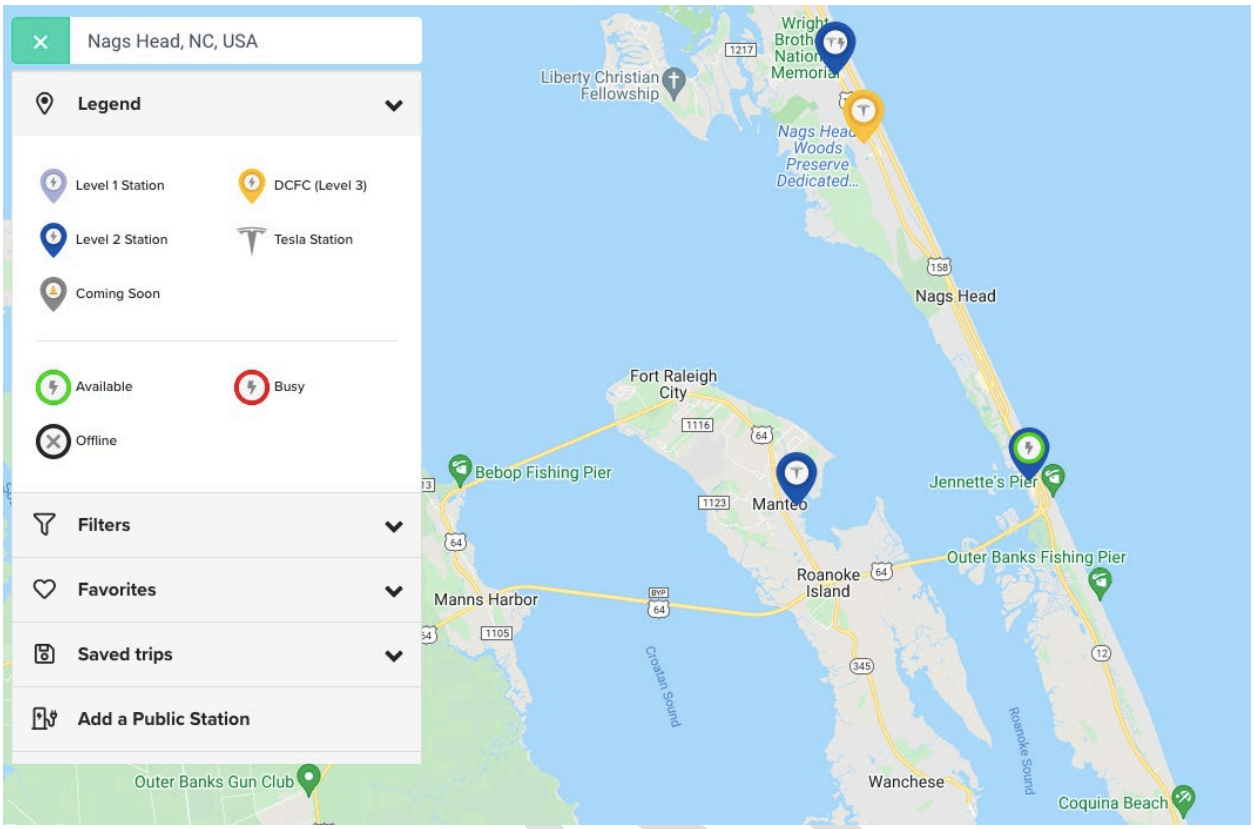

Figure 5. EV chargers in the Town of Nags Head, March 2022. Source: ChargeHub. (2021). ChargeHub Map. Retrieved from https://chargehub.com/en/charging-stations-map.html

B. Scenarios for EV growth- ***(To be completed as part of the final draft.)***

ii. Extrapolate from broader trends and expectations to answer:

1. Forecast EV growth and what that means for residents and tourists
2. What level of charging demand might Nags Head see?
3. How might this vary by season?
4. What would different levels of charging demand mean for the local grid?
5. Potentially include population projections.
6. Potentially include a chart of stakeholders, their expected EV demand, and interest in EV infrastructure.
7. Costs per scenario

C. Opportunities and Constraints for EV's in Nags Head

The utility that supplies the Town their energy is Dominion Energy. They operate in 13 states and provide energy for up to 7 million customer accounts. Dominion's service territory within North Carolina is along Northeastern NC to the coast. According to the Town, there have been differences in engagement between the Town and Dominion Energy compared to Dominion Energy and their territory in VA, or Duke Energy's engagement regarding EV infrastructure

within their territories. Dominion Virginia's website lists a program called Charging Rewards, which incentivizes residential customers for allowing them to leverage their Level 2 EV smart chargers to make adjustments to their charging behavior during periods of high energy demand. However, for its NC territory regarding EVs, its website lists useful resources including an EV charging guide, developing a workplace charging policy, hosting a fast-charging station, workplace charging case studies, light duty fleet EVs, and an overview of electric buses. There is no mention though of specific incentives for NC customers. According to an interview with Dominion's External Affairs representative Winnie Wade, the difference in engagement between the VA and NC service territories is policy. Wade stated that previous Governor of VA Terry McAuliffe was an aggressive proponent of EV infrastructure, with NC Governor Cooper being somewhat aggressive yet moving in the right direction. Despite the VA and NC territories being serviced by the same utility, if Dominion would want to ramp up their EV incentives or services for their NC territory, this would require engaging with the NC Utilities Commission (NCUC) as any matter regarding expanding infrastructure would involve ratepayers. Wade did mention though that Dominion is trying to implement some pilot programs within NC, although the model of these programs is highly inspired by already existing program Powering Smart Transportation in VA.

Other surrounding utilities and electricity cooperatives offer a suite of concrete development plans and incentives listed below:

a. <u>Duke Energy- Park & Plug NC</u>[104]
    i. Duke Energy will install, own and operate a variety of EV chargers to provide a foundational level of EV infrastructure and to help facilitate EV market growth across North Carolina.

        8. This will include installing, owning and operating up to 40 Fast Chargers at 20 locations, 160 level 2 chargers at public locations and up to 80 level 2 chargers at multifamily dwellings. These chargers will make it easier for EV drivers to charge and allow us to gather data on EV charging habits.

b. Additionally, Duke Energy will offset the purchase of 15 electric school buses by districts across the state in order to gather operational data and explore the capabilities of the vehicle-to-grid technology.
c. Cape Hatteras Electric Co-op[105]
    i. EVSE Rebate and Time of Use (TOU) Rate: Cape Hatteras Electric Co-Op offers a rebate of $100 to residential customers who install a Level 2 charger. It also offers a TOU rate to residential customers with an EV.

ii. *EV Rental*: To provide first hand education and awareness of the growing EV industry, Cape Hatteras Co-op offers a 2019 Nissan Leaf rental for their members.

d. Randolph Electric Membership Corporation (EMC).[106]
   i. *TOU Rate:* Randolph Electric Membership Corporation (EMC)'s Electric Vehicle Utility Program (REVUP) program offers residents who own an EV a Plug N2 Savings TOU rate.

e. How EV Action Plan complements and/or conflicts with other climate initiatives within the town (need to do more research on the other initiatives)

D. Policies- ***(To be completed as part of the final draft.)***

E. Federal and State Laws and Regulations

Current federal and state laws and regulations do not particularly constrain or promote the development of electric vehicles in North Carolina. Session Law 2019-132 codifies plug-in electric vehicle and delineates the relationship between the electric utility and operators of EV charging stations, essentially stating that charging stations are not defined as a public utility, and that providing power to a charging station by a utility is subject to that utility's terms and conditions.[107] Exempting charging stations from being classed as a public utility allows charging stations to actually sell electricity to consumers, a right generally reserved only for utilities in North Carolina. This means that charging stations can charge by the kilowatt-hour (a unit of energy), rather than simply by the hour, as was previously the case.[108]

Electric vehicles in North Carolina are afforded a handful of benefits, as well as some drawbacks. EVs in North Carolina are exempt from emissions inspections, making annual inspection fees somewhat cheaper. However, EVs must also pay an annual road maintenance fee to compensate for the funds the NC DOT would have taken in from gasoline taxes on a combustion vehicle.[109] A study by N.C. State University shows that EVs in North Carolina avoid paying roughly $100 in annual gasoline taxes, but currently pay $130 in annual fees.[110] EVs may use HOV lanes in North Carolina, although the only HOV lane currently in North Carolina is the I-77 corridor between Charlotte and Morrisville.

At the federal level, consumers are entitled to federal income tax credits of up to $7,500 when purchasing a new EV.[111] These credits are tied to each manufacturer, meaning that once a certain number of credits are issued for the sale of a manufacturer's vehicles, the credits are no longer

available. For example, in 2020 General Motors sold a sufficient number of EVs that current purchasers of General Motors EVs will not be eligible for a rebate.[1]

The recent federal infrastructure bill, as well as corresponding initiatives in North Carolina, have provided several sources of funding for EVs. These opportunities will be discussed in the following section on sources of support and funding.

F. Sources of Support/Funding

Utilities

The Town of Nags Head is situated in a unique position where they can deepen the relationship between Dominion Energy and the Northeastern NC territories they serve. From the local government perspective, engaging in regulatory proceedings can be critical to planning effective and realistic policies and programs.[112] Some regulatory proceedings also provide opportunities to directly influence state-level or utility-level policies, such as proceedings that shape tariffs or program design in ways that can impact key customers or local economic development.[113] More broadly, gaining awareness of the scope and limits of PUC authority allows local governments to understand when and how to effectively engage in PUC proceedings and with utilities directly.[114] Local governments may address the following issues, and more, when engaging with PUCs[115]:

- Traditional areas such as siting poles and wires, approving franchise agreements, or setting rates
- Access to energy efficiency and renewable energy programs for facilities, including street lights
- The use of municipal facilities for public benefit, such as siting electric vehicle chargers or community solar gardens on municipal buildings or land
- Reliability and resilience of power supply as it contributes to public health and emergency response
- Access to energy programs that support affordability and bill stability for disadvantaged customers, and enhance local economic development
- Approaches to meet renewable energy and greenhouse gas reduction goals adopted by voters or elected officials
- Access to energy data that supports or enables policy implementation (e.g., commercial or government building energy benchmarking)
- Emerging areas such as how utility business models help achieve community goals

The list above demonstrates numerous benefits that can promote the Town's desire to expand EV infrastructure and encourage Dominion Energy to offer additional incentives for Northeastern NC.

i. Government Funding

- Volkswagen Settlement Funds

There is significant funding available for electric vehicle infrastructure in Nags Head and the surrounding area through various government grants. The most prominent of these sources is known as the Volkswagen settlement funds, a large pool of funding created as the result of a legal settlement between Volkswagen and the federal government.

The Volkswagen funds are disbursed from the federal government to individual states. In North Carolina, the Department of Environmental Quality (DEQ) is responsible for disbursing the funds. The disbursals will take place in three phases. Phase 1 is complete; Phase 2 recently began on February 28, 2022. The application period will close on May 31, 2022. In Phase 1, North Carolina spend $4.6 million on charging infrastructure. The DEQ expects to spend the same amount in Phase 2 on charging infrastructure.[116]

A map from the DEQ showing EV fast chargers funded in Phase 1 of the funding process is shown below.[117] As can be seen on the map as a blue line, a proposed priority corridor for fast chargers is planned to run right to the outer banks, and the Manteo area, but no chargers were funded along this corridor in the first phase. This would be another strong argument for Nags Head and eastern North Carolina to receive top priority for funding in the second phase.

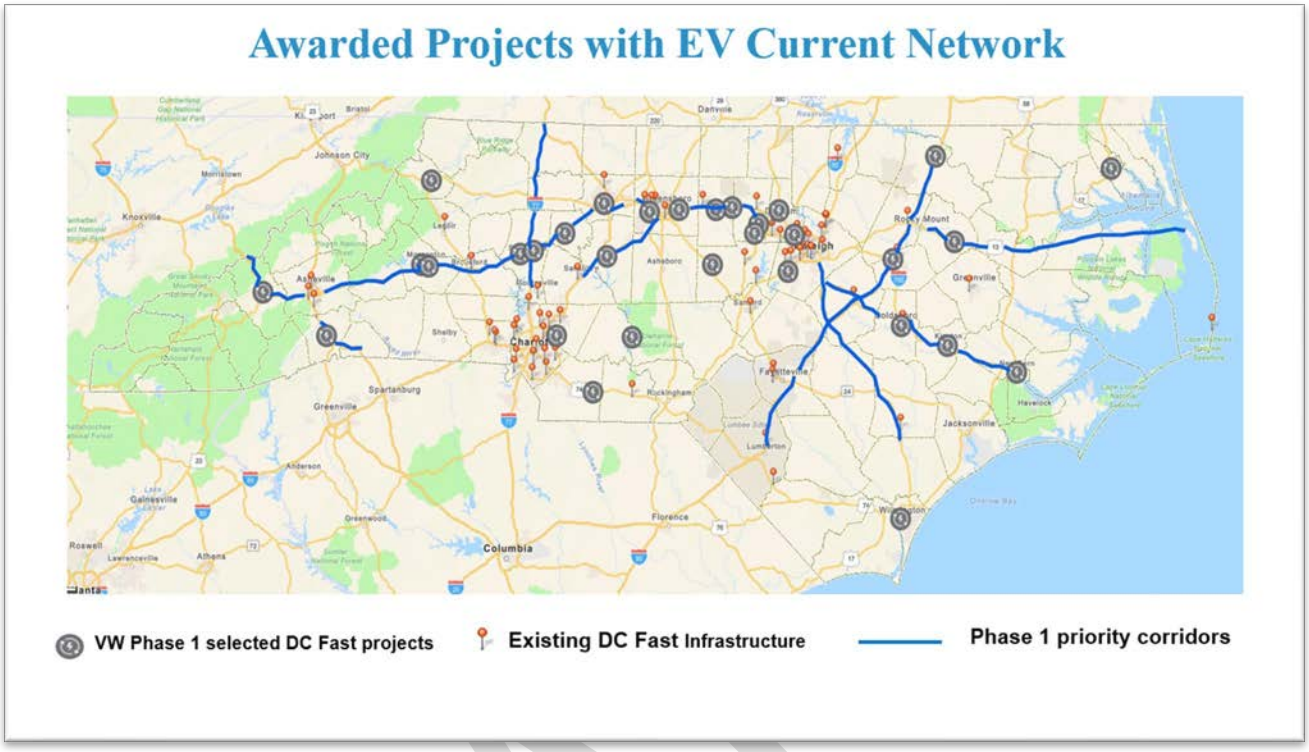

Figure 3.

- The U.S. Department of Energy periodically has other sources of funding available. The Clean Cities Coalition Network maintains a database of potential funding opportunities that should be checked regularly.[118]
- https://www.transportation.gov/rural/ev/toolkit/ev-infrastructure-funding-and-financing/funding-matrix rural ev infrastructure funding matrix

- Infrastructure Investment and Jobs Act

At the federal level, the Infrastructure Investment and Jobs Act passed in late 2021 carries the promise of future funding for charging infrastructure. North Carolina is expected to receive $109 million over five years to support the expansion of an EV charging network in the state.[119] North Carolina will also have the opportunity to apply for $2.5 billion in grant funding dedicated to EV charging in the bill.[120]

The project team interviewed Jennifer Weiss, Senior Advisor for Climate Change Policy at the NC DOT on January 28, 2022 regarding the Infrastructure Investment and Jobs Act. Ms. Weiss made several recommendations for Nags Head if they are going to apply. First, she recommended that Nags Head highlight the need for EV fast chargers as part of evacuation route infrastructure, stressing the importance of providing charging for the growing number of EVs that may need to be used to evacuate the coastline and outer banks. Second, Ms. Weiss advised

that multiple municipalities can apply together for up to $15 million in funding. This would allow municipalities to work together to create a larger charging corridor. Applying with other municipalities would allow for a more deliberate, planned charging corridor to be created, with charging stations logically spaced for visitors to the outer banks. This would also serve to address the issue that EV drivers need a way to get to Nags Head in their EVs, not just be able to charge once they arrive. The Town of Nags Head should consult with Ms. Weiss to access this funding.

Smart City Initiatives

Local governments such as the Town of Nags Head have the ability to make an impact on how effectively EV charging infrastructure is integrated because of their deep connection and understanding of their own municipalities. The City of Columbus, Ohio in June 2016 managed to secure a $50 million Smart City Challenge grant from the US Department of Transportation, beating cities such as Austin and San Francisco in the process. They proposed a comprehensive, integrated plan addressing challenges in residential, commercial, freight, and downtown districts using a number of new technologies, including connected infrastructure, electric vehicle charging infrastructure, an integrated data platform, autonomous vehicles, and more.[121] In 2016, when Columbus's EV initiative began, less than half of 1% of new vehicles purchased in the Ohio capital were electric.[122] A substantial portion of the prize money went toward increasing EV adoption, with a goal of making 1.8 percent of all new light-duty vehicles registrations electric.[123] At the conclusion of the EV grant program, the city announced that it had hit its target, with more than 3,323 electric models sold between April 2017 and February 2020.[124] Smart Columbus's EV strategy focused on building an ecosystem for electric cars. This required careful consideration of every link in the chain, from charging infrastructure and vehicle availability to consumer demand and renewably powered electricity.[125]

Columbus was able to leverage smart city initiatives to expand not only the amount of EVs on their roads, but utilize that money for charging infrastructure and renewable energy to power infrastructure. The Town of Nags Head also has the opportunity to leverage similar funding. The Strengthening Mobility and Revolutionizing Transportation (SMART Challenge) Grant Program, established by the Infrastructure and Investment Jobs Act will provide $500 million to encourage the adoption of smart city or community technologies by large, mid-size and rural communities.[126] According to the grant program, effective use of technology and project benefits include[127]:

(1) increase resiliency of the transportation system;
(2) incorporate relevant security solutions, including those needed for cybersecurity, and address emergency situations based on the scope and necessity.

The use of grant funds can be directed towards[128]:

(A) CONNECTED VEHICLES — Connected vehicles, which send and receive information about their movements in the network, use vehicle-to-vehicle, vehicle-to-infrastructure, and vehicle-to-pedestrian communications to provide connectivity that will enable countless safety, mobility, and environmental applications.

(i) leverage the smart grid (a programmable and efficient energy transmission and distribution system) to support the adoption or expansion of roadway electrification, energy capture, and electric vehicle deployment, including electrically assisted bicycles, or freight or commercial fleet fuel efficiency; and

(ii) explore and utilize interactions between electric vehicles and intelligent transportation systems with the smart grid.

f. Best practices from other EV Action Plans- *(To be completed as part of the final draft.)*

g. Comparison of best practices from other cities- *(To be completed as part of the final draft.)*
    i. Code review.
        1. How does the updated Nags Head EV residential and commercial code compare to best practices? (Check information from the American Planning Association).

h. Comparable communities/case studies (specific cases to be determined)- *(To be completed as part of the final draft.)*
    i. Colorado
    ii. California
    iii. Australia

i. Brief Discussion on Methods (mention how we do interviews with stakeholders, these interviews we need to copy/paste and use in relevant sections of the analysis vs. listing the interviews below)

In this section we first identify and list key stakeholders that can give the Town of Nags Head insightful input for the development of the EV action plan. This, with the objective to understand the stakeholder's opinions and needs regarding EVs and EV infrastructure.

	Stakeholder Name	Organization	Position/Title
1	Jacob Bolin	Plug-in NC	Program Manager
2	Winnie Wade	Dominion Energy	External Affairs
3	Cameron	Bluewater Construction	General Contractor/Builder
4	Willo Kelly	Outer Banks Association of Realtors	Real Estate Agent
5	Cory Tate	Town of Nags Head	Chief Building Inspector
6	Lee Nettles	Tourism Bureau of the Outer Banks	Managing Director
7	Karen Brown	Outer Banks Chamber of Commerce	President/CEO
8	Eric Claussen	Town of Nags Head	Director of Public Services
9	John Harris	Kitty Hawk Kites	Business Owner
10	Jordan Burns	NREL	Risk & Resilience Researcher
11	Jenn Weiss	North Carolina's Department of Transportation	Senior Advisor for Climate Change Policy
12	Heidi Smith	Tideland EMC	Manager of Energy Services & Corporate Communications
13	Tom Haddon	Haddon Homes	OBX Green Builder

Figure 7. List of stakeholders.

- Description of stakeholders provided by Nags Head government and results from the interviews (to be completed)

Outer Banks Chamber of Commerce

Interviewing the President of the Outer Banks Chamber of Commerce Karen Brown, education and outreach are important to convince businesses of hosting charging infrastructure. Brown mentions that businesses would need more understanding and knowledge regarding costs, data on users, the infrastructure, and capability of hosting a charger on their particular property. In addition, she has not heard businesses and their respective customers express a need for EV charging as they need to be educated in order to express demand for infrastructure. This does not imply that the business climate is not open to EV charging, however they just need to be educated and understand the need. What would be useful would be a presentation revealing forecasts of the expected EVs on the road by different timeframes. Additional outreach would also assist the Town of Nags Head to craft an ideal financial incentive for local businesses by engaging them on the value they would place on sacrificing a parking space for an EV charging

spot as cost is a source of hesitancy for hosting EV chargers. The right incentive could help offset some of the charger's initial costs. Ideal locations to host charging according to Brown would be businesses that host customers that spend more than 30 minutes there such as restaurants, laundromats, gyms, and movie theaters.

Outer Banks Visitors Bureau

Interviewing the Managing Director of the Outer Banks Visitors Bureau Lee Nettles, Nettles mentioned a subtle, yet growing trend of summer tourists inquiring about EV charging and arriving with EVs. Nettles mentioned that 70 percent of the Outer Banks annual occupancy collection is from the months of June – August, which reveals that it is a seasonal destination. Analyzing the seasonal destination component, summer months experience peaks in electricity consumption in addition to seasonal tourists, so it will be imperative to prepare the grid for expected summertime demand plus increasing EVs visiting the island. Nettles also mentioned that he has personally seen a gradual increase in EV charging infrastructure in the Outer Banks, in particular a popular EV charging location is a Tesla charging station at a Harris Teeter in Kill Devil Hills. However, he does see the island's welcome centers in Kitty Hawk and Manteo as ideal locations to host chargers as both of these sites have a cooperative relationship with the NC DOT. He also mentioned Town Hall, other municipal parking lots, the former Tanger Outlets in Nags Head, Jennette's Pier, and Jockey's Ridge State Park would be ideal charging sites. Kitty Hawk Kites has also been identified as an environmentally engaged local business, which would be a useful partner to engage. In addition, he also mentioned that gas stations due to their abundance and also associated with refueling could host chargers. The Visitors Bureau website does contain a mapping tool from the app Plugshare showing available chargers, however physical signage from Nettles' perspective is not evident with the exception of the Tesla charging station signage in Kill Devil Hills.

K. Guidance for property managers

- Why providing EV charges at rental properties is important
- Study of increased rentals for properties that provide charging
- Resources for affordable EV charger installation
- Work with Outer Banks visitor Bureau on updating EV information (as insignificant as it sounds, wayfinding and signage are important)

L. Addressing Resiliency

In an email interview with Eric Claussen who is the Director of Public Services for the Town of Nags Head, he provided some insights regarding benefits and challenges of providing resilient EV infrastructure.

From Claussen's point of view, the electric grid is susceptible to prolonged outages, so if the Town becomes reliant on EV vehicles or equipment, there needs to be an understanding of what that resembles during and after a major weather event. During a major weather event though, V2G is a future potential solution given natural gas's limited service on the island. V2G stands for "vehicle to grid" and is a technology that enables energy to be pushed back to the power grid from the battery of an electric car.[129] The potential benefit of a vehicle-to-grid (V2G) exchange is the balancing capacity that will emerge when fleets of EVs absorb excess electricity during periods of low demand and discharge it during periods of high demand.[130] The rechargeable battery and bi-directional power capability in EVs and PHEVs can also make them well suited to provide ancillary services (services that help grid operators retain reliable electricity) to the grid while parked such as grid regulation and storing/discharging electricity[131] However at present only Nissan BEVs (LEAF & e-NV200 van) can use V2G due to their CHAdeMO charging technology.[132] Virtually all other EVs instead use the Combined Charging System (CCS) technology; the body promoting CCS, CharIN, has said it will be 2025 before it can support V2G.[133] The EV manufacturers also need to develop their own products and bring them to market.[134]

Regarding susceptibility to harsh marine elements, the Town of Nags Head potentially pursuing fleet electrification would need to be selective on the locations of equipment and charging stations. With the development of the Public Services master plan, the plan details implementation of EV charging equipment inside of enclosed equipment storage facilities and potentially at the public-facing Administration Office. This can protect the charging stations from saltwater intrusion. Between the coastal environment challenges and beach access congestion, Claussen also does not believe in the feasibility of installing EV charging infrastructure on beach accesses due to obvious corrosion concerns. Existing EV infrastructure in the community, such as the Harris Teeter in Kill Devil Hills needs to be reassessed to evaluate the life expectancy given the salt air.

Another choice for backup power that is more ideal than relying upon fossil fuels though, already exists in the Outer Banks, and would benefit from an interconnected Smart Grid ecosystem are microgrids. A microgrid can improve system reliability by generating their own power to avoid prolonged and rotating blackouts during and after storm events.[135] North Carolina's electric cooperatives have four active microgrids, with one more in development[136]:

Figure 8. Map of current NC microgrids.

The Ocracoke Island microgrid, located on North Carolina's Outer Banks, began operation in February 2017. North Carolina's Electric Cooperatives developed and installed the microgrid in partnership with local cooperative Tideland EMC.[137] Ocracoke Island's remote location leaves it vulnerable during weather events and isolated from central power generation sources.[138] The microgrid will support better power reliability for the island, serve as a resource that can be called on during times of peak demand and allow for the testing of system components to discover future uses.[139]

M. Equity

In 2019, Nags Head, NC had a population of 2.92k people with a median age of 49.6 and a median household income of $65,968.[140] Between 2018 and 2019 the population of Nags Head, NC grew from 2,894 to 2,923, a 1 percent increase and its median household income grew from $58,979 to $65,968, a 11.8 percent increase and is more than the median annual income of $65,712 across the entire United States.[141] The data visualization below reveals a demographic breakdown of the Town of Nags Head.[142] The five largest ethnic groups are White (Non-Hispanic) (92.6 percent), Two+ (Non-Hispanic) (2.05 percent), Other (Non-Hispanic) (1.68 percent), Black or African American (Non-Hispanic) (1.64 percent), and Other (Hispanic) (0.889 percent).[143] Zero percent of the households in Nags Head, NC speak a non-English language at home as their primary language. 99.5 percent of the residents in Nags Head, NC are U.S. citizens.[144]

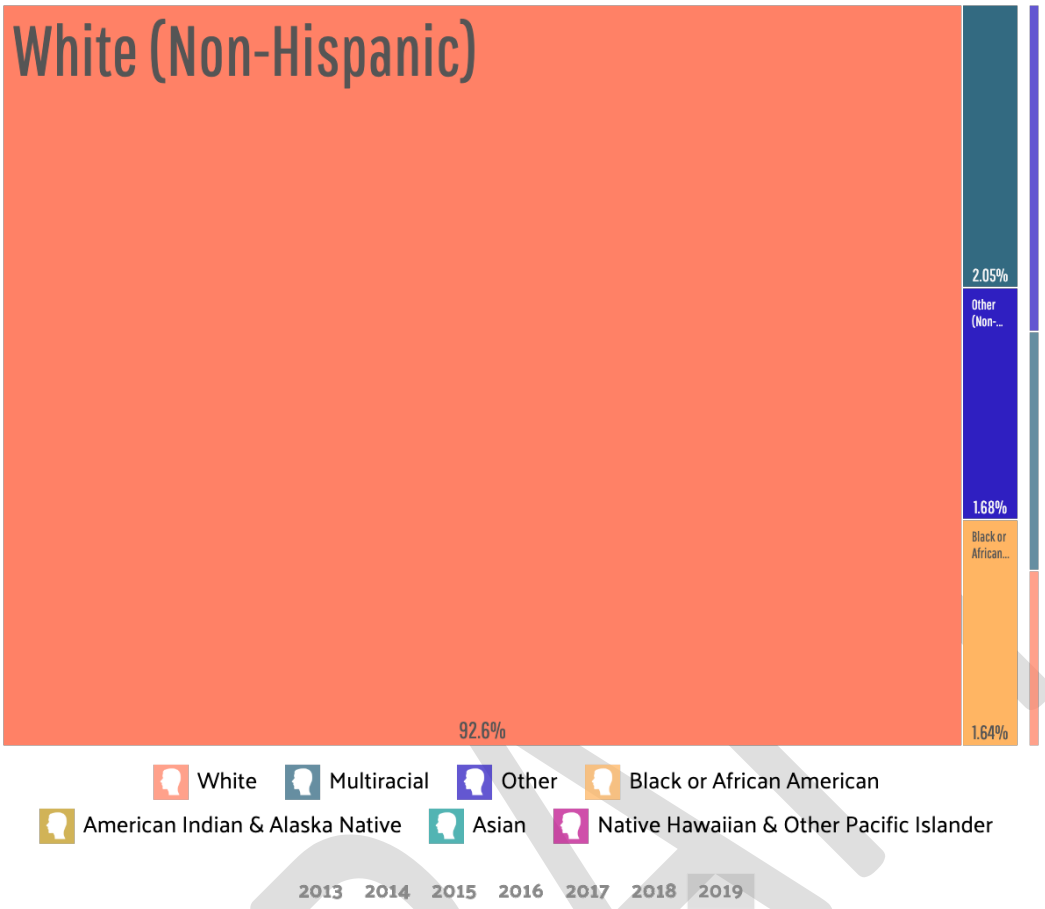

Figure 9. Treemap of demographic makeup of the Town of Nags Head.

In 2019, the median age of all people in Nags Head, NC was 49.6, but people in Nags Head, NC are getting older. In 2018, the average age of all Nags Head, NC residents was 43.[145] In addition, according to the bar chart below, the age group comprising the largest share in Nags Head are between the ages 65-74.[146]

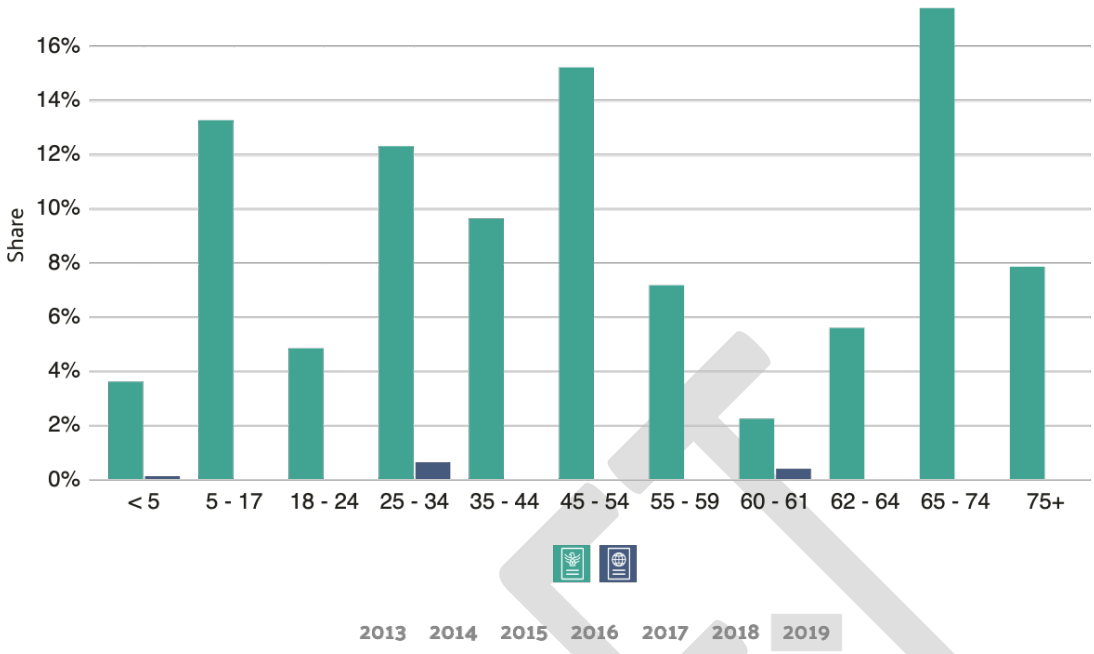

Figure 10. Bar chart of age breakdown of the Town of Nags Head.

Given the demographic information on Nags Head, this will require a retooling of what types of vulnerabilities to consider. Given that the major demographic are older white people who are middle and upper middle class, there is an angle regarding potential social support isolation due to age. There is the possibility of elderly populations living in Nags Head without nearby family, which having social support helps to spread awareness and ultimately accessibility about EVs. Considering elderly populations in planning will be key. In addition, there should be more research and outreach measures regarding the non-white population of Nags Head given the obstacles that lead to people of color being systematically undercounted on the US Census. Residents can be hard to contact (for example, if they live in inaccessible places), hard to interview (if they have limited English proficiency), hard to locate (if they are homeless or have been displaced by a natural disaster) and finally, hard to persuade (people who are angry or distrustful of government can fall into this group).[147]

VI. Recommendations for Nags Head

List of concise recommendations:

1) The desire for expanding EV infrastructure within the Town of Nags Head is an unintended policy window that can promote the Town's interest of expanding EV charging infrastructure. However, the Town of Nags Head's best route to pursue more EV incentives and infrastructure from their utility would be pursuing the NCUC directly.

The Town of Nags Head can approach this through multiple lines of action[148]:

- Build relationships with PUC staff and by monitoring proceedings to build expertise.
- Utilize a light approach strategy by filing public comments or participating in stakeholder proceedings. In this way, they can leverage existing staff and expertise without necessarily intervening in a way that requires legal representation.
- Form coalitions with other local governments to participate in PUC proceedings.
- When funding exists, hire expert staff or contract for outside expertise—including finance experience or former utility or commission employees to oversee regulatory work

2) The Town of Nags Head along partnering other Outer Bank cities, Dominion Energy, NCUC, the DOE, and other entities should consider installing a microgrid in the case of needing a DER that can be islanded from the grid.

3) The Town of Nags Head should consider working with NC DOT connection Jennifer Weiss to also apply for SMART Challenge Grant Program funding under the Infrastructure Bill. SMART Challenge Grant money could be accessed under similar considerations such as resiliency for transportation and emergency situations such as evacuation during a natural disaster event. The grant criteria are also clear on utilization for vehicle-to-infrastructure (ex. V2G), increased EV deployment, and EVs being increasingly paired with autonomous driving features interacting with a grid that is prepared to handle such coupling.

4) In addition, it would also be in the Town's benefit to similarly consider a separate project similar to Columbus, OH or designate someone to develop a smart city initiative, which will inevitably integrate increasingly advanced EVs, EV infrastructure, and associated technology into a broader ecosystem.

5) Installing and accessing DER capacity such as a microgrid or battery storage located near congestion points could compensate for the additional demand arising from plugging in the EVs.[149] Dominion Energy needs to be engaged regarding installing DERs along main congestion points, or close to major charging sites. As gasoline is usually stored during a natural disaster, battery storage will need to store energy for EV drivers. Utilities can also be encouraged to leverage DERs that include distributed generation and storage, such as residential solar systems and batteries.[150] A less ideal choice would also be planning for EV drivers with backup energy via diesel generators for emergencies.

a. This consideration is an additional reason to engage with the NCUC so that they can engage with Dominion Energy to expand infrastructure in the Town's vicinity.

6) Another solution proposed by the email interview with Claussen is his belief of rental homeowners needing to be incentivized to provide EV charging stations at their rental properties. In the event of an evacuation, there are sufficient charging opportunities. Large oceanfront homes could present challenges due to the number of vehicles and the saltwater exposure as most of these parking areas are not enclosed. Incentivizing private installation at homes versus beach accessible chargers by oceanfront homes makes more sense.

Identify 2 Best Sources of support/funding

- Volkswagen Settlement
- Federal Infrastructure Bill + Smart City Grant Money under the Bill
  - Is Nags Head interested in pursuing grants? Stated they previously considered VW funding but decided not to because they would be responsible for upkeep when warranty ends. Does the information in this report on the rise of EV usage change that decision?

What Nags Head should do (sort recommendations above into these buckets): *(To be completed as part of the final draft.)*

- 1-2 years out
- 5 years out
- 10 years out

VII. Final remarks, conclusion- ***(To be completed as part of the final draft.)***

- Discuss how this EV Action Plan could provide a useful template for other Southeast communities (focus to beach towns that share a similar economy and physical environment)
- Discuss in what ways might Nags Head push Dominion or the NC state government to incentivize EV charging.
- Discuss how Nags Head can work with other NC counties that are on the transportation corridors/main highways that take tourists into Nags Head

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