Draft Hampton Roads Comprehensive Climate Action Plan (CCAP)

For Public Comment

October 1, 2025

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Executive Summary

The Hampton Roads Planning District Commission (HRPDC) developed the region's first **Comprehensive Climate Action Plan (CCAP)** with funding from the U.S. Environmental Protection Agency's Climate Pollution Reduction Grant (CPRG) program. This draft plan provides a roadmap for local governments, industry, and communities to work together toward **net zero greenhouse gas (GHG) emissions by 2050**.

What We've Done

- Completed the region's **first GHG emissions inventory** (2022 baseline: 22.6 million metric tons gross / 18.8 million metric tons net carbon dioxide equivalents).
- Conducted **extensive community engagement**: 2 webinars, 3 surveys, 12 tabling events, "Climate Cash" participatory budgeting, and 6 interviews.
- Developed **14 GHG reduction measures** across six major sectors (energy, buildings, transportation, waste, agriculture/natural lands, and industry).
- Modeled a **business-as-usual projection** and a **net zero pathway scenario**, showing the region could reduce emissions ~90% by 2050.

What's in This Draft

- **Sector Snapshots**: Where emissions come from and what actions are possible.
- **Community Voices**: What residents and stakeholders told us.
- **Measures & Actions**: Practical steps Hampton Roads can take to cut emissions and improve resilience.
- **Benefits Analysis**: How climate action benefits public health, equity, and resilience.

Why It Matters

Climate action is not only about cutting carbon. The CCAP also aims to:

- **Improve air quality and health** by reducing co-pollutants.
- **Boost the clean energy economy** and workforce development.
- **Protect vulnerable communities** from flooding, heat, and rising costs.
- **Preserve natural lands and waterways** critical to Hampton Roads' identity and safety.

Introduction

For over two years, HRPDC staff have been working with locality staff, community members, state agencies, consultants, private industry, non-profit organizations, and residents across the Virginia Beach-Norfolk-Newport News, VA-NC Metropolitan Statistical Area (MSA) region to develop the CCAP report.

This is draft is available for the purposes of public comment and includes an overview of the sectors within the Hampton Roads MSA that contribute to and reduce greenhouse gas emissions (GHGs), a quantitative analysis of greenhouse gas emissions by sector, what reductions of GHGs will look like in the future if the region stayed the course, and what Measures and Actions could be taken to achieve net zero GHG reductions.

The following items are still being drafted and will be included in subsequent versions of this report:

- Acronyms and Abbreviations
- Definitions
- Executive Summary
- Relevant Funding Sources
- Appendices

Purpose and Scope

HRPDC led the development of the region's first climate action plan. The plan provides a roadmap to benefit our region by advancing an overall plan for localities, agencies, industry, and communities to work together to reduce emissions, improve local air quality, support clean energy workforce development, and identify methods to ensure a just and equitable energy transition throughout the region. This plan reflects significant input from the community; HRPDC held 2 webinars, released 3 surveys, tabled 12 events in six different localities, created an online climate investment activity, and conducted 6 long form interviews. The plan has three main goals:

Tackle damaging climate pollution while supporting the creation of good jobs and lowering energy costs for families.

Accelerate work to address environmental injustice and empower community-driven solutions in overburdened neighborhoods.

Deliver cleaner air by reducing harmful air pollution in places where people live, work, play, and go to school.

This plan covers the full Virgina Beach-Chesapeake-Norfolk, VA-NC Metropolitan Statistical Area (MSA) and includes data on GHG and other air quality pollutants in the region; identifies key strategies, or measures, to reduce emissions in the region; provides a potential pathway to net zero GHG emissions by 2050; and includes an assessment of potential benefits and workforce considerations for implementing the identified measures (in development).

Figure 1. HRPDC-covered jurisdictions and the MSA boundary

The plan includes a total of 14 measures to reduce emissions, improve air quality and improve local resilience across six sectors:

- **Energy Supply:** Cleaner sources of energy can be used to power our homes, businesses, and transportation.
- **Buildings:** Buildings can run more efficiently and be more resilient to the impacts of climate change, helping to keep the lights on while consuming less power.
- **Transportation & Mobility:** Switching to electric and fuel-efficient vehicles and equipment, increased use of public transportation, and options like walking and biking can have major community and health benefits.
- **Solid Waste and Wastewater:** Better recycling practices and expanded composting activities can help reduce emissions from our landfills, and process efficiency improvements can help reduce emissions from wastewater treatment plants.
- **Agriculture and Natural Lands:** Conserving, restoring, and managing lands to preserve and enhance their benefits – such as wetland and living shoreline restoration and increased tree canopy – can support GHG reductions and increase community protection from storms and flooding.
- **Industry:** Finding collaborative solutions for clean energy use and efficiency improvements along our industrial corridors can help reduce pollution.

Plan Development

Engagement

This CCAP was informed by a multi-channel, iterative engagement program from January through September 2025 that combined broad awareness outreach (press, website, social media), structured input opportunities (surveys, webinars, committee briefings), and interactive in-person activities, such as a participatory-budgeting exercise "Climate Cash" that helped residents prioritize actions across sectors. Engagement aimed to reach both the general public and key technical, civic, and vulnerable-population audiences, with feedback used to refine CCAP measures, actions, and communications.

Specific engagement efforts included:

- Two public webinars, January 22 and June 12, 2025
- Committee engagement with regular updates and feedback with the CCAP Steering Committee, HRPDC/HRTPO Community Advisory Committee (CAC), HRTPO Regional Transit Advisory Panel (RTAP), HRTPO Transportation Technical Advisory Committee (TTAC), and the HRPDC Public Information Officers (PIO) workgroup.
- Three surveys that assessed knowledge, concerns, priorities, and barriers; gathered expert input on mode shift and micromobility; and prioritized proposed measures by sector and overall.
- Participatory budgeting ("Climate Cash") hands-on activity at multiple events (and later digitized) where participants allocated $1/$5/$10 "cash" to preferred actions.
- In person tabling at community events. Targeted pop-ups—from Earth Day and health/social services fairs to a transit center activation—ensured access for youth, families, and transit-dependent residents.
- Public comments & qualitative synthesis. Open-ended comments (events and surveys) were coded for themes; dissenting views and instrument feedback were captured for transparency and improvement.
- Six long-form interviews

These engagement efforts reached members of the public across Hampton Roads, students and youth, transportation professionals, health and social services stakeholders, transit dependent and socially vulnerable residents, and civic advisory bodies. Please see the separate Engagement summary document that accompanies this draft plan, for more specifics on outreach and engagement.

The Hampton Roads MSA's Climate Context

Key Climate Change Impacts

What Are Greenhouse Gases?

- Invisible gases are released into the air when we burn fossil fuels like driving cars, heating buildings, producing electricity, farming, and industrial processes. These gases trap heat in the atmosphere, causing climate change and an increase in the average global temperature. There are six main GHGs:
  1. Carbon dioxide (CO_2) – from burning fossil fuels like coal, oil, and gas
  2. Methane (CH_4) – from landfills, livestock, and natural gas systems
  3. Nitrous oxide (N_2O) – from fertilizers, farming, and some industrial processes
  4. Hydrofluorocarbons (HFCs) – emissions come from a range of sources where HFCs are used primarily as substitutes for ozone-depleting substances (ODS) in refrigeration or air conditioning or for specific industrial applications
  5. Perfluorocarbons (PFCs) – from aluminum production and electronics manufacturing
  6. Sulfur hexafluoride (SF_6) – used as an insulating gas in electrical equipment

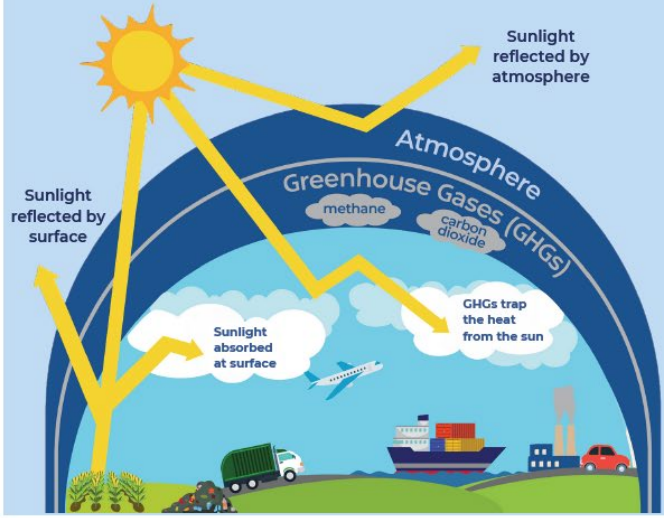
What are Greenhouse Gas (GHG) Emissions?

GHGs trap heat from the sun around the planet, like in a greenhouse. While GHGs naturally occur in our atmosphere, increased GHGs due to human activities are rapidly making our planet too hot and are destabilizing our climate.

Here are some everyday activities that increase GHGs:

- Using fossil fuels for our cars, heating, electricity, cooking, and more
- Cutting down trees
- Industrial processes in factories
- Managing and disposing of waste

The Climate Plan will identify strategies and actions to reduce GHG emissions and protect our community from negative impacts of climate change.



What does "CO_2 Equivalent" Mean?

- Not all greenhouse gases are equal — some trap much more heat than others. To make it easier to compare and add up the impact of different gases, scientists use something called carbon dioxide equivalent, or **CO_2e**.
- CO_2e is a common unit that expresses the warming impact of any greenhouse gas in terms of how much carbon dioxide (CO_2) would cause the same amount of warming over 100 years. This standard way of measuring helps us understand the total impact of all emissions, using one consistent unit — no matter which gas is being emitted.
- For example, 1 ton of methane (CH_4) warms the planet 28 times more than 1 ton of CO_2 over 100 years, so 1 ton of methane is equivalent to 28 tons CO_2e.

What is a Metric Ton?

- GHG emissions are usually measured in metric tons, which is the standard unit used around the world.
- 1 metric ton = 1,000 kilograms
- That's about 2,205 pounds or 1.1. US tons (also known as short tons)

What is carbon sequestration?

- Sequestration is the process of capturing carbon dioxide from the atmosphere (or from emission sources) and storing it so it does not contribute to climate change. The goal of increasing sequestration is to reduce the amount of CO_2 in the atmosphere, helping slow down climate change.
- There are two main types:
    - Natural sequestration: Forests and soil naturally absorb CO_2. For example, trees take in CO_2 during photosynthesis.
    - Technological sequestration: Methods that capture CO_2 from power plants, industrial facilities, or directly from the air and store it underground or use it in products.

Gross vs. Net GHG Emissions

- Gross GHG emissions are the total emissions released into the atmosphere — including from activities like burning fossil fuels, agriculture, or industrial processes.
- Net GHG emissions take that gross number and subtract any CO_2 that is removed (or "sequestered") from the atmosphere through natural or technological means.
- When reporting emissions, both gross and net figures are important. Gross emissions show the scale of total GHGs released into the atmosphere, while net emissions show how much is being sequestered. The net amount of GHGs in the atmosphere is an important metric for assessing rising global temperatures and climate change impacts. Many climate targets, including this plan's goal, focus on net emissions (e.g., achieve net zero emissions by 2050), aiming for a balance between emissions produced and emissions removed.

What are co-pollutants – and why do they matter?

- When we reduce greenhouse gas (GHG) emissions — especially from burning fossil fuels — we also reduce other harmful air pollutants that affect local air quality and health. These are called co-pollutants. When we take climate action (like switching to clean energy or reducing car traffic), we also cut co-pollutants. This means cleaner air, healthier communities, fewer hospital visits and missed days of work and school, and greater benefits to overburdened communities, which often face the highest pollution levels.
- There are two main categories of co-pollutants:
    - Hazardous Air Pollutants (HAPs): Also known as air toxics, these pollutants are known or suspected to cause cancer, birth defects, or serious health problems. Examples include benzene, formaldehyde, and mercury.
    - Criteria Air Pollutants (CAPs): These are six common air pollutants regulated by the U.S. EPA because they harm human health and the environment:

- particulate matter (PM2.5 and PM10) – tiny particles that can enter the lungs and bloodstream;
- ground-level ozone (O_3) – formed when other pollutants react in sunlight and can worsen asthma;
- nitrogen dioxide (NO_2) and sulfur dioxide (SO_2) – cause respiratory issues and smog;
- carbon monoxide (CO) – reduces oxygen delivery in the body; and
- lead (Pb) – toxic to the brain and nervous system, especially in children.

Emissions Inventory

Emissions inventories help to inform which regional areas and sectors should be prioritized during GHG reduction planning. The creation of an inventory is often the first step in an emissions reduction plan to ensure priority areas are identified and adequately responded to. This inventory was compiled for 2022 and assesses GHG sources and sinks across six key sectors: transportation, residential and commercial buildings, electric power use, industry, solid waste and wastewater, and agriculture and natural lands.

The region's first comprehensive emissions inventory will help inform climate mitigation planning, providing a benchmark to assess future progress.

52% of gross emissions in the region are from the Buildings Sectors

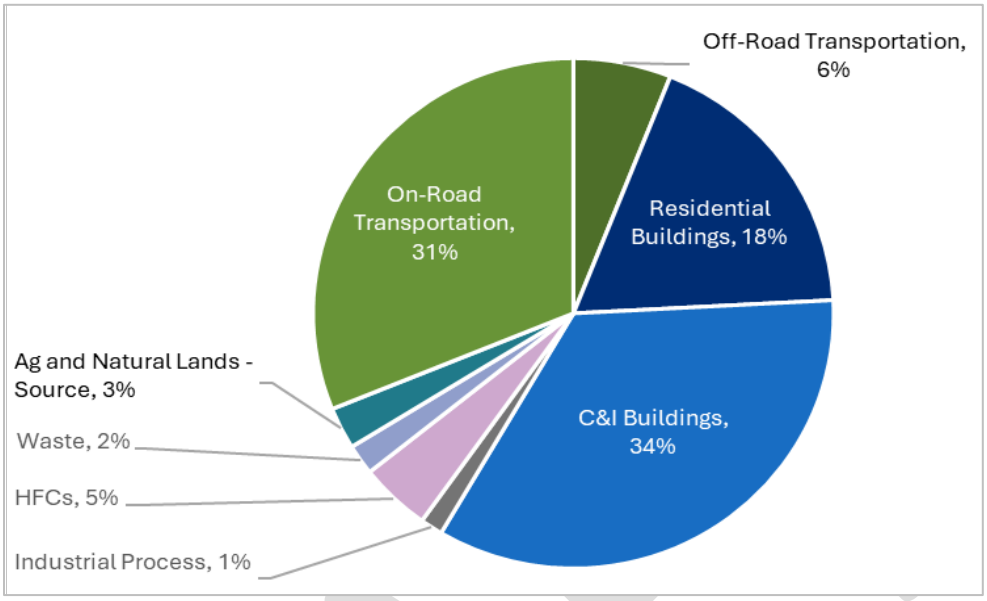
Key Findings

- Total gross emissions in 2022 were 22.6 $MMTCO_2e$, and total net emissions were 18.8 $MMTCO_2e$.
- The largest sources of emissions are electricity and natural gas use in residential, commercial and industrial (C&I) buildings, and light-duty vehicles.
- The largest categories of CO_2 sinks in the region from natural lands are forest (3.4 $MMTCO_2e$ sequestered) and urban trees (~ 0.4 $MMTCO_2e$ sequestered). The region's natural lands are key to help offset emission sources and also provide significant health and climate resilience benefits.

2022 GHG Inventory Summary

The 2022 GHG inventory is a comprehensive assessment of all GHG emissions sources and sinks across the MSA. The inventory was developed using a consumption-based (Scope 1 and 2) approach, which accounts for the emissions associated with the electricity consumed within the region in addition to direct sources of emissions, such as the combustion of fossil fuels in vehicles or buildings. The inventory is also presented in terms of both gross and net emissions. Gross reporting reflects sources of emissions only, while net emissions consider carbon sinks as well, such as the carbon stored in forests and wetlands.

Figure 2. HRPDC MSA Gross Consumption-Based GHG Emissions Inventory by Sector, 2022



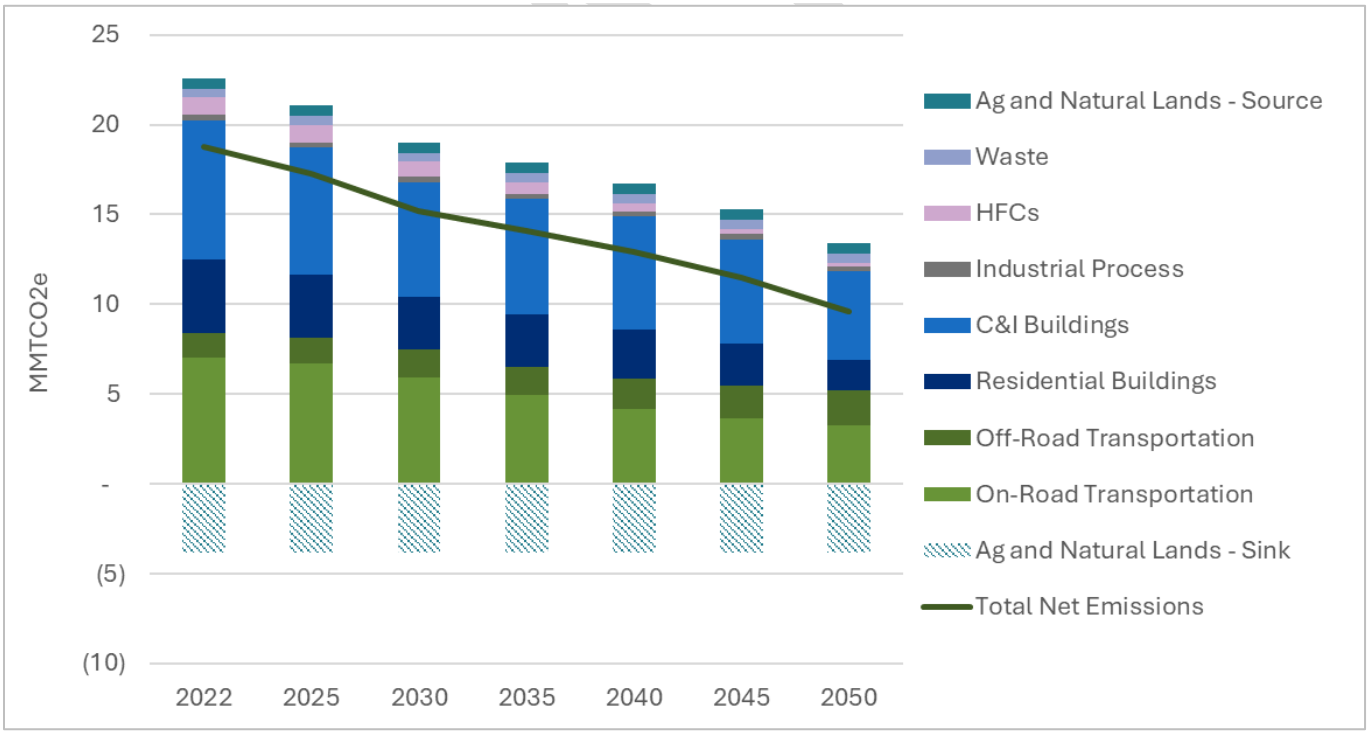
Total gross emissions in 2022 were 22.6 million metric tons CO_2e ($MMTCO_2e$). When accounting for the value of carbon stored in regional sinks, total emissions fall to 18.8 $MMTCO_2e$, with 3.8 $MMTCO_2e$ being stored in regional natural lands. Within the region, emissions vary largely across localities. Those with larger populations and commercial or industrial activity produce higher levels of emissions compared to rural areas. Less densely populated areas may also benefit from greater carbon sinks due to forest or grasslands. The highest emitting localities in the region are Virgina Beach, Norfolk, Chesapeake, and Newport News, all of which are hubs within the region for tourism, military and ship centered installations, and higher education. These localities also host over 60% of the region's population. Gates and Southampton Counties have the highest value of carbon sinks from natural lands.

Business As Usual Projections

A business-as-usual (BAU) GHG emission projection scenario was developed to understand how the region's emissions might look in the future without additional action. The BAU scenario reflects future emissions under current state and federal policies and includes historical trendlines and growth factors such as expected changes in population and employment. This scenario will serve as basis to compare emission reduction benefits from implementation GHG reduction measures.

Figure 3 shows the region's BAU GHG emission projections by sector, including both sources and sinks of CO_2 emissions from natural lands. **Compared to the 2022 inventory base year, the BAU projects that gross GHG emissions will decline 20% by 2035 and over 40% by 2050.** The largest projected reductions are from the transportation sector due to assumed increases in vehicle fuel efficiency and increased zero-emission vehicle adoption. The buildings sector also shows significant reductions due to cleaner electricity being used to power homes and businesses and improved equipment and appliance energy efficiency.

Figure 3. HRPDC MSA Business-as-Usual GHG Projections by Sector



Key Findings

- By 2050, **transportation** sector emissions are projected to decline nearly 40% from 2022 levels driven by improved fuel efficiency and increase electric vehicle adoption.
- By 2050, commercial and residential **building** sector emissions are expected to decline nearly 45% from 2022 levels. These reductions are largely driven by state mandates in Virginia for a net

zero emissions electric power sector by 2050, which leads to a lower carbon intensity for electricity consumed in buildings, and ongoing trends towards more energy efficient building appliances and equipment.

- Emissions from the **waste** sector are projected to rise as population growth increases overall waste generation.
- For the **Ag & Natural Lands** sector, emissions from agriculture are expected to grow slightly based on historical trends tied to livestock populations. Carbon sequestered in natural lands is expected to remain constant in the BAU.
- **Industrial process** emissions are projected to stay relatively flat through 2050.
- **HFC** emissions decline over 80% by 2050 with implementation of the American Innovation and Manufacturing (AIM) Act, which directs the EPA to phase down the production of HFCs in alignment with the Kigali Amendment to the Montreal Protocol, which was ratified in 2022.

Co-Pollutant Emissions Inventory

In addition to greenhouse gases, an emissions inventory for criteria and hazardous air pollutants was developed. Like a GHG inventory, tracking these co-pollutants over time provides an understanding of what pollutants are being released, how much, and key sources of them. There are two categories of air pollutants that affect human health and the environment:

- Criteria Air Pollutants (CAPs) include ozone, particulate matter ($PM_{2.5}$, PM_{10}), carbon monoxide (CO), nitrogen oxides (NO_x), sulfur dioxide (SO_2), and lead and may harm public health and the environment.
- Hazardous Air Pollutants (HAPs), also known as air toxics, include over 180 chemicals such as benzene and mercury, which may cause cancer and other serious health impacts.

In addition, there are many types of pollutants that relate to both CAPs and HAPs, or that are considered a precursor pollutant that may react with other pollutants to form either a CAP or HAP and are thus important to track for air quality assessments.

- Volatile organic compounds (VOCs) are gases that come from things like fertilizer, paints, varnishes, cleaning supplies, gasoline, diesel, and building materials. When VOCs react with nitrogen oxides, they create ozone, a CAP. Some VOCs are HAPs, such as benzene or formaldehyde.
- Ammonia (NH_3) contributes to the formation of $PM_{2.5}$, a CAP, when it reacts with other pollutants like NO_x and SO_2.

Table 1 provides a summary of co-pollutant emissions in the region by sector and pollutant, with a focus on criteria pollutants. The data is compiled from EPA's 2022 Emissions Modeling Platform.

Table 1 1. HRPDC MSA Co-Pollutant Emissions ($MTCO_2e$), 2022

Category	CO	NO_x	VOC	PM10-PRI	PM25-PRI	SO_2	NH_3	Total
Agriculture	12,958	1,651	82,254	5,440	1,693	65	5,204	109,265
Industrial Process	1,424	1,674	17,718	6,672	1,975	637	10	30,109
Mobile Transportation	128,551	18,352	11,054	1,336	791	322	852	161,257
Stationary (e.g., Buildings)	13,638	4,439	1,634	4,059	3,679	269	316	28,033
Waste	6,642	484	908	954	864	177	380	10,409
Other	452	11	114	4,974	939	1	-	6,489
TOTAL	163,664	26,610	113,682	23,434	9,940	1,470	6,762	345,563

GHG Emission Reduction Measures

Mitigation Measures

To identify the path to net zero, overarching Measures were developed by sector to outline how stakeholders within the Hampton Roads MSA can mitigate or reduce GHG emissions. Within each sector there are several Measures followed by Actions that can be undertaken by localities, non-profits, and other regional entities.

Fourteen GHG reduction measures were identified for this CCAP, as presented in Table 2. These measures were developed through a collaborative and iterative process with the CCAP Steering Committee, regional government agencies and authorities, and stakeholders like community-based organizations, private sector actors, utilities, and community members. These strategies span buildings and clean energy, transportation, waste, and land-use sectors. Discussed further in the *Pathway to Net Zero* section of this CCAP, these measures combined have the potential to achieve about 90% reduction in net emissions by 2050 compared to the 2022 inventory base year.

The identified measures are organized and numbered by the following sectors:

- **Agriculture and Natural Lands.** Conserving, restoring, and managing lands to preserve and enhance their benefits – such as wetland and living shoreline restoration and increased tree canopy – can support GHG reductions and increase community protection from storms and flooding.
- **Transportation.** Switching to electric and fuel-efficient vehicles and equipment, increased use of public transportation, and options like walking and biking can have major community and health benefits.
- **Buildings and Energy Use.** Buildings can run more efficiently and be more resilient to the impacts of climate change, helping to keep the lights on while consuming less power.
- **Energy Supply.** Cleaner sources of energy can be used to power our homes, businesses, and transportation.
- **Industry.** Finding collaborative solutions for clean energy use and efficiency improvements along our industrial corridors can help reduce pollution.
- **Waste and Wastewater.** Better recycling practices and expanded composting activities can help reduce emissions from our landfills, and process efficiency improvements can help reduce emissions from wastewater treatment plants.

Table 2: GHG Reduction Measures

#	Sector	Measure
NWL1	Agriculture and Natural Lands	Increase opportunities for carbon sequestration through tree planting, protecting, and restoring high-carbon coastal habitats, wetlands, and forest lands
NWL2	Agriculture and Natural Lands	Support local food production, urban agriculture, and farm-to-school initiatives
NWL3	Agriculture and Natural Lands	Increase soil conservation practices on urban and agricultural lands
T1	Transportation	Increase the adoption of low and zero-emission vehicles (LEV/ZEV) by developing education, outreach, and planning materials to localities for purchasing and maintaining ZEVs and develop a fueling infrastructure deployment strategy
T2	Transportation	Reduce vehicle miles traveled and support alternative modes of transportation through bike/pedestrian infrastructure investments
B1	Buildings	Provide technical and financial assistance for energy efficiency, electrification, and other investments to achieve net zero operations for local government and school buildings
B2	Buildings	Reduce energy consumption and increase building efficiency through programs to support, incentivize, and install weatherization and electrification measures in residential buildings
B3	Buildings	For commercial and industrial buildings, increase energy efficiency through financial incentives and educational outreach programs and strongly encourage the design, building, and operation of buildings above current required code
E1	Energy Supply	Accelerate regional solar energy adoption by expanding program participation, streamlining permitting and increasing community awareness and education through a Solar Hub
E2	Energy Supply	Support the development of grid-scale clean energy development and utility efforts to enhance grid resiliency
I1	Industry	Support emissions reductions from industrial processes
I2	Industry	Reduce emissions from port operations through the adoption of low-carbon fuels, electric equipment, and operational changes
W1	Waste and Wastewater	Decrease amount of waste sent to landfill
W2	Waste and Wastewater	Support efficiency upgrades at wastewater treatment plants (WWTPs)

Measure Development Process

Measures were developed through an iterative process with input from the Steering Committee, stakeholders, and community members at stages throughout. An initial draft list of measures was compiled from the previously completed PCAP report, a comprehensive document review of climate and related sustainability plans and commitments from localities and authorities within the Hampton Roads region, and input from the Steering Committee. Sample actions for each measure were identified from area plans and input on what could help address barriers, which were then shared, discussed, and further developed with stakeholders and community members. With this input, the measures and actions were refined and reviewed with the Steering Committee, producing the final list shown above.

Pathway to Net Zero

The identified measures are intended to help provide a pathway to net zero GHG emissions for the region by 2050. Building from the BAU analysis, the potential for GHG emission reductions from each measure was assessed, creating the Net Zero Scenario. There are multiple ways for each sector to reduce emissions; this scenario provides just one illustrative path to show the opportunities and relative impact in each sector. Figure 4 shows the region's GHG emission projections by sector. **Compared to the 2022 inventory base year, the pathway achieves about 90% reduction in net emissions by 2050**, with around 2 $MMTCO_2e$ of net GHG emissions remaining in 2050.

Figure 4. Hampton Roads MSA GHG Emissions by Sector: Net Zero Pathway Scenario

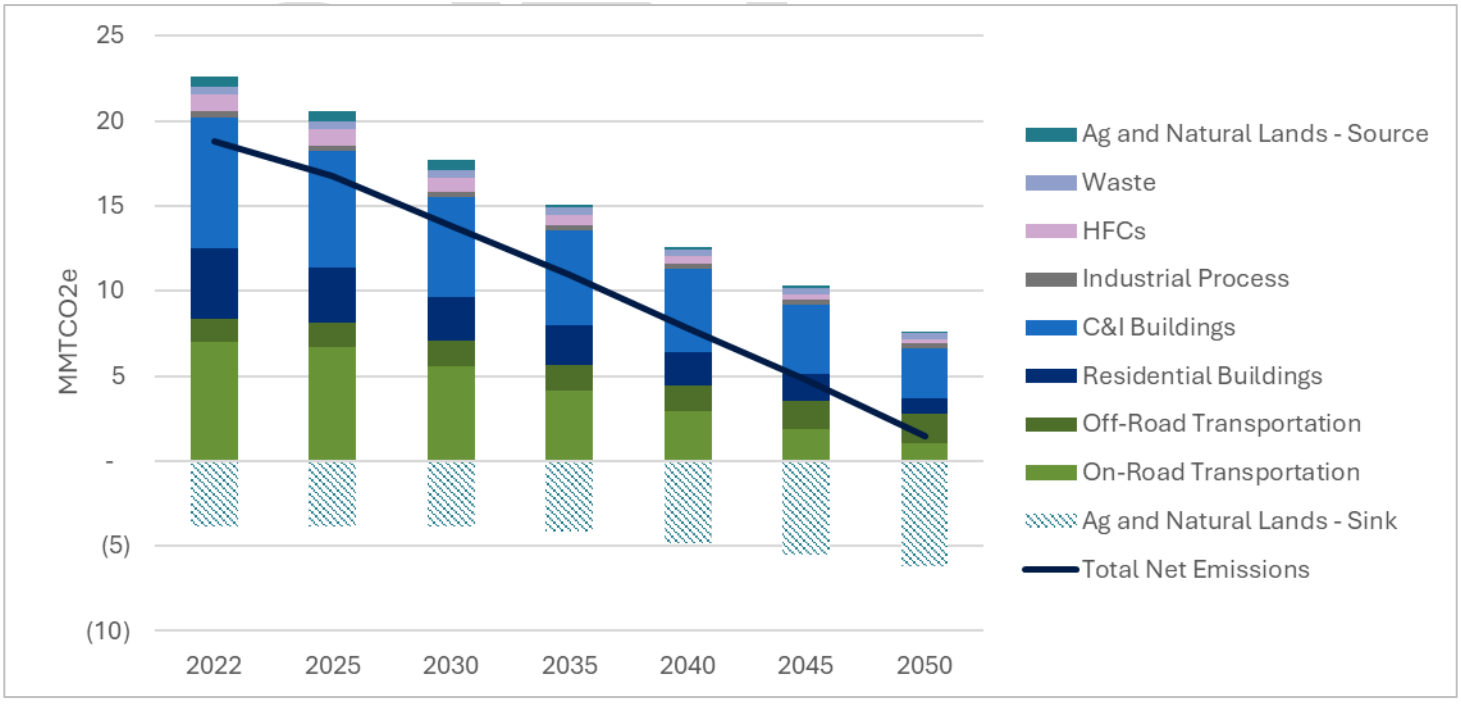


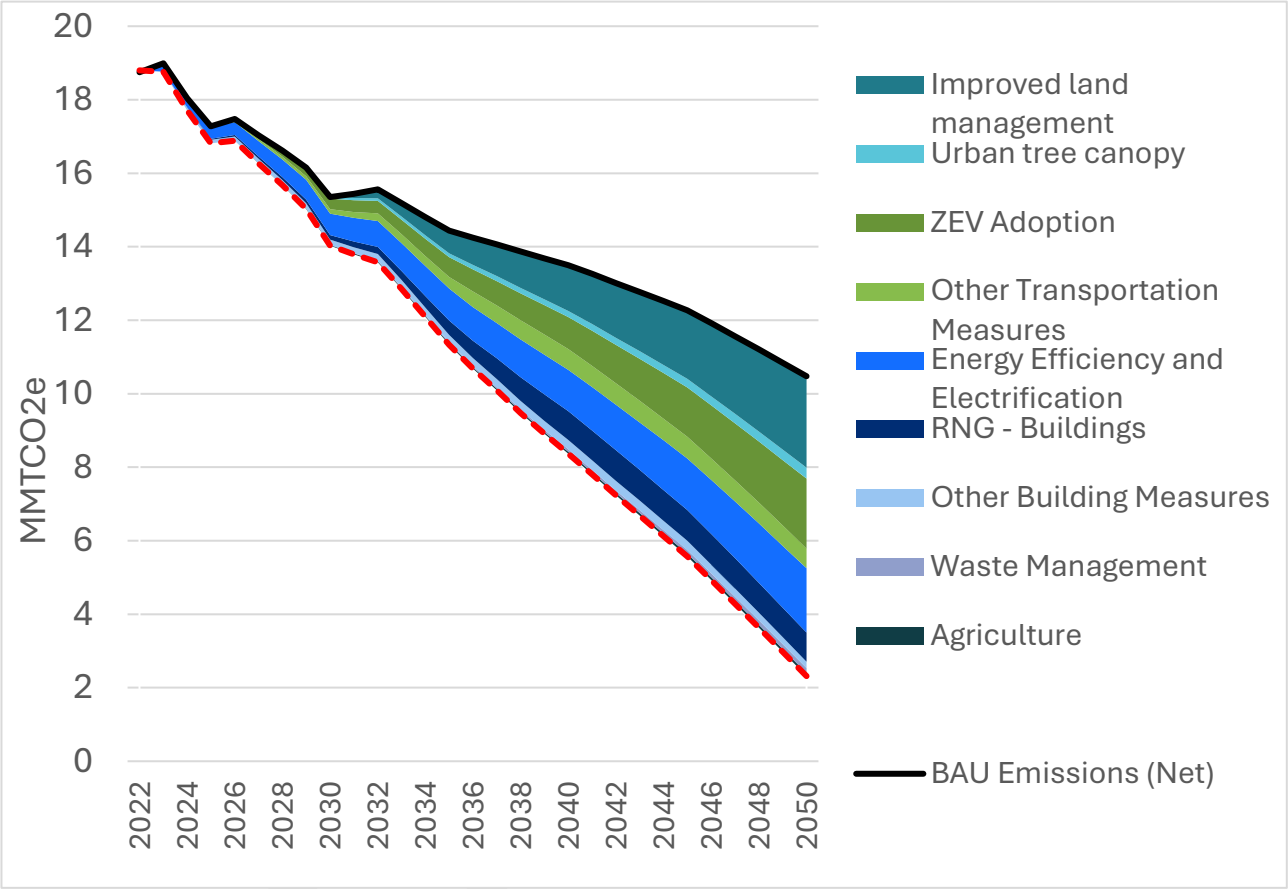
Figure 5 below presents the pathway to net zero scenario via a "wedge chart", which illustrates the impact on GHG reductions from each measure. The measures driving the largest GHG reductions for this pathway include:

1. Increased sequestration protecting and restoring **wetlands** and **forest lands** results in the greatest cumulative GHG reductions from increased CO_2 sequestration.
2. Adoption of **zero-emission vehicles**. When paired with electricity powered by clean energy (as mandated by the Virgina Clean Economy Act), this strategy results in significant emission reductions across the region.
3. **Energy efficiency and electrification** of heating, cooking, and appliances in residential and commercial buildings. Similar to transportation, the region's expected clean grid is a key enabling factor for the reductions achieved by this measure.
4. The use of **low carbon fuels** like renewable natural gas to decarbonize fuel use in **industrial** facilities.

To present GHG reductions by measure, a "wedge chart" may be used in planning efforts to illustrate how different climate mitigation strategies impact GHG emissions over time. Each "wedge" represents a mitigation strategy (e.g., ZEV adoption, urban tree canopy expansion, etc.) tied to the GHG measures list in Table 2. Some measures have been aggregated into wedges to simplify the chart. The chart shows the cumulative reductions from the various measures compared to the BAU Scenario.

The top line of the chart shows the BAU emissions and the bottom line shows the emissions under the Net Zero Scenario. The wedges in between represent the various ways to close the gap between the BAU and Net Zero Scenarios. The bigger the wedge, the bigger the impact of that measure. Taken together, the wedges are a visual tool to help understand how the multiple measures come together to the plan's goal of net zero GHG emissions by 2050.

Figure 5. Net Zero Scenario: GHG Emission Reductions from Each Measure



In order of magnitude, the Ag and Natural Lands, transportation, and residential and commercial buildings sectors are the top three drivers of emission reductions, followed by industry and waste. The state targets for a net zero electric power sector are a key enabling strategy to support end-use electrification across the transportation, buildings, and industrial sectors without shifting emissions from those sectors to the power sector.

CCAP Measures

Agriculture and Natural Lands Sector

What's the community saying about Agriculture and Natural Lands?

Expand urban tree canopy and green space – Top ranked survey action

"Increase green space and restoring tree populations could help address increase heat, storm water runoff and carbon sequestration..."

"Need more trees; increase tree canopy goals; protect mature trees"

Agriculture and natural lands can both release GHG emissions and function as a sink, sequestering and storing carbon dioxide and other GHG emissions. Actions in this sector focus on conserving, restoring, and managing lands to preserve and enhance their benefits – such as wetland and living shoreline restoration and increased tree canopy – and aim to increase soil conservation practices on urban and agricultural lands, support local food production, and promote urban agriculture. Implementing these measures will help reduce GHG emissions, increase carbon sequestration, and also enhance community protection from storms and flooding, contributing to overall climate resilience.

NWL1. Increase opportunities for carbon sequestration through tree planting, protecting, and restoring high-carbon coastal habitats, wetlands, and forest lands

Actions to increase carbon sequestration in Hampton Roads reflect four primary approaches: expansion, conservation, restoration, and promotion of planning practices that support the health and function of natural lands. Focused on urban tree canopy and green space, green infrastructure planning and implementation, and large-scale living shoreline and stream restoration and conservation, these actions have many co-benefits in addition to reducing GHG emissions. Conservation of natural lands protects and restores high-carbon coastal habitats, wetlands, and forest lands. Expanding the urban tree canopy and green space can reduce urban heat islands, improve air quality, and enhance the aesthetic appeal of urban areas. Large-scale living shoreline and stream restoration efforts help stabilize coastlines, reduce erosion, and enhance habitats. Promoting green infrastructure planning and implementation ensures that urban areas incorporate sustainable practices, such as green roofs and permeable pavements,

which can contribute to overall improved environmental quality and climate resilience. In Hampton Roads, localities within the Chesapeake Bay watershed have an average tree cover of 49%, resulting in 2M metric tons of carbon sequestration. To achieve a 20% reduction in emissions, the Bay watershed portion of the MSA would need to increase its tree cover by 20%.

Key Actions

- Expand Urban Tree Canopy and Green Space
    - Develop tree canopy inventories, and/or urban forestry management plans. Use these tools to establish expansion goals and identify implementation strategies for tree canopies in urban areas.
        - The Chesapeake Bay Program has developed tree canopy fact sheets for many of the localities in the MSA, providing a snapshot in time of urban tree canopy change to inform how loss and subsequent gain can be achieved. If more refined data needs are required by localities, they can also partner with the Green Infrastructure Center to conduct an inventory and set goals similar to Norfolk's Green Infrastructure Plan or Suffolk's Green Infrastructure Pla for the Nansemond River Watershed.
        - Localities can collect their own tree canopy data (see Norfolk's City Tree Inventory) or develop their own tree canopy and/or forest management plans like Virginia Beach's State of the Urban Forest report.
        - Consider a regional approach to mapping urban heat islands to communicate, educate, and potentially mitigate the impacts of extreme heat, similar to Plan RVA's Richmond Region Urban Cooling Capacity Analysis Project and building on HRPDC and HRTPO's Shady Stops survey map of tree canopy at bus stops.
        - Leverage the VA Department of Forestry's Community Assistance for Urban and Community Forestry to educate and provide funding for tree planting and local program development. Identify lessons learned from previous successful programs in Norfolk and Virginia Beach.
        - Review the VA Department of Forestry's first statewide Forestland and Urban Tree Canopy Conservation Plan when released (expected November 2026). Identify regionally-specific information and actions appropriate for the Hampton Roads area.
        - For Hampton Roads localities, replicate Chesapeake Bay Foundation's (CBF) tree canopy and green space initiatives in Hopewell: Expand urban tree planting efforts in low-income areas to improve air quality, reduce heat, and prevent runoff. Train and engage local volunteers through tree steward programs to maintain planted trees. Hopewell Restoration Project - Chesapeake Bay Foundation
        - Participate in the Southeast Virginia Urban Forest Roundtable to share best practices and learn about what other localities and volunteer groups are doing regionally.
    - Consider partnering with non-profit organizations to retrofit parking lots to provide more tree canopy coverage.

- Raise awareness and partner with non-governmental organizations (NGOs) about the threats of invasive species to urban forests and parks. Outreach could be focused on removal and adhering to a new law (HB1841/SB1166) that informs consumers on the purchase of invasive species (effective Jan. 1, 2027).
- Encourage localities to establish a tree canopy fund by ordinance to collect, maintain, and distribute fees collected from developers pursuant to new legislation (HB2630). Support future legislation to expand local government authority to conserve or replace trees during development, currently only allowed in northern Virginia.
- Consider partnering with the Department of Defense (DoD) to enhance urban tree canopy in and around installations. Use the Tidewater Sentinel Landscape initiative to pilot this effort and include outreach and education on the benefits for urban heat islands and improvements to qualify of life for military service members and their families.
- Establish policies and guidelines for existing and new roadways for tree planting in street medians and interstate reforestation. Localities are enabled to adopt tree conservation ordinances and can regulate the preservation and removal of trees within public rights-of -way, but there are no requirements for planting.
- Encourage the VA Department of Transportation (VDOT) to adopt a requirement for tree planting along interstate corridors.

- Promote Green Infrastructure Planning and Implementation
  - Using existing local green infrastructure plans as examples (Norfolk and Hampton), partner with the Green Infrastructure Center or other entities to incorporate green infrastructure planning into resilience and development plans.
  - Promote green infrastructure BMPs for stormwater management in localities.
  - Use the Native Plants for Southeast Virginia plant guide in planting plans.
  - Consider more partnerships between localities and universities, like students from Christopher Newport University (CNU) and the Newport News Green Foundation, to develop partnerships and outreach to identify where residents would like to see green space.
  - Share experiences and support localities seeking funding for the Bloomberg American Sustainable Cities initiative.
    - Currently Hampton and Newport News have received funding to pilot projects in underserved areas to address innovative approaches to climate resilience and economic development.
- Increase Conservation and Carbon Sequestration

Existing Project Highlight

Local Green Infrastructure Plans

The Cities of Norfolk and Hampton have established Green Infrastructure Plans. Through partnerships with the Green Infrastructure Center, they identified green assets, established goals to increase natural infrastructure, and prioritized highest value natural resources to protect.

- Using data gathered from localities and through other state tools like the Virginia Natural Landscape Assessment (VaNLA), and the Conserve Virginia 3.0 tool, update and expand on the 2006 Hampton Roads Conservation Corridor Study. This effort would go beyond habitat corridors to identify and prioritize large ecological cores for protection, ensuring that conservation efforts focus on areas with the highest ecological integrity.
- Enhance connectivity to mitigate habitat fragmentation by implementing conservation strategies that maintain and restore landscape corridors, ensuring that ecological cores remain connected to support biodiversity and ecosystem resilience.
- Consider local adoption of Purchase of Development Rights (PDR) programs.
    - James City County established a voluntary PDR program in 2001, allowing landowners to sell their development rights to the County, permanently preserving agriculture and forest land.
- Support ongoing state and local efforts to restore and enhance wetlands, coastal lands, and coastal estuaries.
    - Use the Virginia Wetlands Action Plan and its tracking and strategic planning to identify critical areas for facilitating the growth and preservation of wetlands. Identify priority projects in locality resilience plans that overlap with identified wetlands in the Action Plan to conserve open space, mitigate flooding, and protect vital habitats.
    - Provide continued support and outreach towards the implementation of DEQ's Chesapeake Bay Phase III Watershed Implementation Plan which identified hundreds of acres available for wetland restoration.
    - Wetlands Watch has developed guidance, Wetlands Migration Planning, to help raise awareness of the threat to coastal wetlands due to sea level rise, and offer solutions to protection, restoration, and enhancement.
- Promote conservation by enabling all local governments to enact cluster development ordinances, currently limited to only high-growth local governments as detailed in a 2022 report prepared for the VA General Assembly, A Study of Tree Conservation and Preservation in Development.

- Support large-scale Living Shoreline and Stream Restoration and Conservation
    - Implement living shoreline and stream restoration projects by stabilizing eroding stream channels near schools and parks, reconnecting floodplains, and using native vegetation to improve water quality. Conduct an analysis of all implementation projects proposed through Chesapeake Bay Total Maximum Daily Load (TMDL) Action Plans in MS4 permits.
    - Leverage projects from the Chesapeake Bay Foundation, James River Association, the Elizabeth River Project, and localities that are ongoing in the MSA to implement large-scale living shorelines. Identify funding sources and resources to continue implementation of living shoreline projects throughout the region as identified in DEQ's Phase III Watershed Implementation Plan (WIP).
    - Promote community conservation landscaping by collaborating with local non-profits to promote workshops and provide residents with native plants to create rain gardens and conservation corners that reduce runoff and enhance biodiversity.

- Expand environmental education programs by training local teachers in watershed science and implementing the National Ocean and Atmospheric Administration's (NOAA) Meaningful Watershed Education Experiences (MWEEs) in schools to engage students in conservation.

Key Implementers

- **Local governments and municipalities.** Operate land and conservation programming and policies within their jurisdictions. These entities can also support tree planting programs and goals.
- **Virginia DEQ.** Provides programming, funding opportunities, and technical assistance in conservation and maintenance of natural and working lands.
- **Virginia Department of Forestry.** Provides programming, funding opportunities, and technical assistance for forest conservation.
- **DCNR.** Provides programming, funding opportunities, and technical assistance in conservation and maintenance for Virginia's state parks and natural area preserves.
- **Local universities.** Studies on carbon reductions from natural sequestration and capture can support funding and potential programming.
- **Local non-governmental environmental organizations.** The Nature Conservancy, the Sierra Club, Chesapeake Bay Foundation, Wetlands Watch, James River Association, Elizabeth River Project, Virginia Forestry Association, and other NGOs provide programming, funding opportunities, and technical assistance in conservation and maintenance of natural and working lands.
- **Private sector partners.** Private landowners will be key partners for implementing changes to land use and forestry practices on their land to increase the region's carbon sequestration capacity.
- **Local organizations and nonprofits.** Local and community-based organizations and nonprofits provide valuable insight into strategically positioning trees to support LIDACs.

Metrics for Tracking Progress

- Acreage of implemented BMPs
- Number of trees planted
- Number of oyster reefs restored (acres of reef habitat)
- Linear feet of living shorelines or stream restoration projects implemented.
- Acres of wetlands restored, enhanced, or built.
- Number of volunteers engaged in tree stewardship, invasive species removal, and habitat restoration
- Number of educational programs conducted (teacher training, student watershed programs)
- Number of urban forestry plans created
- Tons of CO2e sequestered from baseline
- Percent of green space in restored and preserved natural lands
- Percent increase in tree canopy in urban and suburban areas
- Reduction in stormwater runoff
- Reduction in pollutants
- Increase in biodiversity (species counts in restored wetlands and forests)

- Reduction in heat island effect in urban areas with expanded tree canopy

NWL2. Support local food production, urban agriculture, and farm-to-school initiatives

Developing an active and productive local food system supports food production within the region and connects the community to regional and urban agriculture. Green, urban agriculture spaces, farm-to-school initiatives that bring fresh produce into school meals and introduce students to farming and growing food, and farmers markets can have health and air quality co-benefits, increase food access, and strengthen the local agriculture economy.

Key Actions

- Create school and community educational programs to support local food production
    - Encourage localities to collaborate with community groups and schools to provide education on the impacts that different types of food production, processing, and transport can have on GHG emissions.
    - Encourage local school districts to join the Virginia Farm to School program to incorporate locally produced foods in student meals.
    - Add gardens in at least 5 public schools by 2030 and establish gardens in all public schools by 2050. Expand school gardens beyond James City County, Virginia Beach, and Norfolk, as shown in the FeedVA Home map.
    - Partner with the Hampton Roads Urban Agriculture group to educate communities and provide more opportunities to access healthy food.
- Develop policies to strengthen local food production including more markets and policies to encourage urban gardens
    - Map and track urban agriculture opportunities throughout the region to identify gaps in availability spatially and/or throughout the year.
    - Develop urban agriculture policies to advocate for zoning laws and incentives that support community gardens, rooftop farms, and small-scale urban agriculture.
    - Promote hydroponics and aquaponics to expand food production in urban areas with limited space.
    - Expand farmers markets and local food hubs to strengthen local food supply chains by supporting farmers markets, community-supported agriculture (CSA) programs, and food hubs that connect producers with institutional buyers.
    - Increase local food procurement by setting targets for public institutions (e.g., schools, hospitals, government facilities) to source a percentage of their food locally.
    - Consider development of an agrivoltaics land use policy, allowing agricultural land use while generating power.
    - Increase food access and reduce food miles in underserved communities.
    - Expand pollinator resources by working with state and local honeybee organizations.

Key Implementers

- **Local governments and municipalities.** Develop and implement policies and programs to support urban agriculture, community gardens, and local food production.
- **Virginia Tech's Virginia Cooperative Extension.** Provide technical assistance, education, and resources to support urban agriculture and local food production. Offer programs and workshops for farmers and community members.
- **Local universities.** Conduct research on sustainable agriculture practices, urban farming, and local food systems. Support farm-to-school initiatives through educational programs and partnerships with local schools.
- **Local non-governmental environmental organizations.** Organizations like the Chesapeake Bay Foundation, Virginia Food System Council, and other NGOs provide programming, funding opportunities, and technical assistance to support urban agriculture and local food production
- **Local school districts.** Implement farm-to-school programs, incorporating locally grown produce into school meals and providing educational opportunities for students about agriculture and nutrition.
- **Community-based organizations and nonprofits.** Support urban agriculture projects, community gardens, and local food initiatives. Provide resources, education, and volunteer support to enhance local food systems.
- **Private sector partners.** Collaborate with local farmers, food producers, and businesses to support local food production and distribution. Partner with schools and community organizations to promote farm-to-school initiatives.
- **Farmers and urban growers.** Engage in sustainable farming practices, participate in local food markets, and collaborate with schools and community organizations to support farm-to-school programs.

Metrics for Tracking Progress

- Number of schools with on-site gardens.
- Number of Farm-to-School meal programs implemented.
- Volume of locally sourced food integrated into school meals.
- Increase in student access to fresh, local produce (%).
- Reduction in food miles traveled and associated carbon emissions (tons CO2e).
- Percentage increase in urban green spaces dedicated to food production.
- Improved food security metrics in participating communities.
- Increase in local food system resilience (measured by local food production as a share of total consumption).

NWL3. Increase soil conservation practices on urban and agricultural lands

Active and healthy soils sequester GHG emissions and support strong agricultural and landscape industries. Conservation practices in agriculture and pasture lands can retain and improve soil quality, reducing the need for chemical-based fertilizers, preventing erosion, and lessening runoff into waterways. Actions in this measure aim to improve the health of soils, expand understanding of their benefits, and support integration of best practices for managing livestock grazing and pasture lands.

Key Actions

- Research and promote soil health on agricultural lands
    - Employ the help of soil health experts at the Hampton Roads Agriculture Research and Extension Center (AREC) to better understand the implications of poor soil health in agricultural fields on GHG emissions.
    - Work with local Soil, Water, and Conservation Districts (SWCDs) to:
        - Reduce nitrogen emissions from soil through soil testing, precision application and use of slow-release fertilizers.
        - Maximize crop rotation and cover cropping practices to fix nitrogen
        - Shift to low- or no-till farming
        - Use cover crops to plant rye, clover, or radishes in off-seasons to prevent soil erosion, fix nitrogen, and enhance microbial life. More resources can be found here: Regenerative Agriculture's Top Eight Conservation Practices - Chesapeake Bay Foundation.
- Research and promote soil health on highly compacted, urban lands
    - With the help of soil health experts at the Hampton Roads AREC or SWCDs, to develop outreach and education materials on the effects of high soil compaction. Soil compaction can reduce the ability for landscapes to support trees and plants, increasing runoff volume, and providing no carbon sequestration.
    - Conduct Soil Profile Rebuilding (SPR) in public urban spaces to rehabilitate compacted soils and promote growth through reactivating biological activity in the soil.
    - Compare and contrast SPR efforts to identify best practices for unique conditions, i.e. consider topdressing, vertical mulching, hydraulic fracturing, or air tillage in various urban landscapes
    - Partner with the Chesapeake Bay Landscape Professionals program to develop a monthly regiment that can be implemented by property owners. Landscaping companies could market a monthly regiment that could be an alternative to traditional techniques, and include composting amendments, aeration, mulching, etc.
    - Add soil amendments or compost to promote infiltration in compacted urban soils.
- Improve manure management to reduce methane
    - Install digesters to capture methane produced during manure storage.
    - Store manure in covered composting facilities or biodigesters to reduce runoff and methane emissions. Apply composted manure to fields at optimal times for soil uptake.

- Increase tree planting on livestock grazing lands
    - Implement silvopasture practices to integrate trees into grazing areas to improve livestock health, reduce polluted runoff, sequester carbon, and enhance soil health.
    - Establish streamside forest buffers by planting native trees and shrubs along waterways, maintaining at least a 35-ft buffer. These absorb runoff, prevent erosion, and provide habitat.
- Support farmer to farmer outreach for grazing and pasture management
    - Leverage CBF's Mountains-to-Bay (M2B) Grazing Alliance to:
        - Support sustainable farming by promoting rotational grazing and related conservation practices.
        - Provide outreach and technical assistance through farmer-to-farmer mentoring, on-farm demonstrations, and peer-to-peer experiences.
        - Explore mechanisms to ensure the longevity of the M2B Grazing Alliance beyond the grant period.
    - Convert cropland to pasture and implement rotational grazing by transitioning degraded cropland to perennial grasses, then divide pastures into paddocks and rotate livestock every few days. This prevents overgrazing, improves soil structure, and enhances carbon sequestration.
- Advocate for funding incentives for agricultural management practices to reduce greenhouse gas emissions and farmland erosion.
    - Advocate for the support of the DCR Ag Incentives Program and other state funding to buffer creation and support, and precision nutrient application.
    - Advocate for continued funding of agricultural cost-share funding for BMP implementation throughout the Commonwealth.

Key Implementers

- **Local governments and municipalities.** Develop and implement policies and programs to promote soil conservation practices. Provide incentives and support for farmers adopting sustainable soil management techniques.
- **Virginia Tech Virginia Cooperative Extension.** Offer technical assistance, education, and resources to farmers on soil conservation practices. Conduct workshops and training sessions on sustainable agriculture and soil health.
- **Local universities.** Conduct research on soil conservation methods and sustainable agriculture practices. Provide outreach and education to farmers and the community on the benefits of soil conservation.
- **Local non-governmental environmental organizations.** Organizations like the Chesapeake Bay Foundation and Virginia Association of Soil and Water Conservation Districts provide programming, funding opportunities, and technical assistance to support soil conservation efforts.
- **Local conservation districts.** Work directly with farmers to implement soil conservation practices. Provide technical assistance, cost-share programs, and resources to support sustainable soil management.

- **Private sector partners.** Collaborate with farmers and agricultural businesses to promote soil conservation practices. Provide funding, resources, and support for sustainable agriculture initiatives.
- **Farmers and agricultural producers.** Adopt and implement soil conservation practices on their farms. Participate in educational programs and collaborate with local organizations to enhance soil health and sustainability.

Metrics for Tracking Progress

- Acres of farmland using precision nutrient management
- Number of methane digesters installed to capture emissions from manure storage
- Acres of cropland converted to rotational grazing through M2B Grazing Alliance
- Miles of streamside forest buffers planted
- Acres of cropland using cover cropping to fix nitrogen and prevent erosion
- Number of farms adopting no-till or low-till practices
- Acres of silvopasture established
- Number of farmers trained in sustainable practices through peer mentoring, workshops, and technical assistance
- Reduction in nitrogen runoff from precision application and cover cropping
- Tons of methane emissions reduced through improved manure management and digesters
- Increase in soil carbon sequestration from rotational grazing, no-till farming, and agroforestry
- Reduction in synthetic fertilizer use due to enhanced nitrogen-fixing practices

Transportation Sector

Transportation is commonly one of the largest sources of GHG emissions in communities due to its deep integration into daily life. Actions to reduce emissions focus on two approaches: reducing the amount of fuel needed and switching to fuels or forms of transportation that produce fewer emissions. In expanding the use of low and zero-emission vehicles, efficient technology and use of electricity as a fuel result in reduced GHG emissions. These types of vehicles need to be supported by a reliable and available EV charging system, providing places to recharge throughout the region. Increasing the use of public transportation and bike/pedestrian infrastructure improvements supports the option for more trips to be made using these forms of transportation and reduces the number of vehicle miles traveled and fuel needed to do so.

What is the Hampton Roads community saying about Transportation?

“Need to encourage walking, biking, and public transit…”

“Increased charging infrastructure for EVs would really be beneficial.”

"I believe that moving away from car dependency would be a huge benefit to the climate crisis.”

T1. Increase the adoption of low and zero-emission vehicles (LEV/ZEVs) by developing education, outreach, and planning materials to localities for purchasing and maintaining LEV/ZEVs and develop a fueling infrastructure deployment strategy

This measure aims to increase the use of low and zero-emission vehicles by expanding the availability of EV charging infrastructure, supporting government agencies and schools' fleet purchasing decisions with peer exchange resources, fleet assessment tools, and procurement practices, and providing educational materials to the community on LEV/ZEVs and incentives.

Key Actions

- Expand EV Charging Infrastructure
    - Develop a regional plan to expand charging stations by identifying high-utilization sites and infrastructure gaps, prioritizing deployment along key tourist routes and in underserved areas, extending installations beyond government facilities to include commercial sites. Consider survey input for NEVI (Virginia DOT – Report Creation)
    - Expand publicly accessible EV charging network locations at government and public agency-owned facilities.
        - Coordinate with the VA Department of Transportation (VDOT) in counties or at park and ride lots.
        - Partner with EV charger network providers to install and maintain the network through cost-sharing programs.
    - Increase regional EV-Readiness and private property electric vehicle supply equipment (EVSE) installations:
        - Participate in the Charging Smart program to enhance EV readiness. Participation includes establishing policies and procedures for deploying EV charging infrastructure. This is modeled after SolSmart, where local governments and PDCs can implement the program.
        - Create incentive programs and outreach initiatives to support installation and permitting. Consider expedited permitting, tax incentives, or density bonuses to developers who voluntarily incorporate EV charging stations.
        - Implement EV charging requirements for multifamily and commercial developments by using examples from international and California building codes for EV-ready standards.
    - As the National Electric Vehicle Infrastructure program expands, advocate for the inclusion of more highways in the VDOT Alternative Fuel Corridor identified in the EV infrastructure deployment plan.
    - Develop an Intergovernmental Support Agreement with Department of Defense to collaborate on charging infrastructure to support military EV charging.

- Increase ZEV adoption in government agency and school fleets
    - Facilitate peer-to-peer information sharing between local governments to share best practices, use common purchasing tools, and be updated on the state of ZEV technology.
        - Promote alternative fuels successes like Newport News propane school bus conversions and Chesapeake's Renewable Natural Gas Fueling station which is the largest in the region.
    - Partner with Virginia Clean Cities to hold Green Fleet Expos, similar to Norfolk's event in 2025.
    - Evaluate and recommend ZEV-focused fleet assessment tools, like the VA Department of Energy's Alternative Fuel Life-Cycle Environmental and Economic Transportation (AFLEET) tool, based on input from early adopters in Hampton Roads.
    - Develop ZEV procurement practices:
        - Integrate ZEVs into government contract networks.
        - Coordinate bulk procurement of ZEVs across the region's localities.
    - Develop ZEV infrastructure plans:
        - Evaluate high-emission vehicle routes and vehicles that serve and pass-through communities with high health risks to prioritize locality trucks (trash/public works/buses) alternative fuel conversion.
        - Develop templates/case studies for siting ZEV fueling infrastructure located to serve both fleet and public use.
        - Develop a concept for shared EV charging infrastructure for fleets across Hampton Roads.
        - Identify city-owned properties and garages that can be used as dual charging opportunities for fleets and the public. There are examples in York County, James City County, Newport News, and Norfolk.
    - Actively pursue federal funding opportunities such as they arise and where applicable.
    - Work with hiring managers to include EV maintenance skills for fleet jobs and offer training for existing staff.
- Provide educational materials to support ZEV adoption
    - Increase acceptance of EVs by demystifying maintenance and highlighting fuel and cost savings.
        - Create a regional EV Information Hub with details on federal and local incentives for residents and businesses, information on the availability of publicly accessible charging stations, and a GIS display with charging locations.
        - Organize community education and outreach events featuring technology demonstrations and EV maintenance information.

Existing Project Highlight

Municipal Renewable Natural Gas Fleets

The Cities of Chesapeake and Newport News are making great strides in converting municipal fleets

- Chesapeake was the first city in Virginia to have a municipal renewable natural gas fleet
- Newport News school buses now fueled by propane

        - Provide a repository for case studies to highlight localities and organizations at various stages of ZEV adoption.
        - Partner with Dominion and/or VA Clean Cities to host a workshop on EV utility services.
    - Advocate for incentives
        - Promote Dominion's program to assist with L2 charging for residents and businesses and provide upfront subsidies to lower cost barriers.
        - Address the annual highway fee for EVs and explore local incentives to offset costs for low-to-moderate income (LMI) residents.
    - Develop training programs at trade schools for EV maintenance.

Key Implementers

- **Dominion Energy.** Engaging with the utility for the MSA will be important to ensure electrical grid stability and reliability to support increased electric loads from electrification.
- **Virginia and Columbia Natural Gas.** Engaging with the utility for the MSA will be important to ensure supply and to project costs for RNG and hydrogen fueled vehicles.
- **Regional planning organizations.** Regional planning organizations, such as the HRPDC/HRTPO, can coordinate development and implementation of EVSE network and ZEV fueling plans.
- **State and local government organizations.** Organizations such as the North Carolina Department of Transportation and Virginia Department of Transportation can use federal funding to build EV charging networks and implement communitywide buying co-ops for EVs for public and private fleets as well as personal vehicles.
- **Private sector partners.** Private businesses and landowners can partner in adopting ZEVs and building publicly accessible charging stations on their properties.

Metrics for Tracking Progress

- Number of new DC fast chargers installed
- Number of ZEVs purchased for public fleets
- Number of localities with EV/EV-ready building requirements
- Number of localities with streamlined EVSE permitting processes
- Number of localities or agencies with ZEV transition plans
- Number of localities or agencies with ZEV transition investments integrated into its capital improvement program
- Percent of new vehicles sales that are EVs
- Percent of government fleets that are ZEVs

T2. Reduce vehicle miles traveled and support alternative modes of transportation through bike/pedestrian infrastructure investments

Through a range of actions, this measure aims to build upon an existing foundation of transit services and bike/pedestrian facilities in Hampton Roads, expanding infrastructure and services

to improve connections, safety, and integration with existing resources. Additional actions focus on operations, supporting an increase in the number of public transit operators and policies and technologies that could reduce the need for fleet vehicle travel.

Key Actions

- Support efficient implementation of transit services throughout the region.
    - Expedite implementation of 757 Express high-frequency transit service for HRT's regional backbone routes by supporting HRT's System Optimization Plan (SOP). The SOP has a goal of how the agency can put its limited resources to best use by reducing low-ridership local bus service and reinvesting those savings in routes with high ridership demand. (There has been a 35%-47% increase in ridership since the first 757 three routes have been implemented.)
        - Identify and provide recruitment and resource needs to increase the number of public transit operators.
        - Expand high-capacity transit coverage and service hours.
    - Support building and improving major roads in ways that help buses move faster and more reliably, like giving them priority at traffic signals or special lanes to skip traffic.
        - Conduct feasibility studies to expand rapid bus service backbone to WATA and Suffolk Transit.
    - Support expansion of On-Demand microtransit where fixed route transit service is limited or infeasible.
        - Develop policies to strengthen microtransit, like Chesapeake and HRT's incentive program for a Microtransit Zone pilot. This will allow riders microtransit opportunities to connect to a larger fixed bus route.
    - Conduct walkability assessments around bus stops. Start with 757express.
    - Encourage localities to construct sidewalks and provide infrastructure for passenger amenities at bus stops to improve transit service accessibility.
    - Encourage businesses/universities to adopt/promote use of bus stops and passenger amenities.
    - Promote existing rideshare programs, transit, and alternative modes of transportation use through GoCommute, employee incentive programs, pre-tax offerings, and discounts.

What is the Hampton Roads community saying about alternate modes of Transportation?

"I really hope the plan includes a significant effort to improve public transportation so it becomes a preferable option..."

"I believe that one of the biggest things that Hampton Roads can do is reduce car dependency by improving access to public transit (including extending the Tide light rail), creating more walkable spaces, and increasing housing density."

    - Coordinate with VDOT, HRT, and localities to partner with large commercial facilities to host Park and Ride lots.
    - Promote passenger rail service, especially to Washington, DC., Petersburg and Richmond.
    - Promote and expand 'free ride transit days' to tie in with holidays, bike, or safety months.
        - HRT already has Ride HRT for free on Transit Equity Day, Earth Day, Juneteenth, and during large public events.
    - Promote the Student Freedom Pass, available through HRT to teens ages 13-17, offering unlimited free rides on HRT's bus, ferry, and light rail services.
        - Advocate for WATA and Suffolk Transit to provide a similar program.

Existing Project Highlight

The Elizabeth River Trail

This urban trail is beneficial for walkers and bikers looking to explore Norfolk's waterfront.

- 10.5 miles of trail, accessible from many places throughout the City
- There is increased interest I connecting this trail to other localities

- Research and support updates to land use and zoning policies
    - Establish on-going dialogue between municipalities and transit agencies serving Hampton Roads to advocate for transit supportive land uses and policies.
        - Develop a series of workshops on the design and impact of transit-oriented development.
        - Implement Complete Street Policies, create a safe and consistent transportation network for all users.
        - Review the TPO's Long Range Transportation Plan (LRTP) growth scenarios and positive consequences of transit-oriented development.
        - Support higher density development that encourages high-frequency transit service.
    - Develop a tool kit for localities to support transit-oriented development
- Consider Government/Agency Operational Changes
    - Convert all water meters to remote reporting to eliminate miles driven for meter reading.
    - Implement policies to reduce commuting by promoting telework options.
    - Consider adopting no idling policies for locality fleets when appropriate.
- Enhance infrastructure to promote micromobility, cycling, and pedestrian-friendly transportation options.
    - Improve rural roadways for safer cycling.
    - Set goals for additional sidewalk infrastructure, provide funding, and encourage safety to counter right of way concerns.
    - Fund the design, construction, and maintenance of approximately 12 miles of new multipurpose trails, including the Trail 757/Virginia Capital Trail Extension, South Hampton Roads Trail, and the Elizabeth River Trail.
    - Use Chesapeake's Trails and Connectivity Plan as a model for other localities to provide access to alternative transportation networks.

- Develop recommendations for scooter/bikeshare expansion by exploring Norfolk's Scooter and Bike Rental Dashboard to better understand micromobility patterns and usage over time.
- Increase biking opportunities.
  - Establish biking to school programs.
  - Promote HRT's bike month in May.
  - Gather data for safe biking routes using handlebar sensors.
  - Consider reduced speeds in highly biked areas.
  - Increase the number of dedicated bike lanes. When re-striping roadways, evaluate road width to add in bike lanes where feasible. Localities can coordinate between departments when re-paving is planned to identify needs for active transportation. Chesapeake and Virginia Beach are good examples of this coordination.
  - Use HRT's GoCommute tool to identify commuting opportunities via biking or walking.

Key Implementers

- **State and local government agencies.** Virginia Department of Transportation, North Carolina Department of Transportation, and local governments can implement programs. The Virginia Department of Rail and Public Transportation (DRPT) can provide funding, studies, and reports to support program implementation.
- **HRTPO.** As a regional planning organization, HRTPO works to align multimodal transportation infrastructure with overarching transportation goals in the region.
- **Community groups and nonprofit organizations.** Community-based organizations can provide insight into the transportation patterns and needs of the community when developing multimodal infrastructure. In some cases, projects can be led by a dedicated local organization; for example, the Elizabeth River Trail Foundation is responsible for planning, programming, and advocating for the Elizabeth River Trail.
- **Private sector partners.** Property owners, developers, and businesses play a key role in development decisions and design that affect the viability and feasibility of using alternatives to driving.

Metrics for Tracking Progress

- Percentage of water meters with remote reporting
- Amount of geographic area served bikeshare programs
- Number of bikeshare program registered users, annual rides, and trip length
- Completed project count and length of:
  - Shared use paths
  - Sidewalks
  - Bike lanes
  - Paved shoulder
  - Paved unpaved road
  - Other bike/pedestrian facilities
  - Bike/pedestrian design features

- VMT per capita
- Additional miles of bicycle or pedestrian lanes added
- Bus ridership counts, including a brake out for BRT
- Number of vehicle miles reduced due to water meter remote reporting

Buildings Sector

Buildings and the energy they use are one of the largest sources of GHG emissions in communities, including residential, commercial, governmental, and industrial buildings. Reducing GHG emissions in this sector includes activities that make existing buildings more energy efficient through upgrades such as weatherization and electrification, encouragement of newly constructed buildings to be designed and built above current code requirements so that they use less energy, and technical assistance for government and school buildings to achieve net zero operations.

What is the Hampton Roads community saying about Buildings?

"It'd be helpful to have access to a certified list of reputable companies that can do solar panels or new windows or even new insulation in a house..."

"Rooftop solar on ALL public buildings, and subsidies for residential solar, reducing the need for huge solar farm."

B1. Provide technical and financial assistance for energy efficiency, electrification, and other investments to achieve net zero operations for local government and school buildings

Starting with a Lead by Example approach, this measure focuses on reducing GHG emissions and energy use in government and school buildings, reducing their ongoing energy use and costs, and fostering an information-sharing environment supported by tools, case studies, implementation guidance, and peer and industry networks.

Key Actions

- Encourage localities to lead by example in facility efficiency and electrification
    - Adopt local requirements for new construction and major renovations of government buildings

        - Meet Virginia's High-Performance Buildings Act requirements to ensure new and renovated buildings meet efficiency requirements.
        - Consider strengthening the High-Performance Buildings Act.
        - Ensure all new government buildings meet LEED standards, following the successful implementations in Hampton and York County.
        - Consider adopting sustainable design standards as exemplified by the City of Richmond with specific requirements for horizontal and vertical public and private projects.
    - Set locality-specific energy consumption and reduction goals and develop building energy performance standards
        - Follow Department of Energy's Better Buildings Challenge
        - Track energy usage through software like EnergyCAP to help identify energy demands, address maintenance issues, reduce costs, pay bills, and achieve goals. Norfolk leads by example with their online data portal, and new energy data dashboard.
        - Consider energy saving performance contracting options.
        - Participate in energy audit program using the Hampton city facilities' audits as a guide.
        - Promote all-electric new construction in municipal buildings.
        - Require energy benchmarking for buildings over 50,000 sq ft.
        - Use analytics and monitoring-based building commissioning to continuously improve building performance over time.
    - Install LED streetlights along public rights-of-way.
        - Consult with Dominion to identify locations and options for replacement.
        - Create dashboard to track LED installations.
        - Share best practices to ensure lighting is not harmful to migrating birds and address community concerns, like adding a shield.
        - Work through Virginia Energy Purchasing Governmental Association (VEPGA) to engage Dominion on color temperature, advancements in lighting technology and environmental best practices.
    - Install LEDs in government buildings.
    - Evaluate public buildings and parking lots for solar installation including prioritizing installations that do not trigger more expensive grid upgrades.
    - Encourage localities, housing authorities, and school districts to participate in VEPGA.
    - Establish a revolving green fund for energy efficiency projects, leveraging resources like DOE's Loan Program Office and Norfolk's $300K Green Fund.

    - Model Virginia Beach's approach to use a third party to conduct energy bill audits for free, owing only 25-30% of their findings.
    - Work with Virginia Association of Counties (VACo) to understand the Virginia Department of Energy's Energy Savings Performance Contracting (ESPC) to "use guaranteed savings from the maintenance and operations budget for utilities as capital to make needed upgrades to a facility, financed over a specified period of time".
- Improve information sharing about energy efficiency programs and case studies across the localities

- Develop forum for local governments to convene and share knowledge.
- Create a regional communication strategy to inform local governments about available resources and engage the public to combat misinformation.
- Develop a list-serve to foster ease of communication and information sharing among local staff.
- Develop cost-savings estimates based on energy tracking and models to better communicate the life cycle costs of sustainable investments.
- Compile cost information for practices and provide implementation guidance.
- Host a clearinghouse for case studies to be used as informational tools and best practices across localities.
    - Create a template for case studies to be shared across localities that highlights successes, challenges, cost-savings, life-cycle costs, and energy savings to be used to advocate for funding, convey lessons learned, communicate critical needs, and showcase successful projects.
    - Evaluate case studies from the annual award program for government projects hosted by the Virginia Energy Efficiency Council.
- Develop an inventory of grants and loans available that fund government building upgrades. Identify requirements, upfront costs, return on investments, program challenges. (See list compiled by HRPDC).
- Provide training for locality staff to understand their energy footprint and how they can help, offer sustainability lunch and learns, provide engaging challenges like "Watts Going Down Norfolk", and create a joint energy team across departments.
- Consider involvement in the Virginia Energy Efficiency Council and the Southeast Sustainability Directors Network to engage with likeminded partners and share best practices, resources, and opportunities.

Key Implementers

- **State governments and local government agencies**. The Virginia Department of Housing and Community Development, Virginia Department of Environmental Quality, Virginia State Corporation Commission, North Carolina Department of Environmental Quality, North Carolina Utilities Commission, and other state agencies can support implementation. Relevant local government organizations (such as the Department of Public Works) in Virginia Beach and Norfolk can provide support and share best practices when implementing this measure.
- **Regional Planning Organizations (RPOs).** These entities can create continuity of work between state and local governments and support technical assistance.
- **Dominion Energy.** The major electric utility provider for the MSA provides energy efficiency programs for residential customers.
- **Contractors and Equipment/energy service providers.** Private sector partners such as contractors and equipment manufacturers service providers can partner to provide the skills and equipment needed to retrofit buildings.

Metrics for Tracking Progress

- Number of LEED-certified local government and school buildings

- Number of schools and local government buildings that participated in incentive programs for building energy efficiency or electrification
- Metrics from building energy performance standard, including energy and emissions from participating facilities
- Number of heat pumps installed
- Number of efficiency gas and electric HVAC systems installed
- Number of projects that paired building upgrades with EV infrastructure installation or onsite solar

B2. Reduce energy consumption and increase building efficiency through programs to support, incentivize, and install weatherization and electrification measures in residential buildings

This measure aims to connect financial, educational, and technical resources with eligible properties, owners, and property managers to support energy upgrades and energy efficiency appliances in residential properties. Specific resources for multi-family, public housing, and other lower income properties are identified, as these property types can require specialized resources and support due to their ownership and investment structures, property size, and having to coordinate with many residents for building access.

Existing Project Highlight

Virginia Beach Green Savers

This initiative, established in 2023, helps residents conserve energy and reduce costs.

- Programs and giveaways available at Virginia Beach's Public libraries
- Toolkits can be loaned out to assess home energy and water usage

Key Actions

- Support and promote residential weatherization programs and energy audits.
    - Work directly with Project Homes and Community Housing Partners
    - Advocate for state and federal funding along with utility sponsors to continue to support weatherization and energy efficiency programs.
    - Promote and utilize the new Virginia Energy Connect hub, a one-stop shop for residents and contractors to find information on incentives and programs for energy efficiency in their homes and businesses
    - Work with locality departments of Social Services, Economic Development, and Community Development to provide referrals and drive efforts to urban centers.
        - Identify multi-family housing partners willing to participate in weatherization and energy programs.

    - Work with Dominion and their Property Management department to connect with multi-family property owners. Partner with training programs (ex. Community Housing Partners Research and Training Center) to encourage earning certification credentials.
    - Recognize that not all localities will have the resources or staff to promote these programs and work towards identifying non-profits that can assist them.
- Promote voluntary residential upgrades to reduce energy consumption.
    - Provide outreach and education on opportunities that are available to homeowners, like installing insulation, sealing holes, duct sealing, replacing heat pumps or air handlers, etc.
    - Work with Dominion and partners (e.g. CHP, Project Homes, Virginia Municipal League) to offer and conduct free energy home audits.
    - Create cost/benefit comparisons between existing gas heating and cooling and electric or hybrid heating and cooling.
    - Develop an information hub on federal tax incentives and utility rebate programs for building efficiency, electrification, and clean energy technologies and available state programs and how to participate in them.
    - Leverage VA and NC Home Electrification and Appliance Rebates (HEAR) programs to advance energy efficiency and building electrification in the region.
    - Promote Dominion's rewards, rebates, and energy efficiency programs for homeowners and target local businesses of all sizes to generate interest in building services and equipment settings programs and specialty efficiency solutions in agriculture, data centers, hotels, and the healthcare industry.
    - Help support or promote micro-grants.
    - Partner with local schools, non-profits, or libraries to create educational programs, toolkits, and give aways.
        - Virginia Beach is doing this through grant funding from Energy Efficiency Conservation Block Grants and Virginia Natural Gas Foundation.
        - Purchase 'kill-a-watt' kits as giveaways for public education to measure and record the amount of electricity consumed to compare across plug, lighting, and mechanical electricity.
        - Place energy savings kits and giveaways in public libraries, users can check a kit out for do-it-yourself home assessments.
- Identify gaps in buildings codes, ordinances, and permitting processes that disincentivize decarbonization in residential buildings.
- Research philanthropic, state, and federal community zero-interest short term loans to retrofit and upgrade public housing.

Key Implementers

- **State governments and local government agencies.** The Virginia Department of Housing and Community Development, Virginia Department of Environmental Quality, Virginia State Corporation Commission, North Carolina Department of Environmental Quality, North Carolina Utilities Commission, and other state agencies can support implementation.

- **Local governments.** They will play a key role in disseminating information and providing educational resources.
- **Non-profit organizations.** These organizations can meet with community members and promote increased education on opportunities to improve energy efficiency of homes and residences.
- **Dominion Energy.** The major electric utility provider for the MSA, Dominion Energy provides energy efficiency programs for residential customers.
- **Homeowners, building managers, and renters.** These groups are ultimately responsible for conducting home improvement projects.
- **Contractors and equipment/energy service providers**. Private sector partners such as contractors and equipment manufacturers service providers can partner to provide the skills and equipment needed to retrofit buildings.

Metrics for Tracking Progress

- Number of residential buildings that participate in incentive programs and number of type of equipment or retrofit undertaken (e.g., weatherization or heat pump installation)
- Energy use change and GHG emissions improvements from tracked projects
- Number of residential homes or units in LIDACS that receive energy efficiency and or/ electrification retrofits or upgrades
- Number of participants in any voluntary benchmarking programs
- Number of outreach events and technical assistance materials developed and shared
- Overall energy consumption and change in GHG emissions from the residential buildings sector in the region

B3. For commercial and industrial buildings, increase energy efficiency through financial incentives and educational outreach programs and strongly encourage the design, building, and operation of buildings above current required code

This measure combines identification of funding and financing sources, incentives, education, and recognition programs to support increased energy efficiency in commercial and industrial buildings.

Key Actions

- Identify funding to support programs for energy efficiency improvements for commercial and industrial buildings
    - Low- to no-cost energy audits for small businesses
    - Promote/research on-bill financing and tax incentives
    - Encourage participation in Commercial Property Assessed Clean Energy (C-PACE) program. Work with lenders and localities to find common ground and identify risks and

terms that work for all parties. Launch a working group to find lenders willing to participate.

- Conduct outreach on decreasing energy consumption in commercial and industrial buildings
  - Replicate North Carolina's High Performance Building program (HiPerB), which is designed to showcase the energy performance of commercial buildings in the state. This program focuses on new construction and major renovations, comparing measured post-occupancy energy data and costs to baseline and design models.
  - Partner with community-based organizations, local and regional civic leagues, business chambers, and utilities to educate building owners, including non-profits, places of worship, and small businesses on best practices for decarbonization, and facilitate connections with utility providers to identify resources and available rebate and incentive programs.
  - Identify locations for Resilience Hubs to learn how to address impacts from climate change. Portsmouth is leading by example through their resilience hub at a local church with the help of community leaders and non-profits. The site can be a place to gather to learn about issues and solutions (like Cool Down P-Town) and can have demonstration projects that residents can implement like tree planting, solar panels, EV charging stations, or possibly a micro-grid.
  - Facilitate connections between commercial and industrial building energy managers or sustainability staff to support knowledge sharing on tangible ways to decrease energy consumption. Ex. Sentara's programs
- Encourage and incentivize voluntary reporting of energy consumption and offer recognition programs for high performing businesses
  - Create energy tracking reporting program for commercial and large multi-family or mixed-use buildings.
  - VA DEQ manages the Virginia Environmental Excellence Program (VEEP) Sustainability Partners track to encourage large businesses to make effective sustainability changes.
  - Model locality programs like York County, James City County, Newport News, and Hampton who all have clean business forum awards.
  - Publicize high performing buildings and recognition programs (LEED certified, Energy STAR, etc.) to ensure that people are aware of the energy efficiency updates that can be made and motivate buildings that are already high performing to continue their efforts.
  - Public tours of high performing buildings to help construction companies, building owners, and other entities to envision future energy efficiency changes

Existing Project Highlight

Clean Business Forum Awards

Businesses on the Peninsula can be rewarded for going above and beyond greening their grounds and providing sustainable options to their consumers.

- James City County, York County, Hampton, and Newport News all participate
- By adopting green initiatives, a business can be recognized, promoting their sustainability and beautification efforts

    - Encourage residential and commercial building owners to make upgrades to their buildings through challenges, outreach, and education activities.
- Advocate for energy efficient building designs
    - Investigate options available to encourage above code development through the permitting process.
    - Engage with state lawmakers and regulatory agencies to update building code.
    - Provide outreach on optimization of a building's energy performance through construction modeling.
        - Focus on passive design strategies such as site orientation, window placement, and materials. Orienting the building to face east-west can maximize natural lighting and minimize glare, while a north-facing window can offer efficient natural lighting with less heat gain.
        - Utilize energy-efficient windows with low-emissivity coatings and high-performance materials like warm edge spacers to reduce heat transfer. This will aid in solar optimization too.

Key Implementers

- **State governments and local government agencies.** The Virginia Department of Housing and Community Development, Virginia Department of Environmental Quality, Virginia State Corporation Commission, North Carolina Department of Environmental Quality, North Carolina Utilities Commission, and other state agencies can support implementation. Relevant local government organizations (such as the Department of Public Works) in the Virginia Beach and Norfolk areas can provide support and share best practices when implementing this measure.
- **Dominion Energy.** The major electric utility provider for the MSA, Dominion Energy provides energy efficiency programs for commercial and industrial customers.
- **Building owners and energy managers.** These groups are ultimately responsible for conducting home improvement projects.
- **Contractors and equipment/energy service providers.** Private sector partners such as contractors and equipment manufacturers service providers can partner to provide the skills and equipment needed to retrofit buildings.
- **Chamber of Commerce**
- **Non-profit organizations.** These organizations can meet with community members and promote increased education on opportunities to improve energy efficiency of homes and residences.
- **Homeowners, building managers, and renters.** These groups are ultimately responsible for conducting home improvement projects.
- **Contractors and equipment/energy service providers.** Private sector partners such as contractors and equipment manufacturers service providers can partner to provide the skills and equipment needed to retrofit buildings.

Metrics for Tracking Progress

- Number of residential buildings that participate in incentive programs and number of type of equipment or retrofit undertaken (e.g., weatherization or heat pump installation)
- Energy use change and GHG emissions improvements from tracked projects
- Number of participants in any voluntary benchmarking programs
- Number of outreach events and technical assistance materials developed and shared
- Overall energy consumption and change in GHG emissions from the commercial and industrial buildings sector in the region
- Number of new buildings that participate in incentive programs and certification level achieve (e.g., LEED or others)
- Number of buildings that are all-electric, net zero, or meet passive house standards
- Number of participants in any ongoing voluntary benchmarking programs
- Number of outreach events and technical assistance materials developed and shared

Energy Sector

With growing technology and manufacturing advances, there are more opportunities to generate renewable and clean energy. Installing solar panels distributed across rooftops and parking lots on public and private sector properties can reduce the amount of energy needed from the grid, freeing up that energy to be used elsewhere. Grid-scale facilities and investments in grid resiliency reduces the overall emissions of energy supply and offers the potential of clean and renewable energy benefits to properties not well suited for their own onsite installations.

What is the Hampton Roads community saying about Energy Supply?

"Need to accelerate our conversion to renewable energy system, like solar and wind."

"Governmental support for renewable energy production needs to be maintained and more created."

E1. Accelerate regional solar energy adoption by expanding program participation, streamlining permitting and increasing community awareness and education through a Solar Hub

A number of program models, tools, and state resources exist to reduce barriers and challenges to installing solar energy systems. This measure identifies specific resources and programs that could be replicated or expanded in Hampton Roads.

Key Actions

- Enhance Solar Energy on government, residential, and commercial buildings
    - Monitor federal program status and encourage localities to participate in Virginia Department of Energy's Solar for All program and North Carolina's Solar for All program, and EnergizeNC when they become available again.
    - Streamline the permitting process across localities, consider using SolarAPP+ for permitting.
    - Encourage localities to participate in the SolSmart recognition program to allow for centralized permitting, to help develop rapid permitting processes, and to continue to promote and make solar easier for residents and business owners.
- Develop a Solar Hub website
    - With help from HRPDC staff, coordinate with the Local Energy Alliance Program (LEAP) to develop a regional solar energy hub
    - Use the Northern Virginia Regional Commission's (NVRC) Solarize NoVA, as a model to participate in the Solarize program through LEAP. This will allow the region to vet solar installers and de-mystify the challenges of residential solar installation.
    - Continue to encourage localities like Norfolk and others to partner with solar co-ops like Solar United Neighbors.
- Expand power purchase agreement options for community solar
    - Request state assistance to support power purchase agreements (PPA) to connect more community solar projects.
    - Model a low-income solar program in the region, similar to the partnership between Dominion and Henrico County.
- Encourage multi-benefit, community scale solar at brownfields, landfills, parking lots and reservoirs.
- Promote grid resiliency with more distributed energy storage to reduce peaks and provide backup power in emergencies.

Key Implementers

- To be determined

Metrics for Tracking Progress

- To be determined

E2. Support the development of grid-scale clean energy development and utility efforts to enhance grid resiliency

As new opportunities in clean energy continue to develop, this measure aims to track and further use of technologies such as under-development offshore wind projects as well as hydrogen, propane, and nuclear resources.

Key Actions

- Support Offshore wind development
    - Continue to advocate regionally for offshore wind development to support Dominion and Virginia's goals for cleaner grid-scale energy sources. The Coastal Virginia Offshore Wind project is underway. Once complete, it will generate enough energy to power up to 660,000 homes (~3,000 MW). Regional support is valued to ensure the project continues to move forward
    - Share information regarding the growing workforce development needs for the wind industry. One example is Centura College that offers a 48-week wind turbine technician program.
- Explore alternative sources of energy like hydrogen, propane, and nuclear
    - Support Virginia Tech's Clean Energy Tech Center in Newport News to advance clean energy hydrogen research and development.
    - Follow recommendations to address public perception of nuclear energy in "Enhancing Community Acceptance of Small Modular Reactors".
    - Coordinate with Virginia Nuclear Energy Consortium.
    - Conduct cost comparisons for alternative energy sources and traditional sources to make informed decisions.
- Identify battery storage needs for alternative energy sources and identify resilience strategies to better respond during emergencies.
- Promote the purchase of renewable energy certificates (REC) to achieve sustainability goals.

Key Implementers

- To be determined

Metrics for Tracking Progress

- To be determined

Existing Project Highlight

Coastal Virginia Offshore Wind

As proposed, this project will generate enough energy to power up to 660,000 homes, that's 176 offshore wind turbines.

- This is a win-win for increasing renewables in Virginia and creating clean energy jobs.
- Construction is underway and the project will be complete in 2026.

Industry Sector

The industrial sector includes activities such as the processing and manufacturing of physical and chemical materials. The Hampton Roads region includes iron and steel production and pulp and paper industries. The majority of emissions in this sector result from the combustion of fossil fuels to power processes. Emissions from industrial processes can be difficult to reduce, especially

processes such as cement and concrete production that involve chemical reactions that produce emissions that cannot be avoided without changes to chemical processes. The measure identified for this sector reflects current technological and policy trends to reduce industrial emissions, including improving process efficiency and fuel switching.

I1. Support emissions reductions from industrial processes

While industrial processes vary significantly across industrial operations, nearly all have opportunities to enhance their thermal or electrical efficiency. In addition to efficiency, this measure seeks to decarbonize industrial operations through the electrification of low and medium temperature processes, and where possible, high heat temperature processes, and by changing industrial processes which generate GHG emissions. However, many industrial processes rely on either high temperature operations which are not easy candidates for electrification or produce GHG emissions from chemical processes and iron, steel, and other metal production, among other industrial processes. Nationally, these areas have been a focus for research and pilot development by federal agencies such as the DOE, and EPA.

Key Actions

- Coordinate with the healthcare sector to better understand their role in contributing to greenhouse gas (GHG) emissions and potential reduction measures
    - Work with the Sentara Sustainability Director to implement energy tracking software for the 12 hospitals and hundreds of care sites in the MSA. Use both educational and energy cost avoidance tools to reduce their usage of unnecessary equipment, encourage best practices, and provide cost savings.
    - Coordinate a workshop with the commercial sector to share Sentara's successes and promote additional information sharing and cost-effective strategies.
    - Partner with Sentara to analyze climate related diseases that impact healthcare in the MSA and how they can be mitigated through GHG reduction efforts.
    - Identify contacts in other regional healthcare systems (e.g. Riverside and Bon Secours) to share best practices and coordinate on reduction measures.
- Support the development of strategic sustainability plans for commercial and industrial facilities. In Hampton Roads, the Port of Virginia leads by example (see I2).
- Develop a long-term regional plan to identify industrial sites with opportunities for hydrogen production and/or use, carbon capture, electrification, or use of other low-carbon fuels, or other reduction measures.
- Coordinate with the Department of Energy to better understand opportunities to participate in demand response programs. The Commonwealth works with Voltus to curtail energy usage during high peaks and conserve for critical uses, government buildings, universities, industry, schools, etc. can participate in these programs.

Metrics for Tracking Progress

While these metrics would help track changes in energy, emissions, and project implementation over time, the data collection and reporting processes may not currently be in place to support these metrics.

- GHG and other pollutants emission reductions
- Amount of energy savings from efficiency projects
- Number of pilot projects in the region for innovative low-carbon solutions, such as the use of hydrogen

I2. Reduce emissions from port operations through the adoption of low-carbon fuels, electric equipment, and operational changes

This measure focuses on reducing GHG emissions through actions to decarbonize operations and electrifying ports, building upon and furthering progress made under the Port Net Zero Programs and infrastructure and electrification upgrades. On the shoreline of ports, the measure could involve deploying shore power (electric power supplied to docked ships to reduce idling), installing renewable energy, and switching to electric forklifts and other cargo handling equipment, among other activities.

Virginia Port Authority (VPA) - The VPA owns and operates (through its private operating subsidiary, Virginia International Terminals, LLC) four general cargo facilities Norfolk International Terminals (NIT), Portsmouth Marine Terminal (PMT), Newport News Marine Terminal (NNMT), and the Virginia Inland Port in Warren County. The port also leases and operates the Viginia International Gateway (VIG) and Richmond Marine Terminal (RMT; outside the MSA).

Existing Project Highlight

Virginia Port Authority (VPA)

The VPA is a regional leader in achieving net zero operations.

- Sourcing clean energy for port operations, 100% goal achieved in 2024.
- VPA continues to electrify and conduct infrastructure upgrades at all facilities.

Key Actions

- Support Port Net Zero Programs from the VPA Sustainability Report
    - Continue to source clean energy for port operations. VPA has met their 2024 goal of utilizing 100% clean energy sources. All terminals except VIP are covered by a power purchase agreement (PPA) with Dominion. VIP is served by a green rider via Rappahannock Electric Co-op for the last 3 years.
    - Expand and enhance existing programs to increase the implementation of current Port Net Zero initiatives, such as the Green Operator (GO) program. GO was expanded two

years ago to have a new at- and near-zero funding option as well as the legacy diesel replacement program. The port has also for the last 9 -10 years been electrifying terminals via sweeping multimillion dollar projects. During this time the Port has spent over $1B on modernizing the terminals and incorporating cleaner equipment. The Port currently has the northern half of NIT under construction expanding this same technology there.

  - Advance Net Zero projects through additional studies, pilot projects, and grant work. The Port has completed most studies needed at this time including electric drayage, hybrid shuttle carriers, hydrogen and electrical studies, as well as a few other studies over the past 2-3 years, leading up to the net zero commitment. The Port also recently performed an emissions study and will do so again at the end of the clean port grant in a few years.

- Continue Port Electrification and Infrastructure Upgrades
  - Continue to fund VPA's Green Operator drayage truck replacement program. There is funding remaining in 2025 for about 8 trucks. The Port will then apply for the next round of programmed state-level funding, about $500K each year for the next few years.
  - Design, deploy and use programs and incentives to decarbonize/electrify ports. With state and federal funding, and following the implementation of the Clean Ports grant, the Port will have NIT and RMT nearly fully on electric and battery power, VIG will be over half. Additional studies are needed for NNMT and the future of VIP. PMT is still being used for the Dominion project and will be for several years by lease arrangement.
  - Explore expanding I-64 barge operations to reduce VMT of port-supporting vehicles. The barge provides an alternative to truck transport and saves on emissions compared to diesel dray trucks. The barge has been expanded to the current level of service over the last several years. Both a new barge and trips between HR ports and RMT were increased to up to 3 times per week as needed depending on demand. The Port currently has the service optimized to address customer needs.
  - Evaluate potential for the provision of shore power or alternative fuels to reduce emissions from oceangoing vessels. Each year staff look at how long vessels stay alongside. Less than 10% are here for more than 24 hours. Until this increases the Port will likely not consider shore power.
  - Complete the transition of the central rail yard at NIT from diesel to electric and begin designing the second phase of this improvement. A new rail bundle has been added and is in operation along with new electric CRMG cranes. The Port only has one switcher locomotive remaining that is not an electric or hybrid piece of equipment. The Port already moves more cargo by rail than any other east coast port. Depending on the time of year, the Port has been hovering around 40% of our cargo being moved on rail.
  - Convert traditional operations at North NIT to electric options. Construction is ongoing with two years to complete.
  - Engage in detailed electrical work for equipment charging on the terminal. This is ongoing for the Clean Ports Grant at NIT and RMT with JACOBS performing.
  - Coordinate with power providers for port electrification by pre-planning infrastructure to avoid future disruptions and ensure resilient siting of chargers to prevent flooding. This is being worked during design, upgrades with Dominion have been discussed. A

second substation is currently under construction on NIT. Investigations are underway at RMT as well.

- Enhance Communication and Recognition
    - Engage the community through quarterly newsletters and the Port's annual sustainability report. Seek recognition through industry awards in maritime and other transportation groups. There is periodic civic league engagement as well las participation in special events.
- Encourage other partners to achieve sustainability goals
    - Continue the partnership with Norfolk Southern to promote and expand the RailGreen Corridor between Front Royal and Norfolk, VA. Shippers hauling freight along this segment may purchase carbon reduction certificates. Funds from the sale of the certificates will be used for Norfolk Southern to buy more low-carbon biofuel. The shippers will receive environmental attribute certificates quantifying and tracking their emissions reductions.

Key implementers

- **VPA.** VPA owns and operates (through its private operating subsidiary, Virginia International Terminals, LLC) four general cargo facilities Norfolk International Terminals, Portsmouth Marine Terminal, Newport News Marine Terminal, and the Virginia Inland Port in Warren County. The port also leases and operates the Viginia International Gateway and Richmond Marine Terminal (outside the MSA).
- **Dominion Energy.** The utility provider for the MSA, Dominion plays a crucial role in helping to connect and manage loads and renewable energy opportunities for port operations.
- **Virginia and Columbia Natural Gas.** The utility provider for the MSA, Virginia Natural Gas may be able to provide reliable access to RNG or hydrogen.
- **Trade groups.** Trade groups will implement the infrastructure updates specified in this measure.
- **Private sector partners.** Private companies and landowners with property near port infrastructure may need to be engaged to coordinate land use planning. VPA has good relationships with other private sector partners including original equipment manufacturers which play a vital role in efforts covered by this measure.
- **Community colleges.** VPA works with Tidewater Community College to provide necessary training for technical operators and maintenance technicians.
- **Regional planning agencies.** The HRPDC has previously provided support to VPA.

Metrics for Tracking Progress

For the Port of Virginia, VPA is already tracking the following metrics:

- CO2e tons per 10,000 twenty-foot equivalent unit (TEU)
- Fuel gallons per 10,000 TEU
- Percent electric equipment
- Virginia International Gateway turn-time
- Norfolk International Terminals turn-time

Waste and Wastewater Sector

The waste and wastewater GHG emissions sector includes emissions from landfills and wastewater treatment, resulting from the decomposition of organic materials and treatment processes. Common GHG reduction actions include capturing landfill gas for energy, upgrading wastewater treatment technologies, diverting organic waste through composting or anaerobic digestion, and improving recycling and source reduction. Reducing emissions in this sector supports climate goals while also improving public health and environmental quality.

W1. Decrease amount of solid waste sent to landfill

Focusing on policies, diversion, and education, this measure aims to reduce the amount of waste material being sent to landfills that could otherwise be directed to recycling or composting programs. With reuse, recycling, and composting, organic materials do not degrade in a landfill release GHG emissions and existing materials, like plastics and glass, can continue to be used instead of new stock materials being produced.

What is the Hampton Roads community saying about Waste?

"...all public buildings should be required to recycle, and actually make sure what ends up in the recycle bin ends up going to be recycled and not thrown in the same dumpster as the trash."

"Reopen or build new waste to energy plant to produce electricity from waste, reducing the waste stream to landfills."

Actions

- Improve regional planning and waste reduction policies
  - Support regional coordination between solid waste planning units (SPSA and VPPSA) and localities to align programs and messaging to decrease overall waste generation and reduce the volume of waste sent to landfills and to improve the effectiveness of recycling processes.
  - Develop a Model Ordinance and develop programs to reduce construction and demolition waste through building reuse, deconstruction, and material diversion and reuse.
- Diversion of Recyclable and Organic Materials from Landfills
  - Create and implement waste diversion programs.
  - Provide case studies and best practices for localities regarding waste diversion programs.
  - Support localities in establishing composting zones.
  - Leverage the development of SPSA's planned automated material recovery facility (MRF) and explore the possibility of expanding application of the technology to the

entire region. The planned facility will segregate the waste stream, remove organics for processing through pyrolysis, and sort recyclable materials for recycling.
    - In conjunction with the development of SPSA's new MRF, develop a regional strategy for removal of cardboard and other materials that would be degraded through single stream processing from the waste stream prior to processing at the MRF.
    - Divert waste for bioenergy projects.
    - Invest in glass recycling programs similar to the purple bins used by James City County and the Glass Half Full Initiative.
- Promote Educational Initiatives
    - Expand the Start Smart, Recycle Right recycling and reuse program by creating additional informational videos and resources.
    - Continue to encourage community members to use the askHRgreen.org website to learn more about recycling and composting. Encourage people to utilize the Waste Wizard lookup tool to learn more about the correct places to dispose of items like electronics, glass, batteries, and household goods.
    - Offer additional opportunities to learn more about composting and recycling initiatives and how community members can engage with them. Utilize funding from the VA DEQ CPRG Implementation Grant award on Methane reduction to reach community members.

Existing Project Highlight

Glass Recycling

James City County is pioneering glass-only recycling in the region.

- Purple bins are deployed across the County for residents to bring their glass recyclables to.
- A nearby glass recycler turns them into recycled bottles and other uses.

Key Implementers

- **Local government and other Sub-State governmental organizations.** Local and other sub-state government entities such as locality Public Works Departments, SPSA, and VPPSA manage landfills and solid waste management. In North Carolina, localities plan and operate services and facilities to meet local needs. Additionally, the Albemarle Regional Solid Waste Management Authority is a regional agency that coordinates waste management for a set of localities in northeast North Carolina including Currituck and Gates counties
- **State government agencies.** VA DEQ is responsible for oversight and guidance on waste management. In North Carolina, NC DEQ sets the rules, issues permits, inspects/enforces, and provides technical and financial assistance.
- **Private sector partners.** Privately owned waste treatment facilities, haulers, and processing facilities can be voluntarily involved in emissions savings measures and incentivized involvement.

Metrics for Tracking Progress

- Number of automated recycling systems implemented

- Number of construction/demolition waste reduction programs supported
- Percentage of documented recycling and waste disposal information maintained
- Number of waste diversion programs created
- Number of composting zones established
- Amount of waste diverted for bioenergy projects
- Number of methane capture systems expanded or upgraded
- Number of educational initiatives and resources developed
- Number of community members engaged through educational programs
- Amount of energy recaptured from any flares using thermal generators
- Number of incineration facilities closed
- Weight of waste diverted from landfills or incineration facilities
- Weight of materials composted
- Increase in recycling rates above the minimum 25% established by the Code of Virginia
- Increase in the production of biochar from organic waste
- Reduction in construction and demolition waste
- Increase in the beneficial use of digester methane gas
- Reduction in overall waste generation within the MSA
- Increase in community awareness and participation in waste reduction and recycling initiatives

W2. Support efficiency upgrades at wastewater treatment plants

This measure focuses on upgrading technology at wastewater treatment plants so that efficiency improvements and smart technology can be introduced, closing incerators, and harness renewable energy from wastewater treatment plants.

Key Actions

- Close incinerators at three major Hampton Roads Sanitation District's (HRSD) WWTPs
    - Reduce emissions related to the burning of natural gas to start up the three closed incinerators at the Boat Harbor WWTP, Army Base WWTP, and closed Chesapeake-Elizabeth WWTP.
    - Reduce emissions from incineration of waste solids by processing them for RNG production at other WWTPs.
- Implement efficiency upgrades at HRSD wastewater treatment facilities
    - Evaluate and determine next steps, funding, and project leads for potential pilot and full-scale projects, such as partial denitrification-anammox (PdNA) treatment and exploration of pyrolysis at the Atlantic Treatment Plant to convert a portion of biosolids into biochar.
- Implement smart technology
    - Complete energy audits on all HRSD facilities, identifying opportunities for energy retrofits across its facility portfolio, and integrate findings into HRSD's capital improvement planning.

  - Evaluate the benefits and feasibility of using a contracting method, such as an energy-savings performance contract or energy as a service, to bundle and fund (and potentially identify) energy retrofits.
  - Implement Smart Technology Upgrades. Some upgrades that could be implemented in regional facilities include advanced monitoring systems, automated controls, and energy-efficient machinery.
  - Investigate battery storage/microgrid opportunities to lessen energy costs and time of use cost impacts.
- Develop systems to create renewable energy from WWTP processes
  - Operate thermal hydrolysis and anaerobic digestion waste solids treatment at the Atlantic WWTP to produce renewable natural gas (RNG).
  - Develop a comprehensive program to capture and convert waste gases from WWTPs into renewable energy sources, such as biogas, to reduce emissions and generate sustainable energy.
  - Treat nearly all (98%) solids formerly incinerated at the Chesapeake-Elizabeth WWTP at the Atlantic WWTP to produce RNG. Treat a significant portion of solids formerly incinerated at the Army Base WWTP at the Atlantic WWTP to produce RNG. Explore opportunities to implement RNG projects at other WWTPs, or modify solids handling across HRSD facilities to divert additional waste solids to RNG production.

Existing Project Highlight

Fuel from Wastewater Byproduct

HRSD is partnering with VA Natural Gas to produce renewable natural gas (RNG)

- Biogas, a byproduct of wastewater treatment, will be converted to renewable natural gas.
- The RNG will be added to an existing pipeline and can fuel up to 4,000 homes in a year.

Key Implementers

HRSD has authority to implement energy programs, policies, and projects within its operations and facilities. To enact specific decarbonization projects, policies, or/or pilot programs, HRSD may need to gain approval from its Board of Commissioners, a City Council or County Board of Supervisors, or other administrative authority that oversees budgets and/or regulations. Agencies like the VA Department of Professional Occupational Regulation are responsible for licensing wastewater facilities.

Metrics for Tracking Progress

- Number of energy audits conducted and resulting amount of energy savings potential and upgrades identified
- Volume of emissions reduced from discontinuing the incineration of waste solids

- Volume of emissions reduced by discontinuing natural gas combustion for three incinerator furnace startups
- Volume of waste gases captured and converted into renewable energy
- Number of smart technology upgrades implemented and corresponding amount of energy savings
- Increase in RNG energy generation from biogas
- Reduction in operational costs due to energy savings
- Enhanced monitoring and control of wastewater treatment processes
- Increased energy efficiency of wastewater treatment plants

Benefit Analysis

Benefits Analysis

In addition to GHGs, emissions from criteria air pollutants (CAPs) also harm public health and the environment, and hazardous air pollutants (HAPs) are pollutants known to cause cancer and other serious health impacts. Like a GHG inventory, tracking these co-pollutants in an inventory over time provides an understanding of what pollutants are being released, how much, and their key sources.

These two categories of air pollutants affect human health and the environment:

- **Criteria Air Pollutants** include ozone, particulate matter (PM2.5, PM10), carbon monoxide (CO), nitrogen oxides (NOx), sulfur dioxide (SO2), and lead.
- **Hazardous Air Pollutants**, also known as air toxics, include over 180 chemicals such as benzene and mercury.

In addition, there are many types of pollutants that relate to both CAPs and HAPs, or that are considered a precursor pollutant that may react with other pollutants to form either a CAP or HAP and are thus important to track for air quality assessments:

- Volatile organic compounds (VOCs) are gases that come from things like fertilizer use in agricultural activities, paints, varnishes, cleaning supplies, gasoline and diesel, and building materials. When VOCs react with nitrogen oxides, they create ozone, a CAP. Some VOCs are HAPs, such as benzene or formaldehyde.
- Ammonia (NH3) contributes to the formation of PM2.5, a CAP, when it reacts with other pollutants like NOx and SO2.

Table 3 provides a summary of co-pollutant emissions in the region by sector and pollutant, with a focus on criteria pollutants. The data is compiled from EPA's 2022 Emissions Modeling Platform.

Table 3.Co-Pollutant Emissions by Sector and Pollutant

Category	CO	NOx	VOC	PM10	PM2.5	SO2	NH3
Agriculture	12,958	1,651	82,254	5,440	1,693	65	5,204
Industrial Process	1,424	1,674	17,718	6,672	1,975	637	10
Mobile Transportation	128,551	18,352	11,054	1,336	791	322	852
Stationary (e.g., Buildings)	13,638	4,439	1,634	4,059	3,679	269	316
Waste	6,642	484	908	954	864	177	380
Other	452	11	114	4,974	939	1	-
TOTAL	**163,664**	**26,610**	**113,682**	**23,434**	**9,940**	**1,470**	**6,762**

Results

This section presents the quantified outcomes of co-pollutant changes and associated health benefits for the MSA building from the modeling conducted for the net zero CCAP implementation scenario. The MSA-wide summary results provide an aggregated view of total emissions reductions and health impacts across all sectors. Sector-specific analyses detailing the contributions of individual sectors to both pollutant reductions and public health improvements can be found in Appendix D. Benefits Analysis. Table 4 and Table 5 show the cumulative reductions by pollutant and sector. Table 6 then presents the monetized health benefits from improved public health due to the lower co-pollutant emissions.

CAPs were quantified because they are common pollutants with widespread public health impacts, causing respiratory and cardiovascular diseases, asthma aggravation, and premature death. Their reductions are directly linked to clear public health benefits and regulatory air quality standards, supported by well-established emissions factors and monitoring methods. HAPs, in contrast, tend to be emitted in smaller quantities with more complex sources and lack widely available emissions factors, making their reductions harder to quantify and often smaller in overall impact. For this report, CAP impacts from each sector were prioritized to address broad public health protection, while HAP reductions may not show significant measurable changes.

Although HAPs are not quantitatively represented, they will still be reduced through GHG reduction measures. Reducing energy use in buildings by increasing efficiency and transitioning to cleaner energy sources lowers the need for burning fossil fuels, which in turn can decrease emissions of toxic air pollutants like formaldehyde, benzene, and other hazardous substances. When more electric vehicles are used and vehicle miles traveled decrease, emissions of

hazardous air pollutants from gasoline and diesel engines, such as 1,3-butadiene, acetaldehyde, and benzene, are also reduced. These shifts generally improve both outdoor and indoor air quality, lessen the public's exposure to a variety of indoor and outdoor toxins, and support better respiratory and overall health outcomes, particularly in densely populated or heavily trafficked areas.[1]

In addition to health benefits from air pollution removals, the natural lands sector provides ecosystem services in the form of avoided runoff, rainfall interception, and transpiration, which help combat urban heat island effects, enhance stormwater management by managing water volume, and improve water quality by reducing stormwater runoff and promoting infiltration. To assess the co-benefits of natural and working lands, EPA's i-Tree Landscape Module was used to estimate ecosystem services provided by increased tree cover. By 2050, the modeled tree canopy expansion could result in avoided runoff benefits reaching over $23 million/yr. The results of the air pollutant removals are included in Table 4.

Table 4. Cumulative Changes in Co-Pollutant Emissions (MT) by Pollutant, 2025-2050

Pollutant	Cumulative Reductions from Change in Energy Use	Removals from NWL
NOx	14,864.1	42,954.0
SO2	1,178.7	52,880.8
PM	964.1	123,522.5
CO	36,281.7	3,898.2
Lead	0.2	0.0

[1] https://www.lung.org/clean-air/outdoors/what-makes-air-unhealthy/buildings

Table 5. Cumulative Co-Pollutant Reductions (MT) by Pollutant and Sector, 2025-2050

Sector	Pollutant	Cumulative Reductions
Waste	CO	423.71
Buildings	CO	8,012.95
Industrial Buildings	CO	(1,739.31)
On-road	CO	28,965.69
Aviation	CO	618.63
Waste	Lead	0.00
Buildings	Lead	0.11
Industrial Buildings	Lead	0.09
On-road	Lead	0.00
Aviation	Lead	0.00
Waste	NOx	28.06
Buildings	NOx	11,760.78
Industrial Buildings	NOx	(817.60)
On-road	NOx	3,087.01
Aviation	NOx	805.89
Waste	PM	9.60
Buildings	PM	802.59
Industrial Buildings	PM	(51.69)
On-road	PM	96.94
Aviation	PM	106.67
Waste	SO2	0.00
Buildings	SO2	398.41
Industrial Buildings	SO2	462.16
On-road	SO2	39.90
Aviation	SO2	278.22