Clackamas County Climate Action Plan: **Implementation Guide**

Introduction

The Clackamas County Climate Action Plan (CAP) outlines the County's pathway to reach carbon neutrality by 2050. This implementation guide brings that pathway to life by providing information about the policies, programs, initiatives, and infrastructure investments needed in order for Clackamas County to implement the CAP by:

- *Reducing emissions to meet the carbon-neutral target,*
- *Creating the necessary work plans, and*
- *Conducting operational and feasibility studies.*

This implementation guide focuses on actions Clackamas County can take as an organization, as well as actions that require county advocacy and education to support residents, businesses and partners as they take necessary actions. It is a snapshot of actions that align with the best practices and local context identified during the development of the CAP. Successfully reaching the target will require dedication and adaptive management.

How the Implementation Guide is Organized

The key focus areas for Clackamas County's CAP align with the following nine distinct sectors identified by the consultant through technical modeling, reviews of best practices and local context, and engagement.

A. *Active transportation*
B. *Clean heating*
C. *Building retrofits*
D. *New building performance*
E. *Low emissions vehicles*
F. *Transit*
G. *Energy generation*
H. *Waste and wastewater*
I. *Natural sequestration*

The nine sectors provide an implementation structure, with overlap between the program, initiative, policy, and infrastructure recommendations. Although the actions are organized by sector, there is a recommended start and end date for each.

These implementation actions will see their greatest returns in concert. Although adaptive management will be needed as technologies and conditions change, it is important to note that the plan will not generate the same outcome if only some actions are completed or if actions are taken out of order.

Within the nine categories are the following detailed breakdowns for each action:

1. ***Action****: The title of the intended outcome*
2. ***Description****: A brief explanation of the action that needs to be taken, including targets (where relevant)*
3. ***CATF Target Outcome****: Targets proposed by the CAP Community Advisory Task Force*
4. ***Timing****: Needed start and completion dates for the action*
5. ***GHG Impact****: Cumulative GHG emissions reduction effect of the action, compared to the Business-As-Planned (BAP) scenario[1], rated based on the scale below:*

Scale of Cumulative GHG Emissions Reduced			
Enabler	*Low*	*Medium*	*High*
Enables the reduction of GHG emissions	*< 1,000 ktCO2e*	*1,000-3,000 ktCO2e*	*>3,000 ktCO2e*

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[1] A BAP scenario projects the county's expected emissions levels with current policies and practices, and no policy or climate action intervention beyond what is currently planned. It includes projections for energy consumption, and emissions from transportation, industrial processes and other sources, and serves as a benchmark against which to measure the effectiveness of emissions reduction efforts. The BAP is further explained in the CAP.

6. **Co-benefits:** *Community benefits expected to occur as a result of implementing the CAP that go above and beyond the primary goal of reducing GHG emissions. The three co-benefits that stood out as most important to community members during public engagement -- equity, employment and cost-effectiveness[2] -- are described in the table below. Each action can be evaluated in part on the relative level of co-benefits it may create. Note that implementing the CAP will create co-benefits beyond these three, such as improved air quality and respiratory health, and reduced noise pollution.*

Co-benefit	Impact	Low	Medium	High
Equity: Some actions, e.g., expanding access to transit, enhance equity without additional intervention because better access for more is beneficial. Other actions, e.g., retrofits, require implementation of programs to drive benefits in a direction that builds equity, such as programs for low-income and social housing. Finally, with some actions, equity considerations and issues need to be checked at the before implementation and are listed as TBI (to be identified).	No discernible direct effect, but positive outcomes may occur in concert with other actions	Without intervention, may favor some groups or create greater disparity between equity-denied and other sections of the population	Likely to be implemented in the community fairly, but existing groups with power may still be at an advantage	Contributes to equity
Employment: based on statistical data for employment factors. Although an action may be rated low based on jobs per million dollars invested, the actual number of jobs may be quite high due to the scale of the investment.	Enables opportunities for people to work	0-5 person-years of work per $1 million invested	5-10 person-years of work per $1 million invested	>10 person-years of work per $1 million invested
Cost-effectiveness (CE): whether an action has a net cost to reduce emissions, breaks even, or will generate a net return. It contextualizes the cost of an action because an action may have a high cost, but also may have a high rate of return. (Some actions with a net cost contribute to the realization of other actions that may have a net return and cannot be taken out of the implementation sequence without a cascading impact.)	-	Will have a net cost	Will break even	Will have a net return/ benefit

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[2] Cost-effectiveness measures the relative efficiency of a policy, program, or intervention in achieving a specific outcome or set of outcomes by comparing the costs of different options and their respective outcomes to determine which one provides the best value for money. Cost-savings focuses on minimizing expenses without necessarily considering the outcomes or the impact on service delivery.

7. **Costs:** *Based on the upfront capital expenditure required to implement each action, above and beyond the Business-As-Planned practice, based on the scale below. Costs do not consider marginal abatement costs or the gain of the investment; these are referred to in the guide.*

Cost Scale				
$	**$$**	**$$$**	**$$$$**	**$$$$$**
<$1 million	$1 million - $100 million	$100 million - $500 million	$500 million – $1 billion	$1 billion +

8. **Metrics:** *The method and measurement unit for measuring the impact of the action taken. All metrics should be analyzed on an annual basis for those that are being actively implemented.*

9. **Implementation Mechanism:** *A brief description of the programs, initiatives, policies, and infrastructure required to implement each action, as shown in the following table.*

Mechanism	Definition
Policy	*An official policy developed by the county and approved by the Board of County Commissioners*
Program	*An ongoing effort by the County, with staff and financing to support the effort*
Initiative	*A study or project with a specific focus undertaken by the county, private sector, not-for-profit or other sectors, individually or together, that is implemented for a set time period*
Infrastructure	*Investment in physical infrastructure by the county, \ private sector, not-for-profit, or other sectors, individually or together*
Advocacy	*Speaking in favor of or recommending another level of government, agency or partner undertake an action, policy or program that reduces emissions that is within the control of that jurisdiction; or speaking against actions that will increase emissions.*
Education	*A defined opportunity to target informative communications and materials to the public, community partners, and/or other governments related to the specific rationale and benefits of implementing climate actions*

Clackamas County Climate Action Plan:

The Implementation Guide

A. Active Transportation

Active transportation is the use of human-powered types of transportation, such as walking, cycling, and using a wheelchair or other mobility aid. It is a sustainable and healthy form of transportation that can reduce air pollution, traffic congestion, and dependence on fossil fuels. It is also often coupled with transit use as a part of what's known as "multi-modal" transportation -- using more than one way to travel and moving away from relying on single-occupancy vehicles. (Transit is a separate section in this implementation plan.) Electric bikes and scooters represent an emerging opportunity at the nexus of active transportation and low-emission vehicles, with the potential to make bikes and scooters viable tools for longer distances and more uses.

Active Transportation Actions

Action	Description	CATF Target Outcome	Timing	GHG Impact	Co-Benefits	Cost	Metrics
Shift transportation from vehicles to transit, active transportation, and carpooling	**Overall:** 57% drive alone 43% non-drive alone by 2040: • 30% carpool (from 9%) • 6% walk, bike or other means (from 4.2%) • 7% transit (from 2.8%) **Urban Zones:** 44% drive alone 56% do not drive alone: • 36% carpool • 12% walk, bike or other active means • 8% transit	T3: Public transportation replaces a portion of fossil-fueled vehicle trips. T6: The energy required to transport people is reduced. T8: Active transportation replaces a portion of fossil-fueled vehicle trips.	Start: Immediately Completion: 2040	Medium	**Equity:** High **Employment:** Medium **Cost Effectiveness:** High	$$$	Number of vehicle miles traveled (VMTs)* by active modes *VMT: total annual miles of vehicle travel divided by the total population*

Active Transportation Implementation Mechanisms

Advocacy	Advocate for the expansion of light rail and the completion of light rail loops, the expansion of transit connections to and within rural communities, and increasing equitable access to frequent transit in places that create the most access for the most people.
Advocacy	Advocate for the state to adopt "Commute Options" which would apply new rules for employers in urbanized areas regarding employer-based commute option programs that would reduce greenhouse gas emissions and improve air quality.
Education	Promote use and benefits of active transportation; new routes and trails, and programs and initiatives such as the Safe Routes to School program. Host active transportation/trails days to share information and hand out promotional items such as bike bells.
Education	Use education, advocacy and promotional support to increase the number of employers that offer commute option programs and subsidized transit passes for their employees.
Infrastructure	Partner with a local transit providers to design and develop mobility hubs that includes a transit stop or transfer station, EV charging, e-bike and e-scooter rentals and charging, a carshare pick-up and drop-off location, and a carpooling lot.
Infrastructure	Fully implement the infrastructure outlined in the County's Active Transportation Plan, Bicycle Master Plan, and Pedestrian Master Plan and the recommendations resulting from the update outlined in the infrastructure recommendation on mobility hubs.
Initiative	Incentivize (or require through site plan permitting) bike/micro mobility parking and storage for new and existing multi-unit and commercial developments.
Initiative	Update the current Transportation System Plan, Active Transportation Plan, Bicycle Master Plan, and Pedestrian Master Plan with a focus on the following elements to increase active transportation rates: • Increase connectivity/safe trail, bike lane and sidewalk connections, and connections to transit stops • Increase uninterrupted, separated active transportation infrastructure • Add multi-modal access points to residences and businesses • Increase trail and sidewalk lighting • Increase end-of-trip facilities
Initiative	Promote locations (e.g. private businesses) that act as drop-off and pick-up sites for rideshare vehicles, carpooling and micro-mobility sharing services such as e-bikes and e-scooters.
Policy	Lower and phase out parking minimum requirements for new and existing developments.
Program	Use County and other public parking facilities as a drop-off and pick-up location for rideshare vehicles, carpooling and micro-mobility sharing services such as e-bikes and e-scooters.

B. Clean Heating

Clean heating refers to the use of energy sources that produce low or zero emissions to heat buildings and other structures such as solar thermal systems, geothermal systems, ground and air source heat pumps, electric (from renewable energy source) boilers, and renewable natural gas (RNG). Clean heating is considered a sustainable and environmentally friendly alternative to traditional fossil fuel-based heating systems, which can produce significant amounts of air pollution and greenhouse gas emissions.

Clean Heating Actions

Action	Description	CATF Target Outcome	Timing	GHG Impact	Co-Benefits	Cost	Metrics
Increase new and existing residential space clean heating and cooling	80% of new homes are electric by 2025 (assume 50% air / 50% ground source heat pumps) 80% of existing buildings' space heating and cooling needs are met by electric systems by 2040 (assume 90% air / 10% ground source heat pumps)	B3: Heating and cooling buildings requires less energy. Switch to non-emitting energy sources. All energy is produced by net zero emissions means.	Start: Immediately Completion: 2040	Medium	**Equity:** Low **Employment:** Medium **Cost Effectiveness:** Low	$$$$$	Number of systems replaced or installed
Increase new and existing residential clean water heating	80% of water heating in new homes is electric by 2025; 100% by 2030. 95%[3] of existing buildings' water heating needs are met by electric systems by 2040, in line with the retrofit schedule.	No related Target Outcome	Start: Immediately Completion: 2040	Medium	**Equity:** Low **Employment:** Low **Cost Effectiveness:** Low	$$$$	Number of systems replaced

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[3] The other 5% can come from RNG.

Increase new and existing non-residential space clean heating and cooling	80% of new-buildings are electric by 2025. Assume 50% air / 50% ground source heat pumps. 80% of existing buildings' space heating and cooling needs are met by electric systems by 2040. Assume 90% air / 10% ground source heat pumps.	B3: Heating and cooling buildings requires less energy. Switch to non-emitting energy sources. All energy is produced by net zero emissions means.	Start: Immediately Completion: 2040	Low	**Equity:** Low **Employment:** Low **Cost Effectiveness:** High	$	Number of systems replaced
Increase new and existing non-residential clean water heating	80% of water heating in new buildings is electric by 2025, 100% by 2030. 95[4]% of existing buildings' water heating needs are met by electric systems by 2040, in line with the retrofit schedule.	No related Target Outcome	Start: Immediately Completion: 2040	Low	**Equity:** Low **Employment:** Low **Cost Effectiveness:** Low	$$$$	Number of systems replaced

Implementation Mechanisms	
Advocacy	Advocate for adding electric water heating conversions to retrofit and incentive programs offered to residents by non-County entities.
Advocacy	Advocate for heating and cooling system conversions, including RNG, to be added to retrofit and incentive programs offered to residents by non-county entities.
Education	Educate residents on the benefits of heat pumps, including efficient air conditioning during heat waves, and address misinformation about their reliability and uses.
Education	Educate residents on the benefits of electric water heating conversions.
Education	Promote Portland General Electric (PGE) incentives to save money by saving energy (https://portlandgeneral.com/save-money).

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[4] The other 5% can come from RNG.

Education	Promote PGE heat pump incentives and on-bill financing programs for heat pumps, and upcoming state heat pump incentive program(s).
Program	Promote retrofits and incentives available to low-income households, as described in the education items above.
Program	Make space heating and cooling system conversions eligible under Property Assessed Clean Energy (PACE) program retrofits and other county-hosted incentive and rebate programs.
Program	Make water heater conversions eligible under Property Assessed Clean Energy (PACE) program retrofits and other county-hosted incentive and rebate programs.
Program	Provide incentives for the installation of heat pumps in new buildings.

C. Building Retrofits

Low-carbon building retrofits refer to the process of upgrading existing buildings to reduce the amount of energy required to heat and power the building and thereby reduce their carbon emissions. This can include a wide range of measures such as:

- Insulating walls, floors and roofs to reduce heat loss and improve thermal comfort
- Installing high-efficiency heating and cooling systems
- Replacing older windows with more energy efficient ones
- Upgrading lighting to LED or other energy-efficient options
- Installing solar panels and other renewable energy systems

Retrofitting buildings presents a significant opportunity to reduce energy consumption and GHG emissions and create local jobs. It is most cost-effective to decarbonize buildings by maximizing energy efficiency prior to adding renewables. Many programs currently retrofit one building at a time; however, in order to achieve the CAP targets, new approaches to retrofit at a larger scale will be required.

Building Retrofits Actions

Action	Description	CATF Target Outcome	Timing	GHG Impact	Co-Benefits	Cost	Metrics
Improve the energy performance of existing residential buildings	Achieve 50% thermal savings and 10% plug load[5] savings in 100% of all existing buildings.	B3: Heating and cooling buildings require less energy.	Start: Immediately Completion: 2040	Medium	**Equity:** High **Employment:** Medium **Cost Effectiveness:** Low	$$$$$	Number of homes retrofitted
Improve the energy performance of existing non-residential buildings	Achieve 50% thermal savings and 10% plug load savings in 100% of all existing buildings.	B3: Heating and cooling buildings requires less energy.	Start: Immediately Completion: 2040	Medium	**Equity:** Low **Employment:** Medium **Cost Effectiveness:** Medium	$$	Number of buildings retrofitted
Improve the energy performance of existing county buildings	Achieve 50% thermal savings and 10% plug load savings in 100% of all existing buildings.	B3: Heating and cooling buildings requires less energy.	Start: Immediately Completion: 2040	Low	**Equity:** Enabler **Employment:** Medium **Cost Effectiveness:** Low	$$	Number of buildings retrofitted

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[5] Plug load: The energy consumed by electronic devices and appliances that are plugged into electrical outlets. These devices include computers, televisions, lamps, chargers, kitchen appliances, and other electronic equipment.

Building Retrofits Implementation Mechanisms

Advocacy	Advocate the state to make home energy scores mandatory upon sale of a home.
Advocacy	Advocate the state and/or PGE to provide energy use scores on monthly utility bills with information on audits and incentives.
Education	Educate residents on energy retrofits that can be completed in their homes, the benefits of energy retrofits, qualified energy auditors and local contractors that can conduct energy retrofits, myth-busting on technologies such as heat pumps.
Education	Promote participation in Energy Trust of Oregon Industrial Equipment & Agriculture Technical Assistance & Incentive programs.
Education	Communicate and promote existing programs and incentive stacking opportunities that residents can take advantage of through state, utility, county, and other local government programs.
Education	Report on county energy retrofits, host public workshops and share information about results and payback.
Education	Promote Oregon's Rural & Agricultural Energy Audit Program to rural small businesses to increase uptake of energy audits and baselining.
Initiative	Partner with low-income housing agencies and seek funding to conduct a bulk energy retrofit pilot to retrofit several housing units at one time with minimal disruption to residents.
Initiative	Have the County apply for Rural Energy for America Program Energy Audit & Renewable Energy Development Assistance Grants to subsidize energy audits and renewable energy site assessments for small rural businesses and agricultural producers.
Initiative	Pilot sub-metering in county buildings to track energy usage by end use.
Initiative	Undertake a building retrofit and recommissioning study to identify measures for reducing energy use and develop an overall schedule for retrofits to occur in county facilities.
Initiative	Integrate the building retrofit and recommissioning study results into the county's asset management plan so replacements and cost estimates reflect energy reduction needs.
Initiative	Provide training to building permit staff so they can be ambassadors of energy efficiency incentive programs to residents applying for building permits.
Policy	Develop a revolving energy fund policy that ensures utility, operations and maintenance savings achieved from county building retrofits is reinvested into future county retrofit projects.
Policy	Amend the county's asset management policy (and budgeting and procurement policies, if necessary) to ensure building upgrades will include energy upgrades.
Program	Develop new and modify existing incentive programs to provide larger incentives for lower-income housing dwellers and individuals earning less than 80% of the average household income.

Program	Expand the county's weatherization and energy audit programs to provide residents with at least partial support if they make less than 80% of the median household income.
Program	Develop and implement a commercial Property Assessed Clean Energy (PACE) program that allows commercial building owners to access a long-term low-interest loan from the county to complete energy upgrades, and pay it back over a period of up to 20 years through increased property taxes. Develop the program so the loan stays with the building rather than the owner (so the current owner receiving the benefits of the upgrades is bearing the costs), drawing from examples in Deschutes County and Multnomah County.
Program	Participate in energy benchmarking initiatives, and annually update energy-use and emissions for each county facility.
Program	Develop and implement a residential Property Assessed Clean Energy (PACE) program that allows homeowners to access a long-term low-interest loan from the county to complete energy upgrades, and pay it back over a period of up to 20 years through increased property taxes. Develop the program so the loan stays with the home rather than the homeowner (so the current homeowner receiving the benefits of the upgrades is bearing the costs), drawing from examples in Deschutes County and Multnomah County.
Program	Develop a split-incentive that benefits both tenants and building owners to encourage more energy retrofits in tenant-occupied housing.

D. New Building Performance

Low-carbon new building performance refers to a new building designed and constructed to consume low levels of energy and generate low levels of greenhouse gas emissions throughout its lifecycle. This can be achieved through various techniques such as:

- Designing the building to maximize natural light and ventilation
- Using energy-efficient materials and equipment
- Incorporating renewable energy systems such as solar panels or wind turbines
- Choosing a location that is close to public transportation and other amenities
- Incorporating green roofs, rainwater harvesting and greywater recycling systems
- Applying, where appropriate: Passive house standards, LEED[6], BREEAM[7], WELL[8] building standards

A new low-carbon building is expected to have low energy consumption, low emissions, and high indoor air quality and thermal comfort, with a positive impact on the people that use it and the environment. Since buildings and building systems are long-lasting assets, choices made today will impact emissions in the county for decades to come and will either increase or decrease the burden on future generations. Increasing the proportion of low-carbon and net-zero builds over time can also prepare the workforce now for changes that will impact the whole industry by 2030. Other benefits include improved air quality and lower utility bills.

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[6] LEED (Leadership in Energy and Environmental Design) is a green building certification system that evaluates a building's overall sustainability, energy efficiency, and environmental impact such as water conservation, indoor air quality, and material use. LEED awards buildings a rating based on performance in these areas.

[7] BREEAM (Building Research Establishment Environmental Assessment Method) is similar to LEED, but originating in the UK. It assesses a building's environmental, social, and economic performance across several categories, such as energy use, water efficiency, and waste management. Based on the building's performance in these categories, it is awarded a rating from Pass to Outstanding.

[8] WELL Building Standard is a certification system focused on human health and well-being within the built environment. It assesses a building's design, operations, and policies based on various aspects, such as air quality, water quality, and lighting, to ensure the occupants' health, comfort, and overall well-being are considered and optimized.

New Building Performance Actions

Action	Description	CATF Target Outcome	Timing	GHG Impact	Co-Benefits	Cost	Metrics
Improve the energy performance of new residential buildings	All new buildings are net-zero energy ready by 2030 - meet thermal net-zero energy standards (4.75 MBTU/ft2) by 2030, adoption increases linearly[9] to 2030.	B1: New buildings are built to a net zero emissions standard.	Start: Immediately Completion: 2030	Medium	**Equity:** Low **Employment:** Medium **Cost Effectiveness:** High	$$$$	Energy intensity [10] of new buildings (MBTU/ft 2)
Improve the energy performance of new institutional, commercial and industrial buildings	All new buildings are net-zero energy ready by 2030 - meet thermal net-zero energy standards (7.92 MBTU/ft2) by 2030, adoption increases linearly to 2030.	B1: New buildings are built to a net zero emissions standard.	Start: Immediately Completion: 2030	Medium	**Equity:** Low **Employment:** Medium **Cost Effectiveness:** High	$$$	Energy intensity of new buildings (MBTU/ft 2)
Improve the energy performance of new county buildings	New county facilities are built with a carbon neutral strategy by 2023. All new buildings are net-zero energy-ready by 2030 (meet thermal net-zero energy standards (7.92 MBTU /ft2) by 2030)	B1: New buildings are built to a net zero emissions standard.	Start: Immediately Completion: 2030	Low	**Equity:** Facilitator **Employment:** Medium **Cost Effectiveness:** High	$$	Energy intensity of new buildings (MBTU/ft 2)

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[9] Adoption increases linearly: the rate of adoption or acceptance of a new concept, technology, or practice grows at a consistent, steady pace over time. In a linear growth pattern, the increase in adoption happens at a constant rate, forming a straight line when plotted on a graph. This contrasts with exponential growth, where the rate of adoption accelerates over time, forming a curve on the graph.

[10] Energy intensity of new buildings: the amount of energy consumed per unit area (usually per square meter or square foot) in a newly constructed building, used to evaluate the energy performance of a building and compare it to other buildings or established benchmarks. Buildings with lower energy intensity are considered more energy-efficient, as they consume less energy for their size. Energy intensity can be influenced by factors such as building design, construction materials, insulation, heating and cooling systems, and the use of energy-efficient appliances and lighting. Reducing energy intensity in new buildings is a crucial aspect of sustainable development and climate change mitigation strategies.

New Building Performance Implementation Mechanisms

Advocacy	Advocate for training and micro-credential programs for skilled tradespeople to increase their knowledge and skills around energy-efficient building practices.
Advocacy	Advocate for building code advancement at the state level and support the ability to require extending the Oregon Reach Code to county governments.
Education	Report on county high-efficiency builds, host public workshops, and share information about results and payback.
Education	Promote the use of Energy Efficient mortgages offered through Energy Star and the federal government, which allow borrowers to purchase or refinance a home that is already energy efficient (such as an ENERGY STAR certified home) or finance energy efficient improvements to an existing home.
Policy	Develop a tiered green building standard and require developers to submit site plans that meet a threshold energy score, and provide financial and non-financial incentives to support them to build to those standards, in particular, for Multi-Unit Residential Buildings (MURBs), provide a density bonus and expedited permits; for commercial buildings, provided expedited permits.
Policy	Adopt a policy that commits the county to completing a carbon neutral strategy for each new county facility.
Policy	Adopt a policy that commits the county to constructing all new county facilities to meet thermal net-zero energy standards of 25 kWh/m2 by 2030.
Policy	Develop a Sustainable Procurement Policy that supports the county's new build commitments.

E. Low Emission Vehicles (LEVs)

LEVs produce lower levels of emissions, and are considered a sustainable and environmentally friendly alternative to traditional gasoline and diesel vehicles which can produce significant amounts of air pollution and greenhouse gas emissions. LEVs include:

- Electric vehicles (EVs) powered by electricity that produce zero emissions at the tailpipe, powered by batteries recharged through the electric grid or by fuel cells that convert hydrogen into electricity.
- Hybrid electric vehicles (HEVs) with both a gasoline engine and an electric motor that can run on either power source or a combination of both, and typically produce lower emissions than traditional gasoline-powered vehicles.
- Plug-in hybrid electric vehicles (PHEVs), similar to HEVs, but with a larger battery that can be recharged through the electric grid. They can run on electricity for shorter distances, and typically produce lower emissions than traditional gasoline-powered vehicles.
- Fuel cell vehicles (FCVs) run on hydrogen fuel cells that convert hydrogen into electricity to power the vehicle and produce only water vapor as emissions.

Low Emission Vehicles Actions

Action	Description	CATF Target Outcome	Timing	GHG Impact	Co-Benefits	Cost	Metrics
Electrify county fleet	100% of new light and medium duty vehicles and equipment purchased for county operations will be zero emissions by 2030, and 100% of light duty vehicles in service will be zero emissions by 2035. 100% of new heavy duty vehicles and equipment purchased for the county will be zero emissions by 2035; 100% of heavy duty vehicles in service will be zero emissions by 2040.	T4: The county's transportation activities produce net-zero emissions.	Start: Immediately Completion: 2040	Low	**Equity:** Enabler **Employment:** Low **Cost Effectiveness:** High	$$	Number of electric vehicles in county fleet

Support low emission personal vehicles	50% of new personal vehicles sold in Clackamas County are zero emission vehicles by 2030, 90% by 2035, and 100% by 2040. 100% of registered vehicles are zero emission by 2050.	T2: Emissions from transporting people are eliminated.	Start: Immediately Completion: 2050	High	**Equity:** Low **Employment:** Low **Cost Effectiveness:** High	$	Electric vehicle sales Number of EV charging stations
Support low emission commercial use vehicles	50% of heavy-duty vehicles sold in Clackamas County are zero emission vehicles by 2035, and 90% by 2040. 100% of registered vehicles are zero emission by 2050.	T4: The county's transportation activities produce net-zero emissions.	Start: Immediately Completion: 2050	High	**Equity:** Low **Employment:** Low **Cost Effectiveness:** High	$$$$	Electric vehicle sales Number of EV charging stations
Electrify last mile delivered	Transfer 10% of heavy/medium duty vehicle miles traveled to light duty/electric micro-mobility in urban areas by 2035	T7: Reduce all emissions and eliminate tailpipe emissions from freight.	Start: Immediately Completion: 2035	Low	**Equity:** Low **Employment:** Medium **Cost Effectiveness:** High	$	VMTs delivered by light duty vehicles
Encourage work From home	12% of potential commutes are replaced with telework by 2025.	T2: Emissions from transporting people are eliminated.	Start: Immediately Completion: 2025	Low	**Equity:** High **Employment:** N/A **Cost Effectiveness:** High	$	Number of jobs able to work from home

Low Emission Vehicles Implementation Mechanisms

Advocacy	Advocate for the implementation of recommendations made by the multi-state Zero Emission Vehicle (ZEV) Deployment Support Task Force to increase the supply of ZEVs and charging infrastructure.
Advocacy	Advocate for a rule similar to the Clean Truck Rule 2021 that applies to agricultural, forestry, and off-road vehicles, and accompanying incentives.
Advocacy	Advocate for the enforcement of the Clean Truck Rule 2021, the enhancement of the Advanced Clean Truck rule as technology evolves and the market expands, and the further development of the multi-state Medium- and Heavy-Duty Zero Emission Vehicle (ZEV) Deployment Support Task Force.
Advocacy	Advocate for implementation of the emissions reduction target set out by the Air Transport Association: • 5% decrease in emissions from Sustainable Aviation Fuel; • 13% reduction from new technologies, electric, and hydrogen; • 3% from operational efficiency; and • 19% from offsets.
Education	Offer an education program for dealerships that sell EVs that allows them to educate potential clients on the benefits of EVs and the availability of incentives. Promote dealerships that have participated.
Education	Develop an education and promotion campaign on the benefits of working from home and hybrid working, while also promoting the ways people can still support local businesses and the local economy.
Education	Promote and share information about electric vehicle incentives from the Federal Tax Credit, Oregon Clean Vehicle Rebate, Oregon Charge Ahead Rebate, and multi-unit residential and commercial electric vehicle infrastructure rebates and residential rebates from Portland General Electric.
Education	Educate commercial fleet owners on and promote their participation in PGE's Fleet Partner Program to receive advice and guidance on fleet decarbonization and potential incentives for EV chargers.
Infrastructure	Purchase zero emissions equipment and machinery for county operations as they become available, as a pilot/demonstration, and share feedback with the public.
Infrastructure	Install rapid charging stations in commercial and business districts with frequent high deliveries.

Initiative	Complete a county fleet optimization study to: ● ensure that future vehicle purchases are right-sized for the tasks they are required for ● investigate the efficiency of vehicle sharing and sign-out programs for county staff ● investigate the efficiency of staging county fleet vehicles at different locations for access by staff ● investigate the potential energy-use and emissions reductions associated with installing technology to monitor driver behavior and reduce idling
Initiative	Develop and implement a Green Fleet and/or Alternative Fuel Fleet Strategy/Roadmap that aligns with the Green Fleet and/or Alternative Fuel Fleet Policy and the modeled timeline for the county acquiring zero emissions vehicles.
Policy	Develop, adopt, and implement a policy that requires all new county operations facilities to include electrical conduit to support EV charging.
Policy	Through the site permitting process, require multi-unit residential buildings and commercial buildings/parking lots to be wired for electric vehicle charging.
Policy	Develop and adopt an anti-idling policy that includes fines for idling in commercial and business districts.
Policy	Develop, adopt, and implement a policy that requires all new publicly accessible county facilities and parking lots to include electrical conduit to support EV charging.
Policy	Develop, adopt, and implement a Green Fleet and/or Alternative Fuel Fleet Policy.
Policy	Review county's policies on remote work to: ● Allow for off-site work when in-person work is not an operational requirement ● Allow for a consolidated work week (e.g. 4 10-hour days) where operationally appropriate ● Allow for off-site work when there are inclement and extreme weather days Make this policy public.
Policy	Support the development of refueling stations for zero emissions medium and heavy-duty vehicles through zoning ordinances.
Policy	Develop policy that makes rules surrounding micro mobility usage clear, and publicize the policy and the county's openness to micro mobility delivery solutions.
Policy	Develop and adopt zoning ordinances that limit and prohibit the development of new gas stations that sell gasoline and non-renewable diesel, and support the development of alternative fueling stations.
Program	Participate in PGE's Fleet Partner Program to receive advice and guidance on fleet decarbonization and potential incentives for EV chargers. (Note: this may partially or completely fulfill the action noted above.)
Program	Register the county for the Oregon Clean Fuels Program and Advanced Crediting Program so the county can sell credit through the Oregon Fuels Reporting System and reinvest funds into fleet greening and EV infrastructure expansion.

F. Transit

Transit refers to the transportation of people and goods using public or mass transportation systems such as buses, trains, subways, trams and ferries. Public transit is typically operated by government agencies or private companies under contract to the government. The goal of transit is to provide efficient, affordable, and accessible transportation to the public. It can help reduce traffic congestion, air pollution, and dependence on fossil fuels, while promoting economic development and improving access to jobs, education, and other opportunities. The various types of transit available include:

- Bus Rapid Transit (BRT)
- Light Rail Transit (LRT)
- Heavy Rail Transit (HRT)
- Commuter Rail
- Cable Cars
- Gondola

Transit systems vary widely in size, scope, and level of service, depending on population density and transportation needs of the area served.

Transit Actions

Action	Description	CATF Target Outcome	Timing	GHG Impact	Co-Benefits	Cost	Metrics
Support low emission transit	Beginning in 2025 all electric transit uses renewable electricity. Only zero emissions buses will be procured beginning in 2025. All transit vehicles will be zero emissions by 2040.	T5: Reduce emissions of transit operations	Start: 2025 Completion: 2040	Low	**Equity:** High **Employment:** Medium **Cost Effectiveness:** High	$$$$	Number of electric transit vehicles in fleet

Transit Implementation Mechanisms

Advocacy	Advocate for all transit operators within Clackamas County to meet the modeled action target for transit electrification (in line with TriMet's decarbonization plan). Increase renewable energy use in transit operations.
Initiative	Convene/facilitate parties in discussions on transit emissions reductions.
Infrastructure	Expand high capacity transit to Oregon City, Boring/Sandy, east/west along the OR212/Sunnyside area.
Infrastructure	Connect end of MAX Orange line to Green MAX lines with high capacity transit.

G. Energy Generation

Low-carbon energy generation refers to the production of electricity or heat using energy sources that produce low levels of greenhouse gas emissions and mitigate climate change. Increasing the use of low-carbon energy sources can help improve air quality and reduce dependence on fossil fuels, which can also have a positive impact on public health.

Renewable energy sources are considered the most sustainable and environmentally friendly option, as they produce little to no emissions and do not rely on finite fossil fuel resources. Renewable energy generation makes a significant contribution to GHG reduction. It can take many forms, but all shifts to renewable energy require drastic changes that are challenging to scale to meet current energy demand. These sources include renewable energy sources such as solar, wind, hydro, tidal, geothermal and renewable natural gas (RNG).

- Renewable natural gas (RNG): a type of natural gas produced through anaerobic digestion from renewable resources, such as organic waste from landfills, sewage treatment plants, and agricultural operations. It is considered a low-carbon energy source because it is produced from organic matter that would otherwise decompose and release methane, a potent greenhouse gas, into the atmosphere. It also can displace fossil fuel-based natural gas and reduce the overall greenhouse gas emissions.
- Solar energy: produced by capturing sunlight and converting it into electricity, primarily by using solar panels, which contain photovoltaic (PV) cells. When sunlight hits the PV cells, it excites the electrons inside, creating an electric current.

- Wind energy: produced by harnessing the natural movement of air to generate electricity. Wind turbines -- tall structures with rotating blades -- capture the wind's kinetic energy. Wind pushes the turbine blades, causing them to spin, and the spinning motion is connected to a generator that converts the mechanical energy into electricity.
- Hydro energy, also known as hydropower: produced by harnessing the power of flowing water typically by building a dam or a barrier across a river to create a reservoir of water behind it. When the water is released through the dam, it flows over turbines, causing them to spin, and the spinning motion is converted into electricity by a generator.
- Tidal energy: generated by capturing the power of ocean tides. Tides create a flow of water that can be harnessed to produce electricity using devices such as underwater turbines, which spin as water flows through them, or by building tidal barrages that create a difference in water levels and generate electricity when water is released through turbines.
- Geothermal energy: produced by harnessing the natural heat from the Earth's core, which is generated by the radioactive decay of elements within the Earth and gets stored in underground reservoirs of hot water and steam. Geothermal power plants drill deep wells into the ground to access these reservoirs and bring the hot water or steam to the surface, where it is used to drive turbines and generate electricity.

Energy Generation Actions

Action	Description	CATF Target Outcome	Timing	GHG Impact	Co-Benefits	Cost	Metrics
Adopt RNG	All natural gas is carbon neutral (via RNG or offsets) by 2035 and fossil-free (no fossil fuel natural gas) after 2050.	E4: Switch to non-emitting energy sources. All energy is produced by net zero emissions means.	Start: Immediately Completion: 2050	High	**Equity:** Low **Employment:** N/A **Cost Effectiveness:** Low	N/A	Amount of natural gas converted to RNG

Adopt new residential rooftop solar	Achieve 50% thermal savings and 10% plug load savings in 100% of all existing buildings by 2040.	E4: Switch to non-emitting energy sources. All energy is produced by net zero emissions means.	Start: Immediately Completion: 2035	Low	**Equity:** Low **Employment:** Low **Cost Effectiveness:** Low	$$$$	Amount of solar installed
Adopt new county rooftop solar	100% of new county facilities include solar photovoltaic (PV) by 2035. 50% of existing county facilities include solar PV by 2050 and battery storage.	E4: Switch to non-emitting energy sources. All energy is produced by net zero emissions means.	Start: Immediately Completion: 2050	Low	**Equity:** Enabler **Employment:** Low **Cost Effectiveness:** Low	$$$	Amount of solar installed
Procure green electricity	30% of residential and business customers purchase carbon-free electricity by 2025.	E2: Energy required for county operations produces net zero emissions. E5: Renewable energy is produced and used locally to the highest degree possible. E6: Energy provided is in dynamic response to demand.	Start: Immediately Completion: 2025	Low	**Equity:** Low **Employment:** N/A **Cost Effectiveness:** Low	N/A	Amount of green electricity purchased

Energy Generation Actions Implementation Mechanisms

Advocacy	Advocate for the implementation of HB 2021.
Advocacy	Advocate for the state to intervene to make it attractive for RNG companies to use locally-sourced RNG in Oregon.
Education	Promote the Solar Within Reach program to low and middle income homeowners to receive rebates for residential solar PV.
Education	Promote Oregon's Solar + Storage Rebate Program to residents, contractors and low-income service providers.
Education	Educate the community on the benefits of community energy and Renewable Energy Credit purchase programs available through PGE.
Education	Develop community education materials on the benefits of solar PV and storage, and address myths about the technologies.
Infrastructure	Upgrade infrastructure to implement the RNG policy.
Initiative	Work with PGE to involve individuals earning low incomes in future program design.
Initiative	Convene PGE and local businesses to explore a program for businesses to sponsor green energy use in low income communities.
Initiative	Undertake a study to explore local generation and distributed energy resources (micro-grid, district energy) opportunities, especially those that are supported through grant programs, can provide access to non-emitting energy for low income residents, and have a minimal impact on the environment, indigenous territories, and human health.
Initiative	Develop and implement a County Solar Strategy/Roadmap that aligns with the County Solar Policy and the modeled timeline for the county adding solar to new and existing facilities.
Initiative	Engage the community on ground mount and community scale solar, explore future opportunities to create a Rural Renewable Energy Development (RRED) zone, add ground mount solar outside the urban growth boundary, and explore opportunities for the county or landowners to utilize the Rural Renewable Energy Development Zones tax exemption.
Initiative	Study the county's ability to further incentivize solar and battery storage for new buildings, and ensure low-income service providers are part of the engagement process.
Policy	Develop and adopt a County Solar Policy to add solar to all new county-owned buildings.
Policy	Explore the development and adoption of a clean energy tariff ordinance that makes renewable energy opt out rather than opt in for residents and commercial energy customers.
Policy	Create a policy to use all renewable natural gas sources controlled by the County (e.g. bio-methane from wastewater treatment).

H. Waste and Wastewater

Waste and wastewater refer to the materials and liquids generated by human activities such as household, industrial, and commercial operations.

- Waste: Solid materials that are discarded as unwanted, such as garbage, paper, plastics, metal, and glass. The management of waste includes collection, transportation, treatment, and disposal through methods such as recycling, composting, incineration and landfilling. The goal of waste management is to reduce the amount of waste sent to landfills, minimize the environmental impact of waste disposal, and recover valuable resources from the waste stream. More broadly, the goal of sustainable materials management and consumption shifts is to reduce the amount of carbon emissions tied to the production, use and waste of products.

- Wastewater: The liquid by-products of human activities, such as sewage and industrial effluent, which is typically collected and transported through a network of pipes to a treatment facility. Wastewater treatment methods include physical, chemical, and biological processes. The goal of wastewater treatment is to remove pollutants and pathogens, so that the water can be safely returned to the environment or reused.

Proper management of waste and wastewater is essential for protecting public health and the environment; preventing the pollution of air, water, and soil; conserving resources, and recovering valuable materials. It can also reduce greenhouse gas emissions by focusing on three key areas: waste reduction, recycling, and proper disposal.

1. **Waste reduction**: Minimizing the amount of waste generated can lower the overall demand for new products and materials, which in turn reduces the energy and emissions associated with manufacturing and transportation.

2. **Recycling**: Recycling materials like paper, plastic, glass, and metals helps to decrease the need for extracting and processing raw materials. This conserves energy and reduces the associated emissions from resource extraction, transportation, and manufacturing processes.

3. **Proper disposal:** Organic waste, such as food scraps and yard trimmings, can release methane, a potent greenhouse gas, when they decompose in landfills. Composting these materials reduces methane emissions and creates valuable soil amendments that help store carbon in the soil. Additionally, capturing and using landfill gas (a mix of methane and carbon dioxide) as a source of energy can also help reduce greenhouse gas emissions.

Waste and Wastewater Actions

Action	Description	CATF Target Outcome	Timing	GHG Impact	Co-Benefits	Cost	Metrics
Divert organic waste	Reduce organic waste sent to landfills by 50%.	FA3: Recycling and waste prevention -- reduce/ eliminate consumption emissions upstream from landfills	Start: Immediately Completion: 2030	Low	**Equity:** High **Employment:** Medium **Cost Effectiveness:** N/A	To be costed when feasibility study conducted	Amount of waste diverted from landfill
Recover wastewater methane	Maximize RNG generation and onsite use at all Waste Water Treatment Plan (WWTP) facilities in Clackamas County where applicable. Produce renewable natural gas (and other fuels) locally from wastewater treatment.	FA1: Reduce wastewater emissions system-wide.	Start: Immediately Completion: 2030	Medium	**Equity:** N/A **Employment:** N/A **Cost Effectiveness:** Low	$$$$$	Amount of renewable natural gas generated from WWTP

Waste and Wastewater Implementation Mechanisms

Advocacy	Advocate for the continued development of extended producer responsibility programs across the state for materials with significant carbon impacts, and for education materials to be developed by the producer responsibility organizations (PROs)[11].
Advocacy	Advocate for the implementation of SB 582, the development of producer responsibility organizations packaging by 2024 and implementation of packaging-oriented extended producer responsibility programs by 2025.
Advocacy	Advocate for the implementation of recommendations made by the Oregon Truth-in-Labeling Task Force, including mandated customer-facing recyclability labels.
Education	Educate residents on food waste reduction.
Infrastructure	Maximize biomethane[12] production.
Initiative	Investigate the potential for heat capture from wastewater to utilize as on-site energy.
Program	Adopt residential and multifamily food scraps collection programs for inclusion of food waste in yard debris.

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[11] Producer responsibility organizations (PROs) support manufacturers, importers, and retailers in meeting their extended producer responsibility (EPR) obligations. EPR is a policy approach that makes producers responsible for the post-consumer management of their products, including waste management, recycling, and disposal.

[12] Renewable natural gas (RNG) and biomethane are often used interchangeably to describe the same product. Both refer to a sustainable and environmentally-friendly form of natural gas produced from organic waste material, such as agricultural waste, landfill waste, and wastewater treatment plant waste. To convert biomethane into RNG, it undergoes a purification process to remove impurities and other gases such as carbon dioxide, hydrogen sulfide, and moisture. The purified biomethane, now called RNG, has similar properties to fossil-based natural gas and can be used interchangeably in the same applications, including heating, electricity generation, and transportation fuel. The main advantage of RNG is that it's derived from renewable sources and helps reduce greenhouse gas emissions, making it a more sustainable energy option.

I. Natural Sequestration

Natural sequestration refers to the process by which carbon dioxide (CO_2) and other greenhouse gasses are naturally absorbed and stored in various carbon sinks such as oceans, soils, forests, and wetlands. These carbon sinks act as a "buffer" against the increasing levels of CO_2 in the atmosphere, helping to mitigate the effects of climate change.

- Forests act as carbon sinks by absorbing CO_2 through photosynthesis, a process in which plants convert CO_2 and water into oxygen and sugar. The carbon is stored in the trees, and other vegetation in the form of biomass.
- Wetlands and coastal ecosystems, such as seagrass beds, mangroves, and salt marshes, act as carbon sinks by absorbing and storing large amounts of carbon in soil and sediment.
- Oceans play a large role as a carbon sink by absorbing about 25% of the CO_2 emitted by human activities.

Natural sequestration can also be enhanced through conservation and restoration efforts, such as reforestation, afforestation [13], agroforestry, and sustainable land management practices. It can also be enhanced through ocean fertilization, which increases the growth of phytoplankton and other microorganisms that absorb CO_2.

Natural sequestration is considered a complementary approach to reducing greenhouse gas emissions and mitigating climate change, rather than a substitute for it, as the CO_2 emissions are still being produced and the storage capacity of natural sinks[14] is limited.

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[13] Afforestation and reforestation are both processes related to the establishment of trees in an area, but they differ in terms of the previous state of the land. Afforestation refers to the establishment of a forest or the planting of trees in an area where there were no trees before. This can be done on land that has never been forested or on land that was deforested long ago and has since been used for other purposes, such as agriculture or urban development. Reforestation, on the other hand, involves planting trees in an area that was recently deforested or had a significant reduction in forest cover. This can occur naturally through the regeneration of native tree species or through human intervention, such as planting trees to replace those that were cut down or lost due to natural disasters, logging, or other human activities.

[14] Natural sinks refer to natural systems' ability to absorb carbon from the atmosphere. For example: trees.

Natural Sequestration Actions

Action	Description	CATF Target Outcome	Timing	GHG Impact	Co-Benefits	Cost	Metrics
Conserve lands with high GHG benefits	Enroll 8,000 acres of lands with high GHG sequestration benefits into the Conservation Reserve Program (CRP) and the Agricultural Conservation Easement Program (ACEP) to reduce GHG emissions through riparian buffers, tree planting, and the conservation of wetlands and organic soils.	No Target Outcome identified.	Start: Immediately Completion: 2050	TBD	**Equity:** TBI **Employment:** TBI **Cost Effectiveness:** TBI	Out of scope for this project.	Number of acres sequestered in the CRP and ACEP. Amount of GHG emissions reduced.
Plant trees in community areas	Plant a new tree for every resident of Clackamas (418,000) in Clackamas County between 2022 and 2050 and manage using regenerative agriculture methods.	FA4: Reduce countywide emissions due to Ag/Forest activities.	Start: Immediately Completion: 2050	Low	**Equity:** TBI **Employment:** TBI **Cost Effectiveness:** TBI	Out of scope for this project.	Number of trees planted.
Increase soil sequestration	Increase sequestration in soils by promoting no-till farming, responsible fertilizer use, etc.	FA5: Increase countywide carbon storage & sequestration	Start: Immediately Completion: 2050	TBD	**Equity:** TBI **Employment:** TBI **Cost Effectiveness:** TBI	Out of scope for this project.	TBD.[15]

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[15] This action is difficult to measure, but important. A metric will be developed, going forward, that is appropriate for this action.

Natural Sequestration Implementation Mechanisms

Advocacy	Advocate for the state to implement its new goals for carbon sequestration with programs that support local government action.
Advocacy	Advocate for state funding for wetland expansion.
Advocacy	Advocate for the approval of the $5 million funding request from the Oregon Agricultural Heritage Program to the state government to be used as a match for federal dollars to implement agricultural easements with willing landowners.
Education	Encourage conservation easements to protect forests and high-value natural heritage lands.
Education	Educate residents and landowners on preserving current trees including minimizes forest fire risk.
Education	Publicly share information on how to install and maintain green infrastructure.
Education	Be a hub for information and promote agricultural practices that increase sequestration in soils.
Education	Promote the Conservation Reserve Program and the Agricultural Conservation Easement Program to landowners and other conservation easements.
Initiative	Develop an urban forest management strategy with recommendations on the following: - Meeting the canopy cover target and number of trees planted, focusing on both individual plantings (street trees) and opportunities to create new rural and urban forests - Identifying trees resilient to expected changes in climate, and build resilience through diversified plantings throughout the county - Maintaining a county-wide tree inventory, and monitoring and tracking tree conditions - Introducing improved soil standards for new county plantings - Monitoring for and managing climate-related risks to trees such as diseases, pests, and heat stress, and identifying the introduced species that can be planted to maintain canopy targets, as well as ways to manage habitat loss for birds and animals reliant on current tree species in the county - Identifying roles for the county, local organizations, and citizen scientists, including considering a collaborative tree monitoring program throughout the community
Initiative	Host community tree planting events and utilize the events to disseminate information about green infrastructure.

Initiative	Develop a strategy for the county to conserve forests and high natural heritage value lands.
Initiative	Plant trees alongside trails, sidewalks, and outdoor sports fields/facilities to provide cooling benefits.
Initiative	Increase planting around creeks to maintain creek temperatures.
Initiative	Assess the health of wetlands within the county and develop restoration plans.
Initiative	Assess current canopy cover in the county, as a whole and separately in more and less developed areas, and with an equity lens (e.g. are there vulnerable communities with less canopy cover that could lead to increased heat risk?).
Initiative	Assess the need/ability for the County to purchase additional lands for tree planting.
Initiative	Add conserved land data/mapping to the County's website/open data and actively reach out to partners and stakeholders to share information.
Policy	Strengthen policy-based protection of natural heritage systems, woodlands, and floodplain areas from development, and utilize zoning ordinances to create and maintain connected natural heritage systems.
Policy	Develop policies to maintain existing tree canopy coverage.
Policy	Develop policies to require enhanced wetland, marsh and riparian buffer areas.
Policy	Set a county-wide canopy cover target of at least 40% and an overall natural cover target that includes wetlands and tall grass of 60%.
Policy	Update standards for green space access and tree planting to address climate change in new developments and determine the funding structure (i.e., co-pay by the county and developers).
Policy	Update standards for tree planting on new private developments to incorporate climate-based targets.
Program	Increase tree management to help young trees thrive in a changing climate. For example, increase watering, add watering bags/gators to street trees and educate property owners on proper care, assist the migration of native trees to areas where they are more likely to survive.
Program	Develop educational materials and a support program to encourage tree buffers for soil protection on agricultural lands.