

**BOARD OF SUPERVISORS
BUSINESS MEETING
INFORMATION ITEM**

SUBJECT: County Energy Strategy Update

ELECTION DISTRICT(S): Countywide

CRITICAL ACTION DATE: At the pleasure of the Board

STAFF CONTACT(S): Marc Aveni, General Services
Ernest N. Brown, General Services

PURPOSE: To update the Board of Supervisors (Board) on the status of the County Energy Strategy (Strategy) currently being developed as directed by the Board (9-0) at the Board Business Meeting on December 1, 2020. The overall vision is one of tangible contribution to achieving the goal set by the Virginia Clean Economy Act (VCEA) goals of net-zero greenhouse gas (GHG) emissions by 2045 and a carbon free grid by 2050 while ensuring energy is clean, reliable, and affordable for all residents and business in Loudoun County.

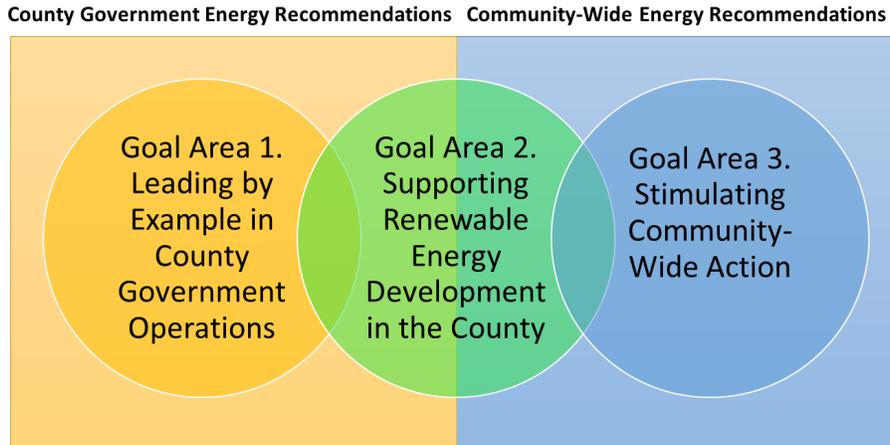
BACKGROUND: At the Board Business Meeting on December 1, 2020, the Board directed (9-0) staff to initiate actions to replace or update the existing [2009 Loudoun County Energy Strategy](#). The County hosted an [Energy Strategies Workshop](#) on September 29, 2021, to get further direction from the Board. Through a competitive procurement process, staff contracted with ICF Incorporated (ICF) to support the Strategy update. The first presentation to the Board was of a framework that laid out a vision and goals for the Strategy. The Board endorsed (6-0-3: Buffington, Kershner, and Letourneau absent) this framework at an Environmental Summit on July 29, 2022.

In addition to developing the framework for the County’s energy strategy, ICF has been working on a baseline GHG modeling assessment and projection of future impacts. ICF is also conducting ongoing sector specific analyses. This assessment has incorporated input from multiple County departments and the public and has included five meetings with the Board-appointed Environmental Commission and one public input session.

The foundation of the framework is a Strategy Vision to “Contribute to achieving Virginia’s goals of net-zero GHG emissions by 2045 and a carbon free grid by 2050 while ensuring energy is clean, reliable, and affordable for all residents and businesses in Loudoun County.” The framework incorporates three Goal Areas that cover two coordinated but distinct sets of recommendations: 1) County government leadership (i.e., Government by Example), 2) supporting renewable energy development in the County, for which government and community recommendations overlap, and

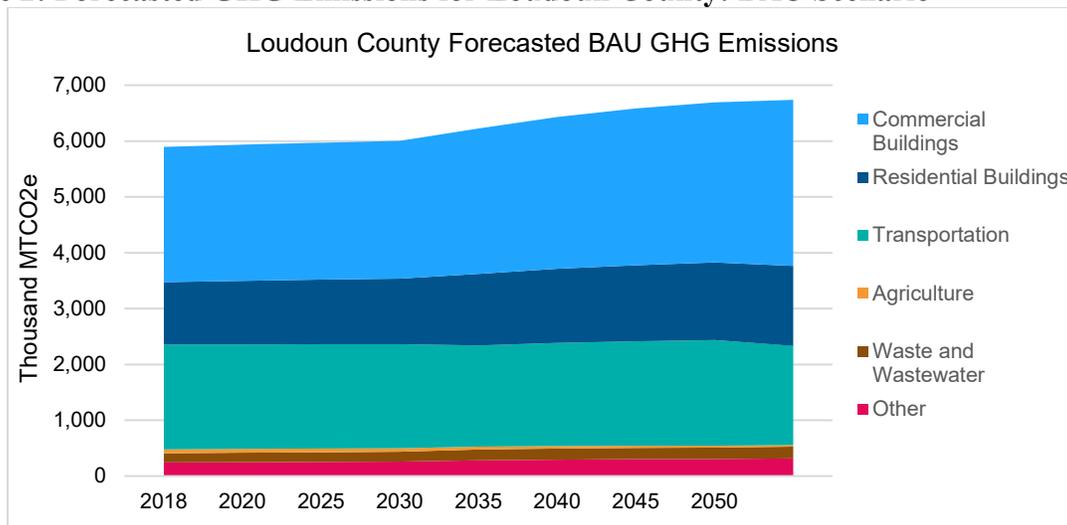
3) stimulating community-wide efforts (Figure 1). Each Goal Area in the framework contains several strategies consistent with the 2019 General Plan and examples of the types of actions that may be taken to implement those strategies.

Figure 1. County Energy Strategy Framework



ISSUES: As described in more detail in the October 4, 2022 Progress Update (Attachment 1), work to date has been further developed within the framework by more clearly defining its goals and analyzing more specific actions that may be used to achieve these goals. For Goal Areas 1 and 3, the Strategy sets some quantitative goals and uses modeling to estimate the impact that achieving these goals will have on overall GHG emissions from the Loudoun County community. The modeling begins with Business-as-Usual (BAU) scenarios to estimate the GHG emissions that would be expected if energy use in the County were to continue as is. Figure 2 shows forecasted BAU emissions from energy use in the County as a whole, starting from the GHG inventory in 2018 as reported by the Metropolitan Washington Council of Governments (MWCOG).

Figure 2: Forecasted GHG Emissions for Loudoun County: BAU Scenario



Further modeling discussed in the following sections shows results that can be accomplished if the County implements actions recommended by the Strategy. (Modeling at this stage is not final and will continue to be updated as further analysis is completed.)

The Strategy will propose several actions that the County government could consider taking to achieve these goals, both direct actions on its own operations and actions to stimulate action in the broader community. Public outreach and efforts towards energy equity within the community are also addressed in the Strategy. This Strategy is an overall road map; further implementation planning will be needed to define specific actions. Given that the Strategy targets goals intended to be accomplished over several decades, near-term actions will focus on further planning and conducting studies to identify actions that will have the most effective impact. More direct action will be phased-in as planning is complete.

Ongoing activities include further analysis of existing and future County facilities for energy sustainability, fleet, and landfill operations as well as potential efforts that could be undertaken with the business community, data centers, homeowners associations (HOAs), and transportation sectors. This will include further refinement of the quantitative analyses presented below. When the Strategy is complete, staff will return to the Board for review and approval. Any actions requiring additional resources will be addressed through the budget development process. It is anticipated that the recent availability of federal grant funds for energy sustainability efforts can be used to help offset the cost of implementation for many of these efforts in the coming years.

Goal Area 1: Leading by Example in County Government Operations

The first Goal Area is to better manage energy within the County's own facilities. Although government operations are only responsible for about 1% of the total GHG emissions in the County, by taking action to manage its own energy use, the County government can both have a direct impact on GHG emissions and can also set an important example to encourage broader action from the community.

The Strategy for government operations proposes a high ambition goal of reducing GHG emissions by 80% by 2040 and 100% by 2050.¹ Quantitative goals are proposed in each of the five categories of actions: 1) increasing County renewable energy use; 2) increasing energy efficiency in new facility construction; 3) reducing energy use in existing facilities; 4) electrifying the County fleet; and 5) reducing emissions from the County landfill. See Table 1.

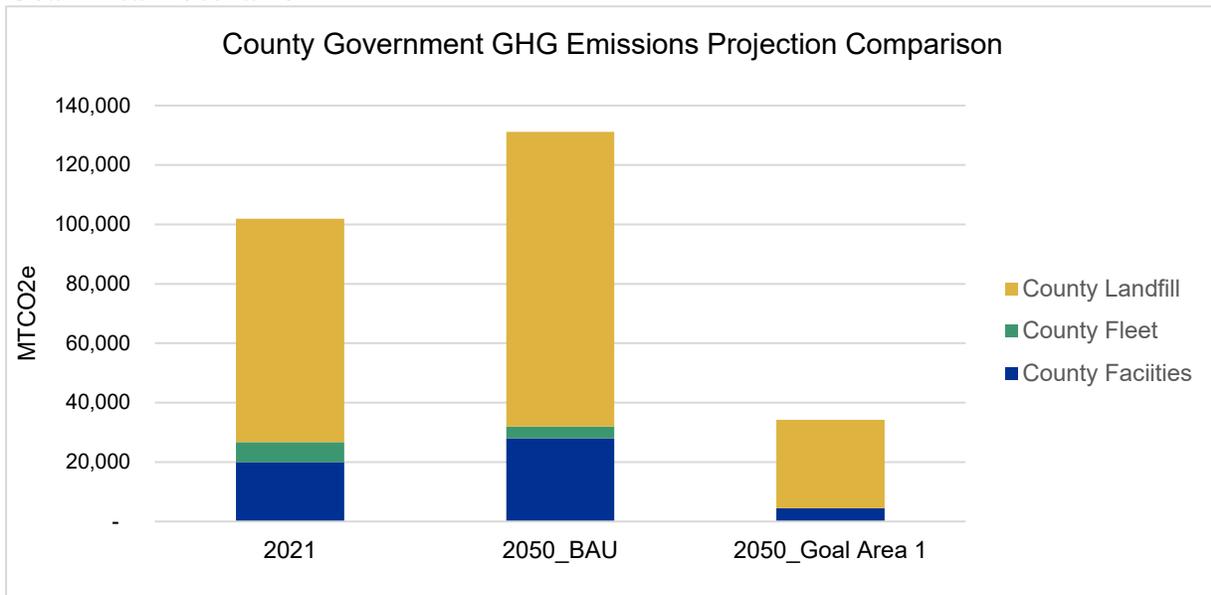
¹ Note: target to reduce overall emissions by 2050 is a **net zero** target and does not imply reaching absolute zero.

Table 1. Strategies for Reducing Emissions from County Operations (Quantitative)

Strategy	2025	2030	2040	2050
1) Decarbonize Electricity Supply ²	NA	100%	100%	100%
2) Energy Efficiency for New Construction	Building Code improvements every 6 years			
3) Energy Use Reduction at Existing Facilities	NA	25% ³	50%	50%
4) Fleet Electrification	By 2050, all vehicles in the on-road fleet are electric			
5) Solid Waste Diversion from Landfill	1% ⁴	10%	30%	70%

Initial modeling shows that meeting these goals will lead to a **total of 66% reduction of emissions from County operations by 2050**. More information about how this modeling was conducted can be found in Attachment 1. Figure 3 shows the GHG emissions for each category in 2021 as well as the projected emissions in 2050 in a BAU scenario and if the targeted goals are reached.

Figure 3. Projected GHG Emissions from County Operations in 2021 and 2050: BAU vs Goal Area 1 Scenario



² Overlaps with Goal Area 2.

³ Percent reduction of emissions from a Business-as-Usual scenario

⁴ Percent diversion of waste from a Business-as-Usual scenario

The Strategy proposes several actions that the County can take to achieve these goals. For example: using onsite solar energy at County facilities; developing a plan to guide facility retrofit plans; implementing vehicle procurement policy changes focused on electric vehicles; and diverting landfill waste by increasing composting and recycling of vegetative and food waste. See Attachment 1 for more detail about potential actions that can be taken to achieve the County’s goals. The Strategy’s action goals alone will not be sufficient to eliminate GHG emissions from County operations. Therefore, to meet a goal of 100% net zero operations, carbon offsets or other tools will be needed as well.

The County landfill represents the majority of GHG emissions from County operations due to methane emissions from organic waste decomposition. Reducing landfill emissions is a unique challenge. It presents the largest opportunity for emissions reduction from County facilities but is also distinct in that the County government does not have direct control over the waste stream. Waste disposal is undertaken by residents of the County; the government can encourage diversion and provide means to make it more accessible to residents, but any success must be implemented with participation of County residents. To that end, for reference, Figure 4b depicts the same wedge chart but without landfill emissions included, in order to provide a more accurate depiction of the magnitude of GHG reductions where the County has the most control. In this case, the need for other actions and carbon offsets is much smaller.

Goal Area 2: Supporting Renewable Energy Development in the County

This Goal Area encompasses both what the County has direct operational control over and where the County can play a role in supporting renewable development and use in the broader community. Meeting the quantitative goals in Goal Areas 1 and 3 will require access to renewable energy sources. County action can support development of these resources and reduce barriers. See Table 2 for qualitative goals.

Table 2. Strategies for Supporting Renewable Energy Development in the County (Qualitative)

Strategy	Goal
1) Facilitate clean energy development	Increased development of clean energy from site-specific to commercial scale with protection of natural resources maintained
2) Facilitate access to clean energy	Reduced barriers to adoption of clean energy by residents and businesses

Facilitating clean energy development can be done through actions such as the ongoing effort to put out a Request for Information for Alternative Energy Projects in the County. The County’s participation in the Northern Virginia Solarize program is an example of facilitating access.

Goal Area 3: Stimulating Community-Wide Action

Goal Area 3 is focused on what the County can do to support the community as a whole in advancing clean energy and reducing GHG emissions while ensuring cost effectiveness and resilience. The Strategy proposes methods to reduce community-wide emissions. Although the Strategy is not expected to formally adopt quantitative goals for targets for the community, numerical projections are used to help inform the potential benefits of some strategies. This modeling will help set priorities for additional resources and investments needed to see real reductions in emissions or energy use. Public education and energy equity are identified as specific goals in this Goal Area but are also intended to be included as considerations throughout Strategy implementation. See Table 3.

Table 3. Strategies for reducing emissions from community-wide actions (Quantitative projections and Qualitative goals)

Strategy	Projections / Goals
1) Reduce transportation emissions <ul style="list-style-type: none"> • Increase (Electric Vehicle) EV sales • Reduce Vehicle Miles Traveled (VMT) 	<ul style="list-style-type: none"> • By 2050, 100% of vehicle sales are electric • By 2050, vehicle miles traveled are down by 14%
2) Reduce residential and commercial building emissions and energy use	Moderate adoption of various technologies and retrofits including electrification, heating and air conditioning, hot water, building envelope, and lighting.
3) Provide education and public outreach	Increased awareness of sustainable energy practices and opportunities to reduce GHG emissions
4) Prioritize energy equity	Equity across all populations in access to financing, equipment, and programs for EVs, building efficiency, and renewable energy

Using assumptions described in Attachment 1, initial modeling for transportation, buildings, and solid waste results in a **total of 59% reduction of County-wide emissions by 2050** from the 2018 base year. (These are draft results; additional changes are still under consideration.) Figure 5 illustrates the change in 2050 emissions under the BAU and mitigation scenarios while Figure 6 shows the GHG emission reductions by strategy wedge.

Figure 5. Projected GHG Emissions in 2018 and 2050: BAU vs Goal Area 3 Scenarios

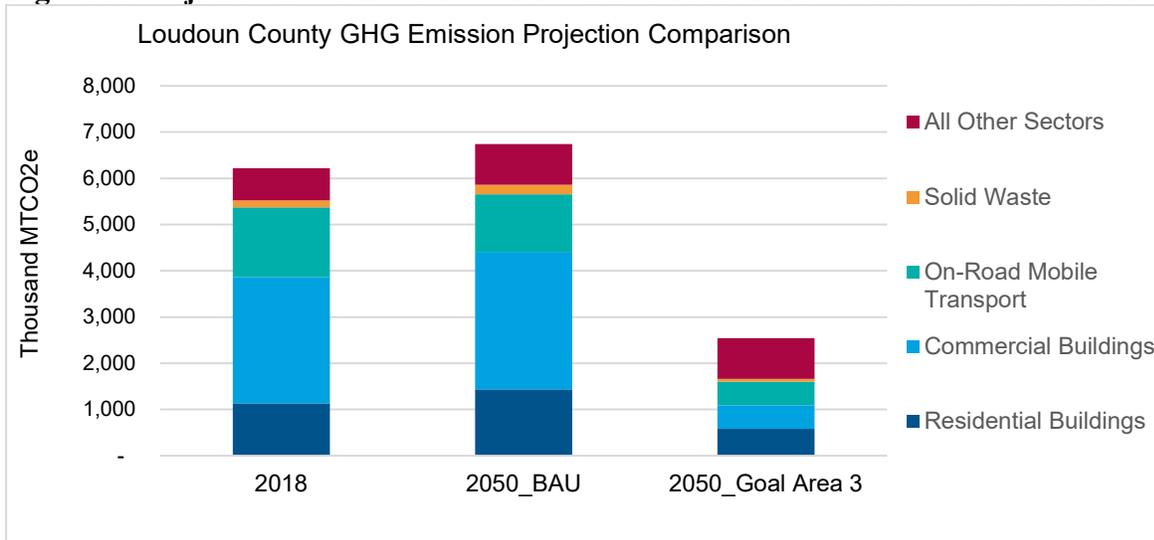
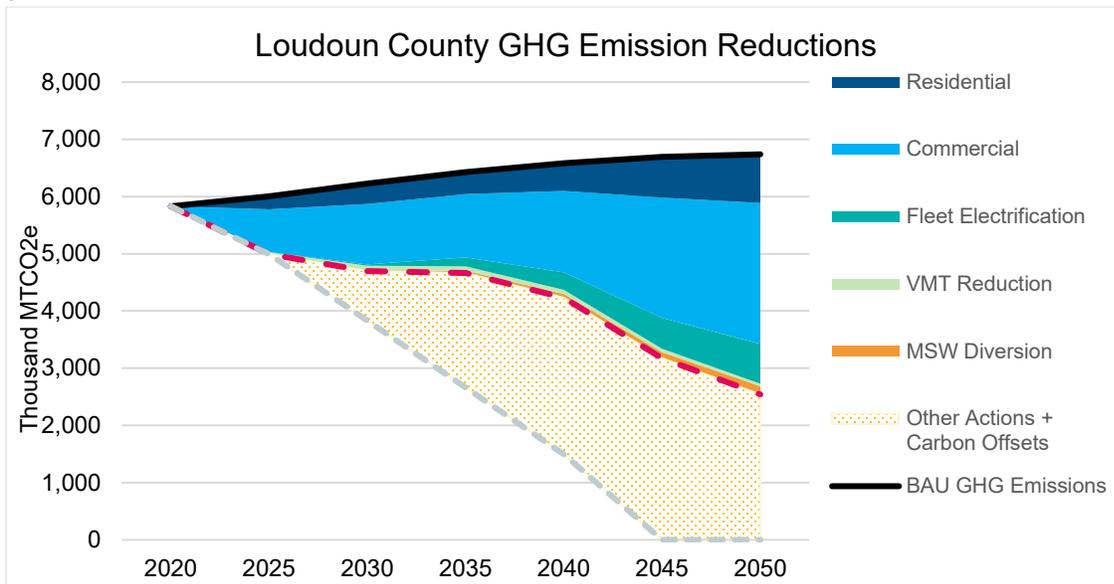


Figure 6: GHG Emissions Reductions by Sector Based on Mitigation Scenario for Goal Area 3⁵



FISCAL IMPACT: This update on staff’s progress on the County Energy Strategy does not have a fiscal impact at this time. It is expected that many of the actions to be recommended through the Strategy will have a fiscal impact. Staff will detail these impacts when the Strategy is presented to the Board.

⁵ VMT = Vehicle Miles Traveled; MSW = Municipal Solid Waste

ATTACHMENT(S):

1. County Energy Strategy Progress Update (October 4, 2022)

Loudoun County Energy Strategy: Progress Update October 4th, 2022

Energy Strategy Development Process Overview and Timeline

Purpose

The Loudoun County Energy Strategy (Energy Strategy) is an updated and comprehensive energy plan for the County government and broader community. The Strategy lays out a series of strategies and supporting actions that, when taken together, will put the County on a path to **contribute to** achieving Virginia’s goals of net-zero greenhouse gas (GHG) emissions by 2045 and a carbon free grid by 2050¹ while ensuring energy is clean, reliable, and affordable for all residents and businesses in Loudoun County. Through creating the Energy Strategy, the County is developing and deepening relationships with key stakeholders and exploring how it can best facilitate efforts in the broader community in support of this vision. **County resource requests** for the next 1-2 years will focus on the next steps in this process: developing implementation plans for each Goal Area and conducting studies for specific action areas. This document provides an update on the County’s progress in developing the Energy Strategy; it is not a draft of the Energy Strategy report.

Stakeholder Engagement

ICF kicked off the Energy Strategy project with Loudoun County in February 2022. ICF and the County met with the Environmental Commission (EC) in March 2022 to provide an overview of the project and solicit feedback on the direction of the Energy Strategy. Those conversations informed the Goal Framework, which was presented to the EC on April 27th and discussed again on May 11th. The County then held a public input session on June 29th and solicited feedback on goals, strategies, and supporting actions for the Energy Strategy through an online comment form. Throughout this time County departments were solicited for and provided feedback on the Goal Framework. The EC, the public comments, and discussions with County departments all informed the final Goal Framework.

A modeling effort to support the Energy Strategy began in May 2022, starting with the Business-as-Usual (BAU) scenario derived primarily from data from the County and the Metropolitan Washington Council of Governments (MWCOCG). Once the Goal Framework was drafted, ICF began modeling various strategies and related quantitative targets within Goal Area 1 (County government operations) and completed a draft scenario in August 2022. ICF has also started modeling strategies within Goal Area 3 (Community). Goal Area 2 (Clean Energy) overlaps Goal Areas 1 and 3 and is being examined concurrently. The County remains engaged with internal stakeholders for the Goal Area 1 modeling process (e.g., Departments of Transportation & Capital Infrastructure and General Services) as well as external stakeholders for Goal Areas 2 and 3 (e.g., Homeowners Associations, Data Center Coalition, Chamber). There is no explicit modeling process for Goal Area 2; rather, those strategies are integrated within Goal Areas 1 and 3. As the modeling process continues, the County is working to develop supporting actions and an overall Energy Strategy report.

¹ The Virginia Clean Economy Act requires 100% clean electricity by 2045 for Dominion Energy and by 2050 for Appalachian Power Company.

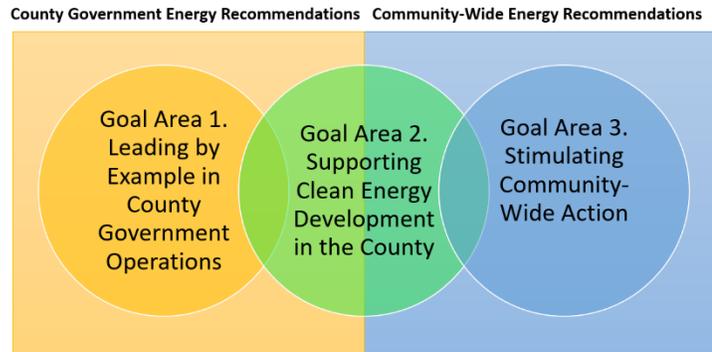
Goal Framework

Overview

Vision: Contribute to achieving Virginia’s goals of net-zero GHG emissions by 2045 and a carbon free grid by 2050 while ensuring energy is clean, reliable, and affordable for all residents and businesses in Loudoun County.

This aspirational vision will be implemented - and success measured - using a framework that incorporates three goal areas that cover two coordinated but distinct sets of recommendations:

- i) County government leadership (i.e., Government by Example) and
- ii) Community-wide efforts.



Each goal area will contain supporting actions to help the County make progress towards established goals. Where applicable, quantitative targets will be included. The final Energy Strategy will include

guiding principles for County implementation, including transparency and tracking. This will include setting up processes to measure progress for each Goal Area and creating an energy dashboard to help track progress, which may be public facing.

Goal Area 1: Leading by Example in County Government Operations

Focused on strategies and actions where the County has direct operational control.

Table 1. Strategies and Supporting Actions for Goal Area 1

Strategy	Supporting Actions
Provide transparent and accessible communications	<ul style="list-style-type: none"> • Establish a public-facing progress reporting web-based dashboard or report • Commit to regular progress updates (e.g., every three or five years) • Publicize County actions to support goal of leadership by example • Establish a County Energy Policy
Increase County renewable energy use	<ul style="list-style-type: none"> • Install onsite solar at select County facilities (including landfill) through Power Purchase Agreements (PPAs) or other methods • Use geothermal or other clean fuels energy at select facilities for heating/cooling • Explore large scale virtual PPAs to cover additional community electricity use
Increase efficiency within new and existing buildings	<ul style="list-style-type: none"> • Update the County Green Building Policy for leased/owned spaces • Develop strategic building retrofit plans for all facilities, with a focus on resiliency for critical facilities (24/7 operations) – Plans will address lighting efficiency, building envelope retrofits, heating, ventilation and air conditioning (HVAC) controls and retrofits and fuel-switching (e.g., electrification) and be supported by an existing project to perform an audit of all County facilities • Develop an overall plan to guide investment and timing for facility retrofit plans, including plans for regular and consistent building energy audits • Implement or expand automated building energy management systems where applicable • Expand building operator training & education • Strive for LEED certification/Energy Star at facilities • Exceed energy code at new facilities • Employee energy committee to promote and track energy conservation • Consider LED replacement program for County-owned streetlights • Develop County energy team (will also support renewable energy use in addition to buildings)
Reduce County fleet emissions	<ul style="list-style-type: none"> • Implement procurement policy changes focused on electric vehicles (EVs) to fully transition the fleet by 2050, focusing on non-emergency vehicles first <ul style="list-style-type: none"> ○ Non-emergency passenger vehicles have an interim goal of 100% sales by 2035, with most other vehicle categories reaching 100% ZEV sales by 2040. • Install EV chargers at County buildings for County and employee vehicles

	<ul style="list-style-type: none"> • Pilot programs for electric and clean fuel vehicles (non-emergency and emergency) • Assess feasibility of EV adoption of landfill vehicles • Provide operator training for proper use of charging equipment and maintenance
Reduce GHG emissions from County landfill	<ul style="list-style-type: none"> • Participate in Virginia Environmental Excellence Program (VEEP) at Environmental Enterprise (level E2, E3, or E4) • Mitigate GHG emissions via flaring of landfill gas (LFG) at over 98% destruction efficiency of methane (CH₄) or via beneficial use instead of flare destruction of CH₄, creating a net positive GHG reduction, e.g., direct injection of pipeline quality gas to gas main or generate electricity • Pursue credit for carbon sequestration in landfill • Divert waste from landfill disposal through: <ul style="list-style-type: none"> ○ Composting and recycling of vegetative and food waste, paper, cardboard, etc. Disincentivize disposal of items such as paper and cardboard in landfill. ○ Construction and demolition waste diversion ○ Provide a permanent full-time site for HHW collection and diversion from landfill disposal, and electronics recycling ○ Divert water treatment plant biosolids to beneficial use instead of landfill disposal ○ Ban television and electronics disposal ○ Ban disposal of food/yard waste from landfill disposal. Pilot food waste collection composting program with RFP among residents, restaurants, schools, etc.

Goal Area 2: Supporting Clean Energy Development in the County

Encompasses both what the County has direct operational control over and where the County can play a role in supporting renewable development and use in the broader community. Facilitating solar development in the County will also support the state’s solar development goals in the Virginia Clean Economy Act (VCEA).

Table 2. Strategies and Supporting Actions for Goal Area 2

Strategy	Supporting Actions
Facilitate clean energy development in the County (support VCEA)	<ul style="list-style-type: none"> • Support outreach and education with large landowners and solar developers • Study potential for development on County-owned land • Support Solarize programs at the neighborhood scale • Consider any policy changes needed (zoning, permitting, tax policy, etc.)
Facilitate access to clean energy	<ul style="list-style-type: none"> • Explore PPAs to cover addition community electricity use (e.g., data centers, HOAs) • Study potential for on-site solar on County property • Assess the potential for low carbon gases (e.g., hydrogen and RNG) within the County • Provide for municipal aggregation • Identify host sites for rooftop solar and battery storage at County facilities • Work with and promote the Northern Virginia Local Energy Alliance Program (LEAP) to accelerate community adoption of onsite renewables

Goal Area 3: Stimulating Community-wide Action

Focused on what the County can do to support the community in advancing clean energy and reducing GHG emissions while ensuring cost effectiveness and resilience. For this Goal Area in particular, the County will coordinate with the Virginia State Energy Office and work to track, understand, and take advantage of emerging and ongoing federal funding opportunities (e.g., through the Inflation Reduction Act).

Table 3. Strategies and Supporting Actions for Goal Area 3

Strategy	Supporting Actions
Reduce transportation emissions	<ul style="list-style-type: none"> • Establish an aspirational goal of 100% ZEV sales by 2050 across all on-road vehicles • Pursue funding opportunities to support public, residential and workplace charging infrastructure • Pilot program for public EV chargers • Reduce vehicle miles traveled through increasing opportunities for public transit, telework, walk-ability/micro-mobility options, transit-oriented development, etc.

<p>Reduce residential and commercial building emissions and energy use</p>	<ul style="list-style-type: none"> • Develop a green bank or connect with other existing regional or federal green bank initiatives • Develop voluntary benchmarking and disclosure or efficiency and electrification programs • Pursue funding opportunities and partnerships for energy efficiency and electrification • Develop data center-focused voluntary programs to reduce energy usage • Promote and incentivize net zero design and efficient operation • Explore case study or pilot program in partnership with the Chamber of Commerce
<p>Provide education and public outreach</p>	<ul style="list-style-type: none"> • Host roundtables and other discussions with key stakeholders • Hold webinars and provide other info to residents about programs, funding, etc. • Provide technical assistance, community events, or training programs for electric vehicles, energy efficiency and weatherization upgrades, buildings efficiency and electrification technologies, and renewable energy • Provide a clearinghouse of information to support access to individual funding, tax credits, and incentives (state and federal programs) • Establish transparent process to help guide Energy Strategy implementation • Hold annual Energy and Environment Forum for Loudoun County (per EC bylaws) • Conduct annual Environment and Energy award program • Landfill actions (Hold recycling and composting events/outreach) • Establish on-going EC communications to engage and advise on Energy Strategy implementation
<p>Prioritize energy equity</p>	<ul style="list-style-type: none"> • Ensure equity across all populations in access to financing, equipment, and programs for ZEVs, efficiency retrofit for buildings, and renewable energy • Develop metrics to reflect portion of County-supported chargers or solar installations that occur in environmental justice or disadvantaged communities • Conduct targeted outreach and education through non-traditional partnerships and channels to access and educate the diverse community in Loudoun (e.g., building owners for lower or moderate-income housing, religious organizations, schools in different communities, tables at community events)

Status

Goal Area 1: Leading by Example in County Government Operations

- High ambition, quantitative targets and supporting actions for each strategy were set by the County in coordination with various departments. The County will track progress towards meeting these targets over time.
- Draft modeling was completed in August and the County is currently working to receive feedback from various County departments and revise the modeling accordingly.
- The ambitious and aspirational target levels were selected to present an example to the rest of the community and provide opportunities for partnerships and education.

Goal Area 2: Supporting Clean Energy Development in the County

- Two strategies were identified (see Table 2) and the actions to support them are being developed based on conversations with key stakeholders and different County activities, including:
 - A survey sent out to HOAs is helping to identify barriers to on-site renewables access.
 - The County’s ongoing Request for Information (RFI) for alternative energy projects within the County aligns with the strategy to *facilitate clean energy development in the County*.
 - The initiative to explore CCAs supports the second strategy to *facilitate access to clean energy*.
 - The RFP process for a clean electricity PPA supports the strategy to *increase County renewable energy use* in Goal Area 1. The PPA is expected to be in place by Spring 2023.

Goal Area 3: Stimulating Community-wide Action

- The County is working closely with community stakeholders to develop actions for the strategies addressing GHG emissions from the energy, transportation and building sectors and to understand how the County can prioritize *energy equity* and *provide education and public outreach* in support of the other strategies.

- The County is engaged with the Data Center Coalition to find a data center to highlight their sustainability actions in the Energy Strategy Report and to partner on a future pilot project.
- The County is engaging regularly with the Chamber of Commerce to involve both large and small businesses as well as minority owned businesses towards more sustainable community wide actions.
- Expanded efforts for the transportation sector are still under development.

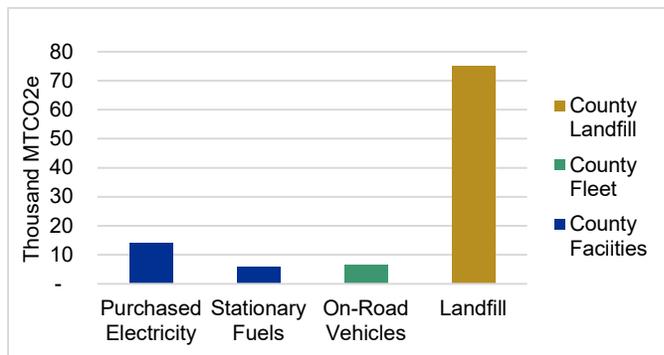
Modeling Process

While supporting actions will be identified for each strategy across the three Goal Areas, modeling is explicitly being conducted to examine the potential effect on GHG emissions and energy use for Goal Areas 1 and 3 (with overlays of Goal Area 2). Draft modeling results are available and are expected to be finalized in October 2022.

Draft Modeling Overview for Goal Area 1

ICF prepared a GHG Inventory for 2021, the selected base year for County operations. The GHG Inventory covers Scope 1 and Scope 2 emissions.² 2021 was selected as a recent year with a return to more normal operations post-COVID and to ensure data accuracy and availability. In 2021, 74% of County GHG emissions came from the County landfill, followed by 20% from County facilities and 7% from the County fleet (see Figure 1).

Figure 1: Scope 1 and Scope 2 GHG Emissions: 2021 County Operations



Based on input from County departments, ICF modeled targets within each strategy under Goal Area 1 that would drive a high level of ambition. The modeling conducted is indicative and designed to help guide the County in outlining a path towards achieving its GHG reduction goals. Using the information from the modeling exercise, the County can consider relative potential changes in GHG emissions along with real-world examples or constraints (e.g., current policy drivers or regulations, legal and acting authority) and then

work to prioritize overall investments and make decisions about how to allocate and request resources.

Table 4. Quantitative Targets Modeled for Goal Area 1

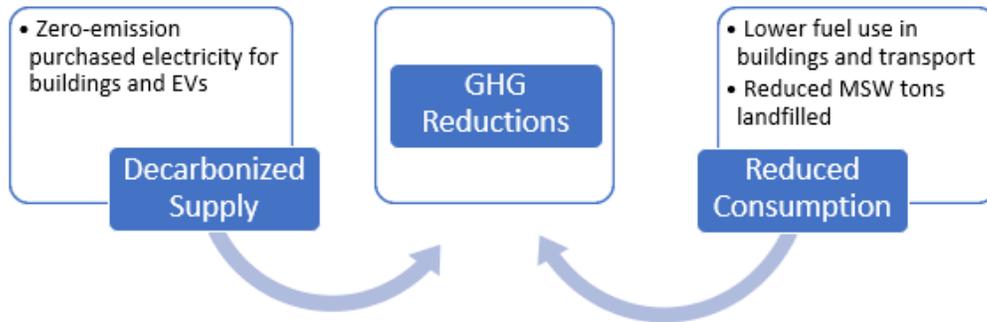
Goal Area 1 Modeled Quantitative Targets	2025	2030	2040	2050
Overall GHG Reduction (% reduction from 2021 base year)	NA	NA	80%	100%
Decarbonize Electricity Supply (<i>Overlaps with Goal Area 2</i>)	NA	100%	100%	100%
Energy Efficiency for New Construction	Code improvements every 6 years			
Energy Use Reduction – Existing Facilities (% reduction from Forecasted BAU)	NA	25%	50%	50%
100% Zero Emission Fleet	By 2050, all vehicles in the on-road fleet are zero-emission			
MSW Diversion from Landfill (% reduction from Forecasted BAU)	1%	10%	30%	70%

Note: target to reduce overall emissions by 2050 is a **net zero** target and does not imply reaching absolute zero.

² Scope 1 covers direct GHG emissions from owned or controlled sources. Scope 2 covers indirect emissions from the generation of purchased electricity, steam, heating and cooling.

The modeling conducted by ICF interacts changes in both energy supply and energy consumed to calculate overall GHG emission reductions (see Figure 2).

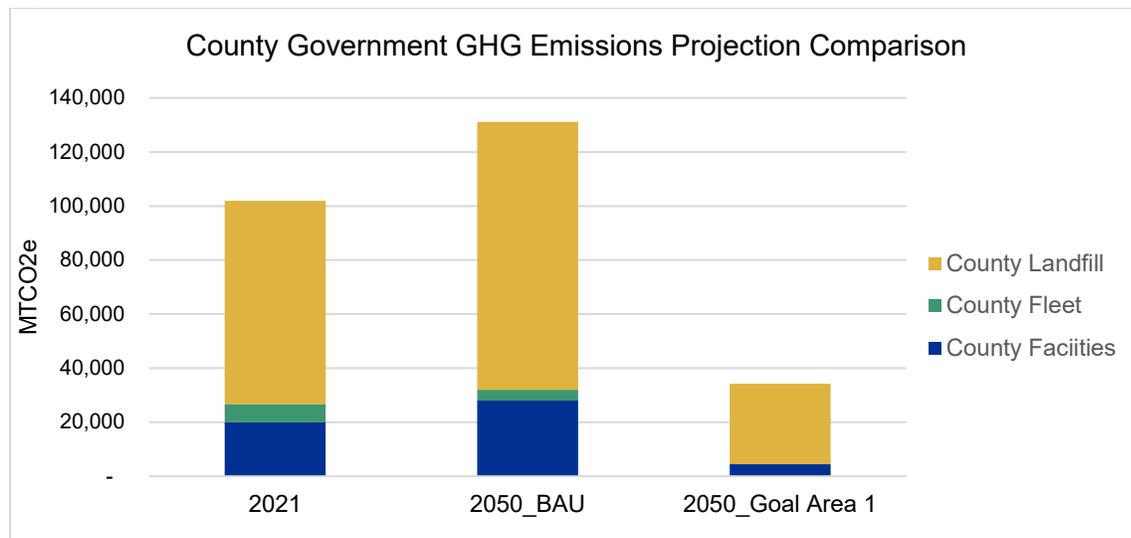
Figure 2. Example of Modeled Interactions for Energy Supply and Energy Consumed



Under a BAU scenario, GHG emissions from County government operations would increase 29% from 2021-2050. This is driven by the addition of new County facilities and increased generation of municipal solid waste due to forecasted population growth. Initial modeling of the quantitative targets outlined above for clean energy, existing buildings, new buildings, transportation, and landfill result in a **66% reduction of emissions by 2050** from the 2021 base year – a decrease from 101,946 MTCO₂e in 2021 to 34,200 MTCO₂e in 2050. Figure 3 illustrates the change in 2050 emissions under the BAU and Goal Area 1 scenarios:

- GHG emissions from the County landfill fall 60% by 2050 due to solid waste diversion.
- GHG emissions from the fleet are zero in 2050; all on-road vehicles are assumed to be zero-emission, and any electric vehicles are being charged with a continually cleaner source of electricity.
- GHG emissions from County facilities fall 78% by 2050, largely due to measures to reduce energy consumption and electrify where feasible.
- The clean electricity strategy ensures that electric vehicles and County facilities are supplied with zero-emissions electricity, a key enabler for reducing emissions.

Figure 3: GHG Emissions from County Operations in 2021 and 2050: BAU vs. Goal Area 1 Scenarios



Sector Category	2021 MTCO _{2e}	2050 Goal Area 1 Scenario MTCO _{2e}	2021-2050 % Change
County Facilities	20,018	4,476	-78%
County Fleet	6,740	-	-100%
County Landfill	75,188	29,725	-60%
Total*	101,946	34,200	-66%

*Totals may be off due to rounding.

Figure 4a below illustrates the GHG emission reductions achieved through each target in Goal Area 1 – and how far they get the County towards net zero GHG emissions by 2050. The County landfill represents the majority of GHG emissions from County operations due to methane emissions from organic waste decomposition. Waste diversion will take significant effort from the entire community and is not entirely under the operational control of the County. To that end, for reference, Figure 4b depicts the same wedge chart but without landfill included to provide a more accurate depiction of the magnitude of County operations GHG reductions where the County has the most control.

Figure 4a: GHG Emission Reductions Wedge Chart: Indicative High Ambition Goals

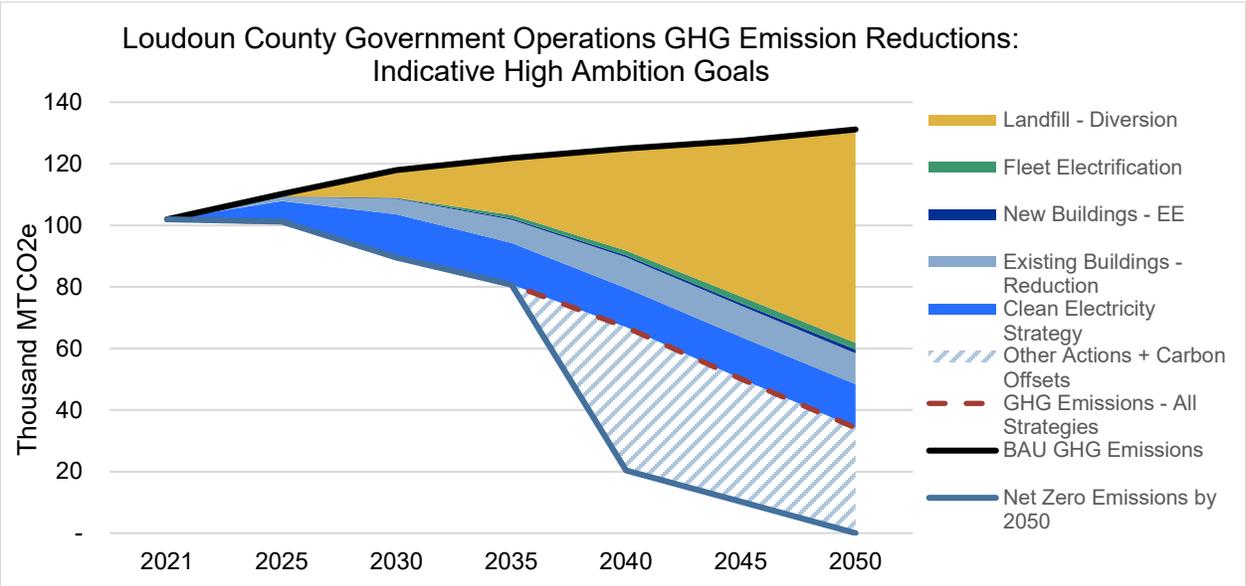
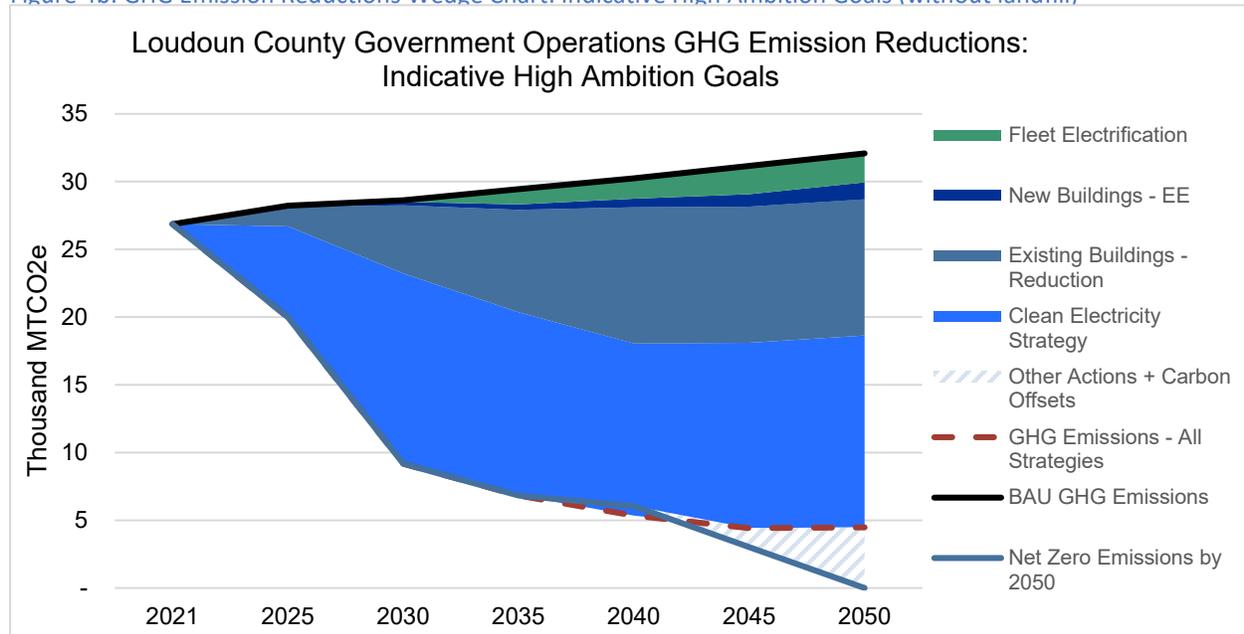


Figure 4b: GHG Emission Reductions Wedge Chart: Indicative High Ambition Goals (without landfill)



As seen in Figures 4a and 4b, the modeled targets do not result in the County achieving net zero GHG emissions in Goal Area 1 in 2050. The **Other Actions + Carbon Offsets** wedge represents the remaining reductions required to achieve net zero GHG emissions by 2050. The wedge represents the additional (not explicitly modeled at this point) actions that would need to be taken to reduce the size of this wedge in Figure 3a. Actions that are being considered to help the County reach net zero emissions for County Government operations include:

- A requirement for all County facilities to be zero-emission by 2050.
 - Modeling is underway to reflect this target by:
 - Focusing on building envelope, lighting, HVAC operations and retrofits and electrification strategies for existing facilities,
 - Targeting an all-electric building design for new County facilities starting in 2030, and
 - Decarbonizing remaining building energy supply (i.e., natural gas)
 - These additional actions would reduce GHG emissions from County facilities 100% below 2021 levels by 2050, shrinking the size of the Other Actions + Carbon Offsets wedge.
- A zero-waste goal for MSW (70-90% diversion by 2050) – *adopted a 70% level*
 - A key action that will be reflected in the Energy Strategy will be to complete a regional comprehensive alternative disposal study to evaluate medium and long-term end disposal options. The alternative disposal study would inform updates to the County’s solid waste management plan, describing actions to be taken and describing the necessary funding and resources required.
 - This is already incorporated in the modeling and therefore, it appears remaining emissions from landfill in 2050 will require the use of carbon offsets
- Obtain carbon offsets, either through purchasing them from verified projects outside the County or by getting carbon credits for sequestration projects inside the County, such as through land use changes like reforestation or alternative energy projects.

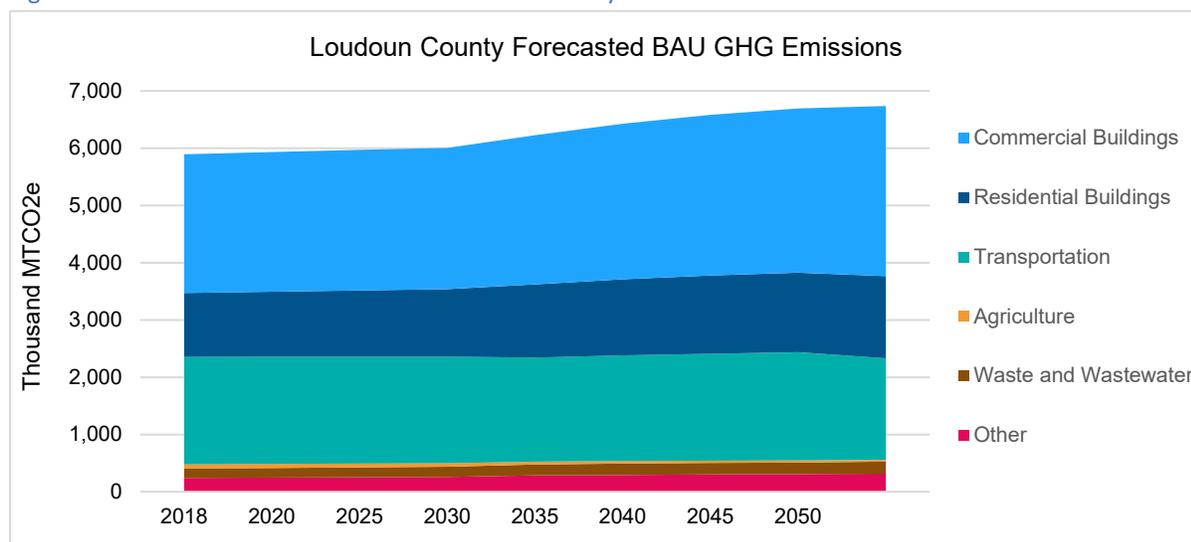
Draft Modeling Overview for Goal Area 3

ICF is conducting indicative scenario modeling for energy and GHG emissions to help inform the potential benefits of each strategy for County-wide GHG emissions and energy use. This modeling will provide General Services,

other County departments, the EC, and the public about potential additional actions that will be needed to see real reductions or changes in emissions or energy use. This can then, in turn be used to help set priorities for additional resources and investments to drive change.

As a first step in the modeling, ICF started from MWCOG GHG Inventory data for 2018, which was the most recent year available. In 2018, 44% of County GHG emissions came from commercial buildings, followed by 24% from on-road transportation, 18% from residential buildings, and 2% from solid waste. Under a BAU scenario, **GHG emissions** from the County would **increase 8% from 2018-2050** (see Figure 5).³ This increase is driven by rising energy consumption in the transportation and building sectors due to an expected growth in population leading to additional buildings and more miles driven. Energy consumption from buildings and transportation increases 23% from 2018-2050. A significant portion of the growth in energy usage is from the forecasted tripling in data center square footage by 2030.⁴

Figure 5: Forecasted GHG Emissions for Loudoun County: Business-As-Usual Scenario



The commercial sector is currently – and is projected to remain – the largest source of GHG emissions within the County. This is a result of the County being a significant hub for economic activity in Northern Virginia, and the host of one of, if not the largest, population of data centers in the country. According to the U.S. Department of Energy, data centers “are one of the most energy-intensive building types, consuming 10 to 50 times the energy per floor space of a typical commercial office building.”⁵ This modeling relies on an annual average emission factor for electricity in Virginia to calculate GHG emissions from electricity consumption from the commercial sector in Loudoun County (including data center electricity use). Many data centers in the County are taking action to offset their electricity consumption through purchases of renewable energy credits from off-site renewable generators. The County, MWCOG, and ICF do not have sufficient data to capture these voluntary corporate actions to offset their emissions from electricity consumption. Therefore, it is likely that the GHG emissions modeling conducted for Goal Area 3 overstates County commercial sector GHG emissions. Based on the understanding that many companies that own data centers have committed to significant renewable energy and climate goals, for the Energy Strategy the County is mainly focused on how it can facilitate emission reductions in other sectors, namely

³ The transportation sector in this chart includes on-road and off-road mobile emissions as well as aviation. Rail is not included. The Waste and Wastewater sector includes wastewater treatment and solid waste treatment. Agriculture includes enteric fermentation, manure management and ag soils. The Other category includes hydrofluorocarbon and refrigerant emissions as well as fugitive emissions from natural gas distribution.

⁴ All data from [2020 Fiscal Impact Committee Guidelines](#)

⁵ <https://www.energy.gov/eere/buildings/data-centers-and-servers>

on-road transportation, residential buildings, and solid waste, while also maintaining regular coordination with the Data Center Coalition.

Table 5 below shows the strategies and supporting actions for the County under Goal Area 3 that will be essential to helping achieve the overall visions for the Energy Strategy – “to contribute to achieving Virginia’s goals of net-zero greenhouse gas (GHG) emissions by 2045 and a carbon free grid by 2050 while ensuring energy is clean, reliable, and affordable for all residents and businesses in Loudoun County.” To support this vision, ICF completed indicative modeling for select strategies.

Table 5. Key Strategies and Supporting Actions for Goal Area 3

Strategy	Supporting Actions
Reduce on-road transportation emissions	<ul style="list-style-type: none"> • Pursue funding opportunities to support public, residential and workplace charging infrastructure to increase the share of electric vehicles in the County • Participate in alternative fuel production programs to support adoption of zero-emission vehicles (ZEV) • Increase public transit usage and non-motorized commuting and encourage telework to reduce VMT
Reduce residential and commercial building emissions and energy use	<ul style="list-style-type: none"> • Assess the feasibility of developing a green bank or connect with existing green bank initiatives to help provide funding opportunities to support building retrofits and rooftop solar • Develop voluntary benchmarking and disclosure or efficiency and electrification programs for the commercial sector • Promote and incentivize net zero design, electrification, and efficient operation
Provide education and public outreach	<ul style="list-style-type: none"> • Increase awareness of sustainable energy practices and opportunities to reduce GHG emissions, including County or partner programs and funding/incentive availability
Prioritize energy equity	<ul style="list-style-type: none"> • Ensure equity across all populations in access to financing or programs to reduce energy consumption and emissions • Create and track metrics for environmental justice (EJ) communities, e.g., # of households with rooftop solar, # of public chargers, # of education/outreach events held
Zero-waste	<ul style="list-style-type: none"> • Divert municipal solid waste 70% from forecasted 2050 baseline levels
Regional Coordination	<ul style="list-style-type: none"> • Coordinate with regional groups and entities to support the above strategies, including the Data Center Coalition, State Energy Office, MWCOG (e.g., regional EV infrastructure planning, Climate Energy and Environment Policy Committee (CEEP) participation), regional development of clean fuels (e.g., hydrogen hub participation)

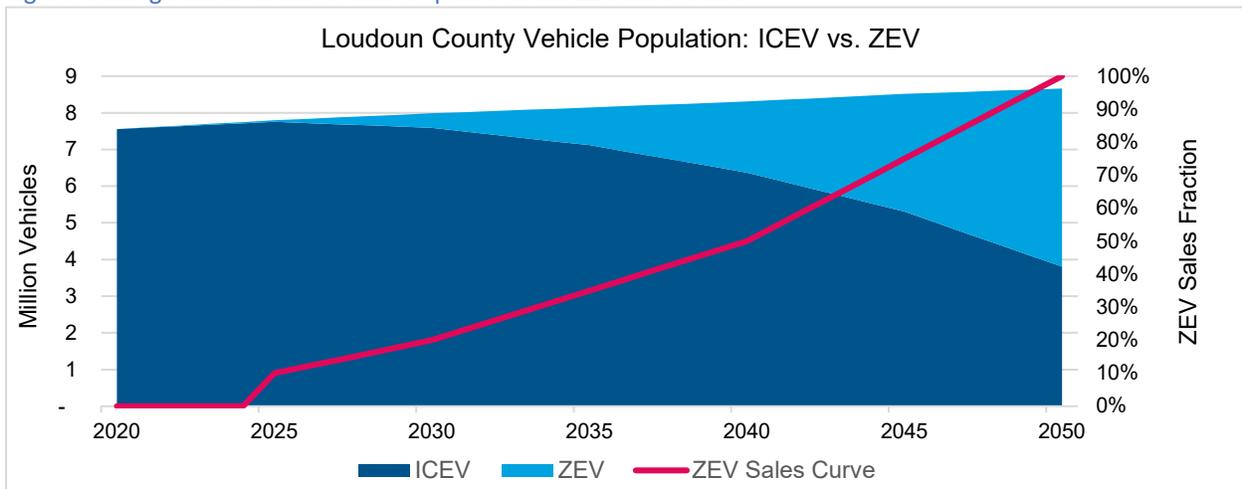
Since the County is not formally adopting quantitative targets for the community, ICF used the following approaches to approximate a scenario with moderate GHG emission reduction impacts for Goal Area 3:

Transportation:

ICF modeled two key assumptions:

1. Reduce the VMT for passenger vehicles by 14% by 2050
2. Reach 100% sales of ZEV by 2050 (see Figure 6)

Figure 6: Mitigation Scenario Vehicle Population and ZEV Sales Curve



Buildings: ICF leveraged its CO₂Sight platform to model the change in energy use that results from adopting various technologies and retrofits, including electrification, HVAC retrofits and controls, hot water/cooking, building envelope and lighting. ICF used moderate assumptions for participation curves and electrification rates.

Waste: ICF used the same approach to modeling the waste sectors as was used for Goal Area 1 by assuming a 70% diversion of MSW by 2050, but the quantity of waste in this instance is everything that is generated by the community. Goal Area 1 only focused on what was being buried in the County landfill, whereas Goal Area 3 also includes waste that is sent to other landfills.

Using these assumptions this initial modeling for transportation, buildings, and solid waste results in a **59% reduction of emissions by 2050** from the 2018 base year – a decrease from 6,216,644 MTCO₂e in 2018 to 2,541,967 MTCO₂e in 2050.

These results are still draft and under development; ICF is working with the County to consider additional changes.

Figure 7 illustrates the change in 2050 emissions under the BAU and mitigation scenarios while Figure 8 below shows the GHG emission reductions by strategy wedge.

Figure 7: GHG Emissions from Loudoun County: BAU vs. Goal Area 3 Scenarios

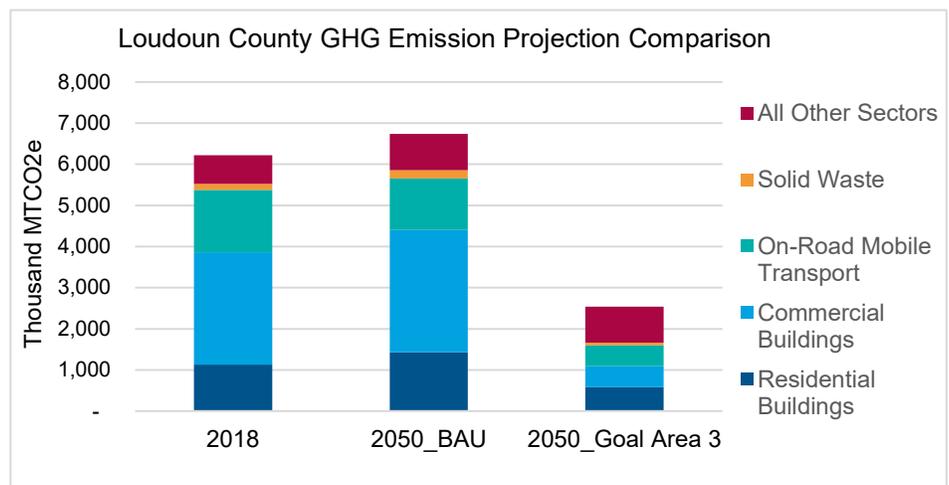
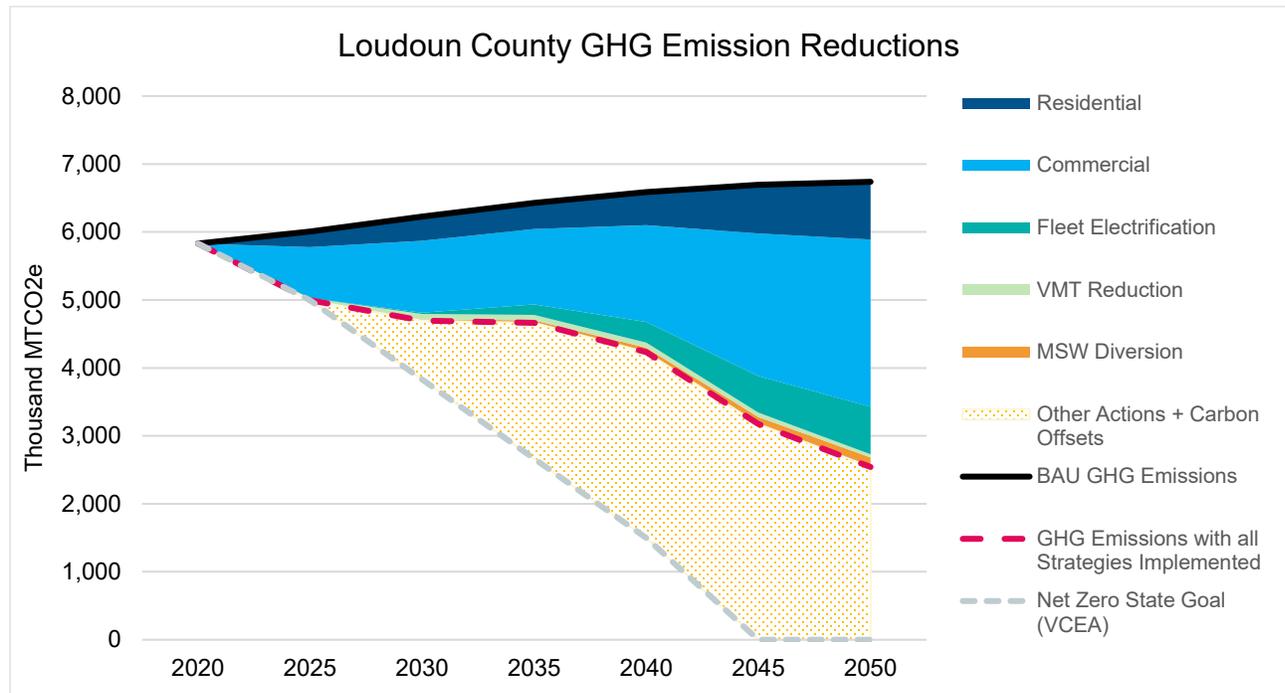


Figure 8: GHG Emission Reductions Wedge Chart: Indicative Mitigation Scenario for Goal Area 3



The assumptions used in the indicative modeling for Goal Area 3 achieve a 59% reduction in County GHG emissions in 2050 from 2018 levels. The modeling focused on reducing emissions by adopting zero-emission vehicles and reducing VMT; implementing energy efficiency and electrification measures in buildings; and diverting solid waste from landfills. These strategies led to significant reductions in GHG emissions from each sector: 72% in buildings, 66% in on-road transportation, and 59% in solid waste treatment. The reductions in on-road transportation and buildings would not have been possible without the support of strategies in Goal Area 2 to support the clean energy goals of VCEA. A decarbonized electricity supply is key to seeing a significant impact from shifting to electric vehicles and electrifying buildings. The reductions in emissions for the commercial sector are so significant because the data center electricity consumption is being powered by a clean grid in the mitigation scenario. As noted above, many companies are already taking action to supply their data centers with clean electricity, but those actions are not captured in the BAU projections.

Next Steps

The Energy Strategy is an overall road map; further implementation planning will be needed to define specific actions. Given that the Energy Strategy contains goals intended to be accomplished over several decades, near-term actions will focus on further planning and conducting studies to identify actions that will have the most effective impact. More direct action will be phased in as planning is complete.

Ongoing activities include additions refinements to the modeling efforts to Goal Areas 1 and 3, including further decarbonizing existing and future County government facilities. The County will continue engaging with stakeholders around Goal Area 3 to discuss potential efforts that could be undertaken with the business community, Data Centers, HOAs, and transportation sectors. Efforts towards energy equity within the community will also be addressed as part of Goal Area 3.

When the Energy Strategy report is complete, County staff will return to the Board for approval. Any actions requiring expenditures will be addressed through the budgetary process.

Definitions & Abbreviations

Goal Area – a framework to define three boundary areas for the Energy Strategy: the County government, clean energy development, and the entire community.

Strategy – within each Goal Area, the County has defined overarching strategies that address emission reductions for various sectors (e.g., buildings, transportation) or represent important considerations for implementation of sectoral strategies and the overall Energy Strategy itself (e.g., equity, communication, transparency).

Supporting Action – each Strategy has multiple Supporting Actions, which are the steps the County could take to realize and implement the Strategy.

Quantitative Target – a goal that the County can track and measure progress towards (e.g., sales of electric vehicles).

BAU – Business-As-Usual, a counterfactual scenario that projects energy and emissions under status quo assumptions; no additional policy change or technological advancement takes place.

EC – Loudoun County Environmental Commission

EE – Energy Efficiency

ESCO – Energy Service Company

EVSE – Electric Vehicle Supply Equipment, including charging infrastructure.

HOA – Homeowner’s Association

ICEV – Internal Combustion Engine Vehicle

LFG – Landfill Gas

MTCO_{2e} – Metric Ton of Carbon Dioxide Equivalent, a unit of measurement for GHG emissions standardized to one unit mass of carbon dioxide (CO₂), based on the global warming potential (GWP) of the gas.

Net Zero Emissions – Net zero emissions are achieved when anthropogenic emissions of greenhouse gases to the atmosphere are balanced by anthropogenic removals over a specified period

PPA – Power Purchase Agreement

RE – Renewable Energy

VMT – Vehicle Miles Traveled

ZEV – Zero Emission Vehicle, a vehicle that produces no exhaust emissions of any criteria pollutant under all possible operational modes and conditions.