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Case No. PUR-2024-00184
Sponsor: ("CITY")
Exhibit No. 47

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February 28, 2025

ELECTRONICALLY FILED
Mr. Bernard Logan, Clerk
c/o Document Control Center
State Corporation Commission
Tyler Building – First Floor
1300 East Main Street
Richmond, VA 23219

Re: Case No. PUR-2024-00184

Dear Mr. Logan,

Please find enclosed for filing in the above-referenced case the Direct Testimony and Schedules of Ryan Freed on behalf of the City of Alexandria, Virginia. Please let us know if there are any questions or concerns.

Thank you.

Sincerely,

Adam B. Winston

ABW:kap
Enclosure
cc: Service List

EXHIBIT #47

DIRECT TESTIMONY
OF
RYAN FREED

ON BEHALF OF
THE CITY OF ALEXANDRIA, VIRGINIA
BEFORE THE
STATE CORPORATION COMMISSION OF VIRGINIA
CASE NO. PUR-2024-00184

Background/Purpose of Testimony

Q. PLEASE STATE YOUR NAME, TITLE, BUSINESS ADDRESS, AND ROLE WITH THE CITY.

A. I am Ryan Freed, Climate Action Officer for the City of Alexandria (the "City"). My business address is:

301 King Street
Alexandria, VA 22314

Q. WHAT IS YOUR EDUCATION AND BACKGROUND?

A. I have been working in the energy and environmental field in various roles for about 25 years. I received my Master's in Public Administration from the University of Kansas. I began my career with the Kansas Corporation Commission ("KCC"), serving in the Energy Division, the designated state energy office for Kansas. As Director, I served a member of the KCC's management team, developed energy efficiency and renewable energy programs for the state, and advised the Commission on energy efficiency in both a policy and regulatory context. Of note during my tenure with the KCC, there was a generic docket related to energy efficiency programming and, in partnership with the regulated utilities, we developed a more-than-$30-million, on-bill financing program for energy efficiency improvements in homes, which included regulatory approval by the KCC. In my roles as the Senior Director for Policy & Regulatory Strategy at the Institute for Market Transformation, I led a team that focused on increasing

participation in regulatory proceedings by local jurisdictions and the public. Our intent was to highlight the critical role played by utility commissions and showcase the importance of city participation in proceedings. My CV is attached hereto and incorporated herein as **Schedule 1**.

Q. HOW DID YOUR EXPERIENCE AS AN ENERGY REGULATOR IN KANSAS PREPARE YOU FOR YOUR CURRENT ROLE?

A. Two of the major expectations of my role are to ensure that Alexandria residents have access to clean, reliable energy sources, and to advocate that the rates for those utilities are appropriate and fair. Utility regulation is a complex, often misunderstood process. With a keen understanding of the inner workings of Commission proceedings, and the responsibility that Commissioners and Commission Staff bear to ensure safe, reliable, efficient service to Virginians, I have the ability to provide a unique perspective that also incorporates the unique perspective of a local government stakeholder.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?

A. The City Council directed the City to participate in Dominion's 2024 IRP Proceedings because the City's environmental and clean energy policies—enshrined in the City's Environmental Action Plan 2040 (the "EAP") and Energy & Climate Change Action Plan (the "ECCAP")—substantially rely on faithful implementation of the Virginia Clean Economy Act (the "VCEA") on the part of the Commission and Dominion. The EAP and ECCAP are attached hereto and incorporated herein as **Schedule 2** and **Schedule 3**, respectively. As a matter of policy, the City has an interest in ensuring that Dominion satisfies VCEA mandates for renewable portfolio standards, emissions reductions, and demand-side management ("DSM") and energy efficiency ("EE") targets.

Dominion's 2024 IRP filing does not satisfy the legal requirements in the VCEA, is not reasonable and is not in the public interest. Dominion's 2024 IRP falls woefully short of several critical VCEA targets, and this testimony will highlight several examples of questionable methodology and other shortcomings.

But the City is not interested in simply decrying the shortcomings of the 2024 IRP. The City seeks regulatory intervention from the Commission, in the form of an Order in these proceedings which will require Dominion to collaborate with interested localities on ways to better comply with VCEA requirements in a more efficient, localized, and targeted way. This testimony will propose several possible methods of cooperation which the Commission could direct Dominion to explore and report on, in coordination with local government partners.

Specifically, the City has identified potential areas of cooperation between Dominion and the City—and other interested localities—in the area of DSM and EE programs. The availability of granular, building-specific data at the local level, if properly incorporated into Dominion's IRP modeling, could produce many synergies for Dominion and participating localities, as this testimony will explain. Cooperation with localities has the potential to increase the penetration and customer participation rates for DSM and EE programs, new or existing.

In short, Dominion is potentially leaving tremendous amounts of achievable demand reduction from EE and DSM on the table by using a modeling approach employing "generic EE" as a "theoretical assumption" of energy savings potentials.[1] There is no other way to explain the enormous delta between the Company's reported economic and achievable potentials for energy efficiency savings.[2]

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[1] *See* 2024 Integrated Resource Plan, Appendix 2A, Load Forecasting Methodologies at 9.

[2] *See Ex Parte: In the matter of establishing energy efficiency savings targets pursuant to Code §§ 56-596.2 B 3 and 56-596.2:2*, Case No. PUR-2023-00227, Virginia Electric and Power Company's Proposed Energy Efficiency Savings Target Report, Attachment 1, at 2 [hereinafter, the "EE Potential Study"].

The City further believes that even the economically viable potential for EE savings is being underestimated in Dominion's models, because it fails to consider the social costs of carbon in its economic modeling, and because it is relying on ineffective methods of customer outreach that do not take advantage of local knowledge that localities possess. The Company's true DSM and EE potential can only be realized using local data that allows for targeted, efficient spending, marketing, and prioritization. At the end of the day, most DSM and EE programs—and all of the behind-the-meter ones—require someone to install, decommission, or update some system or equipment in the real world. Leadership from public regulatory commissions—in partnership with public utilities and local governments—has historically been the only way to effect the type of change that will be necessary for Dominion to reasonably meet its VCEA obligation of a 5% downward adjustment in its forecasted demand.[3]

In cooperation with Dominion, interested localities can work towards their own clean-energy goals while assisting Dominion in meeting its own statutory obligations, in what can only be described as a win-win scenario for all parties. There are so many ways for localities and the Company to work together to achieve these goals. I am certain that my testimony only begins to scratch the surface of the partnership potential.

My testimony will support—and the City respectfully requests—a proposed Ordering Paragraph along the following lines, in accordance with what the Commission deems to be just and proper:

Accordingly, IT IS ORDERED THAT:

[3] *See* Alison Gocke, *Public Utility's Potential*, 133 YALE L.J. 2772, 2828 (2024) ("[D]rawing from the historical example of New York's natural gas transition, in some cases, using energy-law tools to address environmental law issues may be preferable to using the tools of environmental law.").

(1) Before its next IRP, as part of the Stakeholder Process mandated by the Grid Transformation and Security Act ("GTSA"), Dominion shall:

a. Within 60 days of the entry of this Order, form a Stakeholder Subgroup for Local Government Partners (the "Local Government Subgroup"), and invite all interested Virginia cities, counties, and towns in the DOM LSE to join, along with representatives from the Commission. The Local Government Subgroup shall meet with representatives of the Company at regular intervals leading up to the filing of the next IRP. Topics of discussion may include, but are not limited to:

i. The potential for data-sharing between local governments and Dominion—and incorporation of local data into DSM and EE modeling into future IRPs—to move DSM modeling away from "generic EE" and DSM assumptions, and to more accurately capture DSM and EE technical, economic, and achievable potentials.

ii. The potential for the development of energy efficiency pilot programs coordinated with local governments. The Local Government Subgroup may discuss with the Company the ability and prudence of specific, targeted programs that produce high-yield energy savings, to be modeled in future IRPs, and the potential to significantly raise customer participation rates when compared to DOM LSE-wide programs. Accord Code §§ 56-585.1(A)(5)(c) (energy efficiency pilot programs are "in the public interest"); 56-598(1)(c) (an IRP should include recommended plans aimed at "[r]educing load growth and

peak demand growth through cost-effective demand reduction programs").

iii. *The potential for Dominion's DSM and EE resources to be expanded through strategic provisions in Mutual Aid Agreements related to "system upgrades, maintenance, and repair," which can be coordinated to satisfy emergency readiness and energy efficiency public purposes simultaneously. See Code § 15.2-2109.2.*

iv. *The potential for negotiated franchise agreements with Virginia cities and towns to include DSM and EE resource provisions, which can serve to obligate the parties to implement select DSM and EE programs that can then be plugged into future IRP DSM and EE potential models as demand-side resources.*[4] *See Code § 15.2-2100.*

v. *The potential for municipal aggregation to be used to expand DSM and EE resources. Such aggregation may include an opt-in/opt-out aggregation model, or the aggregation of governmental operations requiring the consumption of electric energy, or internal aggregation of the electric energy load of a municipality's own governmental load, subject to "conditions of service," which could be used to memorialize DSM and EE resources. See Code § 56-589.*

b. *In its next IRP filing, report on the progress of the Local Government Subgroup's meetings as part of its report on the Stakeholder Process more*

[4] The City submits that these DSM and EE provisions in the franchise agreements can serve as the theoretical counterpoint to Power Purchase Agreements ("PPA") in Dominion's supply-side models.

generally, including the progress of all discussions conducted along the lines outlined above. The report shall include:

i. *A list of localities that participated in the Local Government Subgroup.*

ii. *A summary of the topics covered by the Local Government Subgroup and the proposals that came out of relevant discussions.*

iii. *The Company's assessment of the potential points of cooperation between local governments and the Company described above to improve Dominion's DSM and EE models in future IRPs.*

iv. *The Company's assessment of the potential points of cooperation between local governments and the Company described above to increase Dominion's compliance with energy efficiency targets in the VCEA.*

v. *A list of demand-side resources which could be created or expanded through continued cooperation between localities and the Company.*

vi. *A summary of comments and feedback received from participating localities.*

vii. *Dominion's comments and reactions in response to the feedback received from participating localities.*

viii. *An action plan for continued development and execution of joint DSM and EE programs between local governments and the Company.*

Establishing Familiarity with VCEA and DSM Requirements

Q. ARE YOU FAMILIAR WITH THE VIRGINIA CLEAN ECONOMY ACT (VCEA) AND ITS ENERGY EFFICIENCY AND DEMAND-SIDE MANAGEMENT (DSM) REQUIREMENTS?

A. Yes, I am.

Q. WHAT ARE THE KEY RENEWABLE ENERGY, ENERGY EFFICIENCY AND DSM OBLIGATIONS PLACED ON DOMINION UNDER THE VCEA, AS IT RELATES TO THE CITY'S REQUEST IN THESE PROCEEDINGS?

A. The VCEA is a crucial law that places responsibilities on the Commission and public utilities under its jurisdiction. Broadly, the VCEA requires Dominion to have a renewable energy portfolio standard program ("RPS") that sees 100% of Dominion's energy to come from renewable, clean sources by 2045. Specifically relevant to this proceeding and the City's prayer for relief, it is particularly important to note the VCEA's requirement that Dominion achieve a minimum of 5% energy efficiency target by 2025 using 2019 sales as a baseline. The VCEA also requires the Commission to consider the social cost of carbon for new generation and declares energy efficiency pilot programs to be "in the public interest."

Q. HOW DOES THE VCEA'S FOCUS ON CARBON REDUCTION ALIGN WITH THE CITY'S OWN CLIMATE GOALS?

A. The EAP aims for an 80%-100% reduction in GHG emissions by 2050, and a 50% reduction by 2030.[5] EAP actions "are focused on local priorities and includes order-of-magnitude cost estimates, relative impactfulness, and references to related documents with more detailed guidance or policy."[6] These order-of-magnitude and relative impact estimates—

[5] Schedule 2 at 11.
[6] Schedule 2 at 2.

informed by local, real-time data—are precisely the inputs Dominion's DSM and EE models in its 2024 IRP filing are missing.

However, if Dominion cannot meet the VCEA's 2045 requirement of 100% renewable energy, the City cannot practically achieve the goals in the EAP.[7] Recognizing the importance of combining energy efficiency with renewable energy, the City takes an aggressive stance on energy efficiency in the EAP. The City aims to transition all applicable Alexandria government facilities to 100-percent electricity and offset this electrical use by 100-percent renewable energy by Fiscal Year 2030. Next, the City's goal is to improve energy efficiency in City facilities and operations by 50% by Fiscal Year 2035.[8] The City will also transition its entire vehicle fleet to electric vehicles by Fiscal Year 2040.[9] In the medium term, the City seeks to "implement energy efficiency strategies in City facilities and operations to reduce energy use by, at minimum, 25 percent over FY2018 usage."[10] All of these targets represent potential demand-side resources for future IRP filings.

In the ECCAP, the City has articulated Extreme Heat Adaptation Priority Strategies and Actions that could also provide fruitful opportunities for the Company to develop targeted DSM and EE resources. The City proposes expansion of waste heat reduction programs that can be marketed and implemented using relative impact analysis.[11]

The ECCAP also notes the creation, in September 2022, of the City's Office of Climate Action, which is tasked, among other things, with community engagement and advocacy duties associated with energy efficiency program adoption.[12] Additionally, GHG Reduction Modeling

[7] *See* Schedule 2 at 27, 29, 32 (setting legislative priority to pursue strategic partnerships with the Commission and Dominion in the DSM and EE space).
[8] Schedule 2 at 24.
[9] Schedule 2 at 27.
[10] Schedule 2 at 26.
[11] *See* Schedule 3 at 112.
[12] *See* Schedule 3 at 119.

performed under the ECCAP has modeled new and existing building electrification programs as a path to meeting the City's climate goals.[13] This type of focused outreach program, coupled with local data and impact analyses, could be an asset in efforts to improve the penetration and customer participation rates of Dominion's current and future DSM and EE programs.

Evaluation of Dominion's 2024 IRP and DSM adjustment

Q. HAVE YOU HAD AN OPPORTUNITY TO REVIEW DOMINION'S 2024 IRP GENERALLY, AND IN PARTICULAR, THE SECTIONS RELATED TO ENERGY EFFICIENCY PROGRAMS, DEMAND-SIDE MANAGEMENT PROGRAMS, AND THEIR COMPLIANCE WITH THE VCEA?

A. Yes, I have.

Q. WHAT IS YOUR OPINION OF DOMINION'S IRP AND ITS REPRESENTATIONS REGARDING EE AND DSM? DOES IT SATISFY THE LEGAL REQUIREMENTS FOUND IN THE VCEA RELATED THERETO?

A. Dominion's filing projects a significant shortfall from the VCEA target of 5% by 2025. According to Figure 1-3 of the Virginia Energy Efficiency Potential Study 2024 to 2033—heavily relied upon by the Company in determining its energy efficiency adjustment factor—Dominion has achieved a mere 2.7% reduction, while the VCEA requires a 5% reduction in 2025.[14] This fails to achieve the basic energy efficiency targets in the VCEA.

Future IRPs must take a more proactive approach to reaching statutory target levels of energy efficiency. Asking for EE target reductions when the load forecast is soaring runs counter to the VCEA's obvious legislative preference for demand-side options over supply-side ones. This is the exact scenario and reason for which the IRP statute requires a systematic evaluation

[13] *See* Schedule 2, Appendix E, at E-4.
[14] EE Potential Study at 2.

of the Company's "investments in demand-side resources, including energy efficiency and demand-side management services."[15] This inflection point in anticipated demand forecasts calls for the systematic evaluation of investments that the 2024 IRP filing lacks.

Q. WHAT ARE SOME OF THE SHORTCOMINGS, IN YOUR ESTIMATION?

A. The VCEA emphasizes that energy efficiency should be considered as a demand-side resource, declaring pilot programs to be within the public interest, requiring the consideration of the social cost of carbon, and setting clear minimum targets for energy efficiency programs. Further, the Commonwealth Clean Energy Policy[16] states that "it shall be the policy of the Commonwealth to: ... Maximize energy efficiency programs ... to the extent determined to be in the public interest, that are the lowest-cost energy option to reduce greenhouse gas emissions, in order to produce electricity cost savings and to create jobs and economic opportunity from the energy efficiency sector."

The 2024 IRP favors supply-side programs over cost-effective demand-side alternatives, thereby underestimating potential.

Dominion's IRP favors use of supply-side programs over DSM and EE demand-side options, which is directly in conflict with both the VCEA and Commonwealth Clean Energy Policy.[17] Fortunately, Dominion's 2024 IRP filing suggests that there is economic and achievable potential that Dominion is not capturing in its EE modeling. There is therefore justification for the Commission to set clear energy efficiency planning goals for Dominion's future IRP filings. Figure 1-1 in the EE Potential Study identifies three types tiers of energy

[15] *See* Code § 56-599(B)
[16] Code § 45.2-1706.1.
[17] *See* 2024 Integrated Resource Plan at 5 (20,131 MW of generation capacity and 1,277 MW of PPA resources, compared with a qualitative description that reads "energy efficiency and demand response programs").

savings potential in Dominion's 2024 IRP analysis. Dominion estimates achievable energy savings potential at 2.8%, significantly below the 5% requirement of the VCEA.

However, that same figure identifies an economic savings potential—which Dominion defines as "the technical potential of those energy conservation measures that are cost-effective ***when compared to supply-side alternatives***"—of 17%. Thus, if Virginia law favors demand-side options over supply-side, then at a minimum, Dominion's IRP, to be compliant with VCEA and Commonwealth Clean Energy Policy, should be proposing EE model portfolios that achieve at least the 17% energy efficiency savings that are economically possible when compared to supply-side alternatives.

It should be noted that the EE Potential Study identifies a technical energy savings potential of 31%, regardless of the economic comparison with cost. If the Commission were to employ a robust analysis that included the social cost of carbon, as required by the VCEA, it is likely Dominion's own energy efficiency analysis would identify an "economic" savings potential significantly higher than 17%.

The approach to generic EE used in the 2024 IRP is not suited for compliance with VCEA DSM and EE requirements.

The Company's DSM forecast and EE adjustment is comprised of two categories: (1) existing programs and (2) forecasted savings growth designed to meet certain minimum requirements and targets.[18] The Company acknowledges that "[t]his approach to meet the EE target reductions is a simplifying assumption used for modeling purposes only."[19] This is followed by an admission that "[t]he actual costs and benefits of future EE will be dependent upon many factors, including the ability of future vendors to deliver program savings at the fixed

[18] *See* 2024 Integrated Resource Plan, Appendix 2A, at 8.
[19] *Id.* at 9.

price, customer participation, and the effectiveness of the program to be administered at the forecasted price."[20]

The latter two factors—customer participation and program effectiveness—are exactly the points at which localities like the City are poised and willing to create real efficiencies. The 2024 IRP invites the type of model innovation the City's request offers.

The EE adjustment and targets do not consider local EE targets and are not yet seeking local partnerships that could expand demand-side options.

In response to an Interrogatory propounded by the City, the Company stated that it does not incorporate local energy efficiency policies and targets into its IRP, except to the extent "they influence customer behavior which would be reflected in the historical data that the Company uses to build its forecast models."[21] Dominion's Responses to the City's Second Set of Discovery are attached hereto and incorporated herein as **Schedule 4**.

This response states by omission that the Company does not consider local policies and targets as potential sources for considerable expansion of its demand-side resources. Given Dominion's earlier admission in its 2024 IRP filing—that effective DSM and EE planning requires a particular focus on customer participation and program effectiveness—this omission would appear to be a potential missed opportunity for the Company's EE and DSM target compliance, and could very well, upon further exploration, allow Dominion to raise its targets and avoid the EE target reductions it seeks in PUR-2023-00227.

Dominion's lack of emphasis on demand-side options goes against the feedback it received from the Stakeholder Process.

Stakeholders told Dominion they want to see "energy savings increasing throughout the modeling plan, rather than a flatline of savings" and "more detailed information in the qualitative

[20] *Id.*
[21] *See* Schedule 4, Responses to Question Nos. 13 and 14.

portion regarding the energy efficiency programs the Company offers and the outreach efforts to inform customers about those programs."[22]

The City's proposal and the Local Government Subgroup can serve as a development platform for DSM and EE programs that would facilitate compliance with stakeholder directives as well as the statutory requirements in the VCEA. The Company states that "[a]chieving the forecasted level of energy savings will require diligence and cooperation among the Company and the many stakeholders who participate in the on-going DSM specific stakeholder process."[23] The City agrees wholeheartedly, and would submit that local governments are particularly suited to this type of cooperation and diligence.

Q. IN YOUR OPINION, CAN DOMINION REALISTICALLY MEET ITS EE AND DSM TARGETS IN ITS IRP? WHAT WOULD IT NEED TO DO/CHANGE TO DO SO?

A. Dominion's own analysis say they can, and mostly have, met the energy efficiency targets in the IRP. The concern is that these targets are considerably lower than the VCEA requires. To meet the targets required in the VCEA would require Dominion to do a more robust analysis and develop more targeted programs.

As mentioned previously, Dominion's analysis is limited by not employing the social cost of carbon in the analysis of what is "economic" savings potential. Further, the City argues that Dominion's analysis of energy efficiency potential is limited by its approach. Identifying a "typical" household and developing energy efficiency targets which are applied across Dominion's territory limits the accuracy of Dominion's targets. Dominion possesses detailed energy use information on every meter in its territory. Combined with information from localities, particularly those with robust environmental action plans, Dominion could develop

[22] 2024 Integrated Resource Plan, Appendix 1, 2024 IRP Stakeholder Process Report, at 9.
[23] 2024 Integrated Resource Plan, Appendix 3D, Demand-Side Management, at 2.

more specific energy efficiency targets within its portfolio. The VCEA declares that energy efficiency program pilots are in the public interest if they are limited in scope and duration and intended to determine the cost-effectiveness of a more robust program. Dominion could develop a more complete energy efficiency target, which complies with the VCEA and Commonwealth Clean Energy Policy, by working directly with jurisdictions to refine its definitions of technical, economic, and achievable energy savings.

The City's Climate Action Plan and Energy Efficiency Programs

Q. CAN YOU PROVIDE AN OVERVIEW OF THE CITY'S CLIMATE ACTION PLAN AND ITS KEY OBJECTIVES?

A. The City of Alexandria adopted the EAP in 2019. Broadly, the EAP directs the City to achieve significant reductions in greenhouse gas emissions and meet other environmental targets. There are over 100 individual actions tracked across the City in achieving these targets, but the high-level commitments are below:

Metric	Short-term	Mid-term	Long-term
CLIMATE CHANGE			
Total GHG emission reduction over 2005 base year			50% by FY2030 and 80-100% by FY2050
ENERGY			
Renewable offset of City-owned facilities electrical use	100% by 2020		
Improve energy efficiency for City-owned facilities and affiliated transportation		Reduce by 25% by FY2027 over FY2018	
Reduce GHG emissions per capita	10 metric tons per capita by FY2022	6 metric tons per capita by FY2030	4 metric tons by FY2040 and 1-3 by FY2050
LAND USE AND OPEN SPACE			
Tree Canopy percent			40% by FY2035
Open Space Acres per 1,000 residents	7.3	7.3	7.3
SOLID WASTE			
Reduce GHG emissions from solid waste over a 2019 base year	By FY2023 reduce by 12%		
WATER RESOURCES			
Achieve stormwater phosphorus pollution reduction (MS4) target	By FY2023 to 70%	By FY2025 to 100%	
TRANSPORTATION			
Reduce vehicle miles traveled	By FY2023 reduce 1% per year		
Increase transit, walking, and biking	By FY2023 Increase by 15% over 2018		
Increase dedicated bus lanes			By FY2030, double to 1.5 miles
AIR QUALITY			
Reduce ozone	By FY2023, reduce to 70 ppb or lower		

Q. WHAT ROLES DO ENERGY EFFICIENCY AND COMMERCIAL BUILDING EFFICIENCY PROGRAMS PLAY IN THE CITY'S EFFORTS TO REDUCE EMISSIONS?

A. Achieving reductions in greenhouse gas emissions requires two major approaches—reducing the amount of energy consumed, and sourcing electricity from carbon-free generation. While theoretically the City's goals could be achieved by only focusing on clean energy

generation, this is bad economic policy, which is presumably why the VCEA and Commonwealth Clean Energy Policy both call for a balance of energy efficiency and renewable energy. To help meet these goals, the City of Alexandria has adopted the 2019 Green Building Policy, which requires certain developments to achieve energy efficiency, renewable energy, and other sustainability targets. The City has limited authority to create energy efficiency targets for existing buildings.

Q. HOW HAS THE CITY PARTNERED WITH BUSINESSES, RESIDENTS, AND OTHER STAKEHOLDERS TO ADVANCE ENERGY EFFICIENCY?

A. The City has a number of programs for residents and businesses to advance energy efficiency. Through the recently launched Eco-City Homes and Eco-City Business programs, the City provides guidance directly to residents and business owners on how to improve their energy performance and sustainability, and provides visible recognition for those that meet certain criteria. Through neighborhood popup events, partnerships with businesses, and numerous community engagement events across the City, staff provide hands-on advice and guidance to residents.

With a keen understanding of the type and character of Alexandria's building stock, the City can provide tailored guidance related to home improvements, coordinate with contractors to educate about existing incentive programs, and highlight the efficiency, health, and comfort benefits that come with energy efficiency improvements. All of these programs, if joined together with the efficiencies that Dominion brings to the table, could catalyze improvement in penetration and customer participation rates for existing and new EE programs.

Data Available to Localities That Could Improve Dominion's IRP Forecasting

Q. WHAT TYPES OF ENERGY-RELATED DATA DO LOCALITIES TYPICALLY COLLECT THAT COULD BE USEFUL FOR INTEGRATED RESOURCE PLANNING?

A. Understanding the potential for energy efficiency requires a specific understanding of how buildings are built, their condition, and the type of systems used in the buildings. Through permitting, property tax assessments, development plan reviews, and more, local jurisdictions have a significant amount of information about how buildings are consuming energy. Coupled with Dominion's information about how much energy is being used, and when, a much more detailed profile of the potential for energy efficiency could be developed.

More importantly, it would provide Dominion and the Commission with more specific interventions and their potential to save energy. Understanding the number of townhomes that are brick masonry construction, which require a different approach for insulation, or that have not upgraded heating or cooling systems in the last 15 years, would create both a specific type of improvement recommendation, as well as a more targeted group for outreach. There is also data that can help target energy efficiency improvements. Tenant complaints about mold, mildew, moisture or pests could identify the potential for significant air infiltration or heating, ventilation and air conditioning improvements.

Q. CAN YOU DISCUSS THE TYPES OF ELECTRIFICATION DATA AVAILABLE, INCLUDING ELECTRIC VEHICLE ADOPTION RATES AND BUILDING ELECTRIFICATION TRENDS?

A. The City is able to create detailed reports about electric vehicle adoption. Through the use of vehicle registration, the City can identify the number of electric vehicles and their specific locations in the City. For electrification of buildings, the City can review its permit data for HVAC, water heater, and other electric improvements.

Q. HOW DOES THIS DATA COMPARE IN GRANULARITY AND RELIABILITY TO WHAT DOMINION CURRENTLY USES FOR LOAD FORECASTING?

A. The data localities have is typically at the household level. Local data is gathered to provide specific services to specific addresses, which allows for a deeper understanding of the components of a building and how it might impact energy use. Coupled with Dominion's energy use data, the forecasts could be enhanced dramatically by creating more unique profiles for specific building types, generate more clear savings profiles for specific energy efficiency measures, and provide a better ability to target improvements.

Q. HOW COULD DOMINION INTEGRATE DATA FROM LOCALITIES TO IMPROVE THE ACCURACY OF ITS IRP LOAD FORECASTS?

A. The effort should begin with a clear partnership between Dominion and localities to understand what types of data each locality is able to share. With detailed property data, such as the type of structures, their construction, and current condition as assessed by property appraisers, for instance, Dominion could develop specific models for a variety of building types, measured against its existing model. With a variety of localities with different population density and building construction types, Dominion's model could be refined to provide the Commission with a more accurate understanding of energy efficiency targets that are "economic." Dominion should also work with localities to better understand the trajectory of electric vehicle adoption and building electrification. Dominion's load forecast models should account for the anticipated growth in new developments, and account for the energy use of these new buildings.

Q. ARE THERE SPECIFIC GAPS IN DOMINION'S CURRENT FORECASTING METHODS THAT COULD BE ADDRESSED WITH MORE LOCAL DATA?

A. One issue that arises in Dominion's forecast is the customer response to their programs.

Presumably, one case for the gap between what Dominion believes is achievable and what it believes is economical is low rates of customer penetration for many programs. Fortunately, local governments have a significant amount of direct contact with residents. Combining the local data and the ability to better target areas for energy efficiency improvements, with the ability for the City to more successfully engage residents, could significantly increase customer penetration for Dominion's energy efficiency programs, and make great strides in achieving more of the savings Dominion identifies as economic. The forecast would both more accurately identify energy efficiency potential by adding in this hyper-local approach, and also more effective in achieving the energy efficiency savings targets established by the forecast.

Q. CAN YOU PROVIDE AN EXAMPLE OF HOW BETTER INTEGRATION OF LOCALITY DATA MIGHT LEAD TO MORE RELIABLE LONG-TERM ENERGY PLANNING?

A. Dominion's IRP demonstrates there will be a significant increase in energy consumption over the next 15 years. Even with new generation facilities, the reliability of the transmission and distribution system are a challenge. If local data can target more cost-effective energy efficiency improvements which can be achieved quickly, the need for new generation and transmission can be potentially slowed or delayed. Dominion's current filing demonstrates there is an opportunity to use energy efficiency as a more significant resource, but by not achieving the 5% energy efficiency requirement, it also demonstrates they have not figured out how to achieve that. Local data will provide specific opportunities for immediate improvement to achieve the mandated energy efficiency requirements, while also providing the Commission with clarity on how to value energy efficiency against new generation. Local data can help particularly target and engage those programs aimed at low-income residents.

How Improved Forecasting Supports Dominion's Compliance and Local Policies

Q. HOW WOULD INCORPORATING LOCAL ELECTRIFICATION AND EFFICIENCY DATA INTO DOMINION'S IRP SUPPORT ITS COMPLIANCE WITH VCEA AND OTHER REGULATORY REQUIREMENTS?

A. Dominion is currently not meeting the VCEA's requirement for 5% energy efficiency, and their IRP illustrates that they will continue to violate this provision of the VCEA. Because Dominion's own analysis indicates that it is aware of "economic" energy savings potential it is not achieving, the Commission should find that Dominion's DSM modeling should at least be attempting to find a path to compliance. Local data will provide this crucial missing data to allow Dominion to more capably target their energy efficiency programs.

Q. IN WHAT WAYS WOULD MORE ACCURATE FORECASTING BENEFIT LOCAL ENVIRONMENTAL AND CLIMATE POLICIES?

A. A better forecast allows local governments to work closely with Dominion on identifying the most impactful improvements that can be made. In addition to the investments in energy efficiency Dominion must make to be compliant with the VCEA, this model would also help local governments supplement Dominion's energy efficiency efforts by building complementary local programs.

Q. COULD THIS DATA-SHARING HELP DOMINION AVOID UNNECESSARY INFRASTRUCTURE INVESTMENTS OR STRANDED ASSETS?

A. Yes. Dominion's analysis indicates a significant gap between what is "economic" and what is "actual" in their energy efficiency programs. Every kilowatt hour saved through energy efficiency is a kilowatt hour that doesn't need to be produced. Energy efficiency projects also reduce strain and congestion on the transmission and distribution systems.

Role of SCC in Facilitating Locality-Dominion Data Integration

Q. WHAT ROLE CAN THE STATE CORPORATION COMMISSION PLAY IN ENSURING THAT DOMINION MEANINGFULLY INCORPORATES LOCAL DATA INTO ITS IRP FILINGS?

A. The Commission can direct Dominion to enhance its load forecast and energy efficiency modeling with the use of local data and in partnership with local governments. The Commission can also clarify the importance of meeting the 5% energy efficiency target in the VCEA, and direct Dominion to develop pilot programs for energy efficiency programs with local governments, which the VCEA deems in the public interest.

Q. SHOULD THE COMMISSION REQUIRE DOMINION TO REPORT ON ITS EFFORTS TO COORDINATE WITH LOCALITIES IN ITS NEXT IRP FILING?

A. Yes. The Commission needs to have a clear understanding of how Dominion's models are being enhanced by local data, and that a good faith effort is being made to create energy efficiency models that are as accurate as possible.

Q. WHAT MECHANISMS COULD THE COMMISSION USE TO ENCOURAGE BETTER INTEGRATION OF LOCAL DATA?

A. First and foremost, the Commission can and should order the formation of a Local Government Subgroup, with the charge of exploring potential points of cooperation between Dominion and the local governments it serves. A key part of the Local Government Subgroup's mission would be to identify data-sharing opportunities that could enhance DSM and EE modeling in future IRPs.

There are also potential points of collaboration between local governments and Dominion that do not exist with other stakeholders. Localities have the ability to aggregate their electric

demand for their governmental operations and to negotiate rates, terms, and conditions of service thereon.[24] They can also enter into mutual aid agreements with Dominion, which could be used to coordinate system upgrades and maintenance so that they satisfy emergency-readiness and DSM policy goals.[25] Cities and towns can enter into franchise agreements with Dominion, which provide broad authority to creatively partner on mutual DSM targets and goals.[26]

Background on Franchise Agreements and Their Potential

Q. CAN YOU BRIEFLY EXPLAIN WHAT A FRANCHISE AGREEMENT IS IN THE CONTEXT OF UTILITY REGULATION?

A. A Franchise Agreement between a city or town and a public utility broadly provides the framework for how the public utility may operate within the locality, and it is entered into by ordinance of the local governing body. Coordination of construction projects, conditions of terms and service to citizens, and the use of the city or town's right-of-way, are examples of aspects that a utility's Franchise Agreement may govern.

Q. WHAT OPPORTUNITIES DO FRANCHISE AGREEMENTS PRESENT FOR ADVANCING LOCAL ENERGY EFFICIENCY AND CLIMATE GOALS?

A. Franchise agreements provide cities, towns, and public utilities a unique opportunity to create clear contractual relationships between the parties. Terms and conditions of service may be negotiated therein, including renewable portfolio, EE and DSM standards and programs.

Q. WHY ARE THERE FRANCHISE AGREEMENTS OUT THERE WITHOUT THESE PROVISIONS ALREADY IN THERE?

A. Many franchise agreements are decades-old and predate the VCEA and widespread

[24] Code § 56-589(C).
[25] Code § 15.2-2109.2.
[26] *See* Code § 15.2-2100.

adoption of clean-energy policies. The proposed Local Government Subgroup could begin to explore the possibility that renegotiating some of these stale franchise agreements might uncover latent opportunities to dramatically increase EE and DSM models in future IRPs.

Examples of Franchise Agreements with Environmental and Energy Efficiency Provisions

Q. ARE YOU AWARE OF OTHER STATES OR JURISDICTIONS THAT HAVE SUCCESSFULLY USED FRANCHISE AGREEMENTS TO ESTABLISH ENVIRONMENTAL OR ENERGY EFFICIENCY STANDARDS?

A. Yes. While this is by no means an exhaustive list, two prominent examples are:

- **Ann Arbor, Michigan**'s franchise agreement with Nordic Electric, L.L.C., which includes provisions for renewable energy portfolios, with the utility to contribute to energy efficiency programs if the portfolio falls short.[27] Additionally, Nordic Electric agrees to partner with Ann Arbor to advance the goals of the Ann Arbor Energy Plan.[28]
- **Sarasota, Florida**'s Renewable Energy, Energy Efficiency, and Energy Sustainability Agreement (the "Sarasota Agreement")—negotiated as part of its franchise agreement with Florida Power & Light Company ("FPL")—"codif[ied] FPL's clean energy commitments to the city."[29] The franchise agreement includes provisions for joint energy projects, energy education initiatives, energy audits, energy savings strategies, customer participation efforts, EE product testing, and more. The Sarasota Agreement is attached hereto and incorporated herein as **Schedule 5**.

[27] Ann Arbor, Michigan, Code of Ordinances § 2:623(6)
[28] Ann Arbor, Michigan, Code of Ordinances § 2:624.
[29] Jeffrey J. Cook, *Franchise Agreements Serving as Vehicles for Local Governments to Achieve Clean Energy Goals*, PM Magazine, available at https://icma.org/articles/pm-magazine/franchise-agreements-serving-vehicles-local-governments-achieve-clean-energy-goals (July 15, 2021) (last visited February 27, 2025).

Q. HAVE THESE AGREEMENTS BENEFITED BOTH LOCAL GOVERNMENTS AND UTILITIES? HOW?

A. Yes. In addition to helping meet statutory targets for renewable energy and energy efficiency, the franchise agreements create a structure for a closer, more cooperative relationship. The examples cited above involved localities and public utilities signing formal agreements that laid the groundwork for real advances in EE and DSM in those localities. These same benefits would redound to Dominion if it were to similarly engage with the cities and towns it serves, with an eye towards developing durable DSM resources.

Q. ARE THERE SPECIFIC PROVISIONS THAT LOCALITIES COULD ADVOCATE FOR IN FUTURE FRANCHISE AGREEMENTS TO IMPROVE COMPLIANCE WITH THE VCEA?

A. There are several components of a franchise agreement that could help compliance with the VCEA. The EPA recommends (Microsoft Word - Franchise Agreement report EPA Part 1):

- Energy efficiency: Requirements for the utility to invest in energy efficiency programs in the jurisdiction.
- Renewable Portfolio Standard: Requiring a specific amount of renewable energy to be sourced for ratepayers in the jurisdiction.
- Energy audits: Programs designed to identify those buildings and customers most in need of EE upgrades, to find energy inefficiencies, and maximize the ROI for DSM dollars spent.

These provisions would allow the development of local EE programs that can augment and improve the Company's DSM and EE modeling. The Local Government Subgroup would be charged with producing a more exhaustive list of potential provisions.

Additional Benefit of Renegotiating Franchise Agreements

Q. ARE THERE ANY OTHER POTENTIAL BENEFITS TO FUTURE IRP FILINGS THAT MAY RESULT FROM DOMINION RENEGOTIATING EXPIRED OR OUTDATED FRANCHISE AGREEMENTS?

A. Yes. Dominion included a downward adjustment in its load forecast due to uncertainty surrounding the energy demand of Choice Customers who have not yet committed to renew their service agreements with Dominion.[30] As retail competition for electric expands in the Commonwealth, attendant volatility in IRP load forecasts may and likely will occur. By renewing expired franchise agreements, Dominion may be able to partially avoid some of this volatility and uncertainty in its load forecasts.

Q. HOW DOES INCREASED RETAIL COMPETITION AFFECT DOMINION'S LONG-TERM ENERGY PLANNING AND IRP FORECASTS?

A. As local jurisdictions continue to advance their climate and energy plans, they will require their utility provider to achieve increasing levels of renewable energy. If Dominion fails to achieve the renewable energy targets required in the VCEA, it will largely require localities to take advantage of retail competition.

Q. COULD FRANCHISE AGREEMENTS AND THE OTHER FORMS OF COOPERATION PROPOSED BY THE CITY HELP MAINTAIN STABILITY IN DOMINION'S FORECASTING AS RETAIL CHOICE EXPANDS?

A. Yes. Dominion's intentional engagement with local jurisdictions could reduce the need to explore retail competition and provide cooperative relationships to achieving the goals of the VCEA together.

[30] 2024 Integrated Resource Plan, Appendix 3D.VI

Conclusion

Q. WHAT DO YOU SAY IN CONCLUSION?

A. Only that this is an historic opportunity for the Commission to intervene in the process of electrical resource development at the IRP/planning stage. The Stakeholder Process provides a perfect forum for local governments and the Company to meet and discuss their common interests in a Local Government Subgroup. By developing data-sharing partnerships, efficiencies can be identified and EE/DSM programs can be more specifically targeted. Localities can use local data to increase and focus customer participation campaigns. Finally, localities can use their unique legal authorities to enter into contracts and agreements with Dominion, which can serve as the modeling counterpoint to PPAs, providing Dominion with reliable, contractual DSM resources that could substantially increase the amount of economic and achievable energy savings potentials modeled by Dominion in future IRPs.

Q. WOULD YOU LIKE TO ADD ANYTHING ELSE?

A. No. Thank you very much for the opportunity to appear before this honorable Commission. I appreciate your time and consideration.

Q. THANK YOU, MR. FREED, FOR YOUR TESTIMONY.

Schedules:

1) **Schedule 1 – Ryan Freed CV**
2) **Schedule 2 – City of Alexandria's Environmental Action Plan 2040**
3) **Schedule 3 – City of Alexandria's Energy & Climate Change Action Plan**
4) **Schedule 4 – Dominion's Responses to the City's Second Set of Discovery**
5) **Schedule 5 – Sarasota, Florida's Renewable Energy, Energy Efficiency, and Energy Sustainability Agreement with FPL**

SCHEDULE 1

Curriculum Vitae

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Professional Preparation:

- **M.A.:** Public Administration, University of Kansas
- **B.A.:** Sociology, Washburn University

Professional Experience:

- **2023 Jan – present:** Climate Action Officer, City of Alexandria, VA
- **2021 Sep – 2023 Jan:** Sr. Director Policy & Regulatory, Institute for Market Transformation
- **2018 May – 2021 Sep:** Director, Public Sector, Institute for Market Transformation
- **2016 Mar – 2018 May:** Associate Director – Policy, Institute for Market Transformation
- **2015 Sep – 2016 Mar:** Operations Manager, Institute for Market Transformation
- **2011 Oct – 2014 Nov:** Director, Energy Division, Kansas Corporation Commission
- **2010 Jan – 2011 Oct**: Energy Efficiency Programs Manager, Kansas Corporation Commission
- **2009 May** – **2010 Jan**: Efficiency Kansas Manager, Kansas Corporation Commission
- **2007 Jun** – **2009 May**: Contract Specialist, Kansas Corporation Commission

Mr. Freed's work includes serving as the City of Alexandria's chief climate-focused staffer. As the Director of the Climate Action Office, Mr. Freed oversees a team whose work includes electric vehicle planning, green building and development review, city facility sustainability and resilience, environmental justice and community engagement initiatives, business and resident engagement, and more. With over 20 years of experience in the environmental field, Mr. Freed has worked at a variety of levels of government and non-government organizations. Mr. Freed's recent work includes co-creation of the Biden Administration's National Building Performance Standards Coalition, and a climate-justice initiative designed to transform the way local governments engage in climate planning, Community Climate Shift. Mr. Freed has managed multiple large and complex projects and budgets, including the creation of a revolving loan fund for the Kansas Corporation Commission using a $38 million grant from the U.S. Department of Energy. In his role as Director of the State Energy Office, he served as a member of Kansas Corporation Commission's management team, provided guidance to Commissioners on policy and regulatory matters related to renewable energy and energy efficiency, and served as an expert witness when needed.

SCHEDULE 2

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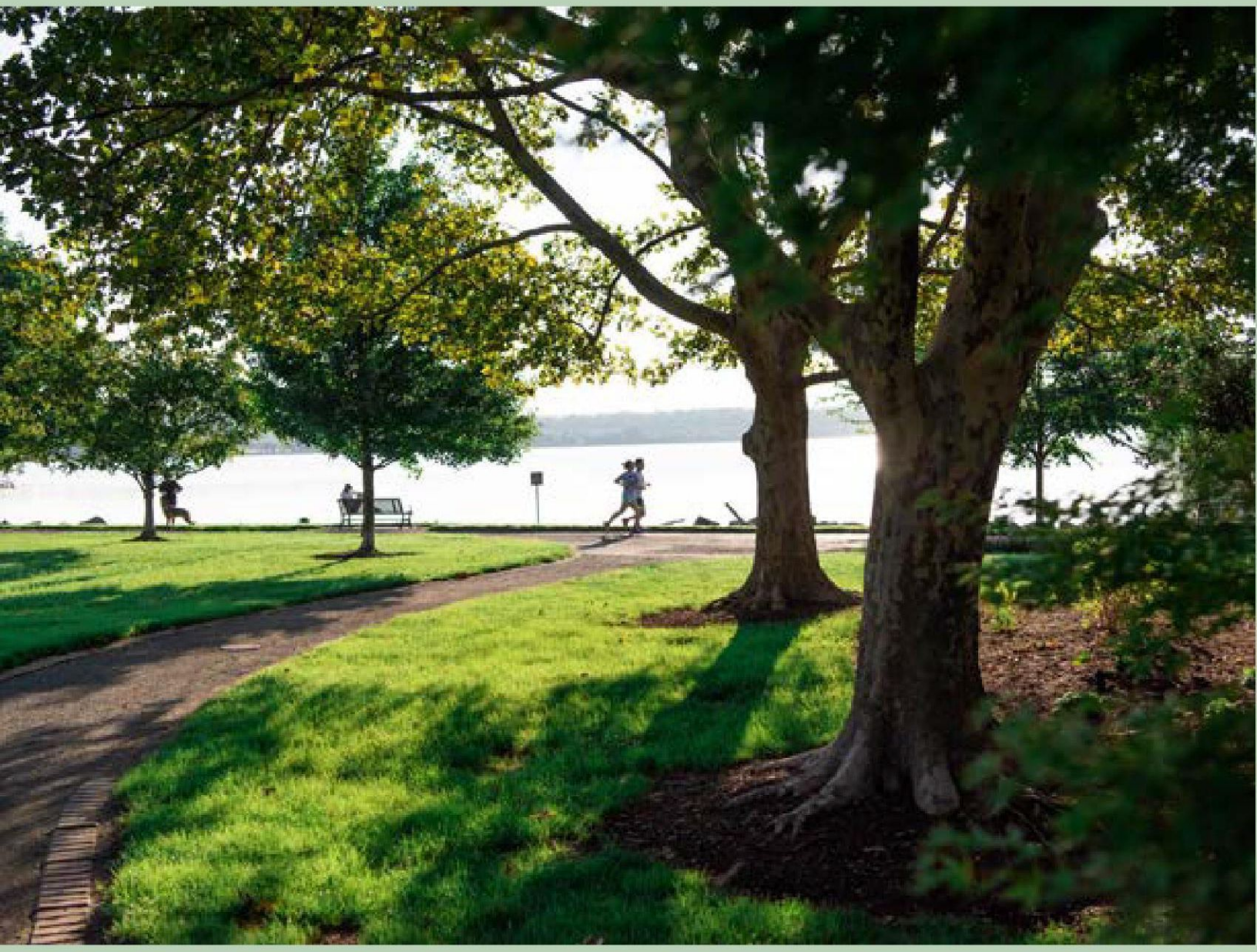
City of Alexandria

ENVIRONMENTAL ACTION PLAN 2040

ECO-CITY ALEXANDRIA

250640102



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Acknowledgements

ECO-CITY ALEXANDRIA

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PREFACE AND INTRODUCTION

Preface

The City recognizes the urgent need for City-wide environmental planning because of the changing climate as indicated by increased carbon dioxide in the atmosphere, extreme weather events, rising coastal waters, and record-breaking rainfall and high temperatures.

Alexandria has been a Virginia Municipal League leader in regional sustainability for 11 years in the Go Green Virginia challenge, a recognition of local government programs and policies to promote sustainability at the highest level. This new Environmental Action Plan 2040 (EAP 2040) for sustainability builds on the 2008 Eco-City Charter and the Environmental Action Plan 2030 (EAP 2030) adopted in 2009. The EAP 2040 covers the same ten topic areas as the original plan with updates on what has been achieved and new action recommendations to further advance sustainability in the City.

The City has achieved a per capita emission reduction of 22 percent for the 2015 emission inventory over the 2005 base year by completing or adopting, as an ongoing initiative, a majority of actions in the EAP 2030 policy plan. The most significant achievement was closing the coal-fired power plant in 2012 well ahead of the target date. Other achievements are highlighted in each section introduction, as well as a summary document in the appendix, and on the Eco-City webpage.

This new EAP 2040 plan is focused on climate change mitigation and adaptation. The plan actions are focused on local priorities and includes order-of-magnitude cost estimates, relative impactfulness, and references to related documents with more detailed guidance or policy. The plan recognizes the need to include environmental impact as a tool for decision making. New metrics can help identify related impacts from actions in other topic sections. For example, transitioning to electric vehicles both improves energy efficiency and local air quality.

Because commercial and residential buildings, businesses and personal transportation account for 96 percent of greenhouse gas (GHG) emissions, a successful plan means people must participate and make sustainability changes. Challenges include engaging the community into action, fiscal constraints of budget and staff resources, time constraints, and legal authority within the Commonwealth. There are other challenges to achieving aggressive goals and targets including the need for state and federal leadership in the areas of legislative support for renewable energy development, minimum efficiency standards, and providing financial assistance.

At a high level, the goals and targets of the City are to exceed regulatory minimums, achieve carbon neutrality by 2050 and provide better tracking and performance. To be successful, everyone in the City will have to take action, make sustainable choices, do their fair share, and work together to truly make Alexandria a more sustainable Eco-City in which to live, work, and play.

Introduction

Take a walk in the City of Alexandria. Stroll along an historic or modern tree-lined street to one of the weekly farmers markets, small shops, parks, or along the improvements to the waterfront and feel the vibrancy and the tranquility of the City of Alexandria while you see elements of sustainability all around you.

The City takes pride in its historic charm and roots as a river town, but also its modern vitality, as characterized by its waterfront, unique neighborhoods and urban villages of small shops and restaurants. These characteristics have been enhanced by smart development, which has maintained their charm while adding new environmental features. Some sustainable features are hidden, like insulation behind walls, but others are plainly visible, like abundant transit options, treelined streets, high efficiency LED traffic lights, bikeshare stations, and amenities within walking distances.

Alexandria is a highly mobile, culturally diverse community of approximately 150,000 residents and seeks to create an environmentally, economically and socially healthy city where people can live, work and play far into a sustainable future.

Alexandria has long been a leader in sustainability, as far back as its 1998 Quality of Life Summit but more recently highlighted by Eco-City Alexandria initiatives that include the adoption of Eco-City Charter in June 2008, the Environmental Action Plan 2030 (EAP 2030) in June 2009, and this updated Environmental Action Plan 2040 (EAP 2040) in 2019.

ECO-CITY ALEXANDRIA

Eco-Cities are places where people can live healthy and economically productive lives while reducing their impact on the environment. The City works to harmonize existing policies, regional realities, and economic and business markets with their natural resources and environmental assets. Eco-Cities strive to engage all citizens in collaborative and transparent decision-making, while being mindful of social equity concerns.

Introduction

The City fulfilled or exceeded a majority of the 363 actions from the EAP 2030 which have materially improved Alexandria's environmental sustainability and quality of life. The EAP 2030's accomplishments are a credit to the vision and diligent efforts of the City and the Alexandria community. This EAP 2040 update acknowledges the accomplishments from the previous plan; considers the changed global, regional and state issues; identifies the fiscal resources required; and creates a responsive environmental road map for the City of Alexandria for the future.

Going forward, the EAP 2040 will be updated every five years to adapt to the needs of the community, fiscal constraints, changing technologies and global, regional and state issues and guided by the Eco-City Charter's guiding principles:

- Builds Wisely
- Embraces Natural Beauty
- Improves Water Quality
- Cleans the Air
- Moves Smartly
- Conserves Energy and Resources
- Minimizes Waste
- Supports Healthy Living
- Readies for Changes
- Leads Intelligently & Holistically
- Shares Responsibility.

These principles are woven into the City Strategic Plan and related tools such as Small Area Plans, and many master plans and guidelines throughout City departments. The strategic tools are critical components of essential City programs, policies, and processes. The City Strategic Plan sets the general policy direction with the Environmental Action Plan as an integral component of that Strategic Plan.

Plan Structure

The EAP 2040 incorporates the EAP Phase One (approved in October 2018), which only focused on the first five topic sections and was limited to only short-term actions. This report expands those five topics (1-5 below) with mid- and long-term actions and some revisions and addresses the five remaining topics (6-10 below) with short-, mid-, and long-term actions. Each term is five fiscal years (FY). Short-term is FY2019 through FY2023, mid-term is FY2024 through FY2028, and long-term is FY2029 and beyond.

1. Climate Change
2. Energy
3. Green Building
4. Land Use and Open Space
5. Solid Waste
6. Water Resources
7. Transportation
8. Environmental Health
9. Air Quality
10. Implementation, Education, and Outreach

The ten topics each have a section in the plan as they did in 2009 with an average of two goals and four to six actions in each goal. One consideration in the update process was to have fewer actions at a higher, less specific, level to prioritize the City's resources on fewer actions, with higher-level goals targets, and actions. Implementation was retitled to include education and outreach. Related and more detailed City plan and guidance documents referred to in the plan develop the details and specifics based on additional information and analysis.

The introduction for each topic section provides an update on where the city is today. It also cites related programs, policies, plans, guidelines, and resources that coordinate with the EAP 2040 in improving the City's sustainability along the path to an EAP target. The implementation action for updating metrics provides the performance measures to know when we reach the targets. Legislative priorities are included in sections to identify areas where the City needs legal authority. Justifications and primary departments to implement actions are indicated for each section of actions.

Synergies

Actions in the EAP 2040 are interconnected and provide additive benefits across multiple sections. The goals, targets, and actions in one section such as reducing single vehicle commuting in transportation affects other sections such as energy, air quality, environmental health, and land use and open space. EAP 2040 actions also impact emission reduction and environmental impact through related changes in City zoning, code regulations, and City policies and programs.These efforts and changes are most effective when aligned with economic, equitable, and coordinated strategic planning.

Reducing single occupant vehicle trips and expanding low carbon options such as transit, bikes, and walking for transportation are significant opportunities to reduce carbon emissions.

This is especially important in cities because cities generally benefit from the close proximity of community amenities, homes, and jobs. Cities can also work to reduce transportation-based carbon emissions by providing infrastructure for electric vehicles.

These "synergies" connect the impacts of the EAP 2040 across topic sections and the results are captured together in the monitoring and tracking of EAP 2040 progress.

Urgency

Shortly after the Council adopted the EAP Phase One update, the Intergovernmental Panel on Climate Change (IPCC)[1] released a special report on the impacts of global warming. The IPCC report describes impacts and risks associated with global average temperature increases of 1.5ºC and higher, and the deep emissions cuts needed to constrain warming at the 1.5ºC limit. All IPCC paths recommend reducing emissions by 50 percent by 2030 (base year 2010), a mere 11 years from 2019.

The future described by the IPCC report is an aggressive carbon diet with no homes, businesses or industry heated by fossil fuels, no vehicles running on fossil fuels, and all fossil fuel power plants closed. It demands increased natural carbon capture by increasing forests by almost 4 million square miles and direct air capture of carbon.

The City target is to reduce emissions by 50 percent by 2030 (base year 2005) and to approach net zero or carbon neutral, an 80-100 percent reduction by 2050. Local governments, especially urban ones, need to be supported by national and state governments for example to significantly push the regional electric grid to be more renewable and improve the efficiency of vehicles. There are currently no options to replace air travel and an array of other issues, so the emission reductions are dramatic and carbon capture is necessary.

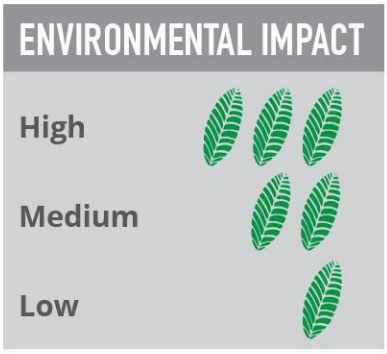
Financing

As a policy plan, the EAP 2040 does not commit or appropriate funds. Rather, it provides strategic guidance for the City Council and City Manager through the regular fiscal planning and budgeting process. Order of magnitude cost estimates are provided. More specific costs will be developed as part of implementation of actions with relevant analysis, evaluation, and task pricing. Incentives, solar bulk pricing, Commercial Property Assessed Clean Energy (CPACE), grants, local partnerships, state and federal funding are part of a mix of opportunities.

1 This Summary for Policymakers should be cited as: IPCC, 2018: Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. World Meteorological Organization, Geneva, Switzerland, 32 pp

Impactfulness

These EAP 2040 topic areas cross pollinate, facilitate, and leverage each other, to increase the collective beneficial contributions to the environmental, health, social, and economic outcomes for the people, businesses, visitors, and City government operations and resiliency. City-wide initiatives have an impact on reducing carbon emissions, reducing energy consumption, reducing water usage, mitigating flood risks, reducing stormwater pollution, enhancing mobility options, providing public and private open space, improving indoor environmental quality, and providing economic and community vitality.



Greener buildings and operations go beyond regulatory requirements and have positive effects on the environment in different ways. Reducing utility costs can be a benefit for all resident housing, and especially affordable housing, if close attention is paid to controlling development costs. Making buildings more energy efficient reduces carbon emissions based on the current grid fuel mix, while stormwater management contributes to the ecological systems in the local and regional waterways. EAP actions and impacts do not happen in a vacuum and interact with each other in addition to the changes at the state and federal levels. A relative value of "high," "medium" or "low" environmental impact has been assigned to each action.

Achievements

Great strides have been made toward the EAP 2030 goals. Especially noteworthy were:

- achieving an overall reduction of 13 percent in GHG emissions (contributed by changes to the fuel mix of the grid)
- the accelerated closing of the coal-fired power plant leading to significant improvements in air quality in the City and the region
- 95 percent of the square footage under construction or built complying with the 2009 Green Building Policy
- reducing stormwater pollution by 40 percent as of FY2018
- achieving a 48 percent recycling rate since 2011
- reducing vehicles miles traveled by 12.5 percent from 2010 to 2016.

While much has been accomplished, scientific information in the environmental community reinforces that there is more to be done by the City government and the community.

The EAP 2040 builds on the previous work and accomplishments of the EAP 2030. These existing programs and policies are being added to the updated GreenVentory in addition to the original 2007 GreenVentory.[2]

2 GreenVentory is a compendium of the current sustainable programs, policies, and processes in the City on the Eco-City web page.

Introduction

This update advances the City's efforts to:

1. reduce GHG emissions across the City by updating or creating new programs, guidelines, and plans,
2. increase focus on energy efficiency,
3. enhance and protect our local water resources through reductions in stormwater pollution,
4. employ significant controls for sanitary sewer impacts to waterways,
5. strategically locate bike racks, bikeshare stations, and other mobility options,
6. improve recycling with a focus on reducing total solid waste,
7. provide year-round weekly Farmers markets with composting, and
8. increase education and outreach by using social media and tools such as the thermal camera loaning program by the Alexandria library.

Collaboration and Community Engagement

This update, a 20-month collaborative effort by City staff, the Environmental Policy Commission (EPC), and the public included: City Council-EPC joint work sessions, EPC retreats, open houses, an Eco-City Café, an Eco-City Summit, Earth Day, online feedback, EPC meetings, joint meetings with Planning Commission and Park and Recreation Commission, and adoption of EAP Phase One in October 2018. As part of the Eco-City Summit, many attendees signed an Eco-City Pledge to make sustainability commitments a part of their lives.

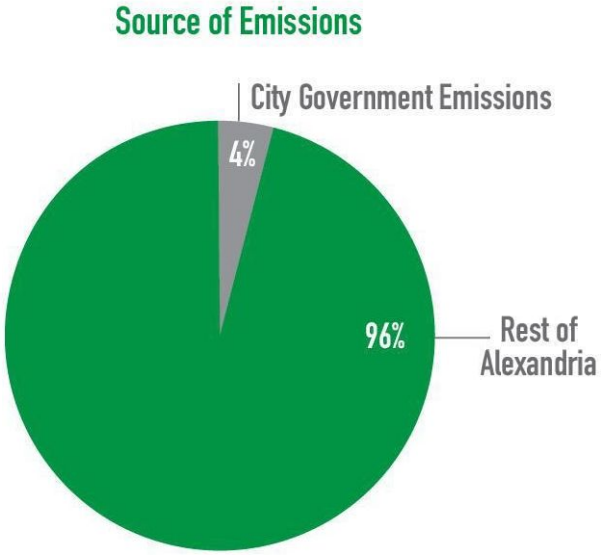
Overarching feedback from public engagement were requests for enhanced education and outreach related to transparency of City's efforts and for guidance on sustainable practices. People generally want to know what individuals, businesses, and the City can do now, and in the future, to reduce environmental impacts. In response, the EAP 2040 includes increased implementation and performance transparency and reporting metrics.

EAP 2040 includes robust education and outreach to the community and businesses including the opportunity to attend a new Eco-City Academy that incorporates all EAP topics and taught by subject matter experts. Community groups and others are encouraged to contact Ellen Eggerton, the Sustainability Coordinator for the City, for more information and to schedule educational events and workshops.

Outreach is essential to engage the community in a call to action and provide feedback on sustainability. The effectiveness of engaging the community can be measured and sharing these key indicators as part of follow-up outreach can facilitate a sustainable culture throughout the City.

Metrics

Updating the key indicators for tracking and measuring, to reflect the new goals, targets, and actions will provide performance monitoring of the EAP 2040 actions and overall accomplishments. Currently City facilities and operations account for only four percent of the emissions and residential, commercial and transportation account for 96 percent, therefore the whole community must act to achieve these goals.

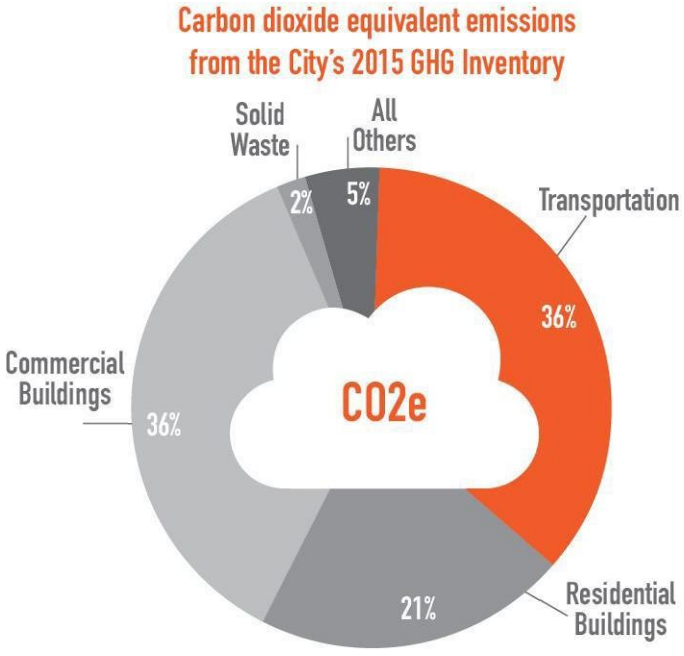


The GHG inventory is done every three years with a base year of 2005. The inventory uses the ICLEI (International Council for Local Environmental Initiatives, which is now Local Governments for Sustainability) methodology prepared by Metropolitan Washington Council of Governments (MWCOG). Some emission values are based on an allocation by population and not directly measured values. The 2015 GHG inventory is in the appendix.

The EAP includes many specific targets that will contribute to overall goals. The City has seen a 22 percent reduction in GHG emissions per capita from 2005 to 2015. Emissions decreased from 14 metric tons of carbon dioxide equivalent (mtCO2e) per capita to 11 mtCO2e per capita while moving towards the target of 10 mtCO2e per capita n 2022, 6 mtCO2e per capita in 2030, and 1-3 mtCO2e per capita in 2050.

According to the most recent GHG emissions inventory (2015 mtCO2e), Alexandria's city-wide profile (includes City buildings and operations) is 57 percent from buildings (36 commercial, 21 residential). Transportation accounts for 36 percent and includes pass through traffic and contributions from rail and air travel. Solid waste accounts for 2 percent with the remaining 5 percent from "all others."

Improvements to reduce emissions cannot always include measures to track actual emission reductions because the values are part of larger aggregate data.



The contribution of City emissions from various sectors of the community show that the majority emissions are from the built environment, followed by transportation.

Summary of Goals and Targets

The EAP 2040 includes targets with metrics to indicate performance. Below is a summary of EAP 2040 targets and metrics. The complete descriptions of goals and targets are in the topic sections.

Metric	Short-term	Mid-term	Long-term
CLIMATE CHANGE			
Total GHG emission reduction over 2005 base year			50% by FY2030 and 80-100% by FY2050
ENERGY			
Renewable offset of City-owned facilities electrical use	100% by 2020		
Improve energy efficiency for City-owned facilities and affiliated transportation		Reduce by 25% by FY2027 over FY2018	
Reduce GHG emissions per capita	10 metric tons per capita by FY2022	6 metric tons per capita by FY2030	4 metric tons by FY2040 and 1-3 by FY2050
LAND USE AND OPEN SPACE			
Tree Canopy percent			40% by FY2035
Open Space Acres per 1,000 residents	7.3	7.3	7.3
SOLID WASTE			
Reduce GHG emissions from solid waste over a 2019 base year	By FY2023 reduce by 12%		
WATER RESOURCES			
Achieve stormwater phosphorus pollution reduction (MS4) target	By FY2023 to 70%	By FY2025 to 100%	
TRANSPORTATION			
Reduce vehicle miles traveled	By FY2023 reduce 1% per year		
Increase transit, walking, and biking	By FY2023 Increase by 15% over 2018		
Increase dedicated bus lanes			By FY2030, double to 1.5 miles
AIR QUALITY			
Reduce ozone	By FY2023, reduce to 70 ppb or lower		

Challenges

There are significant challenges to meet an 80-100 percent GHG emissions reduction by 2050 and the interim goal of 50 percent reduction of GHG emissions by 2030. Opportunities in urban environments are different from rural environments. For instance, low-carbon mobility options are available in urban environments while space for solar farms are available in rural. It can be challenging to implement emission reductions in an existing built environment, but there are opportunities to do so in building upgrades, equipment efficiency, and operational improvements.

The City of Alexandria within the Commonwealth of Virginia is constrained by the Dillon Rule. The Dillon Rule restricts the authority of the City. In the EAP 2040, issues regarding legal authority are shown as legislative priorities and not action items because the ability to take action is outside the authority of the City.

Achieving the goals will take collective action by the City government and the community in all focus areas, along with collaboration with our regional partners and state and federal government - specifically with respect to renewable energy, complementary regulations, and improved federal efficiency standards. Enhanced education and outreach will include a focus on the next generation adopting a culture of sustainability as a new norm.

Introduction

The electric grid provided by the City's utility supplier is currently about 3 percent renewable generation.[3] To achieve emission reduction targets, a significant increase in the renewable energy portion of the electrical distribution is needed. According to the IPCC, the share of electricity supplied by renewable resources needs to increase by 36-97 percent overall. The U.S. Energy Information Administration says that, overall, the grid in the U.S. was about 17 percent renewable in 2018.[4]

The regional methodology calculates transportation as 36 percent of the City's GHG inventory total which includes contributions of through traffic, metro subway, rail, and air travel. While Alexandria was the most successful in reducing vehicle miles traveled in the region there are significant portions of the 36 percent transportation sector emissions that are outside the control of the City government and community.

The EAP 2040 works towards aspirational goals and targets with potentially achievable actions in the short-term and more aspirations in the mid- and long-term. As outside factors change, the EAP 2040 targets may be accelerated.

3 Dominion Energy Virginia's 2018 Integrated Resource Plan, May 1, 2018, figure 3.1.1.3.

4 https://www.eia.gov/energyexplained/index.php?page=electricity_in_the_united_states.

CLIMATE CHANGE

Climate Change

As a tidal riverfront city, Alexandria is particularly vulnerable to the real and urgent threats of climate change. Old Town is already regularly subject to tidal and weather-related localized flooding that affects the wellbeing of the City. Reducing carbon emissions in all sectors is a key mitigation strategy. City-owned buildings and operations generate only about 4 percent of total emissions, while the remaining 96 percent is from residential and commercial buildings and transportation as illustrated in the carbon dioxide equivalent (CO2e) graphic.

Most of the actions outlined in the EAP reduce the City's share of contributions to climate change. The contribution of City emissions from various sectors of the community show that the majority are from buildings, followed by transportation. Current core functions in the City require the use of fossil fuels during the transition to electrification where replacement technologies are not currently available.

The City's GHG inventory trend from 2012 to 2015 indicates decreases from transportation due to lower carbon mobility options and changes in the grid fuel mix with increases from population growth. The data is not normalized for weather.

Rising sea levels and the increased frequency and intensity of storms will make localized flooding a more significant issue, impacting public safety, private property, and businesses. Resiliency planning and adaptations at the waterfront and elsewhere, along with emergency operations, are also key actions.

The Intergovernmental Panel on Climate Change (IPCC) Summary for Policymakers, provides scientific information on the environmental, political and economic impacts of climate change recommendations that cannot be achieved by the City in isolation. It requires significant leadership at the state and federal level. The IPCC target is to be net zero or carbon neutral by 2050. The City targets are a 50 percent reduction by 2030 and at least an 80 percent but ideally 100 percent reduction, by 2050.

The carbon dioxide (CO2) measurement reached 415 parts per million (ppm) in the atmosphere in May 2019 (Mauna Loa Observatory in Hawaii). This is an indication of how humans are changing the climate of the planet. CO2 measurement directly correlates with global temperature and ocean acidification. Excessive carbon dioxide (and CO2 equivalents) put into the atmosphere have been trapping heat, described as a greenhouse effect. This heating effect will continue to accelerate and trap heat for hundreds of years causing new heat records and devastating impacts to the planet.

Getting to the goal of carbon neutral requires actions at all levels of government, participation by the public, substantial emission reductions, carbon sequestrations, and negative emissions technologies such as aggressive tree planting and reforestation.

1 Climate Change

GOAL

Increase the City's preparedness to respond to the impacts of climate change and environmental emergencies

TARGET

Reduce community-wide GHG emissions by 50 percent by FY2030 and 80–100 percent by FY2050 (base year 2005) supported by significant contributions at the state and federal level toward renewable energy and energy efficiency mandates

SHORT-TERM ACTIONS

1.1.1

By FY2021, establish a multidisciplinary task force to guide an update of the Energy and Climate Change Action Plan. The Energy and Climate Change Task Force will base its recommendations for improvements in energy efficiency for both new and existing private and public buildings on the Green Building Policy.

The Plan will include recommendations for specific policies and programs, each with funding strategies, to achieve emissions reductions targets by

1) increasing of renewable energy production and availability for city residents and businesses;
2) working to curtail consumption of fossil fuels;
3) engaging Alexandria residents and businesses in emissions-reducing actions;
4) identifying opportunities for climate adaptation policies and practices.

Cost Estimate: $305,000

Cost Breakdown: $150,000 is for consultant services to propose recommendations for policies and programs and $155,000 is for staff (1 FTE) to support a new task force.

1.1.2

By FY2022, determine appropriate policies and guidelines for estimating projected greenhouse gas (GHG) emission impacts from operations and capital improvement program (CIP) expenditures through the City's budget process. This is a multi-step process which includes: identifying projects and programs likely to have a significant impact on community-wide GHG emissions and calculating costs to programs and projects marked for GHG assessments. By FY2024, the assessment process shall use a Community Energy Model to forecast GHG emissions. Results should be published consistent with the City's budget process.

Cost Estimate: Costs are dependent on the number of projects per year that meet the guidelines, but the process may require one to three percent of project costs to estimate GHG emissions.

1.1.3

By FY2021, establish sustainability criteria for investments made by city-controlled pension funds that consider minimizing the exposure of city investments to publicly-traded companies pursuing fossil fuel extraction.

Cost Estimate: Existing staff resources

Climate Change

MID-TERM ACTIONS

1.1.4 By FY2024, complete a climate vulnerability assessment of community and infrastructure systems. Evaluate the vulnerabilities and risks to the City and community's financial and social-welfare resulting from changing climate conditions. Evaluate critical infrastructure and community systems and their ability to respond during environmental emergencies.

Cost Estimate: $100,000

Cost Breakdown: Consultant engagement and strategy development are estimated to be $75,000–$100,000

1.1.5 By FY2026, update Energy and Climate Action Plan to evaluate the benefits, feasibility, and timing of policies and programs. These policies and programs will support community deep-energy efficiency retrofit programs, electrification transition from fossil fuels of existing private buildings, and potential renewable energy supply implementation locally and regionally to offset community electricity use.

Cost Estimate: $100,000

Cost Breakdown: Consultant engagement and strategy development are estimated to be $75,000–$100,000

1.1.6 By FY2028, update the City's Emergency Operations Plan (EOP) and Continuity of Operations Plan (COOP) to include infrastructure resiliency. Provide and/or identify infrastructure in the city for response to environmental emergencies such as shelter, potable water, and local emergency power planning.

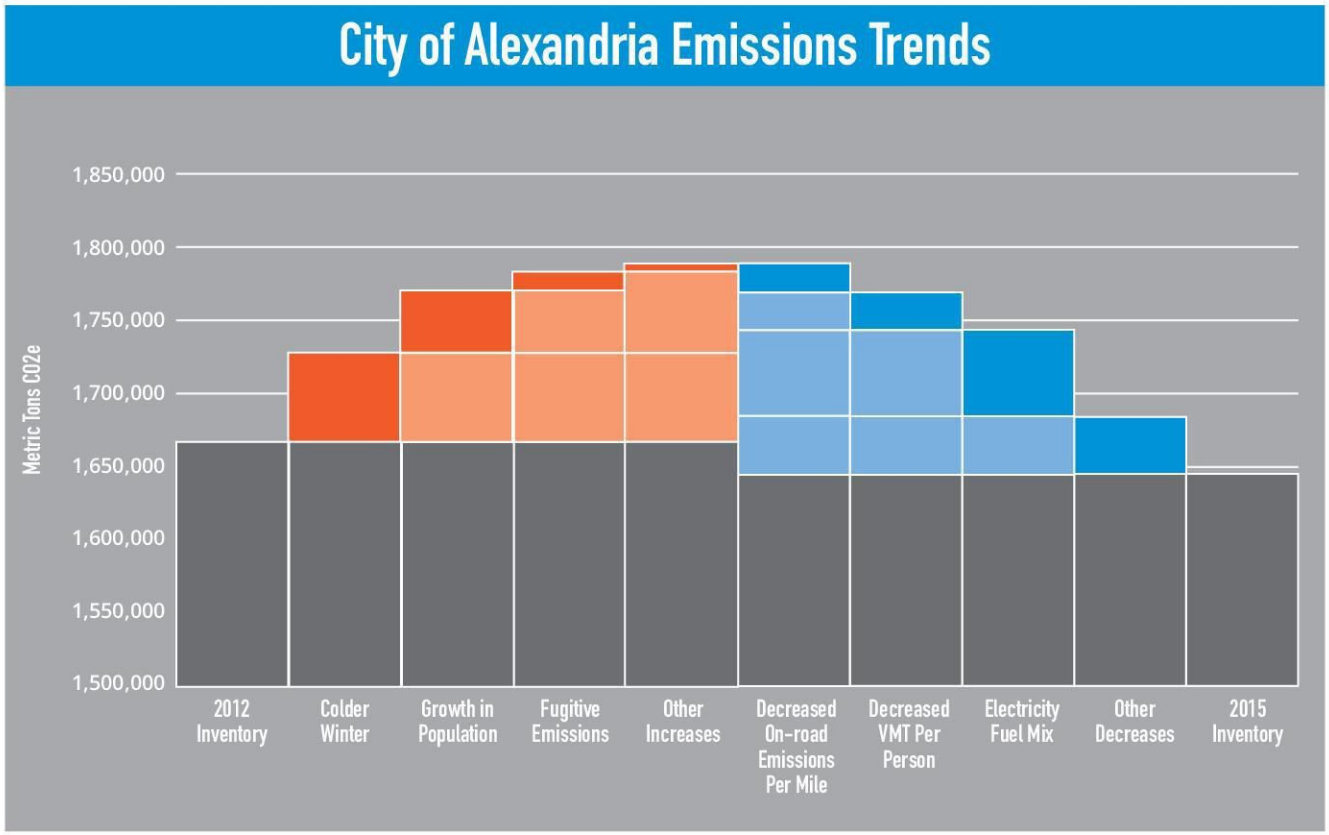
Cost Estimate: $100,000

Cost Breakdown: Consultant engagement and strategy development are estimated to be $75,000–$100,000

1.1.7 By FY2024, develop and implement a state-level legislative and regulatory engagement strategy to identify, create, and/or support policy opportunities to reduce GHG emissions associated with community energy use, and climate adaptation and resiliency.

Cost Estimate: $100,000 strategy development + $25,000 /year

Cost Breakdown: Consultant engagement and strategy development are estimated to be $75,000–$100,000. Estimated $25,000 per year for external staffing or technical support to implement legislative and regulatory policy engagement.



"The "Emissions Trends" graph shows the cumulative changes in GHG values from various factors. Orange represents increasing factors and blue represents decreasing factors. The data is not normalized for weather.

LONG-TERM ACTIONS

1.1.8 By FY2035, implement updated Energy and Climate Change Action Plan action (1.1.4) and include climate action measures in City financial and service decision making.

Cost Estimate: Total costs of updated Energy and Climate Change Action Plan actions will be developed as part of plan development process.

Climate Change

Legislative Priorities

State-level policy and regulatory activities relevant to identifying and creating opportunities for climate adaptation and resiliency.

Justification

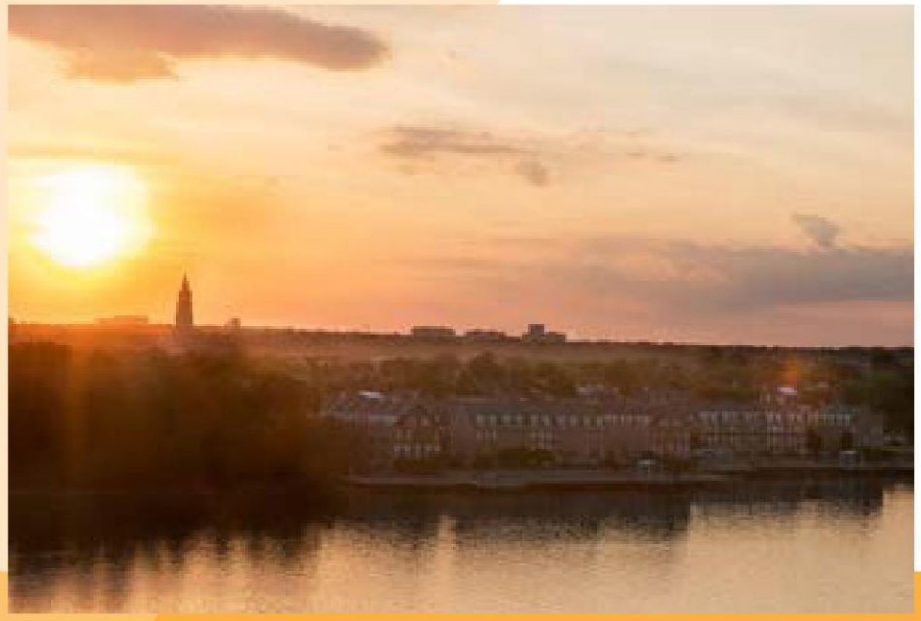
The goal, target and actions are consistent with the City's commitments to addressing climate change as part of the Metropolitan Washington Council of Governments (MWCOG) Regional Climate and Energy Action Plan.[1] They align with the Paris Agreement,[2] our stated commitments, and live up to our identity as an environmental policy leader to achieve our target GHG emission reductions. Such GHG emissions reduction targets are consistent with the Intergovernmental Panel on Climate Change Assessment Report of limiting global warming to within 1.5-degrees C response strategies. Engagement of the community is essential to reducing the 96 percent emissions generated by the community and the 4 percent by city operations.

Accountable Parties

General Services (primary), Transportation and Environmental Services, Management and Budget, Planning and Zoning and the community.

1 MWCOG, Regional Climate and Energy Action Plan, p.24. goo.gl/GmDkzh

2 382 US Climate Mayors commit to adopt, honor and uphold Paris Climate Agreement goals. http://climatemayors.org/actions/paris-climate-agreement/



ENERGY

Energy

Energy is the lifeblood of Alexandria. The systems that provide comfort in the homes and buildings we occupy, the vehicles we drive or the transit we use, the provision of safe and clean drinking water, the production and transportation of goods and services, the growing and processing of food, and communications technologies all rely on the use of energy resources.

Alexandria exists within a complex energy ecosystem where no less than 96% of Alexandria's greenhouse gas emissions result from the direct or indirect use of fossil fuel energy resources. Natural gas to heat homes, buildings, or water; electricity generation from coal, natural gas, oil, or biomass for lights, cooling, computers, and phones; gasoline or diesel fuel to drive – such fossil fuel use results in the release of greenhouse gas emissions into the Earth's atmosphere locally and globally to accelerate and contribute to the effects of climate change.

Alexandria's local actions in the EAP are reducing reliance on fossil fuel energy for buildings and transportation and facilitating the transition to 100 percent renewable energy supply. The actions in this section also support many of the goals in other sections of the EAP 2040 such as Climate Change, Air Quality, Transportation, and Environmental Health. EAP 2040 energy goals, targets, and actions powerfully contribute to the collective regional, state, national, and global efforts necessary to aggressively combat possible disastrous consequences to the planet and society from climate change while enhancing Alexandrians' and society's quality of life.

The City is reducing energy usage through efficient lighting and other projects. For example, two projects alone represent about $45,000 in annual savings; LED lights at the Courthouse have reduced electric demand by 90kW and lowered annual electricity consumption by 15 percent; and at 2900 Business Center Drive demand has been reduced by 70kW, and a 20 percent reduction in total facility electrical use.

The City of Alexandria is rolling out LED lighting upgrades across City buildings and streetlights. Lighting, building system controls, and equipment improvements will reduce the City's electricity consumption to achieve the 25 percent efficiency improvement target and associated greenhouse gas emissions.

2 Energy

2.1. RENEWABLE ENERGY

GOAL

Transition all applicable Alexandria government facilities to 100 percent renewable energy for all energy-use needs to mitigate Alexandria's contribution to climate change

TARGET

By FY2030, transition all applicable Alexandria government facilities to 100 percent electricity and offset this electrical energy use by 100 percent renewable energy

SHORT-TERM ACTIONS

2.1.1 By FY2020, increase Renewable Energy Certificate (REC) purchases to offset 100 percent of electrical energy use by City government facilities. This temporary measure will be phased out as direct purchasing and onsite generation grow to represent an increasing share of the City's electrical energy supply over time.

Cost Estimate: $100,000 per year

Cost Breakdown: Approximately $58,500 has been committed in FY2019 to achieve approximately 60 percent offset of electricity use. Costs will vary slightly year over year to accommodate net changes in electrical energy use from energy efficiency implementation, weather influences, and operational changes.

2.1.2 By FY2021, develop a renewable energy supply strategy to evaluate the risks, benefits, feasibility, optimal mix and timing of potential renewable energy supply implementation pathways considering the City's current and future energy use demands. Should beneficial direct purchase or other opportunities become available before the strategy is complete, the City should prudently evaluate and consider implementation.

Cost Estimate: $100,000

Cost Breakdown: $50,000–$100,000, depending on the rigor of analysis.

Energy

2.1.3 By FY2023, ensure that direct purchasing of offsite renewable electrical energy accounts for at least 50 percent of electrical energy use at all City-operated facilities. The remainder will be made up by REC purchases and onsite renewable electrical energy generation to achieve a 100 percent renewable energy supply.

Cost Estimate: $175,000–$3,500,000

Cost Breakdown: Capital cost (consulting, contracting and procurement, acquisition, installation, etc.) is estimated to be approximately $175,000 for implementation of 50 percent electrical energy offset from a direct purchasing opportunity and up to $3,500,000 if feasible on-site renewable energy installation opportunities are implemented. The balance may be achievable through RECs. Both direct purchasing opportunities and feasible on-site renewable energy installations have high potential to result in cost savings to the City with an estimated simple payback ranging from 10–20 years. As renewable energy markets continue to mature, opportunities may exist that result in shorter simple payback periods. Optimal mix, savings estimates, and purchasing strategies will be identified from short-term action 2.1.2.

MID-TERM ACTIONS

2.1.4 By FY2024, develop an electrification and renewable energy supply transition plan for the City's non-electricity energy use including the conversion of natural gas and other fossil fuel use in facilities and operations that can be supported by renewable energy supply.

Cost Estimate: $100,000–$200,000

Cost Breakdown: $100,000–$200,00, depending on rigor of analysis.

2.1.5 By FY2028, ensure that direct purchasing of offsite renewable electrical energy accounts for at least 80 percent of electrical energy use at all City-operated facilities. Ensure it is from a regional source that contributes to the growth of renewable energy capacity in the region. Onsite renewable electricity generation and REC purchases will make up the remainder, to achieve a 100 percent renewable electrical energy supply.

Cost Estimate: $100,000–$150,000/year

Cost Breakdown: $100,000–$150,000 per year is assumed for purchases of RECs where onsite or purchase from an offsite renewable source is not supported by the City's renewable energy supply strategy. Until further information is available on the long-term electrical energy needs of the City, the total cost of RECs is unknown. However, $100,000–$150,000 should serve as a conservative estimate.

LONG-TERM ACTIONS

2.1.6 By FY2040, implement electrification of all City non-electricity energy use (City facilities, operations, and vehicles).

Cost Estimate: Cost estimates are not available as the cost and technology are rapidly changing. Further study is necessary to provide cost estimates.

2.1.7 By FY2035, ensure that onsite renewable electrical generation and direct purchasing of offsite renewable electrical energy, are from a regional source and add to the supply of renewable energy available, increases to 100 percent of electrical energy use at all City-operated facilities.

Cost Estimate: $0/year

Cost Breakdown: A cost of zero per year assumes previous investment in onsite renewable electrical energy generation that has not exceeded the systems' useful life, offsite renewable electrical energy from a regional source contract continues to be active, and any additional electrical energy supply requirements are met through available renewable energy programs that are at cost parity or the lower marginal cost as compared with conventional generation sources of today.

Legislative Priorities

1. Make permanent an aggregate municipal net metering pilot program, include expanded renewable energy system capacity limits, increase cost offset to equal the value of solar resources, remove administrative costs, and provide applicability across a range of utility rate classes.
2. Consider electricity load aggregation opportunities to leverage statutory retail choices.

Justification

Provides electrification and renewable energy supply transition of the City's non-electricity energy use (natural gas and other fossil fuel use) in City facilities and operations supported by renewable energy supply to offset the City's greenhouse gas emissions.

Accountable Parties

General Services (primary); Transportation and Environmental Services

Energy

2.2 ENERGY EFFICIENCY

GOAL

Accelerate implementation of all feasible energy efficiency and emission reduction measures for City-owned buildings and infrastructure, and City-affiliated transportation

TARGET

By FY2035, improve energy efficiency in City facilities and operations by 50 percent over a FY2018 baseline use

SHORT-TERM ACTIONS

2.2.1 By FY2023, update the facility asset condition auditing process for facility asset conditions (Facility Condition Index, FCI) rating methodology) to reflect facility energy and sustainability performance. In addition, include energy audits, portfolio energy optimization, and similar evaluation processes into the FCI rating methodology. Develop and utilize a portfolio-wide energy model to identify and develop a portfolio-wide energy optimization investment plan as part of a broader energy supply transition planning effort, as recommended in the Renewable Energy action 2.1.2.

Cost Estimate: $200,000 per year

Cost Breakdown: Estimated $150,000–$200,000 per year funding plus staff resources to develop an independent portfolio-wide energy optimization investment plan or as part of a broader energy supply transition planning effort as recommended in the Renewable Energy section.

2.2.2 By FY2021, initiate electric passenger vehicle pilot programs for DASH, Alexandria City Public Schools, and the City vehicle fleet to evaluate costs, benefits, technical feasibility, and implementation opportunities to transition City fleet vehicles to electric vehicle technology, and install vehicle charging infrastructure at City facilities.

Cost Estimate: $150,000 per year

Cost Breakdown: A small-scale pilot of City passenger vehicles may be accomplished with $100,000–$150,000 for vehicle acquisition.

2.2.3

By FY2021, complete retrofits of 75 percent of all City facilities' practicable conventional lighting with light-emitting diode (LED) lighting. By FY2023 retrofit 95 percent of practicable streetlights and outdoor lighting to LED technology, subject to the availability of a suitable LED solution and zoning constraints.

Cost Estimate: Total estimated cost to retrofit practicable lighting is $7,800,000–$11,000,000.

Cost Breakdown: Retrofitting 75 percent of all remaining practicable conventional lighting in City facilities' and operations is estimated to be an additional $4,000,000–$5,500,000. Retrofitting practicable streetlights is estimated to be $5,550,000 ($1,750,000 for conventional roadway and traditional streetlighting and about $3,800,000 for Gadsby). Not all existing lighting is amenable for retrofit, either financially or technically.

Retrofitting 75 percent practicable conventional lighting at City facilities and operations is estimated to be a simple payback range of approximately 3–8 years. The estimated simple payback of retrofitting 100 percent of practicable streetlights is approximately 4–7 years. The Gadsby's make up 840 of ~10,000 lights and are custom poles and fixtures.

Energy

MID-TERM ACTIONS

2.2.4 By FY2027, implement energy efficiency strategies in City facilities and operations to reduce energy use by, at minimum, 25 percent over FY2018 usage.

Cost Estimate: $1,000,000–$3,000,000/year

Cost Breakdown: Assumes investing in energy efficiency actions that reflect non-lighting systems, including HVAC, hot water, etc., and includes whole-system redesign and replacement. Accounts for highest cost actions that have current-dollar simple payback ranging from 7–14 years. Does not reflect costs of building electrification conversions.

2.2.5 By FY2024, implement electrification of, at minimum, 25 percent of applicable non-electric passenger City fleet vehicles consistent with Fleet Replacement Plan criteria and scheduled replacement.

Cost Estimate: $150,000/year

Cost Breakdown: $150,000 per year currently serves as a placeholder as analysis is currently underway to determine the short-term and long-term incremental costs of replacing convention passenger vehicles with electric. These costs only reflect the incremental vehicle costs and do not include costs of charging infrastructure.

2.2.6 By FY2028, implement electrification of, at minimum, 10 percent of DASH, rapid transit routes, and King Street Trolley buses. Provide necessary electric vehicle charging infrastructure at City facility locations.

Cost Estimate: Not available at this time.

LONG-TERM ACTIONS

2.2.7 By FY2035, implement energy efficiency strategies in City facilities and operations to reduce energy use by, at minimum, 50 percent over FY2018 usage.

Cost Estimate: $2,000,000–$4,000,000/year

Cost Breakdown: Assumes investing in energy efficiency actions that reflect non-lighting systems, including HVAC, hot water, etc. and includes whole-system redesign and replacement. Accounts for highest cost actions that have current-dollar simple payback ranging from 14 – 21 years. Does not reflect costs of building electrification conversions.

2.2.8 By FY2040, implement electrification of all non-electric City vehicle fleets and include ACPS, DASH, rapid transit routes, heavy-duty equipment and vehicles. Provide necessary electric vehicle charging infrastructure at City facility locations. Hybrids will be used as an interim until electric vehicles can be substantially implemented.

Cost Estimate: Not available at this time.

Cost Breakdown: Cost estimates are not available as the cost and technology are rapidly changing. Further study is necessary to provide cost estimates. However, a one-time expenditure of $50,000 for evaluation of solid waste vehicles (does not include staff time) has been identified for a consultant study.

Legislative Priorities

1. Provide financial incentives to local governments, state agencies, and private owners of conventional roadway, street, and outdoor lighting to convert to dark-skies compliant LED technologies.
2. Commission a new study of energy efficiency potential to assess the scale, availability, and cost of energy efficiency as an economic, resiliency, and power generation resource in the Commonwealth of Virginia.
3. Direct the Virginia Department of Mines, Minerals, and Energy (DMME), State CorporationCommission (SCC), Virginia Department of Environmental Quality (DEQ), utility companies, and relevant stakeholders to pursue strategic partnerships with Virginia local governments to identify the needs, coordinate the deployment of public electric vehicle charging infrastructure, and incentivize the transition of personal-occupancy vehicles to electric vehicle technologies.

Energy

Justification

Energy efficiency and energy conservation implementation serves as a foundational practice for the City to offset greenhouse gas emissions. In addition, energy efficiency provides a reduction in energy use at a lower cost and higher return on investment than many alternatives and serves as a lower-cost pathway to offset the City's greenhouse gas emission by a renewable energy supply. Similarly, the electrification of the City's public and fleet transportation increases the energy efficiency of the fleet operations, and with support by renewable energy supply provides a pathway to offset the City's greenhouse gas emissions from transportation.

Accountable Parties

General Services (primary); Transportation and Environmental Services

2.3 COMMUNITY ENERGY USE

GOAL

Reduce greenhouse gas (GHG) emissions associated with community energy consumption in support of the City's global GHG emissions reduction goals

TARGET

Reduce greenhouse gas (GHG) emissions to at least 10 metric tons of CO2e per capita by FY2022, 6 by FY2030, 4 by FY2040, and 1-3 by FY2050 from a FY2005 base year

SHORT-TERM ACTIONS

2.3.1 By FY2019, expand participation in state-level policy and regulatory activities relevant to identifying and creating opportunities to reduce GHG emissions associated with community energy use. This should also include intervening in regulatory dockets related to the composition of the utility generation supply mix, utility energy efficiency programs, or utility rates.

Cost Estimate: One full-time equivalent (FTE) at $200,000 per year

Cost Breakdown: Depending on the necessary expertise and level of involvement, efforts may require external support including specialized legal counsel or technical experts. Based on past intervention efforts, these costs may range from an estimated $50,000/$500,000 per year.

2.3.2 By FY2020, adopt an ordinance that implements a Commercial Property Assessed Clean Energy (C-PACE) program to support sustainable economic development opportunities.

Cost Estimate: $75,000

Cost Breakdown: Assumes operation by external administrator. Estimate 75 percent for program implementation and 25 percent ongoing program operation.

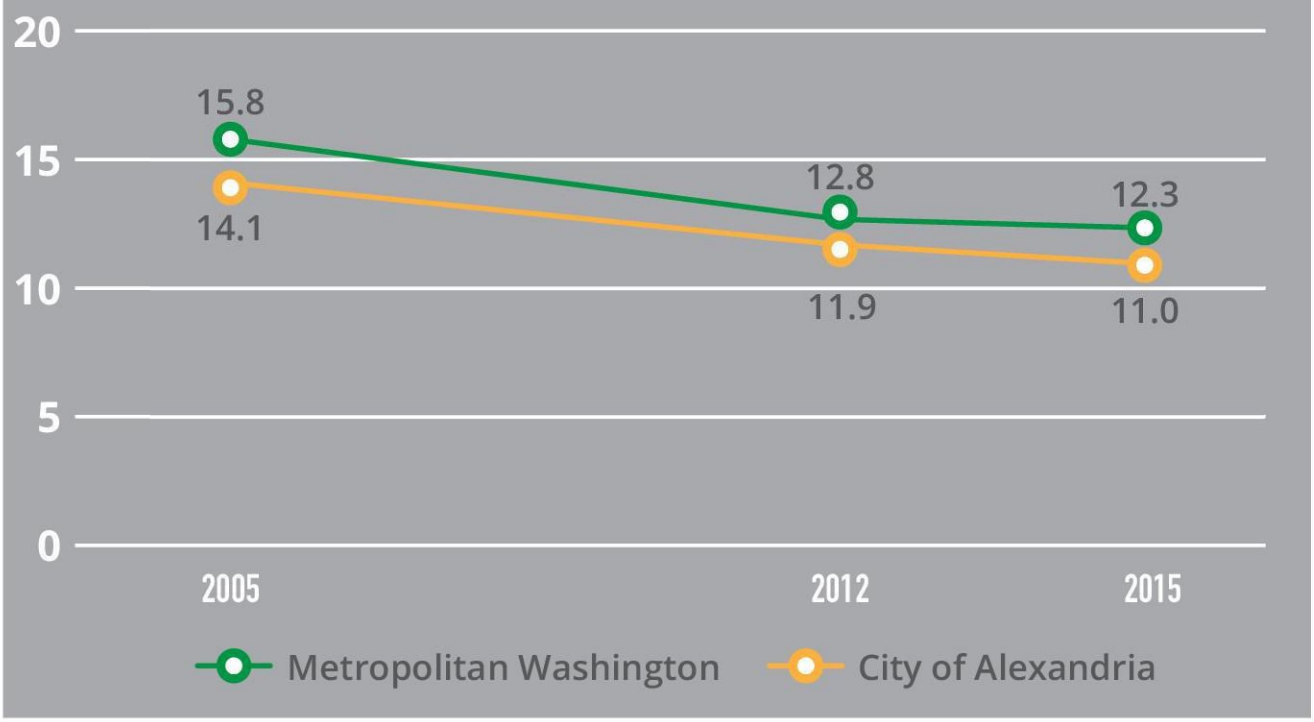
2.3.3 By FY2020, develop a strategy for community electric vehicle charging infrastructure.

Cost Estimate: $100,000

Cost Breakdown: Consultant engagement and strategy development are estimated to be $75,000–$100,000.

Energy

Per Capita Greenhouse Gas Emissions Trends



MID-TERM ACTIONS

2.3.4 By FY2024, develop a community energy model to track energy use and greenhouse gas reductions by various energy efficiency and renewable energy programs offered by the City and other partner organizations and to evaluate cost effectiveness and provide supporting information to optimize community energy use. The community energy model should reflect electrification transition from fossil fuels to electricity of private buildings, electrification in community vehicle use, mobility alternatives, and renewable energy supply implementation. The model should forecast energy use until at least 2040 and provide commensurate greenhouse gas emissions under various scenarios.

Cost Estimate: $100,000 initial + $10,000–$20,000/year to update

Cost Breakdown: Consultant engagement and community energy model development are estimated to be about $100,000. Annual updates are estimated to be $10,000–$20,000 per year.

LONG-TERM ACTIONS

2.3.5 By FY2040, implement policies and programs to support a full suite of community energy efficiency programs, building electrification, transition from fossil fuels, and community renewable energy supply.

Cost Estimate: $100,000–$10 million+/year

Cost Breakdown: Depends on the scope of the full suite of community energy efficiency programs. On the low end, $100,000 for program administration costs, and $10 million+ if financial incentives or related investments were to be offered.

2.3.6 By FY2029, implement and support the implementation of a publicly-accessible electric vehicle charging infrastructure that is supported by renewable energy supply.

Cost Estimate: Costs will be developed upon completion of electric vehicle charging infrastructure strategy. Where applicable, electric vehicle charging infrastructure provided by non-City entities will be prioritized.

Energy

Legislative Priorities

1. Pursue legislative opportunities to provide decarbonization via legal authority and implement a community solar or community choice aggregation-like program to provide subscription access to shared renewable energy facilities to Alexandria community members and businesses to offset individual or business GHG emissions from electricity use.
2. Identify state-level policy and regulatory activities relevant to identifying and creating opportunities to reduce GHG emissions associated with community energy use.
3. Lobby for bills that would expand renewable energy purchasing by the community or utility, advocate for the state of Virginia to join the Regional Greenhouse Gas Initiative (RGGI), set a renewable portfolio standard for electricity generation, and grant Alexandria authority to undertake energy and transportation initiatives to reduce GHG emissions that are currently prohibited by state law.

Justification

The goal, target and actions are consistent with the City's commitments to addressing climate change resulting from community energy consumption in support of City's global GHG emissions reduction goals. They are also consistent with the Metropolitan Washington Council of Governments (MWCOG) Regional Climate and Energy Action Plan. Engagement and programming to support the reduction of community energy use is essential to reducing the 96 percent emissions generated by the community.

Accountable Parties

General Services (primary); Transportation and Environmental Services

GREEN BUILDING

Green Building

The Green Building section's goal to optimize the economic, environmental, and social performance of new and existing buildings in the City of Alexandria is a multi-departmental effort to reduce GHG emissions and to improve air and water quality through development of greener buildings. The updated target and actions build on the successes of the 2009 Green Building Policy and the current standard development conditions which resulted in nearly 10 million square feet of green building built in the City, equating to approximately 95 percent of new development square footage in compliance with the policy.

The 2019 Green Building Policy[1] is the focus of the EAP 2040 Green Building section. The update of the Green Building Policy in June 2019 (a short-term action adopted in Phase One in October 2018) involves the coordination and expertise of the Green Building Policy Update Task Force in addition to the Departments of Planning & Zoning, General Services, Transportation & Environmental Services, Code Enforcement, Office of Housing and Office of Management and Budget.

The policy sets cutting-edge green building standards for new, large-scale private and public development, with the City leading by example through increased certification level of green building performance, plus an enhanced focus on net zero energy buildings, and overall reductions in energy use, stormwater treatment, improved water efficiency, and indoor environmental quality. The actions in this section coordinate with other EAP actions to evaluate and develop additional programs that incentivize green building, measure and monitor building performance and set a pathway to achieve net zero energy in new and existing City-owned buildings. The process and updated policy inform the short, mid, and long-term goals of this EAP section, contributing to overall City sustainability.

As most communities are primarily comprised of existing buildings, the performance characteristics of both new and existing buildings will have an impact long into the future. For the 2015 GHG inventory, existing buildings accounted for 57 percent of GHG emissions in the City.

1 Developers should review the online version of the Green Building Policy for any future updates at the City of Alexandria's Green Building webpage: https://www.alexandriava.gov/GreenBuilding."

3 Green Building

3.1. GREEN BUILDING POLICY

GOAL

Optimize the economic, environmental, and social performance of new and existing buildings in the City of Alexandria

TARGET

By FY2019, the Green Building Policy will set expectations for how both new and existing buildings should contribute toward achieving the goals for GHG emissions, water use, and stormwater runoff reduction established in the EAP, and by FY2020 will set forth a path for new city-owned buildings to meet a net zero energy standard. The City will maintain the same level of policy compliance as in the first decade since its adoption.

SHORT-TERM ACTIONS

3.1.1

Review the effectiveness of the current Green Building Policy and update the Policy in FY2019 with a focus on sustainable strategies that have the greatest impact toward achieving targets across EAP principle areas. The Task Force deliberations will inform the medium and long-term EAP actions for Green Buildings. Through this process, with support of third-party consultant analysis, the update will consider topics such as:

- Increasing LEED or equivalent third-party green building certification standards for private development;
- Establishing a separate green building standard, which includes evaluating the feasibility of a net zero standard where applicable, for new public development, including schools in collaboration with ACPS;
- Establishing incentives for private development participation in green building certifications, to achieve the quantifiable goals for GHG emissions and water use and stormwater runoff reduction established in the EAP;
- Prioritizing specific green building elements;
- Introducing mandatory and/or voluntary green building practices for existing buildings (including historic) and for small buildings not subject to site plan review;
- Instituting a building performance monitoring program;
- The City's ability to be more ambitious than the private sector in meeting green building goals to serve as a sustainability leader, and
- Establishing a Green Zone in the City per the legislative authority of 58.1-3854, Creation of local green development zones for tax incentives, permit fees, special zoning, and exemption from ordinances.

As part of this process, a Green Building Policy Update Task Force will be established by City Council. The Task Force, with critical input from the EPC and the development community, will determine the actual topics to be analyzed by the consultant.

Cost Estimate: $75,000

Cost Breakdown: The funds will be used for consultant studies on policy analysis on a cost analysis. Does not include staff time.

Green Building

3.1.2 By FY2020, evaluate additional sustainable features to incorporate into the "Building Section" of the standard development conditions for the Development Site Plans (DSP) and Development Special Use Permits (DSUP) that will contribute toward achieving targets across EAP principle areas.

Cost Estimate: Existing staff resources

3.1.3 By FY2023, update the Concept 2 Development Plan Checklist to include a requirement for a preliminary compliance narrative that indicates the applicant development team is aware of the City's Green Building Policy and understands how it is applied.

Cost Estimate: Existing staff resources

3.1.4 By FY2020, update checkpoints within the development review process to track compliance with the Green Building Policy.

Cost Estimate: Existing staff resources

3.1.5 By FY2023, update standard development conditions for projects subject to the new Policy to include the following topics:

- Staff access to post construction energy and water performance data
- Sub-metering of EV charging stations (so that whole-building metering is not affected)
- Consideration of energy metering in multifamily and hotel developments
- Consideration of enhanced commissioning measures in private development

Cost Estimate: Existing staff resources

3.1.6 By FY2023, establish a process for evaluating Net Zero Energy standards in new public buildings, including applicable guidelines, standards, and rating systems.

Cost Estimate: Existing staff resources

3.1.7 By FY2021, establish a new green building staff position in the Department of Planning and Zoning to work with the development community and property owners to support the implementation of the Green Building Policy.

Cost Estimate: $120,000

Cost Breakdown: One FTE to implement and manage Actions 3.1.8 through 3.1.17

3.1.8 By FY2023, establish incentive programs that encourage green building renovations for existing buildings, such as encouraging property owners and leasing agents to participate in a Green Lease Leader program.

Cost Estimate: See action 3.1.7

Cost Breakdown: One FTE to implement and manage Actions 3.1.8 through 3.1.17

3.1.9 By FY2023, evaluate regulatory incentives linked to specific green building performance measures for new private development:

- Establishing a City-wide Green Zoning Overlay (e.g., incentivizing solar panels and wind turbines through additional building height or allowing floor area exclusions to accommodate passive design elements).
- The feasibility of permitting bonus building height and density (once affordable housing bonuses are first exhausted) for applying green building practices above those outlined in the new Green Building Policy.

Cost Estimate: See action 3.1.7

Cost Breakdown: One FTE to implement and manage Actions 3.1.8 through 3.1.17

3.1.10 By FY2024, complete a study of feasibility and methods to achieve net zero energy in existing building renovations, including the ability to achieve LEED Zero for LEED certified buildings or other applicable net-zero certifications.

Cost Estimate: See action 3.1.7

Cost Breakdown: One FTE to implement and manage Actions 3.1.8 through 3.1.17

MID-TERM ACTIONS

3.1.11 By FY2028, establish a Performance Monitoring Program for private development as staffing resources become available to manage the Program and track green building certification through the development review process.

Cost Estimate: See action 3.1.7

Cost Breakdown: One FTE to implement and manage Actions 3.1.8 through 3.1.17

3.1.12 By FY2028, evaluate the possibility of establishing a fee-in-lieu program for projects that are unable to comply with the Green Building Policy.

Cost Estimate: See action 3.1.7

Cost Breakdown: One FTE to implement and manage Actions 3.1.8 through 3.1.17

3.1.13 By FY2028, establish a standardized process for NZE public buildings city-wide.

Cost Estimate: See action 3.1.7

Cost Breakdown: One FTE to implement and manage Actions 3.1.8 through 3.1.17

3.1.14 By FY2028, investigate the feasibility of performance-based procurement for the NZE construction of public buildings.

Cost Estimate: See action 3.1.7

Cost Breakdown: One FTE to implement and manage Actions 3.1.8 through 3.1.17

LONG-TERM ACTIONS

3.1.15 Schedule future administrative updates to the Green Building Policy to coincide with changes in third-party certification, the revisions to the state Building Code and the implementation of programs established through the EAP actions, with major updates for City Council every 5-7 years as needed. To maintain alignment with the intent of this Policy, Performance Points may be adjusted over time to correspond with updates to the rating systems, revisions to the building code, and/or updates to state, federal, or other City policies.

Cost Estimate: See action 3.1.7

Cost Breakdown: One FTE to implement and manage Actions 3.1.8 through 3.1.17

3.1.16 By FY2029, establish the legislative, code, education, project support, incentives and verification infrastructure required to ensure that all new construction is carbon neutral by FY2030.

Cost Estimate: See action 3.1.7

Cost Breakdown: One FTE to implement and manage Actions 3.1.8 through 3.1.17

Green Building

Legislative Priorities

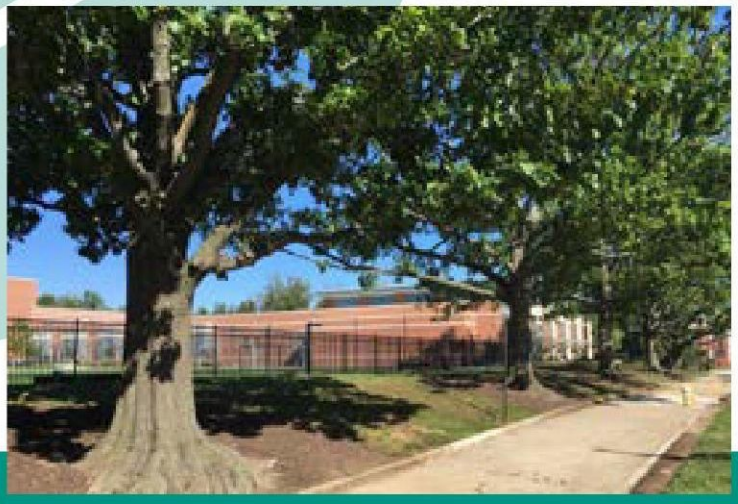
1. Enable local jurisdictions to require energy performance disclosure by private building owners and/or utility companies.
2. Advocate for local building code authority to create, implement, and enforce a local green building code.

Justification

Green building practices are an important instrument in reducing GHG emissions and energy use, potable water consumption, raw materials use, and waste output. Green Building methods also contribute to increased air quality, reduced storm water pollution, reduced energy demands, and economic sustainability.

Accountable Parties

Planning and Zoning (primary); General Services; Office of Housing; Code Administration; Transportation and Environmental Services (EV charging and stormwater); Office of Management and Budget (performance procurement process).



LAND USE AND OPEN SPACE

Land Use

The City of Alexandria is committed to protecting and promoting public open space with a healthy tree canopy. It is an investment in a higher quality of life for residents, visitors, and future generations. The City seeks to protect public open space because:

- It connects the community: Our parks and facilities are the public's common ground that equitably bring together our vibrant and diverse community.
- It improves well-being: Our programs and facilities motivate the community to make healthy choices and live active lifestyles through all stages of life and at all levels and abilities.
- It is an investment in our environment: Our commitment to natural spaces provides physical, mental, and community benefits, while offering opportunities to engage with and conserve our natural resources.

The City achieved a tree canopy of 36 percent in 2016 and has planted about 800 trees per year over the last several years. It also exceeded the 2009 goal of acquiring 100 new acres of open space and maintained a ratio of 7.3 acres of open space per 1,000 residents.

The EAP 2040 actions align with the Open Space Master Plan (2003, updated 2017) and the Recreation, Parks and Cultural Activities Strategic Plan to increase the tree canopy to 40 percent by 2035. The Department of Planning and Zoning development process supports the tree canopy and open space goals of this section and balances the private and public open space needs in Small Area Plans and in private and public development and non-development projects.

4 Land Use and Open Space

4.1 TREE CANOPY

GOAL

Preserve and expand a healthy urban tree canopy

TARGET

By FY2035, average overall tree canopy will be a minimum of 40 percent

SHORT-TERM ACTIONS

4.1.1 By FY2023, update and coordinate the Urban Forestry Master Plan, Environmental and Sustainability Management System (ESMS), and Landscape Guidelines (updated in FY2019) to support increased tree preservation, expansion, maintenance, native species use, and a revised tree canopy coverage goal.

Cost Estimate: $40,000 per year

Cost Breakdown: $30,000–$40,000 per year. $30,000 for the yearly tree inventory study plus $10,000 for the tree canopy survey scheduled for every three years.

4.1.2 By FY2023, enlist City partnerships (community groups) to provide education and outreach to provide technical assistance and opportunities to increase native tree canopy coverage on private property.

Cost Estimate: Existing staff resources

4.1.3 By FY2028, develop an urban forest health index rating system to determine the current and ongoing health and health needs of the urban forest in Alexandria.

Cost Estimate: $100,000

4.1.4 By FY2028, develop a program that supports the planting of trees on private property, commit funding to establish the program and support ongoing implementation.

Cost Estimate: $25,000/year

Land Use

LONG-TERM ACTIONS

4.1.5 By FY2029, update the Urban Forestry Master Plan to support increased tree preservation, expansion, maintenance, native species use, and a revised tree canopy coverage goal.

Cost Estimate: $30,000

4.2 OPEN SPACE

GOAL

Increase open space quantity and improve the environmental quality, management, and social benefits of open space

TARGET

Maintain the ratio of 7.3 acres of publicly accessible open space per 1,000 residents

SHORT-TERM ACTIONS

4.2.1 By FY2023, protect and add open space through acquisition, preservation, and conservation as prescribed in the Open Space Master Plan (updated 2017) and by FY2023, evaluate increasing the target to 7.5 acres per 1,000 residents. This includes, by FY2020, City Council will re-establish the open space steering committee to re-assess the methodology, evaluate, and prioritize potential open space sites. Tools to be considered for open space preservation or restoration will include the purchase of easements or repurposing land as funds can be made available, development occurs, or partnerships can facilitate.

Cost Estimate: The proposed FY20-29 CIP provides $13,175,000 for Open Space acquisition and development. Any proposed changes to this funding will be evaluated through the Open Space Steering Committee's action findings.

Cost Breakdown: The action is also dependent on the development envisioned in small area plans, including city investments, developer contributions, and private philanthropic contributions.

4.2.2 By FY2023, increase the percentage of acres of public natural lands that are actively managed, including restoration and invasive species removal, by 50 percent to 450 acres.

Cost Estimate: Existing staff resources

4.2.3 By FY2020, evaluate and update, using a public process, the requirements of open space on residential, commercial and mixed-use private development. Issues to be addressed include how to achieve meaningful and publicly accessible open space, particularly at the ground level; how to value developer contributions to off-site open space; how to minimize impervious surfaces; how to align vegetation requirements with canopy and native species goals in the Landscape Guidelines; and; how to ensure consistency of open space requirements across similar zones.

Cost Estimate: Existing staff resources

MID-TERM ACTIONS

4.2.4 By FY2028, identify tools and techniques through stream valley plans to maintain and enhance all of the City's stream valleys including public access points for ecological and recreational benefits. The plans will be updated every 10 years.

Cost Estimate: $250,000/10 years (new request)

Cost Breakdown: Based on previous similar plans. Note that this does not include plan implementation which will be determined based on findings of the plan.

MID-TERM ACTIONS

4.2.5 By FY2028, seek publicly accessible open space opportunities in unconventional spaces:

a. Further evaluate the City's network of public alleys and define those most appropriate for informal recreational use and/or green infrastructure improvements.
b. Work with Northern Virginia Conservation Trust to identify potential locations for conservation easements, particularly those that would connect or are adjacent to existing open spaces.
c. Identify and map opportunities to re-purpose public rights-of-way and parking lots for other public uses, including interim and/or permanent recreational use and open space, affordable housing, schools, or other public facilities.
d. Protect and preserve institutional open space by:
    i. Pursing easements for trails and/or ecosystem corridors through institutional space to connect with public open space.
    ii. Develop mechanisms, possibly including incentives, for public/private partnerships to maintain and enhance natural areas on institutional land

Cost Estimate: $60,000/year (part of approved CIP)

Cost Breakdown: The City currently holds a contract with Northern Virginia Conservation Trust to advise on open space concerns and these action items can be added to our joint work plan.

Justification

A healthy and diverse urban forest canopy coverage in Alexandria provides a broad range of environmental and social benefits such as reduced GHG emissions, improved air quality, enhanced property values, stormwater and flood mitigation, public health benefits, and vibrant public spaces. The reduction of GHG emissions improves air quality and contributes to health and wellness.

Legislative Priorities

Advocate for state legislation that would enable the City to expand tree protection and preservation and to increase tree canopy requirements.

Accountable Parties

Recreation, Parks and Cultural Activities (primary); Planning and Zoning, Transportation and Environmental services.

SOLID WASTE

Solid Waste

Solid waste removal is one of the City's most important regulatory responsibilities and core services. In 2009, when the original EAP was written, the City's recycling rate was 28.7 percent. The recycling rate has been above 48 percent since 2011, well above the state minimum requirement of 25 percent and above state average rate of 43 percent. Solid waste processing contributes only two percent of the City-wide GHG emissions. The calculations include the impact of the waste-to-energy plant (COVANTA) that generates electricity from trash instead of emissions from a landfill.

In recent years, the global recycling market has experienced tremendous pressures due to a series of recycling policies implemented by China, the largest importer of scrap materials. To consider how Alexandria should adapt to these pressures, staff began an extensive public engagement process, including the Environmental Policy Commission, to understand and incorporate our customers' needs, values and priorities. In July 2017, staff also retained an independent consultant to conduct a third-party evaluation of the City's current waste management programs and provide recommendations for future long-term management strategies. The results are documented in the City's 20-year strategic plan for solid waste, WasteSmart.

The actions in the EAP 2040 and the WasteSmart Strategic Plan address significant changes for managing solid waste going forward. Implementation of the EAP 2040 action 5.1.1 include new options for glass only bins at the four City recycling drop-off centers and in partnership with a neighboring jurisdiction to turn glass into gravel and sand. This reduces emissions and costs from processing glass in the mixed recycling stream, provides a local use for glass, and can replace some of the non-local resource needs for gravel and sand.

5 Solid Waste

5.1 RECYCLE

GOAL

Recover resources and reduce GHG emissions and other forms of pollution by optimizing and safely handling the collection and processing of solid waste

TARGET

By FY2023, establish a FY2019 GHG emissions base year for the collection and processing of solid waste, measure emissions at least annually, and reduce the emissions rate by at least 12 percent

SHORT-TERM ACTIONS

5.1.1 In FY2020, install special containers for glass only recycling at all recycling drop-off centers to improve the recyclability of glass. In FY2021, if no environmentally and economically justifiable alternative has been identified for recycling glass placed in the single stream, begin to phase out glass from single stream recycling and temporarily reset the City's recycling goal accordingly.

Cost Estimate: $40,000 per year for glass drop-off centers.

Cost Breakdown: Estimate includes containers, plus labor for collection, processing, and administrative fees.

5.1.2 In FY2019, launch a "Recycle Right" education campaign to promote and define recycling best practices with a focus on reducing contamination of recyclables, discouraging the disposal of recyclables inside plastic bags, and maximizing the reduction in GHG emissions.

Cost Estimate: $80,000 per year

Cost Breakdown: Will be built on the existing recycling campaign. Annual fee will be for program administration.

5.1.3 By FY2020, conduct a Route Optimization Study to perform a review of the current truck routing, mileage, staffing levels, homes served per route and tonnages of trash collected. Ensure that routes are performed in the most efficient, economical manner, and maximize the reduction in GHG emissions.

Cost Estimate: $100,000

Cost Breakdown: Maximum of $100,000. The funds will be used for consultant studies. Does not include staff time.

5.1.4 By FY2021, review and update the City's recycling ordinance to reflect changes in the global recycling market and to prioritize recycling practices that maximize the reduction in GHG emissions.

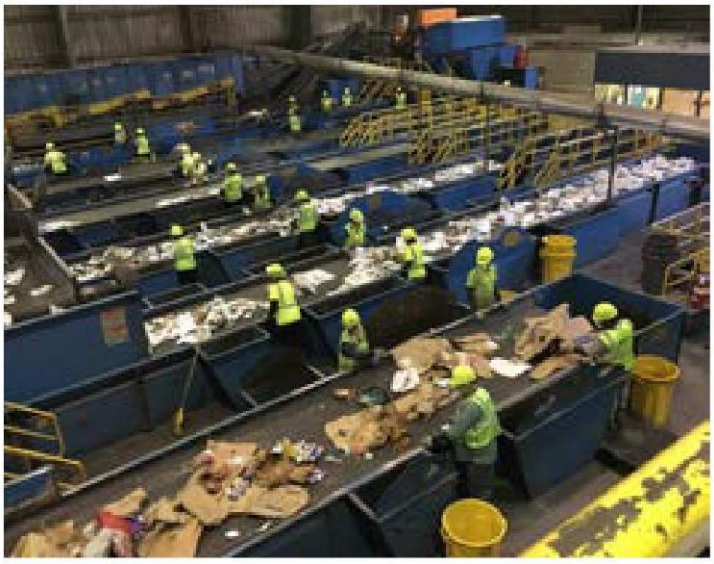
Cost Estimate: $14,400

Cost Breakdown: Includes staff time (320 hours over a two-month period)

Solid Waste

5.1.5 By FY2020, the City's food waste composting program will result in a net reduction in GHG emissions.

Cost Estimate: Total costs of proposed actions will be developed as part of plan development process



MID-TERM ACTIONS

5.1.6 By FY2028, evaluate public space trash and recycling bins and make recommendations for optimizing routes and other operational changes.

Cost Estimate: $75,000

Cost Breakdown: The funds will be used for consultant studies.

5.1.7 By FY2028, review commercial recycling requirements to improve resource recovery in the commercial sector. Evaluate for recycling capacity, convenience, signage, number and type of recyclables required to be recycled, education, outreach, and information required for Recycling Implementation Plan form.

Cost Estimate: $14,400

Cost Breakdown: Includes staff time (320 hours over a two-month period)

5.1.8 By FY2028, evaluate organics processing market readiness and feasibility of curbside organics collection.

Cost Estimate: $75,000–$100,000

Cost Breakdown: The funds will be used for consultant studies.

LONG-TERM ACTIONS

5.1.9 Complete a regional comprehensive alternative disposal study. Evaluate long-term end disposal options, knowing that significant time will be needed for any potential planning and implementation.

Cost Estimate: $75,000–$150,000

Cost Breakdown: The funds will be used for consultant studies.

Justification

In January 2019, City Council unanimously adopted the WasteSmart Strategic Plan to sustainably recover resources. This plan was adopted utilizing the values of the triple bottom line of economics, community values, and environment. The WasteSmart Plan and the EAP aims to reduce greenhouse gas emissions and improve the quality of collected recyclables in response to a more restrictive global recycling market. Action items identified in this section were selected from the WasteSmart Plan that supported this goal. Furthermore, as over 70 percent of the City's waste stream is from the commercial and multi-family sector, an action item addressing commercial recycling requirement is in the EAP.

Accountable Parties

Transportation and Environmental Services (primary)

5.2 REDUCE

GOAL

Reduce total solid waste collected from City-served residential customers

TARGET

By FY2023, reduce the total solid waste per household collected from city-served residential customers by five percent as compared with a base year of FY2018

SHORT-TERM ACTIONS

5.2.1 In FY2019, develop online directory for reuse (consign), donation, repair and include the District of Columbia, Maryland, and Virginia to encourage residents and businesses to prevent waste and reuse existing materials.

Cost Estimate: Existing staff resources

5.2.2 By FY2021, evaluate and make a recommendation to Council on whether to initiate variable-rate pricing for solid waste collection services to reduce waste and provide greater economic equity for residents.

Cost Estimate: $100,000 (does not include staff time).

Cost Breakdown: The funds will be used for consultant studies.

5.2.3 By FY2020, pilot a Share-A-Bag program to encourage residents to use reusable bags over disposable plastic bags.

Cost Estimate: $3,000 per year

MID-TERM ACTIONS

5.2.4 By FY2028, support reduction, reuse and recovery of building material by working with regional partners to keep the Builders Recycling Guide up-to-date and share resources with commercial developers.

Cost Estimate: Existing staff resources are accounted for in current budget.

LONG-TERM ACTIONS

5.2.5 Work with surrounding jurisdictions to develop and implement a regional approach to reducing plastic waste.

Cost Estimate: Existing staff resources

Cost Breakdown: Total costs of proposed actions will be developed as part of plan development process.

5.2.6 Establish sustainable purchasing guidelines to include sustainability issues such as recycled content and chemical evaluation. Purchasing guidelines would be coordinated with all City departments.

Cost Estimate: Existing staff resources

Solid Waste

Legislative Priorities

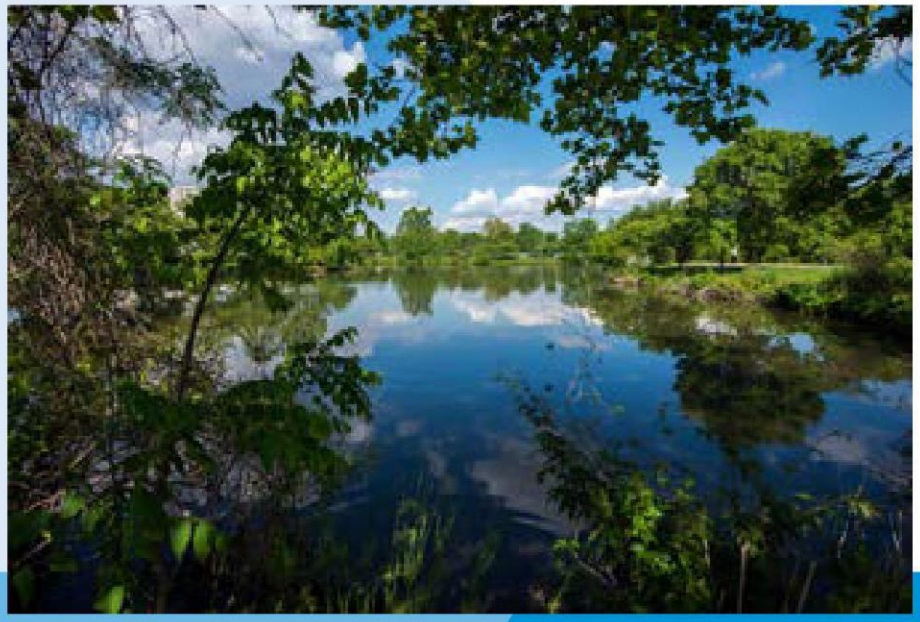
Support the development of a legislative proposal that would authorize the City to enact a deposit program for glass containers (i.e., a "bottle bill") and to control the sale of disposable plastic bags (i.e., "bag law" or "plastic bag tax") in collaboration with neighboring jurisdictions.

Justification

Reducing waste and reusing are the most effective ways to save natural resources, protect the environment, and reduce costs. Reducing waste also supports the goal of reducing greenhouse gas emissions because it reduces the amount of waste that needs to be sent to disposal facilities as well as preventing the need to harvest new raw resources. These actions provide opportunities for reuse prior to entering the waste stream and leverage regional resources and expand relationships with regional partners, agencies, and improve outreach to residents and local businesses.

Accountable Parties

Transportation and Environmental Services (primary); Parks, Recreation, and Cultural Activities; Purchasing



WATER RESOURCES

Water Resources

Water is essential for human life and has significant impacts on the economy and wellbeing of a community particularly in the City of Alexandria that has a deep history as a river town associated with the Potomac River. Managing water resources in a dense urban community in a sustainable manner is both vital and challenging. The City has prioritized the protection of its water resources, recognizing them as a fundamental element of the quality of life in the community and an integral part of the City's thriving economy. The City has embraced "One Water" approach that integrates management of safe drinking water, stormwater, and wastewater resources in a sustainable manner.

The City's drinking water is sourced from the Potomac River and Occoquan Reservoir by Fairfax County Water Authority for treatment and supplied via Virginia American Water Company. The City's wastewater is collected through City maintained collection system and is conveyed to either Alexandria Renew Water Resource Recovery Facility or Arlington Water Pollution Control Plant. Most of the City's stormwater drains into local waterways that drain into the Potomac River and Chesapeake Bay.

The City's water resources are heavily regulated by state, federal, and local requirements such as the Chesapeake Bay Total Maximum Daily Load (TMDL), Virginia Stormwater Laws, and state legislation requiring remediation of the Combined Sewer Overflow (CSO) outfalls by 2025. More importantly, the City has prioritized the protection of its water resources recognizing them as a fundamental element of the quality of life in the community and an integral part of the City's thriving economy.

As the City continues to grow, planning for development activities and infrastructure improvements are critical to protecting and improving water resources, reducing water use, enhancing water related recreation, and mitigating instances of flooding to protect property. Ultimately, the City strives to achieve water quality that is fishable and swimmable.

Managing stormwater helps to improve water quality, mitigate the effects of climate change, and improve the City's climate resiliency by reducing stormwater runoff volumes, recharging groundwater, reducing the urban heat island effect, and lowering energy demands through the use of green roofs. Water conservation and gray water or wastewater reuse reduces energy consumption required for treatment processes, distribution, and collection.

Through its Chesapeake Bay Action Plan, Municipal Separate Storm Sewer System (MS4) Program Plan, Virginia Stormwater Management Program Implementation, Long Term Control Plan for combined sewer system, future planning initiatives such as an update to the Sanitary Sewer Master Plan, and creation of a Stormwater Management Master Plan, the City continues to protect its waterways. As of 2018, the pollution reduction for phosphorus was 40 percent and is targeted to achieve 70 percent by 2023. Dedicated funding through the Stormwater Utility Fee and Sanitary Sewer Fees provide for implementation of these coordinated plans to provide environmental health, recreational and other beneficial uses of the City's waterways.

6 Water Resources

6.1. ENHANCEMENT AND RESTORATION

GOAL

Make Alexandria's waterbodies fishable and swimmable

TARGET

Stormwater will be managed to enhance the quality of local waterways and their ecological, public health, social, and economic benefits, by meeting 70 percent of the City's Chesapeake Bay phosphorus pollution by 2023 ahead of the regulatory requirement

SHORT-TERM ACTIONS

6.1.1 By FY2023, achieve the state and federal mandated nutrient and sediment pollution reductions using the strategies in the Chesapeake Bay Total Maximum Daily Load (TMDL) Action Plan. Exceed the cumulative 40 percent reductions in the 2018 – 2023 MS4 permit to include design and construction of the Ben Brenman / Cameron Station Pond Retrofit and the Lucky Run Stream Restoration.

Cost Estimate: $6,100,000

Cost Breakdown: $4,200,000 to fund the design and construction of the Ben Brenman Pond Retrofit and $1,900,000 to fund the design and construction of Lucky Run Stream Restoration identified in the 10-year CIP. Does not include staff time and effort in developing the Phase 2 Bay TMDL Action Plan.

6.1.2 By FY2021, hire an environmental educator to create and implement educational water resources programs targeted to students and adults.

Cost Estimate: $145,000/year

Cost Breakdown: $120,000/year for a full-time equivalent staff person initially and increasing annually; $25,000/initial year startup; with $10,000/year thereafter for educational supplies.

6.1.3 By FY2020, create a green infrastructure policy document that details implementation of the citywide approach as policy for implementation of green practices to reduce pollution in urban stormwater while delivering other environmental, social, economic and public health co-benefits, such as habitat creation, reduced heat island effect, and the creation of green spaces to enhance the quality of life.

Cost Estimate: $50,000

Cost Breakdown: Cost includes contractor policy development.

MID-TERM ACTIONS

6.1.4 By FY2025, achieve 100 percent of the state and federal nutrient and sediment pollution reductions using the strategies in the Chesapeake Bay TMDL Action Plan.

Cost Estimate: $6,100,000

Cost Breakdown: Approximately $1,600,000 planned for Strawberry Run Stream Restoration design and construction and approximately $4,500,000 for Taylor Run Stream Restoration design and construction identified in the FY2020-FY2029 CIP. Does not include staff time and effort in developing the Phase 3 Bay TMDL Action Plan.

6.1.5 By FY2024, develop a Green Infrastructure Program Plan to prioritize projects, increase green infrastructure projects on public and private property, and promote green infrastructure as the leading approach for stormwater management in the City.

Cost Estimate: Estimated $350,000

Cost Breakdown: Estimated cost of identifying and prioritizing projects for further design and construction identified in the 10-year CIP.

LONG-TERM ACTIONS

6.1.6 By FY2030, develop a Stream Assessment (Phase IV) to prioritize improvement of local waterways for stabilization and restoration of existing natural streams, along with a consideration of daylighting streams where feasible, with a focus on increased access and recreational opportunities.

Cost Estimate: Estimated $350,000

Cost Breakdown: Estimated cost of identifying and prioritizing projects for further design and construction pending capital improvement funding

6.1.7 By FY2029, identify 20 percent of existing proprietary stormwater management devices on City properties as candidates for green infrastructure retrofit opportunities.

Cost Estimate: Cost will be substantiated following development of the plan.

Legislative Priorities

Expand the Virginia Stormwater Best Management Practice (BMP) Clearinghouse list of accepted stormwater quality Best Management Practices to provide localities greater flexibility for development and redevelopment projects, and overall to meet the Chesapeake Bay Total Maximum Daily Load (TMDL) cleanup mandates.

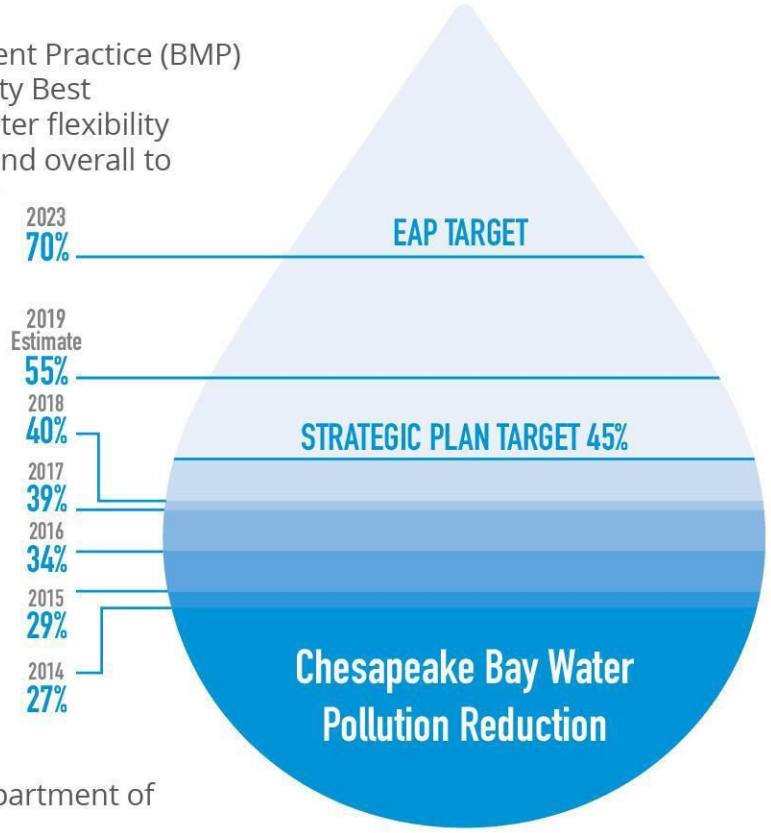
Establish a grant program funded by the City to provide reimbursement to property owners for the installation of BMPs on private property.

Justification

Protecting natural systems through investigation, prioritization and enhancement of the built environment protects natural resources, mitigates adverse impacts, and improves quality of life.

Accountable Parties

Transportation and Environmental Services, Department of Project Implementation, Recreation, Parks, and Cultural Activities.



Percent of the Chesapeake Bay Water pollution reduction goal completed each year

6.2. ONE WATER INFRASTRUCTURE

GOAL

Ensure safe and adequate infrastructure for drinking water supply, stormwater management, and wastewater treatment

TARGET

Meeting current and future, regulatory and infrastructure demands through planning, coordination, and implementation resulting in a safe and adequate drinking water supply, reduced risk of flooding, and improved water quality

SHORT-TERM ACTIONS

6.2.1 By FY2022, prepare a plan to improve our National Flood Insurance Program Community Rating System score from a 6 to a 5 to reduce flood insurance rates as the first '5 rated community' in the region for property owners.

Cost Estimate: $350,000/year

Cost Breakdown: Cost includes estimate from Code Administration for maintenance of the Building Code Effectiveness Grading Schedule (BCEGS) and participation in updates to the Northern Virginia Regional Commission (NVRC) Hazard Mitigation Plan and process.

6.2.2 By FY2022, develop the preliminary prioritization for nuisance drainage projects and by FY2023 develop the Drainage and Flooding Projects Prioritization Plan to manage major capital construction projects.

Cost Estimate: $450,000

Cost Breakdown: Analysis, modeling and mapping, and project prioritization identified in the proposed FY2020-FY2029 CIP.

6.2.3 By FY2023, educate businesses and homeowners in water conservation practices and consider an incentive program (e.g., rebates, fees reductions or tax breaks), and provide outreach to the general public.

Cost Estimate: $25,000–$40,000/year

MID-TERM ACTIONS

6.2.4 By FY2025, work with Alexandria Renew (wastewater treatment) to implement the Long-Term Control Plan through the RiverRenew initiative that addresses all four combined sewer outfalls and minimizes combined sewer overflows (CSOs).

Cost Estimate: $370,000,000–$550,000,000

Cost Breakdown: Planning, design, and construction funded through AlexRenew funding.

6.2.5 By FY2028, explore a reclaimed wastewater reuse partnership between the City and Alexandria Renew, including updating the technical and economic feasibility study for using reclaimed wastewater for irrigation of some of the larger open spaces in the city.

Cost Estimate: $100,000

Cost Breakdown: Updating the previous study and coordinate with AlexRenew.

6.2.6 By FY2028, collaborate with Virginia American Water and regional partners to monitor, evaluate, and ensure safe and adequate water supply for the City now, and in the future.

Cost Estimate: $10,000–$25,000

Cost Breakdown: Required costs will be absorbed within City's operating budget

LONG-TERM ACTIONS

6.2.7 By FY2030, create a stormwater management master plan as an update to the Water Quality Management Supplement to Alexandria's Master Plan, as a comprehensive approach to addressing water quality and quantity issues. The update to the Alexandria Master Plan will act as the guide for future stormwater management and prioritization of efforts to increase the ecological, public health, social, and economic benefits of local waterways while mitigating the impacts of flooding and drainage issues. The successful implementation of this plan will integrate stormwater management into the City's overall planning efforts to preserve and enhance the character of the City.

Cost Estimate: $350,000

Cost Breakdown: Plan will incorporate work done in other efforts as chapters to this section of the Alexandria Master Plan, such as the updates to the Storm Sewer Capacity, the Drainage and Flooding Prioritization Plan, and the Green Infrastructure Program Plan that will be funded through no change to the FY2020-FY2029 CIP.

Water Resources

Legislative Priorities

Seek state and federal grant funding to offset the cost of implementation of Combined Sewer System Long-Term Control Plan and burden on City rate payers.

Justification

Comprehensive water resource infrastructure, education, planning and project implementation ensures the City can meet the communities current and future needs for water, wastewater and stormwater management.

Accountable Parties

Transportation and Environmental Services and Alexandria Renew Enterprises, Code Administration

TRANSPORTATION

Transportation

Transportation is essential. It is the way people access jobs, shopping, parks, and other destinations. However, the way people and goods move can negatively impact health and air quality, and can contribute to greenhouse gases emissions which ultimately worsens climate change. Making transportation more efficient and less carbon-intensive can provide important economic, social and environmental benefits.

The City of Alexandria's transportation sector has an emissions contribution of 36 percent, which is higher than the national average of 28 percent[1] but reflects minimal industrial contributions in the City. Reducing single-occupant vehicle driving (SOV), and promoting sustainable modes of transportation like walking, biking and public transit can help people reduce greenhouse gas emissions, improve air quality, and promote land uses that further reduce carbon emissions.

The City has made significant progress in the transportation sector as a direct result of the recommendations from the EAP 2030. These improvements include:

- Crystal City – Potomac Yard Metroway provides a more frequent transit service using dedicated lanes and limited stops for faster service.
- Complete Streets Guidelines enables safe access for all users regardless of age, ability, or mode of transportation; an expansion of the bicycle and pedestrian network for safer low-carbon travel options; and successful implementation of Capital Bikeshare.

These accomplishments have helped the City surpass the original EAP's 2020 targets for increases in transit ridership and reduced vehicle miles traveled (VMTs), In fact, Alexandria's VMTs reduced by 12.5 percent between 2010 and 2016, the greatest drop in the region.

The new VMT target ensures that the City continues to make significant progress on increasing low carbon travel, improving air quality, and reducing carbon emissions.

By funding and implementing the City's Complete Streets and Vision Zero programs, developing the Alexandria Mobility Plan (update to the 2008 Transportation Master Plan), and building synergies with other recommendations such as fleet electrification, transportation can help meet new goals and targets in Climate Change, Energy, Land Use and Open Space, Air quality, and Environmental Health.

1 https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions

7 Transportation

7.1 PRIORITIZING LOW-CARBON MOBILITY OPTIONS

GOAL

Aggressively promote vibrant, human-scale city streets that prioritize people's access and mobility so that all Alexandria residents and visitors have access to the commercial and cultural resources of the city using low-carbon modes of transportation, consistent with the following level of precedence: pedestrians, bicyclists, public transportation, shared motor vehicles, freight vehicles and private motor vehicles

TARGET

By FY2023, reduce total average vehicle miles traveled (VMT) per capita by at least 1 percent per year and determine the amount of carbon reduction from transportation sector

SHORT-TERM ACTIONS

7.1.1 By FY2023, complete all engineering and education actions outlined in the 2017 Vision Zero Action Plan. These actions increase safety and encourage pedestrians, bicyclists, and public transit riders to use Alexandria's streets.

Cost Estimate: $1,000,000–$5,000,000

7.1.2 By FY2023, add an average of 3 miles of bicycle connections per year, prioritizing low-stress facilities, where possible, and connectivity with existing bicycle infrastructure, to create a network of bike-safe routes.

Cost Estimate: $200,000–$400,000

7.1.3 By FY2023, develop a checklist for transportation staff working on development review to be used in both residential and commercial review processes to incentivize less carbon-intensive modes of transportation and mobility options.

Cost Estimate: Existing staff resources

Transportation

7.1.4 By FY2023, adopt permanent regulations for shared mobility devices such as dockless bikes, electric scooters, and other personal mobility devices.

7.1.5 By FY2021, develop a plan to acquire zero emissions buses on rapid transit routes and conversion of DASH fleet to zero emissions.

Cost Estimate: $100,000–$300,000

7.1.6 By FY2023, determine the feasibility of a low-stress multi-modal, connective bicycle network to increase bicycle mode share.

MID-TERM ACTIONS

7.1.7 By FY2028, complete the bicycle and pedestrian projects prioritized in the pedestrian and bicycle chapters of the Alexandria Mobility Plan (formerly known as the Transportation Master Plan).

Cost Estimate: $5,000,000–$10,000,000

7.1.8 By FY2025, implement the 2017 walk audit recommendations for all schools.

Cost Estimate: $2,000,000 – $5,000,000

Legislative Priorities

1. Encourage statewide legislative efforts to implement stricter traffic safety laws as mandated by the 2017 Vision Zero Action Plan. Alexandria should continue to lobby the state to allocate road funding to local jurisdictions based not on car driving lanes but to adequately fund infrastructure for bicycles, pedestrians, and other low-carbon mobility options.
2. Support federal, state, and regional compacts and initiatives to reduce transportation-related greenhouse gas emissions, including support of the Transportation and Climate Initiative.

Justification

By incentivizing and regulating mobility options, short automobile trips can be replaced with other less carbon-intensive modes of transportation while maintaining safety and providing mobility and access. Furthermore, by increasing safety on City streets, the share of walking and bicycling trips can increase moderately.

Accountable Parties

Transportation and Environmental Services

7.2 REDUCE AUTOMOBILE DEPENDENCY

GOAL

Reduce automobile dependency and educate individuals and employers on mobility options other than single-occupancy driving

TARGET

By FY2023, increase the share of all trips taken by public transit, walking and biking by at least 15 percent taking the 2018 Mobility Survey as the base year

SHORT-TERM ACTIONS

7.2.1 By FY2023, develop a stand-alone Transportation Demand Management (TDM) Chapter in the Alexandria Mobility Plan (formerly the Transportation Master Plan) to promote low-carbon modes of transportation.

Cost Estimate: $50,000–$100,000

7.2.2 By FY2023, finalize construction of the Potomac Yard Metrorail station.

Cost Estimate: $370,000,000

Transportation

MID-TERM ACTIONS

7.2.3 By FY2028, encourage people who work in Alexandria to use sustainable mobility options by developing policies that discourage employee parking (e.g., eliminating monthly parking subsidies, prohibiting retail employees to park long term at parking meters and provide cash incentives in lieu of providing employees free parking).

Cost Estimate: $1,000,000–$5,000,000

Legislative Priorities

1. Advocate for the state to both raise the gasoline tax and to allow local jurisdictions more flexibility in raising gasoline taxes.
2. Advocate for the state to have car property taxes to be assessed with an efficiency bonus/penalty and not just on the value of the vehicle.

Justification

At the National level, approximately 30 percent of combustion related GHG comes from the transportation sector. In the City, transportation is 36 percent for the 2015 inventory. It is important to reduce automobile dependency in order to reduce GHGs that contribute to global warming and pollutants that have been linked to negative health outcomes.

Accountable Parties

Transportation and Environmental Services

7.3 IMPROVE, EXPAND AND INTEGRATE PUBLIC TRANSIT SYSTEMS

GOAL

Improve and expand Alexandria's public transit system so that passenger rail and bus systems are safe, reliable, accessible, convenient, attractive, efficient, and equitable

TARGET

By FY2030, double the miles of dedicated bus infrastructure to at least 1.5 miles

SHORT-TERM ACTIONS

7.3.1 By FY2023, deploy a regionally-integrated, mobile-friendly platform that provides real-time trip information and fare payment capabilities for all multimodal trip options to make travel seamless for people across different regional transit providers.

Cost Estimate: $1,000,000–$5,000,000

Transportation

MID-TERM ACTIONS

7.3.2 By FY2028 expand bus rapid transit by doing design, environmental work, right of way, and construction for West End Transitway, completing the design and Right-of-Way for the Duke Street Transitway, and extend Route 1 Metroway.

Cost Estimate: $150,000,000

Cost breakdown: $75,000,000,000 for design and right of way and construction of Phase 1 (TSM scenario) and an additional $50,000,000 for adding dedicated lanes (Phase 2 – Full Build), and $15,000,000 for design / ROW for Duke Street Transitway, and $10,000,000 for Metroway extension

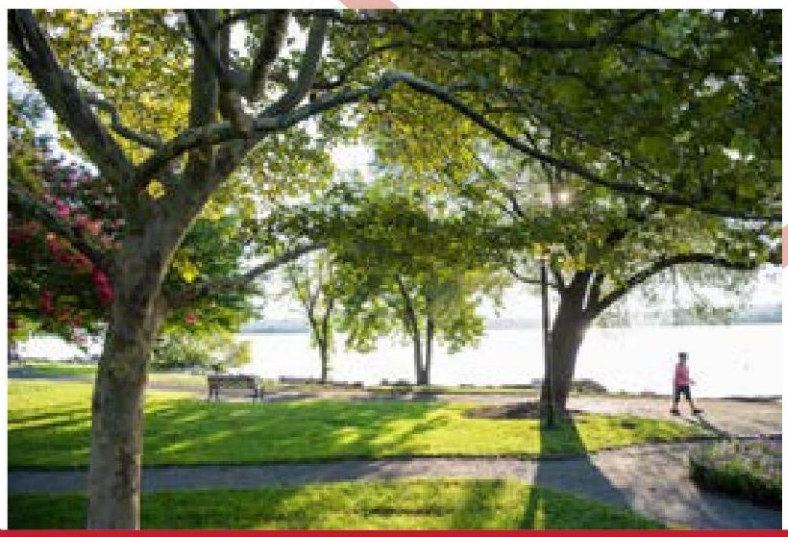
LONG-TERM ACTIONS

7.3.3 By FY2040, expand bus rapid transit with construction for Duke Street Transitway.

Cost Estimate: $115,000,000–$140,000,000

Accountable Parties

Transportation and Environmental Services



ENVIRONMENTAL HEALTH

Environmental Health

The purpose of the Health Department's Environmental Health Division is to ensure the health and safety of our community by providing health education, working with regulated facilities to achieve regulatory compliance and promoting health and safety through public outreach. The Environmental Health Division's focus in the Environmental Health section of the EAP 2040 is to address the concerns affecting the health and safety of the citizens of Alexandria. Specific actionable goals will be determined from the results of the Environmental Health Assessment, which will allow the community to identify environmental success stories and opportunities for health improvement in the city.

8 Environmental Health

8.1. COMMUNITY HEALTH PRIORITIES

GOAL

Explore the broad physical and social environments that are impacting Alexandria's health and safety and develop an action plan using the Protocol for Assessing Community Excellence in Environmental Health

TARGET

By FY2023, create an updated Community Environmental Health Assessment with an accurate and verifiable status of the Community's Environmental Health

SHORT-TERM ACTIONS

8.1.1 By FY2021, create a cross-agency implementation team to develop a new Environmental Health Assessment of the City based on principles contained within the National Association of County and City Health Officer's (NACCHO) Protocol for Assessing Community Excellence in Environmental Health methodology.

Cost Estimate: $100,000/year

Cost Breakdown: Approximately $100,000 for a consultant to start the planning process and develop a Community Based Assessment team to complete the next stage of the Assessment.

MID-TERM ACTIONS

8.1.2 By FY2024, create a comprehensive action plan to address the greatest issues of concern for Alexandria based on community input through the Environmental Health Assessment.

Cost Estimate: $100,000/year

Cost Breakdown: Approximately $100,000 for a consultant to start the planning process and develop a Community Based Assessment team to complete the next stage of the Assessment.

8.1.3 By FY2025, create a list of actionable goals to address the issues of highest concern as identified by the community of Alexandria.

Cost Estimate: This will depend on the issues identified and potential actions required. Additionally, it will require a consultant to oversee the implementation of the action plan and to report progress on achieving these goals.

LONG-TERM ACTIONS

8.1.4 By FY2030, conduct an annual review of progress made towards achieving these goals and be working towards a repeated assessment to determine community benefit and reset goals for the next EAP update.

Justification

The last Environmental Health Assessment was started in 2002 and published in 2007. Since then limited work has been conducted to ensure that the issues highlighted are still relevant to the Alexandria Community. This assessment will create a new benchmark that addresses the needs of today's community in light of the changing Public Health climate based on new science and technologies.

There is a real lack of data on what Environmental Health issues are impacting the lives of the Alexandria community. By completing the assessment, we will be able to target limited resources at environmental health issues that are a genuine concern to the community and that are supported by scientific data as having a real health impact.

Accountable Parties

Department of Housing, Code Administration and Health Department (Primary).

8.2. INDOOR AIR QUALITY

GOAL

Create a City-wide team to investigate mold complaints in residential properties and to provide advice and assistance to residents on remediation strategies

TARGET

By FY2021, create a task force dedicated to providing support and assistance to the residents of Alexandria that are experiencing mold within their homes

SHORT-TERM ACTIONS

8.2.1 By FY2021, create a task force to investigate the best way to manage mold complaints by residents of the City.

Cost Estimate: $20,000/year

MID-TERM ACTIONS

8.2.2 By FY2025, expand the scope of the task force to address other indoor air pollutants of concern to City residents.

Cost Estimate: This will depend on the issues identified and potential actions required.

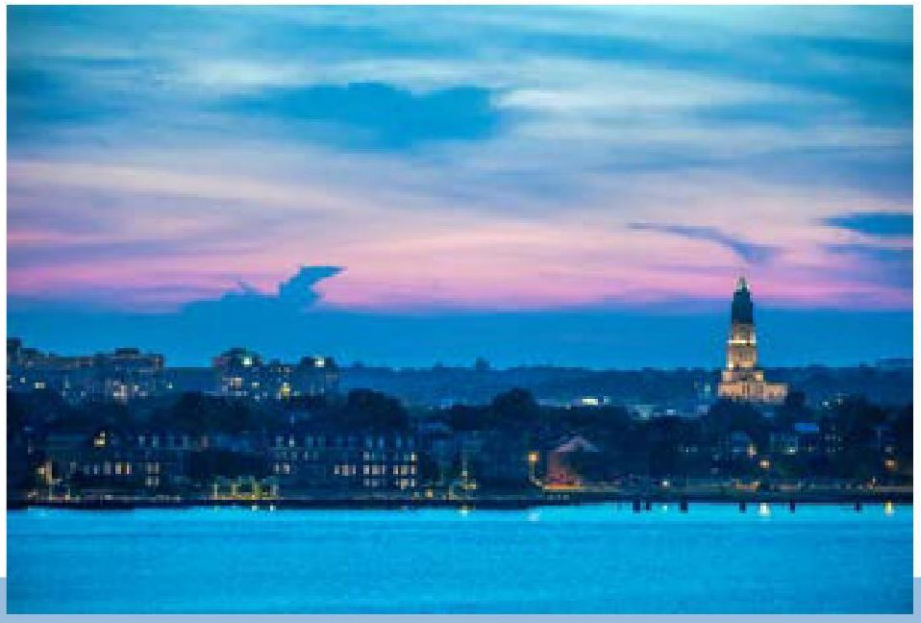
Environmental Health

Justification

There are a significant number of mold complaints made each year by the residents of Alexandria. Currently the only resource available to assist residents is directing them to literature available through the Department of Housing and Urban Development. The City has no legislative powers to assist in facilitating repairs in rental properties, or any staff training in mold remediation.

Accountable Parties

All City Departments led by Environmental Health.

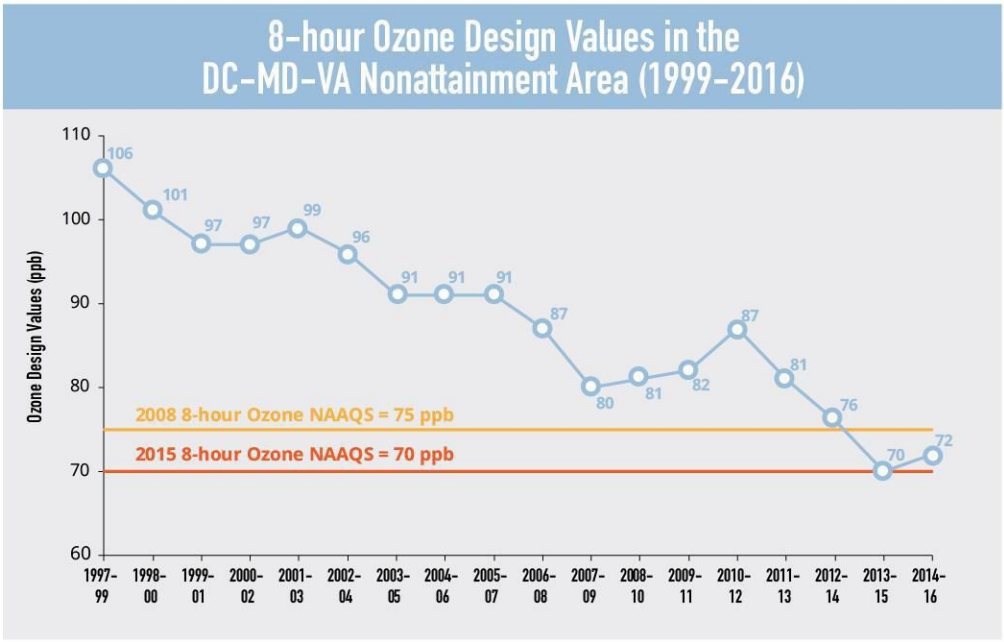


AIR QUALITY

Air Quality

Good air quality is fundamental to our well-being. On average, a person inhales about 500 cubic feet of air every day, and the presence of certain contaminants in this air can adversely affect people's health. People with pre-existing respiratory and heart conditions, diabetes, the young, and the elderly are particularly vulnerable. The Metropolitan Washington region has achieved significant air quality improvements over the last twenty years thanks to more stringent state and federal air pollution control programs as well as efforts by local governments such as Alexandria. MWCOG, in collaboration with member jurisdictions, has been instrumental in leading and coordinating a majority of efforts in air quality improvements. However, even with these improvements, the region, with few industrial point sources, is still not meeting the new 2015 ozone limits of the National Ambient Air Quality Standards (NAAQS). Transportation continues to be a major source of air pollution. As the City and the region make progress on transportation and mobility options, it will result in cleaner air and reduced GHG emissions.

To date, the City has achieved significant reduction in air pollutant emissions from the three major point sources in the City. This was achieved via the permanent closure of the Mirant coal-fired power plant in 2012, installation of state-of-the art air pollution control equipment at the Covanta waste-to-energy-plant in 2000, and issuance of a stringent operating permit limitations to the Virginia Paving Plant in 2006.



Future air quality improvement will directly result from the City's multi-faceted effort in tackling low-carbon transportation, energy efficiency improvements, increased use of renewable energy and green buildings as these sources reduce local fossil fuel use. Another focus will be on reduction of air pollution and the related emissions from transportation and smaller area sources such as construction sites, and lawn and garden equipment. The City will continue collaborating with MWCOG on regional air quality issues and education and outreach. Strategies and priorities will be developed to reduce non-point and area sources of air pollution and emissions within the City.

9 Air Quality

GOAL

Reduce air pollution from all types of sources and assist the Northern Virginia Region in complying with all National Ambient Air Quality Standards (NAAQS) for criteria pollutants

TARGET

By FY2023, achieve compliance with 2015 ozone NAAQS of 70 ppb and other pollutants for the Metropolitan Washington Council of Governments (MWCOG) region including Alexandria

SHORT-TERM ACTIONS

9.1.1 By FY2020, evaluate potential methods for reducing air pollution and incorporate them into the standard development conditions.

Cost Estimate: Using existing resources

9.1.2 By FY2020, enhance/expand the City's Air Quality Action Day and conduct outreach to residents, businesses and City staff.

Cost Estimate: Using existing resources

9.1.3 By FY2021, develop strategies to reduce air pollution from dispersed, non-point sources such as construction sites and powered lawn equipment.

Cost Estimate: Using existing resources

9.1.4 By FY2021, promote the use of battery-powered leaf blowers and lawn mowers and investigate incentive mechanisms.

Cost Estimate: Using existing resources

9.1.5 By FY2022, develop methods to quantify air pollution impacts and benefits of major transportation projects.

Cost Estimate: Using existing resources

Air Quality

MID-TERM ACTIONS

9.1.6 By FY2024, prepare a "State of the Air" report that includes recommendations for pursuing further air quality improvement opportunities.

Cost Estimate: $50,000-100,000 plus existing resources

Cost Breakdown: 100% Consultant's charge

LONG-TERM ACTIONS

9.1.7 By FY2029, complete all recommended measures identified in the "State of the Air" report.

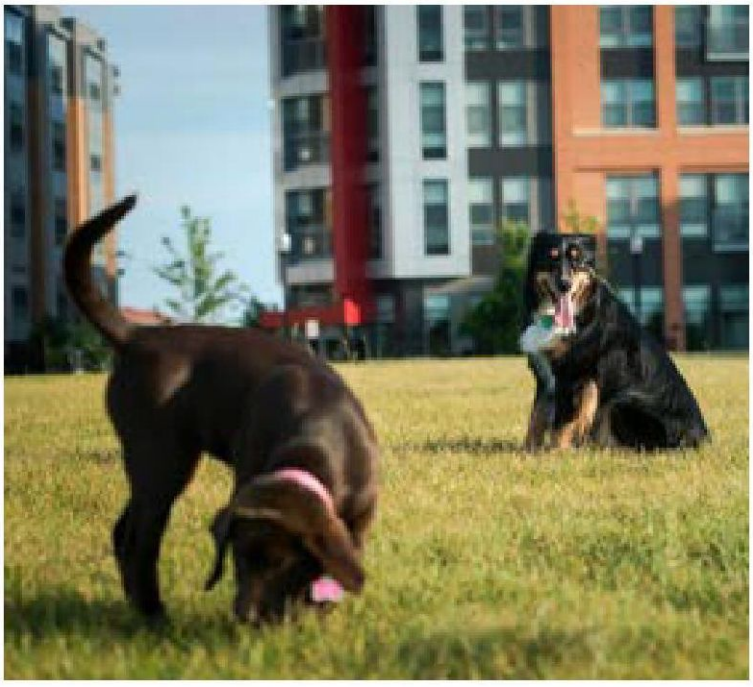
Cost Estimate: Will be based on identified measures.

Legislative Priorities

Continue to work closely with the Metropolitan Washington Council of Governments to advocate for more stringent federal and state regulations aimed at improving air quality in the Metropolitan Washington region.

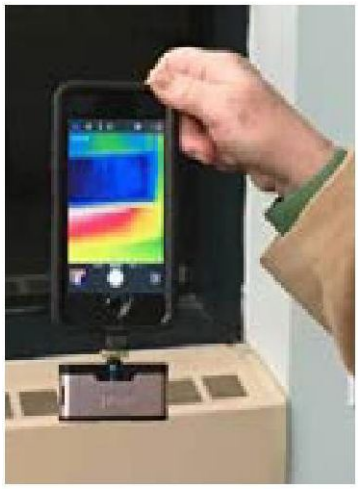
Justification

Ozone in the air can harm human health, especially on hot sunny days when ozone can reach unhealthy levels. Long-term exposure to ozone is linked to aggravation of asthma and is likely to be one of many causes of asthma development. Long-term exposures to higher concentrations of ozone may also be linked to permanent lung damage, such as abnormal lung development in children.



IMPLEMENTATION, EDUCATION, AND OUTREACH

Implementation, Education, and Outreach



The City government, businesses, and individuals need to take responsibility, be informed, participate in decision making, and work together to achieve common goals and targets of sustainability for the benefit of Alexandrians now and for generations to come.

Getting the community to participate in environmental actions involves getting people excited with creative messaging, activities, and incentives. There is a continuous evolution of policies, programs, and resources that can facilitate community engagement in collaboration with regional partners. These programs include working with partners to leverage limited resources such as an Eco-City Academy program to graduate Eco-City Ambassadors. This program can put boots on the ground and spread sustainability similar to Energy Masters and Master Gardener programs.

The annual Earth Day festival is organized by an engaged community committee lead by an Environmental Policy Commissioner with support from staff in many departments of the City. This premier environmental education and outreach event in the City features a trash fashion show by students, activities and exhibits by City departments, displays by the water and wastewater utilities, tent talks on specific topics, and many other private exhibits for a full day of fun and learning. The City has also been successfully partnering with libraries in a loan program for thermal cameras and kill-a-watt meters to help residents and businesses see what energy losses are hidden behind the walls and how electronics and equipment draw electricity even when not in use.

The existing Eco-City Green Building Resource Center was created with DOE grant money and available on Eco-City web site in since 2012 with extensive resources and videos. Many of the still-applicable suggestions are provided as easy to use one-page handouts. Any out-of-date materials will be updated as part of the EAP action to engage and educate residents, businesses, and City staff.

The actions in the EAP will be coordinated across City departments and in collaboration with regional partners to provide opportunities for the education of the general public, contractors, and trade professionals. It involves providing more frequent education and outreach, online tools and videos, and leveraging support from professional organizations such as MWCOG, Virginia Building Code Officials Association and schools. Ultimately, the City's youth needs to be a priority in order to grow a culture of sustainability.

Additional metrics and monitoring will be added as part of the implementation of EAP 2040 actions. Verification of performance can be enhanced by using metrics and sharing them on a public dashboard. Green certifications, recognition, and award programs can help in advancing adoption and participation by residents and businesses.

10 Implementation, Education, and Outreach

10.1 EDUCATION AND OUTREACH

GOAL

Motivate the public to take actions that make Alexandria more sustainable

TARGET

By FY2023, establish ongoing educational opportunities to increase awareness of environmental challenges and provide recommendations for adoptable daily sustainable practices for residents, businesses, and City staff

SHORT-TERM ACTIONS

10.1.1 By FY2020, design and implement robust outreach campaigns to engage and educate residents, businesses, and City staff on how to adopt emission-reducing strategies, environmental efforts related to the EAP, and opportunities for involvement. Tactics may include outreach events, educational materials, social media and website content, live-streamed events, and hands-on learning experiences. Update the Green Building Resource Guide Resource Center for new small businesses and existing buildings. Additional outreach and education will be leveraged with Eco-City Ambassadors who go through an Eco-City Academy to assist in spreading sustainability throughout the community and participate in the City's commitment to reduce GHG emissions and address climate change.

Cost Estimate: $20,000/year

Cost Breakdown: New costs for info-graphics, handouts, sustainability giveaways, and to create a vibrant and current web presence with instructional videos, sustainable signage, and workshops. Staff time and effort is not included in this cost.

10.1.2 By FY2020, update Eco-City web-based information and coordinate with related sustainability information on other city web sites.

Cost Estimate: No direct cost, staff time only.

Implementation, Education, and Outreach

10.1.3 By FY2020, initiate a collaborative effort to update environmental education in the Alexandria City Public School curriculum, focusing on City-specific sustainability issues. This work may include creating resources to facilitate student education and outreach.

Cost Estimate: $30,000/year

Cost Breakdown: New costs for curriculum and materials design and printing.

10.1.4 By FY2021, select and launch a green business recognition or certification program in collaboration with the local business community and using a third-party rating system. Link local recognition opportunities via the City website to facilitate consumer selection based on sustainability.

Cost Estimate: $10,000/year

Cost Breakdown: New costs for program (if applicable), implementation, and promotional materials.

10.1.5 By FY2021, establish a voluntary program for residents, schools, and businesses to report their efforts in reducing their environmental impact and create an awards program to incentivize participation.

Cost Estimate: $30,000/year

Cost Breakdown: New costs for program development, promotional materials, and awards event.

Justification

Multifaceted outreach and education are vital to grow a sustainable culture with the youth of the City and for the adoption by the overall community. Coordination with the schools will facilitate the effectiveness of the messaging. Using Eco-City Ambassadors will leverage City staff resources and utilize engaged community resources within the City.

Accountable Parties

Transportation and Environmental Services

10.2 IMPLEMENTATION AND MONITORING

GOAL

Enhance EAP implementation by increasing monitoring, measuring, and reporting efforts by the City and the community

TARGET

Annual updating of EAP progress and sustainability metrics

SHORT-TERM ACTIONS

10.2.1 By FY2020, update measurement methods, monitored actions, and key indicators to capture and report new, changed, and trending sustainability goals, public building performance, regional efforts, and accomplishments in online dashboards.

Cost Estimate: Existing staff resources

10.2.2 By FY2020, participate in regional and state efforts to increase the sustainability and enforcement of construction practices, regulations, and codes (International and Virginia Energy Conservation Code, recycling, stormwater management, and others). Partner with regional municipalities and organizations to provide shared professional training to contractors, design professionals, and individuals in sustainable building and operating methods to achieve more sustainable infrastructure.

Cost Estimate: $10,000/year

Cost Breakdown: New costs for travel, and registration fees, certifications, and resource materials

MID-TERM ACTIONS

10.2.3 By FY2024, publish interim EAP Progress report of short-term actions.

Cost Estimate: $10,000

Cost Breakdown: New costs for graphic and web design.

Implementation, Education, and Outreach

Justification

Implementation and monitoring provides vital feedback to the community. Regional coordination and participation in development of state and national regulations and policies provides coordination and education of enforcement and monitoring methods for municipalities.

Accountable Parties

Transportation and Environmental Services-Office of Environmental Quality, General Services, Transportation, and Resource Recovery

APPENDICES

Acronyms and Abbreviations

Base Year	Reference year used to measure from
BTU	British thermal unit
CO2	Carbon dioxide gas
CO2e	Carbon dioxide equivalents based on global warming potential
CPACE	Commercial Property Assessed Clean Energy
DASH	Driving Alexandria Safely Home (DASH) is Alexandria's transit system
Dillon Rule	A legal principle that local governments have limited authority
EAP	Environmental Action Plan
Eco-City	Cities that enhance sustainability through planning and management
EPC	Environmental Policy Commission
FY	Fiscal year
GHG	Greenhouse gas
GreenVentory	A compendium of existing programs, policies, and processes that are sustainable
GWP	Global warming potential
ICLEI	International Council on Local Environmental Initiatives (now Local Governments for Sustainability)
IPCC	Intergovernmental Panel on Climate Change
KWh	Kilowatt hours
LED	Light emitting diode and a high-efficient light bulb
LEED	Leadership in Energy and Environmental Design
MS4	Municipal separate storm sewer system
MWCOG	Metropolitan Washington Council of Governments
MWh	Megawatt hours
Ozone	Colorless unstable toxic gas
PPB	Parts per billion
PPM	Parts per million
VMT	Vehicle miles traveled

APPENDIX B

Alexandria's Major Environmental Achievements since Adoption of the Environmental Action Plan 2030 (2009 – 2017)

In June 2009, the City adopted the comprehensive **Environmental Action Plan 2030** (EAP 2030) aimed at achieving the vision and principles set forth in the Eco-City Charter and leading the City further toward environmental sustainability. The following is a summary of major projects and initiatives that are either completed or ongoing since the EAP 2030 was adopted.

TRANSPORTATION & TRANSIT

The City's **Transportation Master Plan** approved in 2008, aims at an unprecedented paradigm shift, putting Alexandrians first, and providing them with innovative options for transportation.

Metroway Premium Bus Service on the Crystal City - Potomac Yard Transitway – With the introduction of the Washington Metropolitan Area Transit Authority's (WMATA) Metroway service in 2016, the Crystal City - Potomac Yard Transitway provides reliable service along the congested Route 1 corridor between the Braddock Road and Crystal City Metrorail Stations, with stops in Potomac Yard. Ridership on this service grew 44% from October 2015 through October 2016.

Expansion Company DASH the Pentagon periods. DASH operates 54 energy efficient and electric buses, representing 60% of its fleet. It is buses will reduce annual diesel fuel consumption

of the Alexandria Transit (ATC) DASH service and Fleet – operates 12 routes and serves all of Alexandria Metrorail Stations and the Metrorail station during peak environmentally friendly hybrid estimated that ATC's hybrid electric by 60,000 gallons and carbon dioxide emissions by 1,300,000 lbs. ATC also took over operation of the King Street Trolley using five brand new 30-foot low-floor hybrid electric trolleys. Earlier this year, DASH celebrated its fifth anniversary of taking over daily operation of the King Street Trolley. Trolley ridership has grown steadily since 2012, and the single-month record for trolley ridership (115,000 boardings) was set in July 2017.

New Metrobus Route NH2 - Partnering with Fairfax County, State of Maryland, and Peterson Company, the City started a **Metrobus route** that operates between Alexandria and the new MGM Grand Casino in National Harbor, MD. The route will operate every 30 minutes from early in the morning until late at night and each stop in Alexandria will offer connections to local bus service (DASH, Metrobus), shuttles, Metrorail, Virginia Railway Express (VRE), and Amtrak.

Capital Bikeshare - The City launched its participation in the Capital Bikeshare Network with an initial installation of eight bikeshare stations in the Old Town area in 2012. There are now 31 Bikeshare stations throughout the City, with an additional 10 stations planned for installation in spring 2018. Bikeshare members reported using Bikeshare equally for work and non-work trips, thereby reducing the number of vehicle miles traveled (VMT) in automobiles. This program has been used by residents and visitors alike, with approximately 235,000 trips departing from Alexandria stations since the program began. The average number of rides increased 17 percent between 2015 and 2016 and 24 percent between 2016 and August 2017.

Traffic Lights LED Replacement Program – The City replaced all 2500 incandescent traffic lights with energy efficient LED lights. This reduces energy consumption by 650,000 kWh and $70,000 in electricity costs annually. As a pilot project using a US Department of Energy grant, City also installed 34 **LED street lights** in partnership with Dominion Virginia Power. Currently, new developments in the City are required to install LED street lights.

New Potomac Yard Metrorail Station is aimed at increasing transportation choices and attracting transit-oriented development. The resulting development around the station would support up to 26,000 new jobs within one-quarter mile, and 13,000 new residents within one-half mile, while removing thousands of private vehicles from the

congested Route 1 corridor. The Environmental Impact Statement (EIS) was completed in 2016 and WMATA is forecasted to award the project contract in the spring of 2018. The project provides a new direct access point to the regional transit system, maximizes potential transit ridership, and shifts automobile trips to other modes. It also provides accessibility to the regional transit system for the greatest number of area residents and employees and results in the following: 11,300 weekday station boardings by 2040; 6,700 daily automobile trips shifted to transit by 2040; 19 - 30% more residents within a half-mile walking; and 43 - 103% more employees within a quarter-mile.

Pedestrian and Bicycle Master Plan

The City's 2008 Transportation Master Plan encourages the use of alternative modes of transportation, reduces dependence on the automobile, and promotes a balance between travel efficiency and quality of life. The City updated the Pedestrian and Bicycle chapters of this plan to reflect changes that have occurred since 2008, including the Complete Streets policy, Capital Bikeshare program, and on-street bicycle facilities.

Complete Streets Policy and Program

Complete Streets are streets for everyone. They are a vital part of livable, attractive communities and are designed and operated to enable safe access for all users, including pedestrians, bicyclists, motorists and transit riders of all ages and abilities. City Council adopted a Complete Streets Policy in 2011 and was reenacted on May 17, 2014. In 2016, The City developed Alexandria Complete Streets Design Guidelines for the design of the City's public and private streets. The City has 26 miles of on-street bicycle lanes and 24 miles of sharrows. The City recently completed the highly-visible project on King Street, resulting in a reduction of annual crashes from seven to zero with no traffic diversion on sideroads. .

Safe Routes to School

Safe Routes to School (SRTS) is a federal program to improve the well-being of children by improving walking and bicycling conditions on the route to school and enabling and encouraging children to walk and bike. These efforts include new sidewalks, crossing improvements, speed limit reductions, bicycle parking and bicycle lanes; partnering with parents, schools and local non-profits, and evaluating of habits and effectiveness. In 2017, the City completed Safe Routes to School Walk Audits for the 13 Alexandria City Public Schools (ACPS) elementary schools during the 2016/2017 school year.

Multi-use Trail Maintenance and Usage

The City has 29 miles of bicycle and pedestrian paved and unpaved trails. From 2013 to 2017, the number of cyclist in the City has been increasing steadily. In 2015, the City installed data collection devices at strategic locations of a number of trails, including: Eisenhower Ave., Four Mile Run, Holmes Run, Mount Vernon and Potomac Yard Trails. The data collected shows an increase in trail usage of more than 82 percent from 2016 to 2017 alone. Improving commuting conditions for bicyclists and pedestrians represents a significant potential for shifting automobile trips to non-motorized modes that helps reduce air pollutants and greenhouse gas emissions.

WATER QUALITY

Chesapeake Bay TMDL (Total Maximum Daily Load) Action Plan - The City has been proactive in designing and implementing projects for the Chesapeake Bay TMDL to address total nitrogen (TN), total phosphorus (TP), and total suspended solids (TSS). The Virginia Department of Environmental Quality (VDEQ) requires a reduction by 2018 of 5% during the 2013-2018 permit cycle. The City's initial 2015 Bay TMDL Action Plan for 5% reductions actually outlined strategies to address approximately 44%, 39% and 39% of TN, TP and TSS reductions, respectively, by 2018, with the City achieving about 21% TP reduction to date. Projects in the Plan include retrofits to existing ponds such as Lake Cook and Ben Brenman Pond to enhance the treatment capacity and/or pollution reduction efficiency, while improving aquatic habitat and recreational benefits. The City continues to look for innovative solutions for addressing the Chesapeake Bay TMDL such as performing stream restorations, retrofitting City properties, and applying an integrated wet-weather approach.

Eisenhower Pond 19, a **regional stormwater management facility** identified as a strategy in the Bay TMDL Action Plan, was constructed on Eisenhower Avenue by a private developer on newly developed property. This regional pond drains over 67 acres and provides estimated pollutant reductions that exceed the state water quality requirements for development, and provides credits toward the Chesapeake Bay TMDL requirements.

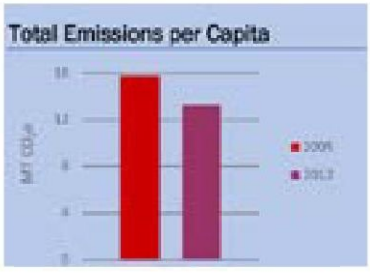
Stormwater Utility - The City has adopted a Stormwater Utility Fee to more equitably funding the City's stormwater management program to reduce the impact of stormwater pollution and flooding, perform infrastructure operations and maintenance, and ensure Alexandria is in compliance with state and federal stormwater regulations.

Combined Sewer System (CSS) Long Term Control Plan - The City submitted the CSS Long Term Control Plan Update to the VDEQ for approval on December 2, 2016. As part of the 2017 Virginia Legislative Session, legislation was passed and signed by the Governor that requires the City to revise this Long Term Control Plan Update to meet the 2017 legislation. The legislation requires that 1) the City to remediate all of its combined sewer outfalls, 2) construction of future combined sewer infrastructure projects begin no later than July 1, 2023; and 3) construction of these projects be completed by July 1, 2025. The City is currently revising its plan and will be providing updates on the development of the plan.

AIR QUALITY & GREENHOUSE GAS INVENTORY

City Eliminated the Largest Air Pollutant Source in the City and Northern Virginia – After a lengthy technical and legal challenge in front of the State Air Pollution Control Board, the City of Alexandria successfully reached an agreement with GenOn Inc. to permanently close its outdated coal-fired power plant located on the shore of the Potomac River in 2012. At the peak of its production, this plant emitted 15,000 tons of sulfur dioxide, 6,000 tons of nitrogen oxides and 600 tons of PM_{10} annually. Its closure also eliminated a major source of up to 4.5 million metric ton of annual carbon dioxide emissions, the equivalent of emissions of 600,000 cars. Substituting the electricity generation capacity of this power plant with one using cleaner fuel such as natural gas would result in an annual reduction of more than 2 million metric ton of carbon dioxide which is more than the total amount of carbon dioxide emitted annually by the whole city of Alexandria.

Greenhouse Gas (GHG) Inventory Conducted for 2005 and 2012 – City conducted GHG inventories for 2005 and 2012. The results showed total GHG emissions from the whole city decreased by 5% between 2005 and 2012 while the population increased by ~6% for the same period. Furthermore, the per capita GHG emissions reduced by 16%.



GREEN BUILDING

Private Development and Green Building - Since adoption of the City's Green Building Policy in 2009, approximately 25 million square feet of private development has been approved. Of this amount, more than 95% of the square footage complies with the City's Green Building Policy of LEED Certified (or equivalent) for residential buildings and LEED Silver (or equivalent) for commercial buildings.

City Government Buildings Built to LEED Ratings - The City adopted a policy of building all government buildings to at least LEED Silver certification. **LEED Gold Buildings** - T.C. Williams High School, Charles Houston Recreation Center, DASH Administration Facility, Alexandria Police Department Headquarter, James K. Polk Elementary School, Jefferson Houston Elementary School; **LEED Silver** – 2525 Mt. Vernon Avenue, Fire Station 209, Fire Station 210.

Green Roofs in City Government Buildings - Duncan Library, Cora Kelly School, City Hall, Alexandria Health Department, T.C. Williams High School, James K. Polk Elementary School

The City also developed an **Online Green Building Resource Center** and provided 10 free workshops for residents and business interested in learning about various green topics as part of the EECBG grant program.

AlexRenew's Multi-purpose Athletic Field on the Roof of the New Nutrient Management Facility – This innovative project creates a multi-purpose athletic field with artificial turf on the roof of an 18-million gallon nutrient management facility. As a partnership between AlexRenew, the City and the site developer, the field supports Eco-City Alexandria's goal of increasing open space in the City.

LAND USES

The City completed multiple land use plans including the Landmark Van Dorn Corridor Plan, Waterfront Plan, and the Beauregard, Eisenhower West, North Potomac Yard and Old Town North Small Area Plans, several of which are award winning. Each of these Plans includes a sustainability section, establishing standards and guidelines for sustainable practices, in addition to the Green Building Policy, as part of redevelopment that are of importance to the City and its residents and that advance the City's Eco-City sustainability goals. For the first time, the City requires LEED-ND Silver certification for the North Potomac Yard Small Area Plan (SAP) and the former power plant area within the Old Town North SAP.

OPEN SPACE AND ECOLOGY RESTORATION

The City adopted an **Open Space Plan** in 2003 addressing the City's short and longer-term open space needs. In 2013, the City achieved its 100-acre goal for acquiring, dedicating or placing land in conservation easements in order to maintain a 7.3 acre per 1,000-person ratio. A 2016 update to the Open Space Plan determined that if every open space specified in all active small area plans comes to fruition, the City can maintain this ratio until 2040.

In 2017, the **Northern Virginia Conservation Trust** acquired, through a fee simple donation, a 1.97-acre wetland where Cameron Run and Little Hunting Creek meet before flowing into the Potomac. It is a highly developed area, and sandwiched between major freeways and the Hunting Terrace residential building currently under construction. The site is listed as an eBird "Hotspot," with more than 100 different bird species observed in the immediate vicinity. The site also includes the two only known, still surviving Pumpkin Ash trees remaining in the City. Currently, the site is only accessible to the public by boat.

The **Four Mile Run Wetlands Restoration Project** restored an historic 2-acre tidal wetland along Four Mile Run. This wetland plays a prominent role in regional efforts to protect the Potomac River and the endangered Chesapeake Bay by restoring the diverse habitat and natural cycles that support life in and along these waterways. The wetlands restoration project integrates flood protection, environmental restoration, community aesthetics, community access and connectivity, recreation, and education.

Chambliss Stream Restoration and Crossing - The City completed a stream restoration project on Holmes Run near Chambliss Street that restored the banks and prevented tons of sediment from entering the stream system.

SOLID WASTE MANAGEMENT

City's Solid Waste Recycling Rate Increased Steadfastly toward the 2020 Target of 50% –Starting with a solid waste recycling rate below 30% when the Environmental Action Plan was adopted in 2009; the City reported its highest ever recycling rate of 49.3% to the Virginia DEQ for Calendar Year 2016, thanks to several waste collection initiatives.

Covanta Waste-to-Energy (WTE) Plant Significantly Contributes to City's GHG Emissions Reduction Effort - The City Council and Arlington County Board extended the Covanta Waste-to-Energy plant lease agreement through 2038 for the disposal of municipal trash. The Covanta waste-to-energy facility meets and exceeds all environmental requirements and co-produces 21 megawatts of energy that can power approximately 20,000 homes. This lease agreement results in estimated cost savings of $26 million through 2038 and yields a significant reduction in greenhouse gas emissions compared to landfilling. Based on Virginia specific data and assuming that the COVANTA WTE plant displaces landfills equipped with modern methane gas recovery systems, every ton of municipal solid waste diverted to COVANTA WTE plant reduces GHG emissions by approximately 0.7 ton of carbon dioxide equivalent (CO_2e). This equals a reduction in GHG emissions of ~220,000 tons a year. To put things in perspective, it would take the installation of a 10 kW solar photovoltaic system on each of about 34,000 homes in Alexandria to reduce the same amount of GHG emissions.

ENERGY MANAGEMENT & RENEWABLE ENERGY

A 42 kW solar photovoltaic system was installed at the Beatley Central Library. Smaller systems were also installed at the restroom building at Witter Recreational Fields (10kW) and Alexandria Renew's main pump station building. The City is Green Power Partner through the United States Environmental Protection Agency's Green Power Partnership program for offsetting 19% of the City's electricity use from renewable energy sourced through Renewable Energy Credits (RECs).

Solarize Alexandria, a program designed to make installation of solar power systems on Alexandria homes easy and more affordable, was launched in 2015 with campaigns following in 2016 and 2017. So far, fifteen residents installed solar power systems producing 70 KW through the program. The City's renewable energy capacity has increased from 97 kW to 480 kW since 2009.

The City received **Bronze designation** from the national SolSmart program for making it faster, easier, and more affordable for homes and businesses to go solar. SolSmart is led by The Solar Foundation and the International City/County Management Association (ICMA) and funded by the U.S. Department of Energy SunShot Initiative. As a SolSmart Bronze designee, the City is helping solar companies greatly reduce the cost of installations and pass those savings on to consumers. This allows even more local homes and businesses to obtain affordable, clean, and reliable electricity through solar. By making changes to local processes to reduce the time and money it takes to install a solar energy system, the City is helping and encouraging solar companies to do business in Alexandria, driving economic development and creating local jobs.

City Government Energy Management Program

- City carried out LED lighting retrofits at the Beatley Library and parking lot, Duncan Library, Burke Library, Barret Library, Chinquapin Recreation Center, Ramsay House, Black History Museum, Lyceum, Public Safety Center, Alexandria Health Department parking lot, Market Square parking garage, Courthouse parking garage, Union Street parking garage, Thompsons Alley parking garage, Cora Kelly Recreation Center exterior lighting, Alexandria Community and Detox Center, Ramsey Recreation Center, Chinquapin Recreation Center, and 2900 Business Center Drive.
- Re- and retro-commissioning projects to enhance the energy performance at Barrett Library, Beatley Library, Burke Library, Courthouse, Duncan Library, and Fire Station 204.
- High-efficiency boiler upgrades as replacements for older boiler technologies at City facilities, including Lee Center, Beatley Library, Courthouse, Barrett Library, Chinquapin Recreation Center, and Fire Station 201.

- High-efficiency HVAC system upgrades at City facilities, including Public Safety Center, Courthouse, Lee Center, Beatley Library, Chinquapin Recreation Center, Fire Station 204.
- Building Management System upgrades and controls optimization at Lee Center, Beatley Library, Public Safety Center, Barrett Library, Alexandria Health Department, and DASH Transportation Center. The City operates **31 hybrid-electric and 1 electric vehicles** in the City's vehicular fleet, including the operation of a shared pool fleet for employees to share in order to minimize the number of vehicles the City owns and operates.

The Alexandria City Public Schools (ACPS) completed renewable energy and green projects at several schools including:

- Minnie Howard's renewable energy HVAC system results in a 39% drop in energy costs.
- James K. Polk operates with 5 forms of renewable on-site energy including the first ground to air heat exchange commercial system in North America.
- The City collaborated with ACPS to complete a green roof and monitoring camera at Cora Kelly School to reduce energy consumption and stormwater generation, improve water quality, and to serve as an educational tool.

AlexRenew reduces annual energy consumption by 17% from a 2008 baseline. In 2016, AlexRenew reduced its total energy consumption per million gallons of flow by 13%, while reducing greenhouse gas emissions by 6% from its 2011 baseline. In the process of cleaning dirty water, AlexRenew also produces methane gas that is used to heat its buildings and fuel its boilers. AlexRenew generates more than 150 million cubic feet of renewable methane gas — enough energy to power 1,800 Virginia homes for one year. AlexRenew offset purchased energy by 32% using gas produced in its digesters.

AFFORDABLE HOUSING AND ENERGY EFFICIENCY

Since 2009, all new affordable multi-family residential communities in the City of Alexandria have met **EarthCraft design and construction certification program,** the accepted green standard for assisted housing financed through the Virginia Housing Development Authority (VHDA). Completed affordable communities include the **Station at Potomac Yard** (64 units) and Jackson Crossing (78 units) and communities under construction include **AHC's St. James Apartments** (93 units) and AHDC's **Gateway Apartments** (74 units). In addition, **CLI and Wesley Housing** have completed substantial renovation of their affordable multifamily properties in the City including installation of energy efficient appliances, window replacement and upgraded heating and cooling equipment. **Brent Place**, a 207-unit high rise affordable rental property, was selected to participate in an energy and water conservation demonstration program under the Department of Energy's (DOE) Weatherization Innovation Pilot Program. To facilitate Brent Place's participation in the DOE program, the City subordinated its loan for a period of 10 years to allow the property to take advantage of federal dollars available to fund improvements recommended by the audit.

The City expanded the Arlingtonians for a Clean Environment (ACE) **Energy Masters' Program** into Alexandria in 2015. This program trains volunteers to work with residents of affordable rental housing to complete basic energy efficiency improvements and train households on energy conservation techniques. Energy Masters volunteers have worked with renters in more than 110 units in the City to make apartments serving low and moderate income households more water and energy efficient. This program has resulted in reduced utility bills for low-income renters As well as increased outreach in the community and schools.

Since 2009, 30 affordable homeownership opportunities have been created through the City's **Neighborhood Stabilization Program (NSP**) in partnership with Rebuilding Together Alexandria. The City received a grant from the Virginia Department of Housing and Community Development (DHCD) to acquire, rehabilitate and re-sell distressed properties in three target areas in the City. Through this effort, Rebuilding Together conducts a pre- and post-rehabilitation energy audit of each unit and completes a range of energy and water efficiency improvements to help lower energy costs for lower-income first-time homebuyers.

The City's **Home Rehabilitation Loan Program (HRLP),** primarily funded through the federal Community Development Block Grant (CDBG), assists approximately 10 low income Alexandria homeowners each year to address code violations, energy efficiency improvements, and accessibility needs. This program provides no-interest, deferred payment loans to income eligible households. Common improvements include replacement and installation of energy efficient heating and cooling systems, insulation upgrades, installation of Energy Star certified appliances and water conserving toilets and faucets. While the focus of the program is not limited to energy efficiency, funded improvements have assisted lower income homeowners in lowering their monthly utility costs and have served to reduce the City's carbon footprint. The City also supports home repair initiatives administered by Rebuilding Together Alexandria through annual funding for both their year-round volunteer-based home repair program as well as for their April Rebuilding Day.

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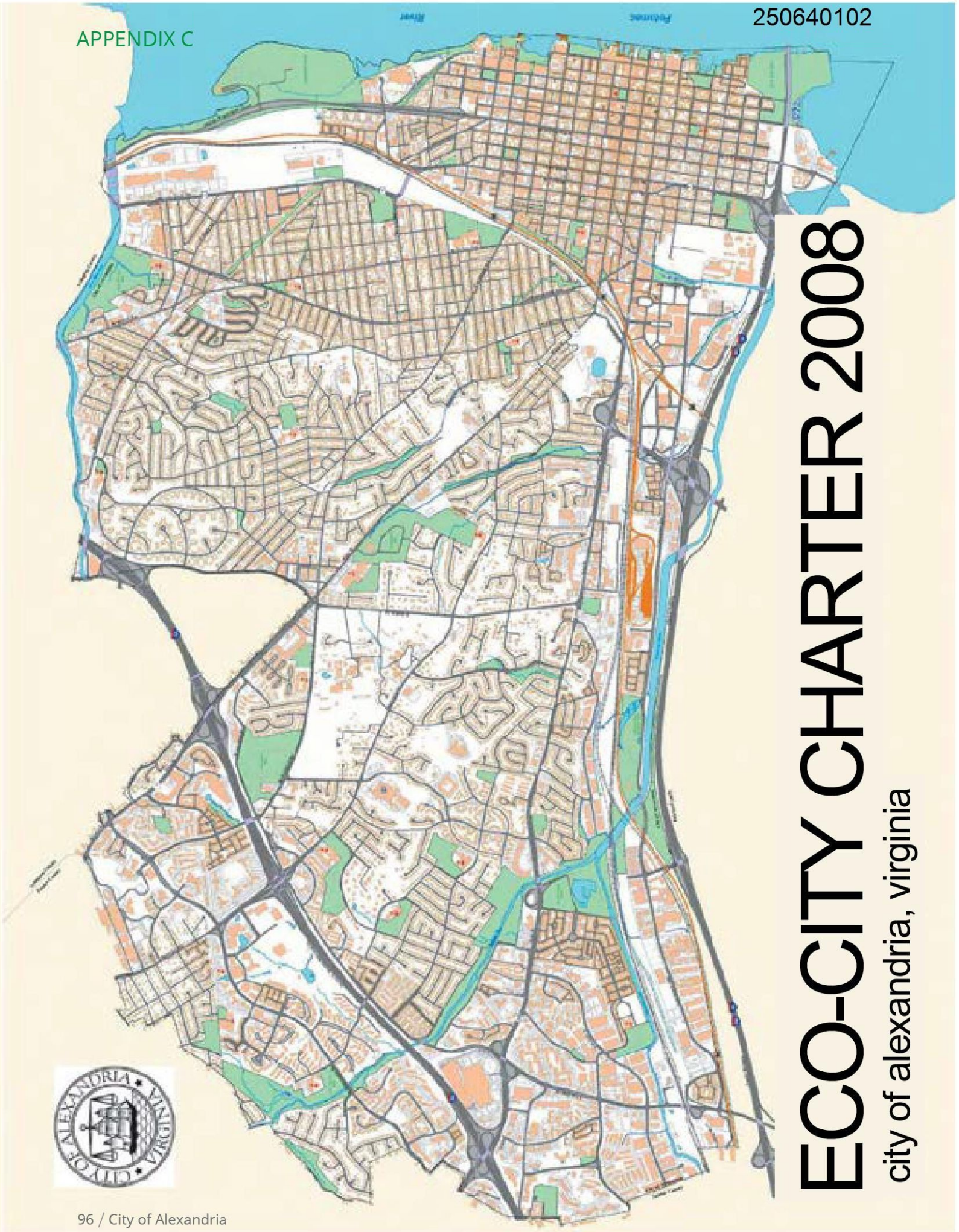

ECO-CITY CHARTER 2008

city of alexandria, virginia

COMPILED BY:

Environmental Policy Commission
City of Alexandria

The Urban Affairs and Planning Program
Virginia Polytechnic & State University
Alexandria Center

SUBMITTED TO:

Alexandria City Council
Mayor, William D. Euille
Vice Mayor, Redella S. “Del” Pepper
Councilman Ludwig P. Gaines
Councilman Rob Krupicka
Councilmember Timothy B. Lovain
Councilman Paul C. Smedberg
Councilman Justin M. Wilson

ADOPTED:

June 14, 2008

Cover | City of Alexandria, GIS Base Map

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ECO-CITY ALEXANDRIA

Eco-City Charter

City of Alexandria, Virginia

Vision
Definition of Sustainability
Guiding Principles
Roles & Responsibilities
Pledge & Commitment

JUNE 14, 2008

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vision

On September 14, 2004, the City Council of Alexandria, Virginia adopted the 2004-2015 Strategic Plan* that sets forth the following vision:

Alexandria is a Vibrant, Diverse, Historic, and Beautiful City with Unique Neighborhoods and Multiple Urban Villages where we take Pride in Our Great Community.

Using the 201 5 Strategic Plan as our guide, we offer the following Eco-City Vision in which Alexandria's citizens, businesses, and City government participate in a vibrant community that is always mindful of the needs and lifestyles of the generations to come.

We see Alexandria as a city where social well-being is supported by a strong economy and sustained by a healthy environment. Specifically, we envision Alexandria as a city that:

Builds Wisely

Where our built environment preserves and maximizes open spaces, natural landscapes, historic resources, and recreational opportunities, while protecting and improving our natural environment and public health.

Embraces Natural Beauty

Where we create beautiful parks, gardens, streetscapes, trails, and open spaces that embrace Alexandria's natural beauty, preserve our biodiversity, increase our tree canopy and streamside vegetation, and encourage a healthy, active lifestyle for all of our residents.

Improves Water Quality

Where we celebrate our heritage as a great port city by improving the Potomac River waterfront, eliminating combined sewer overflows, reducing storm water runoff, and improving the quality of our streams so that they are once again fishable and swimmable.

Clears the Air

Where we reduce significantly air pollution from all sources including vehicles, industrial sources, and power plants.

* See http://www.alexandriava.gov/uploadedFiles/council/info/strategicplan.pdf

Moves Smartly

Where we travel less and less by car and increasingly by mass transit, walking, and bicycling.

Conserves Energy and Resources

Where we reduce our energy and water use and minimize our environmental footprint.

Minimizes Waste

Where we reuse and recycle materials and significantly reduce our volume of solid waste and toxic chemical releases.

Supports Healthy Living

Where we create environmental policy and programs not only for a healthier planet but also for a healthier and safer citizenry.

Readies for Change

Where we foresee and mitigate the impacts of environmental threats such as climate change.

Leads Intelligently & Holistically

Where we implement change harmoniously and synergistically across interdependent areas.

Shares Responsibility

Where individuals take responsibility, decision-making is shared, and the community works together to achieve common goals that reflect the interests of a growing, diverse, and well-informed population.

definition of sustainability

Sustainability means meeting our community's present needs while preserving our historic character and ensuring the ability of future generations to meet their own needs. It involves balancing and integrating environmental, economic, health and social issues so as to maximize the quality of life for all of Alexandria's residents. Sustainability also requires us to consider the impacts of our decisions and actions beyond the City of Alexandria and seek the continuous evolution of policies and programs.

ADOPTED JUNE 14, 2008

guiding principles

The following guiding principles are rooted in the definition of sustainability and reflect the goals established in Alexandria's 201 5 Strategic Plan. This interdependent network of guiding principles and policies is consistent with a systematic and integrated approach to sustainability.

LAND USE & OPEN SPACE

The City's land use and open space policies must harmonize its built and natural environments to ensure that growth does not jeopardize environmental sustainability and preserves Alexandria's character. The City's land use policies will accommodate increases in people and jobs through green development that:

- Ensures that land use is designed to encourage walking, biking, and public transportation through mixed-use zoning, interconnected pathways, and targeted density increases around public transportation hubs.
- Creates greater opportunities for sustainable compact development and redevelopment that requires the use of green building practices and prioritizes provision of usable open space and recreational areas.
- Ensures that City building codes, zoning ordinances, and other land use regulations reflect the goals of this Charter, so that sustainability requirements are consistently applied to all preservation, redevelopment, and development across Alexandria in ways appropriate to the character of the particular neighborhood.
- Ensures that development protects and enhances natural resource capacity.
- Protects, enhances, and increases Alexandria's open space and green infrastructure including wildlife habitat, parks, trails, tree canopy, and watersheds.
- Ensures that land use decisions do not foster or perpetuate social injustice.

WATER RESOURCES

Alexandria's past, present, and future are indelibly linked to the Potomac River and the quality of life the river sustains. Water quality in Alexandria will be managed in a sustainable manner consistent with good stewardship of the local streams, the Potomac River and the Chesapeake Bay for the public health, ecological and recreational benefits of current and future generations. The City will:

- Promote public health by continuing to ensure safe and reliable drinking water.
- Use environmentally responsible flood management, stormwater control, and wastewater treatment to protect the public's health and property.
- Promote - through sustainable practices - safe, swimmable, and fishable waterways for its citizens and visitors, and enhance the ecological integrity of its downstream waters, by minimizing stormwater runoff and pollutants draining to the Potomac River and Chesapeake Bay.

- Advocate water conservation and reuse in order to preserve the quantity, not just the quality, of our water resources.

AIR QUALITY

Alexandria faces significant challenges in improving air quality including those presented by emissions from vehicles, older industrial facilities, and the regional transport of air pollution. Given that one in eight residents have respiratory illnesses, the City should influence and control emissions sources in a manner that reflects the choices and wishes of the community. The City and its citizens will:

- Enhance their ability to manage outdoor air quality from damaging pollutants in its jurisdiction and will consider emerging threats when establishing outdoor air quality goals and regulatory approaches.
- Be proactive in protecting public health and ecological quality by lowering the amount and number of sources of air, light, and noise pollution.
- Educate those who manage commercial and public buildings on methods for improving indoor air quality and educate citizens on the harms associated with poor indoor air quality.

TRANSPORTATION

The City of Alexandria will encourage modes of transportation that reduce dependence upon the private automobile by promoting mass transit and pedestrian- and bike-friendly transportation networks. The City will integrate transportation options with land use decisions in order to ensure a healthy environment while continuing economic growth. The City will:

- Provide all its citizens - regardless of age, income, race or ability - with safe, accessible, efficient, and affordable transportation options.
- Prioritize walking, biking, and public transit in order to discourage single-occupancy vehicles.
- Reduce the environmental footprint of travel by introducing, designing and encouraging sustainable methods of transport and infrastructure.

ENERGY

The quantity and sources of energy used by Alexandria's government, businesses and residents impact our environment and quality of life—whether it be through pollutants added to the air, negative effects on water quality or local contributions to climate change. Recognizing this, Alexandria commits to managing its energy—both the electricity that powers our buildings and homes and the fuel that powers our vehicles and other equipment—based upon the following principles:

- Reduce energy consumption through conservation.
- Produce energy locally and sustainably, through installation and promotion of the use of renewable and efficient energy technologies.
- Convert existing uses of fossil-fuel energy to renewable energy. We envision and work toward a day when Alexandria relies solely on renewable energy sources.

BUILDING GREEN

Alexandria's government, businesses, and citizens impact our environment through the choices they make when renovating existing structures and constructing new ones. These choices manifest themselves in the quantity and types of energy we use, the impact we have on our water quality, the amount of waste we create, the amount and quality of green space available to us, and our public health. Therefore, the City's building practices will:

- Adopt and maintain initiatives that require best in practice measures to reduce overall environmental impact of renovation, redevelopment, and new development.
- Integrate green building and sustainability standards into all private and public development, including historic preservation, renovation, and new construction.
- Encourage the preservation and adaptive reuse of existing buildings, and promote the reuse and recycling of building materials in all development.

SOLID WASTE

Recognizing that managing waste is a public health issue as well as a quality of life issue, Alexandria will maintain its well-preserved public image by managing, handling, and disposing of solid waste in an environmentally sustainable manner. Alexandria will manage waste as a hierarchy of uses with the following priorities:

- Priority One: Reduce
- Priority Two: Reuse
- Priority Three: Recycle
- Priority Four: Resource recovery (e.g., convert to energy, composting, etc.)
- Priority Five: Proper disposal

ENVIRONMENT & HEALTH

Sustainability is not just about the health of the earth; it is also about human health. Indoor and outdoor air quality, water quality, land use planning, toxic chemical exposure, noise and light pollution, and the safety and habitability of buildings directly impact human health and the natural environment. Alexandria will:

- Promote and support policies and individual decisions that reduce exposure to toxins and pollutants, minimize environmental impact, and encourage a healthy lifestyle.
- Increase equitable access to safe, healthy, and organic food, in particular for children and adolescents, and encourage local and regional food production.

EMERGING THREATS

Alexandria must be adaptive and responsive to emerging and unforeseen environmental threats – such as climate change – that could strain infrastructure, deplete natural resources, disrupt the economy, and threaten public health. Failure to respond quickly and appropriately to such threats will likely have severe consequences for the health and economy of Alexandria and its citizens. To better prepare for and avert environmental crises, Alexandria will:

- Make policy, infrastructure, and land use decisions that prepare for flooding, drought, disease, and other impacts to humans and wildlife from environmental threats such as climate change.
- Conserve energy and achieve carbon-neutrality.

- Identify ways to reduce/eliminate nutrient loading to waterways.
- Conduct accurate and continual assessments of resource and infrastructure capacity when planning to ensure growth and development does not exceed capacity.
- Ensure that Alexandria understands these threats, its role in the problem, and its part in the solution.

IMPLEMENTATION

Improving environmental quality, conservation and the public welfare requires a harmonized approach to implementation, as well as collaboration both within and around Alexandria. The primary responsibility of environmental steward-ship shall be equally shared by all Alexandrians. In order to achieve the Eco-City Vision and the Guiding Principles set forth in this Charter, the City will:

- Educate and engage its citizens, visitors, local businesses, schools, and civic organizations on the City's concept of sustainability, the importance of identifying goals for environmental quality, and the vision and principles of this Charter.
- Develop and encourage more public-private-civic partnerships within Alexandria and beyond, and work with federal, state, and neighboring governments to implement these principles and achieve sustainability.
- Conserve resources, make sustainable purchasing choices, and make the long- and short-term investments necessary to achieve the principles of this Charter.
- Ensure city policies give incentives for achieving the vision and principles of this Charter and disincen-tives for behaviors that impede sustainability.
- Become a leader, educator, advocate, facilitator, integrator, and innovator in sustainability.

roles & responsibilities

The Eco-City Charter serves as a guide for moving the city towards a sustainable future. Fulfilling this Charter requires coordinated participation and commitment by the EPC, City government, and the community. The Charter's success depends on each of these parties taking an active and innovative role as stewards and guardians of this Charter's principles and vision.

ENVIRONMENTAL POLICY COMMISSION

- Develop an Environmental Action Plan that adheres to the principles outlined in this Charter and ad-vances the City towards the vision of a sustainable city; review and revise the Action Plan as needed, but no less than once every five years.

ADOPTED JUNE 14, 2008

- Inform and educate the community on the vision, principles, and policies outlined in the Charter and the Environmental Action Plan.
- Identify specific steps that citizens and businesses can take to help Alexandria achieve the principles and vision set forth in this Charter.
- Work with and support City Departments, Boards, and Commissions to promote and ensure that the principles within the Charter are considered in key decisions and infused in City programs and policies.
- Produce an annual report card that evaluates the progress of the City toward meeting the sustainable vision set forth in the Charter and Environmental Action Plan.
- Review the Charter no less than every ten years and amend as necessary to ensure that it continues to meet emerging sustainability issues and the needs of the City and its residents.

CITY COUNCIL, CITY MANAGER, CITY DEPARTMENTS, BOARDS & COMMISSIONS

- Lead by example: identify and implement specific projects for the City government to become more sustainable and create incentives for Alexandria citizens to do the same.
- Maintain our best environmental practices while investing in new ideas to achieve the vision and principles of this Charter.
- Incorporate sustainability practices, and encourage interdepartmental coordination to ensure all City decisions are compatible with the principles of the Charter.
- Work with the Environmental Policy Commission to advance the principles in the Charter and the steps set forth in the Environmental Action Plan.
- Work to make sustainability the natural, easy, and preferred choice for decisions by the City as well as its citizens and businesses.
- Develop and implement an outreach program to educate the community on the vision and principles in the Charter, with particular attention on ensuring that the City's youth are given a foundation of knowledge in the principles of environmental stewardship.
- Identify and develop key regional partnerships to address the sustainability challenges of the region.

CITIZENS & COMMUNITY

- Take responsibility for the social, environmental, economic, and health impacts of our decisions and be accountable for our actions.
- Encourage children, businesses, neighbors and community organizations to practice and demand sustainability.
- Engage in and contribute to the City's sustainability planning processes and bring forth ideas to ensure the Charter and the Environmental Action Plan are current and meet the needs of the community.
- Hold local, regional, state, and national leaders accountable for achieving sustainability.

This charter is the result of a collaborative effort between the City of Alexandria, its Environmental Policy Commission, and Virginia Tech's Urban Affairs & Planning Program in Alexandria.

Virginia Tech

250640102

Design by Kimberley Hodgson

APPENDIX D

Metropolitan Washington Council of Governments

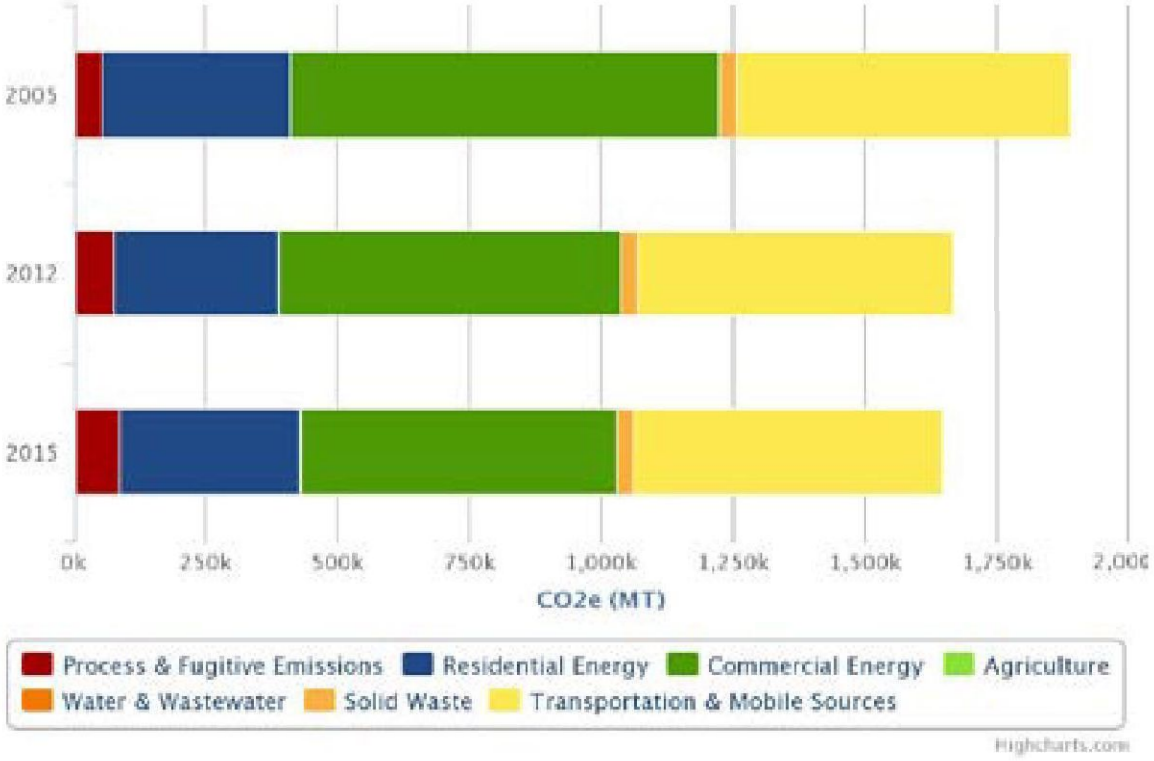
City of Alexandria, Virginia

Community-Wide Greenhouse Gas Inventory Summary Factsheet

Emissions Summary

City of Alexandria community-wide greenhouse gas (GHG) emissions decreased by 13% between 2005 and 2015.

- Despite an 12% growth in population, GHG emissions reduced from 1.89 $MMTCO_2e$ (million metric tons of carbon dioxide equivalent) in 2005 to 1.64 $MMTCO_2e$ in 2015.
- Per capita emissions decreased 22% between 2005 and 2015; from 14.1 $MTCO_2e$ (metric tons of carbon dioxide equivalent) in 2005 to 11.0 $MTCO_2e$ in 2015.
- In 2015, energy consumption (residential and commercial) accounted for 57% and transportation and mobile sources accounted for 36% of GHG emissions. Efficiency and switching to cleaner fuel sources contribute to GHG reductions.



Inventory Background

In 2008, the Metropolitan Washington Council of Governments (COG) and local governments across metropolitan Washington collaboratively established the regional GHG emission reduction goals of: 10% below business as usual projections by 2012 (back down to 2005 levels); 20% below 2005 levels by 2020; and 80% below 2005 levels by 2050. COG and its member jurisdictions are working toward these goals. City of Alexandria surpassed the 2012 goal, demonstrating that GHG reductions are possible even as the population and economy grows.

Metropolitan Washington Council of Governments

Emissions Activities

These inventories measured GHG-emitting activities undertaken by residents, businesses, industry, and government located in the City of Alexandria, as well as emissions from visitors. Emissions sources accounted for include:

- Electricity consumption from all sectors within the county;
- Combustion of natural gas and other fuels;
- Mobile transportation, including on-road vehicular travel, air travel, and commuter rail travel undertaken by residents, business, and visitors in the county, and off -road activities such as use of construction and landscaping equipment;
- Collection and treatment of solid waste produced by residents and activities within county boundaries;
- Pumping and treatment of water and wastewater used or produced by residents and activities; and
- Agricultural emissions from enteric fermentation, manure management, and soils (including fertilizer application);
- Fugitive emissions from ozone depleting chemicals and natural gas.
- All emissions are reported in million metric tons of carbon dioxide equivalent ($MMTCO_2e$) or metric tons of carbon dioxide equivalent (MTCO2e).

Methodology

- The methodology for the City of Alexandria GHG inventory is consistent with the metropolitan Washington regional GHG inventory. Both the regional and jurisdictional inventories use the ICLEI US Community Protocol and ClearPath tool to measure emissions.
- Utility data was collected from regional electric and natural gas utilities. Emissions factors for electricity were based on EPA's Emissions & Generation Resource Integrated Database (eGRID) versions for 2005, 2012, and 2014.
- On-road and off-road transportation emissions were calculated using the EPA's Motor Vehicle Emission Simulator (MOVES v2010a and 2014) and based on VMT data provided by COG's Transportation Planning Board. Air travel emissions were calculated using national emissions from the EPA GHG Inventory scaled locally using population and air travel data from the Washington-Baltimore Regional Air Passenger Survey. Commuter rail emissions were calculated using MARC and VRE diesel consumption data scaled to the region.
- Emissions from landfills were calculated based on local and regional solid waste data. Wastewater treatment emissions were determined by data collected from local water utilities.
- Agricultural emissions were calculated using EPA's State GHG Inventory Tool and data from EPA's Chesapeake Assessment Scenario Tool and USDA's Census of Agriculture.
- Ozone depleting chemicals were calculated using national emissions scaled locally by population.

Links

- Metropolitan Washington Climate Energy and Environment Policy Committee Webpage: https://www.mwcog.org/committees/climate-energy-and-environment-policy-committee/
- Eco-City Alexandria: https://www.alexandriava.gov/Eco-City

CITY OF ALEXANDRIA

2019 Green Building Policy

POLICY STATEMENT:

Green building is a practice that brings environmental and economic benefits to present and future generations. A green building ensures that sustainable standards are adhered to throughout the design and construction processes to lessen the impacts of the building on the local and global environment, resulting in lower operational costs and a healthy indoor environment for building occupants. The standards of the 2019 City of Alexandria Green Building Policy provided herein establish minimum green building practices for new private development and furthers the City's commitment to lead by example through new development and renovation of its own public buildings. In addition to instituting standards to achieve an overall improvement in building performance, this Green Building Policy includes a cutting-edge, directed-use approach that targets the reduction of energy use and mitigating greenhouse gas emissions, increased water efficiency and improved indoor environmental quality in both new private and public buildings. As a result, implementation of this Green Building Policy will contribute to reduced greenhouse gas emissions, conservation of potable water and improved human health in the City of Alexandria.

DEVELOPMENT STANDARDS:

New private development, new public development (City-owned buildings, including Alexandria City Public Schools) and major renovations that require a Development Site Plan (DSP) or a Development Special Use Permit (DSUP) are subject to comply with the Green Building Policy. The Green Building Policy is in effect as of March 2, 2020 for DSP and DSUP applications submitted on or after this date.

The 2019 Green Building Policy identifies: 1) the pathways to achieve the City's green building performance standards, including certification through three nationally recognized green building rating systems, 2) a minimum level of green building certification for both private and public developments, and 3) priority "Performance Points" within each rating system that a project is expected to achieve.

RATING SYSTEMS & MINIMUM LEVEL OF CERTIFICATION:

LEED, Green Globes, and EarthCraft are the standard third-party green building rating systems accepted under the Green Building Policy. The minimum level of certification for each rating system is provided on the following pages for both public and private development. The latest version of each rating system at the time of the first Final Site Plan submission shall apply.

In addition to the LEED, Green Globes or EarthCraft green building rating systems, projects may choose an alternative path for certification through an independent, third-party certifier. The independent, third-party certifier must verify that the performance standards of the Green Building Policy are met.

PERFORMANCE POINTS:

Performance Points are defined as specific minimum credit points each project must achieve within the minimum level of certification for the selected green building rating system. Performance Points are identified within the areas of energy use reduction and greenhouse gas emission reductions, water efficiency, and indoor environmental quality. Projects that use LEED should refer to the LEED Credit Library for the specific criteria of each point. Those who utilize Green Globes or EarthCraft must comply with the Performance Point overlay criteria in Appendix A and Appendix B of this Policy, respectively. To maintain alignment with the intent of this Policy, Performance Points may be adjusted over time to correspond with updates to the rating systems, revisions to the building code, and/or updates to state, federal, or other City policies.

In addition to the minimum level of certification and the designated Performance Points, public development will meet the following criteria:

STORMWATER	100% of the required stormwater treatment through green infrastructure.
NET ZERO ENERGY	An energy-efficient building where, on a source energy basis, the actual annual delivered energy is less than or equal to the on-site renewable exported energy.

PUBLIC BUILDING RENOVATIONS:

For renovations of City-owned buildings that do not require a DSP or DSUP, the City will apply LEED Interior Design and Construction (ID+C) and LEED Operations and Maintenance (O&M) rating systems as a guideline for interior design and construction projects and targeted renovations of individual building systems (e.g.; HVAC, roof, windows, plumbing, etc.). Actual third-party certification may be used when technically and financially feasible.

FLEXIBILITY:

Flexibility from the Green Building Policy will be considered on a case-by-case basis. If flexibility is requested, the Director of Planning and Zoning will consider the project size, proposed use and the alternate green building practices the applicant proposes to incorporate into the project to determine if the request is justified. The City will use the data collected from this process over time to establish consistent criteria and thresholds for alternatives to compliance with the Green Building Policy.

2019 GREEN BUILDING POLICY | Leadership in Energy and Environmental Design (LEED)

RATING SYSTEM	MINIMUM LEVEL OF CERTIFICATION		PERFORMANCE POINTS								
			ENERGY USE REDUCTION			WATER EFFICIENCY			INDOOR ENVIRONMENTAL QUALITY		
	Private	Public	POINTS Private	POINTS Public	CREDIT	POINTS Private	POINTS Public	CREDIT	POINTS Private	POINTS Public	CREDIT
LEED BUILDING DESIGN AND CONSTRUCTION (BD+C)	Silver	Gold	5	7	Optimize Energy Performance	4	4	Indoor Water Use Reduction	1	1	Low-Emitting Materials
			2	3	Renewable Energy Production				1	1	Construction Indoor Air Quality Management Plan
			1	1	Advanced Energy Metering[2]	1	1	Outdoor Water Use Reduction	1	1	Thermal Comfort
			Optional	3	Enhanced Commissioning				Optional	2	Daylight
									Optional	1	Indoor Air Quality Assessment

NOTES: 1) Refer to LEED Credit Library for point criteria.
2) Applies to non-residential projects only (excludes hotels).

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2019 GREEN BUILDING POLICY | Green Globes

RATING SYSTEM	MINIMUM LEVEL OF CERTIFICATION		PERFORMANCE POINTS									
			ENERGY USE REDUCTION			WATER EFFICIENCY			INDOOR ENVIRONMENTAL QUALITY			
	Private	Public	POINTS Private	POINTS Public	CREDIT	POINTS Private	POINTS Public	CREDIT	POINTS Private	POINTS Public	CREDIT
GREEN GLOBES NEW CONSTRUCTION (NC)	2 Green Globes	3 Green Globes	60	68	**3.3.1.1** Assessing Energy Performance (Path A, B, or C)	24	24	**3.4.1.1** Indoor Water Consumption	11	11	**3.7.1.1** Ventilation Air Quality
			9	9	**3.3.9.1.1** On-site Renewable Energy Feasibility Study				8	8	**3.7.1.2** Air Exchange
			-AND-			6	6	**3.2.4.1** Landscape and Irrigation Plan (LIP) by Certified Professional	10	10	**3.7.2.1** Volatile Organic Compounds
			23	23	**3.3.9.1.2** On- or Off-site Renewable Energy						
			-OR-			3	3	**3.2.4.1.1** Soil Type, Drainage and Light Conditions			
			18	18	**3.3.9.2.1** Off-site Renewable Energy						
			-OR-			2	2	**3.2.4.3.2** Native/Non-invasive Plant Material	5	5	**3.1.2.4** IAQ During Construction
			32	32	**3.3.9.1.2** (Partial) and **3.3.9.2.1** (Partial)						
			COMMISSIONING			3	3	**3.2.4.3.3** Turfgrass Minimalized			
			Optional	4	**3.1.3.2.1.1** HVAC and Refrigeration Systems	1	1	**3.4.8.2.2** Drip/low Volume Irrigation[3]	Optional	3	**3.1.2.4.2** IAQ of Occupied Areas During Construction
			Optional	3	**3.1.3.2.1.5** Plumbing						
			Optional	1	**3.1.3.2.1.6** Electrical				2-12	2-12	**3.7.4** Thermal Comfort
			Optional	1	**3.1.3.2.1.7** Lighting						
			Optional	1	**3.1.3.2.1.8** Building Automation						
			Optional	1	**3.1.3.3.1** Training Requirements						
			Optional	6	**3.1.3.4.1** Operations and Maintenance Manuals	1	1	**3.4.8.2.3** WaterSense/SWAT/Smart Control System[3]	Optional	8	**3.3.5.4** Daylighting
			METERING, MEASUREMENT AND VERIFICATION[2]			0.5	0.5	**3.4.8.2.4** Regulation of Precipitation Rate on Sprinkler[3]	Optional	7	**3.7.3.1.1** Daylighting
			1	1	**3.3.3.1.1.1** Electricity						
			1	1	**3.3.3.1.1.2** Heating Fuels						
			1	1	**3.3.3.1.1.4** Other, with description (as applicable)	0.5	0.5	**3.4.8.2.5** Swing Joints/Flex Pipes on Irrigation Heads[3]	Optional	2	**3.1.2.4.1** IAQ During Construction Indoor Air Quality Test Pathway
			0.5 - 3	0.5 - 3	**3.3.3.1.2** Sub-metering (as applicable)						

NOTES: 1) Refer to Appendix A: "City of Alexandria, VA Performance Design Targets – Directed Use Criteria ("Performance Points") for Green Globes" for Performance Point criteria.
2) Applies to non-residential projects only (excludes hotels).
3) Credit is only applicable if an automated irrigation system is installed.

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2019 GREEN BUILDING POLICY | EarthCraft Multifamily

RATING SYSTEM	MINIMUM LEVEL OF CERTIFICATION		PERFORMANCE POINTS								
			ENERGY USE REDUCTION			WATER EFFICIENCY			INDOOR ENVIRONMENTAL QUALITY		
	Private	Public	POINTS Private	POINTS Public	CREDIT	POINTS Private	POINTS Public	CREDIT	POINTS Private	POINTS Public	CREDIT
EARTHCRAFT MULTIFAMILY (ECMF)	Gold	N/A	2-5	N/A	**IN 1.1** Solar, Micro-hydro, Wind Electric **IN 1.2** Solar-ready Design **IN 1.3** Solar Electric System or **IN 1.5** Common Areas Solar Electric Use	INDOOR WATER USE			4	N/A	**IAQ 2.7** VOC Materials and **IAQ 2.12** Zero Carpet in Units
						9-14	N/A	**WE 1.2** Water Treatment **WE 1.3** Water Softeners **WE 1.4** Storage **WE 1.5.1** WaterSense Toilet **WE 1.5.2** WaterSense Urinal **WE 1.5.3** WaterSense Lavatory Faucet **WE 1.5.4** WaterSense Showerhead **WE 1.6** Toilet < 1.1 gallon/flush			
			1-2	N/A	**EO 3.4** Light Commercial Community Center (as applicable) or **EO 3.5** Light Commercial Ready Spaces (as applicable)	-OR-					
						5-10	N/A	**WE 1.2** Water Treatment **WE 1.3** Water Softeners **WE 1.5.1** WaterSense Toilet **WE 1.5.2** WaterSense Urinal **WE 1.5.3** WaterSense Lavatory Faucet **WE 1.5.4** WaterSense Showerhead **40%** Reduction from Baseline	2	N/A	**BE 3.15** Insulation **BE 3.16** Walls **BE 3.17** Exterior Insulation **BE 3.18** Ceilings **BE 3.19** Attic Kneewalls or **BE 3.20** Insulate Roofline
			COMMISSIONING			OUTDOOR WATER USE					
			Optional	N/A	**EO 2.3** Pre-occupancy Briefing	4-9	N/A	**WE 2.4** Turf <40% **WE 2.5** Vegetate 4:1 Slopes **WE 2.7** Drought Tolerant/Native Plants **WE 2.8** Guidebook and **WE 2.6** Irrigation[2]			
			Optional	N/A	**EO 2.4** Post-occupancy Briefing						
			Optional	N/A	**EO 2.5** Environmental Management and Building Maintenance Guidelines for Staff	-OR-					
						3	N/A	**WE 2.10.1** Greywater Irrigation[2]			
			Optional	N/A	High-rise Addendum	-OR-			1	N/A	**IAQ 2.9** Pre-occupancy Flush
			METERING								
			Optional	N/A	**IN 1.7 12** Months Post-Construction Energy Monitoring	3	N/A	**WE 2.10.2** Rainwater Irrigation[2]			

NOTES: 1) Refer to Appendix B-1: "City of Alexandria, VA Performance Design Targets – Directed Use Criteria ("Performance Points") for Earthcraft Multifamily (ECMF)" for Performance Point criteria.
2) Credit is only applicable if an automated irrigation system is installed.

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2019 GREEN BUILDING POLICY | EarthCraft Light Commercial

RATING SYSTEM	MINIMUM LEVEL OF CERTIFICATION		PERFORMANCE POINTS								
			ENERGY USE REDUCTION			WATER EFFICIENCY			INDOOR ENVIRONMENTAL QUALITY		
	Private	Public	POINTS Private	POINTS Public	CREDIT	POINTS Private	POINTS Public	CREDIT	POINTS Private	POINTS Public	CREDIT
EARTHCRAFT LIGHT COMMERCIAL (ECLC)[2]	Certified	Gold	1	1	**BE 1A** Envelope Air Tightness Test	INDOOR WATER USE			2	2	**IEQ 5** Certified Flooring **IEQ 6** Composite Wood or **IEQ 7** Product Transparency
			1	1	**ES 5** High Performance Duct System	3	3	**WE 1A** High Efficiency Toilets **WE 1B** Pint Flush or Waterless Urinals **WE 1C** Automatic Faucets, and/or **WE 1D** High Efficiency Showerheads	1	1	**IEQ 1** Decoupled Ventilation **IEQ 2** (DCV) **IEQ 3** Air Filtration Media or **IEQ 4** Radon Exposure Prevention
			-AND-								
			1	1	**IN 1** Renewable Energy Installation						
			-OR-								
			2	2	**IN 2** Renewable Energy Procurement				Optional	1	**BE 7** Daylighting Design Strategies
			COMMISSIONING								
			Optional	3	**EO 1** Building Systems Commissioning	OUTDOOR WATER USE					
			METERING			3	3	**WE 2** Landscape Plan **WE 3** Efficient Irrigation System and/or No Irrigation and/or **WE 4** Non-potable Water Source Used for Irrigation[3]	PR[4]	PR[4]	**IEQ R3** Minimize Indoor Air Contamination
			PR[4]	PR[4]	**EO R1** Utility Tracking						

NOTES: 1) Refer to Appendix B-2: "City of Alexandria, VA Performance Design Targets – Directed Use Criteria ("Performance Points") for Earthcraft Light Commercial (ECLC)" for Performance Point criteria.
2) Applicable to commercial buildings, schools and public facilities up to 80,000 square feet.
3) Credit is only applicable if an automated irrigation system is installed.
4) PR = Program Requirement; no points assigned.

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APPENDIX A: CITY OF ALEXANDRIA, VA PERFORMANCE DESIGN TARGETS – DIRECTED USE CRITERIA ("PERFORMANCE POINTS") FOR **GREEN GLOBES FOR NEW CONSTRUCTION (NC)**.

For additional information, refer to the Green Globes for New Construction Technical Reference Manual v1.50.

As part of achieving a minimum certification of Two Green Globes for private projects, or Three Green Globes for public projects in the City of Alexandria, VA, Green Globes projects must fulfill the following Green Globes criteria:

ENERGY

Energy Reduction for Private Projects

Green Globes Criteria: 3.3.1.1: All private projects must achieve a minimum of 60 points under Pathways A, B, or C, identified in criteria 3.3.1.1 for an EUI > 30% (60 points)

Energy Reduction for Public Projects

Criteria 3.3.1.1: All projects must achieve a minimum of 68 points under Pathways A, B, or C, identified in criteria 3.3.1.1 for an EUI ≥ 35% (68 points)

Renewable Energy for Private Projects

3.3.9.1.1.: Perform feasibility study under criteria 3.3.9.1.1 to determine whether 5% onsite renewable energy equipment or 40% off-site renewable energy equipment is achievable for the project (9 points)

Per the result of the feasibility study, achieve these criteria by following one of the three paths below:

PATH 1: Criteria 3.3.9.1.2: Installation of 5% or greater **on-site** renewable energy; or installation of 40% or greater **off-site** renewable energy. (23 points)

OR

PATH 2: Criteria 3.3.9.2.1: Procurement of RECs and/or offsets for 200% of building energy for a minimum of three years (18 points)

OR

PATH 3: Achieve Criteria 3.3.9.1.2 for installation of either 2% on-site or 20% off-site renewable energy equipment (14 points) **AND** achieve 3.3.9.2.1 for procurement of RECs and/or offsets for 100% of building energy for minimum of three years (18 points).

Renewable Energy for Public Projects

3.3.9.1.1.: Perform feasibility study under criteria 3.3.9.1.1 to determine whether a minimum of 10% onsite renewable energy equipment or 60% off-site renewable energy equipment is achievable for the project (9 points)

Per the result of the feasibility study, achieve these criteria by following one of the three paths below:

PATH 1: Criteria 3.3.9.1.2: Installation of 10% or greater **on-site** renewable energy; or installation of 60% or greater **off-site** renewable energy (23 points)

OR

PATH 2: Criteria 3.3.9.2.1: Procurement of RECs and/or offsets for 200% of building energy for a minimum of six years (18 points)

OR

PATH 3: In cases where the onsite/offsite renewable energy goals may be partially achieved, Criteria 3.3.9.1.2 for installation of either a minimum of 5% on-site or 30% off-site renewable energy equipment (14 points) **AND** achieve 3.3.9.2.1 for procurement of RECs and/or offsets for 100% of building energy for minimum of six years (18 points).

Commissioning for Public Projects (Optional for Private Projects)

The City of Alexandria recommends that all private projects attempt to include Commissioning whenever possible, although it is not required for private projects. Public projects must fulfill commissioning criteria related to mechanical systems, plumbing, and electrical, specifically by utilizing the following Green Globes Criteria:

3.1.3.2.1.1., HVAC and refrigeration systems (4 points)
3.1.3.2.1.5., Plumbing (3 points)
3.1.3.2.1.6., Electrical (1 point)
3.1.3.2.1.7., Lighting (1 point)
3.1.3.2.1.8., Building automation (1 point)
3.1.3.3.1., Training requirements (1 point)
3.1.3.4.1., Operations and Maintenance manuals (6 points)
Total points: (17 points)

*Advanced Energy Metering for Public and Private Projects**

All applicable points in the following Green Globes Criteria related to whole building/significant use metering must be fulfilled (*as applicable to the building's systems*):

3.3.3.1.1.1., Electricity (1 point)
3.3.3.1.1.2., Heating Fuels (1 point)
3.3.3.1.1.3., Steam (1 point)
3.3.3.1.1.4., Other, with description (1 point)
Total possible points for this section: (4 points)

And, for the following end uses making up over 10% of the building load, *as applicable to the building*:
3.3.3.1.2.1., Sub-metering on lighting and lighting controls by floors or zones (0.5 points)
3.3.3.1.2.2., Sub-metering on plug loads by floor or zones (0.5 points)
3.3.3.1.2.3., Sub-metering on major electric HVAC equipment (0.5 points)
3.3.3.1.2.4., Sub-metering on chilled water generation (0.5 points)
3.3.3.1.2.5., Sub-metering for onsite renewable energy generation (0.5 points)

3.3.3.1.2.6., Sub-metering for heating water or steam generation (0.5 points)
Total possible points for this section: (3 points)

**Applies to non-residential projects only, excluding hotel projects. Such projects are excluded from being required to comply with these criteria, although the City of Alexandria urges projects to consider compliance with these criteria, where possible.*

WATER EFFICIENCY

Indoor Water Use for Public and Private Projects

The following Green Globes Criteria must be fulfilled:

3.4.1.1, Projected water consumption determined to be less than the baseline by a minimum of 40% (24 points)

Outdoor Water Use for Public and Private Projects

The following Green Globes Criteria must be fulfilled through a project achievements in both landscaping (Site), and irrigation systems (Water) performance:

3.2.4.1., Landscape Irrigation Plan (LIP) by Landscape Architect (6 points)
3.2.4.1.1., LIP for soil type, drainage and light (3 points)
3.2.4.3.2., Native/Non-invasive plants (2 points)
3.2.4.3.3., Turf grass minimalized (3 points); and
-The following criteria and points are only applicable if an automated irrigation system is installed-
3.4.8.2.2., Drip/low volume irrigation (1 point)
3.4.8.2.3., Watersense/SWAT/Smart Control system (1 point)
3.4.8.2.4., Regulation of precipitation rate on sprinkler systems (0.5 point)
3.4.8.2.5., Swing joints/Flex pipes on irrigation heads (0.5 point)

INDOOR ENVIRONMENTAL QUALITY

Indoor Environmental Quality for Public and Private Projects

The following Green Globes Criteria must be fulfilled:

3.1.2.4 IAQ During Construction (5 points maximum)
3.3.5.4 Daylighting (8 points) (public buildings only)
3.7.3.1.1 Daylighting (7 points) (public buildings only)
3.7.1.1 Ventilation Air Quantity (11 points)
3.7.1.2 Air Exchange (8 points)
3.7.2.1 Volatile Organic Compounds (10 points)
3.7.4 Thermal Comfort (up to 12 points depending on building use/purpose)

Indoor Air Quality for Public Projects

3.1.2.4.1 IAQ During Construction: Indoor Air Quality Test pathway (2 points)
3.1.2.4.2 IAQ of Occupied Areas During Construction (3 points)

APPENDIX B-1: CITY OF ALEXANDRIA, VA PERFORMANCE DESIGN TARGETS ("PERFORMANCE POINTS") – DIRECTED USE CRITERIA FOR **EARTHCRAFT MULTIFAMILY (ECMF).**

For additional information, refer to the EarthCraft Multifamily Technical Guidelines.

The EarthCraft Multifamily rating system is not applicable to public projects. For private projects, as part of achieving the minimum certification requirements for EarthCraft Gold, the following must also be completed projects in the City of Alexandria:

ENERGY:

Renewable Energy

Achieve one of the four paths below:

IN 1.1: Solar, micro-hydro, or wind electric system (4 points)

OR

IN 1.2: Solar-ready design (2 points)

OR

IN 1.3: Solar electric system (5 points)

OR

IN 1.5: Common areas use solar electric system (4 points)

Community Buildings/Commercial Spaces (as applicable for mixed-use developments with ground floor commercial use and multifamily units above).

Achieve one of the two following credits:

EO 3.4: EarthCraft Light Commercial for community center (2 points)

OR

EO 3.5: EarthCraft Light Commercial ready spaces (1 point)

Commissioning (optional)

Achieve the following credits:

EO 2.3: Provide pre-occupancy briefing for tenant (2 points)
EO 2.4: Project participates in post-occupancy debriefing (2 points)
EO 2.5: Environmental management and building maintenance guidelines for staff (2 points)
Achieve all applicable items on the High Rise Addendum (applicable for low-, mid-, and high-rise projects)

Advanced Metering (optional)

Achieve the following credit:

IN 1.7: Developer contracts for at least 12 months post-construction energy monitoring (6 points)

WATER EFFICIENCY

Indoor Water Use

Achieve one of the two paths below:

PATH 1: Earn a minimum of 9 points and up to 14 points from any combination of the following credits:

WE 1.2: Water treatment system NSF certified (2 points)
WE 1.3: Water softeners certified to NSF/ANSI Standard 44 (2 points)
WE 1.4: Store < .5 gallons of water between water heater and furthest fixture (2 points)
WE 1.5.1: WaterSense toilet (2 points); WE 1.5.2: WaterSense urinal (1 point)
WE 1.5.3: WaterSense lavatory faucet (1 point);
WE 1.5.4: WaterSense showerhead (2 points) and
WE 1.6: Toilet < 1.1 gallon/flush (2 points)

OR

PATH 2: Earn a minimum of 5 points and up to 10 points from any combination of the following credits:

WE 1.2: Water treatment system NSF certified (2 points)
WE 1.3: Water softeners certified to NSF/ANSI Standard 44 (2 points)
WE 1.5.1: WaterSense toilet (2 points)
WE 1.5.2: WaterSense urinal (1 point);
WE 1.5.3: WaterSense lavatory faucet (1 point)
WE 1.5.4: WaterSense showerhead (2 points); and demonstrate a 40% reduction from the baseline through the Indoor Water Use Calculator

Outdoor Water Use

Achieve one of the three paths below:

PATH 1: Earn a minimum of 4 points and up to 9 points from any combination of the following credits:

WE 2.4: Turf <40% of landscaped area (2 points);
WE 2.5: Vegetate slopes exceeding 4:1 (1 point);
WE 2.7: Drought-tolerant/native landscaping turf and plants (1 point);
WE 2.8: Xeriscape guidebook given to property manager or owners (1 point); and
WE 2.6: Irrigation (4 points) (WE 2.6 is only applicable if automated irrigation is installed)

OR

OR

PATH 3: WE 2.10.2: Rainwater irrigation system (3 points) (only applicable if automated irrigation is installed)

INDOOR ENVIRONMENTAL QUALITY

Achieve the following:

Earn a total of 4 points between IAQ 2.7: Certified low or no VOC materials and IAQ 2.12: No carpet in all units

AND

Earn a total of 2 points from any combination of the following credits:

BE 3.15: Insulate with foam insulation
BE 3.16: Walls
BE 3.17: Continuous exterior insulation
BE 3.18: Ceilings
BE 3.19: Attic kneewalls, and/or
BE 3.20: Insulate roofline

AND

Achieve IAQ 2.9: Pre-occupancy flush (1 point)

APPENDIX B-2: CITY OF ALEXANDRIA, VA PERFORMANCE DESIGN TARGETS ("PERFORMANCE POINTS") – DIRECTED USE CRITERIA FOR **EARTHCRAFT LIGHT COMMERICAL (ECLC) v2.1**.

For additional information, refer to the EarthCraft Light Commercial Technical Guidelines.

As part of achieving the minimum certification requirements for EarthCraft Light Commercial (ECLC) Certified for private developments and ECLC Gold for public developments, the following must also be completed for projects in the City of Alexandria:

ENERGY:

Energy for Private Projects:

Achieve the following credits:

BE 1A: Measured ELR75 is 0.30 or better (1 point)

AND

ES 5: High Performance Duct System (1 point)

AND

IN 1: Renewable Energy Installation of 5% or greater on-site renewable energy; or installation of 40% or greater off-site renewable energy. (1 point)

OR

IN 2: Renewable Energy Procurement of RECs and/or offsets for 200% of building energy for a minimum of three years (2 points)

Energy for Public Projects:

Achieve the following credits:

BE 1A: Measured ELR_{75} is 0.30 or better (1 point)

AND

ES 5: High Performance Duct System (1 point)

AND

IN 1: Renewable Energy Installation of 10% or greater **on-site** renewable energy; or installation of 60% or greater **off-site** renewable energy. (1 point)

OR

IN 2: Renewable Energy Procurement of RECs and/or offsets for 200% of building energy for a minimum of six years (2 points)

Commissioning for Public Projects (Optional for Private Projects)

Achieve the following credit:

EO 1: Building Systems Commissioning (3 points)

WATER USE:

Indoor Water Use

Earn a total of 3 points from any combination of the following credits:

WE 1A: High Efficiency Toilets
WE 1B: Pint Flush or Waterless Urinals
WE 1C: Automatic Faucets and/or
WE 1D: High Efficiency Showerheads

Outdoor Water Use

Earn a total of 3 points from any combination of the following credits:

WE 2: Xeriscape Landscape Plan
WE 3: Efficient Irrigation System or No Irrigation System and/or
WE 4: Non -Potable Water Source Used for Irrigation (WE 4 is only applicable if an automated irrigation system is installed)

INDOOR ENVIRONMENTAL QUALITY

Achieve 4 points from the following credits:

Earn a total of 1 point from any combination of the following credits:

IEQ 1: Decoupled Ventilation
IEQ 2: Demand Control Ventilation (DCV)
IEQ 3: Air Filtration Media: MERV 11 or Higher or
IEQ 4: Radon Exposure Prevention

AND

Earn a total of 2 points from any combination of the following credits:

IEQ 5: Certified Flooring
IEQ 6: Composite Wood Contains No Added Urea-Formaldehyde or
IEQ 7: Product Transparency Label Material Selection

AND

Earn 1 point from BE 7: Daylighting Design Strategies

Welcome!

250640102

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Adopted July 9, 2019

CITY OF ALEXANDRIA, VIRGINIA

SCHEDULE 3

250640102

City of Alexandria, Virginia Energy & Climate Change Action Plan

May 2023

CITY OF ALEXANDRIA VIRGINIA

ICF

Acknowledgements

The City of Alexandria Energy and Climate Change Action Plan (ECCAP) was developed in partnership with the Alexandria Department of General Services and the Department of Transportation and Environmental Services. Throughout the development of this plan the Departments sought input, guidance, and feedback from other departments across the City, as well as community and civic groups, commissions, organizations, residents, and businesses operating in the City.

The *Energy and Climate Change Task Force* was initiated by City Council under Resolution 2958, which established the Task Force and its purpose to provide guidance to the City of Alexandria during the process to update the ECCAP. The Task Force is comprised of 12 members appointed by the City Manager, as well as, one member designated by the Environmental Policy Commission. The 13 members include general community representation; environmental advocates; energy, climate, and related technical experts; representatives from Alexandria's youth and representing equity issues; and those representing engagement with Alexandria's businesses and institutional partners.

Energy and Climate Change Task Force Members

- Javier Bastos
- Leah Devendorf
- Mary Harris, Co-Chair
- Fiona Herbold
- Praveen Kathpal
- Alyssa Morin
- Raquel Nicora
- Marian Pegram, Co-Chair
- Josh Sawislak
- Marta Schantz, Environmental Policy Commission
- Rose Stephens-Booker
- Stephen Walz
- Sangina Wright

The City would also like to recognize the efforts and contributions of:

Mayor and City Council

- Mayor Justin Wilson
- Vice Mayor Amy Jackson
- Councilman Canek Aguirre
- Council Member Sarah Bagley
- Councilman John Chapman
- Councilwoman Alyia Gaskins
- Councilman R. Kirk McPike

City Departments and Offices

- City Manager's Office
- Department of General Services
- Department of Transportation & Environmental Services
- Department of Community &Human Services
- Department of Planning & Zoning
- Department of Finance
- Office of Communications & Public Information
- Office of Housing
- Office of Management & Budget
- Office of Performance Analytics
- Office of Race & Social Equity
- Code Administration
- Virginia Department of Health/Alexandria Health Department
- Alexandria Economic Development Authority
- Alexandria Transit Company (DASH)
- Department of Project Implementation
- Department of Recreation, Parks, & Cultural Activities

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Bottom, from left to right: Electric bus (DASH), construction, bikes and trolleys (City of Alexandria), and rooftop solar installation (Unsplash, Bill Mead, 2022)

A Note From the Climate Action Officer

As the Climate Action Officer for the City of Alexandria, it is my pleasure to present the Energy and Climate Change Action Plan. I want to start with my great thanks for the work of many City staff, community members, consultants and others that came together to create this document.

Putting together clear recommendations on how to tackle such a complicated issue is a difficult task. Balancing the need to be bold with an understanding of what is possible given the resources we have available can be a challenge. Alexandria, though, is fortunate to have such valuable resources as we confront the climate crisis. As you read through this document, I hope you'll come to the same conclusion as I have: our greatest resource is our community. Alexandrians have and are continuing to come together to address challenges that impact us today, will impact our next generations of Alexandrians, and doing our part to limit the destruction of climate change across the world.

The Energy and Climate Change Action Plan is another community-created tool we can use together. The majority of the actions included in this report are already under way by the talented City employees serving Alexandrians every day. This report will bolster those efforts by providing recognition of their importance and impact, and helping identify next steps to expand and amplify the positive impacts of these programs. The Plan also provides new programs the City can explore to continue to expand our ability to positively impact Alexandrians and the climate.

One of the things that makes this report different is the commitment to understanding the need for actions that don't just focus on outcomes in 2030 or 2050. Throughout this document, you'll find discussion of how specific actions not only achieve reductions in greenhouse gas emissions over the long-term, but also how they address the reality of climate change's immediate impacts today. Addressing issues of rising utility costs, health disparities, heat and flood vulnerability, and more are crucial to ensuring an equitable outcome of these efforts.

Finally, it should be noted that the Energy and Climate Change Action Plan, while comprehensive in its recommendations, is also clear in its purpose as a document to inform policy and program decisions based on information, technology, and resources available today. Without doubt, new technologies, changing costs, and approaches will emerge and the City must be flexible enough to respond to these changes. Using the Energy and Climate Change Action Plan as a guide, the Office of Climate Action and our colleagues across the City departments will continually refine and adapt our approaches.

Thank you to everyone who participated in the creation of this document, and to all of you reading this who will surely be inspired to take action with us or on your own.

Sincerely

Ryan Freed
Climate Action Officer

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Executive Summary

Over the past decade, climate change has increasingly impacted the wellbeing of communities around the world, including the City of Alexandria, Virginia (the City). The unchecked release of greenhouse gas (GHG) emissions has triggered climate impacts including extreme heat, flooding, drought, increased lighting/thunderstorms, and other extreme weather conditions. To slow the impacts of climate change and the resulting health, financial, societal, and ecological challenges, the City has taken a stand to support limiting global temperature rise to 1.5°C, in accordance with the Paris Agreement.[1] ***This commitment requires a 50% reduction in greenhouse gas (GHG) emissions by 2030 (compared with 2005 GHG levels) and an 80-100% reduction by 2050.*** In striving toward this shared vision, through this ECCAP, the City is leading efforts to limit emissions, build resilience, and give all Alexandrians a framework for action.

In addition to rising climate risks, shifts in the economy, science, technology, and policies related to climate change make this the right time for the City to act. The ECCAP builds off the City's 2011 Energy and Climate Change Action Plan 2012–2020 and Environmental Action Plan 2040 (EAP2040), and clearly lays out the major changes that Alexandrians must make to tackle climate change. The strategies and actions in the ECCAP, when implemented, will provide

Working together to achieve a shared vision for a low carbon and more resilient future

The ECCAP is a framework for how the City, working with its government stakeholders, residents, business, and institutions, will achieve its ambitious, but necessary climate goals. This plan is designed to communicate what priorities for action as all levels of government, the private sector, and citizens have roles to play in addressing climate change.

City staff and policymakers: City staff and policymakers need to lead by example by continuing to reduce emissions in the City's own operations and ensure the City is resilient to climate change. They can also provide funding, programs, infrastructure, and information to the community and set standards, policy, and requirements to advance action. City staff and policy makers are obligated to be transparent about actions and progress toward achieving goals, and to ensure actions advance racial and social equity for all Alexandria residents.

Individuals: To minimize and prepare for the impacts of climate change, individuals in Alexandria can make many decisions in their day-to-day actions. This could include choosing walking, public transit or biking over driving, replacing appliances with more efficient options, installing rooftop solar, or reducing household waste through reusing products. Individual can also advocate for governments, businesses, and other organization to take more ambitious action. More information is at alexandriava.gov/Energy.

Businesses and Institutions: Like individuals, businesses and institutions have a key role to play in reducing emissions and increasing resiliency. This could include adopting organizational goals and practices, making climate-friendly purchasing and organizational policy decisions, and providing training and education to employees.

[1] The Paris Agreement is an international treaty signed in 2015 by 196 parties (i.e., countries) at the United Nations Conference of Parties (COP21) to commit to limiting emissions to no more than 2.0°C, and striving to limit emissions to 1.5°C to avoid the worst potential climate change impacts.

numerous benefits to Alexandrians through its equitable approach to reducing GHG emissions and focus on reducing impacts on the most vulnerable communities in the City. Equity and justice considerations in the ECCAP will help ensure all Alexandrians will benefit from actions.

By working together with the City's leadership, Alexandrians can achieve the ECCAP's goals to limit climate risks and GHG emissions to ensure a sustainable future for generations to come.

What is the City of Alexandria's ECCAP?

The ECCAP describes a pathway and specific actions for the City and stakeholders, to include City staff and policymakers, individuals, and businesses and institutions, to reduce GHG emissions 50% by 2030 (from 2005) and 80-100% by 2050, as well as strategies to minimize the potential impacts of increasing extreme heat and flooding risks. It provides the City government, the community, and its partners a robust understanding of how the City is addressing climate change, and serves as a guidebook for how City resources will be prioritized and allocated. The ECCAP includes strategies and actions that will achieve these goals.

Building upon past and existing efforts, the ECCAP incorporates goals, strategies, and actions from the EAP2040, the Metropolitan Washington Council of Governments (MWCOG) 2030 Climate Action and Energy Plan, and the 2017 Northern Virginia Hazard Mitigation Plan, among others. The ECCAP strategies recognize and integrate City, regional, and State initiatives, such as the Alexandria Green Building Policy, regional priority actions identified by the MWCOG, and the energy transition guided by the Virginia Clean Economy Act (VCEA). In addition, this ECCAP update places a significant focus on prioritizing ALL Alexandria to support racial and social equity as a critical lens to advance energy and climate change action planning and implementation.

How Alexandrians Are Involved in the ECCAP

While the new Office of Climate Action will ultimately be responsible for driving the implementation of the ECCAP, sustained community participation and collaboration will be necessary to achieve its goals. The ECCAP was developed by engaging with the community and stakeholders through Task Force meetings, community workshops, direct outreach, meetings with City commissions, and public comments. Continued involvement and participation of the community will be critical to the implementation and success of the ECCAP. To that end, the ECCAP calls for education initiatives, incentives, technical assistance, and building new partnerships and relationships to bring Alexandrians together to take climate action.

The whole Alexandria community will need to work collaboratively across all sectors to achieve this vision for our city's future. This plan includes tangible next steps for the City and stakeholders alike to implement the strategies within it. These span continual communications and engagement with the community and stakeholders, establishing protocols for demonstrating accountability and progress, tracking progress through established and transparent metrics, and seeking and securing funding (e.g., from the Infrastructure and Investment Jobs Act (IIJA) and the Inflation Reduction Act (IRA)).

The importance of these established actions cannot be understated, but they still fall short in meeting the goals necessary to fully address climate change. Recognizing the urgent and grave nature of climate change, the City of Alexandria declared a climate emergency in 2019 to jumpstart mitigation and adaptation actions and mobilize the community to achieve climate goals. Further, the City Council authorized $1.85 million in September 2022 for the establishment of an Office of Climate Action to respond to the ongoing climate crisis. This new office will be leading the implementation of the ECCAP and tracking and reporting on progress towards achieving the City's climate goals.

Climate Change Impacts in Alexandria

Higher average temperatures and more frequent heat waves

More intense storms with heavy rainfall

Sea level rise from the Potomac River inundating coastal areas

More frequent flood events

Extreme winter weather conditions

The ECCAP lays out a possible pathway for the City to achieve its GHG emissions reductions goals of 50% by 2030 and 80% to 100% by 2050, compared to 2005 levels. These goals are aligned with global reductions recommended by the Science Based Targets initiative (SBTi) and included in the Paris Agreement. The SBTi methodology largely focuses on corporate and financial institution GHG reduction goal setting efforts consistent with reductions necessary to meet the goals of Paris Agreement – limiting global warming to 1.5°C above pre-industrial levels. SBTi does not currently assess targets for cities, local governments, public sector institutions, educational institutions, or non-profit organizations. However, in an effort for the City to reflect the most up-to-date approaches to climate action planning and GHG reductions, the City has worked with ICLEI Local Governments for Sustainability to evaluate an approximate SBTi reduction requirement of 58.8% and 63.3% by 2030, absolute and per capita emissions, below 2018 emissions levels to account for the City's "fair share" in supporting the goals of the Paris Climate Agreement. While this is not the City's adopted target, it underscores the need for bold action. The 27th Conference of the Parties (COP27) to the United Nations Framework Convention on Climate Change (UNFCCC) reinforced the urgency of these efforts by concluding "subnational governments will be critical in achieving climate action outcomes." By establishing the ECCAP, the City is taking action to limit climate impacts for its citizens, economy, and the future of Alexandria.

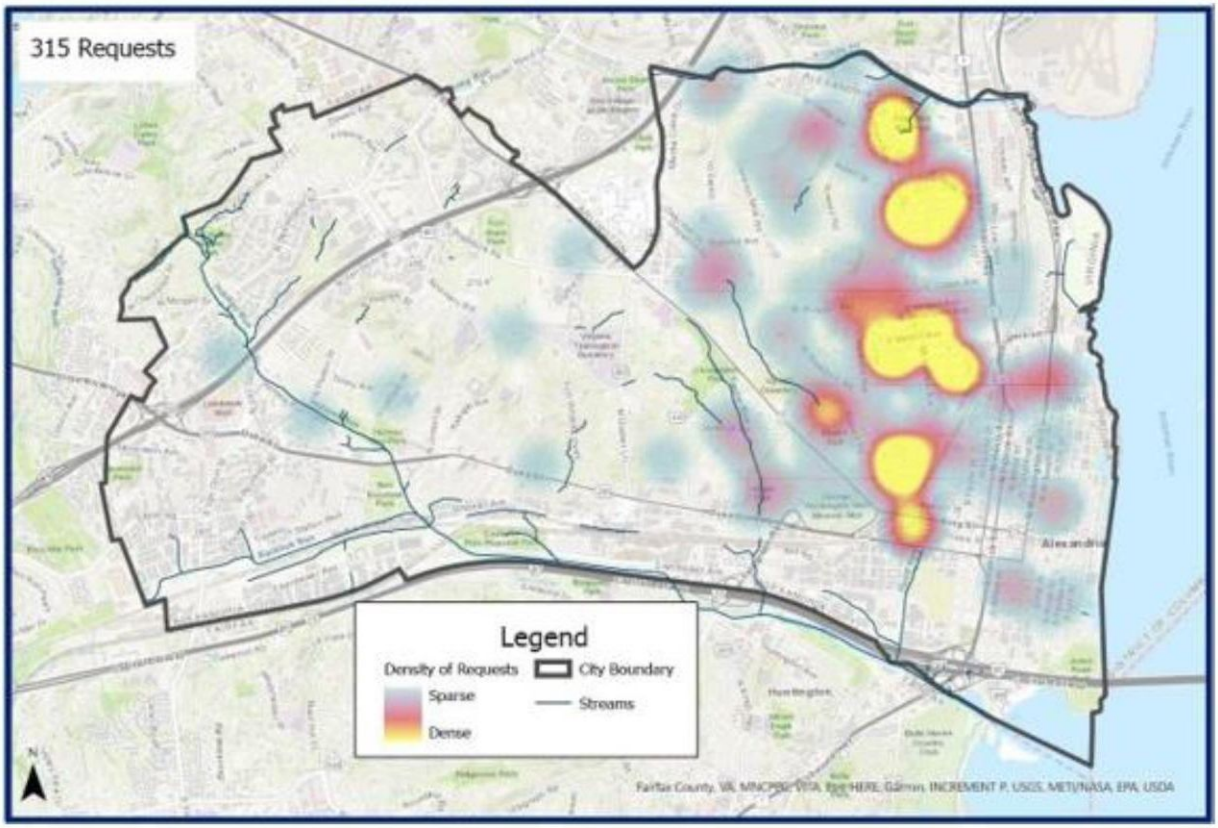
The ECCAP identifies several practical, near-term strategies Alexandria can take to adapt to the climate risks it faces. These strategies address increased risks from flooding and extreme heat in the community and put the City on a course to further integrate climate change risk and resilience considerations into existing municipal decisions and activities. Furthermore, though this plan outlines significant actions which the City may undertake to reduce GHG emissions and adapt to a changing climate, much has been done at the local, regional, state, and federal

levels to limit GHG emissions. The ECCAP captures these trends, changes, and previous actions and includes details on how Alexandria has worked to adapt to climate change.

Why does this plan matter to Alexandrians?

Like other communities across the world, Alexandrians are already experiencing the impacts of climate change. For the City, this mainly comes in the form of flooding and extreme heat, which are becoming increasingly severe. Furthermore, Alexandria is situated along the shore of the Potomac River, which is anticipated to rise 1.5-2.1 feet by 2060 if GHG emissions are not reduced. This will contribute to increased flooding in the City, which has several coastal areas that are highly vulnerable to flooding. Flooding from severe storm events is already affecting Alexandrians today (see Figure ES-1). Extreme heat is also a concern for Alexandrians, as the number of days per year with temperatures over 95°F is expected to double by 2030 and triple by 2050 (see Figure ES-2).

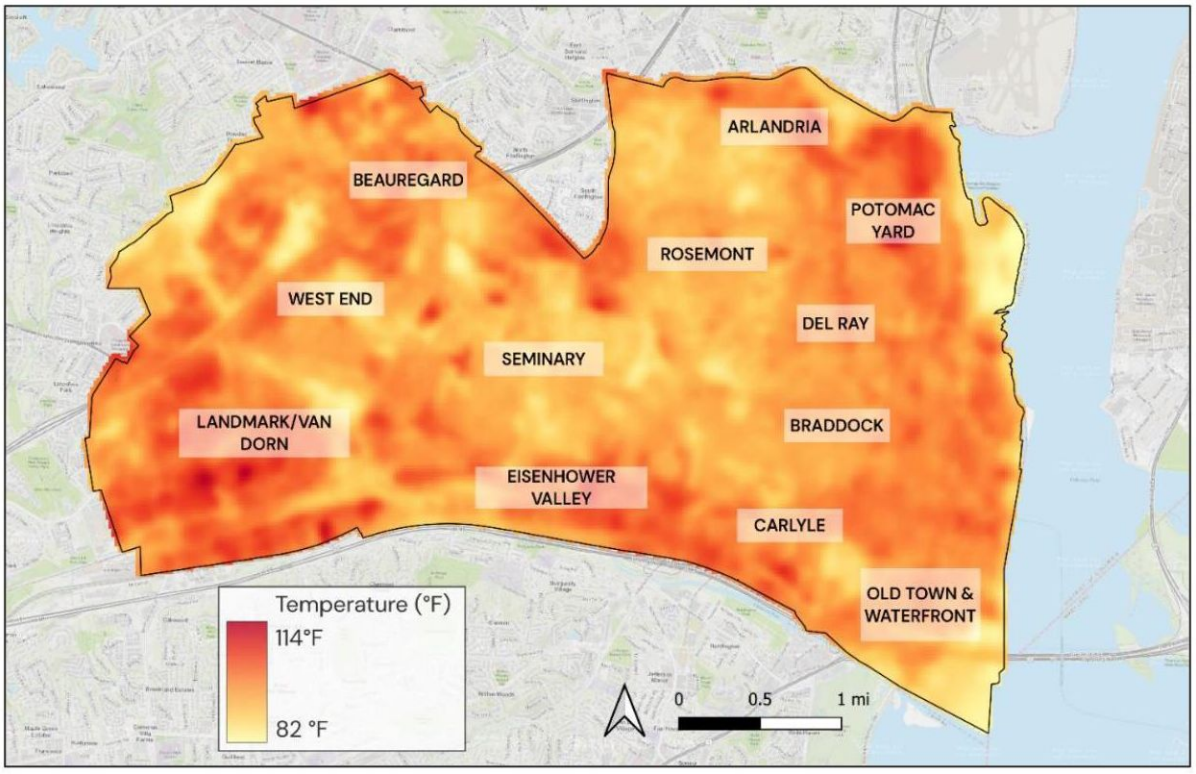
Figure ES-1. Flood-related requests for service during a rain event on September 10, 2020



Unchecked, climate-driven flooding and extreme heat will damage the City's infrastructure and economy and lay harm to Alexandria's wellbeing. Costs and damages associated with flooding and heat stunt the local economy by decreasing real estate value and deterring tourists and investors. These events also put lives at risk of danger from flash floods and heat stroke. The ECCAP includes actions Alexandria can take to adapt the City to these risks and reduce their severity. These actions will be developed further through two separate planning processes not

included in this Action Plan—one focused on flood adaptation through the Flood Resilience Plan and one focused on heat adaptation.

Figure ES-2. Relative summer land surface temperatures in Alexandria



Your Choices Matter: What Can Citizens Do to Reduce Greenhouse Gas Emissions

Collectively, the implementation of the ECCAP rests in the hands of the government and the Alexandria community. There are several key things members of the Alexandria community can do that will make a big impact in GHG reductions that align with the actions in this report:

Be More Energy Efficient: Implement energy efficiency retrofits on your home or business, including installing insulation, weatherizing, and changing to more efficient lighting. Moreover, consider upgrading to a more efficient HVAC system.

Electrify Your Property: Switch to electric from gas, install a heat pump water heater and/or heat pump HVAC system, and install solar panels. Work through your condo association to improve the building efficiency. Contact the City for more information for multi-family properties.

Consider Other Transit Options: Go "car free", combine trips, or choose the bus, metro, biking, or walking as your means of transportation as much as possible.

Choose an Electric Vehicle: If you choose to drive, commit to purchasing an electric vehicle.

Rethink Your Waste: Reduce, reuse, and recycle materials will help to reduce emissions from the waste sector. Take advantage of household compost drop off at farmers markets.

What does the City need to do to meet its ambitious climate goals and adapt to a changing world?

The City must drive critical actions on two fronts: 1) reducing GHG emissions and 2) increasing the resiliency of City operations and the community. While the investment for the new Office of Climate Action reflects the significant emphasis the City is placing on addressing climate change and the real and present risks it poses to the community, more resources will be needed to implement the ECCAP and transform the City's infrastructure and how Alexandrians live, work, play, and learn.

Reducing GHGs

In 2020, the City of Alexandria emitted 1.28 million metrics tons of GHGs, equivalent to 161,000 average homes' energy use for one year or 275,000 gasoline-powered passenger vehicles per year..[2] The ECCAP identifies 13 strategies across five sectors—Buildings (B), Transportation (T), Carbon-free Electricity (CE), Waste (W), and Other (O)—that together set a path to reduce GHG emissions in line with achieving a 50% reduction in emissions by 2030 (from a 2005 base year) and 80-100% by 2050 while also considering the cost and equity implications of the actions. For each strategy the ECCAP includes specific recommended actions for the City, along with its stakeholders and partners. The scale of actions to reduce GHG emissions in Alexandria provides a snapshot of several key activities required to achieve the target reductions and is intended to show the magnitude of actions at a broad-level.

[2] United State Environmental Protection Agency, Greenhouse Gas Equivalencies Calculator, Greenhouse Gas Equivalencies Calculator | US EPA.

Buildings (B)

In Alexandria, GHG emissions from buildings are projected to nearly double between 2018 and 2050 unless action is taken to improve energy efficiency in new and existing buildings. The growth in GHG emissions is in large part due to projected new commercial and multifamily residential construction. However, in the next decade, GHG reductions in the building sector are expected to be mainly a result of implementing changes for existing buildings. In later years, because of the significant increase in new construction, GHG reductions will mainly be driven by decarbonizing new buildings. To reduce building emissions, the ECCAP includes strategies and actions to improve the efficiency of heating, ventilation, and air conditioning (HVAC) systems, lighting, and appliances and to increase the efficacy of building insulation materials. It also strategizes ways to electrify buildings to replace fuel-powered heating systems, which is projected to lower emissions and improve indoor air quality. When paired with on-site solar panels and batteries, electric HVAC, hot water, and other appliances can lead to reduced energy costs and increased resilience. The ECCAP also lists actions such as establishing an incentive program or supplementing with other funding sources to encourage Green Building renovations, supporting access to decarbonized buildings fuel supply, and accelerating decarbonization measures at City-owned buildings.

Transportation (T)

For the transportation sector, actions include reducing vehicle miles traveled (VMT) through actions such as an expanded transit network and transit-oriented development. In addition, to VMT reductions, the ECCAP actions include accelerated vehicle electrification including electric vehicle (EV) charging infrastructure, and an increase in alternative fuel use in the City vehicle fleet and for targeted uses such as medium and heavy-duty vehicles.

Scale of Action to Reduce GHG Emissions in Alexandria

By 2030

- 53,000+ housing units retrofitted with efficiency upgrades or built to be high efficiency
- 49% of existing housing units use electric heating
- 95% of new housing built with high energy performance
- 13 million square feet of commercial space retrofitted
- 50% of personal car sales are electric
- 50% of buses on the road are electric
- 30% of medium/heavy-duty vehicle sales are electric

By 2050

- 106,000+ housing units retrofitted with efficiency upgrades or built to be high efficiency
- 65% of existing housing units use electric heating
- 33 million square feet of commercial space retrofitted
- 100% of personal car sales are electric
- 100% of buses on the road are electric
- 100% of medium/heavy-duty vehicle sales are electric

Note: Retrofit is defined as the addition of new systems and equipment to a housing unit to increase energy efficiency and energy performance. A housing unit is single family detached home, a duplex, townhome, condominium, apartment, or other dwelling that is used by a single household.

Carbon-free Electricity (CE)

A cleaner electricity supply complements efforts in the commercial and residential building space to decarbonize and improve energy efficiency. It is also deeply connected to reducing transportation emissions.

The City continues to support the achievement of Virginia Clean Economy Act (VCEA) through initiatives such as SolarizeAlexandria, a municipal aggregation program, large-scale off-site renewable energy projects, and a transition of all City government facilities to 100% renewable energy. However, most of the transition to clean electricity will depend on Dominion Power, the city's electric utility. Dominion is required through the VCEA to provide 100% clean electricity to its customers by 2045 and has voluntarily committed to achieving net zero emissions by 2050.

Waste (W)

Waste sector emissions will be reduced through actions specified in the EAP2040 that aim to recover resources and reduce GHG emissions and other forms of pollution by optimizing and safely handling the collection and processing of solid waste and reducing the total solid waste collected from City-served residential customers.

Other (O)

In addition to buildings, on-road transportation, energy, and waste, other sectors also contribute to Alexandria's GHG emissions, albeit on a smaller scale. These other sector emissions must also be addressed to meet the City's goal of 100% emissions reduction by 2050. Some sectors, like aviation and refrigerants, can be addressed with the help of federal action such as the Sustainable Aviation Fuel (SAF) Act,[3] federal SAF tax credits through the Inflation Reduction Act (IRA),[4] or the American Innovation and Manufacturing Act (AIM Act),[5] while others can be dealt with at the state or local level. For instance, the ECCAP proposes the City work with Washington Gas to address potential methane emissions leaks in Alexandria's gas system and stay up to date on emerging technologies that could support GHG reductions and an eventual carbon neutral future. As sectors develop and policy, technology, and the economy change, it is important to keep all climate mitigation and adaptation options open in the future to reach carbon neutrality.

Taken together, the strategies in the ECCAP provide a pathway to achieve the City's GHG reduction goals (see Figure ES-3).

---

[3] H.R.741- Sustainable Aviation Fuel Act, https://www.congress.gov/bill/117th-congress/house-bill/741/text

[4] H.R. 5376 – Inflation Reduction Act, https://www.congress.gov/bill/117th-congress/house-bill/5376/text/rh

[5] 42 U.S. Code Section 7675, https://uscode.house.gov/view.xhtml?req=granuleid:USC-prelim-title42-section7675(a)&num=0&edition=prelim

Figure ES-3. A pathway to meet Alexandria's GHG reduction goals

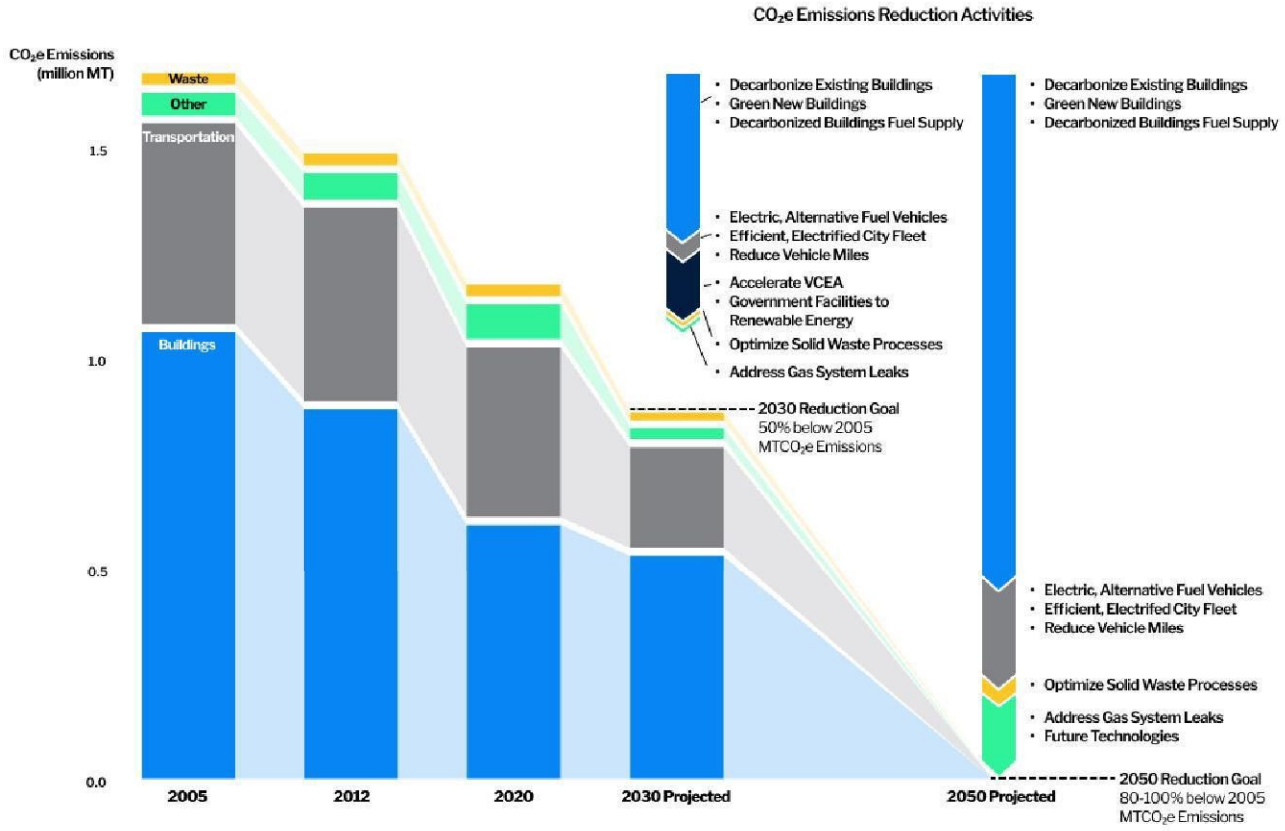


Figure ES-4 shows key implementation milestones that will need to be met to support achievement of the GHG reduction pathway shown in Figure ES-3.

Figure ES-4. Key implementation milestones to support Alexandria's GHG reduction pathway

Key Implementation Milestones	2025	2030	2040	2050
Buildings: Existing Home Energy Retrofits (B-1) (% of housing units with efficiency and/or electrification retrofits)	43%	61%	86%	96%
Buildings: New Building Decarbonization (B-2) (% net zero ready buildings)	95%	95%	95%	95%
Buildings: Decarbonized Building Fuels (B-3) (% supply)	0%	5%	30%	50%
Transportation: Passenger Vehicle Electrification (T-2) (% on road EV sales)	10%	40%	80%	90%
Carbon-Free Electricity (CE-1) (% carbon-free electricity generation serving Alexandria)	30%	50%	85%	100%
Waste: Landfill Waste Diversion (W-1) (% diverted)	2%	25%	60%	90%

Increasing Resiliency

The ECCAP identifies several practical, near-term strategies Alexandria can take to adapt to the climate risks it faces. These strategies are grouped into three categories, described below.

Integrate climate change risk and resilience considerations into existing municipal decisions and activities

These strategies will ensure Alexandria accounts for climate change in its plans and investments. This includes, for example, establishing an internal working group, addressing future climate conditions in capital projects, and leading by example to address resilience of municipal infrastructure (see Figure ES-5).

The Relationship Between Adaptation and Resilience

The terms adaptation and resilience are often used interchangeably, though they have slightly different meanings.

Adaptation—The process of adjusting to new or changing climate conditions to reduce or avoid negative impacts to valued assets and take advantage of emerging opportunities.

Resilience—The capacity of a community, business, or natural environment to prevent, withstand, respond to, and recover from disturbances, while retaining the basic functions of the system.

Figure ES-5. Primary actions to integrate climate change in municipal decisions and actions

Flooding adaptation strategies

These strategies outline ways to reduce flood risks in the City, such as improving modeling and understanding of risks, improving flood response, engaging the public, and pursuing specific infrastructure improvements like stormwater capacity improvements, flood barriers, and floodproofing buildings. These strategies will be further developed through a separate planning process in concert with Flood Action Alexandria to culminate in the Flood Resilience Plan.

Heat adaptation strategies

These strategies outline ways to reduce heat risks in the City, from expanding and incentivizing urban greening to providing heat relief programs, expanding cooling center availability, and enhancing heat response programs. These strategies will be further developed through a separate planning process to culminate in the Heat Adaptation Plan.

How is the City accelerating action?

To accelerate climate action and achieve GHG reduction and adaptation goals in an equitable manner, the City will focus on six key areas: technology, citizen and business action, funding, workforce development and training, a favorable policy and regulatory environment, and education and outreach These focus areas summarize the tools the City can most effectively

leverage to act on the ECCAP and achieve climate goals, while also building the green economy and addressing environmental justice.

- **Technology** is needed to decarbonize and electrify buildings, provide clean electricity and other fuel supplies, and reduce emissions from the transportation sector. Examples include adding electric vehicles, electrifying building HVAC systems, and installing distributed renewable energy (e.g., solar panels). As technologies evolve and become more integrated into the market, costs reduce and the approach to climate change advances. City, state and federal programs can help drive market transformation to result in more widespread technology changes and deployment. These programs, when designed to do so, will also target and accelerate change for low- and moderate-income or disadvantaged communities and provide other benefits such as increased health benefits (e.g., for highway adjacent communities). While many of the key technologies to reduce emissions are available today, reducing emissions by 100% by 2050 relies on new technologies being developed and current technologies advancing.
- **Citizens and businesses** play a key role in climate action, especially when it comes to adopting technologies, reducing waste, and supporting green policies and economic growth. The ECCAP is only effective if citizens and businesses buy-in and take personal climate action, such as reducing solid waste output, increasing efficiency in buildings (e.g., improved insulation, smart thermostats), or installing battery storage. These actions can be supported by City education and financial incentive programs, especially to promote equity for underserved communities.
- **Funding** can come from the federal, state, and municipal level, and from local utilities or other sources. Recent federal policies, including the Bipartisan Infrastructure Law (BIL) and the IRA set aside billions of dollars for sustainable development to reduce emissions and adapt to a changing climate. Most funding from the BIL and IRA have a Justice40 requirement or element, which requires benefits to go to disadvantaged communities. Additional funding can come from the City and State programs and grants. For instance, the City's Commercial Property Assessed Clean Energy (C-PACE) program is a financing program enabling owners of commercial, multifamily, and industrial properties to obtain low-cost, long-term financing for clean energy, stormwater management, and resiliency improvements. Local utilities such as Dominion also offer incentives and rebates for home energy efficiency upgrades and have programs targeted at low-income, elderly, and disabled individuals for saving energy costs and improving health and safety.
- **Workforce development and training** will help the City and partners to implement this ECCAP and create and maintain jobs to establish a green economy around climate action. Jobs will be created through upgrading the electricity grid and buildings and installing the local portion of the nationwide EV network. As the energy economy undergoes a major transition over the coming decade, there will be many opportunities to train and re-train the workers that are key in this evolution. These trainings may also be established in an equitable way to increase employment in underserved communities.
- The **current policy and regulatory environment** supports climate action at the federal, state, and local levels. Locally, the City has policies and programs in place and has been working with City Council and different commissions and task forces for more than a decade to advance these. At the state level, the VCEA is a critical driver for clean electricity. Similarly, federal policies, including the BIL and IRA, favor and incentivize

climate action. Utilizing these tools, while available, will aid in climate action acceleration. However, policies and regulation must continue to evolve at all levels of government to support new technologies, advancing science, and innovative approaches.

- **Education and outreach** allow the City to connect directly to the community and educate others on the benefits of climate action. Education about new technologies can equip citizens with tools to reduce their emissions. Education can also help build climate resilience by teaching communities how to respond to climate hazards and reduce their own emissions. This especially benefits socioeconomically underserved communities who are the most vulnerable to climate change impacts.

Inevitably, there are uncertainties, risks, and variables outside of the City's control related to these focus areas. One of the most uncertain and potentially fluid areas is the policy and regulatory environment, which can change with elections and new administrations. Funding from grants and applications are also uncertain, as is the dynamic nature of ever-developing technology.

The ECCAP portrays the best available information today and attempts to provide a diverse range of strategies and actions, involving many City departments and stakeholders, residents, and businesses, to meet ambitious climate targets set forth by the EAP2040. As with all other successful plans, it is flexible enough to accommodate changes in the future. It does not dictate specific implementation steps for each action. The City's plan will continue to evolve and consider updates as the new Office of Climate Action implements the identified strategies and actions, learns from those efforts, tracks progress over time, and evaluates new information and innovations.

Acceleration of climate action cannot occur in a vacuum, rather it requires collaboration across the City, state, and country. Policies, funding, cultural impacts, and technology integration must occur at all levels to reduce GHG emissions effectively and equitably and increase resiliency locally and nationwide. With increasing climate impacts and advancing technologies, new funding sources available and policies in place, there has never been a more opportune time to act.

Where does the City and Alexandrians go from here?

Looking forward, the City will use the ECCAP as a foundation to accelerate climate action in pursuit of its goals to reduce GHG emissions 50% by 2030 (from 2005) and 80%-100% by 2050, and create a more resilient Alexandria. The ECCAP lays out a possible pathway toward 2050 and resilience strategies, but can be adapted as new risks, technologies, policies, and other factors arise. This adaptive management approach allows for flexibility to assess continuously changing risks and undertake appropriate actions to mitigate those risks. Therefore, the ECCAP is not the final solution, but rather a robust framework and approach that can be monitored, adapted, and managed as needs and risks change.

The implementation of the ECCAP and tracking progress of its goals, strategies, and actions will be led by the City's new Office of Climate Action. All levels of government, businesses, institutions, and individuals have roles to play in addressing climate change. With the groundwork laid by the ECCAP, the City and Alexandrians can take collective responsibility to equitably address climate change, build resilience, and achieve deep emissions reduction goals.

Priority GHG Actions

This Action Plan includes 12 actions that, collectively, will reduce GHG emissions approaching 100% as we move towards 2050. Of these 12 actions, three are of critical importance as demonstrated in Figure ES-3. *A pathway to meet Alexandria's GHG reduction goals*. These three actions are: (1) **B-1: Support decarbonizing buildings through financial opportunities (existing buildings)**; (2) **T-2: Accelerate the deployment of electric and alternative fuel vehicles**; and (3) CE-1: Support implementation/acceleration of the Virginia Clean Economy Act (VCEA) by increasing carbon-free electricity, specifically **CE-1.C: Consider implementation of municipal/community choice aggregation program**, which is within the City's authority. These three actions represent the vast majority of the GHG reductions for the City and though all of the actions included in this Action Plan are necessary for the City to achieve the goal of carbon neutrality by 2050, these will make the greatest impact and can be driven or influenced by the City.

Introduction

Over the past decade climate change has increasingly impacted the wellbeing of communities around the country, including the City of Alexandria, Virginia (the City). The unchecked release of greenhouse gas (GHG) emissions has triggered climate impacts including extreme heat, flooding, drought, lighting/thunderstorms, and other extreme weather conditions.

As a result, in **July 2019**, the Alexandria City Council adopted the City's Environmental Action Plan 2040 (EAP2040), which established community-wide GHG emission reduction goals of 50% by 2030 (base year 2005) and 80-100% by 2050. These goals were also adopted regionally by the MWCOG and are based on the Intergovernmental Panel on Climate Change's (IPCC) recommendations to limit global temperatures from increasing more than 1.5-degree Celsius above pre-industrial levels to prevent more severe climate change impacts. These goals are aligned with global reductions recommended by the Science Based Targets initiative (SBTi).[6] and included in the Paris Agreement..[7] The SBTi methodology largely focuses on corporate and financial institution GHG reduction goal setting efforts. SBTi does not currently assess targets for cities, local governments, public sector institutions, educational institutions, or non-profit organizations. However, in an effort for the City to reflect the most up-to-date approaches to climate action planning and GHG reductions, the City has worked with ICLEI Local Governments for Sustainability to evaluate an approximate SBTi reduction requirement of 58.8% and 63.3% by 2030, absolute and per capita emissions respectively, below 2018 emissions levels to account for the City's "fair share" in supporting the goals of the Paris Agreement. While this is not the City's adopted target, it underscores the need for bold action.

In **October 2019**, the Alexandria City Council adopted a resolution declaring a climate emergency, recognizing that climate change poses a grave threat to everyone in Alexandria and around the world..[8] In **September 2020,** the City Council approved Resolution 2958, establishing the Energy and Climate Change Task Force to provide guidance to the City of Alexandria during the process to update the City's ECCAP..[9] The City adopted the initial ECCAP in 2011, three years after the original Environmental Action Plan was adopted (2009).

Since the 2011 ECCAP, the urgency of climate change has become more apparent as local governments and its citizens face daily challenges stemming from a warming planet. Technology, policy, financing, and programmatic options for energy and climate change have rapidly evolved while the City and the broader Washington D.C. Metropolitan Region has been

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[6] The Science-based Target Initiative (SBTI) methodology largely focuses on making corporate and financial institutions' GHG reduction goal setting efforts consistent with reductions necessary to meet the goals of Paris Agreement—limiting global warming to 1.5°C above pre-industrial levels.

[7] The Paris Agreement is an international treaty signed in 2015 by 196 parties (i.e., countries) at the United Nations Conference of Parties to commit to limiting emissions to no more than 2.0°C, and striving to limit emissions to 1.5°C to avoid the worst potential climate change impacts.

[8] City of Alexandria, Alexandria City Council Declares Climate Emergency, https://media.alexandriava.gov/archives/news/2019/10-23/111923/archive.html.

[9] City of Alexandria, Resolution No. 2958, https://alexandria.legistar.com/View.ashx?M=F&ID=8829555&GUID=9514C8DC-472F-4554-A73A-B6A9349D5BBA.

forced to adapt. Furthermore, though this plan outlines significant actions which the City may undertake to reduce GHG emissions and adapt to a changing climate, much has been done at the local, regional, state, and federal levels to limit GHG emissions. The ECCAP captures these trends, changes, and work that has been done towards GHG reductions and includes details on how Alexandria has worked to adapt to climate change. The ECCAP outlines a set of actions the City, stakeholders and Alexandrians can take to deeply reduce GHG emissions and become more resilient to climate change.

ALL Alexandria

The Alexandria City Council issued the ALL Alexandria resolution in 2021 to acknowledge the need for and importance of community involvement in developing and implementing policies to achieve more equitable outcomes. The resolution includes four specific pledges:

1. Ensure that race and social equity are incorporated and centered in all planning.
2. Implement and sustain structures and systems to advance race and social equity.
3. Align and implement policy efforts designed to advance race and social equity goals.
4. Ensure accountability mechanisms related to the progression and transparency of work to advance race and social equity.

Source: Resolution No. 2974, City of Alexandria Virginia.

In September 2022, the Alexandria City Council authorized $1.85 million for the establishment of an **Office of Climate Action** to respond to the ongoing climate crisis which continues to impact the well-being of our community. The creation of the City's Office of Climate Action marks an achievement aimed at combating climate change through a city-wide approach to empower the Alexandria community to actively participate and contribute to sustainable action. A Climate Action Officer and Public Affairs and Engagement Specialist will join five reallocated employees from the partnering departments to serve in the City's Office of Climate Action. The overall composition of the Office of Climate Action both recognizes the prior and ongoing efforts across City departments and aims to set up an implementation and partnership-oriented approach. The Office of Climate Action will lead efforts in a variety of areas, including but not limited to, energy efficiency, high-performance buildings, renewable energy, climate change mitigation and reporting, electric mobility, business assistance, community engagement, and advocacy. The Office of Climate Action will work closely with City departments, other governmental entities, and the community in achieving EAP2040 and ECCAP commitments. While the investment for the new Office of Climate Action reflects the significant emphasis the City is placing on addressing climate change and the real and present risks it poses to the community, more resources will be needed to implement the ECCAP and transform the City's infrastructure and how Alexandrians live, work, play, and learn.

Purpose of the ECCAP and Development Process

This ECCAP serves as an update to the 2011 ECCAP 2012–2020. Significant advancements in climate change science and solutions, identification and analysis of climate-induced vulnerabilities, climate adaptation and resiliency practices, and climate action planning approaches provides the City opportunities to meaningfully advance the Alexandria community's efforts towards climate action.

The ECCAP describes a pathway and specific actions for the City and stakeholders, to include City staff and policymakers, individuals, and businesses and institutions, to

reduce GHG emissions 50% by 2030 (from 2005) and 80-100% by 2050, as well as strategies to minimize the potential impacts of increasing extreme heat and flooding risks. It provides the City government, the community, and its partners a robust understanding of how the City is addressing climate change, and serves as a guidebook for how City resources will be prioritized and allocated. In addition, the ECCAP update places a significant focus on prioritizing ALL Alexandria to support racial and social equity as a critical lens to advance energy and climate change action planning.

The ECCAP aligns with the goals in the 2019 EAP2040 and builds upon existing City energy, GHG reduction, and climate action efforts. The ECCAP leverages regional priority actions identified in the MWCOG 2030 Climate and Energy Action Plan[10], as well as the climate action planning efforts underway or completed by the City's regional and national peers.

The ECCAP's development was supported through input and guidance by the Energy and Climate Change Task Force (ECCTF) and input by the Alexandria community through community engagement workshops (see Appendix D). This guidance included: feedback on the ECCAP's various analyses and planning considerations, including business-as-usual (BAU) GHG emissions projections; evaluation of climate change vulnerabilities and equity considerations; climate adaptation recommendations; and the consideration of implementing the EAP2040's actions. The ECCTF also provided input on the identification, evaluation, and prioritization of recommendations for additional policy, programmatic, or technology actions to achieve science-based emissions reductions consistent with the EAP2040's targets and goals. Such actions include, but are not limited to, efforts that:

1. Increase renewable energy production and availability for city residents/businesses;
2. Work to curtail consumption of fossil fuels and reduce energy waste;
3. Engage Alexandria residents and businesses in emissions-reducing actions; and
4. Identify opportunities for climate adaptation and resiliency policies and practices.

Additionally, the ECCTF provides guidance on the ECCAP's implementation roadmap, funding and budgeting strategies, specific implementation steps and approaches, and methods to measure and track progress against time-specific goals consistent with the EAP2040.

Achieving the City's climate goals through implementation of the ECCAP's strategies and actions requires collaborative action from the City government along with the Alexandria community, and its businesses, institutions, utilities, regional partners, as well as significant contributions by state and federal government.

The ECCAP's development also included leveraging partnerships with regional and national partners. For example, the City leveraged previous climate action planning efforts by the MWCOG and the Northern Virginia Regional Commission (NVRC), along with many Metropolitan Washington regional peers, including, but not limited to, Arlington County and Fairfax County in Virginia, the District of Columbia, and Montgomery County in Maryland. In

[10] Metropolitan Washington Council of Governments, Metropolitan Washington 2030 Climate and Energy Action Plan, Metropolitan Washington 2030 Climate and Energy Action Plan | Metropolitan Washington Council of Governments (mwcog.org)

addition, the City leveraged best practice climate action planning information, resources, and examples through participation in an integrated climate action planning cohort program through ICLEI – Local Governments for Sustainability.[11] , the Urban Sustainability Directors Network peer exchange, and other organizations. Notwithstanding, ECCTF and members of the Alexandria community graciously provided best practice climate action planning examples to help inform the City's ECCAP development process.

The process to develop the ECCAP included several overlapping phases.

Phase 1. Initiations

The EAP2040 set a target to reduce community-wide GHG emissions by 50% by 2030 and 80–100% by 2050—given a baseline of 2005—with support by significant contributions at the state and federal level towards renewable energy and energy efficiency mandates. The EAP2040 introduced short-term Action 1.1.1 which includes:

- By FY2021, establish a multidisciplinary task force to guide an update of the ECCAP. The ECCTF will base its recommendations for improvements in energy efficiency for both new and existing private and public buildings on the Green Building Policy. The Plan will include recommendations for specific policies and programs, each with funding strategies, to achieve emissions reductions targets by:
    1. Increase renewable energy production and availability for city residents/businesses;
    2. Work to curtail consumption of fossil fuels and reduce energy waste;
    3. Engage Alexandria residents and businesses in emissions-reducing actions; and
    4. Identify opportunities for climate adaptation and resiliency policies and practices.

As a result, the ECCTF was established by the Alexandria City Council by Resolution 2958 in September 2020. Subsequently, members of the ECCTF were selected by the City Manager after an open application process.

Phase 2. GHG Inventories, Regional Energy and Climate Action Plan, Transportation Mitigation Studies

This phase includes coordination with MWCOG on the City's 2005–2020 GHG Inventories, the MWCOG Regional Energy and Climate Action Plan, and the Transportation Planning Board (TPB) 2021 Climate Mitigation Study.

Phase 3. Goal and Priority Setting, Planning, and Scoping

The ECCTF was established in May 2021 and convened four times from May 2021 to December 2022 to learn important background information regarding the ECCAP's development, including the City's existing body of climate action and environmental sustainability and considerations for climate mitigation solutions.

Phase 4. Community Engagement

Alexandria incorporated community input and feedback at two different points in the development process of the ECCAP:

[11] See https://icleiusa.org/ for more information.

- In early 2022, the City hosted three open-house workshops (two virtual and one in-person) led by City staff with support of the ECCTF to inform the community about the impacts of climate change in Alexandria and solicit feedback about ways the City can adopt to climate impacts. Each workshop had a different thematic focus: 1) emissions reductions, 2) heat and flooding vulnerability and adaptation, and 3) new and ongoing City climate actions. The community input from these sessions helped shape the priorities throughout this plan to ensure that the City's programming works for the people it serves.
- The City opened a preliminary feedback period for a working draft of the ECCAP report, and the feedback gathered was incorporated throughout the plan. During this process, the ECCTF, the Transportation Commission, Planning Commission, and Environmental Policy Commission provided meaningful feedback that helped refine the plan.

The new Office of Climate Action will continuously publish metrics and updates throughout the implementation of the strategies and programs in this plan to inform the public and encourage continued community engagement.

Phase 5. Analysis and Reduction Planning, Vulnerability Assessment, and Climate Adaptation Planning

Flooding and heat were identified as priority vulnerabilities based on climate data analysis, previous regional climate studies (including the MWCOG Regional Energy and Climate Action Plan and the 2017 Northern Virginia Hazard Mitigation Plan), and community workshops.

A heat vulnerability assessment was conducted to identify populations likely to be most vulnerable to extreme heat impacts. The City is already taking action to mitigate flooding through Flood Action Alexandria.

Recommendations to enhance resiliency to flooding and extreme heat were developed to build upon the City's existing adaptation activities. Five primary actions will help the city integrate climate action into municipal decisions and activities while enhancing equity (see Figure 27).

Phase 6. Development of the ECCAP Report

The 2019 update of the EAP2040 established GHG emissions targets. In October 2019, the City Council adopted a resolution declaring a climate emergency, mobilizing resources to mitigation and adaptation efforts. The ECCTF was tasked with supporting the development of the ECCAP to follow up on the EAP2040 and build on existing energy, GHG reduction, and climate action efforts.

Relationships to Other Energy and Climate Plans in the City and Region

The City of Alexandria has shown its commitment to addressing climate change through actions and various planning efforts. This ECCAP recognizes and builds on these efforts and others throughout the region, including:

- The predecessor plan to this, the 2011 ECCAP.[12]
- The 2019 updated EAP2040, which provides strategic guidance for the City's efforts to reduce GHG emissions, improve energy efficiency, protect water resources and waterways, improve mobility options, and reduce waste.
- The 2019 WasteSmart plan.[13] which provides Alexandria's 20-year strategic plan to sustainably recover resources.
- The 2021 Alexandria Mobility Plan (AMP).[14] provides policies and strategies that guides transportation decisions for the next 10 years in pursuit of enhanced quality of life, sustainability, and equity, centered around the concept of choice. Additionally, strategies from the AMP seek to improve safety, comfort and connectivity of bicycle and pedestrian infrastructure by addressing network gaps, upgrading existing infrastructure, improving signage and wayfinding, and other actions to increase the share of residents walking and biking for transportation.
- The 2021 Alexandria Electric Vehicle Charging Infrastructure Readiness Strategy.[15], which provides a framework for advancing EV charging infrastructure in the City of Alexandria, Virginia.
- The 2022 Alexandria Transit Vision.[16], which lays out a roadmap for the future City bus networks to provide more useful bus service for the City of Alexandria by introducing frequent, all-day bus service to areas where more people will be able to use it. The new bus networks will significantly increase access to frequent transit for low income, minority, and senior residents, while establishing important bus connections to the future Potomac Yard Metrorail Station and other key development areas.
- The MWCOG 2030 Climate and Energy Action Plan.[17] which establishes priority collaborative actions for area governments and partners to work on together over ten years to help move the region towards meeting its 2030 climate mitigation and resiliency goals.

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[12] City of Alexandria, City of Alexandria Energy and Climate Change Action Plan 2012-2020, Energy and Climate Change Action Plan (alexandriava.gov).

[13] City of Alexandria, WasteSmart, Alexandria WasteSmart Strategic Plan 2019 (alexandriava.gov).

[14] City of Alexandria, Alexandria Mobility Plan, AMP_Final Document (alexandriava.gov).

[15] City of Alexandria, Electric Vehicle Charging Infrastructure Readiness Strategy, Electric Vehicle Charging Infrastructure Readiness Strategy FINAL (alexandriava.gov).

[16] City of Alexandria, Alexandria Transit Vision Final Report, ATV_final_plan_2-24-2020 (alexandriava.gov).

[17] Metropolitan Washington Council of Governments, Metropolitan Washington 2030 Climate and Energy Action Plan, Metropolitan Washington 2030 Climate and Energy Action Plan | Metropolitan Washington Council of Governments (mwcog.org).

- Transportation strategies are informed by the National Capital Region TPB Climate Change Mitigation Study of 2021[18], which assesses transportation-related actions needed to reduce GHG emissions and strives towards achieving regional goals for 2030 and 2050.

Building on these plans and the City's existing policies and programs, the ECCAP offers a strategic pathway towards the City's goals of 50% emissions reduction by 2030 and 80-100% reduction by 2050 while also adapting to and becoming more resilient to the impacts of climate change. The strategies and guidance in the ECCAP focus on reducing GHG emissions across key sectors and preparing for the impacts of flooding and heat, while applying a lens of diversity, racial and social equity, and inclusion in keeping with the ALL Alexandria vision.[19]

Current Energy and Climate Context for Alexandria

Climate Change Impacts in Alexandria

In Alexandria, the effects of climate change can already be felt in the form of increasing temperatures and more frequent and intense flooding events. A study conducted by the MWCOG as part of the 2030 Climate and Energy Action Plan identified flash and riverine flooding and extreme heat as the greatest climate risks to the area. Drought, coastal flooding, lightning/ thunderstorm, and extreme winter conditions were also identified as local climate-related risks.

Climate Change Impacts in Alexandria

Higher average temperatures and more frequent heat waves

More intense storms with heavy rainfall

Sea level rise from the Potomac River inundating coastal areas

More frequent flood events

Extreme winter weather conditions

The Potomac River in the D.C. area is anticipated to rise 1.5-2.1 feet by 2060 under an intermediate emissions scenario..[20] This could inundate some low-lying coastal areas and contribute to increased flooding in the City. Additionally, National Oceanic and Atmospheric

[18] Metropolitan Washington Council of Governments, TPB Climate Mitigation Study of 2021, TPB Climate Change Mitigation Study of 2021 | Metropolitan Washington Council of Governments (mwcog.org).

[19] City of Alexandria, ALL Alexandria Resolution: Committing to Race and Social Equity, ALL Alexandria Resolution: Committing to Race and Social Equity | City of Alexandria, VA (alexandriava.gov).

[20] NOAA, Sea Level Rise Viewer, https://coast.noaa.gov/slr/#/layer/vul-soc/0/-8580120.72562164/4695745.0055577895/13/satellite/152/0.8/2050/inter/midAccretion.

Administration (NOAA) has identified several regions within Alexandria as having a medium or high level of vulnerability to flooding..[21]

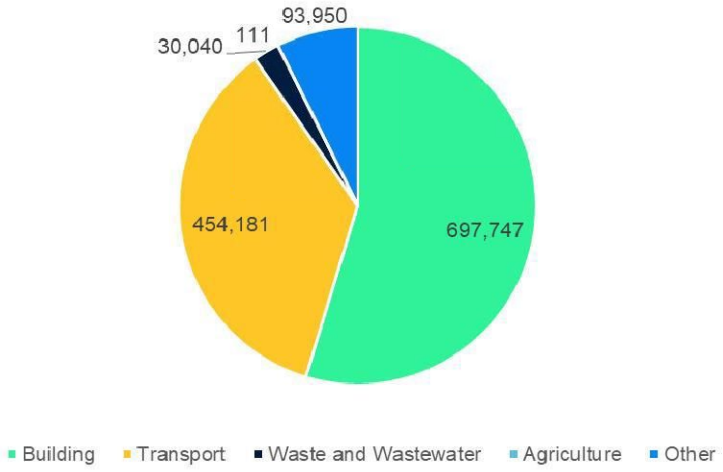
Temperatures are also projected to continue increasing in Alexandria. Historically, Alexandria has experienced an average of eight days per year with temperatures over 95°F. That number is projected to increase to 19-20 days by 2030 and 26-33 days by 2050. The ECCAP identifies areas of the city where residents are likely to be vulnerable to extreme heat. Heat vulnerability is based on average summer temperatures, proximity to green spaces and cooling centers, and socioeconomic characteristics.

While the impacts of climate change cannot be completely avoided, they can be reduced by curbing GHG emissions and proactive climate adaptation planning. The ECCAP focuses on potential impacts of flooding and extreme heat in Alexandria, and details initiatives and strategies to address the impacts of climate change locally.

GHG Emissions in Alexandria

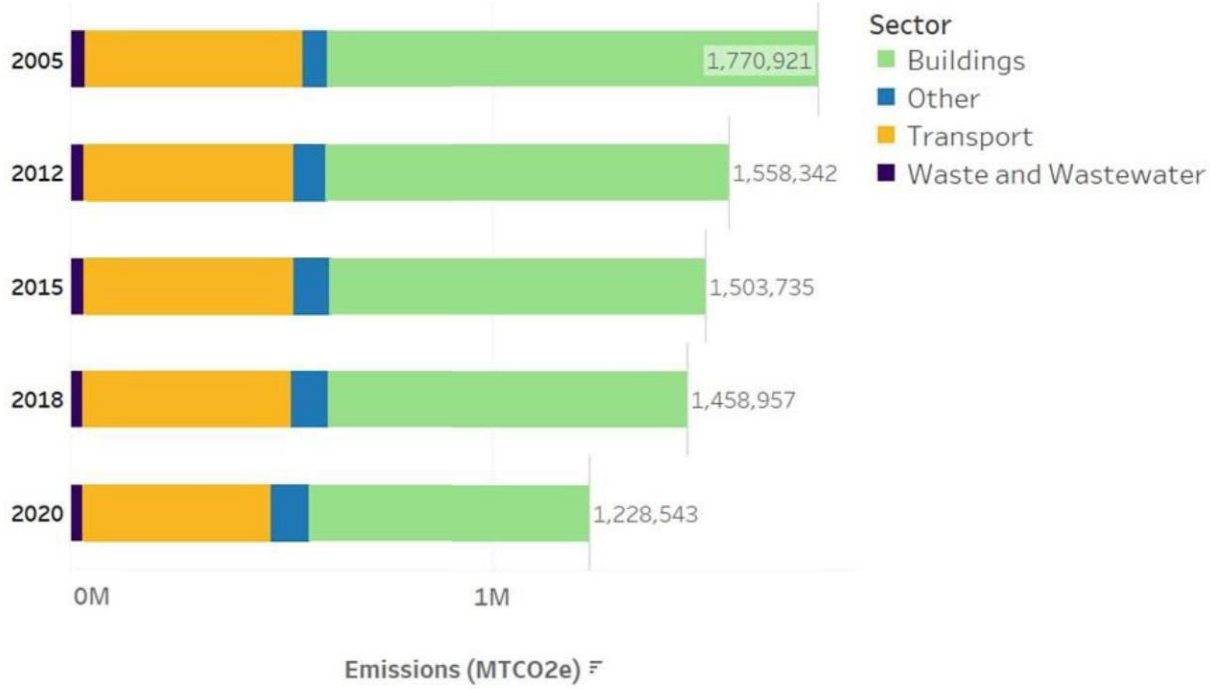
In 2020, Alexandria's total GHG emissions were 1.27 million metric tons of carbon dioxide equivalent ($MTCO_2e$). Most emissions (55%) came from the use of energy in residential and commercial buildings. Transportation emissions account for 36% of overall emissions, with most (80%) from on-road sources. The category "other" represents hydrofluorocarbon and refrigerant emissions, as well as fugitive emissions from natural gas distribution, and contributed 7% of the City's 2020 emissions. Waste and wastewater emissions were 2% of total emissions, followed by agricultural emissions (e.g., from agricultural soils), which were well under 1% of the City's total emissions. Figure 1 shows total GHG emissions allocated by sector. Figure 2 shows the trend in the City's GHG emissions over time. Between 2005 and 2020 the City's GHG emissions have decreased by 31%, with the largest reductions seen in the building sector.

Figure 1. 2020 GHG emissions by sector ($MTCO_2e$)



[21] NOAA, "Social Vulnerability to sea level rise in Alexandria," Sea Level Rise Viewer, https://coast.noaa.gov/slr/#/layer/vul-soc/0/-8580120.72562164/4695745.0055577895/13/satellite/152/0.8/2050/inter/midAccretion.

Figure 2. Trends in Alexandria's GHG emissions by sector from 2005 through 2020



Acknowledging Embodied Carbon

In the building sector, embodied emissions or embodied carbon, refers to the emissions produced from extraction, manufacture, transport, construction, and disposal of building materials. These can be distinguished from operational building emissions, which are represented in the City's GHG inventory shown in Figure 1 and Figure 2, and associated with energy and material flows after the building has been constructed and is in operation, such as its recurring electricity and fuel consumption and waste streams. Because embodied emissions have limited opportunity for reduction after a building's construction (i.e., in the disposal or reuse phase), addressing these emissions proactively will be an important area of future action to achieve deep, global GHG reductions. Future actions to address these emissions might include undertaking a consumption-based emissions inventory, revision of procurement policies to incorporate Environmental Product Declarations (EPDs), or any actions that would send climate-conscious signals through the supply chain. Beyond buildings, embodied emissions are also important to consider for transportation, infrastructure, food, waste, and other goods and services.

Climate Equity

The City of Alexandria is committed to working toward a world where everyone is embraced for who they are and all are able to thrive and reach their greatest potential. Equity means promoting just and fair inclusion throughout our city and creating the conditions in which everyone can participate, prosper, and reach their full potential. To integrate equity through City plans and actions, the City issued the ALL Alexandria resolution on January 23, 2021, committing to race and social equity.

ALL Alexandria Vision: Alexandria is a caring, kind, compassionate, fair, just, and equitable city that is an affordable, livable community for all.

ALL Alexandria Goal: Reduce and eliminate disparities and inequities experienced by all Alexandria residents, especially residents of color and those that have been historically and systemically marginalized.

In line with ALL Alexandria, the ECCAP considers and integrates equity across both GHG reduction and climate adaptation strategies, with a particular focus on thinking about equity and justice in terms of risks and benefits, as well as implementation of strategies and actions. The Alexandria City Council prioritizes environmental justice as a critical lens for evaluating considering community priorities, to include minimizing environmental and health hazards for all Alexandrians, as well as providing equal access to decision making in issues that affect Alexandria's environment and the impacts of climate change on community members. The approach by which equity was assessed and is addressed differs for both climate mitigation and climate adaptation strategies.

Equity in GHG Reductions

To assess equity within GHG reduction strategies the City used the following approach:

Step 1. Develop equity assessment framework and indicators. In line with ALL Alexandria, the City developed an equity framework and indicators to assess GHG mitigation actions that help reduce and eliminate disparities and inequities experienced by Alexandria residents, especially for marginalized and minority residents. The equity framework is presented in Table 1.

Step 2. Host a workshop with multiple City departments and staff. In the summer of 2022 City departments and staff convened to discuss the equity framework and GHG strategies for the ECCAP and approaches for ensuring equitable benefits resulting from and equitable implementation of those strategies.

Step 3. Provide a qualitative assessment of GHG strategies using input from the workshop and the equity framework and indicators. The City assessed the GHG reduction strategies qualitatively to determine if the strategy will have a detrimental, neutral, or beneficial impact on equity. The evaluation is a result of reviewing and assessing the questions and considerations for each indicator and is presented for each strategy and action presented in the

GHG strategies section. Equity is also considered when developing the key milestones and when considering implementation of each strategy and action (e.g., energy equity or access to technologies and programs).

Table 1. Equity indicator definitions and questions

Indicator	Definition and Questions
Economic	**Actions that support economic benefits (e.g., poverty reduction, lower energy costs) and reduce economic disparities.** • Does an action reduce energy burden, utility cost burden, or transportation cost burden for communities, especially marginalized and minority communities? • Does an action ensure energy reliability, reduce energy intensity, and/or reduce per capita energy consumption? • Does an action generate new living wage construction, manufacturing, clean technology, green infrastructure, or similar employment opportunities? • Does an action introduce training, job placement, and career growth opportunities to support disadvantaged communities and/or the transition of workers away from carbon-intensive industries? • Does an action align with existing local economic policies and goals?
Health	**Actions that support health benefits (e.g., improved air quality)** • Does an action help address the needs of or improve health outcomes for vulnerable populations (e.g., marginalized and minority communities, elderly)? • Does an action directly reduce PM2.5 or other particulate matter and air pollutants (e.g., ozone, diesel PM)? • Does an action directly result in or support mechanisms to improve air quality? • Does an action directly result in or support mechanisms to improve indoor air quality (e.g., building electrification, improved monitoring systems and data collection)? • Does an action reduce VMT, with an emphasis on peak hour congestion, and reduce air pollution exposure for sensitive populations? • Does an action support more active transportation modes or increased physical activities? • Does an action reduce health risks to sensitive populations, such as people with respiratory or cardiovascular diseases? • Does an action reduce VMT, with an emphasis on peak hour congestion, and reduce air pollution exposure for sensitive populations?
Social	**Actions that support social and other quality-of-life benefits (e.g., reduced traffic congestion, increased opportunities for socioeconomic mobility).** • Does an action help address the needs of or provide increased opportunities for socioeconomic advancement of marginalized and minority communities? • Does an action create or protect natural or recreation spaces? • Does an action improve educational attainment across communities? • Does an action reduce the housing burden across communities? • Does an action encourage closer housing-work proximity to reduce transportation cost burden and GHG emissions? • Does an action alleviate poverty? • Does an action align with existing local social policies?

Equity in Climate Adaptation

Adaptation is defined as a community's ability to adapt to changes in the environment. Adaptation strategies were created with the knowledge that the impacts of climate change will not be experienced uniformly among community members. People who are elderly, young, low-income, or disabled are more vulnerable to climate change impacts, especially as impacts become more frequent and intense. Municipal plans and operations can proactively address systemic inequities by identifying the communities at greatest risk and considering the distribution of resources related to climate resilience.

This plan identifies communities likely to face the worst impacts from flooding, extreme heat, and other climate-related hazards. For extreme heat in particular, the City provides an interactive web map that uses socioeconomic data to provide an overview of heat vulnerability across the city. The City of Alexandria recommends that its resources for combating the impacts of extreme weather be primarily directed towards vulnerable communities to alleviate the consequences of climate change. Adaptation strategies include expanding climate-focused outreach and education, improving emergency management response, and making infrastructure improvements in the most vulnerable communities.

GHG Emissions and Reduction Strategies

Existing GHG Reduction Strategies and Programs

The City of Alexandria's existing strategies and programs to reduce community greenhouse gas emissions serves as a foundation for this updated ECCAP's promotion of actions to support the reduction of community-wide GHG emissions.

The City of Alexandria's **Green Building Policy**, adopted by City Council in 2019, identifies: 1) the pathways to achieve the City's green building performance standards, including certification through nationally recognized green building rating systems, 2) a minimum level of green building certification for both private and public developments, and 3) priority "Performance Points" within each rating system that a project is expected to achieve. The Green Building Policy applies to new private development, new public development (including City-owned and Alexandria City Public Schools (ACPS) buildings) and major renovations that require a Development Site Plan (DSP) or a Development Special Use Permit (DSUP). In addition, new public development is required to also achieve net-zero energy defined as an energy-efficient building where, on a source energy basis, the actual annual delivered energy is less than or equal to the on-site renewable exported energy. For renovations of City-owned buildings that do not require a DSP or a DSUP, the City will apply Leadership in Energy and Environmental Design (LEED) Interior Design and Construction (ID+C) and LEED Operations and Maintenance (O&M) rating systems as a guideline for interior design and construction projects and targeted renovations of individual building systems (e.g., HVAC, roof, windows, plumbing). Actual third-party certification may be used when technically and financially feasible.

The **Alexandria Commercial Property Assessed Clean Energy (C-PACE)** program, established in 2021, is an innovative financing program enabling owners of commercial, multifamily (5+ units) and industrial properties to obtain low-cost, long-term financing for eligible clean energy, stormwater management, and resiliency improvements. Clean energy improvements can include energy efficiency, renewable energy, electrification, water efficiency, and EV charging infrastructure projects and technologies. The City continues to promote C-PACE as an attractive option for implementing clean energy options to existing Alexandria commercial properties and for new construction.

The City continues to work closely with Dominion Energy to implement **light-emitting diode (LED) streetlighting retrofits** with nearly 50% retrofitted to date. The completion of these streetlighting retrofits is anticipated for 2023.

Since 2015, the City has worked with the Northern Virginia Regional Commission (NVRC) and the Virginia non-profit Local Energy Alliance Program (LEAP) to offer bulk discounted solar system pricing and other energy savings through **SolarizeAlexandria**. As of 2022, over 80 properties have installed solar panels through the program, totaling over 500 kW of newly installed solar energy system capacity. In total, there is about 1.5MW of solar energy installed within Alexandria. SolarizeAlexandria also offers participants special pricing on EV charging stations and battery storage. The SolarizeAlexandria application process is open annually from March through June.

The City promotes **LEAP's** suite of energy assessment, weatherization, and energy efficiency services in partnership with the NVRC. LEAP is an implementation partner to Dominion Energy and Washington Gas's energy efficiency incentive program offerings.

The City offsets nearly 90% of its operational electricity use with purchased **Renewable Energy Certificates (RECs)** from wind, solar, and other renewable energy resources from around the United States.

The City of Alexandria's support of the **Energy Masters** program, in partnership with Arlington County, continues to serve Alexandria residents living in affordable housing communities. This program trains volunteers to deliver hands-on conservation upgrades and community education in affordable housing communities.

The City's **Energy Efficiency Loan Program** offers eligible low- and moderate-income Alexandrians energy assessments to identify energy efficiency improvement opportunities and loan funding to complete these improvements such as air sealing, insulation, energy efficient appliances as well as heating and cooling systems. The program serves owner occupants with combined incomes below 80% of the area median income by family size. Eligible households may receive no-interest loans for energy efficiency improvements for their homes. Repayment of the loans is deferred for 99 years or until the property is sold or the owner(s) move, whichever comes first.

The City partners with community organizations to support weatherization assistance programs to help low and moderate-income City residents weatherize their homes and reduce their monthly energy bills. For example, Community Housing Partners Corporation is the Commonwealth of Virginia's **Weatherization Assistance Program (WAP)** local provider to include diagnostic tests to evaluate areas of heat loss, and the installation of energy efficiency improvements, such as repairing or installing attic and wall insulation and weather-stripping doors. The City also assists in coordination of heating and cooling assistance through the Virginia Department of Social Services, as well as referring income-eligible households to utilize Dominion EnergyShare program which offers year-round financial assistance with energy bill payments to qualified customers.

The **Alexandria Mobility Plan (AMP)** was adopted in November 2021 and focuses on expanding high-quality transportation choices so transportation in the City continues to serve the needs of residents, businesses, and visitors. The AMP is a strategic update to the 2008 Transportation Master Plan and sustainability is a guiding principle. Many of the policies and strategies in the plan seek to make transportation options in Alexandria more sustainable including reducing congestion, making transit greener and more convenient, and creating comfortable walking and bicycling environments.

The continued implementation of the Vision Zero Action Plan and Complete Streets Design Guidelines supports the use of low-carbon mobility options aligned with the EAP2040. Numerous crossing improvements citywide, most notably on Commonwealth Avenue and Braddock Road and others, have helped increase safety for students walking and biking to Naomi Brooks Elementary and George Washington Middle School. On Braddock Road, a new **H**igh-Intensity **A**ctivated Cross**w**al**k** (HAWK signal) improved safety for students walking or

biking to Minnie Howard Campus and Episcopal High School. The posted speed limit was reduced on Seminary Road to minimize fatal and severe crashes.

The City joined the region's **capital Bikeshare** system in 2011 and so far has installed over 60 stations to serve the community, including expansion to the West End.

The Alexandria Transit Company—Driving Alexandria Safely Home (DASH)—started implementation of the **Alexandria Transit Vision** – a strategic effort to design a more useful and equitable bus network that encourages more people to get to more places using transit – and a "**Fare Free DASH**" program in September 2021. These two programs have increased service levels by over 15% and substantially increased the accessibility and usefulness of public transit in Alexandria. The Alexandria Transit Vision features major improvements to service span and frequency on key transit corridors, with an emphasis on improving transit access for Alexandria's Senior, Disabled, Minority, and Low-Income communities.

The City of Alexandria identified three corridors throughout the community as transitway or **Bus Rapid Transit** (BRT) Corridors. Since its launch in August 2014, the National Landing-Potomac Yard Metroway provides frequent BRT premium service between the Braddock Road Metro Station and Pentagon City Metro Station, with service through the Alexandria and Arlington sections of Potomac Yard and the Crystal City area of Arlington. The West End Transitway will include a BRT system along the Van Dorn/Beauregard corridor and Duke Street. The Duke Street In Motion effort is focused on ensuring transit improvements along the Duke Street corridor, from Landmark Mall area to the King Street Metro Station.

The City of Alexandria invests in **Smart Mobility** transportation technologies that improve road safety and traffic management while also preparing the City to take advantage of future transportation infrastructure advancements, such as self-driving cars and real-time traffic management. The Alexandria Information Technology Services (ITS) program is installing transit vehicle signal priority (TSP) along key transit routes. The purpose of TSP is to provide reliable transit bus operation by improving schedule adherence. The goal of TSP is to keep buses running on schedule with little to no variation. Smart buses will request priority from traffic signals when running behind schedule. This is part of a regional effort which will allow buses to seamlessly travel between jurisdictions.

As of November 2022, DASH operates 14 battery electric buses as part of its transition to operating a 100% **Zero-Emission Bus fleet**: the largest deployment of zero emissions buses in the Commonwealth of Virginia. These busses represent the first step in an ongoing expansion of DASH's battery electric bus in the transition to a 100% zero emissions fleet. Altogether, the 14 total battery electric buses will reduce DASH's carbon emissions footprint by over 14,000 tons over the buses' lifespan. DASH has started its Zero Emissions Bus Implementation Study Phase II and Facility Expansion Pre-Design to support the remainder of the fleet's transition to zero emissions by 2035.

In April 2021, the City Council adopted the **Electric Vehicle Charging Infrastructure Readiness Strategy (EVRS)**. The EVRS provides a framework for advancing electric vehicle charging infrastructure and describes current initiatives, technologies, and public perceptions related to EV charging in Alexandria. The EVRS provides recommendations to build a thriving

electric vehicle ecosystem to contribute to achieving the City's GHG emission goals in the EAP2040.

Business As Usual (BAU) Scenario

Alexandria's BAU projections estimate future annual emissions under the assumption that no new policies or actions are taken to mitigate emissions as of 2020. It incorporates factors such as projected population growth, economic growth, and electricity grid emission factors. It does not assume or incorporate any additional GHG emissions reductions from anticipated future action (e.g., anticipated state level policies such as VCEA).

In 2020, Alexandria's total GHG emissions were 1.28 million metric tons of carbon dioxide equivalent ($MTCO_2e$). In the BAU scenario, Alexandria's GHG emissions are expected to increase to 1.65 million $MTCO_2e$ by 2050. This represents a 30% increase compared to 2020 emissions. Most of the growth is driven by commercial sector buildings emissions due to projected high job growth and population rates, which are used as proxies for increases in building square footage. Between 2020 and 2025, Alexandria is projecting six times the annual job growth as compared to other years in the forecast. This increased job growth drives commercial building square footage growth by 8%-11% from 2020 to 2025, compared to the 1%-2% in all other years in the forecast. As a result, commercial building emissions are predicted to grow by 55% from 2020 to 2025. The growth in commercial building emissions growth is largely due to expected mixed use projects with significant new multifamily residential components. In the BAU, GHG emissions from buildings are projected to nearly double as depicted in Figure 3. BAU emissions per capita decreased by 18% from 2020 to 2050 (see Figure 4). This is primarily attributed to the increase in Alexandria's population and relatively stable GHG emissions. The growth in GHG emissions in total is in large part due to commercial new construction and a growing population, not existing buildings, as depicted in Figure 5.

Figure 3. Alexandria BAU GHG emissions

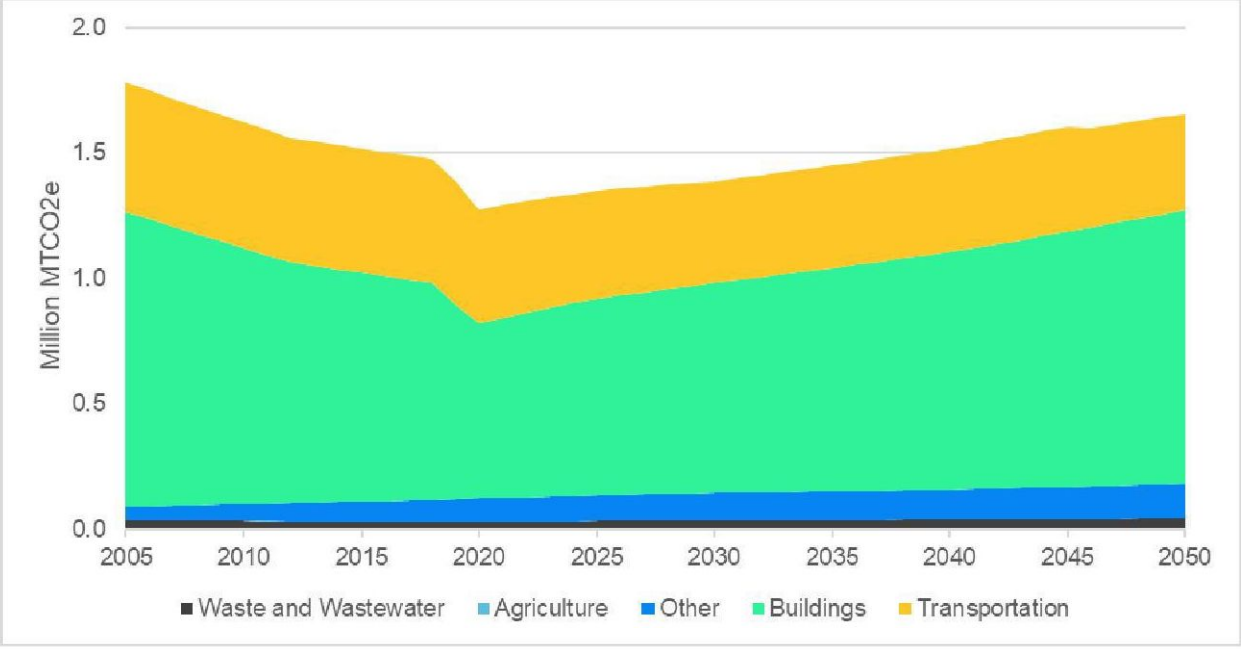


Figure 4. Alexandria BAU GHG emissions per capita

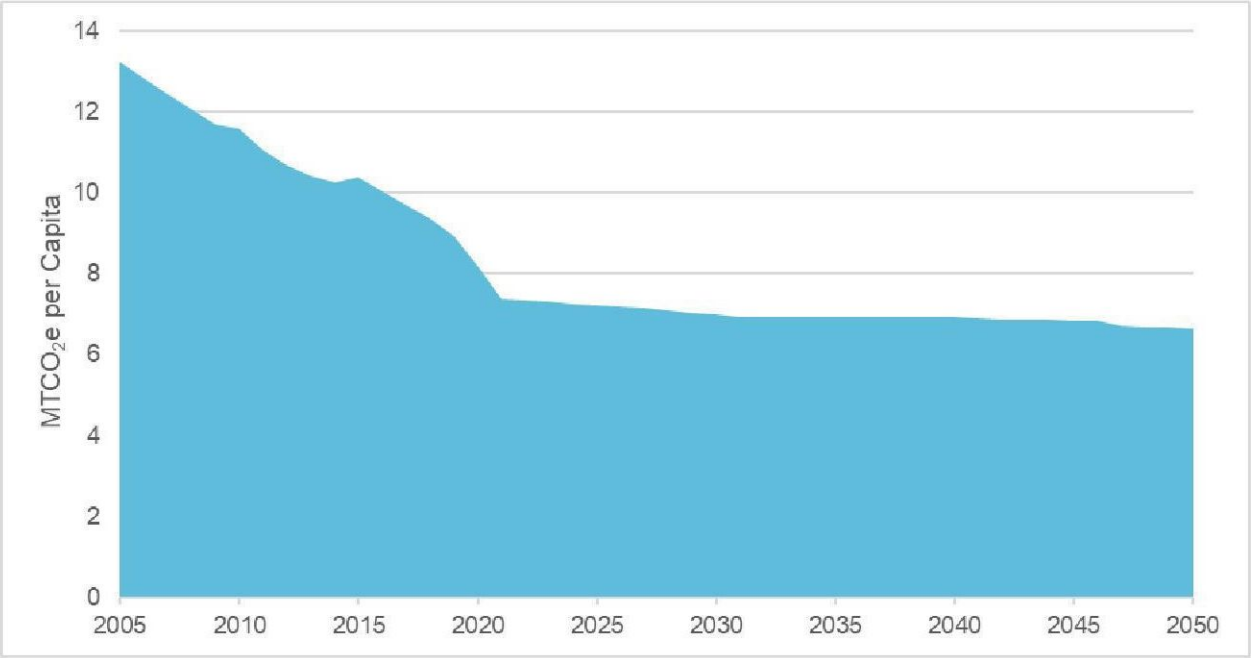
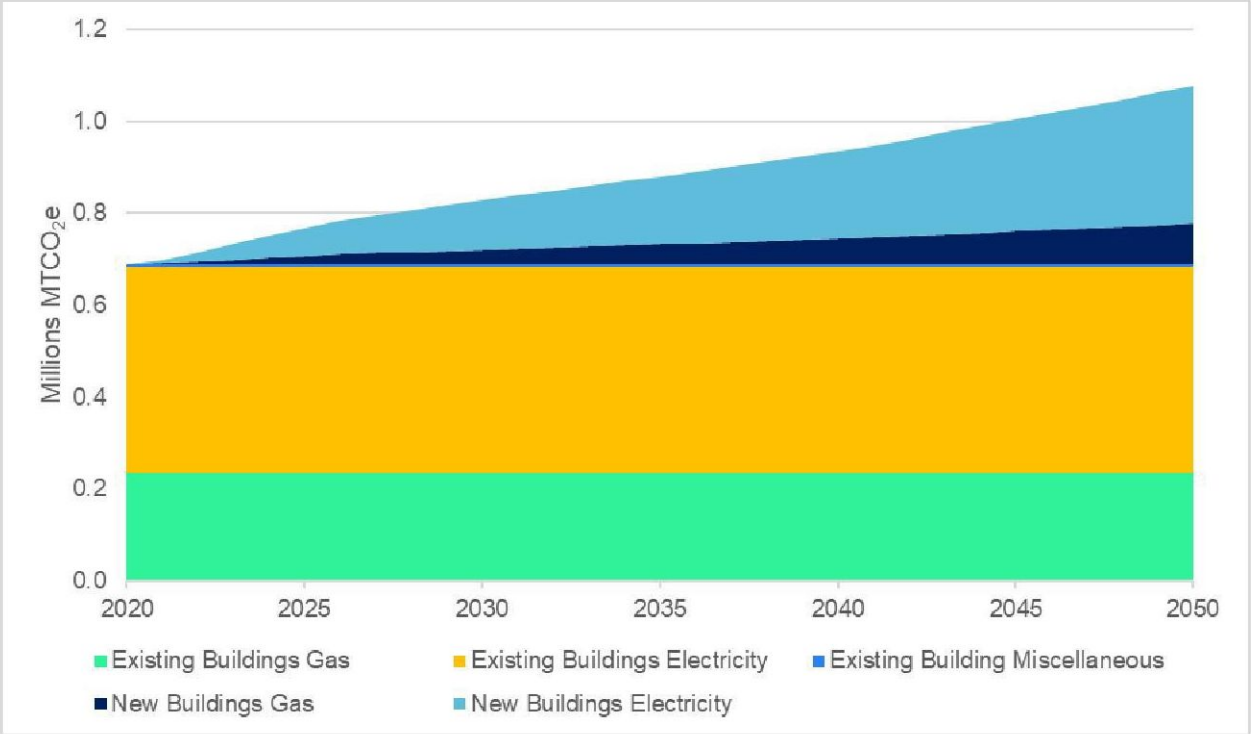


Figure 5. GHG emissions from existing and new buildings in Alexandria



GHG Reduction Priority Strategies and Actions

As established in EAP2040, the City of Alexandria's GHG targets are to reduce community-wide GHG emissions by 50% by 2030 and 80 to 100% by 2050 from 2005 levels. The City is planning to use multiple strategies and actions to accelerate progress towards and achieve these goals. Working with the understanding of resource and authority constraints that Alexandria faces (see City Authority and Influence box), the City identified and analyzed priority strategies and actions that will be used to reduce the City's GHG emissions.

City Authority and Influence

The Commonwealth of Virginia follows the "Dillon Rule", as opposed to the "Home Rule". Dillon Rule and Home Rule are opposing legal interpretations of local government authority. In Virginia, under Dillon Rule, state law is pre-emptive of local law unless the state confers the power to local government. The Dillon Rule is strictly interpreted so that if there is reasonable doubt about whether a power has been conferred to a local government, then it has not been. Within Virginia, this limits the ability of local governments to require, for example, stricter mandatory green building standards in the private sector than the standards set by the State. However, this does not preclude the City from implementing standards for their own operations, running voluntary programs (e.g., City of Alexandria Green Building Policy), influencing and advocating for state policy changes, and setting new building requirements. The City of Alexandria continues to collaborate with state legislature and regional municipalities to advance climate change initiatives.

These priorities are mostly focused on addressing the highest emitting sectors—buildings and transportation—but also cover waste and other types of emission reductions such fugitive methane emissions associated with natural gas use. They build directly on and incorporate the plans and work the City has already done or is doing (e.g., the strategies and actions outlined in EAP2040). Additional details about the strategies and supporting actions listed in Table 2 below are provided in the following sections. The strategies and actions summarized reflect the technology context and policy landscape today. As technologies evolve and policies that address GHG emissions at the federal and state levels continue to develop the City's priorities will also evolve.

The following definitions are used in Table 2.

- **GHG reductions 2030:** reductions in 2030 emissions as compared to the BAU.
- **GHG reductions 2050:** reductions in 2050 emissions as compared to the BAU.
- **Cost ($)*:** cost effective investment (payback of less than 10 years).
- **Cost ($$)*:** small cost premium or cost neutral investment.
- **Cost ($$$)*:** significant cost premium or large capital cost.
- **Equity (+):** beneficial or favorable potential impact when considering the equity. indicators and definitions presented in Table 1.
- **Equity (/):** neutral or minimal potential impact when considering the equity indicators and definitions presented in Table 1.

*Cost includes the relative economic impact to businesses, institutions, and/or community members. Further work needs to be done to estimate the numerical costs and savings for

strategies and actions. Table 2 provides an indicator of economic impact under “Cost”. The City anticipates conducting a more robust, quantitative assessment of costs and savings, available resources and budget for each strategy. Prior to implementation, the City may work with stakeholders to assess the benefits and costs (to include the cost of delayed action, the cost of inaction, and/or the social cost of carbon) of specific programs or actions, and look to offset costs with external funding sources such as those offered through the Inflation Reduction Act of 2022.

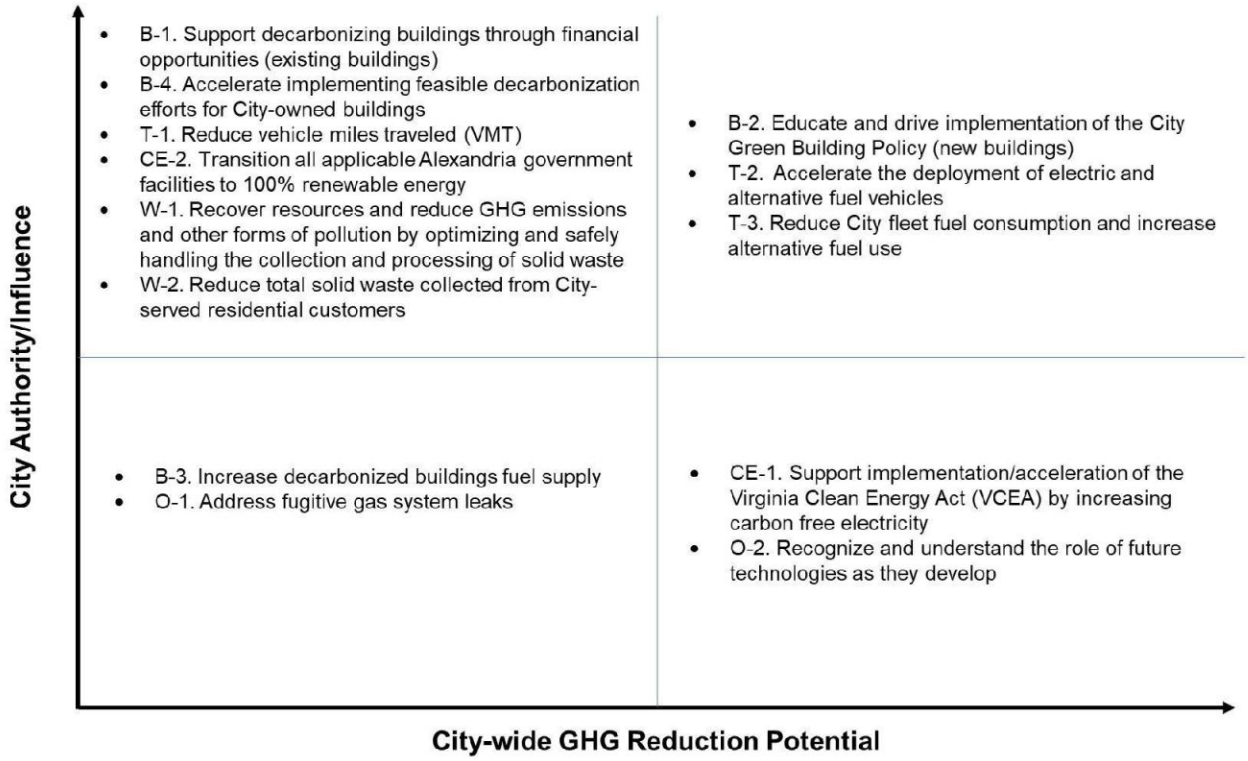
Table 2. Alexandria's priority GHG reduction strategies and actions

STRATEGY/ACTION	GHG REDUCTIONS	COST	EQUITY
Buildings			
B-1: Support decarbonizing buildings through financial opportunities (existing buildings)	**2030:** 320,000 $MTCO_2e$ **2050:** 1.02 million $MTCO_2e$ (Includes B-2)	**$$**	**+**
B-1.A: Support opportunities for a City or regional green bank			
B-1.B: Increase marketing and promotion of Alexandria's C-PACE program			
B-1.C: Establish an incentive program(s) that encourages green building renovations of existing buildings			
B-2: Educate and drive implementation of the City Green Building Policy (new buildings)	Estimated in B-1	**$**	**+**
B-2.A: Support compliance with the City Green Building Policy for new buildings			
B-2.B: Design and implement a program to support residential and commercial energy efficiency and beneficial electrification in new buildings			
B-3: Increase decarbonized buildings fuel supply	**2030:** 87,000 $MTCO_2e$ **2050:** 116,000 $MTCO_2e$	**$$$**	**+**
B-3.A: Increase energy supply from resource recovered gas and renewable hydrogen			
B-4: Accelerate implementing feasible decarbonization efforts for City-owned buildings	Estimated in B-1	**$$**	**/**
Transportation			
T-1: Reduce vehicle miles traveled (VMT)	**2030:** 30,000 $MTCO_2e$ **2050:** 50,000 $MTCO_2e$	**$$$**	**+**
T-1.A: Implement strategies from the Alexandria Transit Vision and Mobility Plans			
T-1.B: Land use changes focused on redistribution of future growth to activity centers and areas better served by transit			
T-1.C: Advocate for reduced transit fares and parking pricing in workplaces			
T-1.D: Support telework policies			
T-1.E: Promote a job/housing balance by focusing on-site affordable housing units near transit, jobs, and amenities			
T-2: Accelerate the deployment of electric and alternative fuel vehicles	**2030:** 41,000 $MTCO_2e$ **2050:** 240,000 $MTCO_2e$ (Includes T-3)	**$$**	**+**
T-2.A: Implement recommendations that support EV charging infrastructure development			
T-2.B: Provide education and outreach to the community about EVs and available state and national incentives			
T-2.C: Advocate with Dominion and regulators for fee-based EV charging; educate the community about these options			
T-2.D: Transition public fleets to electric (DASH)			
T.2.E: Connect private fleets with partners and opportunities to educate and incentivize electrification			

T-3: Reduce City fleet fuel consumption and increase alternative fuel use	Estimated in T-2	$$	/
T-3.A: Optimize the size of the City fleet			
T-3.B: Increase average fuel economy of City fleet			
T-3.C: Reduce VMT through various best practices			
T-3.D: Purchase vehicles with highest emissions certification standards			
T-3.E: Increase use of alternative fuel vehicles and equipment (i.e., electric and hybrid vehicles)			
Carbon-Free Electricity			
CE-1: Support implementation/acceleration of the Virginia Clean Economy Act (VCEA) by increasing carbon-free electricity	**2030:** 160,000 $MTCO_2e$ **2050:** None (Includes CE-2)	**$**	**+**
CE-1.A: Increase on-site renewable deployment within the City			
CE-1.B: Support deployment of battery storage through promoting community ownership, incentives, and pairing with on-site renewables			
CE-1.C: Consider implementation of municipal/community choice aggregation program			
CE-1.D: Encourage large-scale off-site renewable energy working with businesses and others within the City to procure through PPAs			
CE-2: Transition all applicable Alexandria government facilities to 100% renewable electricity	Estimated in CE-1	**$**	**/**
CE-2.A: Implement government operations renewable electricity actions from the EAP2040			
Waste			
W-1: Recover resources and reduce GHG emissions and other forms of pollution by optimizing and safely handling the collection and processing of solid waste	**2030:** 8,900 $MTCO_2e$ **2050:** 39,000 $MTCO_2e$ (Includes W-2)	**$$**	**/**
W-1.A: Continue to implement actions defined in the EAP2040 addressing resource recovery and GHG emissions			
W-2: Reduce total solid waste collected from City-served residential customers	Estimated in W-1	**$**	**/**
W-2.A: Implement actions defined in the EAP2040 that will reduce solid waste from City-served residents			
Other			
O-1: Address fugitive gas system leaks	**2030:** 620 $MTCO_2e$ **2050:** 1,500 $MTCO_2e$	**$$**	**/**
O-1.A: Set requirements for Washington Gas to report level of leaks in Alexandria's distribution system and upstream piping systems serving Alexandria			
O-1.B: Analyze whether the state approved SAVE rider provides for a fair recovery of pipeline infrastructure upgrades to reduce leaks			
O-2: Recognize and understand the role of future technologies as they develop	**2030:** None **2050:** 186,000 $MTCO_2e$	**TBD**	**/**

Figure 6 presents another view of each GHG reduction strategy organized by GHG reduction potential and City authority or influence. Organizing strategies with this approach and based on the GHG reduction modeling presented below, along with the qualitative analysis included within this ECCAP on relative cost and equity impacts, will help guide the City in allocating resources and effort to implement this ECCAP.

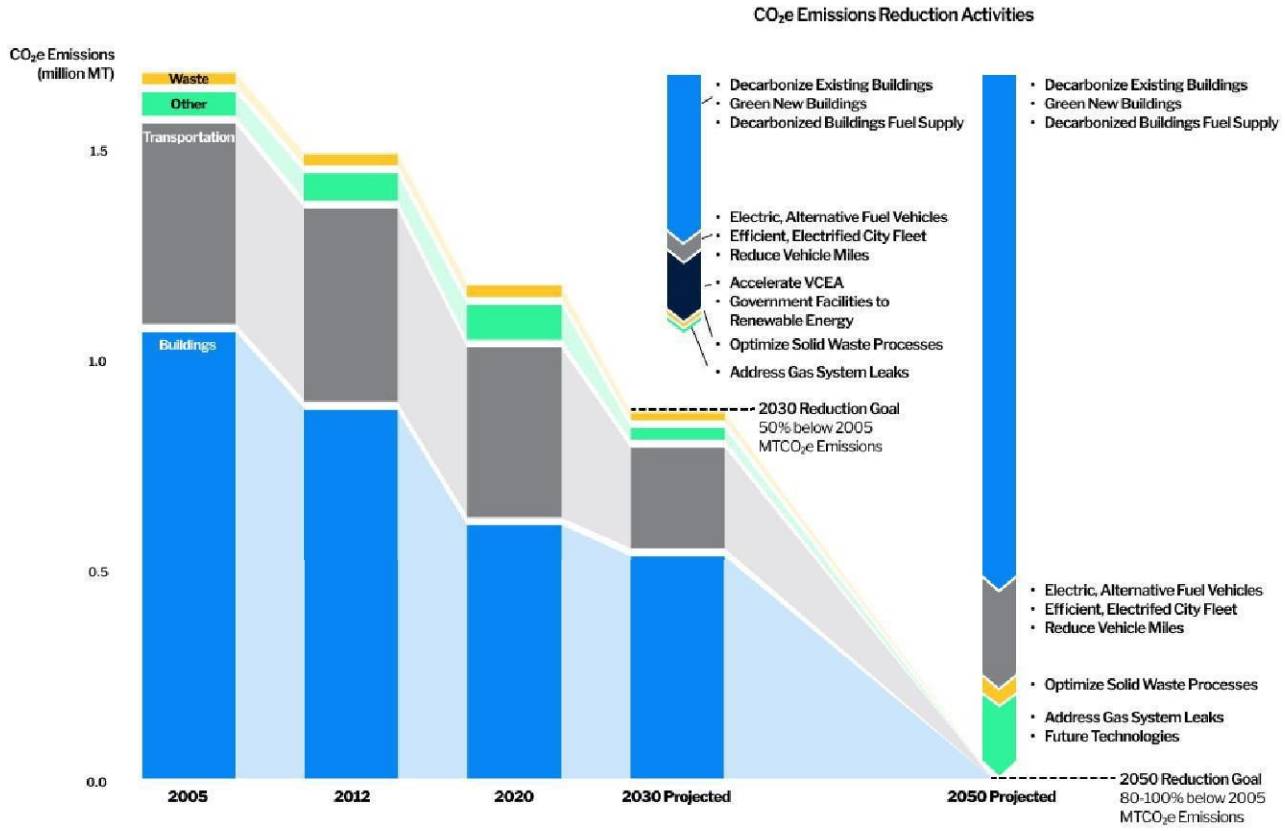
Figure 6. GHG reduction strategies organized by GHG reduction potential and City authority/influence



The City analyzed a potential GHG reduction pathway related to these 13 strategies by considering the technical potential, feasibility, and availability of the technologies and programs needed to reduce emissions to meet the City's GHG reduction goals. Existing state and local GHG policy targets (e.g., VCEA, 2019 City Green Building Policy) are met or exceeded within the modeling, but constraints with current policies and regulations were not considered. Of particular importance is VCEA, as decarbonizing the electricity supply is critical to broader economy-wide GHG reductions.

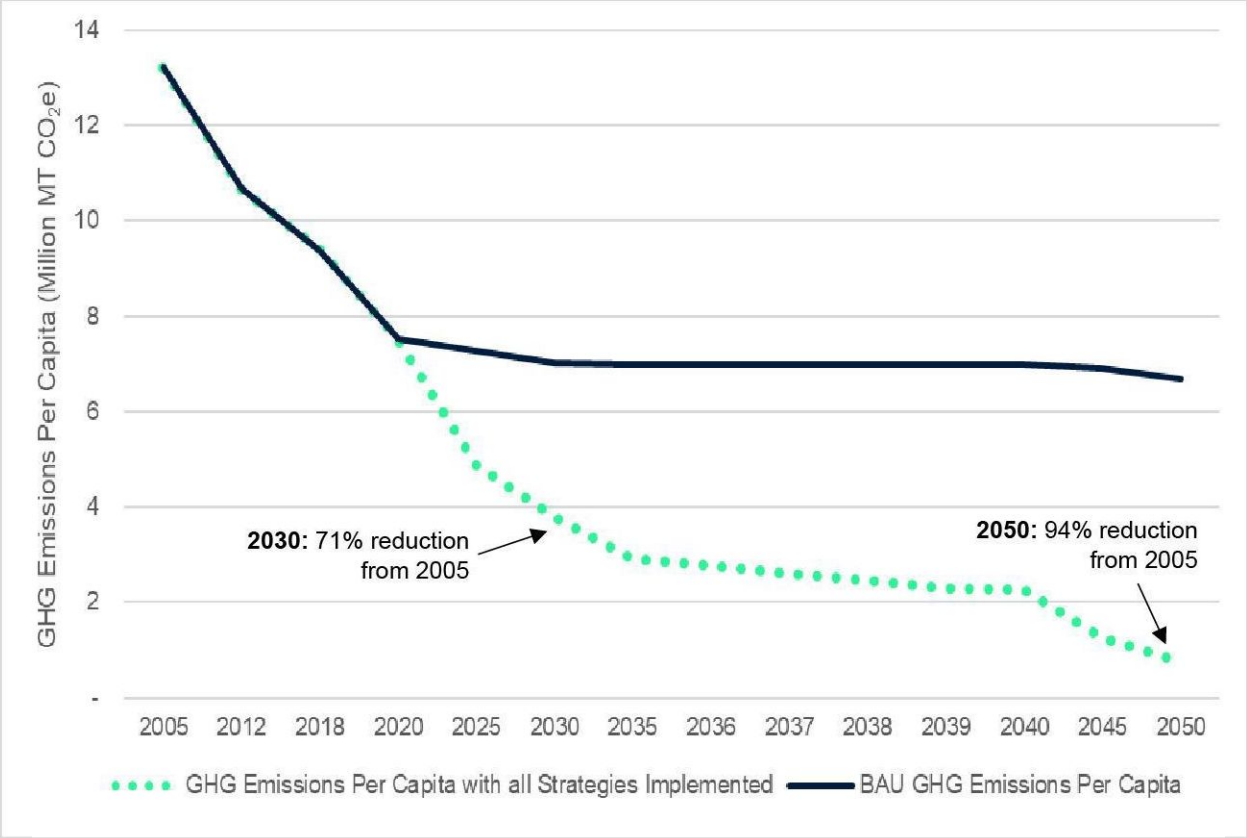
While each specific strategy and action was not modeled using a bottom-up approach, the 13 strategies in this ECCAP, are needed to reach the GHG emission reduction goals. For more details on modeling procedure and key assumptions made, see Appendix E.

Figure 7. A pathway to meet Alexandria's GHG reduction goals



The modeled GHG reduction pathway for the City of Alexandria results in a 58% reduction of emissions by 2030 from a 2005 base year, and 90% by 2050, meeting Alexandria's 2030 and 2050 emission reduction targets. Per capita emissions decrease by 71% in 2030 and 94% in 2050 from 2005 (see Figure 8) under this pathway. Most of the reductions in emissions come from decarbonization of the building sector. Reductions in transportation emissions also play a major role. Enabling reductions across these two sectors is cleaner, and eventually carbon-free electricity.

Figure 8. Alexandria GHG emissions per capita under the BAU and GHG reduction pathway



Buildings

Decarbonization of the building sector is a result of a combination of measures. Existing buildings modeling included deep energy efficiency measures such as change to HVAC, new building envelopes, and lighting retrofits. Additionally, electrification of HVAC, cooking, and hot water from buildings was prioritized as equipment reaches the end of its useful life. Electrification, in concert with the cleaner grid, allowed for buildings to emit only a very small amount of carbon. New buildings were modeled as both highly efficient and almost entirely powered by electricity in alignment with the City's green building policy. In the near-term most reductions are from existing buildings, but as construction increases over time, long-term reductions are driven by actions to increase efficiency and electricity new buildings.

Transportation

In the transportation sector, decarbonization will occur from anticipated increases in sales of EVs in future years. As EVs make up larger and larger shares of the overall fleet, the amount of electricity used to power the fleet will grow. Existing and future clean grid policies mean that the transportation fleet will realize some emissions reductions through anticipated electrification and associated reduction in electricity generation emissions factors alone despite increases in population and VMT.

Additional measures have been simulated to further encourage decarbonization in the transportation sector, and these measures fall into three buckets aligned with the 2021 TPB analysis:

1) Vehicle Technology and Fuels (VT),
2) Mode Shift and Travel Behavior (MS), and
3) Transportation System Management and Operations (TSMO) along with efficiency improvements from autonomous vehicles (TSMO + connected/automated vehicles (CAV)).

VT measures include aggressive increase in EV sales (50% of light duty vehicle sales by 2030 and 100% by 2050, 30% of medium and heavy-duty truck sales in 2030 and 100% by 2050, and 50% of the bus fleet by 2030 and 100% by 2050.) They also include increased uptake of biodiesel and renewable diesel.

MS measures include land use changes to accommodate new housing in activity centers with high quality access to transit, reductions in transit fares and travel times, priced workplace parking, sustained telework participation, and increased bicycle, pedestrian, and micromobility uptake for short trips.

Lastly, TSMO + CAV measures incorporate marginal effects from new ITS hardware for reducing congestion in area roadways. Benefits in fuel economy from eco-driving behavior of CAVs are also included.

The impacts from these policies are summarized in Figure 9 and Table 3. Baseline reduction estimates are presented first, which represent benefits that would be realized anyway in future years without additional action by the City. Next, individual contributions, including VT, MS, and TSMO + CAV are presented. These represent the benefits that would be realized if the measures supporting that pathway were introduced. It should be noted that the emissions reductions from these pathways are inclusive of the baseline reductions, and as such should be interpreted as the results of the pathway as if they were implemented in isolation of the other pathways. The COMBO Pathway combines the results of all individual pathways and includes the baseline effects..[22] Results are presented using the electricity emission factors from each of the BAU scenario and the GHG pathway.

[22] COMBO emission reductions can be approximately calculated by subtracting the baseline % from the VT, MS, and TSMO + CAV pathway results. Next, multiply 100% by 1 minus the resulting differences.

Figure 9. Summary of GHG reductions estimated for all transportation scenarios under all electric grid cases (% reduction from 2005 Level)

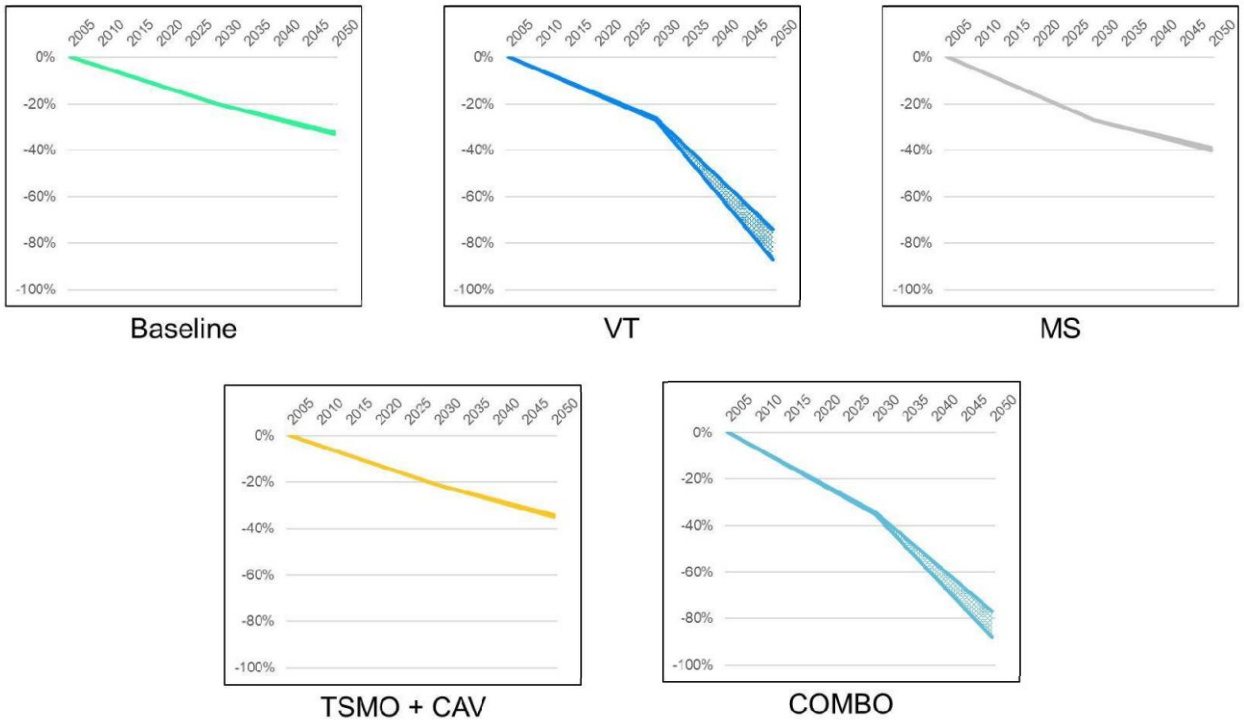


Table 3. Summary of on-road transportation scenario key components

Pathway	Key Components
Baseline	Base assumptions for vehicle technology; population growth through 2050
VT	50% of new light-duty (LD) vehicle sales are EVs in 2030, with 100% by 2040; 30% of new medium- or heavy-duty (M/HD) truck sales are EVs in 2030, with 100% by 2050; 50% of buses on the road are EVs in 2030, 100% in 2050; biofuels/renewable diesel make up 10% of diesel fuel use in 2030 and 20% in 2050
MS	Land use changes, including new housing in the region; transit fares reduced 50% by 2030 and 75% in 2050; all workplace parking in activity centers priced by 2030; 10% reduction in transit travel time by 2030 and 20% by 2050; 25% telework; increased bike/ped/micromobility
TSMO + CAV	Optimized ITS/TSMO, with benefits from CAVs by 2050
COMBO	Combined scenario: VT+ MS + TSMO

Electricity

Decarbonization of the electricity grid is foundational to Alexandria's goals. In addition to lowering the carbon of existing electricity uses, it enables deep reductions for new uses that are electrified such as buildings and transportation. The modeled grid in the policy shows a decrease in emissions of over 97% by 2050 compared to the 2020 grid and is near zero emissions per unit of electricity.

Additional Strategies to Accelerate Climate Action

The City recognizes that although the modeled strategies will achieve the City's GHG reduction goals, there are additional strategies that could be explored to accelerate climate action and go beyond the City's goals. These additional strategies include (a) existing technologies that may be costly; (b) to be developed technologies; and (c) accelerated action. Specifically, these additional strategies could encompass technologies like carbon capture, utilization, and storage; advanced batteries; and very rapid shifts to move the fleet toward zero emissions vehicles, so that nearly all new vehicles sold in the next few years would be electric or other zero emissions (well beyond the most aggressive EV sales targets in place today). In addition, further reducing single occupancy vehicle trips and VMT could be achieved through cordon pricing, VMT pricing, or other policy constructs that are feasible but do not yet exist.

Key Milestones

The modeled GHG reduction pathway demonstrates key milestones that will put Alexandria on the path to meeting its GHG goals. These milestones across major-emitting sectors are summarized in Figure 10. It is important to understand that this is just one potential pathway. Looking decades into the future inherently has several uncertainties such as technology development, costs, policy, and customer behavior. This, compounded with how different technologies and policies across sectors may interact (e.g., if the electric sector decarbonizes at a slower pace, emission reductions in the buildings sector will also be slower because buildings use electricity), will results in changes to these milestones over time. These milestones are presented to provide more insight into the modeling conducted and the magnitude of change that needs to occur for the City to meet its GHG reduction goals.

Figure 10. Key implementation milestones to support Alexandria's GHG reduction pathway

Key Implementation Milestones	2025	2030	2040	2050
Buildings: Existing Home Energy Retrofits (B-1) (% of housing units with efficiency and/or electrification retrofits)	43%	61%	86%	96%
Buildings: New Building Decarbonization (B-2) (% net zero ready buildings)	95%	95%	95%	95%
Buildings: Decarbonized Building Fuels (B-3) (% supply)	0%	5%	30%	50%
Transportation: Passenger Vehicle Electrification (T-2) (% on road vehicles)	10%	40%	80%	90%
Carbon-Free Electricity (CE-1) (% carbon-free electricity generation serving Alexandria)	30%	50%	85%	100%
Waste: Landfill Waste Diversion (W-1) (% diverted)	2%	25%	60%	90%

Costs, Equity, and City Staff Resources for Actions

Additional lenses that are useful for understanding the potential impacts of GHG reduction strategies and actions on the Alexandria community include:

- **Equity:** An indication as to the directional impact of the action in the context of the equity assessment framework and indicators presented above.
- **Costs (and Savings):** A measure of the general costs and savings to implement the actions. These costs may be incurred, and savings realized from the City, community members, businesses to implement the action. Costs and savings considered include considerations of program or policy implementation and technology and energy costs and savings. The impacts presented do not consider any cost offsetting through incentives, tax credits, or federal or other funding resources.
- **City Staff Resources:** An indication of the level of resources, in terms of staff time and effort), that would be needed to implement the action.

Each action was evaluated across these types of impacts and is summarized below.

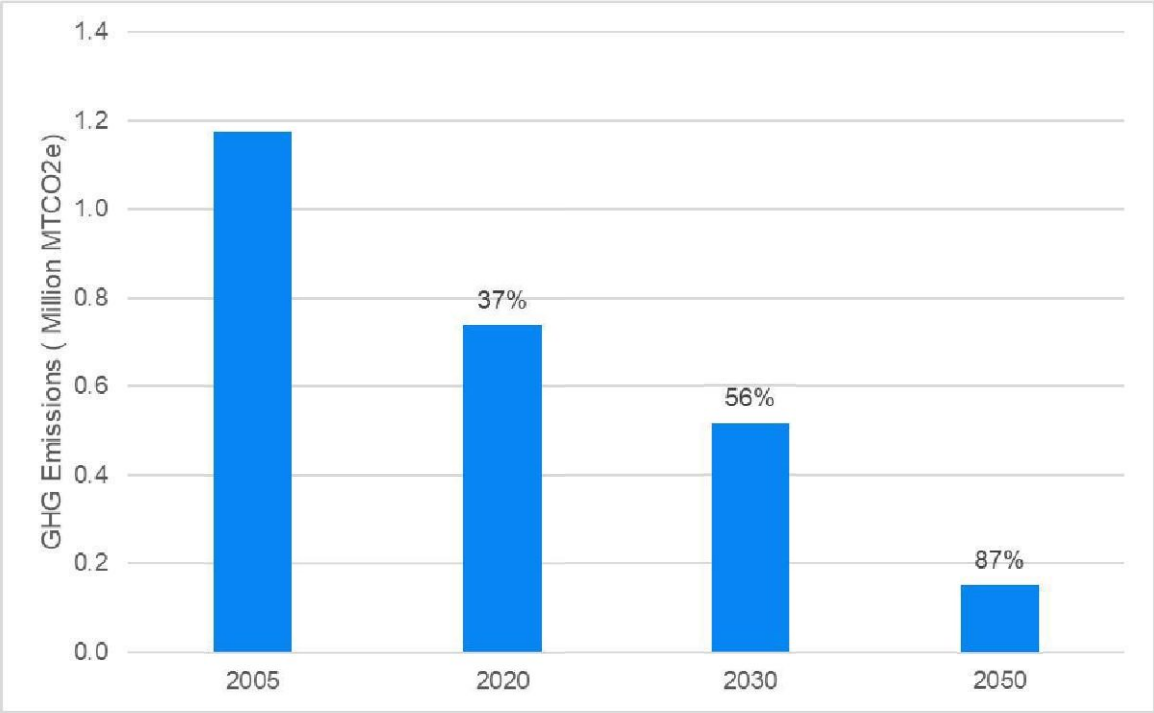
Buildings

The buildings sector includes four priority strategies:

- B-1: Supporting decarbonizing buildings through financial opportunities (existing buildings)
- B-2: Educate and drive implementation of the City Green Building Policy (new buildings)
- B-3: Increase decarbonized buildings fuel supply
- B-4: Accelerate implementing all feasible decarbonization measures for City-owned buildings

These strategies will result in a 56% reduction in GHG emissions by 2030 and an 87% reduction in GHG emissions by 2050 as compared to the 2005 base year (see Figure 11). As of 2020, GHG emissions were reduced by 37% as compared to 2005. This is mostly from a cleaner electricity supply, electrification, and energy efficiency. These reductions occur despite considerable new growth in the building sector through 2050.

Figure 11. Buildings GHG emissions under the GHG reduction pathway



Note: % indicates reductions in buildings emissions in the GHG reduction pathway year as compared to building emissions in 2005.

B-1: Support decarbonizing buildings through financial opportunities (existing buildings)

This strategy focuses on opportunities to finance and incentivize building efficiency and electrification for new and existing buildings. Building retrofit strategies should also consider lower global warming potential refrigerants to further reduce emissions. Actions the City can take to help spur investment in building decarbonization include:

- B-1.A: Support opportunities for a City or regional green bank
- B-1.B: Increase marketing and promotion of Alexandria's C-PACE program
- B-1.C: Establish an incentive program(s) that encourages green building renovations of existing buildings

Strategy B-1 and B-2 Modeling Results

Total GHG Emissions Reduced from BAU

320,000 $MTCO_2e$ (2030)

1.02 million $MTCO_2e$ (2050)

Interactions with Other Strategies

Strategy B-1 would help support implementation of Strategy B-2. A cleaner energy supply through strategies B-3 and CE-1 will compound with strategies B-1 and B-2 to increase the GHG reductions from on-site energy (electricity and fuels) use for new and existing buildings.

Equity

Through each of the actions within this strategy the City can develop and use tailored approaches to benefit low- and moderate-income residents of Alexandria. Programs, and more specifically marketing and engagement efforts, metrics tracked and technical assistance, can be tactically used to target low- and moderate-income (LMI) communities and multi-family building owners and ensure that benefits of financing opportunities are distributed equitably or more proportionally towards the LMI community in line with the ALL Alexandria vision and goals.

As a result of decarbonizing buildings there will be reductions in energy use and a shift to cleaner energy supply within the City. The resulting air quality and related public health impacts will be experienced by all population groups within the City. Therefore, this strategy likely will not more significantly benefit LMI communities or disadvantaged populations within Alexandria.

GHG Reductions

When combined with the actions under strategy B-2 (Educate and drive implementation of the City Green Building Policy) GHG emission reductions for new and existing buildings are expected to be 320,000 $MTCO_2e$ below BAU levels in 2030 (37%/63% new/existing buildings) and 1.02 million $MTCO_2e$ in 2050 (69%/31% new/existing buildings). Overall strategies B-1 and B-2 combined are expected to result in a 62% reduction from base year 2005 buildings' GHG emissions in 2030 and a 95% reduction from base year buildings emissions in 2050.

Cost

The costs associated with establishing and administrating financial and incentive programs in support of building efficiency and beneficial electrification for new and existing buildings opportunities will include City staff and consultant support expenses associated with starting-up and administering such initiatives. These costs could be encumbered by the City directly, or paid for by grants or as a component of program administration. Over time, through administration fees and interest, a green bank could become financially self-sustaining, and only seek outside investments from local government to launch new products or services. The funding for the actual initiative will depend on scale and breadth of the program. For example, the total pool of funding will be smaller for a limited incentive for specific appliances based on income ($50 water heater replacement for LMI) compared to whole dwelling retrofits. In addition, the source of funding can be augmented and structured based on the underlying program and can be sourced through application for competitive federal funding opportunities, tax credits, funding from the Regional Greenhouse Gas Initiative, among others. In one example, Montgomery County Council members proposed legislation that would allocate 10% of the county's energy-tax revenue to its green bank, amounting to approximately $18 million annually. PACE programs have also enabled private lenders to finance building upgrades and then to receive their loan repayment through the jurisdiction's property assessment. Over the last decade, C-PACE loans have financed over $800 million in projects across 35 states and D.C..[23]

[23] Greenpace Capital, Everything You Need to Know About C-PACE Financing, 2022. https://greenpacecapital.com/wp-content/uploads/2022/06/GreenPACE-PACE-Financing-Guide-3.pdf

B-1.A: Support opportunities for a City or regional green bank

Description	The City should consider opportunities to implement or support a City or regional green bank. A green bank, or green investment bank, is a public entity, quasi-public entity, depository bank, or nonprofit entity established or capitalized using local, state, or federal government funding that leverages private capital to support investment in clean energy projects, including residential and commercial energy efficiency, beneficial electrification, and renewable energy systems. Local green banks are available to Virginia local governments by ordinance per 15.2-958.3:1 of the Code of Virginia,.[24] as amended. A first step in establishing a green bank is to conduct a feasibility study to analyze the market potential for, and the costs, benefits, and equity implications of establishing a City or regional green bank. Such a feasibility study may build off preliminary market assessment studies completed by Virginia Energy and Fairfax County in January and August 2022, respectively. Other examples of regional examples of green banks include neighboring Washington D.C. and Montgomery County, MD which may serve to evaluate the market potential of local or regional green bank opportunities. The City or region would need to consider funding for operations, incentives, etc. to implement a green bank. Options may include pursuing state or federal funding opportunities to support implementation of a City or regional green bank. Additionally, the City or region would need to identify and secure private capital, organizational, and/or implementation partners that may include the use of public-private partnership models.
Equity Impacts and Implementation Considerations	**Impacts:** Green banks provide programs to a range of different demographics and increasingly focus on underserved markets such as LMI communities. With strong program design, green banks can have significant positive impacts on disadvantaged populations. **Implementation:** During implementation of green bank programs, Alexandria should ensure that equity considerations are attached to loan products and programs to maximize participation to underserved populations.
Cost Considerations	Costs of green bank startup and administration should be nominal relative to the funding available for projects. The total funding for the green bank will depend on the scale and breadth of the underlying program.
Risks and Uncertainties	While green banks and associated implementation programs are a growing tool used by governments to reduce carbon emissions, they require significant governmental support and public sector investment to succeed.
Lead Implementer(s)	Office of Climate Action
Stakeholders and Partners	Legislative Director, City Attorney's Office, Office of Management and Budget, Regional Jurisdictions, Virginia Energy

Milestones and Next Steps	**Status**
• Conduct feasibility study to identify the market potential the market potential and the costs, benefits, and equity implications to support or implement a City or regional green bank.	Not Implemented
• Pursue state or federal funding opportunities to support implementation of a City or regional green bank.	Not Implemented
• Identify and secure private capital, organizational, and/or implementation partners.	Not Implemented

[24] Code of Virginia Section 15.2-958.3:1, 2021, https://lis.virginia.gov/cgi-bin/legp604.exe?212+ful+HB1919ER.

B-1.B: Increase marketing and promotion of Alexandria's C-PACE program

Description	The City of Alexandria launched a C-PACE financing program in 2021. The Alexandria C-PACE program is an innovative financing program enabling owners of owners of commercial, multifamily (5+ units), institutional, and industrial properties to obtain low-cost, long-term financing to implement eligible clean energy, stormwater management, and resiliency improvements. These improvements support reducing GHG emissions primarily from the City's commercial and multifamily buildings sector. While the GHG reduction potential for clean energy projects supported by the Alexandria C-PACE program is significant, to date there have been a limited number of C-PACE projects executed in Virginia, and no projects in Alexandria. Increasing marketing, promotion, and training opportunities supports awareness of C-PACE financing to identify, increase, and accelerate clean energy project opportunities. The City may also consider establishing a working group with City and regional jurisdictions, and energy efficiency financing and other stakeholders to identify hurdles in implementation of Alexandria's C-PACE program and suggest methods to improve the process and projects.
Equity Impacts and Implementation Considerations	**Impacts:** C-PACE's potential equity impacts are limited to improving clean energy opportunities for multifamily affordable housing and small businesses. **Implementation:** The City should provide dedicated promotion opportunities to affordable housing developments and small business owners.
Cost Considerations	Current C-PACE administration costs are negligible and the responsibility of the City's 3rd-party C-PACE Administrator. Costs to provide additional marketing, promotion, and workforce training.
Risks and Uncertainties	To date there have been limited Virginia C-PACE projects and no projects in the city of Alexandria. While utilizing Alexandria's C-PACE program to implement eligible clean energy projects offers many benefits to owners of eligible properties, participation in the Alexandria C-PACE program is not mandatory. Participation in the Alexandria C-PACE program is voluntary and left to the determination of property owners.
Lead Implementer(s)	Office of Climate Action
Stakeholders and Partners	Department of Finance, City Attorney's Office, OCPI, Planning and Zoning, Housing, Code Administration, Regional Jurisdictions, Virginia Energy

Milestones and Next Steps	**Status**
• Join Statewide C-PACE program to expand marketing and outreach opportunities.	Implementing
• Develop local marketing and outreach plan with Statewide C-PACE Program Administrator and Virginia Energy.	Not Implemented
• Implement C-PACE program marketing and outreach to commercial building owners, developers, institutions, affordable housing developers, and related workforce (architects, MEP engineers, trades, etc.).	Not Implemented
• Establishing a working group with City and regional jurisdictions, and energy efficiency financing and other stakeholders to identify hurdles in implementation of Alexandria's C-PACE program and suggest methods to improve the process and projects.	Not Implemented

B-1.C: Establish an incentive program(s) that encourages green building renovations of existing buildings

Description	In alignment with the EAP2040 actions, as another financing option, the City should consider establishing a green building incentive program(s) that encourages energy efficiency, beneficial electrification, or building renovations of existing buildings that aligns with the outcomes of the City's Green Buildings Policy. Incentives could be aligned with meeting certain levels of greenhouse gas emission reductions and could align with standards that promote and accelerate building decarbonization, including existing building benchmarking and disclosure compliance programs, building energy performance standard programs or other standards that accelerate decarbonization could be considered, with more incentives for higher standards. This action aligns with EAP2040 actions 3.1.8, 3.1.9, and 3.1.12.
Equity Impacts and Implementation Considerations	**Impacts:** A green buildings renovation incentive program can improve access to funding for LMI, including pairing with additional state (including WAP), federal, or utility incentives or services. With a strong program design, such a program can have significant positive impacts on disadvantaged populations. **Implementation:** Incentives and programs should be identified to provide direct benefits to LMI communities.
Cost Considerations	Costs to evaluate options, startup, and administer a Green Building renovation incentive program should be nominal relative to the incentives available for projects. The total incentive amount available will depend on the scale and breadth of incentives and sources of funding. Incentives could be paired with financial opportunities related to a City or regional green bank or the Alexandria C-PACE program for commercial, multi-family (5+ units), and institutional properties. Additionally, incentives could pair with available state, federal, or utility incentive programs to enhance incentive offerings.
Risks and Uncertainties	While incentive programs are used by governments to reduce GHG emissions, they require careful program design and require an adequate and reliable source of funding. In addition, a user friendly and easy to understand program is critical in ensuring that Green Building renovation incentives are utilized.
Lead Implementer(s)	Office of Climate Action
Stakeholders and Partners	Department of Finance, City Attorney's Office, OCPI, Planning and Zoning, Housing, Code Administration, Regional Jurisdictions, Virginia Energy

Milestones and Next Steps	**Status**
• Conduct implementation study and planning to include coordination and leverage of funding, incentives, and supporting programs (including rebates, public-private partnerships, regional/state/federal investment) to improve existing building energy efficiency/use of energy efficient technology/high-efficiency and renewable energy sources.	Not Implemented
• Pursue state, federal, or public-private partnership funding opportunities to support implementation of incentives.	Not Implemented
• Develop and conduct outreach (e.g., in-person and live-streamed events, info-graphics sustainable signage, social media and website content, hands-on learning experiences, partnerships) to promote use of City, regional, state, federal incentive programs (e.g., Including IRA) other residential energy efficiency/renewable/EV charging/rebate programs and leverage partnership opportunities.	Not Implemented
• Advocate to the Virginia General Assembly to pass policies that authorize local or state implementation of existing building benchmarking and disclosure compliance programs, building energy performance standard programs, or for the ability to issue other standards that accelerate decarbonization.	Not Implemented

B-2: Educate and drive implementation of the City Green Building Policy (new buildings)

Through this strategy, the City will continue to work with stakeholders to drive the implementation of the City's Green Building Policy. The Green Building Policy is an innovative policy that institutes standards to achieve an overall improvement in building performance, and includes a cutting-edge, directed-use approach that targets the reduction of energy use and mitigation of greenhouse gas emissions for new development and public buildings. This includes new public buildings achieving net-zero energy, defined as an energy-efficient building where, on a source energy basis, the actual annual delivered energy is less than or equal to the on-site renewable exported energy. Actions the City can take to help spur investment in building decarbonization include:

- B-2.A: Support compliance with the City Green Building Policy
- B-2.B: Design and implement a program to support residential and commercial energy efficiency and beneficial electrification in new buildings

Interactions with Other Strategies

Strategy B-2 would be supported through the implementation of strategy B-1. A cleaner energy supply through strategies B-3 and CE-1 will compound with strategies B-1 and B-2 to increase the GHG reductions seen from on-site energy (electricity and fuels) use for new and existing buildings.

Equity

Compliance with the Green Buildings Policy will result in reductions in energy use and a shift to cleaner energy supply within the City. The resulting air quality and related public health impacts will be experienced by all population groups in the county and within the City. Depending on the types of green building improvements made, indoor air quality may also improve resulting in public health benefits (i.e., better indoor ventilation and electrifying appliances). Therefore, this strategy may result in positive equity outcomes in Alexandria. In addition, using implementation approaches such as working with local community groups, translating materials in other languages, and working through ALL Alexandria initiatives can also improve equity outcomes.

GHG Reductions

GHG emission reductions for this strategy are included in the reductions for B-1.

Cost

Green buildings tend to be more complex and incorporate newer technologies. Incorporating green building practices early in the design process is often a best practice for controlling costs for any increased complexity or costs and risks of newer technologies and promoting a project's financial viability. The later green building practices are considered within the design and construction process, a project may be subject to higher design and construction costs than less sustainable buildings. However, lower operating costs can result in net cost savings through lower energy bills for both tenants and owners.

B-2.A: Support compliance with the City's Green Building Policy for new buildings

Description	Compliance with the City's Green Building Policy has been fundamental to reducing greenhouse gas emissions from new private development. The 2019 Green Building Policy update, including specifying minimum credit points each new development project must achieve within a minimum level of green building certification from priority "Performance Points" focused on energy use reduction, supports further greenhouse gas reductions from any new private developments currently in planning, design, or construction. Furthermore, the City's Small Area Plan (SAP) and Coordinated Development District (CDD) Conditions processes have introduced additional opportunities to consider reducing greenhouse gas emissions at building and development site-wide scales, including the use of the United States Green Building Council's LEED for Neighborhood Development certification process. In addition, the North Potomac Yards Environmental Sustainability Master Plan (ESMP), the Landmark Mall Site Redevelopment's Energy and Resilience Plan, and the Old Town North Coordinated Sustainability Strategy (CSS) – to include a voluntary Carbon Neutral Analysis (CNA) – supports reducing greenhouse gas emissions to target building and district carbon neutrality consistent with the EAP2040 targets. Where applicable, the City has subsequently introduced DSUP conditions to specify additional energy use reduction and greenhouse gas emission reduction targets that include requirements for increases in energy efficiency, beneficial building system electrification, reducing embodied carbon intensity, and on-site and off-site renewable energy use to further pursue carbon neutrality targets. The EAP2040 prompts scheduling future administrative updates to the Green Building Policy to coincide with changes in third-party certification, revisions to the Virginia Uniform Statewide Building Code and implementation of programs established through the EAP actions, with major updates for City Council consideration every 5-7 years as needed. Green Building Policy administrative updates or major updates may also consider greenhouse gas emission reduction opportunities that reflect requiring specific Energy Use Intensity (EUI) maximums for specific building types; increasing on-site renewable energy performance or requirements; and sufficient EV charging infrastructure installed. Major updates to the Green Building Policy will be considered through the development and consideration of the City's annual Long-Range Planning Interdepartmental Work Plan (LRPIWP). Each year, City departments involved in long-range planning and implementation jointly prepare a LRPIWP for the upcoming fiscal year and beyond. The work program includes the completion of plans and studies underway, new plans scheduled to begin, and implementation of previously approved plans. The LRPIWP ensures coordination of work, staffing and financial resources, and the opportunity for Planning Commission and City Council to ensure alignment of proposed planning work across departments with the City's Strategic Plan. The City's breadth of tools that complement the Green Building Policy's implementation offer a unique opportunity to further support the reduction of greenhouse gas emissions from new private development. For example, SAPs, CDDs, the DSUP/DSP process, and building code updates all contribute to greenhouse gas emission reduction outcomes. As such, evaluating opportunities to leverage Small Area Plans, CDDs, the DSUP/DSP processes, building code updates, and the Green Building Policy to support and expand compliance with Green Building Policy outcomes may advance Green Building Policy compliance. A joint Planning Commission and Environmental Policy Commission working group is currently evaluating such

	opportunities, which may include recommendations to the Alexandria City Council to consider a more immediate or near-term major Green Building Policy update to focus on net-zero energy buildings and greenhouse gas emission reductions of new development. Further, the City should consider developing and implementing a tracking and compliance dashboard to support Green Building Policy compliance.
Equity Impacts and Implementation Considerations	**Impacts:** GHG reductions through compliance with the Green Building Policy will likely benefit all of society. However, additional benefits via improved indoor air quality and public health benefits may be provided to disadvantaged communities through initiatives such as a Green Lease Leader program. **Implementation:** During design and implementation of programs to encourage Green Building Policy adherence, the City should ensure that equity considerations are integrated and prioritized to maximize positive impacts on disadvantaged populations.
Cost Considerations	Supporting compliance with the Green Building Policy, be it through an incentive program or a communication campaign, will have costs for the City. Depending on scope and breadth of these programs, costs can range from design and implementation of said programs, and costs associated with incorporation of cleaner, newer technologies.
Risks and Uncertainties	Establishing clear, concise methods of encouraging Green Building Policy adherence is critical to not overwhelm the public.
Lead Implementer(s)	Planning and Zoning / Office of Climate Action
Stakeholders and Partners	Transportation and Environmental Services, Recreation Parks and Cultural Activities, Code Administration, Housing, Office of Performance Analytics

Milestones and Next Steps	**Status**
• Evaluate opportunities to leverage CDD, Small Area Plans, DSUP/DSP processes, building code updates, and the Green Building Policy to support and expand compliance with Green Building Policy outcomes.	Implementing
• Develop and implement a Green Building Policy tracking and compliance dashboard.	Not Implemented
• Include in the City's LRPIWP an update to the Green Building Policy to coincide with changes in third-party certification, revisions to the Virginia Uniform Statewide Building Code and implementation of programs established through the EAP actions, with major updates every 5-7 years as needed, or sooner, upon direction of the Alexandria City Council.	Not Implemented

B-2.B: Design and implement a program to support residential and commercial energy efficiency and beneficial electrification in new buildings

Description	Design and implement a technical assistance program to support accelerating the adoption of energy efficiency and beneficial electrification measures for new and existing residential and commercial buildings. The program should provide technical assistance to participants through various forms (e.g., direct assistance, an information and resource clearinghouse, workshops, and training, etc.). Ideally this action should be combined with the offering of financial opportunities, including services provided by a City or regional green bank (B-1.A), the Alexandria C-PACE program for commercial, multi-family (5+ units), and institutional buildings, or any incentives programs for energy efficiency and beneficial electrification (B-1.C). This technical assistance program is necessarily voluntary to participate. A technical assistance program implementation may be available through local and regional partnerships, not-for-profit coordination, or a contract for a vendor.

Equity Impacts and Implementation Considerations	**Impacts:** Residential and commercial energy efficiency and beneficial electrification programs serve various demographics and are increasingly focusing on LMI communities. With an equity focus, a voluntary program to support residential and commercial energy efficiency and beneficial electrification often provides benefits such as reduced energy costs and improved indoor environmental quality, **Implementation:** Equity considerations should be central during design and implementation of a voluntary program to ensure LMI communities stand to benefit. This could include addressing the long-standing principal-agent /renter-landlord issue through constructs such as green leases.
Cost Considerations	The costs of an energy efficiency and beneficial electrification program will depend on the breadth and scope of the initiative. If the City were to provide a full-service technical assistance program, this may require an increase in program management and technical assistance staffing to accommodate interest. Marketing and communicating technical assistance may rely on the City's existing communications strategies but may require additional investments to increase promotion. If the City were to leverage local or regional partnerships, not-for-profit coordination, or vendor support, costs would need to be further evaluated based on the level of technical assistance being provided.
Risks and Uncertainties	A voluntary program doesn't guarantee participation nor emissions reductions. In addition, program success may be in-part attributed to the simplicity and concision of communication about the program, and the ease-of-access of program resources.
Lead Implementer(s)	Office of Climate Action
Stakeholders and Partners	Department of Finance, City Attorney's Office, OCPI, Planning and Zoning, Housing, Code Administration, Regional Jurisdictions, Virginia Energy

Milestones and Next Steps	**Status**
• Develop and implement technical assistance programs to support residential/small business/non-profits in green building/renewable energy/energy efficiency/EV charging implementation to includes potential for leveraging local technical assistance providers to benefit workforce development and attract economic development opportunities.	Not Implemented
• Pursue state, federal, or public-private partnership funding opportunities to support implementation of incentives.	Not Implemented
• Develop and conduct outreach (e.g., in-person and live-streamed events, info-graphics sustainable signage, social media and website content, hands-on learning experiences, partnerships) to promote use of City, regional, state, federal incentive programs (e.g., Including IRA) other residential energy efficiency/renewable/ EV charging/rebate programs and leverage partnership opportunities.	Not Implemented

B-3: Increase decarbonized buildings fuel supply

Constraints such as space and cost, and customer preferences (e.g., for cooking), will likely lead to continued use of fuels such as natural gas in buildings. Moving from high-carbon sources of energy, such as natural gas, to a fuel supply with lower carbon content, or that are carbon neutral, will help further reduce GHG emissions from building energy use. Low- or no-carbon fuels – typically - resource recovered (or renewable) gas or renewable hydrogen – are still in development and not broadly commercially available at any level of scale. Statutory prohibition limits Virginia local governments from restricting the use of natural gas service to new or existing buildings.[25] However, cost drivers – especially from increases in fuel supply options – have shown to influence energy users to shift form higher cost fuels such as fuel oil and propane to natural gas. As such, the City can actively engage in activities to:

Strategy B-3 Modeling Results

Total GHG Emissions Reduced from BAU

87,000 $MTCO_2e$ (2030)

116,000 $MTCO_2e$ (2050)

- B-3.A: Increase energy supply from resource recovered gas and renewable hydrogen

Interactions with Other Strategies

A cleaner fuel supply to buildings within the City would work with strategies B-1 and B-2 to increase the GHG reductions seen from on-site energy (fuels) use for new and existing buildings.

Equity

This strategy is not expected to have significant impacts on equity within the Alexandria community.

GHG Reductions

This strategy is expected to reduce GHG emissions from BAU levels by 87,000 $MTCO_2e$ and 116,000 $MTCO_2e$ in 2030 and 2050 respectively. This reduction is achieved using 4.19 million mmBtu (or energy for 28,000 housing units per year) of low or no carbon fuels in 2030 and 2.29 million mmBtu (or energy for 15,000 housing units per year) in 2050.

Cost

The cost to support access to a decarbonized buildings fuel supply varies, ranging from an education campaign informing the public of their choice in building fuel supply, to subsidizing the alternative fuel (i.e., resource recovered gas or renewable hydrogen). Policy instruments exist to

[25] Virginia House Bill (HB) 1257: Natural gas utilities; retail supply choice, 2022, https://lis.virginia.gov/cgi-bin/legp604.exe?221+sum+HB1257.

minimize the public cost of providing such subsidy, such as minimum renewable fuel requirements and low carbon fuel standards, among others. Resource recovered gas is currently more expensive than conventional natural gas, and production and processing costs are high.

B-3.A: Increase energy supply from resource recovered gas and renewable hydrogen

Description	The City can help promote the use of low- or no-carbon fuels in buildings through education and outreach. The City may also consider pilot programs in partnership with renewable natural gas providers or soliciting request for information (RFI) to help support understanding of availability, applications, or opportunities to promote use of low- or no-carbon fuels. Where applicable, updates to the City's franchise agreement with Washington Gas may serve as an opportunity to promote or transition natural gas supply to alternatively provide resource recovered gas options. Providing education, supporting pilot programs, or supporting collection of more information can help address and misconceptions and address how low- or no-carbon fuels may offer additional future options to decarbonize building energy use.
Equity Impacts and Implementation Considerations	**Impacts:** This strategy is not expected to have significant impacts on equity outcomes within the Alexandria community. However, regional air quality benefits may be an outcome that will lead to overall better public health outcomes, such as fewer cases of asthma, across the community. **Implementation:** This strategy is not expected to have significant equity impacts within the Alexandria community.
Cost Considerations	The cost of designing and implementing an education campaign will be nominal relative to the cost of transitioning to an alternative fuel. The cost of transitioning to an alternative fuel may be high if subsidized but can be negated if mandated through a policy construct such as a low carbon fuel standard.
Risks and Uncertainties	Many technologies for resource recovered gas projects are in the early stages of development and are not currently deployed at large scale. Not all pipeline infrastructure will be able to accommodate the use of resource recovered gas potentially necessitating costly infrastructure upgrades.
Lead Implementer(s)	Office of Climate Action
Stakeholders and Partners	Regional jurisdictions, Virginia Energy, regional utilities

Milestones and Next Steps	**Status**
• Explore and research emerging opportunities for availability and uses of resource recovered gas or renewable hydrogen.	Not Implemented
• Develop and distribute a RFI to help support understanding of availability, applications, or opportunities to promote use of low- or no-carbon fuels.	Not Implemented
• Providing education, supporting pilot programs, or supporting collection of more information can help address and misconceptions and address how low- or no-carbon fuels may offer additional future options to decarbonize building energy use.	Not Implemented

B-4: Accelerate implementing feasible decarbonization efforts for City-owned buildings

The EAP2040 outlines a series of actions the City is taking and will take to decarbonize its own buildings in line with the target of improving energy efficiency in City facilities and operations by 50% over FY2018 baseline use by FY2035. Energy efficiency and energy conservation implementation serves as a foundational practice for the City to offset greenhouse gas emissions and lead by example. In addition, energy efficiency provides a reduction in energy use at a lower cost and higher return on investment than many alternatives and serves as a lower-cost pathway to offset the City's GHG emission by a renewable energy supply. This series of actions being led by General Services and Transportation and Environmental Services include EAP2040 actions:

- 2.2.1 (update the facility asset condition auditing process for facility asset conditions (Facility Condition Index, (FCI) rating methodology) to reflect facility energy and sustainability performance. In addition, include energy audits, portfolio energy optimization, and similar evaluation processes into the FCI rating methodology. Develop and utilize a portfolio-wide energy model to identify and develop a portfolio wide energy optimization investment plan as part of a broader energy supply transition planning effort)
- 2.2.3 (complete retrofits of 75% of all City facilities' practicable conventional lighting with LED lighting. By FY2023 retrofit 95% of practicable streetlights and outdoor lighting to LED technology, subject to the availability of a suitable LED solution and zoning constraints)
- 2.2.4 (By FY2027, implement energy efficiency strategies in City facilities and operations to reduce energy use by, at minimum, 25% over FY2018 usage)
- 2.2.7 (implement energy efficiency strategies in City facilities and operations to reduce energy use by, at minimum, 50% over FY2018 usage)
- 2.1.6 (By FY2040, implement electrification of all City non-electricity energy use (City facilities, operations, and vehicles)).

Interactions with Other Strategies

The acceleration of feasible decarbonization measures will be increased with the financial support for building decarbonization (B-1), new buildings built under the City's Green Building Policy (B-2) will increase the stock of decarbonized buildings in Alexandria. Increased building fuel for decarbonized buildings (B-3) will allow for large decarbonization projects without jeopardizing the reliability of energy for buildings. Increased carbon-free electricity use (CE-1 and CE-2) will decarbonize the fuel used in buildings, reducing GHG emissions and support full decarbonization of buildings. With buildings being decarbonized, there is less need for natural gas, and the pipeline that deliver that gas, helping with strategy O-1 and O-2 in reducing fugitive emissions of natural gas.

Equity

Reduced GHG emissions and pollution from criteria pollutants from the reduction in fossil fuel usage in buildings results in better health outcomes, especially for those in sensitive populations. The reduction in fossil fuel usage additionally provides economic benefits as electricity prices are projected to decrease while fuels as they are phased down in use will

become more expensive. This reduces the economic energy burden and is most impactful in disadvantaged communities where energy costs may make up a greater portion of total living expenses. To maximize these benefits, decarbonization efforts should be targeted in disadvantaged communities with sufficient support to avoid adding additional burden from the costs of implementing the decarbonization measures in these buildings.

GHG Reductions

GHG emission reductions were quantified under B-1 for this strategy.

Cost

Implementers of these decarbonization strategies will face many costs associated with pursuing all viable decarbonization projects, starting with the updated assessment and audit process which will be the basis for determining the highest impact projects. The projects themselves will range from less complex and least expensive such as lighting retrofits, to more complex energy efficiency projects and the implementation of energy efficiency strategies. In the long term, electrification at the scale suggested in this action will be very costly from the replacement of non-electric equipment to the necessary upgrades to the local grid and interconnections to allow for the high electricity demands of electrified buildings. As appropriate, the City may consider the use of Energy Savings Performance Contracts (ESPC), Energy-as-a-Service, or other public-private partnership or third-party financing options to accelerate implementation of all feasible decarbonization measures for City-owned buildings.

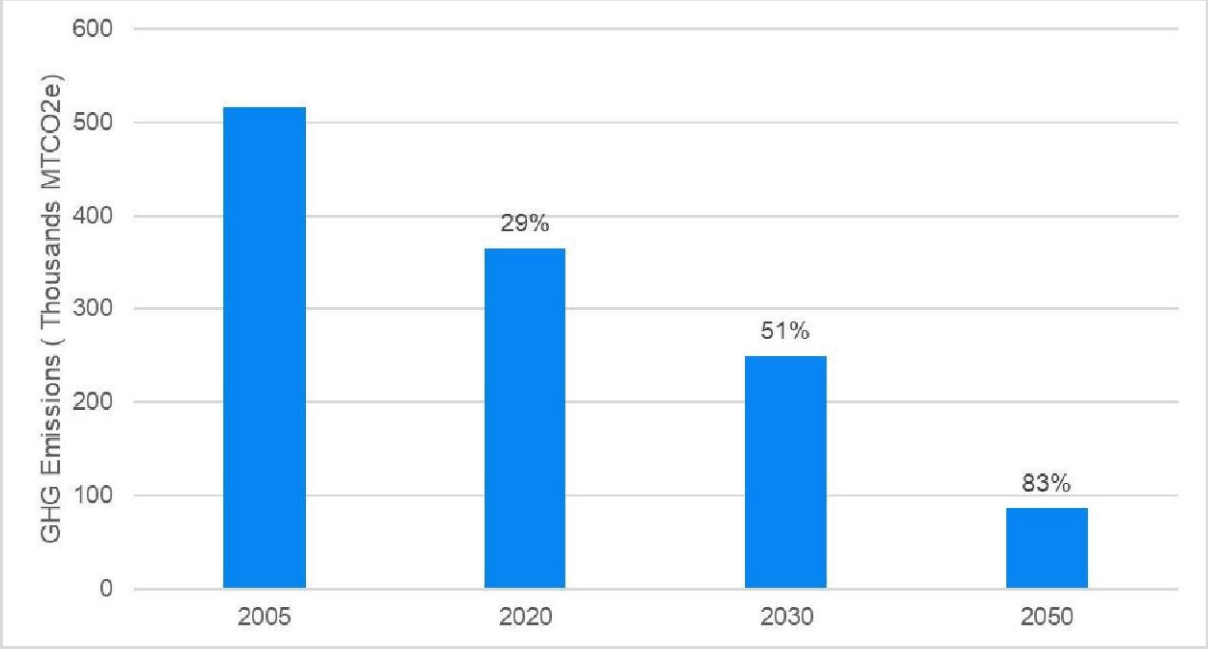
Transportation

The transportation sector includes three priority strategies addressing on-road GHG emissions:

- T-1: Reduce vehicle miles traveled (VMT)
- T-2: Accelerate the deployment of electric and alternative fuel vehicles
- T-3: Reduce City fleet fuel consumption and increase alternative fuel use in line with the City Alternative Fuel Policy

These strategies will result in a 51% reduction in GHG emissions by 2030 and an 83% reduction in GHG emissions by 2050 as compared to the 2005 base year (see Figure 12). As of 2020, GHG emissions were 29% below 2005 levels for the transportation sector. While development and growth occurred in the region during this time, vehicle efficiency improvements and management of VMT likely contributed to holding emissions stable.

Figure 12. Transportation GHG emissions under the GHG reduction pathway



Note: % indicates reductions in transportation emissions in the GHG reduction pathway year as compared to transportation emissions in 2005.

Consideration of Metropolitan Washington Council of Governments and Transportation Planning Board's 2030 GHG Goals

In 2021, the National Capital Region Transportation Planning Board (TPB) conducted a scenario study to assess ways to reduce GHG emissions in the on-road transportation sector. The study assessed the types of transportation-related actions, and their levels of implementation, that might be needed to reduce GHG emissions to meet regional goals of 50% reduction by 2030 and 80%-100% reduction by 2050 as compared to a 2005 baseline. The results of this study and options for GHG reduction goals for the on-road transportation sector were discussed at a May 18, 2022, TPB meeting and working session. Three goal options for on-road transportation were considered, including 1) an aspirational goal (50% reduction by 2030) identical to the region's overall (non-sector-specific) goal, 2) an aspirational goal (32% reduction by 2030) that would achieve the region's overall goal, assuming other sectors achieve reductions consistent with the 2030 Climate and Energy Action Plan, and 3) a pragmatic goal (23-29% reduction by 2030), based on GHG reduction strategies that appear to be supported by the TPB in a member survey. The TPB decided to adopt first option, an aspirational GHG reduction goal. As indicated by in the memo *Clarifications Regarding On-Road Transportation Greenhouse Gas (GHG) Reduction Goals and Strategies*, dated June 3, 2022, none of the scenarios analyzed as part of the 2021 study, including the most aggressive combinations of strategies, could achieve close to this aspirational goal. The most aggressive scenario analyzed illustrated a maximum GHG reduction of 33-36% reduction from 2005 GHG levels by 2030. This modeling was conducted at the regional level, however if Alexandria were to work towards achieving the aspirational goal set by the TPB of a 50% reduction in GHG emissions by 2030, additional technology, policy, and other advancements would need to occur, beyond what is considered available based on today's current technology understanding and policy and regulatory constructs. For example, this would likely require a combination of:

- Very rapid shifts to move the fleet toward zero emissions vehicles, so that nearly all new vehicles sold in the next few years would be electric or other zero emissions (beyond the level of the aggressive EV sales targets in California).
- Incentives for residents to get rid of their personal vehicles or trade in existing vehicles for zero emissions vehicles to remove conventional vehicles more rapidly from the fleet.
- Dramatic reductions in vehicle travel through aggressive strategies beyond parking pricing, road pricing, fare-free transit, enhanced transit services, increased telework, and other strategies analyzed as part of the study (e.g., may involve for instance, significant increases in fuel prices or other driving costs, limitations to driving in certain areas of the city (e.g., car-free zones), conversion of road lanes to transit or bicycle use only, significant increases to transit and shared vehicle services, provision of e-bikes to all residents, and other strategies.

T-1: Reduce vehicle miles traveled (VMT)

Through this strategy the City could implement several actions to reduce overall vehicle miles and accelerate the implementation of the *Alexandria Transit Vision and Mobility Plan* and the *Bike Master Plan*. This strategy includes the following actions:

- T-1.A: Implement strategies from the Alexandria Transit Vision and Mobility Plans
- T-1.B: Land use changes focused on redistribution of future growth to activity centers and areas better served by transit
- T-1.C: Advocate for reduced transit fares and parking pricing in workplaces
- T-1.D: Support telework policies
- T-1.E: Promote a job/housing balance by focusing on-site affordable housing units near transit, jobs, and amenities (language from Old Town North Small Area Plan)

Strategy T-1 Modeling Results

Total GHG Emissions Reduced from BAU

30,000 $MTCO_2e$ (2030)

50,000 $MTCO_2e$ (2050)

Interactions with Other Strategies

Strategy T-1 will support strategy T-3 by reducing miles traveled for city fleet, in addition to other vehicles. It will also support strategy T-2 by making electric and alternative fuel vehicles more accessible to those with concerns about long commuting distances with limited charging access.

Equity

Reducing VMT will have notable impacts across all three indicated areas of equity indicators. Related to economic impacts, this action lowers the transportation cost burden, reduces energy usage per capita, and reduces employment barriers related to commuting for marginalized communities. This action will provide significant health benefits by limiting harmful pollutants generated from burning transportation fuel, especially for sensitive populations. Also, reducing vehicle miles encourages more active modes of transportation (e.g., walking, biking) providing additional health benefits.

GHG Reductions

GHG emission reductions for reducing VMT is expected to be 30,000 $MTCO_2e$ below BAU levels in 2030 and 50,000 $MTCO_2e$ in 2050. This corresponds to a 12% VMT reduction in 2030 and a 15% VMT reduction in 2050.

Cost

The costs associated with strategy are high and fall more heavily on companies and businesses than the City government. The most significant cost comes from land purchase, land use change, and infrastructure development needed to create communities designed for low-emissions transit (e.g., walking, biking, public transportation). Additionally, to make these communities equitable, the inclusion of affordable housing will lower developers' return on

investment. For the City, however, some of these investments will recoup costs overtime (e.g., low O&M costs associated with electric bus fleets). Other lower costs include investment in technology to support telecommunications and creation and distribution of advocacy materials.

T-1.A: Implement strategies from Alexandria Transit Vision and Mobility Plan

Description	The Alexandria Transit Vision **(ATV)** Plan is a collaboration between the City of Alexandria and DASH to design a future bus network. The ATV plan recommends coordinating with the Washington Metropolitan Area Transit Authority (WMATA) and Arlington for route responsibility and coordination and expansion of key bus infrastructure such as bus bays, additional vehicles, and speed and reliability investments along key corridors. The plan also recommends securing funding from the City, the extent of changes depends on the budget allocation DASH receives. The AMP is a strategic update to the 2008 transportation master plan. Along with the expanded transit network outlined in the ATV plan, the AMP seeks to build out the city's priority transitway corridors and identify improvements on congested, high ridership corridors to reduce travel times, improve reliability, transition bus fleets to electric zero-emission vehicles, improve rider experience from trip planning (e.g., accessing stops, riding the bus, and arriving at destinations). It also recommends evaluating fare-free service and continuing to explore low-income WMATA fares, supporting a better-connected regional transit network, and modernizing the paratransit program for the city's aging population. Additionally, strategies from the AMP seek to improve safety, comfort and connectivity of bicycle and pedestrian infrastructure by addressing network gaps, upgrading existing infrastructure, improving signage and wayfinding, and other actions to increase the share of residents walking and biking for transportation.
Equity Impacts and Implementation Considerations	**Impacts:** An expanded transit network allows for underserved communities to have expanded access to mobility options and an increased ability to benefit from opportunities not previously reachable without the use of a personal vehicle. Eliminating or reducing transit fares would have the greatest economic benefit on low-income populations. Modernizing the paratransit program would improve access and reliability for elderly individuals. **Implementation:** As the strategies from the ATV and Mobility Plan move from planning to implementation stages, considerations of how to guide the strategies toward the greatest outcomes for disadvantaged populations.
Cost Considerations	The largest costs to implement this strategy are connected to the expansion of infrastructure, such as bus depots, street improvements for bus reliability and improved priority transit corridors. Additionally, the strategy of electrifying the bus fleet has high initial costs from the purchase of new vehicles but will likely recoup those costs with reduced O&M costs for the fleet.
Risks and Uncertainties	Much of the strategies laid out in the two plans rely on infrastructure investments that do not currently have guaranteed sources of funding, expanded transit networks will not be able to operate with the required capacity and reliability without sufficient infrastructure investment.
Lead Implementer(s)	Transportation and Environmental Services
Stakeholders and Partners	Office of Climate Action, DASH, Planning and Zoning, Office of Management and Budget

Milestone and Next Step	**Status**
• Identify and fund priority AMP and ATV policies, programs, and investments.	Implementing

T-1.B: Land use changes focused on redistribution of future growth to activity centers and areas better served by transit

Description	To allow for greater use of transit systems in currently active or planned expansion areas, transit-oriented development (TOD) should continue to be encouraged. This can be supported through land use change policies, allowing for more dense housing infrastructure, encouraging the development of mixed-used neighborhoods, supporting TOD efforts, and/or reducing or eliminating parking minimums in specific areas. The City's LRPIWP process coordinates long-range planning through a joint interdepartmental planning program that reflect plans currently in completion, studies or planning efforts currently underway, new plans scheduled to begin, or the status of implementing previously approved plans. In 2023, the LRPIWP includes starting a Vision Plan/Land Use Master Plan to engage the community in documenting and updating City policy established through the City's Small Area Plans since 1992 and the policy that will inform the City's future growth and challenges. Additionally, the LRPIWP includes related planning efforts that support land use changes that reflect opportunities to align areas better served by transit across jurisdictions. Additional planning efforts include the Duke Street Transitway, Update of City's Multi-modal Transportation Study Guidelines and Standards, Parking Standards Evaluation & Update. Moreover, the City has initiated the Zoning for Housing/Housing For All planning process to evaluate opportunities to promote affordable housing in activity centers and those areas better served by transit across jurisdictions. Additional efforts include implementation of the ATV and AMP. A robust public transportation system is a key ingredient to a successful community mobility strategy. The 2020 ATV Plan has provided a roadmap to achieve a future frequent, all-day bus network in Alexandria. The AMP is a strategic update to the City's 2008 Transportation Master Plan and focuses on expanding high-quality transportation choices so transportation in the city continues to serve the needs of residents, businesses, and visitors as the region grows and new technology impacts the ways we get around. The AMP supports transportation opportunities, that accommodate local and regional population and job growth, prepares for new mobility options and emerging technologies, promotes environmental responsibility to reduce greenhouse gas emissions from transportation sources, and enhances the City's focus on equity in transportation planning. Additionally, strategies from the AMP seek to improve safety, comfort and connectivity of bicycle and pedestrian infrastructure by addressing network gaps, upgrading existing infrastructure, improving signage and wayfinding, and other actions to increase the share of residents walking and biking for transportation. The effect of these efforts is focused on reducing Alexandria's VMT and TOD and its impact on reducing greenhouse gas emissions.

Equity Impacts and Implementation Considerations	**Impacts:** The development of new housing opportunities can provide economic drivers for all three areas of equity indicators. The focus on transit availability reduces VMT which lowers the transportation cost burden, reduces energy use, reduces employment barriers related to commuting for marginalized communities. Reduced VMT additionally has the potential to impact air quality, limiting harmful pollutants and improving health outcomes, especially in sensitive populations. **Implementation:** Any policy regarding land use change should be considered with the lens of equity considerations forefront to ensure that the maximum positive impact will be had for disadvantaged populations and that those groups are not left out of the benefits from new development.
Cost Considerations	The costs stemming from promoting land use change fall mostly on developers who will enact the vision that land use change policy seeks to accomplish.
Risks and Uncertainties	For developers, guidance will need to be offered to ensure that development does not fall squarely into the highest profit development. Without adequate guidelines there will likely be an imbalance in the groups who benefit from new development. The city must ensure that new developments have significant impacts on disadvantaged communities while still working towards profitable developments that developers are willing to take on.
Lead Implementer(s)	Planning and Zoning
Stakeholders and Partners	Transportation and Environmental Services, Housing, Recreation Parks and Cultural Activities, Office of Climate Action

Milestones and Next Steps	**Status**
• Identify and fund priority AMP and ATV policies, programs, and investments.	Implementing
• Conduct proposed L**RPIWP** planning processes planning efforts that support land use changes that reflect opportunities to align areas better served by transit across jurisdictions, including the Vision Plan/Land Use Master Plan, planning efforts for the Duke Street Transitway, update of City's Multi-modal Transportation Study Guidelines and Standards, Parking Standards Evaluation & Update, and the Zoning for Housing/Housing For All plan.	Proposed

T-1.C: Advocate for reduced transit fares and parking pricing in workplaces

Description	**Reduced transit fare and parking pricing in workplaces can lift barriers to those seeking to live and work within Alexandria. Along with that reduction comes the potential for reduced VMT with the reduction of distance of commutes and the increased use of public transit options.** **The City of Alexandria's GOAlex employer services program provides businesses and commuters assistance for using economical and eco-friendly transportation options. The City's GOAlex Program offers employers free assistance in designing and implementing a successful commuter benefits program and customized transportation solutions. The City's GOAlex Program provides complimentary assistance to businesses and organizations by offering an array of programs, including providing transit benefit assistance; seminars, special events and transportation fairs to help educate about transportation options; promoting bicycle programs; create parking management plans to help develop strategies to reduce demand for workplace parking. In addition, the City's GOAlex Program supports promotion of WMATA's SmartBenefits program to make it quick and easy to allocate transit tax benefits to a businesses' employees to promote transit use.**

	In September 2021, DASH eliminated fare collection on all DASH buses. This policy was made possible with the support of the Alexandria City Council. The intention of the policy was to encourage bus ridership, promote the New DASH Network, and alleviate a major financial burden for many low-income riders still recovering from the economic impact of the COVID-19 pandemic. More recently, the City of Alexandria was awarded $7.2 million in state grant funding to offset the cost of lost passenger fare revenues over the next three years through the Transit Ridership Incentive Program (TRIP), which is managed by the Virginia Department of Rail & Public Transit (DRPT). The DASH fare free program the fare-free program can be considered a major success story. The primary goals of the fare-free program are to reduce cost-related barriers to transit usage, especially for low-income riders, and to increase DASH ridership by drawing new customers and encouraging existing customer**s** to ride DASH more frequently. Other goals include reducing costs associated with fare collection, promoting awareness of the new DASH network, and improving bus speeds and reliability by decreasing dwell times at bus stops.
Equity Impacts and Implementation Considerations	**Impacts:** Encouraging the increased use of transit and reducing the cost of commuting by personal vehicles work toward positive economic outcomes by reducing the barrier to employment related to commuting costs. While encouraging the use of transit additional reduced VMT, leading to better health outcomes from the reduction of pollutants, and the encouragement of more active commuting methods, reducing parking prices in workplaces has the opposite effect, encouraging the use of personal vehicles and increasing VMT in the area which have negative health outcomes, especially for populations sensitive to criteria pollutants. **Implementation:** The focus on partnerships with transit authorities should be on reducing the burden of ridership for those most disadvantaged communities, especially if reduced transit fares are not universal. For parking pricing reduction, especially in cases where partners are employers, outreach should be directed to those businesses where a significant part of the employee base is from one of the equity populations to maximize impacts for those communities. Existing programs, such as WMATA's SmartBenefits program for commuters, should continue to be leveraged in GOAlex's advocacy and outreach materials.
Cost Considerations	The costs would stem from the creation of advocacy materials and the distribution of this material to the businesses that could implement these benefits. This action does not require any funds from the jurisdiction to run the program outside of offering those benefits to city employees.
Risks and Uncertainties	Because this action deals with advocacy and not the requirement for business to offer transit benefits, it is likely outside the control of the City how widespread these benefits become.
Lead Implementer(s)	Transportation and Environmental Services
Stakeholders and Partners	Planning and Zoning, Housing, Office of Climate Action

Milestones and Next Steps	**Status**
• Identify and fund priority AMP and ATV policies, programs, and investments.	Implementing

• Continue providing the City's GOAlex employer services program to provide businesses and commuters assistance for using economical and eco-friendly transportation options, including support for reduced transit fares through the WMATA SmartBenefits program, and providing seminars, special events and transportation fairs to help educate about transportation options; promoting bicycle programs; create parking management plans to help develop strategies to reduce workplace parking demand.	Implementing
• Support fare-free transit policies for DASH and WMATA as legal and financial opportunities allow.	Implementing

T-1.D: Support telework policies

Description	Telework has become increasingly popular as both a necessary way to continue work throughout the COVID-19 pandemic and as a choice by many employees. Supporting telework policies for City employees and private business**es** can reduce VMT, especially in areas not well served by current or future transit options. The City's GOAlex program encourages the reduction of automobile dependence, increasing mobility, and improving air quality through the promotion of public transit, ridesharing, bicycling, and walking as money and time-saving alternatives. GO Alex also works to improve the commuter experience, assisting employers with creating customized commuter programs for their employees. The City's GO Alex employer services program provides businesses and commuters assistance for using economical and eco-friendly transportation options such as providing guidance and best practices for implementing and supporting telework policies.
Equity Impacts and Implementation Considerations	**Impacts:** This action allows workers more freedom of choice in where they choose to live and work. It may also reduce the use of or need for a personal vehicle to commute to an office. The need for home working setups may not allow everybody to take advantage of teleworking opportunities, and not all business can realistically support telework.
Cost Considerations	For the City, continue offering telework options to City employees. Advocacy for teleworking policies in businesses will need to be conducted through existing GOAlex advocacy materials and outreach efforts by City staff.
Risks and Uncertainties	The need for home working setups may not allow everybody to take advantage of teleworking opportunities, and not all business can realistically support telework.
Lead Implementer(s)	Transportation and Environmental Services
Stakeholders and Partners	Planning and Zoning, Housing, Office of Climate Action

Milestones and Next Steps	**Status**
• Identify and fund priority AMP and ATV policies, programs, and investments.	Implementing
• Continue providing the City's GOAlex employer services program to provide businesses and commuters assistance for using economical and eco-friendly transportation options, including support for teleworking policies.	Implementing

T-1.E: Promote a job/housing balance by focusing on-site affordable housing units near transit, jobs, and amenities

Description	Actively seeking the development of affordable housing units near transit, jobs, and amenities promotes the creation of areas of mixed-use building types and uses with varied housing options, multi-modal transportation availability, and easy access to both residential and commercial activities. These diverse areas reduce the need for personal use vehicles and reduced VMT in Alexandria and allow for more opportunity of access for necessities and jobs for all members of the community. **Efforts described under** T.1-B also will benefit this action. Coordination with the Alexandria Redevelopment and Housing Authority (ARHA) and other affordable housing stakeholders will be vitally important to develop future affordable housing near activity centers and areas better served by low-to-moderate income residents. Many of these residents would be better served by housing being built near metro stations and transit hubs to provide better transportation options. The effect of these efforts is focused on reducing the Alexandria's VMT and TOD and its impact on reducing GHG emissions.
Equity Impacts and Implementation Considerations	**Impacts:** Reduced VMT and emissions will improve air quality and health outcomes. Greater access to retail leads to better nutritious food availability, and more opportunities for work without the need for a personal vehicle can lead to greater economic prospects. I**mplementation**: During the design of programs to promote on-site affordable housing units near transit, jobs, and amenities, the City should ensure the equity considerations are prioritized to ensure that the maximum benefits are generated for disadvantaged communities. For affordable housing projects, ensuring that a large enough portion of developments are affordable, and that those who need affordable housing have first access to these new developments is likely to be an important factor.
Cost Considerations	Costs to purchase land in desired areas will be considerable companies that may develop in areas where the development of affordable housing will have greater access to transit, jobs, and amenities. Incentivizing the development of affordable housing beyond what may be required by law may prove costly given the lower return on investment (ROI) compared to market-rate developments.
Risks and Uncertainties	The availability of land to develop into affordable housing where there will be most access to transit, jobs, and amenities is low in a previously developed city. Opposition from those who do not support affordable housing projects may make approval of developments more challenging.
Lead Implementer(s)	Planning and Zoning, Housing
Stakeholders and Partners	Transportation and Environmental Services, Recreation Parks and Cultural Activities, Office of Climate Action

Milestones and Next Steps	**Status**
• Identify and fund priority AMP and ATV policies, programs, and investments.	Implementing
• Conduct proposed L**RPIWP** planning processes that support land use changes that reflect opportunities to align areas better served by transit across jurisdictions, including the Vision Plan/Land Use Master Plan, planning efforts for the Duke Street Transitway, update of City's Multi-modal Transportation Study Guidelines and Standards, Parking Standards Evaluation & Update, and the Zoning for Housing/Housing For All plan.	Proposed

T- 2: Accelerate the deployment of electric and alternative fuel vehicles

This strategy, would expand accessibility to and public awareness of electric and alternative fuel vehicles. Emissions from charging are built into the transportation sector estimates using assumptions about grid emissions factors and energy efficiency (kWh/mi) for different vehicle classes. This strategy also includes reductions associated with changes to fuels for offroad vehicles and aviation operations.

Strategies T-2 and T-3 Modeling Results

Total GHG Emissions Reduced from BAU

41,000 $MTCO_2e$ (2030)

240,000 $MTCO_2e$ (2050)

This strategy includes the following actions:

- T-2.A: Implement recommendations that support EV charging infrastructure development (including addressing gaps in meeting charging demand)
- T-2.B: Provide education and outreach to the community about EVs and available state and national incentives
- T-2.C: Advocate with Dominion and regulators for fee-based EV charging; educate the community about these options
- T-2.D: Transition public fleets to electric (DASH)
- T-2.E: Connect private fleets with partners and opportunities to educate and incentivize electrification

Interactions with Other Strategies

Strategy T-2 will be supported by strategy T-1 by making electric and alternative fuel vehicles more accessible to those with concerns about long commuting distance with limited charging infrastructure. It will also be supported by CE-1 by electrifying and transitioning the transportation sector to alternative fuels.

Equity

Deploying electric and alternative fuel vehicles reduces GHG emissions and harmful pollutants from burning fossil fuels, thus improving air quality, particularly of concern for sensitive populations. This action will also aim to increase access to EVs for marginalized populations, who currently cannot afford new EVs. This trend is due to higher sticker prices, limited access to expensive charging infrastructure, lack of information on low-carbon vehicles, and other socio-economic barriers. Supporting the expansion of EV charging infrastructure may also generate new low-carbon construction jobs.

GHG Reductions

When combined with the actions under strategy T-3 (Reduce City fleet fuel consumption and increase alternative fuel use in line with the City Alternative Fuel Policy), GHG emission reductions for the transportation sector are expected to be 41,000 $MTCO_2e$ below BAU levels in 2030 and 240,000 $MTCO_2e$ in 2050.

Cost

The costs associated with Strategy T-2 are moderate to high and fall both on the Alexandria public and the City. Most of the costs will come from the purchase of electric and alternative fuel vehicles and the installation of charging infrastructure. Even with incentives like rebates for purchasing low-emission vehicles and installing chargers, the upfront costs are higher than those associated with an internal combustion engine (ICE) vehicle. Both public and private entities will have to determine the cost-efficiency of switching over from ICE vehicles. This switch will likely be more cost-efficient overtime though because electricity is cheaper than fossil fuels. Other lower costs associated with the strategy include new fees for public charge stations and creating and distributing advocacy materials.

T-2.A: Implement recommendations that support EV charging infrastructure development (including addressing gaps in meeting charging demand)

Description	With the aim of increasing the use of EVs, developing a robust charging infrastructure is a necessity to ease the barrier to entry that people have in switching to an EV. Implementing recommendations for new developments to have a requirement on EV charging spots where parking infrastructure is developed or encouraging city owned property or local businesses to install charging infrastructure are effective actions that can be taken to make more robust EV charging infrastructure prepared for the growing demand of electric vehicles in Alexandria. The Electric Vehicle Charging Infrastructure Readiness Strategy (EVRS) is the City's roadmap to anticipate the EV charging infrastructure needs of City residents, workforce members, and visitors as EVs become more mainstream. The EVRS identifies 31 recommendations —including potential near- and long-term actions—that support the Alexandria community's electric vehicle charging infrastructure needs. The recommendations address six key areas: • Meeting Charging Demand. Actions that remove charging availability as a barrier for segments of the population like vehicle owners without private parking. • Enhancing Communications and Awareness. Actions that inform and build capacity among the general population. • Strengthening Zoning, Building Codes, and Permitting. Actions that remove barriers to installing new charging infrastructure. • Advocating in State Government or with Dominion Energy. Actions for which City staff can advocate at the state level or with Dominion Energy that will strengthen the region's EV network. • Building Successful Business Models for Chargers. Actions that improve the business case for publicly-accessible charging stations.

Equity Impacts and Implementation Considerations	**Impacts:** Increasing the use of EVs reduces GHG and harmful pollutant emissions that are currently emitted from the burning of fossil fuel. This improves air quality, especially critical for sensitive populations. Reducing the energy consumption per capita, electric and alternative fuel vehicles will decrease the transportation cost burden as the price of fossil fuels increases. This action will also increase access to low-carbon vehicles for marginalized populations as most are currently used by affluent communities due to vehicle cost, charging infrastructure expense and access, information on low-carbon vehicles, and other socio-economic barriers. Supporting the expansion of EV charging infrastructure will also contribute new low-carbon construction jobs. **Implementation:** The City should work to expand charging infrastructure City-wide with a focus in low-income areas to make electric and alternative fuel vehicles more accessible as they become less expensive. The expansion of charging infrastructure in public locations will be crucial to this effort as most chargers are currently located in private residences and businesses. Alexandria's EVRS notes the large share of City residents that live in either multifamily dwellings or homes without driveways and garages; innovative and equitable solutions such as curbside (right-of-way) charging as seen in Montgomery County, MD and Los Angeles, CA offer examples for addressing the EV charging needs of those residents.
Cost Considerations	The installation of electric vehicle charging is a moderately expensive infrastructure project which can range in cost depending on the need for the jurisdiction to develop the infrastructure versus private businesses being incentivized to develop their own EV charging infrastructure projects. The largest costs are to the community as they will need to be the ones to make the individual choice to purchase an electric vehicle. Currently the costs of EVs are much greater than a comparable ICE vehicle, even with current incentives for people to purchase an EV.
Risks and Uncertainties	Charging infrastructure will only be needed if the demand is great enough to warrant large expansions of EV charging infrastructure. Currently EVs are much more expensive compared to ICE vehicles and it will depend on the market, along with any federal, state, or local incentives to bring the costs to a comparable level with ICE vehicles. This is not a certainty, and projects expanding EV charging infrastructure will not move forward if the demand for EVs is not similarly rising.
Lead Implementer(s)	Office of Climate Action
Stakeholders and Partners	Transportation and Environmental Services, Planning and Zoning, Code Administration, Recreation Parks and Cultural Activities, Regional Jurisdictions, Virginia Energy, MWCOG, regional utilities

Milestones and Next Steps	**Status**
• Appoint an EV Navigator and establish an Inter-departmental EV Charging Implementation Working Group.	Implementing
• Implement EVRS recommendations to meet charging demand, including: enhancing communications and awareness; strengthening zoning, codes, and permitting; and advocating for critical legislative changes with state government and Dominion Energy.	Implementing
• Build successful business models for chargers, including coordinating between parties' interested in new charging stations; consider City investment to support publicly accessible charging and develop City-owned charging stations as a last resort through the Capital Improvement Program EV Charging infrastructure Project or public-private partnership; and through regional coordination for state, federal, and utility incentives and funding.	Implementing

T-2.B: Provide education and outreach to the community about EVs and available state and national incentives

Description	One of the main barriers to the adoption of EVs and alternative fuel vehicles is the cost to the individual consumer. There are state and national incentives that help bring the costs to be more comparable to ICE vehicles, and where applicable, local tax rate options may also be considered. Some of these incentives are not well known or well understood by the public and efforts from Alexandria to increase awareness and provide education about these incentives can lead to the greater adoption of EVs and alternative fuel vehicles. Where vehicle ownership may not be desired or available, the City may also consider promoting or partnerships with car share programs that utilize electric vehicles instead of ICE vehicles.
Equity Impacts and Implementation Considerations	**Impacts:** Increasing the use of electric vehicles reduces GHG and harmful pollutant emissions that are currently emitted from the burning of fossil fuel. This improves air quality, especially for sensitive populations. Reducing the energy consumption per capita, electric, and alternative fuel vehicles will decrease the transportation cost burden as the price of fossil fuels increase. This action will also increase access to low-carbon vehicles for marginalized populations as most are currently used by affluent communities. This trend is due to limited access to expensive charging infrastructure, information on low-carbon vehicles, and other socio-economic barriers. One concern with the incentive programs relates to tax-based incentives where only those affluent enough to wait on receiving the incentive and have enough taxes owed to make full use of the incentive will have the most benefit from these incentive programs. **Implementation:** Ensure that educational opportunities are accessible in several forms (e.g., offering virtual and in-person meetings) to reach the most community members. A notable access constraint is limited Internet availability in marginalized communities.
Cost Considerations	The costs would stem from the creation of advocacy materials and the distribution of this material to the community where the increased awareness and understanding of incentives can help drive people to make the switch to an EV or alternative fuel vehicle.
Risks and Uncertainties	Even with the incentives that are offered, EVs and alternative fuel vehicles are likely to remain at a greater cost compared to an ICE vehicle, this is especially true in relation to tax incentives where not everybody can benefit.
Lead Implementer(s)	Office of Climate Action
Stakeholders and Partners	Transportation and Environmental Services, Planning and Zoning, Code Administration, Recreation Parks and Cultural Activities, Regional Jurisdictions, Virginia Energy, MWCOG, regional utilities

Milestones and Next Steps	**Status**
• Develop and implement technical assistance programs to support residential/small business/non-profits EV charging implementation to includes potential for leveraging local technical assistance providers to benefit workforce development and attract economic development opportunities.	Implementing
• Pursue state, federal, or public-private partnership funding opportunities to support implementation of incentives.	Implementing
• Develop and conduct outreach (e.g.**,** in-person and live-streamed events, info-graphics sustainable signage, social media and website content, hands-on learning experiences, partnerships) to promote use of City, regional, state, federal incentive programs (e.**g.,** Including IRA) other residential energy efficiency/renewable/ EV charging/rebate programs and leverage partnership opportunities.	Implementing

T-2.C: Advocate with Dominion and regulators for fee-based EV charging; educate the community about these options

Description	Some of the most impactful policies regarding EV charging infrastructure derive from state- and federal-level policy action, as well as through electric utility regulation and programs. The City's EVRS identifies several specific policies and programs the City could consider supporting through its state representatives, state agencies, federal policy advocacy, or in partnership with local electric and other utilities. For example, fee-based EV charging would result in users paying a fee to use public charging infrastructure, comparable to what private charging stations already charge. This will increase the accessibi**lity** of chargers, and private and public chargers would cost similar amounts. The resulting funds could be reinvested in the community by improving/expanding EV charging infrastructure or funding other actions that can help support Alexandria's climate goals.
Equity Impacts and Implementation Considerations	**Impacts:** Increasing the use of electric vehicles reduces GHG and harmful pollutant emissions that are currently emitted from the burning of fossil fuel. This improves air quality, especially for sensitive populations. Reducing the energy consumption per capita, electric and alternative fuel vehicles will decrease the transportation cost burden as the price of fossil fuels increases. This action will also increase access to low-carbon vehicles for marginalized populations. **Implementation:** Ensure that educational opportunities are accessible in several forms (e.g., offering virtual and in-person meetings) to reach the most community members. A notable access constraint to EVs is limited Internet access in marginalized communities to monitor the charge status.
Cost Considerations	The main cost will be the users of EVs who may have previously been using free public EV chargers would have to pay a fee, increasing the cost of owning an EV in Alexandria. Education and advocacy tend to have little to no new costs associated for implementation as it is absorbed through existing efforts.
Risks and Uncertainties	The increased costs of EV ownership due to the fee-based EV charging has the potential to disincentivize the community from adopting EVs, even if the potential savings compared to an ICE vehicle are still happening. This could work against other goals that support the adoption of EVs in the community.
Lead Implementer(s)	Office of Climate Action
Stakeholders and Partners	Transportation and Environmental Services, Planning and Zoning, Code Administration, Recreation Parks and Cultural Activities, Regional Jurisdictions, Virginia Energy, MWCOG, regional utilities

Milestones and Next Steps	**Status**
• Support state and federal EV purchase rebates and clean car (ZEV) mandates.	Implementing
• Advocate to Dominion Energy and regulators opportunities to support EV ownership and charging station deployment by designing tariffs that alleviate demand charges and introduce fee-based rates to expand and support cost-effective publicly-accessible charging options. or fleet fast chargers. Further, pursue state, federal, or public-private partnership funding opportunities to support implementation publicly-accessible charging opportunities supported through fee-based rates.	Not Implemented
• Advocate additional policy actions to Virginia General Assembly, State Corporation Commission, and electric utilities that are demonstrated to support greater charging infrastructure, including charging infrastructure incentives and rebates, charger make-ready programs, and aggressive low-carbon fuel standards	Not Implemented

T-2.D: Transition public fleets to electric (DASH)

Description	The EAP stated the intent to develop a plan to acquire zero-emissions buses on rapid transit routes and convert the DASH and ACPS fleet to zero emissions vehicles. The DASH Board of Directors and the City of Alexandria have adopted a policy goal of converting the entire fixed-route bus fleet to 100% zero emissions (ZE) technology by the year 2035 and have required that all new bus purchases starting in 2027 will have zero tailpipe emissions. Based on this policy directive, DASH has been at the forefront of the fleet electrification movement over the last three years. In 2020, DASH completed a DASH Zero Emission Fleet Feasibility Study to determine the best path forward for DASH to achieve its goals of transitioning its fleet to zero emission buses. DASH then completed the first phase of its Zero Emission Bus (ZEB) Implementation Plan in 2021, which focused on facility expansion and improvements needed to support a ZEB fleet. The Alexandria Transit Company (DASH) received approximately $5.1 million for six battery-electric transit buses and fast chargers. The funding has been allocated from the Volkswagen Environmental Mitigation Trust (VW Trust), as well as statewide transit capital funding. The Commonwealth received the VW Trust as part of its emissions violation settlement with Volkswagen. Prior to acquiring the buses, DASH and the City of Alexandria partnered with The Center for Transportation and the Environment (CTE) to perform a zero-emission bus fleet feasibility and planning study. CTE provided a feasibility recommendation for deploying zero-emission bus technology into DASH service. This partnership builds on prior action taken by DASH to gain a better understanding of various types of low- to zero-emission bus technology. The study evaluated economic cost, risks, and performance expectations of the DASH fleet to provide insight on responsibly and sustainably transitioning to an all zero-emission fleet. Another important outcome of the feasibility study was to create of scope of work for the DASH ZEB Implementation Plan. In addition to the first six 100% electric buses, DASH has secured funding for 20 additional electric buses by 2025 through Northern Virginia Transportation Authority (NVTA) and DRPT grant programs. A total of fourteen buses are currently in operation. DASH is planning to expand and upgrade its facility in the coming years to accommodate this new fleet of electric buses. The City's vehicle fleet contains a small amount of EVs currently. Transitioning the vehicle fleets of the police and sheriff's department to zero emission vehicles will vastly reduce overall emissions. Most emissions from the police fleet occur from idling when officers are out on patrol and the transition to electric vehicles will eliminate this main source of emissions
Equity Impacts and Implementation Considerations	**Impacts:** Deploying electric and alternative fuel vehicles reduces GHG emissions and harmful pollutants from burning fossil fuels, thus improving air quality, particularly critcal for sensitive populations. **Implementation:** In the implementation of the transition of the DASH fleet to electric, considerations should be made to transition buses that cover areas where there is a larger proportion of people from disadvantaged communities. This then increases the potential localized air quality improvements to those areas where air quality improvements will lead to the largest health outcome improvements.

Cost Considerations	Electric vehicles, especially larger vehicles like buses, come at a significantly higher cost than an ICE bus. There are incentives for electric vehicles, especially for the transition to electric public transportation that can help alleviate these costs but there is still likely to be additional costs in purchasing electric buses over ICE alternatives. Over time, the lower cost of electricity versus fossil fuel will make the fleet more economically viable, which larger organizations can more easily consider when deciding to upgrade their fleet.
Risks and Uncertainties	The risk of transitioning to an electric fleet comes with how the transition takes place, by gradually replacing the fleet at buses reach the end of their service life the risk of not having adequate capacity to run service effectively while the role of the bus network is being expanded is mitigated.
Lead Implementer(s)	DASH / Transportation and Environmental Services
Stakeholders and Partners	General Services, Office of Climate Action

Milestones and Next Steps	**Status**
• Complete Phase 2 of the DASH Zero-Emission Bus Implementation Plan to evaluate current ZEB fleet; timing and phasing of transitioning to a full ZEB fleet; conducting energy, maintenance, and utility grid assessments; and evaluating the total cost of ownership of a ZEB fleet.	Implementing
• Design and build an expansion bus depot to include ZEB charging infrastructure.	Implementing
• Pursue state, federal, or public-private partnership funding opportunities to support implementation of DASH Zero-Emission Bus Fleet.	Implementing

T-2.E: Connect private fleets with partners and opportunities to educate and incentivize electrification

Description	Education and outreach combined with voluntary incentive programs can accelerate the adoption of electric vehicles in private fleets.
Equity Impacts and Implementation Considerations	**Impacts:** The deployment of electric and alternative fuel vehicles reduces GHG emissions and harmful pollutants from burning fossil fuels, thus improving air quality, particularly for sensitive populations. However, this action will have a limited impact on other indicators of equity for the broader community due to the size of private fleets compared to all vehicles in Alexandria. **Implementation:** This action is unlikely to have equity impacts during the implementation of the action.
Cost Considerations	Alternative fuel and electric vehicles are currently significantly more expensive than traditional ICE vehicles, especially for larger vehicles such as trucks. While there are incentives to reduce this barrier, it does not fully alleviate the additional costs for alternative fuel and electric vehicles, and it will be a consideration for private fleets to ensure it is economically viable to switch to electric or alternative fuel fleets.
Risks and Uncertainties	This action would be more effective with the reduction in cost of alternative fuel and electric vehicles. While the costs are expected to decrease over time, this is not something that private fleet owners can affect, as prices are determined by market forces, and the level of incentivization offered by federal and state legislation.
Lead Implementer(s)	Office of Climate Action
Stakeholders and Partners	Transportation and Environmental Services, OCPI, Alexandria Economic Development Partnership

Milestones and Next Steps	Status
• Develop and conduct outreach (e.g., in-person and live-streamed events, info-graphics sustainable signage, social media and website content, hands-on learning experiences, partnerships) to promote use of electric vehicles in private fleets, including commercial fleets, taxis, and transportation network companies (TNCs).	Not Implemented

T-3: Reduce City fleet fuel consumption and increase alternative fuel use in line with the City Alternative Fuel Policy

This strategy includes the following actions:

- T-3.A: Optimize the size of the City fleet
- T-3.B: Increase average fuel economy of City fleet
- T-3.C: Reduce VMT through various best practices (i.e., teleconferencing, limited idling, alternative modes of transportation, optimized routes, centralized meeting locations)
- T-3.D: Purchase vehicles with highest emissions certification standards
- T-3.E: Increase use of alternative fuel vehicles and equipment (i.e., electric and hybrid vehicles)

Strategies T-2 and T-3 Modeling Results

Total GHG Emissions Reduced from BAU

Included in T-2

Interactions with Other Strategies

Strategy T-3 supports strategy T-1 by implementing best practices like teleconferencing and incentivizing alternative modes of transportation, among others. Additionally, expanding alternative fuel City vehicles affects the amount of carbon-free electricity needed by the city to achieve Strategy CE-2. Strategy T-3 would also be supported by CE-1 by electrifying and transitioning the transportation sector to alternative fuels.

Equity

This action will reduce GHG emissions and harmful pollutants from burning fossil fuels, thus improving air quality. Over time, this also will likely reduce costs as alternative fuel sources fall in price while fossil fuel prices increase. However, this action will have a limited impact on other indicators of equity for the broader community.

GHG Reductions

GHG emission reductions for this strategy are included in the reductions for T-2.

Cost

The costs associated with Strategy T-3 are moderate to high and mostly fall on the City. Alternative and electric vehicles cost more compared to ICE vehicles, even after incentives. Purchasing these vehicles will be a significant, but necessary, cost to the City to achieve a lower average fuel economy and improved emissions standards across their fleet. However, the lower cost of electricity versus fossil fuel will make the fleet more economically viable overtime. The

City may also need to invest in additional technology to reduce VMT by means like teleconferencing, but these costs should be relatively low.

T-3.A: Optimize the size of the City fleet

Description	Emissions can be reduced by decreasing vehicle sizes within of the City fleet to the extent possible. The City's Alternative Fuel Fleet Policy provides guidance on decreasing vehicle size as well as goals to replace 25% of the City's fleet with electric vehicles by 2024 and reducing overall vehicle emissions from the City's fleet by 25% over the next 10 years. As more electric charging infrastructure comes available, the City will explore all options to lower emissions and purchase the most cost-effective vehicles possible.
Equity Impacts and Implementation Considerations	**Impacts:** The reduced VMT from the city fleet will lead to reduced air pollution from the burning of fossil fuels, improving air quality. However, this action will have a limited impact on other indicators of equity for the broader community due to the size of the city fleet compared to all vehicles in Alexandria. **Implementation:** This action is not expected to have significant equity impacts during the implementation of the action.
Cost Considerations	By reducing the size of the fleet, the City is expected to reduce O&M costs for their fleet. This is especially effective when a fleet of vehicles comes to the end of its service life and rather than being replaced with a new vehicle, has its function replaced with an existing vehicle in the fleet.
Risks and Uncertainties	A thorough review of the uses and potential overlap in uses for the City's fleet is needed to ensure that if a vehicle is phased out, there are no likely scenarios where the City cannot accomplish the task performed by that vehicle. This becomes especially important to consider in scenarios where the fleet is currently out under stress and is used near capacity.
Lead Implementer(s)	Transportation and Environmental Services
Stakeholders and Partners	City departments, Office of Management and Budget, Department of Finance

Milestones and Next Steps	**Status**
• Continue implementation of City's Alternative Fuel Fleet Policy, including implementing considerations for optimizing fleet size **within** of the City fleet to the extent possible.	Implementing

T-3. B: Increase average fuel economy of City fleet

Description	The City's Alternative Fuel Fleet Policy provides guidance on increasing the use of alternative fuel vehicles and equipment, to include goals to increase the overall average fuel economy of the City fleet over time. The Alternative Fuel Fleet Policy includes goals to replace 25% of the City's fleet with electric vehicles by 2024 and reducing overall vehicle emissions from the City's fleet by 25% over the next 10 years. As more electric charging infrastructure comes available, the City will explore all options to lower emissions and purchase the most cost-effective vehicles possible.
Equity Impacts and Implementation Considerations	**Impacts:** The reduced fuel usage from the city fleet will lead to reduced air pollution from the burning of fossil fuels, improving air quality. However, this action will have a limited impact on other indicators of equity for the broader community due to the size of the city fleet compared to all vehicles in Alexandria. **Implementation:** This action is not expected to have significant equity impacts during the implementation of the action.

Cost Considerations	To increase the average fuel economy of the City fleet, new vehicles will have to be purchased. Higher efficiency vehicles, especially alternative fuel and electric vehicles are more costly than ICE vehicles, even with incentives. This requires a significant investment in the fleet from the city to drive up the average fuel economy of the City fleet.
Risks and Uncertainties	This action would be more effective with the reduction in cost of alternative fuel and electric vehicles. While the costs are expected to decrease over time, this is not something the City can affect, as prices are determined by market forces, and the level of incentivization offered by federal and state legislation. Additionally, not all vehicles in the city fleet can be replaced with an electric or alternative fuel option, replacing a vehicle with a more fuel-efficient option may not be worth the cost of replacement, and if new vehicles allow for a switch to and EV or alternate fuel option, they are likely to be significantly more expensive than current ICE vehicles.
Lead Implementer(s)	Transportation and Environmental Services
Stakeholders and Partners	City departments, Office of Management and Budget, Department of Finance

Milestones and Next Steps	**Status**
• Continue implementation of City's Alternative Fuel Fleet Policy, including implementing considerations for increasing the use of alternative fuel vehicles and equipment, including electric and hybrid vehicles.	Implementing

T-3.C: Reduce VMT through various best practices

Description	Work to reduce VMT of the City fleet by implementing best practices such as teleconferencing, limited idling, alternative modes of transportation, optimized routes, and centralized meeting locations.
Equity Impacts and Implementation Considerations	**Impacts:** The reduced VMT from the city fleet will lead to reduced air pollution from the burning of fossil fuels, improving air quality. However, this action will have a limited impact on other indicators of equity for the broader community due to the size of the city fleet compared to all vehicles in Alexandria. **Implementation:** The actions being implemented should be designed to ensure that behavioral changes and technology changes to how business is conducted by the City do not lead to further barriers for disadvantaged communities to participate, such as public meetings that are held virtually, which some people may not have adequate technology to attend.
Cost Considerations	Most of these best practices come at little cost to the City to implement. The main costs come from ensuring there is adequate technology available to implement teleconferencing successfully in a way that does not cut off access to those who do not have access to technology that allows them to participate.
Risks and Uncertainties	If people do not have access to the requisite technology to participate in teleconferencing, there could be unintended barriers to participation in City politics. This can also be said for centralized locations for meetings as a lack of transit options or length of commute may become a barrier for those who wish to participate if not managed thoughtfully.
Lead Implementer(s)	Transportation and Environmental Services
Stakeholders and Partners	City departments, Information Technology Services, Human Resources

Milestones and Next Steps	**Status**
• Continue implementation of City's Alternative Fuel Fleet Policy to include limiting idling, promoting alternative modes of transportation and optimized routes.	Implementing
• Continue outreach of anti-idling policies and practices to City departments.	Implementing

• Continue implementation of best practices such as teleconferencing and providing opportunities for centralized meeting locations.	Implementing

T-3.D: Purchase vehicles with highest emissions certification standards

Description	The City's Alternative Fuel Fleet Policy provides guidance on increasing the use of alternative fuel vehicles and equipment to include goals to replace 25% of the City's fleet with electric vehicles by 2024 and reducing overall vehicle emissions from the City's fleet by 25% over the next 10 years. However, the City will review purchases for the City fleet to ensure that any vehicles that do partly or fully use fossil fuels will meet the highest emission certification standards to limit the emission of GHG and other criteria pollutants.
Equity Impacts and Implementation Considerations	**Impacts:** Vehicles with higher emission certificate standards are more fuel efficient and will reduce GHG emissions along with air pollution, improving air quality. However, this action will have a limited impact on other indicators of equity for the broader community due to the size of the city fleet compared to all vehicles in Alexandria. **Implementation:** This action is not expected to have significant equity impacts during the implementation of the action.
Cost Considerations	Vehicles that meet higher emissions certification standards, especially those that go significantly beyond federal, or state standards are likely to be more costly compared to other vehicles.
Risks and Uncertainties	The continued use of ICE vehicles in the City fleet does not fully align with other recommended actions, driving the transition to EVs and alternative fuel vehicles. Additionally, the increased costs for the vehicles that meet the highest emissions certification standards may not be justified for the emission reductions compared to vehicles that do not meet the highest emissions certification standards.
Lead Implementer(s)	Transportation and Environmental Services
Stakeholders and Partners	City departments, Office of Management and Budget, Department of Finance

Milestones and Next Steps	**Status**
• Continue implementation of City's Alternative Fuel Fleet Policy to include review of City fleet and equipment purchases for any vehicles that do partly or fully use fossil fuels will meet the highest emission certification standards to limit the emission of GHG and other criteria pollutants.	Implementing

T-3.E: Increase use of alternative fuel vehicles and equipment (i.e., electric and hybrid vehicles)

Description	The City's Alternative Fuel Fleet Policy includes goals to replace 25% of the City's fleet with electric vehicles by 2024 and reducing overall vehicle emissions from the City's fleet by 25% over the next 10 years. As more electric charging infrastructure comes available, the City will explore all options to lower emissions and purchase the most cost-effective vehicles possible.
Equity Impacts and Implementation Considerations	**Impacts:** This action will reduce GHG emissions and harmful pollutants from burning fossil fuels, thus improving air quality. Overtime, this also will likely reduce costs overtime as alternative fuel sources fall in price while fossil fuel prices increase. However, this action will have a limited impact on other indicators of equity for the broader community. **Implementation:** This action is not expected to have significant equity impacts during the implementation of the action.

Cost Considerations	Alternative fuel vehicles are currently significantly more expensive than traditional ICE vehicles, especially for larger vehicles such as trucks. While there are incentives to reduce this barrier, it does not fully alleviate the additional costs for alternative fuel and electric vehicles.
Risks and Uncertainties	This action would be more effective with the reduction in cost of alternative fuel and electric vehicles. While the costs are expected to decrease over time, this is not something the City can affect, as prices are determined by market forces, and the level of incentivization offered by federal and state legislation.
Lead Implementer(s)	Transportation and Environmental Services
Stakeholders and Partners	City departments, Office of Management and Budget, Department of Finance

Milestones and Next Steps	**Status**
• Continue implementation of City's Alternative Fuel Fleet Policy, including implementing considerations for increasing the use of alternative fuel vehicles and equipment, including electric and hybrid vehicles.	Implementing

Carbon-Free Electricity

The City is prioritizing two strategies to increase the availability of clean and renewable electricity for the City:

- CE-1: Support implementation/acceleration of the VCEA by increasing carbon-free electricity
- CE-2: Transition all applicable Alexandria government facilities to 100% renewable electricity

The emission reductions associated with the increased availability and use of renewable and clean electricity in Alexandria is modeled and represented within the buildings and transportation sector results. GHG reductions presented within this section are for informational purposes only, to help facilitate the understanding of the role of lower and zero carbon electricity in meeting the City's GHG reduction goals.

CE-1: Support implementation/acceleration of the Virginia Clean Economy Act (VCEA) by increasing carbon-free electricity

VCEA establishes a 100% clean energy target for the state's largest utility (and the utility serving Alexandria) by 2045 and for the rest of the state by 2050. The City and its stakeholders can help support the implementation and acceleration of achieving the VCEA's clean electricity goals through a series of actions:

- CE-1.A: Increase on-site renewable deployment within the City (through SolarizeAlexandria, Solar Equipment Tax Exemption, Green Building Policy (new construction), and low- and moderate-income programs)
- CE-1.B: Support deployment of battery storage through promoting community ownership, incentives, and pairing with on-site renewables
- CE-1.C: Consider implementation of municipal/community choice aggregation program
- CE-1.D: Encourage large-scale off-site renewable energy through working with businesses and other organizations within the City to procure through PPAs

Strategy CE-1 Modeling Results (Informational)

Total GHG Emissions Reduced from BAU

370,000 $MTCO_2e$ (2030)

None (2050)

Unlocking a clean, reliable electricity grid is the most critical aspect of achieving the City's climate goals. Not only will grid decarbonization immediately result in lower carbon intensities for current electricity uses, but it can also accelerate and amplify additional reductions through 2050 and beyond as different end uses (e.g., cars, building heating systems, appliances) electrify. Within this plan, a low or no carbon electric mix will further support GHG reductions within the Buildings Energy and Transportation Sectors, and more specifically as the City pursues actions to electrify both buildings and the transportation sector.

Within the modeled pathway towards carbon neutrality, the achievement of the 2045 carbon-free grid is assumed.

Interactions with Other Strategies

Strategy CE-1 will contribute to achieving the goals of strategies B-2 and B-3, contributing to decarbonization of buildings and increasing the GHG reductions seen from electricity use in new and existing buildings. In addition, strategy CE-1 will also support achieving the goals of strategies T-2 and T-3 of electrifying and transitioning the transportation sector to alternative fuels.

Equity

Installation of distributed renewable energy (e.g., solar panels) within the City is not expected to tangibly address inequities such as regional air quality improvements and related public health impacts. However, equity is a key consideration in the design of programs and policies that support the deployment of renewable energy within the City and for access to renewable energy through other means including municipal aggregation or PPAs. For those that install panels on-site or are a part of potential large-scale or aggregated buying structures, energy costs can be reduced over time, but these types of actions require upfront financial investments and education. People who live in multi-family buildings where there is limited control over energy choices typically are not able to individually install solar panels. Additionally, disproportionate actions from higher income homes and businesses could increase electricity rates, creating a disproportionate impact on lower income utility customers.

GHG Reductions

GHG emission reductions associated with increased renewable and clean electricity in Alexandria are included in building and transportation sector results. The contribution of a municipal aggregation program is expected to result in emissions reductions of 370,000 $MTCO_2e$ below BAU levels in 2030 and none in 2050.

Cost

Although the capital costs of developing renewable energy and energy storage projects may be significant, the investment generally decreases future energy costs to energy users. This is true for both grid-scale facilities as well as for rooftop solar projects at the individual customer level. It's important to note that the upfront capital cost of renewable energy and storage continues to fall, and that tax credits also provide a financial incentive to install renewable energy installations.

CE-1.A: Increase on-site solar deployment within the City (through SolarizeAlexandria, Solar Equipment Tax Exemption, Green Building Policy (new construction), and low- and moderate-income programs)

Description	The City has prioritized the installation of on-site solar at select facilities to increase the share of renewable electricity supply over time. The 2040EAP identifies the following actions to support this outcome: • 2.1.3 (By FY2023, ensure that direct purchasing of off-site renewable electrical energy accounts for at least 50 % of electrical energy use at all City-operated facilities. The remainder will be made up by REC purchases and on-site renewable electrical energy generation to achieve a 100 % renewable energy supply.) • 2.1.5 (By FY2028, ensure that direct purchasing of off-site renewable electrical energy accounts for at least 80 % of electrical energy use at all City-operated facilities. Ensure it is from a regional source that contributes to the growth of renewable energy capacity in the region. On-site renewable electricity generation and REC purchases will make up the remainder, to achieve a 100 % renewable electrical energy supply.) To support the increase of on-site solar through the Alexandria community, the City provides programs to expand on-site solar opportunities for existing non-City buildings. These programs include the annual SolarizeAlexandria campaign and the provision of a Solar Energy Equipment Tax Exemption. Since 2014, the SolarizeAlexandria campaign has supported the installation of 75 on-site solar installations totaling nearly 500 kW of installed solar capacity which has contributed to the 1.5MW of on-site solar in the Alexandria community as of 2021. Furthermore, the City's certification as a SolSmart Gold designation in July 2020 for its work to support installation of on-site solar in the Alexandria community. In addition, the Green Building Policy provides a pathway for installation of on-site solar on new building construction. Additionally, state and federal programs (including extension of the federal Investment Tax Credit) will also support investment in on-site solar deployment for new and existing buildings.
Equity Impacts and Implementation Considerations	**Impacts:** Installation of on-site renewable energy is unlikely to address inequities associated with regional air quality and public health impacts. Inequities may be exacerbated if the transition to a renewable energy system results in disproportionate actions from higher income homes and businesses increasing electricity rates for lower income utility customers. However, increased deployment of affordable solar energy throughout the community will reduce the energy burden on communities as a relatively inexpensive energy source that continues to decline in cost overtime. **Implementation:** This action will have a limited impact on other indicators of social equity for the broader community.
Cost Considerations	The upfront capital cost associated with grid-scale or behind-the-meter renewable energy projects can be significant. These costs are decreasing, as the industry matures and costs decrease (e.g., decreasing price of solar panels). In addition, tax credits offset some of the upfront capital costs. Lastly, energy costs over time are lower with renewable energy projects compared to fossil fuel power generation, resulting in significant energy cost savings over time.
Risks and Uncertainties	Deployment of on-site renewables should be considered in parallel to energy storage systems to provide consistent electricity to end users. In addition, consideration should be given to electrical grid impacts including grid interconnection.

Lead Implementer(s)	Office of Climate Action
Stakeholders and Partners	Transportation and Environmental Services, Planning and Zoning, Recreation Parks and Cultural Activities, Code Administration, Department of Finance, OCPI, Housing

Milestones and Next Steps	**Status**
• Develop and conduct outreach (e.g., in-person and live-streamed events, info-graphics sustainable signage, social media and website content, hands-on learning experiences, partnerships) to promote use of City, regional, state, federal incentive programs (e.g., Solar Energy Equipment Tax Exemption, IRA programs, etc.) to expand on-site solar opportunities, including participation in annual SolarizeAlexandria campaigns.	Implementing
• Develop and implement technical assistance programs to support residential/small business/non-profits on-site solar implementation to include potential for leveraging local technical assistance providers to benefit workforce development and attract economic development opportunities.	Not Implemented
• Pursue state, federal, or public-private partnership funding opportunities to support implementation of incentives.	Not Implemented

CE-1.B: Support deployment of increased battery storage for on-site solar through promoting community ownership, incentives, and pairing with on-site renewables

Description	This action supports the increased deployment of battery storage through promotion of community ownership, incentives, and paring with on-site renewables. The installation and operation of behind-the-meter batteries can support distributed renewable energy generation efforts and improve resilience of local properties.
Equity Impacts and Implementation Considerations	**Impacts:** The deployment of battery storage to pair with on-site renewables will contribute to GHG remissions reductions and improved regional air quality. However, like CE-1.A, this action is unlikely to address inequities associated with regional air quality and public health impacts. **Implementation:** Renewable energy projects combined with battery storage, if strategically located to benefit disadvantaged neighborhoods, could have a beneficial impact and improve resilience.
Cost Considerations	Although battery costs are decreasing, they still require an upfront capital expenditure that can be prohibitive. Tax credits help offset the upfront capital cost, and a battery paired with a renewable energy system contribute to long term energy cost savings.
Risks and Uncertainties	Battery technology is evolving. Lithium-ion batteries currently dominate the market, and other energy storage alternatives are being explored and deployed (e.g., hydrogen, zinc-ion, redox flow). These alternatives may have properties that are more aligned with the user's needs, such as long-duration storage. Investing in a battery technology now may lock-in the user for decades to come. The City can support battery storage through a technology agnostic approach.
Lead Implementer(s)	Office of Climate Action
Stakeholders and Partners	Planning and Zoning, Transportation and Environmental Services, Code Administration

Milestones and Next Steps	Status
• Develop and conduct outreach (e.g., in-person and live-streamed events, info-graphics sustainable signage, social media and website content, hands-on learning experiences, partnerships) to promote use of City, regional, state, federal incentive programs (e.**g.,** Solar Energy Equipment Tax Exemption, IRA programs, etc.) to expand battery storage opportunities with the implementation on-site solar installation. Continue to offer battery storage opportunities through annual SolarizeAlexandria campaigns.	Not Implemented
• Develop and implement technical assistance programs to support residential/small business/non-profits use of battery storage with on-site solar implementation, including leveraging local technical assistance providers to benefit workforce development and attract economic development opportunities.	Not Implemented
• Pursue state, federal, or public-private partnership funding opportunities to support implementation of incentives for battery storage.	Not Implemented

CE-1.C: Consider implementation of municipal/community choice aggregation program

Description	A municipal/community choice aggregation program would enable the City or a regional partner to purchase renewable electricity in bulk from an electricity supplier on behalf of the City residents and businesses to accelerate transition the clean electricity.
Equity Impacts and Implementation Considerations	**Impacts:** Should the municipal aggregation program result in procurement of renewable energy resources that displaces fossil fuel electricity generation sources, this will reduce GHG emissions and thus improve air quality while reducing energy costs for the government. However, this action will have a limited impact on other indicators of social equity for the broader community. **Implementation:** A municipal/community choice aggregation program would need to be carefully managed to ensure that costs remain competitive with conventional sources. Renewable energy projects combined with battery storage, if strategically located to benefit disadvantaged neighborhoods, could have a beneficial impact and improve resilience.

Cost Considerations	Although there is a cost associated with procuring energy on behalf of customers, this cost is ultimately borne by the customer. The costs associated with administering a municipal/community choice aggregation program would need to be explored and considered by the City.
Risks and Uncertainties	Although Virginia has legislation enabling municipal aggregation models, there is the risk that any program could be challenged in court and implementation held up in court proceedings. In addition, there is also the risk of push-back from traditional utilities that would face potential new competition.
Lead Implementer(s)	Office of Climate Action
Stakeholders and Partners	City Attorney Office, Department of Finance, Regional jurisdictions, Virginia Energy, electric utilities
Milestones and Next Steps	**Status**
• Coordinate with regional jurisdictions, including Arlington and Fairfax counties, to conduct necessary legal, technical and market feasibility, and organizational structure study to evaluate opportunities for local or regional implementation of a municipal/community choice aggregation program to accelerate renewable electricity opportunities for residents and businesses.	Not Implemented
• Advocate to the Virginia General Assembly and State Corporation Commission for clear authority for Alexandria (and regional jurisdictions) for local or regional implementation of a municipal/community choice aggregation program to accelerate renewable electricity opportunities for residents and businesses.	Not Implemented

CE-1.D: Encourage large-scale off-site renewable energy by working with businesses and other organizations within the City to procure through PPAs

Description	Large businesses and organizations operating in Alexandria could participate in utility-scale power purchase agreements (PPAs) and procure renewable energy. Encouraging pursuit of large-scale PPAs could be achieved through a regional or local framework or program that coordinates PPAs. This could include the City educating businesses and organizations on PPAs, facilitating introductions between interested parties, and helping potential partners identify and address challenges. Notably, while the Green Building Policy provides a pathway for installation of on-site solar on new building construction, not every new building or new development site may make it feasible for sufficient renewable energy installation to result in reducing greenhouse gas emissions consistent with net-zero energy or carbon neutrality. As such, the ability to procure large-scale off-site renewable energy may offer opportunity to reduce sufficient greenhouse gas emissions reductions from all energy used on-site by a new or existing building.
Equity Impacts and Implementation Considerations	**Impacts:** While the use of renewable energy will have an impact on the national, regional, or global GHG emissions, PPAs for renewable energy in areas far from Alexandria will not have an impact on regional air quality and the health benefits associated with reducing fossil fuel combustion. **Implementation:** Renewable energy projects combined with battery storage, if strategically located to benefit disadvantaged neighborhoods, could have a beneficial impact and improve resilience.
Cost Considerations	The cost to the City for encouraging large-scale off-site renewable energy projects through PPAs is nominal relative to the cost of the business or organization securing the PPA.
Risks and Uncertainties	As part of encouraging a PPA program, there should be an evaluation of the energy loads of participating businesses and organizations and the carbon content of delivered power. This could potentially be an issue if the energy load does not correspond to when the renewable energy is generated.
Lead Implementer(s)	Office of Climate Action
Stakeholders and Partners	Regional jurisdictions, Virginia Energy, electric utilities
Milestones and Next Steps	**Status**

• Develop and conduct outreach (e.g., in-person and live-streamed events, info-graphics sustainable signage, social media and website content, hands-on learning experiences, partnerships) to businesses and other organizations to promote procurement of large-scale off-site renewable energy options through PPAs.	Not Implemented
• Develop and implement technical assistance programs to support procurement of large-scale off-site renewable energy options through PPAs by businesses and other organizations.	Not Implemented
• Advocate additional policy and regulatory actions to the Virginia General Assembly, State Corporation Commission, and electric utilities that support procurement of large-scale off-site renewable energy options through PPAs by businesses and other organizations.	Implementing

CE-2: Transition all applicable Alexandria government facilities to 100% renewable electricity

Alexandria is leading by example and committing 100% renewable energy across all government facilities. Action the City can take to help achieve this goal includes:

- CE-2.A: Implement government operations renewable electricity actions from the EAP2040

Interactions with Other Strategies

Transitioning all government facilities to 100% carbon-free electricity for all power-use needs can in part be supported by financial support for building decarbonization (B-1) and through implementation of all-feasible decarbonization measures for City-owned buildings (B-2). In addition, increasing alternative fuel City vehicles and associated charging infrastructure (T-3) will impact the amount of renewable energy needed by the City. Lastly, increasing City-wide carbon-free electricity (CE-1) will be complementary to this strategy.

Equity

Installation of distributed renewable energy (e.g., solar panels) within the City is not expected to tangibly address inequities such as regional air quality improvements and related public health impacts. However, equity is a key consideration in the design of programs and policies that support the deployment of renewable energy within the City and all for access to renewable energy through other means including municipal aggregation or PPAs. For those that install panels on-site or are a part of potential large-scale or aggregated buying structures, energy costs can be reduced over time, but these types of actions require upfront financial investments and education. People who live in multi-family buildings where there is limited control over energy choices typically are not able to individually install solar panels. Additionally, disproportionate actions from higher income homes and businesses could increase electricity rates, creating a disproportionate impact on lower income utility customers.

GHG Reductions

GHG emission reductions were quantified under CE-1 for this strategy.

Cost

The cost of transitioning all of Alexandria's government facilities to 100% renewable energy will include a sizeable upfront capital investment with long-term energy cost savings. These costs can be dampened through tax credits and financing arrangements to spread the costs out over the lifetime of the renewable energy installation.

CE-2.A: Implement government operations renewable electricity actions from the EAP2040

Description	The EAP2040 details actions and milestones for transitioning government operations to renewable energy. These actions include: • 2.1.1 (Increase REC purchases to offset 100% of electrical energy use by City government facilities.) • 2.1.2 (Develop a renewable energy supply strategy to evaluate the risks, benefits, feasibility, optimal mix and timing of potential renewable energy supply implementation pathways considering the City's current and future energy use demands. Should beneficial direct purchase or other opportunities become available before the strategy is complete, the City should prudently evaluate and consider implementation.) • 2.1.3 (Ensure that direct purchasing of large-scale off-site renewable electrical energy accounts for at least 50 percent of electrical energy use at all City-operated facilities. The remainder will be made up by REC purchases and on-site renewable electrical energy generation to achieve a 100 percent renewable energy supply.)
Equity Impacts and Implementation Considerations	**Impacts:** Installation of on-site renewable energy is unlikely to address inequities associated with regional air quality and public health impacts. The procurement of large-scale off-site renewable energy will have an impact on the national, regional, or global GHG emissions, PPAs for renewable energy in areas far from Alexandria will have a minimal impact on regional air quality and the health benefits associated with reducing fossil fuel combustion. **Implementation:** Renewable energy projects combined with battery storage, if strategically located to benefit disadvantaged neighborhoods, could have a beneficial impact and improve resilience.
Cost Considerations	The cost to the City for large-scale off-site renewable energy projects through PPAs could result in a higher cost of electricity initially, but may become more cost neutral over time. Costs for consulting, contracting and procurement, acquisition, and installation for implementation of 50% electrical energy offset from large-scale off-site renewable energy projects and on-site renewable energy installations are outlined in the EAP2040. The balance may be achievable through RECs. Both direct purchasing opportunities and feasible on-site renewable energy installations have high potential to result in cost savings with an estimated simple payback of 10–20 years. As renewable energy markets continue to mature, opportunities may exist that result in shorter simple payback periods. Optimal mix, savings estimates, and purchasing strategies will be identified from the results of a renewable energy supply strategy.
Risks and Uncertainties	Although Virginia has legislation enabling municipal aggregation models, there is the risk that any program could be challenged in court and implementation held up in court proceedings. In addition, there is also the risk of push-back from traditional utilities that would face potential new competition.
Lead Implementer(s)	Office of Climate Action
Stakeholders and Partners	General Services, Office of Management and Budget, Department of Finance

Milestones and Next Steps	**Status**
• Increase RECs to offset 100% of electrical energy use by City government facilities.	Implementing
• Develop a renewable energy strategy to evaluate the risks, benefits, feasibility, optimal mix and timing of potential renewable energy supply implementation pathways considering the City's current and future energy use demands.	Implementing
• Direct purchasing of large-scale off-site renewable electrical energy to account for at least 50% of electrical energy use at all City-operated facilities.	Not Implemented

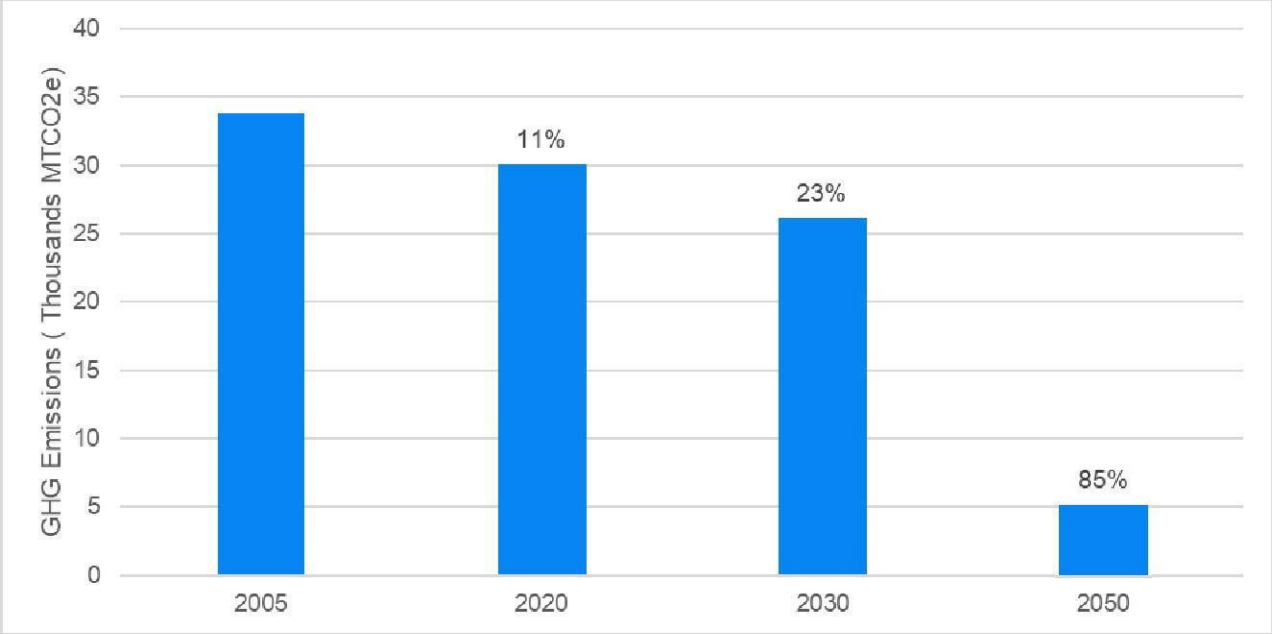
Waste

The waste sector includes two priority strategies:

- W-1: Recover resources and reduce GHG emissions and other forms of pollution by optimizing and safely handling the collection and processing of solid waste
- W-2: Reduce total solid waste collected from City-served residential customers

These strategies will result in a 23% reduction in waste sector GHG emissions by 2030 and an 85% reduction in GHG emissions by 2050 as compared to the 2005 base year (see Figure 13). As of 2020, GHG emissions were reduced by 11% as compared to 2005, due to the various programs and policies the City has developed around recycling and resource management.

Figure 13. Waste GHG emissions under the GHG reduction pathway



Note: % indicates reductions in waste emissions in the GHG reduction pathway year as compared to waste emissions in 2005, the BAU year.

W-1: Recover resources and reduce GHG emissions and other forms of pollution by optimizing and safely handling the collection and processing of solid waste

The City's waste policy is guided by the 2019 Alexandria WasteSmart Strategic Plan. The plan focuses on reducing GHG emissions from waste and shifting toward waste disposal practices that optimize the collection and processing of solid waste. This can be done by separating waste and recycling products like glass from the single stream recycling system, creating education campaigns for the community to be more conscious of how they dispose of solid waste, and reviewing the state of current solid waste treatment options to see where processes can be improved to reduce GHG emissions from the processing of solid waste. This strategy includes:

Strategies W-1 and W-2 Modeling Results

Total GHG Emissions Reduced from BAU

8,900 $MTCO_2e$ (2030)

39,000 $MTCO_2e$ (2050)

- W-1.A: Continue to implement actions defined in the EAP2040 addressing resource recovery and GHG emissions

Interactions with Other Strategies

The reduction in solid waste being generated from city residents in strategy W-2 will allow for further reductions in GHG emissions due to a lower amount of waste that would need to be processed.

Equity

Diverting waste can lead to better health outcomes, especially for communities that are located near such facilities which have historically been the most adversely affected from the emissions from waste disposal and processing. Program implementation must allow for programs to increase ease of access to recycling and resource recovery. Programs should also be implemented along with education in areas where the economic incentive for right recycling practices and the diversion of waste will have the greatest impact.

GHG Reductions

When combined with the actions under strategy W-2 (Reduce total solid waste collected from City-served residential customers) GHG emission reductions for new and existing buildings are expected to be 8,900 $MTCO_2e$ below BAU levels in 2030 and 39,000 $MTCO_2e$ in 2050. Overall strategies W-1 and W-2 combined are expected to result in a 23% reduction from base year 2005 GHG emissions in 2030 and an 85% reduction from base year emissions in 2050.

Cost

The costs to the City include the costs to provide the infrastructure and to run the programming for initiatives intended to have residents recycle more and in more appropriate ways to maximize the potential for resource recovery.

W-1.A: Continue to implement actions defined in the EAP2040 addressing resource recovery and GHG emissions

Description	The EAP2040's Solid Waste section includes short- and medium-term actions to reduce total solid waste collected from City-served residential customers and recover resources and reduce GHG emissions and other forms of pollution by optimizing and safely handling the collection and processing of solid waste. These actions include, but are not limited to: • 5.1.1 (Glass-only recycling receptacles at all recycling drop off centers and the phase-out of glass in single stream recycling.) • 5.1.2 (Educational campaigns to promote and define recycling best practices.) • 5.1.4 (Update recycling ordinances to reflect changes in the global recycling market.) • 5.1.7 (Review commercial recycling requirements to improve resource recovery in the commercial sector.) • 5.1.8 (Evaluate for recycling capacity, convenience, signage, number and type of recyclables required to be recycled, education, outreach, and information required for Recycling Implementation Plan form.) These EAP2040 actions reflect a subset of broader actions to reduce total solid waste and recover resources and reduce GHG emissions and other forms of pollution as outlined in the City's WasteSmart Strategic Plan.
Equity Impacts and Implementation Considerations	**Impacts:** Diverting waste from facilities can lead to better health outcomes, especially for communities that are located near waste disposal facilities. **Implementation:** Program implementation must allow for programs to increase ease of access to recycling and resource recovery. Programs should also be implemented along with education in areas where the economic incentive for right recycling practices and the diversion of waste from landfills will have the greatest impact.
Cost Considerations	The costs to the City include the costs to provide the infrastructure and to run the programming for initiatives intended to have residents recycle more and in more appropriate ways to maximize the potential for resource recovery.
Risks and Uncertainties	The risk associated with the EAP2040 resource recovery actions regards the volatility of the global recycling market and the value of resource recovery versus disposal. Without proper education there is a risk that the infrastructure put in place to allow for better recycling practices will go underutilized.
Lead Implementer(s)	Transportation and Environmental Services
Stakeholders and Partners	Office of Climate Action

Milestones and Next Steps	**Status**
• Continue implementation of EAP2040 Solid Waste short- and medium-term actions, and WasteSmart Strategic Plan Implementation.	Implementing

W-2: Reduce total solid waste collected from City-served residential customers

The EAP recommends short-, mid-, and long-term actions that include actions such as creating a registry for reuse, donation, and repair to encourage waste prevention and reuse of existing materials, implementing variable rate pricing for solid waste collection service, encouraging the use of reusable bags over disposable plastic bags, and supporting the reduction, reuse, and recovery of building material. To that end this strategy includes:

- W-2.A: Implement actions defined in the EAP2040 that will reduce solid waste from City-served residents

Interactions with Other Strategies

The strategies in W-1 to encourage more thoughtful consideration in what waste should be disposed of and what can be sent for recycling or for reuse will further reduce the waste generated by city-served residential customers.

Equity

Diverting waste can lead to better health outcomes, especially for communities that are located near waste disposal facilities which have historically been the most adversely effected from the emissions from waste disposal and processing facilities. Programs, especially those that increase the costs to the community, should be carefully considered to ensure that an undue burden is not placed on communities without proper support.

GHG Reductions

GHG emission reductions for this strategy are included in the reductions for W-1.

Cost

The costs of this action for the City comes from studies and staff time used to implement programs, provide community outreach, and prepare legislation.

The cost to the community comes from potential additional costs associated with solid waste, either through additional charges for using plastic bags or from variable rate pricing, for example.

W-2.A: Implement actions defined in the EAP2040 that will reduce solid waste from City-served residents

Description	The EAP2040's Solid Waste section includes short- and medium-term actions to reduce total solid waste collected from City-served residential customers and recover resources and reduce GHG emissions and other forms of pollution by optimizing and safely handling the collection and processing of solid waste. These actions include, but are not limited to: • 5.2.1 (Creating a registry for reuse, donation, and repair to encourage waste prevention and reuse of existing materials.) • 5.2.2 (Evaluate variable rate pricing for solid waste collection services.) • 5.2.3 (Encourage the use of reusable bags over disposable plastic bags.) • 5.2.4 (Support the reduction, reuse, and recovery of building material.) These EAP2040 actions reflect a subset of broader actions to reduce total solid waste and recover resources and reduce GHG emissions and other forms of pollution as outlined in the City's WasteSmart Strategic Plan.
Equity Impacts and Implementation Considerations	**Impacts:** Diverting waste from facilities like landfills can lead to better health outcomes, especially for communities that are located near waste disposal facilities. **Implementation:** Programs, especially those that increase the costs to the community should be carefully considered to ensure that an undue burden is not placed on communities without proper support.
Cost Considerations	The costs of this action for the City comes from studies and staff time used to implement programs, provide community outreach, and prepare legislation. The cost to the community comes from potential additional costs associated with solid waste, either through additional charges for using plastic bags or from the variable rate pricing, for example.
Risks and Uncertainties	Passing legislation that has the potential to increase costs in the community is not certain to be enacted. Outreach and education efforts to change behaviors are also not guaranteed to drive significant change in behavior.
Lead Implementer(s)	Transportation and Environmental Services
Stakeholders and Partners	Office of Climate Action

Milestones and Next Steps	**Status**
• Continue implementation of EAP2040 Solid Waste short- and medium-term actions, and WasteSmart Strategic Plan Implementation.	Implementing

Other GHG Strategies

Additional GHG reduction strategies are necessary to achieve the EAP's 2050 targets. Remaining emissions are present in all sectors, but in relatively small amounts. Some of these areas, such as aviation, refrigerants, and Sulfur hexafluoride (SF_6), may be addressed in partnership with federal government. Alexandria can participate by supporting federal action such as the SAF Act.

To fully achieve the City's GHG reduction goals other GHG reduction strategies will need to be used. This ECCAP prioritizes one specific strategy to address fugitive methane emissions from the gas system and one strategy that recognizes there will be a role for adopting future technologies as they become more developed and economically feasible.

- O-1: Address fugitive gas system leaks
- O-2: Recognize and understand the role of future technologies as they develop

O-1: Address fugitive gas system leaks

Fugitive emission from distribution systems can be a sizable source of GHG emissions. By requiring Washington Gas to report the level of leaks in the Alexandria distribution system and upstream piping system feeding into the Alexandria system, a better handle on the full emissions from Alexandria can be known and action can be taken to address leaks or to have more data to advocate for changes from Washington Gas. To ensure that the resources are available for Washington Gas to reduce leaks from their system, the Steps to Advance Virginia's Energy (SAVE) rider was implemented. The efficacy of this rider should be examined to determine if any adjustments should be made to allow for the program to work effectively for reducing fugitive methane emissions from natural gas distribution systems.

Strategy O-1 Modeling Results

Total GHG Emissions Reduced from BAU

620 $MTCO_2e$ (2030)

1,500 $MTCO_2e$ (2050)

- **O-1.A:** Set requirements for Washington Gas to report level of leaks in Alexandria's distribution system and upstream piping systems serving Alexandria
- **O-1.B:** Analyze whether the state-approved SAVE rider provides for a fair recovery of pipeline infrastructure upgrades needed to reduce leaks

Interactions with Other Strategies

Transitions to carbon-free electricity (CE-1, CE-2) and building electrification and decarbonization (B-1, B-2, B-3, and B-4) will reduce the need for natural gas distribution in the city, this will lead to less natural gas leakage as well as reduce the amount of natural gas pipe in the city, both of which will lead to smaller overall emissions from the distribution of natural gas.

Equity

Reduced GHG emissions from the pipeline system can lead to better air quality, especially for those from sensitive populations. Additionally, lower waste from natural gas distribution systems can lead to lower energy costs, alleviating the energy burden for disadvantaged populations. If effort is undertaken to have a better understanding of the fugitive emissions from distribution systems, efforts should be made to help pass savings along to consumers, especially for disadvantaged populations.

GHG Reductions

Over half of emissions from gas systems occur during storage or transportation of gas in pipelines. With increased servicing and better storage technology, fugitive emissions can be significantly reduced. The contribution of reducing fugitive gas system leaks is expected to result in emissions reductions of 620 $MTCO_2e$ below BAU levels in 2030 and 1,500 $MTCO_2e$ in 2050.

Cost

The costs to set requirements for Washington Gas is relatively small, and it is likely that Washington Gas can gather the data without significant investments in their systems. To evaluate the efficacy of the SAVE rider the costs will stem from the costs to commission the analysis.

O-1.A: Set requirements for Washington Gas to report level of leaks in Alexandria's distribution system and upstream piping systems serving Alexandria

Description	Fugitive emission from distribution systems can be a sizable source of GHG emissions. Coordinate with Washington Gas to report the level of leaks in the Alexandria distribution system and upstream piping system feeding into the Alexandria system, a better handle on the full emissions from Alexandria can be known and action can be taken to address leaks or to have more data to advocate for changes from Washington Gas.
Equity Impacts and Implementation Considerations	**Impacts:** Reduced GHG emissions from the pipeline system can lead to better air quality, especially for those from sensitive populations. Lower waste from natural gas distribution systems can lead to lower energy costs, alleviating the energy burden for disadvantaged populations. **Implementation:** If effort is undertaken to have a better understanding of the fugitive emissions from distribution systems, efforts should be made to help pass savings along to consumers, especially for disadvantaged populations.
Cost Considerations	The costs to set requirements for Washington Gas is relatively small, and it is likely that Washington Gas can gather the data without significant investments in their systems.
Risks and Uncertainties	Washington Gas may oppose any legislation setting this type of requirement or may not have the ability to track leaks at the level required to be useful for making further decisions and taking further actions.
Lead Implementer(s)	Office of Climate Action
Stakeholders and Partners	City Attorney Office, Regional jurisdictions, Virginia Energy, MWCOG, natural gas utilities

Milestones and Next Steps	Status
• Coordinate with Washington Gas to report the level of leaks in the Alexandria distribution system and upstream piping system feeding into the Alexandria system.	Not Implemented
• Advocate policy and regulatory actions to the Virginia General Assembly, State Corporation Commission, and natural gas utilities that support reducing fugitive emissions from natural gas distribution systems.	Not Implemented

O-1.B: Analyze whether the state-approved SAVE rider provides for a fair recovery of pipeline infrastructure upgrades needed to reduce fugitive natural gas leaks

Description	The SAVE rider allows Washington Gas to take on projects that replace current infrastructure given they improve reliability and reduce GHG emissions. An analysis of this program seeks to determine if the program provides a fair recovery of pipeline infrastructure upgrades needed to reduce fugitive natural gas leaks.
Equity Impacts and Implementation Considerations	**Impacts:** Reduced GHG emissions from the pipeline system can lead to better air quality, especially for those from sensitive populations. Lower waste from natural gas distribution systems can lead to lower energy costs, alleviating the energy burden for disadvantaged populations. **Implementation:** If effort is undertaken to have a better understanding of the fugitive emissions from distribution systems, efforts should be made to help pass savings along to consumers, especially for disadvantaged populations.
Cost Considerations	Working with consultants to perform the analysis will be the bulk of the costs associated with the analysis.
Risks and Uncertainties	Even after an analysis is conducted there is no guarantee that action will be taken to improve conditions, allowing for more work to be done to reduce leaks.
Lead Implementer(s)	Office of Climate Action
Stakeholders and Partners	City Attorney Office, Regional jurisdictions, Virginia Energy, MWCOG, natural gas utilities

Milestones and Next Steps	Status
• Advocate policy and regulatory actions to the Virginia General Assembly, State Corporation Commission, and natural gas utilities that support reducing fugitive emissions from natural gas distribution systems.	Not Implemented

O-2: Recognize and understand the role of future technologies as they develop

The strategies modeled in this ECCAP demonstrate the pathway the City can take to meet its 2030 and 2050 GHG reduction goals. To accelerate climate action and go beyond the City's goals, additional strategies could be explored. Specifically, these additional strategies could encompass technologies such as carbon capture, utilization, and storage, advanced batteries, and very rapid shifts to move the fleet toward zero emissions vehicles. In addition, further reducing single occupancy vehicle trips and VMT could be achieve through cordon pricing, VMT pricing, or other policy constructs that are feasible but do not yet exist.

Strategy O-2 Modeling Results

Total GHG Emissions Reduced from BAU

None (2030)

190,000 $MTCO_2e$ (2050)

Interactions with Other Strategies

These future technologies have the potential to interact with many of the existing strategies. For example, acceleration of EV adoption may be supported by T-1 by making EVs more accessible to those with concerns about long commuting distance with limited charging infrastructure. It will also be supported by CE-1 by providing electricity to a bigger fleet of vehicles.

Equity

Equity impacts will depend on the future technology adopted. They could be positive, for instance, if a cordon pricing policy decreases ICE traffic in disadvantaged communities leading to better air quality. Conversely, the deployment of a carbon capture and storage (CCS) facility near a disadvantaged community may not drastically improve air quality in that community, rendering no change to the status quo.

GHG Reductions

This strategy is not contributing emissions reductions to the 2030 goal since the other ECCAP strategies cumulatively achieve the City's 2030 goal. By 2050, emissions reductions from future technologies are expected to be 190,000 $MTCO_2e$ below BAU levels in 2050.

Cost

The costs to deploy this strategy are high. Widespread adoption of existing technologies such as EVs or efficient appliances is feasible with significant subsidies or incentives. Yet-to-be discovered technologies need the research and development investment, and then the commercial scale-up, which can both be capital intensive investments.

Climate Impacts and Adaptation Strategies

Climate Change Impacts and Vulnerabilities

Alexandria is seeing the impacts of warming global temperatures on critical infrastructure and public health across the community. The Metropolitan Washington region has warmed 2° F over the past century, leading to more frequent hot days and heavy rainstorms..[26] Future temperature increases will exacerbate extreme heat, drought, flooding, and extreme storm conditions, including hurricanes and tropical storm events. Already, the Potomac River is rising by nearly one inch every eight years..[27] Additionally, climate change will pose a threat to low-lying wetlands along the Potomac River and its tributaries due to exacerbated flooding conditions.

GHG Emissions and Climate Hazards

The magnitude of local changes in climate hazards – including extreme heat, flooding, storms, and extreme winter conditions – over the coming decades will depend on the rate of future global GHG emissions.

Mitigation of GHG emissions is imperative, however, the region is facing impacts from climate change now and will continue to experience these impacts over the next 20-30 years because of GHGs that have already been emitted. Adaptation and resilience measures are important to undertake to minimize impacts to the community and infrastructure now, and in the future.

The impacts of climate change will not be felt uniformly across all of Alexandria's community. Vulnerable populations including elderly, youth, low-income, and disabled community members are at the highest risk of negative impacts associated with climate change..[28]

The MWCOG Metropolitan Washington 2030 Climate and Energy Action Plan quantifies the probability, consequences, and risks of climate change-driven impacts on the greater Washington D.C. metropolitan area, including Alexandria..[29] In this study, risk is calculated as a product of the probability and consequence of each climate hazard type. Flooding and extreme heat present the greatest risk, ahead of drought, extreme thunder and lightning storms, and extreme winter conditions (Figure 14).

n this study, risk is calculated as a product of the probability and consequence of each climate hazard type. Flooding and extreme heat present the greatest risk, ahead of drought, extreme thunder and lightning storms, and extreme winter conditions).

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[26] U.S. Army Corps of Engineers Baltimore District, "Metropolitan Washington District of Columbia Coastal Storm Risk Management Feasibility Study," 2022, https://www.nab.usace.army.mil/Media/News-Releases/Article/3051747/army-corps-releases-draft-report-environmental-assessment-for-metro-dc-coastal/.

[27] U.S. Army Corps of Engineers Baltimore District, "Metropolitan Washington District of Columbia Coastal Storm Risk Management Feasibility Study."

[28] IPCC, "Summary for Policymakers of IPCC Special Report on Global Warming of 1.5°C Approved by Governments," Accessed April 8, 2022, https://www.ipcc.ch/2018/10/08/summary-for-policymakers-of-ipcc-special-report-on-global-warming-of-1-5c-approved-by-governments/.

[29] MWCOG, "Metropolitan Washington 2030 Climate and Energy Action Plan," Accessed April 8, 2022, https://www.mwcog.org/documents/2020/11/18/metropolitan-washington-2030-climate-and-energy-action-plan/.

Figure 14. MWCOG risk level of hazards in Metropolitan Washington .[30]

Hazard	Probability	Consequence	Risk
Extreme Heat	3	3	9
Drought	2	3	6
Flooding (Flash and Riverine)	3	3	9
Coastal Flooding	3	2	6
Lightning/Thunderstorm	3	2	6
Extreme Winter Conditions	2	3	6

Note: In the MWCOG study, risk from each hazard is rated as the product of the probability and consequence of that hazard, each rated on a scale of 1 (low) to 3 (high). For Alexandria, the risk of coastal flooding may also be considered high due to the tidal characteristics of the Potomac River.

Additionally, the 2017 Northern Virginia Hazard Mitigation Plan analyzed hazards and risk levels for the City, further highlighting the importance of flooding as an area of major concern (Figure 15)..[31] This hazard mitigation plan also identifies wind, tornados, and winter weather as high-risk hazards.

Figure 15. Northern Virginia Hazard Mitigation Plan, hazard rankings for Alexandria

Hazard	Flood	Wind	Tornado	Winter Weather	Drought	Earthquake	Landslide	Wildfire	Karst
Ranking	High	High	High	High	Med-High	Med	Low	Med-Low	Med-Low

The City also led several Community Workshops to gather a holistic understanding of climate vulnerabilities and impacts to the community. During a Workshop on March 1, 2022, participants identified the following climate vulnerabilities from most concerning to least: Extreme Heat/Urban Heat Island, Extreme Precipitation/Inland Flooding, Extreme Storms, Sea Level Rise/Waterfront Flooding, Drought, Wildfires, Extreme Cold, and Other (Figure 16)..[32] The City is committed to engaging with the community and understanding the impacts of climate risk as it relates to resident and energy community perspectives.

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[30] The risk of coastal flooding for the City may see a risk value as high as 9 due to the tidal characteristics of the Potomac River.

[31] Northern Virginia Mitigation Advisory Committee, "Northern Virginia Hazard Mitigation Plan," 2017, https://media.alexandriava.gov/docs-archives/fire/info/hazmit-final-draft-8.24.17.pdf.

[32] City of Alexandria, VA, "Energy and Climate Change Action Plan, Community Engagement Workshop 1," March 1, 2022, https://www.alexandriava.gov/sites/default/files/2022-03/MentimeterPollResults03012022_0.pdf.

Figure 16. City climate vulnerabilities, ECCAP Community Engagement Workshop #2

This ECCAP focuses on the potential impacts of flooding and extreme heat throughout the City, including within various neighborhoods and demographic groups. These two hazards were selected because they represent the highest priority risks to the City based on the findings of the studies described above and the community priorities gathered from workshops and engagement activities. The plan addresses ongoing initiatives by the City to combat these hazards. The plan lays out potential planning and adaptation strategies the City may undertake in the future to expand existing initiatives or adopt new approaches to reduce and adapt to the impacts of climate change.

Flooding

The City of Alexandria is located along the tidal Potomac River which is included in the Virginia Coastal Zone Management Area (CZM), which encompasses more than 5,000 miles of shorelines in the Commonwealth..[33] Virginia's CZM experiences different threats than non-coastal communities.

The City experiences a variety of flooding types, including:

- **Tidal flooding** from the Potomac, generally caused by a higher-than-average high tides, which may be compounded by heavy rainfall across the region. Sea level rise caused by global climate change is increasing the frequency of these high tide events.
- **Riverine flooding** events occur when water levels rise enough to overtop riverbanks and are due to one or more events such as excessive rain from tropical storm systems,

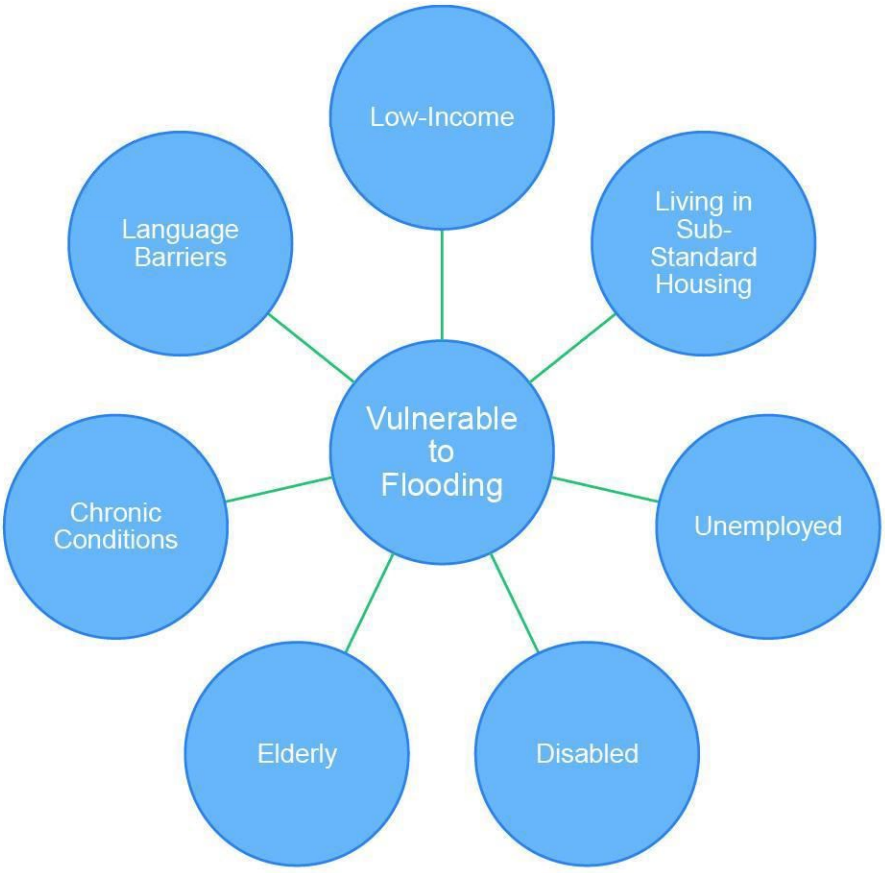
[33] Virginia Department of Environmental Quality, "Coastal Zone Management," Accessed August 10, 2022, https://www.deq.virginia.gov/coasts/coastal-zone-management.

persistent thunderstorms over the river's watershed for an extended period, as well as combined rainfall and snowmelt.

- **Stormwater flooding, or inland flooding,** takes place when intense rainfall that occurs over a relatively short period, often 6 hours or less, overwhelms storm sewer infrastructure and results in flooding of alleys, streets, buildings, and streams. This type of flooding also leads to infiltration and inflow (I&I) into the City's sanitary sewer system which causes sanitary sewer backups.

Recent flood events, such as those caused by Hurricane Isabel in 2006, Hurricane Irene in 2011, Tropical Storm Lee in 2011, and the more recent, severe flash flooding events of July 2019, July and September 2020, and August and September 2021, illustrate the impacts of these flood events. For example, flooding endangers public health and may impair continuity of transportation and business operations, emergency response services, and the functions of sanitary sewers. Demographics of communities particularly vulnerable to the socio-economic impacts caused by flooding are shown in Figure 17..[34]

Figure 17. Demographic characteristics that contribute to flooding vulnerability

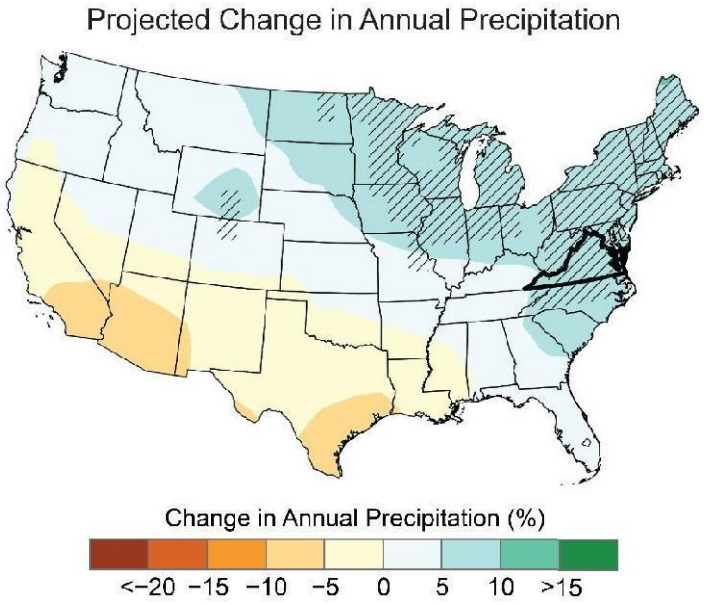


The City of Alexandria and the continental U.S. are already experiencing increases in annual precipitation and heavy rainfall. This is because warmer air holds more moisture. Overall annual precipitation in the mid-Atlantic is projected to increase by 5-10% by the middle of the 21st

[34] MWCOG, "Metropolitan Washington 2030 Climate and Energy Action Plan," 2020.

century based on historical observations, and may come in the form of more frequent and intense heavy rainfall event (Figure 18)..[35]

Figure 18. Virginia is expected to see increases in average annual precipitation through 2050 and beyond. The hatch mark area represents areas with a statistically significant change in precipitation. Source: NOAA National Centers for Environmental Information, State Climate Summaries 2022, Virginia.



Increasing annual precipitation and heavy rainfall places significant structural and functional burdens on combined sewer and stormwater infrastructure. Additionally, historic architecture and landmarks within Old Town are at risk of damage due to overbank flooding from the Potomac River. Sewage overflows to the Potomac River, flood damage to properties, and the impacts of tropical storms will continue to worsen city-wide disruptions, damage, and injury.

As of 2022, nearly 20% of the city is mapped in the Federal Emergency Management Agency (FEMA) floodplain (Figure 19)..[36] The majority of these areas are in Zone AE, which depicts flood zone areas that historically have a 1% annual chance of flooding (or a 26% chance of flooding at least once over the life of a 30 year mortgage)..[37] The FEMA floodplain maps for Alexandria were last updated in 2011, and the FEMA floodplain updates presented to the community of Alexandria in 2020 will take effect the Fall of 2022.

It is important for residents and business owners to know current flood risks, especially if residences or businesses are in a FEMA floodplain, or property is susceptible to damage from

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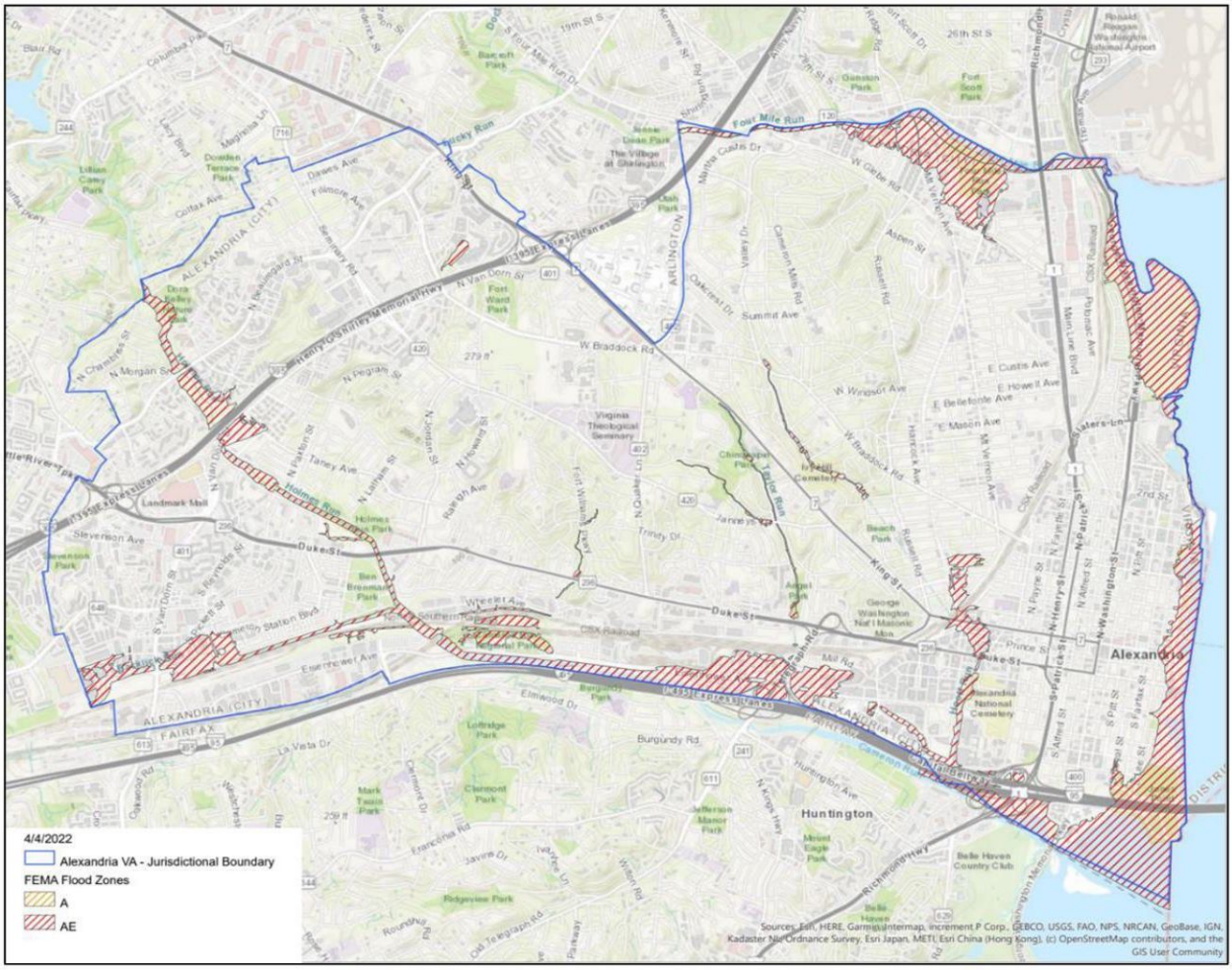
[35] K.E. Kunkel, "State Climate Summaries 2022," Accessed April 8, 2022, https://statesummaries.ncics.org/chapter/va/.

[36] City of Alexandria, VA, "Flood Map," Accessed April 8, 2022, https://www.alexandriava.gov/FloodMap.

[37] FEMA, "Glossary," Accessed April 22, 2022, https://www.fema.gov/about/glossary.

any type of flooding that may occur. However, all must be prepared as properties outside of the FEMA-designated floodplain may also experience flooding. Residents and business owners can take steps to protect themselves and their property by understanding where they are situated within the floodplain, their risk of flooding impacts, and what mitigating resources are available.

Figure 19. FEMA Flood Zones, Alexandria, VA



The FEMA 100-year floodplain shown in Figure 19 only displays the mapped floodplain and does not represent all areas of the City that may be exposed to, or experience flooding. FEMA floodplains are based on historical data associated with water bodies (streams, rivers, etc.) and do not account for increased precipitation, sea level rise, or aging infrastructure so the FEMA floodplain does not depict all flooding concerns. A complete list of current and planned actions is summarized under Existing Adaptation and Resilience Activities below. Highlights include:

- Through the Flood Action Alexandria program, the City is currently undertaking several activities to further assess flood risks and take action to reduce those risks.
- The City's combined sewer system, which serves over 500 acres of Old Town Alexandria, is presently being rehabilitated through a public-private partnership known as the River Renew program. This program will reduce the number of and volume of potential sewage overflows to the system.

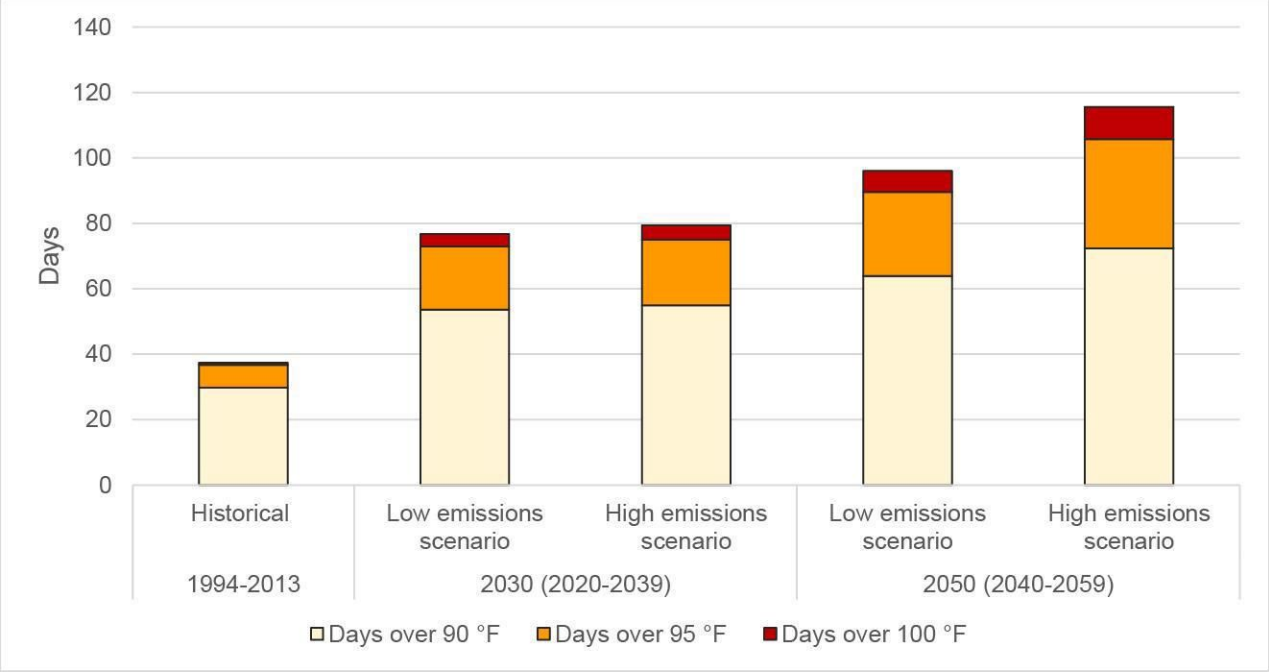
- The City's Waterfront Mitigation Plan will reduce tidal flooding by building a six-foot bulkhead along the waterfront..[38]

Extreme Heat

Extreme heat is another priority risk for the City's focus, with impacts to public health and infrastructure. Extreme heat is a leading cause of weather-related deaths and illness in the U.S..[39] The City has historically experienced temperatures exceeding 95°F, on average, nearly 8 days per year. However, depending on future emissions, the number of days in Alexandria with such temperatures is projected to increase to 19-20 days by 2030 and 26-33 days by 2050, respectively.

Figure 20 shows the number of days per year above 90 °F, 95 °F, and 100 °F under low and high emission scenarios.

Figure 20. Number of days per year in Alexandria with maximum temperatures exceeding 90°F, 95°F, and 100°F (under high emissions scenario RCP 8.5 and low emissions scenario RCP 4.5)



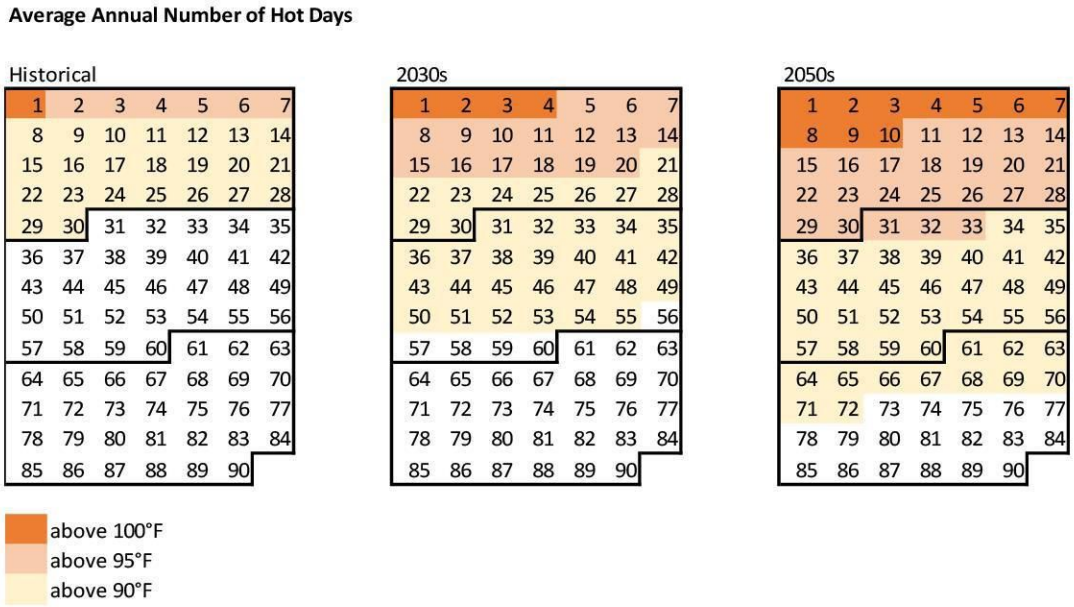
[38] U.S. Army Corps of Engineers Baltimore District, "Metropolitan Washington District of Columbia Coastal Storm Risk Management Feasibility Study," May 2022. https://www.nab.usace.army.mil/Media/News-Releases/Article/3051747/army-corps-releases-draft-report-environmental-assessment-for-metro-dc-coastal/.

[39] National Weather Service, Natural hazard Statistics, "Weather Related Fatality and Injury Statistics, 2020," Accessed May 26, 2022, https://www.weather.gov/hazstat/.

Figure 21 shows the average annual number of hot days above 90°F, 95°F, and 100°F over a period of 90 days, or the average length of the summer season for the region. Historically, such conditions are only experienced during 30 of the 90 day of a typical summer season. As we approach mid-century projections, over 10 out of 90 days of the summer season will be above 100°F, 22 days will be above 95°F, and almost 80% of all summer days will be above 90°F.

Extreme heat can have cascading impacts on public health and the livelihoods of Alexandria's inhabitants. Extreme heat disproportionately increases adverse health effects on children under five years of age, people aged 65 and older, individuals with obesity, asthma, and chronic obstructive pulmonary disease (COPD), and individuals with underlying chronic illnesses (Figure 22)..[40]

Figure 21. Number of days per year in Alexandria with maximum temperatures exceeding 90°F, 95°F, and 100°F (under high emissions scenario RCP 8.5)



[40] Health Matters Alexandria, "Number of Extreme Heat Days," Accessed April 8, 2022, https://www.healthmattersalexandria.org/indicators/index/view?indicatorId=8677andlocaleId=2967.

Figure 22. Demographic characteristics that contribute to heat vulnerability

Additionally, extreme heat can damage overhead electrical transmission wires, buckle rail lines, and impact Alexandria's transportation and other critical infrastructure. The MWCOG TPB is leading a resilience study to address major issues related to transportation resilience.

Heat Vulnerability Assessment

Methodology Overview

As a part of the ECCAP, the City of Alexandria conducted a heat vulnerability assessment to provide a foundational understanding of increasing heat's impact on the Alexandria community, and to identify preliminary opportunities to address challenges related to extreme heat.

The heat vulnerability assessment uses data on sociodemographic and physical features (e.g., tree canopy cover) to determine areas of the City where populations are more vulnerable to extreme heat..[41] The assessment is based on indicators of the three components of vulnerability: **exposure** (i.e., locations expected to experience the most heat), **sensitivity** (i.e., populations most likely to experience adverse impacts from extreme heat), and **adaptive capacity** (i.e., the ability to cope with and recover from heat impacts) at a neighborhood scale for the City. A heat vulnerability index (HVI) score is calculated for each Census block group, based on the sum of

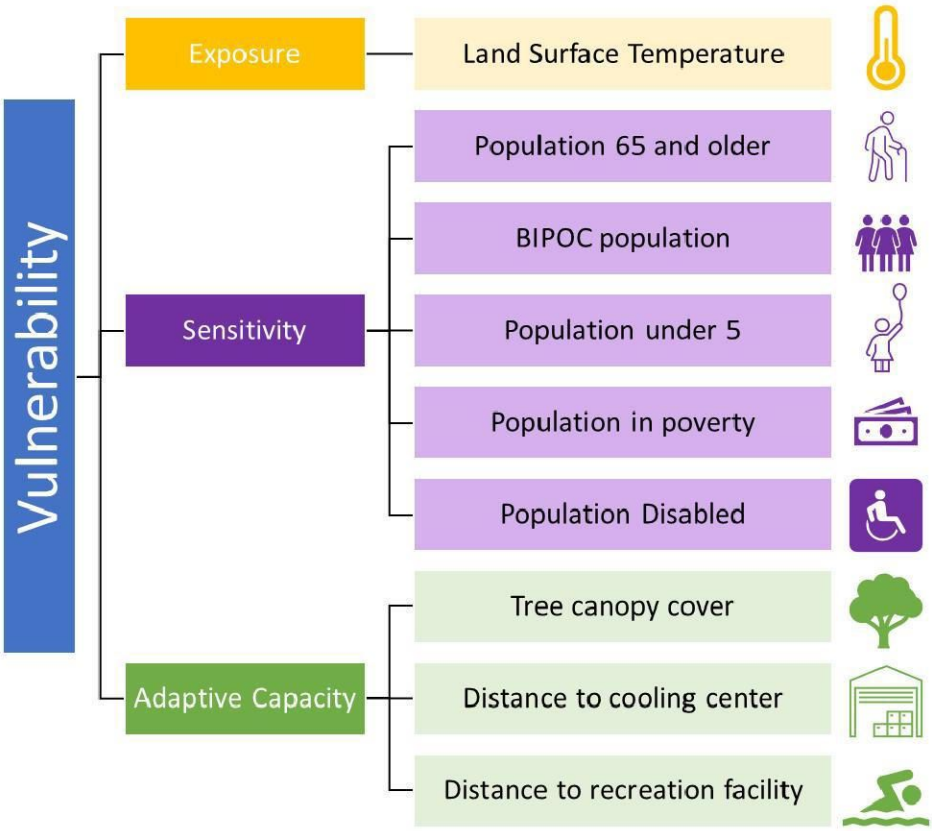
[41] Nayak et al., "Development of a heat vulnerability index for New York State," 2017, https://doi.org/10.1016/j.puhe.2017.09.006.

scores for each of these three vulnerability components. The HVI ranks each neighborhood's susceptibility to extreme heat events in relation to the rest of the City.

The HVI can be used to identify neighborhoods and groups most vulnerable to heat, so that short-term and long-term planning and programs can be prioritized to combat heat related illnesses, death, and impacts among highly vulnerable populations.

Figure 23 summarizes the vulnerability indicators and data sources used in the Heat Vulnerability Assessment. Additional methodology details are found in Appendix F.

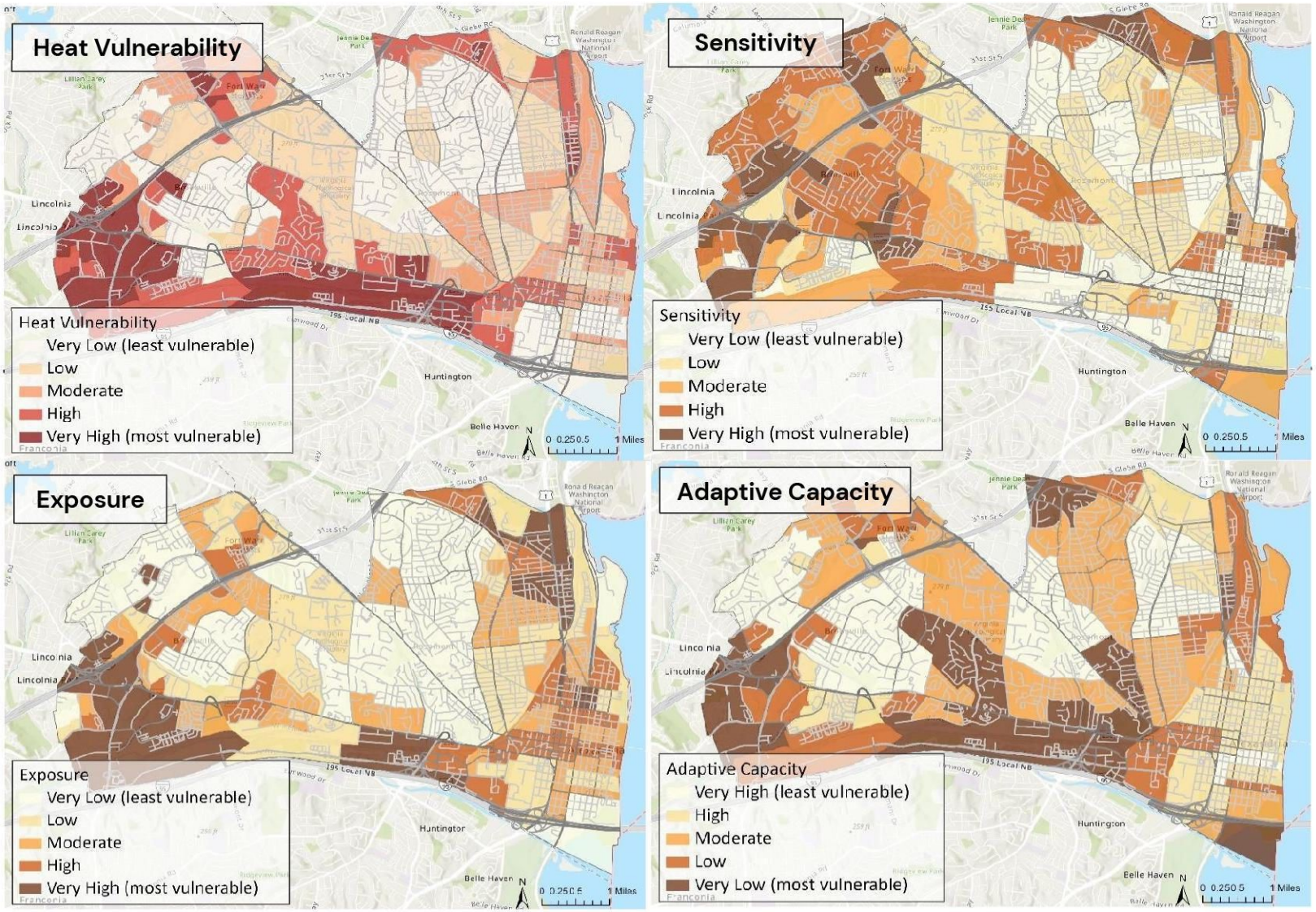
Figure 23. Variables included in the HVI



Results

Figure 24 shows results of the heat vulnerability assessment, including the cumulative HVI score, as well as the individual components that contribute to vulnerability: exposure, sensitivity, and adaptive capacity. The results showcase a strong relationship between all three components.

Figure 24. Results for the heat vulnerability assessment. Heat vulnerability (top left) is composed of separate scores for sensitivity (top right), exposure (bottom left), and adaptive capacity (bottom right).

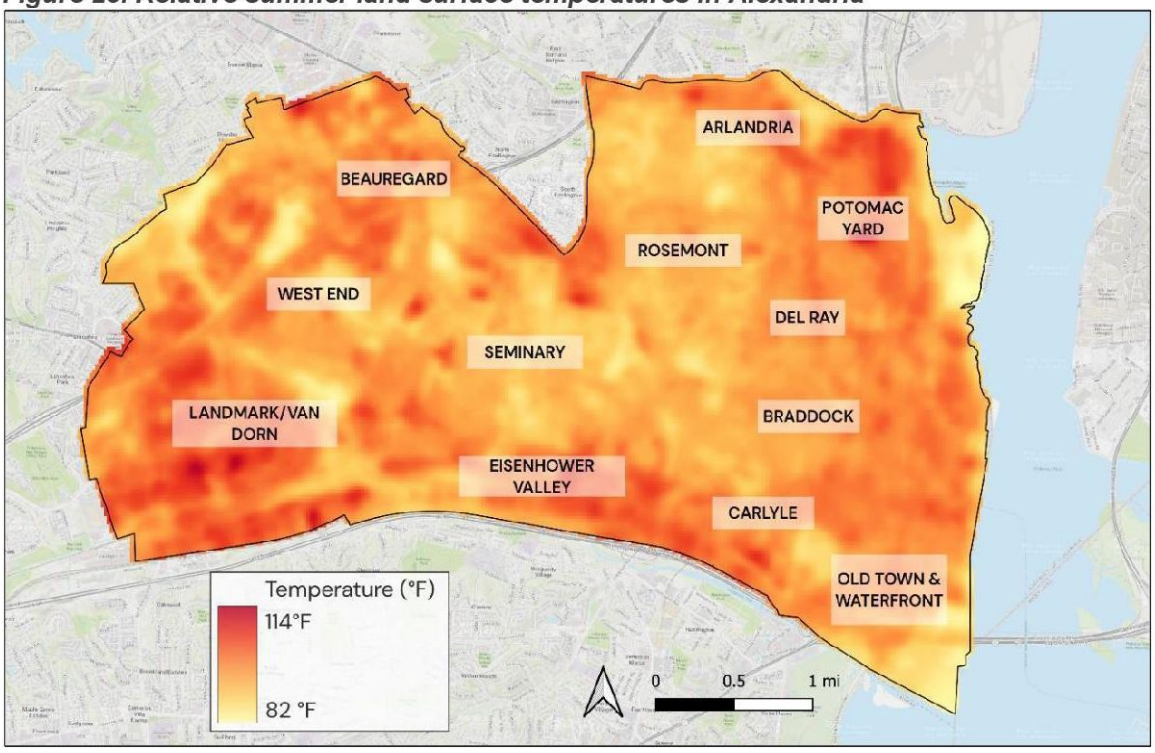


The results of the Heat Vulnerability Assessment can also be viewed in an interactive map available on the City's website. Overall, the neighborhoods of Landmark/Van Doren, Potomac Yard, Eisenhower Valley, and portions of the West End and Beauregard have the highest vulnerability, driven by high relative temperatures/urban heat island, high concentrations of sensitive populations, and less tree canopy cover. This indicates that these areas would benefit most from heat reduction and management strategies executed by the City. Additional details on the drivers of heat vulnerability in Alexandria are provided below.

Exposure

Exposure represents which areas of the City are most likely to experience extreme heat (Figure 24, top right), determined by land surface temperatures from two hot summer days in 2020 and 2021 (Figure 25). Block groups that are warmer than the City average have higher exposure scores. Cooler areas of Alexandria largely overlap with parks since vegetation and trees provide passive cooling and shade (Figure 25)..[42] The hottest areas of the city are in the Landmark, Van Dorn, Carlyle, Arlandria, and Potomac Yard neighborhoods. These locations may be good candidates for urban heat island reduction strategies such as enhancing green space, tree planting, shading, or cool roofs. Old Town, Beauregard, and Del Ray are cooler because of existing parks and tree canopy coverage that help mitigate heat. Additional data analysis could offer additional insights for adaptation planning, as discussed further in this report in Appendix F.

Figure 25. Relative summer land surface temperatures in Alexandria



[42] Wong, et al., "Greenery as a mitigation and adaptation strategy to urban heat," Nat Rev Earth Environ 2, 166–181 (2021), https://doi.org/10.1038/s43017-020-00129-5.

Sensitivity

Sensitivity captures populations most likely to experience negative impacts such as health or financial burdens because of extreme heat. For example, lower income households may not be able to afford air conditioning units or associated utility expenses to enable options for reducing the impact of extreme heat. Disabled and older residents may have underlying health issues that increase their susceptibility to heat and have limited mobility to transport themselves to cooling centers. Black, Indigenous, and People of Color (BIPOC) have experienced higher mortality rates during heat events than white individuals..[43]

The City used Census data to determine the percentage of each block group with a disability; under the age of five; 65 and older; in poverty; and identifying as BIPOC to estimate sensitivity. In the future, other demographic or socioeconomic groups could be included. The variables were added and averaged to determine the overall sensitivity score (Figure 24, bottom left). Overall, sensitivity is highest in the western half of the city.

The methods the City will employ to combat urban heat will vary depending on the demographics of vulnerable populations and their immediate needs. For example, enhancing education and outreach efforts may be most effective in minority communities that may have minimal access to resources that assist with extreme heat events, while increasing the number of emergency responders may be most effective for neighborhoods with large elderly and disabled populations that are likely to need emergency care. Figure 26 shows individual HVI for each of the five sociodemographic variables used in the sensitivity score. The variables were isolated and combined with exposure and adaptive capacity to help the City identify at-risk neighborhoods and to consider options to tailor potential solutions to specific vulnerable populations. For example, disabled residents, residents over 65, and residents under five are particularly vulnerable to heat in the southern and southwestern sections of the City. Increasing the amount of green space and parks in these areas could give young children an area to play while lowering air temperatures. Addressing the mobility needs of disabled populations to get to and from cooling centers would be an effective strategy for locations with a high concentration of disabled persons. Additionally, cooling centers and areas of congregation during climate hazards should be equipped with precautions to prevent the spread of air-borne and vector-borne diseases, so that accessibility for individuals with disabilities is preserved.

[43] EPA, “Climate Change and Social Vulnerability in the United States: A Focus on Six Impacts,” 2021, https://www.epa.gov/system/files/documents/2021-09/climate-vulnerability_september-2021_508.pdf.

Figure 26. Heat vulnerability indices for separate vulnerable population groups

Adaptive Capacity

For the heat vulnerability assessment, adaptive capacity was defined as the ability to cope with and recover from heat impacts..[44] Existing features that facilitate cooling and other ways to alleviate heat were considered in the adaptive capacity score. These include the total tree canopy cover over each block and the proximity of each block group to recreation facilities (including parks and green space) and cooling centers. A cooling center is a location with air conditioning designated to provide respite and safety from extreme heat. Recreation facilities

included tennis and basketball courts, parks, playgrounds, swimming pools, picnic areas, and dog parks from the City's recreation facilities data. Adaptive capacity is lowest in areas with low tree canopy and parks, which are also areas of high heat. Neighborhoods with low adaptive capacity include Eisenhower Valley, Landmark, Van Dorn, parts of Beauregard, and parts of Arlandria (see Figure 24, bottom right).

Existing Adaptation and Resilience Activities

The City has already begun planning and implementing strategies to address the expected impacts of climate change.

Flooding

The City's Capital Improvement Program plan for fiscal years 2023–2032 includes over $256 million dollars of funding to support the City's Flood Action initiative. This funding supports stormwater sewer system improvements identified, in part, by the 2016 City of Alexandria Storm Sewer Capacity Analysis (CASSCA). This funding also supports response to service requests through Alex311 during large storm events, and the related investigations, maintenance, and other key program areas to help mitigate the impacts of flooding.

Flood Hazard Mitigation Projects Underway

The City is actively implementing several flood hazard mitigation projects, as identified in the City ECCAP and the Flood Action Alexandria Master Schedule Project Tracker..[45] For example, the heavy cleaning and rehabilitation of the Hooff's Run Culvert, completed in 2021, restored stormwater conveyance and reduced local flooding. Additionally, the Commonwealth Avenue, East Glebe Road, and Ashby Street flood mitigation projects will result in the implementation of storage, capacity, and green infrastructure solutions to provide flood mitigation within Four Mile Run Watershed..[46]

The City is also undertaking a program to develop the Flood Mitigation Implementation Project along the City's Waterfront. The project will mitigate tidal flooding experienced along the Potomac River at Queen Street, Duke Street, and Union Street. Tidal flooding has significantly disrupted movement of residents, business-owners, and visitors through the area, and has also damaged homes, businesses, and infrastructure. The project will investigate and implement a combination of engineered solutions, including a bulkhead designed to keep Potomac River's waters from entering the City, a bypass storm sewer system to increase capacity and divert

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[44] M. Guardaro, et. al., "Adaptive capacity to extreme urban heat: The dynamics of differing narratives," *Climate Risk Management*, Volume 35, 2022, 100415, ISSN 2212-0963, https://doi.org/10.1016/j.crm.2022.100415.

[45] City of Alexandria, VA, "Flood Action Alexandria, Project Implementation Schedule," Accessed April 8, 2022, https://www.alexandriava.gov/sites/default/files/2022-03/baseline%20schedule.pdf.

[46] City of Alexandria, VA, "Flood Action Alexandria, Flooding and Drainage Projects," Accessed April 8, 2022, https://www.alexandriava.gov/flood-action/flooding-and-drainage#CityFloodingandDrainageProjects.

stormwater flows, and the potential for pump stations to alleviate stormwater overflows and localized flooding..[47],[48]

Stormwater Utility Fee

In 2018, the City adopted a Stormwater Utility Fee to serve as an equitable, dedicated revenue stream for the stormwater management program, which includes new capital projects to reduce sediment and nutrient pollution to the Potomac River and, more recently, address flooding through improved stormwater conveyance capacity..[49] Through this program, the City educates residents on the Stormwater Utility Fee credit program which provides financial incentives to participating property owners for water quality improvements and flood mitigation measures including tree planting and installing rain gardens with native plants, permeable pavement installation, and flood protection, among other activities.

Community Rating System

The City continues to maintain a Class 6 Community Rating System (CRS) for flood insurance..[50] The CRS Program rates communities on a 1 to 10 scale, with Class 1 receiving a 45% premium discount, and Class 10 receiving no discount. The CRS is a voluntary incentive program that encourages individuals situated within the floodplain to develop best practices that exceed the requirements of FEMA's National Flood Insurance Program (NFIP) based on their compliance with the requirements of the NFIP and the community's CRS credit points..[51]

Extreme Heat

Extreme heat is increasingly a cause of concern for individuals across the region living in dense, urban areas. The City has launched several programs that attempt to provide cooling measures and mitigation programs to combat mortality and injury related heat incidences.

Emergency Response and Energy Assistance

The City has focused its attention on emergency response efforts by providing cooling centers in recreation centers, libraries, and schools across the City..[52] Moreover, the City continues to

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[47] City of Alexandria, VA. *Alexandria Waterfront: Flood Mitigation Implementation*: *Master Storm Water Management Plan,* 2018. https://media.alexandriava.gov/docs-archives/special/waterfrontplan/info/20181116=awf-stantec-mswmp=-akrf-soc.pdf.

[48] City of Alexandria, VA, *Alexandria Waterfront: Flood Mitigation Implementation*: *Master Storm Water Management Plan*, 2018, https://media.alexandriava.gov/docs-archives/special/waterfrontplan/info/20181116=awf-stantec-mswmp=-akrf-soc.pdf.

[49] City of Alexandria, VA, "Stormwater Utility Fee," Accessed April 8, 2022, https://www.alexandriava.gov/stormwater-management/stormwater-utility-fee.

[50] City of Alexandria, VA, *Environmental Action Plan 2040*, 2018, https://media.alexandriava.gov/docs-archives/tes/EAP2040v25.pdf.

[51] FEMA, *Community Rating System*, n.d. https://www.fema.gov/floodplain-management/community-rating-system.

[52] City of Alexandria, VA, "Summer Cooling Options for Alexandria Residents and Seniors," Accessed April 8, 2022, https://www.alexandriava.gov/dchs-connect/2021-10-01/summer-cooling-options-for-alexandria-residents-and-seniors.

engage with the ECCTF to understand the community perspective as it relates to heat emergencies and ever-increasing seasonal temperatures. The City has also launched and supported several financial aid programs related to cooling resources, such as the Senior Cool Care Program and the Virginia Energy Assistance Cooling Program, which has provided cooling apparatus as well as rebates to compensate residents for the increased energy burdens of residential cooling..[53]

Increasing Tree Canopy and Enhancing Open Space

Complementing these efforts, the City has proposed several key recommendations in the 2009 Urban Forestry Master Plan, which will serve to increase tree canopy through improved maintenance of existing trees and a thorough assessment of available land for new tree plantings. Recommendations include the planting of 400 additional trees per year adjacent to school grounds and public spaces, the development of master landscaping, planting, maintenance plans for all public properties, and providing and promoting incentives to plant trees and implement projects to preserve and enhance the tree canopy on institutional and semi-public sites, such as hospitals and faith-based establishments..[54]

In addition, the Alexandria City Council unanimously adopted the updated EAP2040, which includes short, medium, and long-term goals for open space and land use objectives relating to preserving existing and increasing new tree canopy by maintaining a ratio of 7.3 acres of publicly available accessible open space per 1,000 residents with approximately 40% total tree canopy cover across the City. The City also maintains a street tree planting program in the public right-of-way. By 2028, the City should seek to create publicly accessible open space opportunities in unconventional spaces, such as public alleys, conservation easements, public rights-of-way, parking lots, and through the careful assessment of new developments and vacant lots..[55]

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[53] City of Alexandria, VA, "Seasonal and Emergency Warming and Cooling Options," 2022, accessed April 8, 2022, https://www.alexandriava.gov/homeless-services/seasonal-and-emergency-warming-and-cooling-options.

[54] City of Alexandria, VA, *Urban Forestry Master Plan*, 2009, https://media.alexandriava.gov/docs-archives/planning/info/masterplan/mpa200900012.pdf.

[55] City of Alexandria, VA, *Environmental Action Plan 2040*, 2019, https://media.alexandriava.gov/docs-archives/tes/EAP2040v25.pdf.

Adaptation and Resilience Strategy Recommendations and Next Steps for Planning

Building on the City's existing activities as well as a greater understanding of climate risks, this ECCAP, and complementary efforts undertaken by the City, will serve to provide strategies in the expansion of existing efforts, and will provide new adaptation and resilience strategies to be executed by the City.

These actions are grouped into three categories and summarized in Table 4:

1. Activities to integrate climate change risk and resilience considerations into existing municipal decisions and activities;
2. Specific activities to reduce, manage, and coordinate a response to impacts from increasing temperature and extreme heat;
3. Specific activities and next steps to continue to reduce, manage, and coordinate a response to impacts from flooding.

Enhancing Equity in Climate Resilience Planning & Actions

It is essential to consider social equity when planning and implementing resilience strategies because members of the community will experience climate change impacts unevenly. Municipal plans and operations can proactively address systemic inequities by considering both *communities at greatest risk* and *distribution of resources* related to climate resilience.

The City of Alexandria will incorporate equity into their climate resilience planning process using the following guiding principles:

- Focus on the Root Causes of Inequity
- Balance Power Dynamics Among the City, Stakeholders, and Residents
- Foster a Sense of Belonging for All
- Empower and Prepare Climate Vulnerable Groups

Table 4. Adaptation priority strategies

STRATEGY
Integrating in Municipal Decisions and Activities (I)
I-1: Review existing city and state plans, programs, and activities
I-2: Develop an internal multi-department working group for climate resilience
I-3: Identify innovative financing mechanisms
I-4: Integrate resilience into capital planning
I-5: Lead by example in infrastructure resilience
Flooding Adaptation (F)
F-1: Hazard identification and information dissemination
F-1.A: Update stormwater models
F-1.B: Identify flood-vulnerable neighborhoods and populations
F-1.C: Engage the public in flood resilience

STRATEGY
F-2: Flood mitigation
F-2.A: Formulation of solutions
F-2.B: Assistance for property owners, businesses, and residents
F-3: Flood preparedness and response
F-3.A: Monitor and prepare for sea level rise
F-3.B: Enhance local flood warnings
F-3.C: Enhance the City's internal flood response mechanisms
F-3.D: Regional stakeholder coordination
F-4: Land development policies and regulations
F-4.A: Update policies for flood resilience
F-5: Financing strategy
F-5.A: Seek external funding sources
Extreme Heat (H)
H-1: Heat reduction
H-1.A: Establish cool roof and pavement programs
H-1.B: Expand waste heat reduction programs
H-1.C: Expand and incentivize urban greening
H-2: Heat management
H-2.A: Expand heat relief programs for vulnerable residents
H-2.B: Expand cooling centers for residents
H-2.C: Address personal exposure to heat
H-3: Heat coordination
H-3.A: Establish a heat preparedness program
H-3.B: Develop an extreme heat incident response plan
H-3.C: Coordinate regionally

Integrating Climate Change in Municipal Decisions and Activities

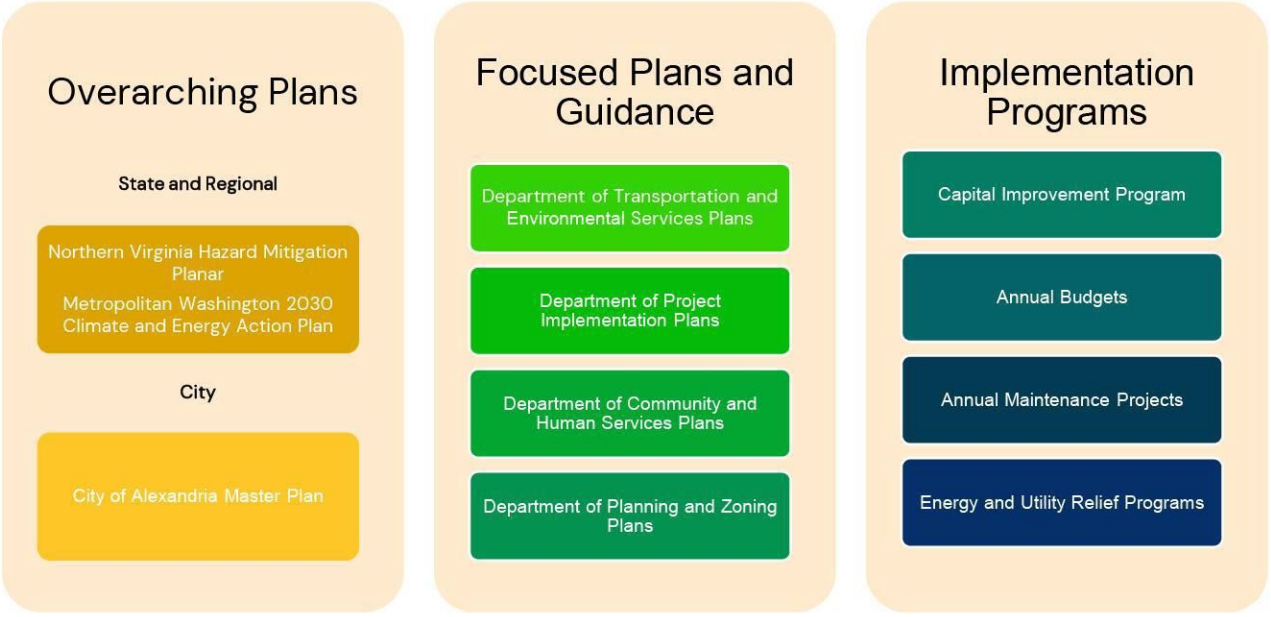
An important step to building climate resilience in Alexandria is to ensure climate change resilience and equity are considered as a matter of course in all municipal decisions and activities. This report proposes five primary actions, shown in Figure 27, in which the City may integrate climate change into municipal decisions and activities. Each of these actions will be underpinned by active efforts to address climate equity and prioritize increased resilience among vulnerable populations.

Figure 27. Primary actions to integrate climate change into municipal decisions and activities

I-1: Review existing city and state plans, programs, and activities

Review existing Alexandria and state-wide resilience plans, as well as department-specific plans and guidance and the City's ongoing implementation programs, to identify additional needs for targeted resilience analyses across City departments and functions. Figure 28 shows examples of existing high level statewide planning documents and City plans. These plans can inform focused plans and guidance for Alexandria departments, and subsequent implementation programs that could increase resilience. Plans like the Northern Virginia Hazard Mitigation Plan, the MWCOG 2030 Climate and Energy Action Plan, and the City of Alexandria's master plan provide actions taken on a broader scale for the region and the City at-large. These types of plans help to inform the development of the ECCAP. Furthermore, this ECCAP outlines the elements of a Flood Resilience Plan (FRP).

Figure 28. Examples of the City's plans and programs that may enhance climate resilience



Implementation programs will introduce a variety of adaptation and resilience strategies in combatting climate change. Four key areas have been identified in integrating climate change to City implementation programs:

- The City could review **Capital Improvement Programs** to assess whether climate resilience initiatives may be folded into these programs. Additional details regarding the integration of resilience into capital planning are described below in the "Integrating Resilience into Capital Planning" section of this report.
- Review of **annual budgets**, including those allocated to ACPS, to accommodate climate resilience needs, such as those related to awareness and educational programs to inform community members of priority climate hazard impacts and resources. For example, ACPS could reinstate their sustainability ambassadors program, which could focus on increasing climate resilience and sustainability within each school and across the school system.
- **Annual maintenance projects**, like annual sidewalk and paving programs, may benefit from expanded budgets to include heat mitigating pavement treatments and additional tree planting provisions. This work currently is coordinated and managed by Transportation and Environmental Services (T&ES) Public Works Service (PWS).
- **Energy and utility relief programs,** as well as social aid programs that indirectly alleviate the financial burden of internal heating, cooling, and weatherization costs on residents, may be expanded and improved to target a greater number of specifically vulnerable residents. This expanded program could potentially be managed through the ARHA.

I-2: Develop an internal multi-department working group for climate resilience

Climate change will affect all sectors in the City and affect the work of nearly all City departments. An internal working group could identify specific activities each department will need to undertake to integrate resilience into their decision-making processes, and coordinate actions citywide.

The multi-department working group may focus their attention on **improving cross-departmental collaboration, long term capital planning efforts, external cooperation with city-wide stakeholder groups, and developing short term strategies** to address impacts of primary climate hazards like flooding and extreme heat. Through the development of this working group, City departments **would build capacity regarding climate change risks** so that they are better equipped during early project development to identify marginal add-on opportunities to reduce risks and enhance resilience.

Table 5 establishes a roadmap of priority actions for the City's internal working group.

Table 5. Priority actions roadmap of City internal working group

Priority Action	How may the Internal Working Group achieve this priority action?
Cross-Collaboration across City Departments	• Meet quarterly to focus attention on relevant City departments and their climate resilience roles and responsibilities. • Draw on the ECCAP and regional climate resilience plans to establish quarterly and annual objectives for city departments to report on.
Review of Capital Improvement Plans to Determine Gaps	• Review capital improvement plans and identify areas in which climate resilience could be incorporated. • Provide recommendations for City Council to address these gaps and provide early notice of adaptations or changes to long-range capital improvement plans.
Establish a Framework for External Collaboration	• Incorporate external stakeholders at quarterly meetings from city-wide non-profits, organizations, public programs, or other relevant stakeholders. • Circulate a report on updated City initiatives regarding climate hazards to relevant stakeholders and community members for public comment.
Develop Short-Term Adaptation Strategies	• Implement short-term adaptation projects to deal with extreme heat, such as expansion of cooling centers and shade structures. • Develop adaptation projects and relief programs for prioritized environmental justice communities as identified in this report's heat vulnerability assessment.

Once the working group has been established, the City can then begin to identify innovative financing mechanisms to execute the climate adaptation strategies.

I-3: Identify innovative financing mechanisms

Upfront capital investments to effectively combat climate change can be costly, due to the intensive planning, designing, engineering, and construction necessary. There are positive benefits associated with investing in climate resilience efforts. The National Institute of Building Sciences found that natural hazard mitigation saves $6 on average for every $1 spent..[56] Approaching the City's governing bodies with creative and innovative financing mechanisms can ensure that projects directly and indirectly addressing climate resilience are implemented.

Identify key decision makers to further its climate adaptation and resilience initiatives. City departments, internal stakeholders, and the community can most effectively advance climate action when they are directly engaged with key decision makers responsible for approving projects and programs.

[56] Federal Insurance Mitigation Administration, *Natural Hazard Mitigation Saves Interim Report*, 2018, https://www.fema.gov/sites/default/files/2020-07/fema_mitsaves-factsheet_2018.pdf.

Seek opportunities to engage with external stakeholders who could help identify options for private investment and sponsorship of climate resilience and adaptation projects suggested in this plan. The City has developed several public-private partnerships and has benefited from these relationships within energy and waste management, arts and culture, expansion of transit opportunities, and publicly guided private development. Public-private partnerships are contractual arrangements between public and private sectors that allow for a combination of the financial and knowledge-based strengths of the private sector with public sector interests. These partnerships may enable new feasibility of high-impact and high-cost infrastructure and community development projects.

Conduct ROI analyses that consider future climate projections and evaluate the upfront costs of implementation with the climate resilience benefits among all project alternatives. An ROI analysis would effectively weigh the up-front costs in constructing assets and infrastructure which are resilient to climate change over their useful lives with the long-term benefits of reductions in extensive repeat maintenance and repairs after extreme weather events.

The analysis may also be extended to showcase the potential reductions in property damage and loss of life as a benefit of climate-resilient assets or infrastructure. The City could develop a list of climate resilience projects to **articulate the cost savings of climate adaptation and resilience infrastructure and programs** to City Council on an annual basis.

I-4: Integrate resilience into capital planning

For Alexandria to adequately prepare for the long-term impacts of climate change across a range of sectors, the City will need to ensure its infrastructure investments today and in the coming decades are made in consideration of climate change—both in identifying and prioritizing project needs, and in evaluating and designing projects.

The City invests in municipal infrastructure through its Capital Improvement Program (CIP). The City could **consider climate resilience in planning for capital investments** throughout the CIP development process**.** Entry points for climate resilience at each stage within the CIP process are described below.

Identifying project needs: The CIP is informed by the needs within Alexandria, such as the need for additional cooling centers; the development of additional open and green space; or the rehabilitation of stormwater infrastructure. Climate changes should be considered in identification and prioritization of project needs, such as in the following ways:

- ***Identify whether projected climate changes and impacts may create a need for new capital investments*** – For example, new cooling centers may need to be established to meet increasing needs for relief in parts of the City not previously experiencing intense urban heat island effects, or new flood mitigation projects may be necessary in parts of Alexandria that have not historically flooded in the past but will under future climate conditions.
- ***Identify whether climate change may increase the future costs of assets*** – If an existing asset has needed more maintenance over the past few years following extreme weather impacts, there may be a cost-effective solution to accelerate the upgrade of

such assets within the CIP pipeline, to allay future costs of recurring damage to the asset.

- ***Consider impacts of the project on climate resilience as part of the project prioritization process*** – The City will continue to have a range of capital needs, some of which will and will not relate to climate change impacts. This review would evaluate whether it may be valuable to place additional priority on any projects that would enhance climate resilience (regardless of whether they were initially designed for that purpose).
- ***Consider impacts to and needs of vulnerable populations in project identification and prioritization*** – Prioritizing projects based on areas of vulnerability will increase the influence on overall equity in project selection and implementation. For example, the creation of cooling centers and new heat mitigation infrastructure may need to be constructed first in areas of highest vulnerability and high extreme heat, as identified in the Heat Vulnerability Assessment, rather than areas where extreme heat is highest overall.
- ***Identify opportunities for projects in coordination with regional partners*** – The City may identify areas where climate hazards should be addressed in which external stakeholders hold influence or assets. For example, climate impacts often cross jurisdictional boundaries and capital investments in resilience measures may be more cost-efficient if jointly implemented. An example is a large-scale flood mitigation projects that protects public and private property across two or more municipalities.

Evaluating and designing capital projects: All capital investments should be reviewed to ensure they are maximizing opportunities to reduce climate risks, regardless of the project. A high-level screening guidance or tool to help project managers identify whether the capital project could face climate risks and whether the project could feasibly incorporate increased climate resilience in its design or implementation could be developed. These screening tools may be particularly helpful for projects that have a long expected useful life—for example, new buildings or other long-lived infrastructure.

Another strategy is to **develop climate resilience design guidelines and general standards** related to best practices and opportunities to integrate adaptation strategies for existing or new capital projects. Such resources could be referred to if the screening process flags a project for climate risk. It will be essential to coordinate with and monitor neighboring jurisdictions such as via the NVRC working group to keep abreast of related regional efforts.

I-5: Lead by example in infrastructure resilience

The City could accomplish their “lead by example” initiative through the following principles in infrastructure resilience projects (Table 6).

Table 6. Example areas for the City to lead by example in infrastructure resilience investments

Example Activities	How will the City Lead by Example within Infrastructure Resilience Projects?
Annual Roadway Maintenance	• When resurfacing roads, the City could consider using **materials that are less likely to buckle or soften** due to extreme heat or choose **materials that are more reflective** to reduce the urban heat island effect. ○ **Example:** The City can improve this initiative by targeting road replacement in particularly hot areas of the City where vulnerable communities live.
Building Rehabilitation and Renovations	• When installing new roofs, **incorporate white or light sealant options** to reduce radiative heating of building and extreme heat impacts. ○ **Example:** The City can improve this initiative through the prioritization of new roofs on schools, libraries, and other critical public facilities with particularly vulnerable patrons such as young children and the elderly. • When implementing new public facilities, the City of Alexandria will not construct within 100-year or 500-year floodplains as feasible.
Rehabilitating Stormwater Infrastructure	• When installing or replacing stormwater infrastructure, the City may **consider the projected increase in storm intensity and include it in the design process**. ○ **Example:** The City can improve this initiative by prioritizing infrastructure rehabilitation in areas where floods impact critical facilities, commerce, emergency response, and healthcare facilities.
Budgeting for O&M of Public Facilities	• **Consider implications to budgets for O&M** of capital assets. ○ **Example:** The City can consider greater attention and larger O&M budget for capital assets that, should they fail or become damaged, could put vulnerable populations at the highest risk. For example, maintenance of storm drains could be emphasized in areas prone to flooding during severe storms.

Promoting awareness around the impacts of climate change on public facilities and communicate the effects of activities in Table 5 which will serve as an example for private property owners and businesses. The spotlighting of infrastructure resilience improvements on public facilities and properties may be utilized as a tool to help convince private stakeholders, property owners and property developers to increase resilience to climate hazards. This will translate to a city-wide effort to increase climate resilience on all public and private assets, facilities, and properties.

Flooding Adaptation Priority Strategies

The City of Alexandria is already undertaking several flooding adaptation strategies which align with the EAP2040 Goal 6.2, to reduce risk of flooding. Climate impacts are projected to worsen, however, and flooding is already becoming a more frequent occurrence throughout the City. Residents, property owners, and city officials need to be prepared to respond to flooding and implement new adaptation strategies. The City's recommendations are presented in the context of the development of a FRP as a framework to improve flood resilience across the City. The execution of the FRP will enable estimation and reduction of flood risk, development of initiatives for flood preparedness and response, and technical support for implementation of mitigation measures. The FRP will include the following elements:

1. Hazard identification and information dissemination
2. Flood mitigation
3. Flood preparedness and response
4. Land development policies and regulations
5. Financing strategy

Subsequent sections describe components of these elements of the FRP. This effort will be led by the City's Transportation and Environmental Services Stormwater Management Division in partnership with the Department of Project Implementation who currently manage the City's Flood Action Alexandria Program. The actions included in this Action Plan will build upon the existing efforts done to date.

F-1: Hazard identification and information dissemination

The City of Alexandria was founded in 1749 and has many historic neighborhoods all with unique characteristics and varying ages of infrastructure. The topography in Alexandria is such that the 'low lying' neighborhoods are closer to the Potomac River in the older areas of the City. The City is almost 50 % impervious which means that stormwater does not soak into the ground but runs off into the City's stormwater system into local waterways. Approximately 500-acres in Old Town are served by a combined sewer system that travels to AlexRenew to be treated. During storm events, the combined sewer system overflows into local waterways. Severe storm events cause sanitary sewer backups as water enters the system through I&I. Developing a deep understanding of the City's sewer infrastructure system and the impacts of severe storms on the system can enable staff to identify areas that would benefit from increased conveyance or storage. Current design standards focus on creating and maintaining infrastructure for a 10-year 24-hour storm, but storms are becoming more severe and causing significant flooding. It is imperative to help think through scenarios that will help create a more flood resilient Alexandria.

F-1.A: Update stormwater models

Finalized in 2016, CASSCA analyzed the City's current storm sewer system and provided the following major outcomes: (1) the identification of problem flooding areas and (2) the development and prioritization of solutions for these areas. The study showed that approximately 22% of the system may experience flooding and 16% may have a water level within 2 feet below the surface—referred to as insufficient freeboard—at some point during the storm. Also 16% of the system may be surcharged such that the water completely fills the storm sewer causing system backups. The City could **undertake a modeling process similar to, or**

more comprehensive than CASSCA, to further understand infrastructure vulnerabilities and help develop targeted flood mitigation solutions.

F-1.B: Identify flood-vulnerable neighborhoods and populations

During and directly after severe flooding events, residents use the Alex311 request system to inform the City of flooding in their neighborhoods. This data, combined with modeling efforts and information gained from other inputs such as emergency services, cameras, and rain and stream gauges help inform the **development of flood vulnerability maps**. Combined with social and equity indicators, these maps will help the City prioritize areas for infrastructure improvements and outreach on flood mitigation efforts.

F-1.C: Engage the public in flood resilience

To help the public understand the impacts from severe storms and changes in the Potomac River due to climate change, the City could **develop an online interactive platform** to help engage and inform the public about flood hazards across the City. This platform will rely on the updated modeling efforts; new flood vulnerability maps; and will help better inform the public, and particularly vulnerable communities, about flood hazards. The City could **develop a flood resilience engagement program** to help disseminate this critical information across the City.

F-2: Flood mitigation

Flood mitigation efforts are underway in the City through the implementation of several large capacity projects, which improve the conveyance of the storm sewer system, as well as "spot improvement" projects that help reduce flooding at the neighborhood scale. These smaller projects may include for example, increasing the size of inlets to convey flood waters into the sewer system more quickly.

F-2.A: Formulation of solutions

To continue mitigating the effects of flooding, the City will continue to formulate strategies and projects that reduce the occurrence and severity of flooding throughout the City. In addition to the large capacity projects and spot improvements mentioned above, other projects may include deployment of flood barriers; acquisition and elevation of buildings; and flood proofing infrastructure and buildings. Projects under consideration will be based on climate change projections, will be evaluated on their long-term cost/benefit ratios, and will be prioritized based on the findings from the modeling efforts and the flood vulnerability maps.

The City's storm sewer drainage network follows watershed contours and, as such, should be managed in a way that considers the entire watershed. Projects proposed upstream may impact residents downstream; therefore, solutions must be formulated at a watershed-scale.

F-2.B: Assistance for property owners, businesses, and residents

In addition to developing and implementing flood mitigation projects, the City also will continue to **encourage property owners to mitigate flooding through various methods including financial incentives and technical assistance**.

F-3: Flood preparedness and response

Monitoring and regular data collection of all flooding impacts and sea level rise over time will help inform the City's current development and future planning of infrastructure improvements.

F-3.A: Monitor and prepare for sea level rise

The City will **monitor readings from the Washington, D.C. NOAA tide gauge, to understand better how sea level rise may exacerbate tidally influenced riverine flooding**..[57] As the city monitors sea level rise over time and considers future projections in sea level rise by mid-century, the City will incorporate additional design and engineering parameters to help to negate flooding and inundation to city-wide utilities.

F-3.B: Enhance local flood warnings

Warnings at a hyper-local scale will benefit the entire City. Therefore, the City may **expand its flood warning procedures** from radio and television stations to incorporate the use of Alex311, reverse 911 calls, and social media to announce flash and riverine flooding events through multi-lingual and multi-media platforms to City residents. Providing the public with information and timely warnings about storm events and forecasted flooding will improve preparedness and the protect the safety of residents. The City may also choose to continue to implement remote sensors on roadways and within culverts to provide specific roadway flooding warnings to drivers and nearby property owners. The City may also begin to connect its remote sensor network and rain gauges to regional networks.

F-3.C: Enhance the City's internal flood response mechanisms

The City could integrate flood vulnerability maps into the City's flood readiness and response plans and adjust and coordinate inter-departmental response plans including notification procedures and continuity-of-operations to also include utility companies and service-providers whose services may be impacted by flooding.

F-3.D: Regional stakeholder coordination

The City will continue to **coordinate with stakeholders and adjacent agencies to build institutional capacity and share data**. The City could plan to meet on a quarterly basis with Fairfax County and Arlington County under the guidance of the NVRC. The City will also coordinate with the MWCOG, District of Columbia Flood Task Force and other non-Virginia entities such as Montgomery County and Prince George's County, Maryland. Coordination with these regional partners can identify and establish best practices from around the region and may aid in efforts to solicit and facilitate additional state and federal financing for flood adaptation strategies.

F-4: Land development policies and regulations

The City's current population is 165,000 and is expected to increase significantly over the next few decades as outlined in this Action Plan. Most of the City's development is considered re-development, and replacing older development with new development based on current

[57] NOAA, Tides and Currents, Accessed April 27, 2022, https://tidesandcurrents.noaa.gov/map/index.html.

stormwater quality and quantify standards will improve the City's resilience to flooding. However, looking into the future of development, the City will benefit from a thorough review and analysis on the current land development regulations. This analysis may include reviewing the building requirements and waiver process. The City will also review stormwater management rules that regulate development and consider updates to the size of disturbance, location of disturbance, and stormwater volumes to manage on site. Updates to these factors will consider climate change impacts.

F-4.A: Update policies for flood resilience

The City couldl **review current policies and regulations** that are impacted by stormwater and rising tides including how land use is managed within the FEMA-regulated floodplain. Based on this review, the City may develop watershed-based standards to improve flood resilience.

F-5: Financing strategy

The creation of the Flood Action Alexandria program coincided with a doubling of the local Stormwater Utility Fee and a shift in resources to develop the Stormwater Management 10-Year Plan to focus on flood mitigation capital projects and related programs. Grants have allowed the City to further accelerate capital projects to begin the design and construction to mitigate flooding impacts. The City has been awarded approximately $5.5 million to help accelerate capital projects to bring relief to the community even faster than previously planned.

F-5.A: Seek external funding sources

The City will continue to **seek adaptation funding** to help supplement City-funding for implementation such as grants and public-private partnerships.

Extreme Heat Adaptation Priority Strategies and Actions

Extreme heat will have a wide range of impacts across the City and will primarily jeopardize the health of vulnerable residents. The City's strategies to address extreme heat have been organized into three categories: heat reduction, management, and coordination strategies..[58] The strategies and actions included in this Action Plan will require a new model of leadership in the heat vulnerability space that currently does not exist. Therefore, creating an internal working group comprised of staff across multiple City departments including the Health Department, Transportation and Environmental Services, and Recreation, Parks, and Cultural Activities, among others, to strategize and organize these efforts will be essential.

H-1: Heat reduction

Heat reduction strategies will serve to reduce additive heat contributions by the built environment. The built environment contributes to the urban heat island effect and extreme heat in a variety of ways. Waste heat generated by buildings, an abundance of impervious surfaces, and a lack of vegetation all contribute to extreme heat throughout the City. Several areas of intervention exist to promote heat reduction.

H-1.A: Establish cool roof and pavement programs

Traditional and dark roof and paving materials trap heat from solar radiation and release it into back into the surrounding environment. Cool roofs may be achieved using high solar reflectance and high thermal emittance materials in place of traditional roof sealants. Cool roofs absorb less heat and have been shown to stay nearly 50-60°F cooler than conventional materials during peak heat conditions..[59]

The expansion of cool roof programs throughout Alexandria could therefore have major benefits in reducing the urban heat island effect and the impacts of extreme heat. The City of Alexandria will consider utilizing **regional and State collaborations to create new financing mechanisms, like grants, low-interest loans, etc.** for cool roof implementations on private properties.

> **Example Program: The New York City CoolRoofs Program** *offers financing of cool roofs and provides New Yorkers with paid training and work experience installing cool roofs on private properties.*

The City of Alexandria could work with the Commonwealth of Virginia and adjacent municipalities to expand financing and will leverage the findings of MWCOG's 2030 Climate and Energy Action Plan and the Northern Virginia Hazard Mitigation Plan as evidence that such a program should exist.

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[58] American Planning Association, *PAS Report 600, Planning for Urban Heat Resilience,* 2022, https://planning-org-uploaded-media.s3.amazonaws.com/publication/download_pdf/PAS-Report-600-r1.pdf.

[59] EPA, Reducing urban heat islands: Compendium of strategies, 2008, https://www.epa.gov/heat-islands/heat-island-compendium.

The City could **work to promote and implement lighter paving materials** to increase solar reflectance and thermal emittance of publicly owned roadways and parking lots throughout the City. As identified above, these efforts will culminate to a series of "Leading by Example" initiatives undertaken by the City to mitigate extreme heat and spread awareness of this climate hazard. The City will rely on data before and after implementation of these new roofs, roadways, and parking lots to showcase reductions in extreme heat, and construct a narrative and model for private property owners to consider and implement themselves.

> **Example Program: The City of Cambridge, MA Piloted a Pavement Surface Treatment** *to reduce the urban heat island effect at a municipal parking lot in a dense, vulnerable neighborhood..*[60]

H-1.B: Expand waste heat reduction programs

Industrial and commercial properties contribute to extreme heat primarily through the creation of waste heat during their use of high volumes of energy. The City could **plan and implement programs in which industrial and commercial sites will reduce waste heat through heat recovery technology**, as well as improved HVAC controls and the use of on-site renewable energy and battery storage. The City could **develop a plan to engage with industrial and commercial property owners** to assess a combination of energy efficiency building retrofits in tandem with waste heat reduction improvements.

H-1.C: Expand and incentivize urban greening

The City will continue to **expand its efforts to increase the number of trees throughout the City**, as identified in its Urban Forestry Master Plan and the goal outlined in the EAP2040 to achieve a 40 % overall tree canopy by 2035 (Section 4.1). The City, through its identification of heat vulnerable areas with relatively low access to parks and open space, will work to implement new vegetated parks and open space. The City will also review ongoing development plans for parks and open spaces, and could **incorporate shade structures and water features**, to enable additional heat reduction around the City.

The City could work to **incentivize urban greening initiatives** by residents and developers through assistance through the continuation of its Green Building Policy, as well as the development of financial incentives to support residents in purchasing and planting trees in on their properties.

> ***Example: Montgomery County gives away free shade trees*** *to individuals who reside in particularly heat vulnerable areas throughout the County..*[61]

The City could seek out the potential for **establishing public-private partnerships to expand urban greening**. The City will complement these efforts with a rigorous O&M plan to ensure newly planted trees thrive and provide established shade canopies to combat heat.

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[60] City of Cambridge, MA, The Works, *City Pilots Pavement Surface Treatment to Reduce Urban Heat Island Effect, 2021.*

[61] Montgomery County, *Free Shade Trees*, 2022.

Example Program: Sacramento Tree Foundation and Sacramento Municipal Utility District Partnership. *Private contributions, like those provided by the Sacramento Tree Foundation to the Sacramento Municipal Utility District to plant over 350,000 shade trees, can assist in providing the incentives and materials needed to robustly expand tree canopy throughout the City..*[62]

The expansion of urban greening can also occur through other methods, like the implementation of green stormwater infrastructure within city streets and parks. Green infrastructure utilizes soil and plants, permeable pavements, and natural systems to store, retain, and infiltrate stormwater. Such infrastructure is co-beneficial to reducing the volume of stormwater in underground utilities, and provides an environment for trees, vegetation, and habitat to flourish. The City could **assess all city streets, public ways, and parks for the installation of green infrastructure**, especially within districts that are highly vulnerable to both heat and flooding.

H-2: Heat management

Heat management strategies will serve to equip residents with the financial and physical resources necessary to grapple with extreme heat events. Heat management strategies will work to address energy use during extreme heat events, understand personal exposure to heat, mitigate negative public health outcomes, and increase overall emergency preparedness of residents.

H-2.A: Expand heat relief programs for vulnerable residents

One of the primary ways in which individuals protect themselves and their families from extreme heat is via internal cooling methods, such as air conditioning and electric fans. Vulnerable residents, however, are often individuals with smaller relative disposable income, and may not be able to keep up with the costs of operating such cooling appliances throughout the hot summer months. The City already provides energy assistance cooling programs to income-eligible households comprised of elderly, young, and disabled individuals. The City could work to **expand and tailor these energy assistance services** to vulnerable neighborhoods, and will utilize the Heat Vulnerability Assessment to guide this process. Additionally, the City will work to **provide energy efficient air conditioning (AC) units** to vulnerable residents to replace outdated cooling appliances or provide new means of cooling for residents.

H-2.B: Expand cooling centers for residents

The City could utilize the findings of its Heat Vulnerability Assessment to **identify new cooling centers** and **extend existing cooling center hours** and cooling at night during extended heat periods while prioritizing the new implementation and expansion of hours of cooling centers situated in heat vulnerable neighborhoods. The City will engage with the community to raise awareness of these services, and might **conduct a resident survey** to understand the needs of vulnerable residents during extreme heat. The survey will include questions relating to the need for transportation to and from cooling centers for residents with disabilities, as well as the location and services offered at cooling center locations.

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[62] Sacramento Municipal Utility District (SMUD). *Shading Sacramento*. Accessed on April 27, 2022.

H-2.C: Address personal exposure to heat

Individuals will be impacted by heat outside of their homes and during times when they are unable to access cooling centers. The City will address personal exposures to heat across multiple sectors, including schools, occupational settings, and transportation systems. The City could **identify schools throughout the City that are deficient in adequate cooling mechanisms** for students and staff and work with the Alexandria Public School system to address financial or logistical gaps in providing these appliances. The City could **incorporate training programs for City staff working outdoors** and will provide educational materials to businesses and firms to inform them of National Institute for Occupational Safety and Health standards. The City could **identify public transportation hubs and facilities that require additional cooling mechanisms** such as on-board AC systems, shaded transit stops, and the addition of drinking fountains and misting stations along walking, biking, and transit routes.

H-3: Heat coordination

Heat coordination strategies will enable the City and its departments to facilitate focused preparedness and response programs to support heat reduction and heat management strategies, while providing a focused set of roles and responsibilities for City staff and emergency response personnel.

H-3.A: Establish a heat preparedness program

The City could **establish a heat preparedness program**. The goal of the heat preparedness program is to increase community participation in preparing for and spreading awareness of extreme heat throughout the City. The program will be staffed by relevant city department staff and neighborhood leaders.

> **Example Program: The City of Philadelphia's Beat the Heat Toolkit** was developed through the coordination of city departments and neighborhood groups to combat and increase community resilience to extreme heat..[63] The program included the elements shown in Figure 29.

Figure 29. Elements of the Philadelphia Beat the Heat Toolkit

The City could work with public and community stakeholders, including the Virginia Department of Health, ACPS, neighborhood groups, and other relevant boards and commissions to identify leaders of this Heat Team. A city survey will aid in understanding knowledge around extreme heat, and what proposed improvements can be made to address its impacts. Community events will spread awareness and increase participation within the Heat Team and will allow for the election of Heat Ambassadors who may represent specific neighborhoods around the City. Heat Ambassadors will function as a liaison of their neighborhood community's needs and concerns

related to extreme heat. Effectively, this process will simultaneously spread awareness of heat impacts, and assist the community in preparing for extreme heat.

H-3.B: Develop an extreme heat incident response plan

The adaptive capacity to deal with extreme heat events is reliant on the City's ability to streamline emergency response services to residents in need. The City could begin the **creation of an extreme heat incident response plan**, which will serve to define the roles and responsibilities of city departments and public service agencies in responding to extreme heat events. Roles and responsibilities, and the commitment of the City to conduct assessments of community preparedness and resilience, are mentioned within the ResilientALX Charter and may be stewarded by the Citizen Corps Council..[64] The goal of the Extreme Heat Incident Response Plan will be to foster a coordinated and tailored response to heat emergencies, while building the City's internal capacity and understanding of extreme heat impacts on residents. The Extreme Heat Incident Response Plan may incorporate the following elements..[65]

- **Defining Roles and Responsibilities:** City departments, such as the Alexandria Fire Department, Police Department, and Emergency Services Department, DCSH, should understand their response to extreme heat and how they can best serve the needs of their residents.
- **Worker Safety:** The City may review the impact of heat on workers in both indoor and outdoor settings, with special attention given to workers spending the majority of their time in outdoor settings. A review of resources available to the Department of Public Works staff, City construction workers, crossing guards, and any other relevant personnel should be undertaken by the City and adjusted to ensure adequate cooling and emergency response plans are in place.
- **Identifying Response to Vulnerable Residents:** The City should work with the Department of Community and Health Services and the Office of Emergency Management to create plans for regular check-ins with community members who are disabled, unhoused, or particularly vulnerable to extreme heat.
- **Coordinate Communications Strategies:** The City has resources available to assist residents during times of extreme heat. The City will work to expand its communication strategies, potentially using coordinated public broadcasts, multi-lingual and multi-platform alert systems, and/or through the establishment of resident led buddy programs for vulnerable residents.

H-3.C: Coordinate regionally

The City may coordinate with regional partners, such as the District of Colombia's Ready D.C. program, to share experiences and strategies in reducing and managing heat impacts to Alexandria. The City of Alexandria will consider joining a regional working group to address the

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[64] City of Alexandria, *ResilientALX Charter*, 2020, *https://media.alexandriava.gov/docs-archives/tes/stormwater/resilientalxcharterfinal20210108.pdf*.

[65] Arizona Department of Health Services, *Extreme Heat Incident Annex*, 2021, https://www.azdhs.gov/documents/preparedness/emergency-preparedness/response-plans/extreme-heat-incident-annex.pdf.

impacts of extreme heat in Northern Virginia communities. The City may request the support of the Northern Virginia Planning District Commission to serve as a steward of such meetings.

Implementation and Next Steps

Recommendations for Further Action and Funding

Achieving the ambitious goals laid out in this plan will require the whole Alexandria community to work collaboratively across sectors to achieve this vision for the City's future. However, there are tangible next steps for the City and stakeholders alike to take to ensure that this plan is translated into impactful actions. These span continual communication and engagement with the community and stakeholders, establishing protocols for demonstrating accountability and progress, tracking progress through established transparent metrics, and seeking and securing funding from multiple sources, including federal funding opportunities offered through the Infrastructure Investment and Jobs Act (IIJA) and the Inflation Reduction Act (IRA). Community and stakeholder resources for continued action vary from Federal, State, regional, and local resources. These resources are listed below by sector.

Buildings

- Weatherization Assistance Program (DOE)
- Database of State Incentives for Renewables and Efficiency
- Commercial Property Assessed Clean Energy (C-PACE) Program
- 2019 Green Building Policy
- Virginia Clean Energy Act 2020, Emissions Reductions Strategies and Actions

Transportation

- Federal EV Tax Credits
- DOE Alternative Fuels Data Center
- GOAlex

Renewable and Clean Electricity

- VA Database of State Incentives for Renewables and Efficiency
- Alexandria Community Renewable Energy Resources
- Northern Virginia Solar Map
- Solarize Virginia

Waste

- Purple Can Club (glass recycling)
- Alexandria Food Waste Composting Stations
- Alexandria Recycling

Water

- Flood Action Alexandria
- Alexandria Stormwater Utility Fee and Credit Program
- Locate Your Watershed

Additionally, there are federal funding opportunities to support the City in implementing the ECCAP, especially via the IIJA and IRA.

IRA – Inflation Reduction Act

The IRA of 2022 is the largest federal clean energy and climate investment to date. While the IRA will not singlehandedly accomplish current U.S. climate commitments, the bill is projected to cut GHG emissions by between 37-41% below 2005 levels by 2030. The act includes $369 billion for climate and energy investment and tax breaks (The National Law Review, "What's In the Inflation Reduction Act?" August 24, 2022, https://www.natlawreview.com/article/what-s-inflation-reduction-act). These are mostly comprised of expanded tax credits and funding programs to promote the following goals that align with the ECCAP priorities:

- Deployment and generation of clean energy and fuels;
- Electrification and resiliency improvements to existing electrical grids;
- Low-carbon technologies and materials for homes and buildings; and
- EV adoption.

The City may take advantage of the community benefits reaped by promoting these tax credits to Alexandria citizens while also considering the following direct funding opportunities provided in the IRA, such as:

- Block grants from the Department of Housing and Urban Development for projects addressing affordable housing and climate change issues;
- Grants from the Department of Energy for local government to implement greener energy codes (2021 International Energy Conservation Code for residential, ANSI/ASHRAE/IES Standard 90.1—2019 for commercial);
- Clean Heavy-Duty Vehicle program covering incremental costs of zero-emissions school buses, garbage trucks, and transit buses;
- Low Emission Electricity program funding and providing technical support to reduce GHG emissions, particularly in low-income and disadvantaged communities;
- Greenhouse Gas Reduction Fund financing zero-emissions technology deployment (including community solar) with 60% of funds to go towards low-income and disadvantaged communities; and
- Improving Energy Efficiency or Water Efficiency or Climate Resilience of Affordable Housing grant program which helps cover the cost of efficiency upgrades (including electrification).

IIJA – Infrastructure, Investment, and Jobs Act

In November 2021, Congress passed the IIJA—also known as the Bipartisan Infrastructure Act—which includes $550 billion in federal funding to grow a more sustainable economy. The act aims to create new jobs and invest in sustainable infrastructure ranging from bridges and roads to broadband internet. Notably, IIJA focuses on investments designed to create a more climate-friendly energy and transportation sector. This includes—but is not limited to—the expansion of EV infrastructure, deployment of clean energy, and creation of a new Grid Development Authority for sustainable electrification of the power grid. As of December 2021, Virginia is projected to receive over $8 billion in infrastructure funding over five years as a result of IIJA (Transportation Today).

This funding will go towards various grants for new and existing energy programing to achieve the following:

- Reduce the energy burden in low-income and marginalized communities;
- Expand access to energy efficiency solutions for families, communities, and businesses (like electrification and low-carbon technologies for building retrofitting);
- Increase the generation of reliable, clean, and affordable power; and
- Deploy EV charging infrastructure.

The EAP2040 includes actions to integrate estimates of projected greenhouse gas emissions impacts from municipal operations and capital improvement program expenditures through the City budget process. In addition, the City should evaluate the entire budget with a "Climate Lens" and consider greenhouse gas emissions and adaptation during the budget process. The budget process should also incorporate the cost of the City not taking climate actions (i.e. cost of inaction) or delaying implementation. The cost of inaction or delayed implementation may result in higher costs or more significant consequences to Alexandria in the long term.

The City should also consider funding opportunities through public-private partnerships; innovative partnership structures; philanthropic sources; or other funding streams that are best suited for supporting investment in climate action.

Office of Climate Action, Ongoing Community Engagement, and Communications

In September 2022, the Alexandria City Council authorized $1.85 million for the establishment of an Office of Climate Action to respond to the ongoing climate crisis which continues to impact the well-being of our community. The creation of the City's Office of Climate Action marks a monumental achievement aimed at combating climate change through a city-wide approach to empower the Alexandria community to actively participate and contribute to sustainable action. A Climate Action Officer and Public Affairs and Engagement Specialist will join five reallocated employees from the partnering departments to serve in the City's Office of Climate Action. The overall composition of the Office of Climate Action both recognizes the prior and ongoing efforts across City departments and aims to set up an implementation and partnership-oriented approach. The Office of Climate Action will lead efforts in a variety of areas, including but not

limited to, energy efficiency, high performance buildings, renewable energy, climate change mitigation and reporting, electric mobility, business assistance, community engagement, and advocacy. The Office of Climate Action will work closely with City departments, other governmental entities, and the community in achieving EAP2040 and ECCAP commitments. While the investment for the new Office of Climate Action reflects the significant emphasis the City is placing on addressing climate change and the real and present risks it poses to the community, more resources will be needed to implement the ECCAP and transform the City's infrastructure and how Alexandrians live, work, play, and learn.

Evaluating Progress, and Continual Planning

In addition to the action plans in this report, the City will strive to ensure that such actions have positive impacts on the Alexandria community and the environment at large. Tracking these impacts through the course of planned action is critical to ensuring the efficacy of these efforts. Clear qualitative and quantitative metrics for impacts in areas like environmental health, economic growth, and equity considerations, among others, will be tracked throughout the lifetime of a project or action. The City could partner with community stakeholders and subject matter experts to provide, collect, and analyze impact data to produce accurate and substantive impact reports.

Recognizing the crucial role of ongoing data collection and transparency to ensure the success of actions, the City intends to conduct regular data collection and metrics tracking to understand the state of their programming progress. The City will continue its participation in the collaboration with Metropolitan Washington Council of Governments (MWCOG) and other regional jurisdictions to perform updates to the region's Greenhouse Gas Inventory performed, on average, every three years. The region's Greenhouse Gas Inventory serves as the basis for Alexandria's Greenhouse Gas Inventory also performed by MWCOG. Working with MWCOG, the City aspires to conduct interim or more frequent updates to the region's Greenhouse Gas Inventory for purposes of tracking progress of successful ECCAP strategy and action implementation. This information will be shared with the public through an accessible dashboard that will be regularly updated and managed by the new Office of Climate Action, which will be responsible for implementing the ECCAP, with oversight as deemed appropriate by the Alexandria City Council.

As a part of ongoing progress monitoring and tracking, the City will continue to participate in national and global reporting initiatives and programs that serve to benchmark its performance against peer jurisdictions, provide transparency to the community, and showcase its projects and successes. In April 2022, the City received LEED Gold certification through the U.S. Green Building Council's (USGBC) LEED for Cities rating system..[66] The City has also begun reporting to CDP, a global disclosure platform..[67] Reporting to CDP reflects the City's commitment to transparency and contributes to the global repository of climate action data. The 2022 reporting cycle has been completed and the City will continue to disclose to CDP annually.

Follow up action plans, policy changes, and future impact reports will play a key role in fulfilling the City's climate goals in the long term, beyond the scope of this report alone. These future accountability measure taken by the City will demonstrate commitments to continuously shape a greener, thriving Alexandria.

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[66] LEED is a globally recognized framework and rating systems used to assess the sustainability performance of buildings on various metrics, including energy efficiency, cost savings, health outcomes, and others. See https://www.usgbc.org/leed for more information.

[67] CDP is a disclosure system used by companies, investors, local governments, and other organizations to evaluate their climate and environmental performance. This public platform increases the accountability and transparency of reporting organizations and helps identify additional opportunities to reduce their environmental impacts. See https://www.cdp.net/en for more information.

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Appendix B: Acronyms

ACPS	American Innovation & Manufacturing Alexandria City Public Schools
AIM	American Innovation & Manufacturing
ARHA	Alexandria Redevelopment and Housing Authority
AMP	Alexandria Mobility Plan
ATV	Alexandria Transit Vision plan
BIL	Bipartisan Infrastructure Law
BAU	Business-as-usual
BIPOC	Black, Indigenous, and People of Color
BRT	Bus Rapid Transit
CASSCA	City of Alexandria Storm Sewer Capacity Analysis
CAV	Connected/automated vehicles
CBECS	Commercial Building Energy Survey
CBEI	Consumption-based emissions inventory
CCS	Carbon capture and storage
CDD	Coordinated Development District
CIP	Capital Improvement Program
CE	Carbon-free Electricity
COPD	Chronic obstructive pulmonary disease
C-PACE	Commercial property-assessed clean energy
CTE	Center for Transportation and the Environment
CZM	Coastal Zone Management
DASH	Driving Alexandria Safely Home
DOE	Department of Energy
DRPT	Department of Rail & Public Transit
DSP	Development Site Plan
DSUP	Development Special Use Permit
EaaS	Energy-as-a-Service
EAP	Environmental Action Plan
ECCAP	Energy and Climate Change Action Plan
ECCTF	Energy and Climate Change Task Force

EPA	Environmental Protection Agency
EPC	Environmental Policy Commission
ESMP	Energy Sustainability Master Plan
ESPC	Energy Savings Performance Contract
EUI	Energy use intensity
EV	Electric vehicle
EVRS	Electric Vehicle Charging Readiness Strategy
FCI	Facility Condition Index
FEMA	Federal Emergency Management Agency
FRP	Flood Resilience Plan
FTA	Federal Transit Authority
GHG	Greenhouse gas (emission)
HCF	Hydrofluorocarbons
HVAC	Heating, ventilation, and air conditioning
HVI	Heat vulnerability index
I&I	Infiltration and inflow
ICE	Internal combustion engine
IIJA	Infrastructure and Investment Jobs Act
IPCC	Intergovernmental Panel on Climate Change
IRA	Inflation Reduction Act
ITS	Information Technology Services
IWG	Internal Working Group
LD	Light-duty (vehicle)
LEAP	Local Energy Alliance Program
LED	Light-emitting diode
LEED	Leading Energy and Environmental Design
LiDAR	Light Detection and Ranging
LMI	Low and moderate income
LRPIWP	Long-Range Planning Interdepartmental Work Plan
MWCOG	Metropolitan Washington Council of Governments
NFIP	National Flood Insurance Program
NIOSH	National Institute for Occupational Safety and Health

NOAA	National Oceanic and Atmospheric Administration
NREL	National Renewable Energy Lab
NVRC	Northern Virginia Regional Commission
NVTA	Northern Virginia Transit Authority
O&M	Operations and Maintenance
PCA	Principal component analysis
PPA	Power purchase agreements
PWS	Public Works Service
REC	Renewable Energy Certificate
RECS	Residential Energy Consumptions Survey
RFI	Request for information
RNG	Renewable natural gas
ROI	Return on investment
SAF	Sustainable Aviation Fuel
SAP	Small Area Plan
SAVE	Steps to Advance Virginia's Energy
TMP	Transportation Management Plan
T&ES	Transportation & Environmental Services
TOA	Top of atmosphere
TOD	Transit-oriented development
TPB	Transportation Planning Board
TRIP	Transit Ridership Incentive Program
TSMO	Transportation systems management and operations
TSP	Transit vehicle signal priority
USDN	Urban Sustainability Directors Network
VCEA	Virginia Clean Economy Act
VMT	Vehicle miles traveled
WAP	Weatherization Assistance Program
WMATA	Washington Metropolitan Area Transit Authority
WTE	Waste-to-energy
ZE	Zero emissions
ZEB or ZEV	Zero emissions bus or Zero emission vehicle

Appendix C: Glossary

Adaptation—The process of adjusting to new or changing climate conditions to reduce or avoid negative impacts to valued assets and take advantage of emerging opportunities.

Adaptive management—An iterative risk management approach. As conditions change, adaptive management suggests using adaptation actions that address current risks and preparing for variable future changes. This approach provides flexibility to assess continuously changing risks and undertake appropriate actions to mitigate those risks.

Alternative Fuel (buildings)—A fuel, through combustion, used by building systems for heating (i.e. HVAC, etc.), hot-water heating, cooking, power generation, or providing amenities (fireplaces, historic lighting, etc.) that is derived from resource recovered gas or renewable hydrogen.

Alternative Fuel (transportation)—The City's Alternative Fuel Fleet Policy defines Alternative Fuel as "any fuel other than gasoline, diesel, and other substantially petroleum-based fuels that is less polluting than gasoline or diesel fuel. Alternative fuel has included, but is not limited to, natural gas, propane, ethanol (E-85), biodiesel (5 percent blend or above) and electricity."[68] For purposes of strategies and actions outlined in the ECCAP, alternative fuels primarily implies use of electricity as a fuel (i.e. electric vehicles).

Business-as-usual Scenario (BAU)—A climate modeling tool used to project potential climate impacts based on current GHG emissions, energy consumption rates, population growth, and other factors contributing to climate change.

Climate equity—The result of efforts to alleviate negative climate change impacts that disproportionately fall on vulnerable and marginalized populations.

Decarbonization—Efforts to reduce or eliminate carbon emissions resulting from a particular activity.

Electrification—Converting energy infrastructure to run on electricity rather than burned fossil fuels for the purpose of increased energy efficiency and accessibility to low- or zero-emissions energy sources

Embodied emissions (carbon) – Greenhouse gas emissions arising from the manufacturing, transportation, installation, maintenance, and disposal of building materials.

Environmental justice (EJ)—The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies..[69]

Energy consumption—End-use consumption of energy fuels and electricity in Alexandria's residential, commercial, industrial, and transportation sectors.

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[68] City of Alexandria, Alternative Fuel Fleet Policy, February 8, 2021, https://media.alexandriava.gov/docs-archives/tes/eco-city/alternative-fuel-fleet-policy-final-signed-02082021.pdf

[69] EPA," Environmental Justice," August 5, 2022, https://www.epa.gov/environmentaljustice.

Energy burden—The percentage of gross household income spent on energy costs. The national average energy burden for low-income households is 8.6% and can be as high as 30%..[70]

Energy efficiency—The use of less energy to perform the same function or action.

Energy generation—Grid-connected electricity generating units located in Alexandria or other generation sources located in Alexandria facilities.

Green bank—A public entity, quasi-public entity, depository bank, or nonprofit entity established or capitalized using local, state, or federal government funding that leverages private capital to support investment in clean energy projects, including residential and commercial energy efficiency, beneficial electrification, and renewable energy systems.

Green buildings—Building structures (residential, commercial, or otherwise) that use energy sources, building materials, and other low-carbon technologies to reduce GHG emissions and other negative environmental impacts, e.g., human or environmental exposure to toxic substances, across a building's lifespan.

Greenhouse gases (GHG)—Gases that trap heat in the atmosphere, contributing to global warming and climate change. Common GHGs include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) and fluorinated gases.

GHG reductions—Reducing the emissions of heat-trapping greenhouse gases into the atmosphere

Housing Units – A single family detached home, duplex, townhome, condominium, apartment, or other dwelling that is used by a single household.

Impacts—Refers to the effects of a climate hazard, e.g., potential impacts of warmer temperatures include health risks on hot days.

Resilience—The capacity of a community, business, or natural environment to prevent, withstand, respond to, and recover from disturbances, while retaining the basic functions of the system.

Retrofit – The addition or renovation of systems and equipment to a housing unit to increase energy efficiency and energy performance.

Risk—The chance of a climate hazard with cause harm. Risk is a function of the likelihood of an adverse climate impact occurring and the severity of its consequences (e.g., Risk = Likelihood x Consequence).

Science-based Target—Greenhouse gas emission reduction targets are considered 'science-based' if they are in line with what the latest climate science deems necessary to meet the goals of the Paris Agreement – limiting global warming to well-below 2°C above pre-industrial levels and pursuing efforts to limit warming to 1.5°C.

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[70] Office of Energy Efficiency and Renewable Energy, "Low Income Community Energy Solutions," Accessed August 31, 2022, https://www.energy.gov/eere/slsc/low-income-community-energy-solutions#:~:text=Energy%20burden%20is%20defined%20as,which%20is%20estimated%20at%203%25.

Transportation cost burden—The percentage of gross household income spent on transportation costs.

Vulnerable populations— Populations more likely to experience adverse impacts from exposure to climate hazards because of demographic factors (e.g., race, gender, sexual orientation), socio-economic status, and life-or livelihood-sustaining needs (e.g., dependence on electricity for critical medical care)..[71]

[71] EPA,"EJ 2020 Glossary," 2020, https://www.epa.gov/environmentaljustice/ej-2020-glossary.

Appendix D: Community Engagement

The ECCAP's development has included a focus on engaging with the Alexandria community and stakeholders in five primary ways: (1) convening of the ECCTF; (2) community engagement workshops; (3) targeted or directed outreach; (4) commission engagement; and (5) public comment.

Energy and Climate Change Task Force (ECCTF)

The members of the ECCTF serve as representatives of the Alexandria community. The Task Force is comprised of 13 members appointed by the City Manager and includes general community representation; environmental advocates; energy, climate, and related technical experts; representatives from Alexandria's youth and representing equity issues; and those representing engagement with Alexandria's businesses and institutional partners. The Environmental Policy Commission (EPC) has designated their own representative.

- Javier Bastos, Alexandria's business community and institutional organization interests
- Leah Devendorf, Alexandria youth interests with specific priority of Alexandria high school students
- Mary Harris, Co-Chair, Clean energy and climate policy or technology
- Fiona Herbold, Alexandria youth interests with specific priority of Alexandria high school students
- Praveen Kathpal, At-large member of the Alexandria community
- Alyssa Morin, At-large member of the Alexandria community
- Raquel Nicora, Diversity, racial and social equity, and inclusivity issues of diverse Alexandria populations, including those of Alexandria's aging population
- Marian Pegram, Co-Chair, Diversity, racial and social equity, and inclusivity issues of diverse Alexandria populations, including those of Alexandria's aging population
- Josh Sawislak, Alexandria's business community or institutional organization interests
- Marta Schantz, EPC Member
- Rose Stephens-Booker, Member reflecting climate change solutions to support the City's economic development goals
- Stephen Walz, Member reflecting environmental, clean energy, or climate change action advocacy organization or interest
- Sangina Wright, At-large member of the Alexandria community

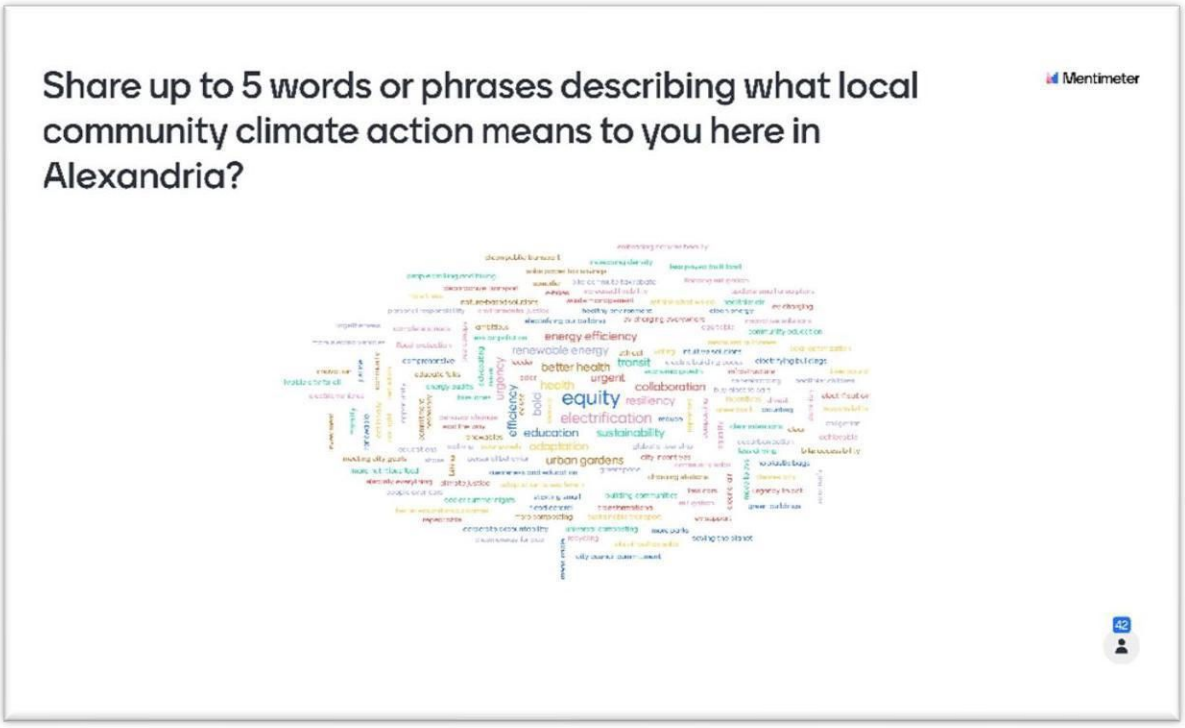
The Task Force will apply a lens of diversity, racial and social equity, and inclusion following the ALL Alexandria vision, goals, and actions in making recommendations about energy and climate change action planning, and will leverage climate change action solutions to support Alexandria's COVID-19 pandemic economic recovery efforts and economic development goals.

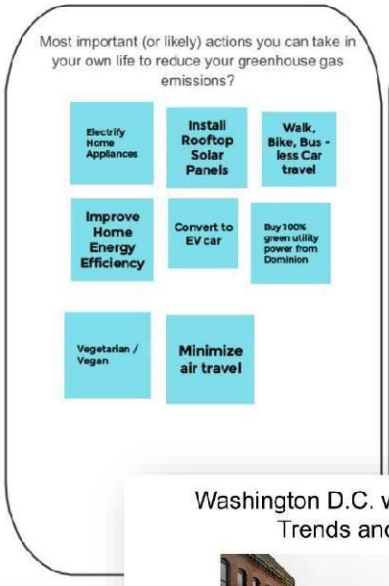
- Meeting 1 – May 4, 2021 – Introduction
- Meeting 2 – July 27, 2021 – Mitigation
- Meeting 3 – October 5, 2021 – Mitigation
- Meeting 4 – December 7, 2021 – Vulnerability and Adaptation
- Meeting 5 – February 2, 2022 – Adaptation
- Meeting 6 – July 17, 2022 – Action Overview
- Meeting 7 – October 26, 2022 – Preliminary review
- Meeting 8 – January 4, 2023 – Final review and recommendation

Community Engagement Workshops

Community Engagement Workshop 1 – November 16, 2021 - Climate Mitigation

The Alexandria community learned about energy and climate change issues affecting Alexandrians, specifically focused on climate change mitigation (i.e., greenhouse gas inventory, emissions, mitigation actions, and equity considerations). Participants shared ideas and perspectives on how Alexandria can help mitigate climate-change causing greenhouse gas emissions from commercial and residential buildings and transportation systems. Jason Samenow of the Washington Post's Capital Weather Gang provided reflections on how changing climate is impacting our local Metropolitan D.C. communities and the importance of collective community climate action to mitigate greenhouse gas emissions. In addition, Andrea Denny of the U.S. Environmental Protection Agency's State and Local Climate and Energy Program Energy and Climate, and Josh Radoff of ICLEI Local Governments for Sustainability shared share important actions local communities can take for collective climate action. The workshop included facilitated roundtable discussions focused on reducing energy use and greenhouse gas emission in buildings and transportation share benefits of community equity, health outcomes, and economic prosperity. Due to the COVID 19 pandemic, the community workshop was held via Zoom.


Share up to 5 words or phrases describing what local community climate action means to you here in Alexandria?
Mentimeter
energy efficiency
renewable energy
better health
transit
urgent
health
equity
resiliency
collaboration
electrification
education
sustainability
adaptation
urban gardens
42


Most important (or likely) actions you can take in your own life to reduce your greenhouse gas emissions?
Electrify Home Appliances
Install Rooftop Solar Panels
Walk, Bike, Bus - less Car travel
Improve Home Energy Efficiency
Convert to EV car
Buy 100% green utility power from Dominion
Vegetarian / Vegan
Minimize air travel

What barriers do you experience that prohibits you from taking action to reduce your greenhouse gas emissions in your own life?
Lack of contractor knowledge on high-efficiency/all-electric home appliance options
Inertia. Too lazy to make home improvements.
Cost. Solar panels are expensive.
lack of technical and financial assistance (including C-PACE) for condo building EE/RE improvements and electrification
lack of ability to enter into PPA's

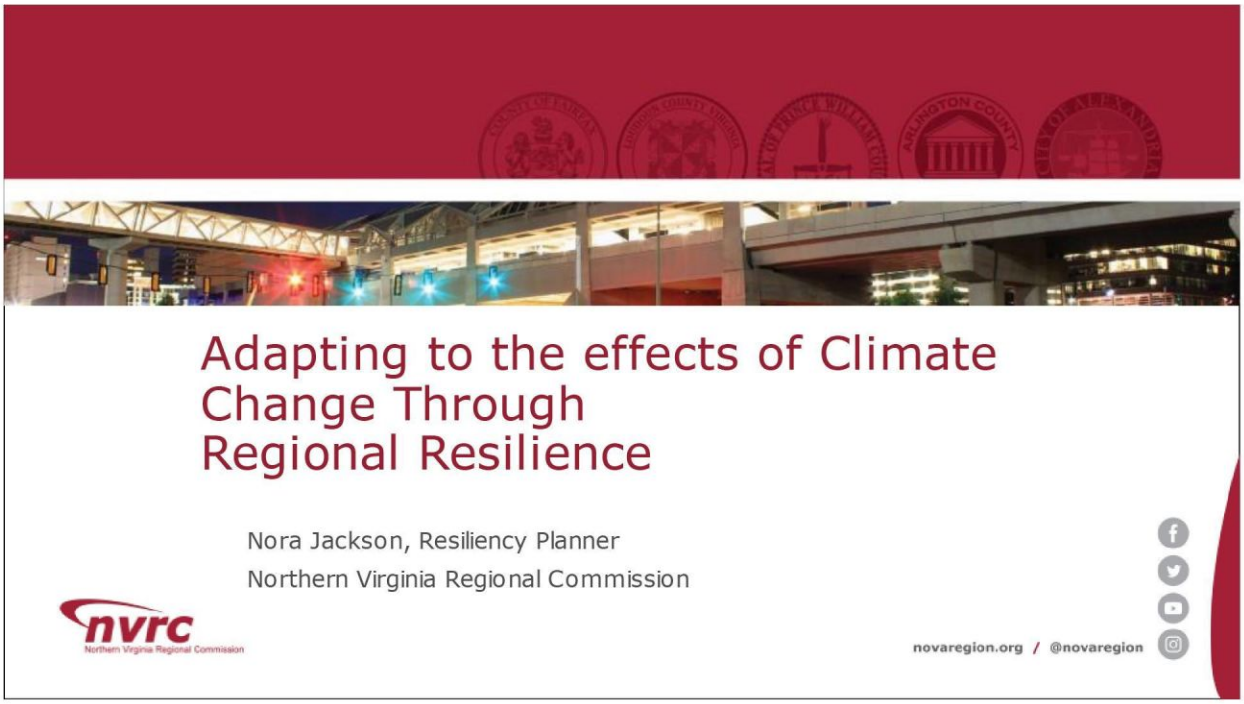
What is a priority action the City of Alexandria can take to support your reduction of greenhouse gas emissions in your own life or in the community?
Facilitate Community Solar Installations
Offer Programs & Incentives to make improving home sustainability easy
Electrify DASH bus network
Add bike lanes
Offer major education events at community hotspots - farmers markets, TWU and ARHA events, etc
Hire a City Manager who supports & understands climate action
Make Dominion offer Green Power in easier, cheaper ways
More vegetarian / vegan meals in public school
Workforce education on efficiency/ sustainability
Hire outreach staff for residents, businesses, and developers to lead electrification and EE/RE retrofits
Make the necessary investments to enable rapid, deep emissions reductions, even if that means changing typical budget policies and assumptions
Dedicated Bus Lanes on Duke Street
Lack of information on building energy and refrigerant use and resulting GHG emissions

Washington D.C. weather and climate: Trends and projections
Salwan Georges
Jason Samenow
November 16, 2021
The Washington Post

Community Engagement Workshop 2 – March 1, 2022 – Climate Vulnerability and Adaptation

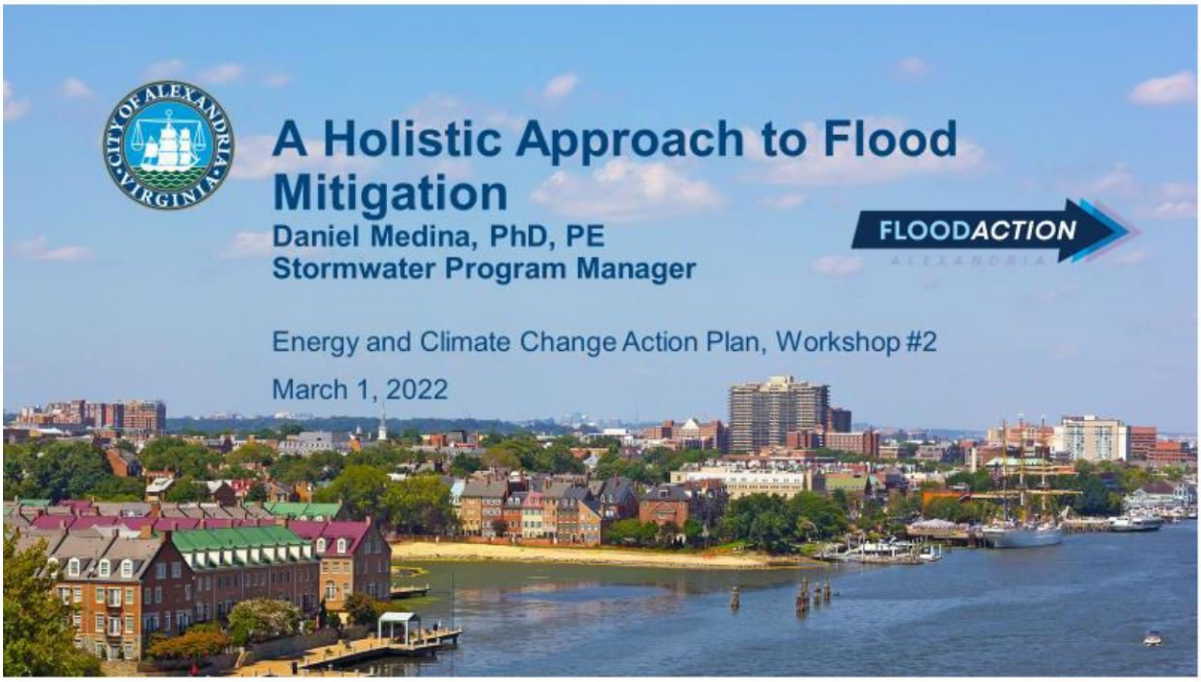
The Alexandria community learned about energy and climate change issues related to climate change vulnerabilities and adaptation. Specifically, the presentation topics included impacts of increased temperatures, increased precipitation, and sea level rise. During the Community Workshop, participants shared ideas and perspectives on how Alexandria can help better adapt to the impacts of climate change.

Dr. Reid Sherman, climate adaptation consultant for federal agencies and former EPC, provided an overview of what constitutes climate adaptation and why it is important with a focus on governance, policy, and implementation. Ms. Nora Jackson, a resilience planner with the NVRC discussed adaptation at the regional level by highlighting mitigation and planning efforts that address extreme heat and severe storms. Dr. Dan Medina, PE, with the City of Alexandria's Department of Project Implementation will highlight Flood Action Alexandria initiative, which focuses on becoming a more flood resilient City. The workshop included opportunities for participation via facilitated roundtable discussions focused on climate change vulnerability and adaptation to help create a more resilient Alexandria. Due to the COVID-19 pandemic, the workshop was held via Zoom.



The Climate Adaptation Landscape

Reid Sherman



Community Engagement Workshop 3 – August 27, 2022

The Alexandria community learned about the development of the ECCAP, including preliminary BAU projections, proposed strategies and actions, and participated in a series of polling and facilitated feedback discussions. The workshop featured opening remarks from Yon Lambert, Interim Deputy County Manager / Director, Department of Transportation and Environmental Services, and Mary Harris, Co-Chair, ECCTF. Mr. Lambert discussed the City's ongoing climate action efforts including discussing specific transportation projects to reduce greenhouse gas emissions and flood mitigation efforts to adapt to the impacts of increased precipitation resulting from the impacts of a changing climate. Ms. Harris the background of the ECCTF and discussed the Task Force's work in supporting the City's development of the ECCAP.

The Alexandria community participated in polling and facilitated feedback discussions to reflect biggest concerns of the impacts of climate change, ideas and perspectives on proposed strategies and actions related to buildings and transportation greenhouse gas emissions, heat vulnerability and flood mitigation, and opportunities to communicate climate change action.

Provide a few words or phrases telling us your biggest concerns or fears about climate change?

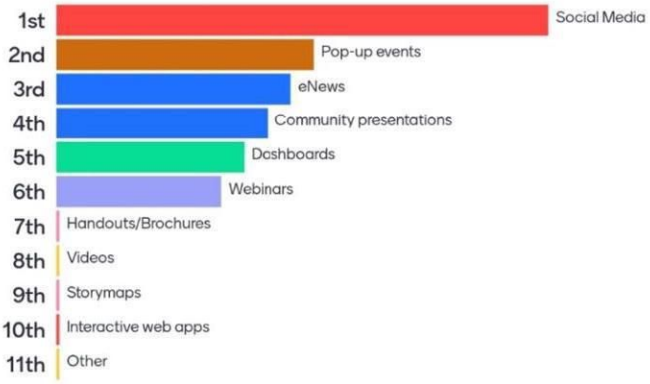
Mentimeter

War	Extreme heat	Apathy
Greenwashing personal electric cars	Collapse of species	Inaction and moderation
Pollution and limited natural resources	Political interfearance	Ecological Collapse, mass extinction

19

What types of communications from the City do you find most helpful?

Mentimeter



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Direct Outreach

City staff conducted direct outreach with several community organizations to learn about specific concerns and needs of community members, to include community members represented by UNITE Here!, Tenants and Workers Union, and Casa Chirilagua. These organizations provided input on concerns related to healthy housing, energy burden, the need for support to implement energy efficiency opportunities, access to public transportation, and the impacts of increasing extreme heat conditions. In summary, these organizations reflected on equitable outcomes in the Alexandria community's climate action approach. Additionally, these community organizations advocated, and provided example, for ways to enhance communications particularly to community members where English is not the primary language spoken in a household.

City Commissions

Subsequent to the ECCTF's Meeting #7 where City staff received feedback on a working draft of the ECCAP, City staff presented the ECCAP working draft to the City's Transportation Commission (November 17, 2022), EPC (November 21, 2022), Planning Commission (December 1, 2022), and, by request, the Commission on Aging (December 8, 2022). Each commission provided feedback on the working draft for City staff consideration.

Public Comment

The draft ECCAP was open for Public Comment between January 6, 2023 and February , 2023.

Appendix E: GHG Emissions Technical Methods and Approach

BAU Modeling

The Alexandria BAU model estimates future annual emissions assuming that no new policies or actions are taken to mitigate emissions. It incorporates factors such as projected population growth, economic growth, and electricity grid emission factors. Even anticipated state level policies such as the Virginia Clean Economy Act[72] are not factored into the BAU model. The outcome of this model is intended to be a reasonable worst-case scenario for emissions from Alexandria through 2050. The outputs of the BAU scenario focus on sectors most applicable to target mitigation efforts. The sectors modeled in the Alexandria BAU scenario include:

- Buildings – Energy consumption from electricity, natural gas, fuel oil, and propane from existing and new construction in residential and commercial subsectors.
- Transportation – On- and off-road vehicle, rail, and aviation travel emissions.
- Waste – Emissions from landfills or waste-to-energy plants for solid waste emissions, emissions from wastewater treatment for wastewater emissions.
- Agriculture – emissions from agricultural activities.
- HFCs – HFCs usage in sectors such as refrigeration and AC.
- Fugitive Emissions – Emissions from leaked gases, mainly natural gas.

Buildings

Building energy use includes building emission projections based on energy consumption from electricity, natural gas, fuel oil, and propane in existing buildings and new construction in residential (both single family and multifamily), and commercial buildings. The base year for energy consumption in existing buildings is 2020 and was taken from the preliminary *2020 Alexandria GHG Inventory* provided by MWCOG.

Forward looking projections through 2050 (excluding 2019-2021) for existing buildings determine energy use as the sum of the prior year's energy consumption from existing buildings and the energy use added from the new construction. The additional energy consumption from new construction is based on Energy Use Intensity (EUI) (amount of energy used per square foot annually) represented by the energy consumption per household/commercial square foot multiplied by the number of new households or commercial square feet each year. This EUI is derived from the preliminary *2020 Alexandria GHG Inventory* provided by MWCOG in terms of number of households or commercial square feet, and the energy use for the residential and commercial subsectors, respectively. This derived EUI was then multiplied by the projected number of new households or commercial square feet. This household/commercial square foot growth was derived from the City's projections for commercial building growth based on 1,000

[72] Code of Virginia 56-585.1:11, 56-585.5, 56-585.6, https://lis.virginia.gov/cgi-bin/legp604.exe?201+ful+HB1526ER+pdf

square feet per household and 250 square feet per job. New growth of households was assumed to be housed in 95% multifamily households.

For 2021 specifically, energy consumption was calculated by applying a weighted average of energy consumption in newly constructed households/commercial square feet. Newly constructed buildings employ a stricter energy code and electricity consumption than in existing buildings. Additionally, an 80 to 90% compliance rate is applied to newly constructed houses to account for industry-average code compliance. A similar methodology was used to calculate energy use in 2022. Projecting forward past 2022, building EUI for new construction were then held constant at 2020 levels in the BAU scenario.

Fuel oil and propane uses, which are significantly lower and virtually non-existent as compared to electricity and natural gas, were held at a constant value, resulting in constant emissions from these two fuels throughout the time series of the BAU scenario.

The 2019 Green Building Policy is evaluated within the mitigation strategies and actions and is therefore not accounted for in the BAU scenario.

Transportation

Transportation emissions consist of the emission from on-road vehicles, off-road vehicles, rail, and aviation travel emissions. On-road emissions projections are estimated using VMT and emissions projections developed by MWCOG as part of the TPB's Long-Range Transportation Plan..[73] GHG and VMT estimates are provided for 2018, 2030, and 2045. These are used to calculate an implied emission factor for these years. VMT, emission factors, and then total emissions for intervening years are interpolated, and 2046-2050 are extrapolated using a linear trend. Due to the estimates' built-in assumptions regarding increases in vehicle efficiency and increase in electrification that reduces tailpipe emissions, the vehicle emissions factor decreases from 2020 to 2050. Specifically, the CO_2 emission factor decreased by 27% from 2018 to 2045 and 8% from 2030 to 2045, while N_2O and CH_4 follow a similar pattern. This decrease in emission factors also causes overall emissions to decrease, thus why BAU emissions are decreasing over time.

Off-road emissions are projected through 2050 by growing the emissions in the base year of 2018 in line with the growth rate of the population of Alexandria from population forecasts. The base year emissions in 2018 were estimated from MWCOG's Long-Range Transportation Plan.

Rail emissions were held constant through 2050 and were based on 2018 emissions estimated in the 2018 MWCOG Inventory.[74], which calculates emissions based on diesel consumption data from transit authorities provided by the Federal Transit Authority. Similarly, to off-road

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[73] Metropolitan Washington Council of Governments, Visualize 2045: A Long Range Transportation Plan for the National Capital Region, https://www.mwcog.org/documents/2022/06/15/visualize-2045-a-long-range-transportation-plan-for-the-national-capital-region-featured-publications-tpb-visualize-2045/

[74] Metropolitan Washington Council of Governments, Community-wide Greenhouse Gas Inventory Summary, https://media.alexandriava.gov/docs-archives/tes/eco-city/alexandria-2018ghg-factsheet=finalene-=1=.pdf

emissions, aviation travel was projected and grown through 2050 based on population forecasts with a base year of 2018 from data found in the MWCOG's Inventory. These emissions assume no major changes to rail or aviation infrastructure and does not project any changes in transportation habits of Alexandria.

Waste

Solid Waste

Solid waste emissions projections assume that all of Alexandria's solid waste is treated at the Alexandria/Arlington Covanta waste-to-energy (WTE) plant and that no waste is treated by landfill. This is consistent with the methodology and results of the 2020 Alexandria Inventory ICLEI Local GHG Contribution Analysis Tool.[75]. The BAU scenario assumes that this treatment method will not change, and that the Covanta WTE will operate through 2050 with no changes to the percentage of solid waste from Alexandria treated by the facility. The emissions generated from that facility are estimated based on ICLEI – U.S. Community Protocol for Accounting and Reporting of GHG Emissions.[76] with the most recent calculation values (which were last updated in 2013). The amount of solid waste generated from Alexandria through 2050 was projected using population forecasts using 2020 as the base year for waste combustion emissions, which was taken from the 2020 Alexandria Inventory generated using the ICLEI Local GHG Contribution Analysis Tool.

Wastewater

Wastewater emission projections assumes that the population is entirely serviced by sewer systems and that there is no significant population that is served by septic systems, as is reported in the 2020 Alexandria Inventory generated using the ICLEI Local GHG Contribution Analysis Tool. Emissions from wastewater treatment increases using the same growth rate as population for Alexandria, using 2020 as the base year for wastewater emission in sewer and sewer N_2O effluent in alignment with the 2020 Alexandria Inventory generated using the ICLEI Local GHG Contribution Analysis Tool. Emission factors from the treatment of wastewater and wastewater effluent N_2O emissions are derived from the emissions per capita from the data in the 2020 Alexandria Inventory generated by the ICLEI Local GHG Contribution Analysis Tool.

Agriculture

Agriculture emissions projections are based on the 2020 Alexandria Inventory generated by the ICLEI Local GHG Contribution Analysis Tool. Emission projections are extrapolated to 2050 based on the inferred annual growth rate of -5% between 2005 and 2020 from emissions from agricultural activities which are mainly soil fluxes from urban fertilizer applications.

HFCs

HFC emissions are projected through 2050 using population forecasts of Alexandria using 2020 as the base year for HFC emissions. HFC emissions in 2020 are derived as a proportion of total

[75] ICLEI, Greenhouse Gas Contribution Analysis, https://icleiusa.org/ghg-contribution-analysis/

[76] ICLEI, U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions, https://icleiusa.org/us-community-protocol/

HFC usage found in EPA's Inventory of U.S. Greenhouse Gas Emissions and Sinks.[77] and Alexandria's population in relation to the total U.S. population.

Fugitive Emissions

Fugitive emissions are based on applying a natural gas leakage rate to the natural gas consumption of residential and commercial buildings from the 2020 Alexandria Inventory generated using the ICLEI Local GHG Contribution Analysis Tool, which is derived from the *Metropolitan Washington Energy Utility Data Survey Analysis*..[78] The natural gas leakage rate is derived using reported 2020 natural gas fugitive emissions from the 2020 Alexandria Inventory generated using the ICLEI Local GHG Contribution Analysis Tool divided by natural gas consumption.

GHG Reduction Modeling

The Alexandria Mitigation model lays out decarbonization strategies to decrease GHG emissions in each sector. The strategies modeled in the mitigation model includes:

- Buildings (B)
  - New Buildings – Energy Efficiency and Electrification
  - Existing Buildings – Energy Efficiency and Electrification
  - Renewable Natural Gas
- Transportation (T)
  - On-Road GHG Reduction Packages
- Carbon-Free Electricity (CE)
- Solid Waste Emissions Mitigation (W)
- Other Sectors (O)
  - Controlling Fugitive Natural Gas Emissions
  - Off-Road Emissions Mitigation
  - Aviation – Clean Fuels
  - HFC Phasedown – AIM Act
  - Future Technology and Acceleration Mitigation

Buildings

New Buildings

It was assumed that 70% of new buildings will be multifamily residential while 30% will be commercial, which also includes mixed-use developments. It is assumed that new buildings will be more efficient when compared to existing buildings due to increased stringency from improved buildings codes through 2050. In addition, new construction is assumed to be 95% all-electric starting in 2022. Efficiency levels over baseline building code requirements was assumed to be 15% for new buildings built between 2022 and 2030, 10% over code for new

[77] U.S. EPA, Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2020, https://www.epa.gov/system/files/documents/2022-04/us-ghg-inventory-2022-main-text.pdf

[78] MWCOG, Greenhouse Gas Emissions Inventory Methodologies, https://www.mwcog.org/documents/2022/12/09/greenhouse-gas-emissions-inventories-methodology-guide/

buildings built between 2030 and 2040, and 5% over code for new buildings built between 2040 and 2050. The declining trend in increased efficiency recognizes that as buildings become more efficient, it is more difficult to build above energy code.

Existing Buildings

ICF's approach to existing buildings leveraged its CO_2Sight© platform and utilized ICF's Distributed Energy Resources Planner (DER Planner) model. Together the platform and tool estimate energy and emissions changes from a range of decarbonization strategies. To reduce emissions from existing buildings, it was assumed that Alexandria's buildings have similar electricity and natural gas usage profiles as those within the South Atlantic region of Commercial Building Energy Survey (CBECS).[79] and Residential Energy Consumptions Survey (RECS).[80]. The South Atlantic regional energy use was calibrated to use Alexandria's BAU based on total commercial, multifamily residential, and single family residential's energy use. It was assumed that 50% of existing commercial energy use is multifamily residential based on Alexandria's building data. Using this approach, the energy use, equipment and building types from the South Atlantic regional CBECS/RECS data serve as a proxy for the Alexandria's building stock.

A total of 57 commercial energy efficiency, electrification, and building envelope measures were identified for commercial buildings, and 24 were identified for residential buildings. These measures were then applied individually to each building contained within the South Atlantic regional CBECS/RECS buildings, providing an output of energy use per measure that could be scaled to match Alexandria's energy use change over time.

Implementation rates of energy measures within existing buildings aligned with CO_2Sight's end-of-life electrification strategy from DER Planner whereby individual building systems will switch to comparable efficient electric versions as those building systems reach the end of their useful life, as determined by technology adoption curves. The end-of-life electrification strategy's adoption curves aligned with the National Renewable Energy Lab (NREL) Electrification Futures Study.[81], which provides feasible adoption curves for residential and commercial space and water heating, and cooking. NREL's Electrification Future Study models a range of factors on how all-electric technology will be adopted including, costs, supporting infrastructure, ownership and availability, and health and sustainability benefits.

Generally, the "High" electrification scenario for building system technology from NREL's Electrification Future Study was applied to building profiles as replacements to existing equipment reaching the end of its useful life. Similarly, energy efficiency adoption curves, which provide a measure of the available implementable energy efficiency for residential and commercial equipment, were derived from New York State's Energy Efficiency and Renewable Energy Potential Study, which provides a more comprehensive study of energy efficiency potential than other local similar studies.

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[79] U.S. Energy Information Administration, Commercial Buildings Energy Consumption Survey (CBECS), https://www.eia.gov/consumption/commercial/

[80] U.S. Energy Information Administration, Residential Energy Consumption Survey (RECS), https://www.eia.gov/consumption/residential/

[81] National Renewable Energy Laboratory, Electrification Futures Study, https://www.nrel.gov/analysis/electrification-futures.html

The measure energy savings, technology adoption curves, and building typologies were provided into the DER Planner model, which provides the energy consumption change from each representative South Atlantic regional building, and the modeled savings percentage associated with each mitigation measure, as an output. These outputs were combined to create the estimated total change for all buildings in the region. The total energy change for the region was then calibrated to provide a representative energy change for Alexandria's buildings.

In addition to modeling for electricity and natural gas, modeling was completed to reduce other fuels such as fuel oil and propane gas in the City's commercial and residential buildings. Conversions to gas were anticipated for both fuels on a schedule of 2% by 2025, 50% by 2035, and 90% by 2050.

Renewable Natural Gas

To reduce emissions from natural gas use, modeling showed the City of Alexandria employing the use of renewable natural gas (RNG). The methodology involves using the results of the 2020 study on the use of biofuels in the Greater Washington D.C. metropolitan region.[82] (Study on the Use of Biofuels (RNG) in Greater Washington, D.C. Metropolitan Area- Washington Gas Company, 2020) which provides conservatively-low, achievable, and aggressively-high estimates for levels of adoption of RNG within the D.C. region by 2040. These estimates were scaled to the City's level by determining Alexandria's gas consumption level as a percentage of the D.C. region, which estimates the City's RNG adoption rate in 2040. The City's RNG adoption rate will grow linearly until the estimated amount in 2040 and held constant through 2050.

Transportation

The City of Alexandria is mitigating transportation emissions through three major pathways: 1) vehicle technology and fuels (VT), 2) mode shift and travel behaviors (MS), and 3) transportation systems management and operations (TSMO).

The vehicle technology and fuels pathway involve transitioning traditional ICE light, medium, and heavy-duty vehicle sales into EV sales by 2050. In addition, promoting the adoption of electric city buses, achieving a 50% adoption rate by 2030 and 100% by 2050. The increased use of biodiesel and renewable diesel fuels is also adopted.

The mode shift and travel behaviors pathway focus on providing alternatives to vehicle travel and thereby reducing overall greenhouse gas emissions. This pathway includes enhancing bike, pedestrian, and micromobility environments to encourage walking and biking, reducing transit fares to encourage the use of public transportation, and promoting telework options to reduce the need to commute into work.

TSMO pathways are targeted at improving overall transportation efficiency, decreasing overall vehicle idling time and increasing traffic flow. This includes ramp metering, improved incident management, active signal control, and active transportation demand management. Ecodriving emission improvements are also included.

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[82] ICF, Study on the use of Biofuels (Renewable Natural Gas) in the greater Washington, D.C. Metropolitan Area, https://www.washingtongas.com/-/media/3a5633e2c3c64ed08fe1ef96c65d8207.pdf.

The modeling process used here was also employed by the TPB Climate Change Mitigation Study of 2021..[83] Alexandria-specific baseline VMT, emissions, and grid assumptions were used to adapt the model.

Carbon-Free Electricity

Electricity Grid

To reduce overall emissions from electricity generation, modeling showed the City of Alexandria is experiencing the results of a cleaner electricity grid through the implementation of VCEA. The VCEA outlines a path for Virginia's electricity grid to get to zero carbon emissions by 2050. Thus, all mitigation strategies will assume that the VCEA emission factor will be utilized. The emissions factors used include electricity imports to Virginia from other states in the region, including those served by PJM Interconnection, who do not presently have mandates equivalent to the VCEA that require zero carbon electricity. As such, the emissions factor used is slightly above zero for 2045-2050 in the modeling.

Community Choice Aggregation

In addition to the VCEA, an action to implement new local municipal/community choice aggregation program was modeled to begin operation in 2025 aimed at accelerating clean, carbon-free, renewable electricity adoption. The program was assumed to be an opt-out, program whereby all single-family housing units and small commercial/multifamily buildings (30% of total commercial electricity use) are automatically enrolled in the program. It assumed a 3% opt-out rate (in alignment with findings of similar California programs.[84]) and that 80% of new development would participate in the program. The program was modeled to sunset in 2045 consistent with the time horizon of VCEA mandates an electricity grid supplying zero carbon electricity.

Waste

The methodology to estimate GHG reductions from waste reduction and diversion assumes a 50% reduction in waste generation by 2035 and a 90% reduction by 2050 (compared to the BAU). The modeling also assumes that waste will continue to be processed through combustion at the Covanta WTE facility. These modeling assumptions were set based on the reductions necessary to meet the long-term carbon neutrality goal by 2050, as well as national-level carbon reduction goals and guidance for waste sector goal setting.[85].

Other

Fugitive Emissions

Fugitive emissions are attributable to leaks in the natural gas distribution systems serving the City of Alexandria. Through the implementation of leak reduction programs and improved servicing, fugitive emissions can be reduced to zero. For this mitigation strategy, the amount of

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[83] Metropolitan Washington Council of Governments, TPB Climate Change Mitigation Study, https://www.mwcog.org/tpb-climate-change-mitigation-study-of-2021/.

[84] Energy Freedom Colorado, Community Choice Energy (CCE), https://energyfreedomco.org/cca.php

[85] Zero Waste Alliance, Policies and Standards, https://zwia.org/policies/

fugitive emissions was calculated after current and new building electrification was implemented. This accounted for between 1.2% and 1.4% of total gas consumption. This total emissions amount was then fully mitigated.

Off-Road Emissions

Emissions from off-road vehicles are reduced through better fuel efficiency (from technology upgrades, and hybrid equipment), the use of cleaner fuels (including renewable hydrogen, biofuels), and some electrification of equipment. This strategy was modeled in alignment with medium- and heavy-duty vehicle decarbonization of 2% by 2025, 50% by 2035, and 80% by 2050.

Aviation

To reduce emissions from the aviation sector, the City is assuming the implementation of the Sustainable Aviation Fuel Act..[86] This Act is assumed to decrease emissions from aviation by 2% in 2025, 25% in 2035, and achieve aviation fuel carbon neutrality by 2050.

HFC Phasedown

The American Innovation and Manufacturing Act of 2020[87] directed the EPA to drawdown the use of hydrofluorocarbons (HFCs) in use as a refrigerant, blowing agent, and other applications. Taking a stepwise approach, an eventual drawdown to 15% of 2020 levels by 2036 is expected. This methodology assumes that 5% of HFC using equipment turns over annually, with new equipment lowering emissions along the set schedule. This provides for an 82.5% reduction in total emissions from HFCs by 2050 given an assumed 20-year lifetime of the equipment.

Future Technology and Acceleration Mitigation

To calculate other emission reductions needed to achieve Alexandria's GHG goals by 2050, the difference between total emissions with all strategies implemented in a given year is subtracted from the goal level emissions for that same year.

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[86] H.R.741 – Sustainable Aviation Fuel Act, https://www.congress.gov/bill/117th-congress/house-bill/741/text.

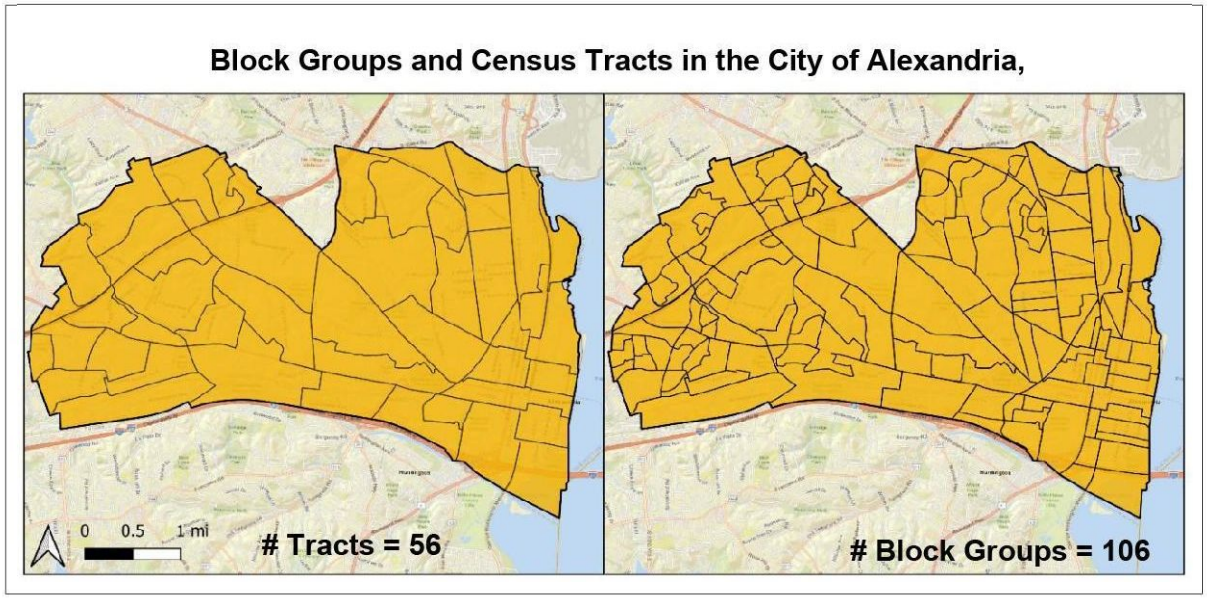
[87] 42 U.S. Code Section 7675, https://uscode.house.gov/view.xhtml?req=granuleid:USC-prelim-title42-section7675(a)&num=0&edition=prelim

Appendix F. Heat Vulnerability Assessment Methodology

The City of Alexandria conducted a heat vulnerability assessment to identify areas with greatest vulnerabilities and opportunities for adaptation. A HVI was calculated for each Census block group in the City.

The vulnerability assessment was conducted at the block group level, as opposed to larger census tracts to analyze heat vulnerability at a smaller geographic granularity (see Figure 1). The higher resolution will enable the city to make more targeted adaptations based on identified vulnerabilities.

Figure 1. Census tracts and block groups in Alexandria



The HVI included variables representing the three components of vulnerability, based on the following formula:

$$Heat\ Vulnerability\ Index\ (HVI) = Exposure\ (E) + Sensitivity\ (S) + Adaptive\ Capacity\ (AC).$$[88]

Where:

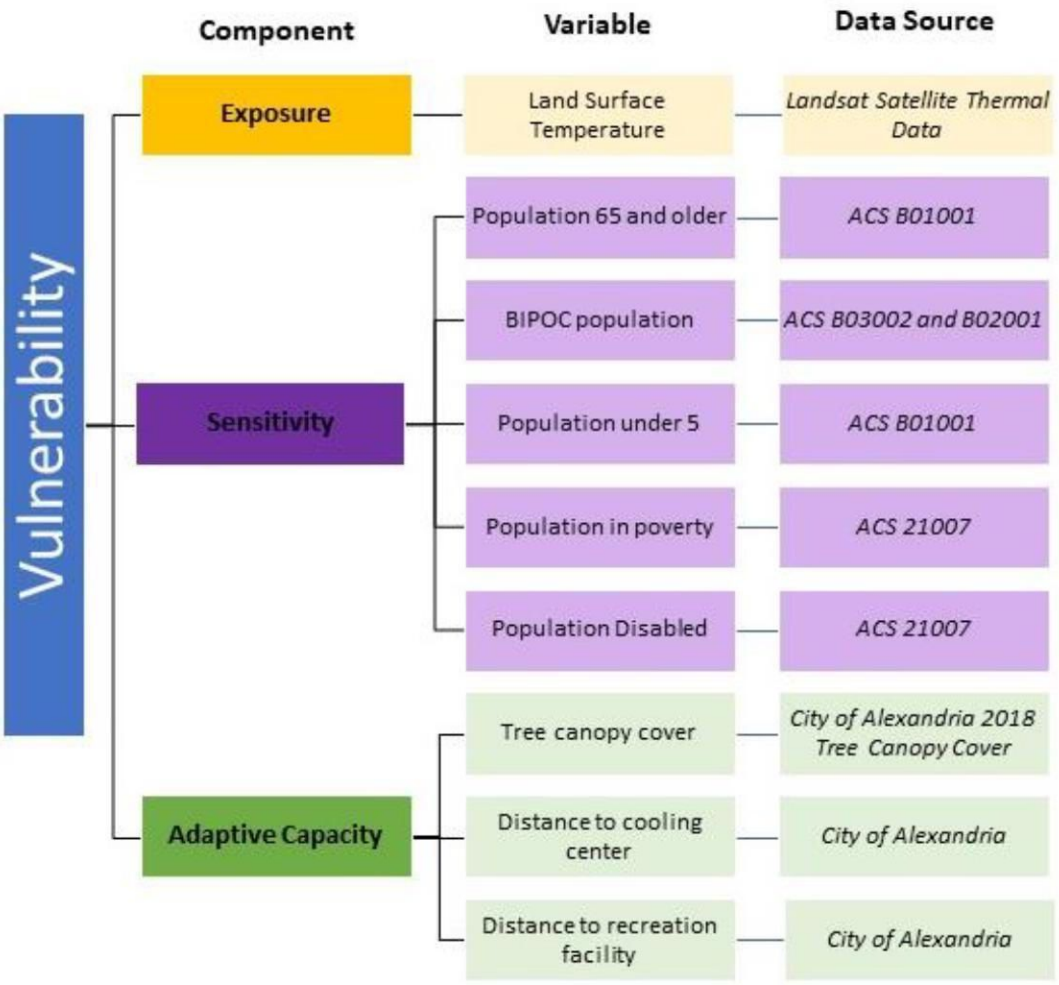
- **Heat Vulnerability Index** for each block group was scored on a scale of 0 (least vulnerable) to 3 (most vulnerable), which effectively ranked HVI's among block groups within the City of Alexandria
- **Exposure** was determined by the block group's relative land surface temperature, compared to regional maximum and minimum temperatures, from two extreme heat events.
- **Sensitivity** included an aggregated average of characteristics that can contribute to greater adverse impacts from heat (Adults Aged 65 and Older, Minority Status, Poverty, Disability Status, and Children Aged 5 and Younger)

[88] HHVA Methodology 4.5.2021.pdf (harriscountytx.gov).

- **Adaptive Capacity** included an aggregated average of physical characteristics of block groups which increase adaptive capacity and decrease overall vulnerability. In this assessment, we will assess tree canopy cover, proximity of block groups to cooling centers, and proximity of block groups to recreation amenities and green space.

The overall methodology is summarized in Figure 2. Each component type and its associated variables are described in greater detail below. Each component was scored on a scale of 0 to 1, where 0 represents lowest vulnerability and 1 is highest vulnerability. This resulted in a possible HVI range of 0 to 3.

Figure 2. Vulnerability assessment methodology

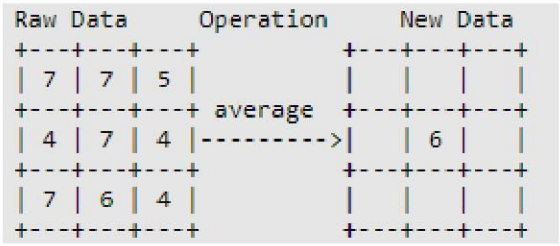


Exposure

Exposure was calculated using the average relative land surface temperature in each block group for two summer days..[89] This produced a value between 0 and 1 for each block group's temperature and was assessed within percentile ranges above minimum temperature and up to the maximum temperature during a given extreme heat event.

The City extracted land surface temperature from two Landsat images using Google Earth Engine. A methodology developed by Ermida et al. was utilized to transform top of atmosphere values into land surface temperature values..[90] Two Landsat 8 images from summer months (May through September) from 2020 to 2021 were selected using optimization techniques that selected the images with the least amount of cloud cover over the city of Alexandria. Minimal cloud cover is desired because clouds prevent the satellite sensor from taking measurements, leaving a blank area without data. Landsat does not capture temperature directly, but rather the top of atmosphere (TOA) brightness temperature. The TOA temperature was converted into land surface temperature by combining TOA measurements with the Normalized Vegetation Index, atmospheric data, and surface emissivity. After land surface temperature was calculated, the two images were uploaded to QGIS and clipped to the city's boundary. From there, the average pixel value was calculated on a cell-by-cell basis following NVRC Urban Heat Islands methodology..[91] The r.neighbors.[92] tool was used to calculate the mean statistics for each cell in the surrounding [area] (see Figure 3).

Figure 30. Sample of the r.neighbors Tool in QGIS. This method was used to smooth the average land surface temperature layer.



The land surface temperature was normalized on a scale of 0 to 1 using the equation for exposure. The minimum temperature was subtracted from the average land surface temperature value from the r.neighbors output for each cell and divided by the difference between the maximum and minimum temperature. This resulted in a scaled value ranging from 0 to 1 for each 30m-by-30m cell. Zonal statistics were calculated to find the average scaled value variation for each block group.

$$Exposure^{93} = \frac{Block\ Group\ Average\ Temperature - Minimum\ Temperature}{Maximum\ Temperature - Minimum\ Temperature}$$

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[89] Land surface temperatures are generated utilizing LANDSAT 8 Thermal Infrared Sensor (TIRS) taken on July 29, 2020, and September 2, 2021. These images were selected as the least cloudy Landsat images from summer months (June through September) 2020 to 2022.

[90] Ermida, S.L., Soares, P., Mantas, V.M., Göttsche, F., & Trigo, I.F. (2020). Google Earth Engine Open-Source Code for Land Surface Temperature Estimation from the Landsat Series. Remote. Sens., 12, 1471.

[91] Northern Virginia Regional Council. "Urban Heat Islands." Accessed April 2022. https://www.novaregion.org/1509/Urban-Heat-Islands.

[92] This makes each cell category value a function of the category values assigned to the cells around it, and stores new cell values in an output raster map layer.

[93] The input for this equation is the smoothed average of the two Landsat images.

Sensitivity

Sensitivity captures which populations may be most likely to experience health or financial burdens because of extreme heat. Five socio-economic variables were identified from existing literature discussing vulnerable demographics and indicators that contribute to heat vulnerability.

Previous studies (Reid et al., 2009.[94]; Conlon et al. 2020.[95]; Nayak et al. 2018.[96]) used principal component analysis to distill various vulnerability factors to determine a HVI. The City drew on these analyses to identify variables for use in the heat vulnerability assessment, limiting the number of variables to five to focus the assessment and its outcomes. The variables and justification for including them are described below.

- **Percentage of Population 65 and Older**
  - People who are 65 years and older are more prone to heat-related health problems, according to the CDC.[97]
  - Data source: Census Bureau ACS 2020 5-Year Estimates Table B01001
    - Added population estimates for males and females 65 years and older
- **Percentage of Population 5 and Younger**
  - Young children are more susceptible to heat illness than adults, due to greater surface area to body mass ratio, lower rates of sweating, and slower rates of acclimatization.[98]
  - Data source: Census Bureau ACS 2020 5-Year Estimates Table B01001
    - Added population estimates for males and females 5 years and younger
- **Percentage of Population Designated as BIPOC**
  - Minority groups are more likely to experience heat risk due to comorbidities associated with higher rates of asthma in youth and COPD in adults..[99]
  - Data source: Census Bureau ACS 2020 5-Year Estimates, Table B03002 and Table B02001
    - This variable is the percentage of the population that identifies as non-white.
- **Percentage of Population with Poverty Status**

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[94] Reid CE, O'Neill MS, Gronlung CJ, Brines SJ, Brown DG, Diez-Roux AV, et al. (2009). Mapping community determinants of heat vulnerability. *Environmental Health Perspectives,* 117(11):1730-1736, PMID: 20049125, 10.1289/ehp.0900683.

[95] Conlon KC, Mallen E, Gronlund CJ, Berrocal VJ, Larsen L, and O'Neill MS. (2020). Mapping Human Vulnerability to Extreme Heat: A Critical Assessment of Heat Vulnerability Indices Created Using Principal Components Analysis. *Environmental Health Perspectives,* Vol. 128, No. 9.

[96] Nayak SG, Shrestha S, Kinney PL, Ross Z, Sheridan SC, Pantea CI, Hsu WH, Muscateillo N, Hwang SA. (2018). Development of a heat vulnerability index for New York State, Public Health, Volume 161, Pages 127-137, ISSN 0033-3506, https://doi.org/10.1016/j.puhe.2017.09.006.

[97] Heat Stress in Older Adults | Natural Disasters and Severe Weather | CDC.

[98] Heat illness in children – PubMed (nih.gov).

[99] https://planning-org-uploaded-media.s3.amazonaws.com/publication/download_pdf/PAS-Report-600-r1.pdf.

  - Individuals in poverty are less likely to be able to afford AC, leaving them susceptible during extreme heat events.
  - Data source: Census Bureau ACS 2020 5-Year Estimates, Table C21007, "Age by Veteran Status by Poverty Status by Disability Status for the Civilian Population 18 Years and older"
    - Estimates for the number of nonveteran and veterans below the poverty line were added together for populations under 64 and 65 and older to get total estimates for the population below the poverty line for residents 18 years and older
- **Percentage of Population with Disability Status**.[100]
  - Individuals with disabilities are more likely to be unemployed and earn less income compared to those without disabilities. Additionally, disabilities create mobility issues which reduces access to cooling centers and other resources..[101]
  - Data source: Census Bureau ACS 2020 5-Year Estimates, Table C21007
    - Estimates for the number of nonveteran and veterans with disabilities were added together for populations under 64 and 65 and older to get total estimates for the population disabled and population below the poverty line for residents 18 years and older
- *Additional Variables for Consideration that were not included in the sensitivity score: Income by Household, Immigration Status, Housing Density, Adults with Asthma and/or COPD, Adults with Diabetes, Percentage of Population without Health Insurance, Percentage of Population Working Outdoors, Educational Attainment*

The overall sensitivity score for each block group were quantified as an aggregated percentage of total block group populations vulnerable to heat, out of the overall total population of each block group.

$$Sensitivity\ Per\ Variable\ = \frac{\text{Vulnerable Population}}{\text{Total Population}}$$

$$Sensitivity = \frac{Sensitivity\ Per\ Variable\ (S1 \ldots S5)}{5\ Social\ Variables}$$

Adaptive Capacity

Adaptive capacity captures physical characteristics of surface conditions and cooling resources at the block group level. Adaptive capacity is primarily achieved through higher degrees of tree canopy cover and the presence of cooling centers within reasonable walking or commuting distance..[102]

The methodology accounted for the following physical attributes of each block group:

- **Percentage of tree canopy cover**

[100] Based on the census block group dataset "Poverty Status in the Past 12 Months by Disability Status"

[101] Climate Change and the Health of People with Disabilities (epa.gov).

[102] 8. HHVA Methodology 4.5.2021.pdf (harriscountytx.gov).

- This variable was scored on the inverse of the percentage of the block group with tree canopy cover, whereby a score of 1 represents no tree canopy (and higher vulnerability), and 0 represents lower vulnerability.
- Data source: City of Alexandria Tree Canopy Cover

- **Distance from locations of cooling centers**
  - Block groups were scored based on the distance to the closest cooling center from the block group centroid, as shown in the table below.

Table 1. Scoring rubric used for the cooling center component value of the adaptive capacity score

Distance to closest cooling center	Score (1 = higher vulnerability)
≤ 0.5 miles	0
0.5 – 1 mile	0.5
> 1 mile	1

  - Cooling center locations:[103]
    - Charles Houston Recreation Center (901 Wythe St.)
    - Leonard "Chick" Armstrong Recreation Center (25 West Reed Ave.)
    - Lee Center (1108 Jefferson St.)
    - Mount Vernon Recreation Center (2701 Commonwealth Ave.)
    - Nannie J. Lee Recreation Center (1108 Jefferson St.)
    - Patrick Henry Recreation Center (4653 Taney Ave.)
    - William Ramsay Recreation Center (5650 Sanger Ave.)
    - Libraries (Branch hours vary, check the links below for hours)
    - Charles E. Beatley, Jr. Central Library (5005 Duke St.)
    - Kate Waller Barrett Branch Library (717 Queen Street)
    - Ellen Coolidge Burke Branch Library (4701 Seminary Road)
    - James M. Duncan Branch Library (2501 Commonwealth Ave.)

- **Distance from recreation amenities (sports fields/courts, swimming pools, public gardens, playgrounds, picnic shelters, and dog parks)**
  - Block groups were scored based on the distance to the closest open or green space from the block group centroid, as shown in the table below.

Table 2. Scoring rubric used to determine the recreation amenity component value of the adaptive capacity score

Distance to recreation amenities	Score (1 = higher vulnerability)
≤ 0.5 miles	0
0.5 – 1 mile	0.5
> 1 mile	1

  - Data source for recreation amenities: City of Alexandria

[103] Summer Cooling Options for Alexandria Residents and Seniors | City of Alexandria, VA (alexandriava.gov).

The overall adaptive capacity score for each block group was quantified as a portion or number of resources over a given block group. For example, for tree canopy over, adaptive capacity will be calculated as follows:

$$Tree\ Canopy\ Cover\ variable = 1 - \ Proportion\ Tree\ Canopy\ Cover\ of\ Block\ Group$$

$$\text{Adaptive Capacity} = \frac{Cooling\ Center\ Score + Adaptive\ Capacity\ Score + Proportion\ nontree\ canopy\ cover}{3}$$

The overall adaptive capacity score is an average of each of the three variable scores. A higher score corresponds to lower adaptive capacity. This is the opposite of the exposure and sensitivity variables where higher scores correspond to higher exposure or sensitivity. Scores for all three variables were arranged so that higher scores correspond to higher vulnerability.

Vulnerability Output

An aggregated HVI across block groups for the entirety of Alexandria was developed by adding the exposure, sensitivity, and adaptive capacity scores together. Additionally, the Heat Vulnerability Indices were broken down by each of the five social variables into separate, viewable, layers. The separate sensitivity HVIs were created by adding the sensitivity variable (as proportion of the population from each block group) with the exposure and adaptive capacity scores.

The HVI scores by block group will help the City identify and assess priority areas for targeted adaptation interventions.

Areas of Future Research

This heat vulnerability assessment provided a foundational understanding of increasing heat's impact on the Alexandria community, to identify preliminary opportunities to address challenges related to extreme heat. Further analysis could provide additional insights for adaptation planning, such as in the following areas.

Consideration of ambient air temperatures. This study used daytime land surface temperature to measure heat exposure. Land surface temperature is how hot the ground is to the touch, while ambient air temperature is the temperature of the air from just above the ground to roof height. Ambient air temperatures are generally less extreme than land surface temperatures since they are subject to winds and other atmospheric forces. The human physiology primarily experiences the stress of heat through both land surface temperature and ambient air temperature, so additional research into ambient air temperatures can aid in developing heat indices that reinforce the impacts on public health due to extreme heat.

Consideration of nighttime air temperatures. Concrete, brick, and asphalt absorb and store heat throughout the day and slowly release it back into the air at night. During heat waves, heat stress can continue to build overnight and the lack of respite from hot temperatures can prevent those susceptible to heat stress from recovering. .[104] The sensitivity and adaptive capacity maps

[104] Belles, Johnathan. Why Nighttime Temperatures Are Also Dangerous During Heat Waves. (2019, August). *The Weather Channel,* https://weather.com/safety/heat/news/2019-07-19-nighttime-heat-wave-deadly-dangerous.

provided in this heat vulnerability assessment could be paired with an analysis of nighttime hot spots to identify populations vulnerable to nighttime heat.

Overlay heat vulnerabilities with housing density and building material. Housing density and building material also play a significant role in how extreme heat will impact a community. The IPCC Sixth Assessment Report found that tall buildings that are closely constructed next to one another absorb and store heat, while also reducing natural ventilation. Therefore, it is apparent that increased housing density over a given footprint has a positive correlation with extreme heat impacts on residents. For areas around Alexandria where such developments and urban geometries exist, further studies can be carried out to assess retrofits to building materials and surfaces to prevent radiative head from being absorbed, retained, and elevating internal building temperatures to unsafe levels.

Summarize heat vulnerabilities by zoning type. Additional analysis of the heat vulnerability assessment results compared to local zoning typologies may also offer useful insights for adaptation planning. For example, it would be valuable to compare HVI in residential and commercial areas, as well as identify the number of people impacted in certain zones.

Incorporation of additional sensitivity indicators or demographic groups. The HVI currently focuses on five demographic characteristics that contribute to heat vulnerability. Additional characteristics could be included in future analyses as needed.

Refine recreation facilities data. Proximity to recreation facilities is currently included in the adaptive capacity component of the HVI, as recreation facilities often have green space or shade, drinking fountains, and other cooling amenities. However, some recreation facilities may have stronger cooling amenities than others, which could be accounted for in future interactions of the assessment as needed.

SCHEDULE 4

Virginia Electric and Power Company
Case No. PUR-2024-00184
City of Alexandria
Second Set

The following objection to Instruction No. 6 of the First Set of Interrogatories and Requests for Production of Documents propounded by City of Alexandria received on February 13, 2025, has been prepared under my supervision.

Nicole M. Allaband
McGuireWoods LLP

Instruction No. 6

If any document or other information called for is withheld on a claim of privilege, identify the document or other information withheld and each and every person listed as an addressor, addressee, or indicated on blind copies; identify all persons to whom distributed, shown, or explained; and identify the nature and legal basis of the privilege asserted. Set forth the factual and legal predicates to any claim of privilege or other immunity from discovery in sufficient detail for the City to ascertain Dominion's right to such treatment and provide redacted copies of requested materials or information. If the Company intends to withhold documents or other information on the basis that such documents or other information are "voluminous," provide information sufficient to enable the City, and other participants to assess the true nature of the objection. Without limiting the foregoing this information should include a description of the documents, the approximate number of pages, number and thickness of volumes, and other such identifying information.

Response:

The Company objects to Instruction No. 6 on the grounds that it is overly broad, potentially voluminous, and unduly burdensome. Rule 260 of the Commission's Procedural Rules, 5 VAC 5-20-260, does not require a party claiming that any document is privileged or otherwise non-discoverable to provide a privilege log, much less one with the requested level of detail. Additionally, Rule 260 does not require a party claiming the information is "voluminous" to provide the level of detail requested.

Virginia Electric and Power Company
Case No. PUR-2024-00184
City of Alexandria
Second Set

As it pertains to DSM inputs, the following response to Question No. 1 of the Second Set of Interrogatories and Requests for Production of Documents propounded by City of Alexandria received on February 13, 2025, was prepared by or under the supervision of:

Rachel L. Hagerman
Senior Energy Market Analyst
Dominion Energy Virginia

As it pertains to the load forecast adjustment, the following response to Question No. 1 of the Second Set of Interrogatories and Requests for Production of Documents propounded by City of Alexandria received on Feburary13, 2025, was prepared by or under the supervision of:

Joseph L. Bocanegra
Manager, Sales and Revenue
Dominion Energy Services, Inc.

As it pertains to legal matters, the following response to Question No. 1 of the Second Set of Interrogatories and Requests for Production of Documents propounded by City of Alexandria received on Feburary13, 2025, was prepared by or under the supervision of:

Nicole M. Allaband
McGuireWoods LLP

Question No. 1

Please identify, provide and explain all modelling inputs used to determine the DSM adjustment in the Company's 2024 Integrated Resource Plan ("IRP").

Response:

The Company objects to this request as overly broad, unduly burdensome, and potentially voluminous to the extent it seeks "all modeling inputs used to determine the DSM adjustment." Notwithstanding and subject to this objection, the Company provides the following response.

The Company used inputs supplied by the vendors for the various DSM and EE programs to project incremental DSM values . These inputs include:

- Annual forecasted participation
  - Gross installations per year
- Annual 8760 load shape
- Net to gross (Free rider designation)

- Program Measure life
- Realization rate
- Annual kWh per participant
- Peak kW reduction per participant
- VA/NC split of participation
- Incentive level per participant
- EE or DR product?
    - DR product
        - Can it be called Weekends?
        - Can it be called on Holidays?
        - Maximum Number of Events Per Year
        - Maximum Number of Hours per Day
        - Maximum Number of Events per Day
        - Maximum Hours of an Event
        - Minimum Hours of an Event
        - Average % Payback
        - Average Payback Duration (in hours)*
        - Average Payback Duration (in % of event duration)*
        - When Does Payback Occur?
        - If Payback is Delayed Please Describe
        - Month available
        - Max hours available per month for dispatch
        - Max number of events per month

The projected incremental DSM values are then used as an adjustment to the load forecast. See Appendix 2A.V of the 2024 IRP for details on the energy efficiency adjustment.

Virginia Electric and Power Company
Case No. PUR-2024-00184
City of Alexandria
Second Set

As it pertains to the EM&V report and future projections, the following response to Question No. 2 of the Second Set of Interrogatories and Requests for Production of Documents propounded by City of Alexandria received on February 13, 2025, was prepared by or under the supervision of:

Rachel L. Hagerman
Senior Energy Market Analyst
Dominion Energy Virginia

As it pertains to the load forecast adjustment, the following response to Question No. 2 of the Second Set of Interrogatories and Requests for Production of Documents propounded by City of Alexandria received on February 13, 2025, was prepared by or under the supervision of:

Joseph L. Bocanegra
Manager, Sales and Revenue
Dominion Energy Services, Inc.

As it pertains to legal matters, the following response to Question No. 2 of the Second Set of Interrogatories and Requests for Production of Documents propounded by City of Alexandria received on Feburary13, 2025, was prepared by or under the supervision of:

Nicole M. Allaband
McGuireWoods LLP

Question No. 2

Please identify, provide and explain all assumptions you used in arriving at the DSM adjustment used in the Company's 2024 IRP regarding customer participation rates, measure lifetimes, and penetration levels for all EE and DSM Programs.

Response:

The Company objects to this request as overly broad, unduly burdensome, and potentially voluminous to the extent it seeks "all assumptions you used in arriving at the DSM adjustment." Notwithstanding and subject to this objection, the Company provides the following response.

See the Company's EM&V Report filed on June 12, 2024, in Case No. PUR-2022-00210 for historic customer participation rates and measure lives for existing programs. See the Company's pending annual DSM filing in Case No. PUR-2024-00222 for future penetration

projections. See Appendix 2A.V of the 2024 IRP for how these assumptions are incorporated into the load forecast for the 2024 IRP.

Virginia Electric and Power Company
Case No. PUR-2024-00184
City of Alexandria
Second Set

The following response to Question No. 3 of the Second Set of Interrogatories and Requests for Production of Documents propounded by City of Alexandria received on February 13, 2025, was prepared by or under the supervision of:

Joseph L. Bocanegra
Manager, Sales and Revenue
Dominion Energy Services, Inc.

As it pertains to legal matters, the following response to Question No. 3 of the Second Set of Interrogatories and Requests for Production of Documents propounded by City of Alexandria received on Feburary13, 2025, was prepared by or under the supervision of:

Nicole M. Allaband
McGuireWoods LLP

Question No. 3

Please identify, provide and explain all cost-effectiveness tests and screening criteria used to justify the DSM adjustment, DSM and EE measures, and decisions in the 2024 IRP, including all assumptions used to determine the technical, economic, and achievable potentials for energy savings and peak demand savings.

Response:

The Company objects to this request as overly broad, unduly burdensome, and potentially voluminous to the extent it seeks "all cost-effectiveness tests and screening criteria used to justify the DSM adjustment, DSM and EE measures, and decisions in the 2024 IRP, including all assumptions used to determine the technical, economic, and achievable potentials for energy savings and peak demand savings." The Company also objects to this request as not relevant or reasonably calculated to lead to the production of admissible evidence in this proceeding. The cost-effectiveness tests and screening criteria are reviewed in the Company's annual DSM filings for approval of new programs. The Company's 2024 DSM petition is currently pending the Commission's review in Case No. PUR-2024-00222. Notwithstanding and subject to these objections, the Company provides the following response.

See Appendix 2A.V of the 2024 IRP for details regarding the energy efficiency adjustment to the load forecast.

Virginia Electric and Power Company
Case No. PUR-2024-00184
City of Alexandria
Second Set

The following response to Question No. 4 of the Second Set of Interrogatories and Requests for Production of Documents propounded by City of Alexandria received on February 13, 2025, was prepared by or under the supervision of:

Joseph L. Bocanegra
Manager, Sales & Revenue
Dominion Energy Services, Inc.

As it pertains to legal matters, the following response to Question No. 4 of the Second Set of Interrogatories and Requests for Production of Documents propounded by City of Alexandria received on Feburary13, 2025, was prepared by or under the supervision of:

Nicole M. Allaband
McGuireWoods LLP

Question No. 4

Please identify, provide and explain all economic and demographic data used in forecasting energy efficiency potential savings in Dominion's service territory.

Response:

The Company objects to this request as overly broad, unduly burdensome, and potentially voluminous to the extent it seeks "all economic and demographic data used in forecasting energy efficiency potential savings in Dominion's service territory." Notwithstanding and subject to this objection, the Company provides the following response.

Please see the Company's response to City Set 02-03.

Virginia Electric and Power Company
Case No. PUR-2024-00184
City of Alexandria
Second Set

The following response to Question No. 5 of the Second Set of Interrogatories and Requests for Production of Documents propounded by City of Alexandria received on February 13, 2025, was prepared by or under the supervision of:

Rachel L. Hagerman
Senior Energy Market Analyst
Dominion Energy Services, Inc.

Joseph L. Bocanegra
Manager, Sales & Revenue
Dominion Energy Services, Inc.

Question No. 5

Please describe and explain the historical accuracy of the Company's energy efficiency potential estimates in prior IRP filings.

Response:

The Company's approach to modeling energy efficiency adjustments to the load forecast has continually updated and evolved over the course of IRP filings and consistent with relevant Commission orders. Accordingly, no such evaluation is possible.

Virginia Electric and Power Company
Case No. PUR-2024-00184
City of Alexandria
Second Set

The following response to Question No. 6 of the Second Set of Interrogatories and Requests for Production of Documents propounded by City of Alexandria received on February 13, 2025, was prepared by or under the supervision of:

Rachel L. Hagerman
Senior Energy Market Analyst
Dominion Energy Services, Inc.

As it pertains to legal matters, the following response to Question No. 6 of the Second Set of Interrogatories and Requests for Production of Documents propounded by City of Alexandria received on Feburary13, 2025, was prepared by or under the supervision of:

Nicole M. Allaband
McGuireWoods LLP

Question No. 6

Please provide all documents in your possession comparing projected energy savings to actual energy savings in prior IRP years.

Response:

The Company objects to this request as overly broad, unduly burdensome, and potentially voluminous to the extent it seeks "all documents in your possession comparing projected energy savings to actual energy savings in prior IRP years." Notwithstanding and subject to this objection, the Company provides the following response.

Please see the Company's response to City Set 02-05. Also see the Company's EM&V Report filed on June 12, 2024, in Case No. PUR-2022-00210, which compares actual energy savings to the projected values from the DSM case in which a program was approved.

Virginia Electric and Power Company
Case No. PUR-2024-00184
City of Alexandria
Second Set

The following response to Question No. 7 of the Second Set of Interrogatories and Requests for Production of Documents propounded by City of Alexandria received on February 13, 2025, was prepared by or under the supervision of:

Rachel Hagerman
Senior Energy Market Analyst
Dominion Energy Virginia

As it pertains to legal matters, the following response to Question No. 7 of the Second Set of Interrogatories and Requests for Production of Documents propounded by City of Alexandria received on Feburary13, 2025, was prepared by or under the supervision of:

Nicole M. Allaband
McGuireWoods LLP

Question No. 7

Please provide all DSM and EE program cost-effectiveness reports, or other documents that evaluate the effectiveness of DSM and EE programs, in your possession.

Response:

The Company objects to this request as overly broad, unduly burdensome, and potentially voluminous to the extent it seeks "all DSM and EE program cost-effectiveness reports, or other documents that evaluate the effectiveness of DSM and EE programs." Additionally, the Company objects to this request as not relevant or reasonably calculated to lead to the production of admissible evidence in this proceeding because it seeks information not used to develop the 2024 IRP. The IRP is a forward-looking planning exercise. The Company's DSM programs are reviewed and approved in annual DSM filings. Notwithstanding and subject to these objections, the Company provides the following response.

The Company's DSM portfolio evaluation, measurement, and verification (EM&V) reports are all publicly filed with the Commission annually. They are available in each of these Commission case dockets:

DSM Program Phase	SCC Case No.
Pilot DG	PUE-2007-00089
Phase I	PUE-2009-00081
Phase II	PUE-2011-00093
Phase III	PUE-2013-00072
Phase IV	PUE-2014-00071
Phase V	PUE-2015-00089
Phase VI	PUE-2016-00111
Phase VII	PUR-2018-00168
Phase VIII	PUR-2019-00201
Phase IX	PUR-2020-00274
Phase X	PUR-2021-00247
Phase XI	PUR-2022-00210
Phase XII	PUR-2023-00217

Virginia Electric and Power Company
Case No. PUR-2024-00184
City of Alexandria
Second Set

The following response to Question No. 8 of the Second Set of Interrogatories and Requests for Production of Documents propounded by City of Alexandria received on Feburary13, 2025, was prepared by or under the supervision of:

Rachel Hagerman
Senior Energy Market Analyst
Dominion Energy Virginia

Question No. 8

Please provide all third-party evaluations of the Company's DSM and EE programs.

Response:

Please see all EM&V reports filed annually in the Company's DSM dockets, the case numbers for which can be found in the response to City Set 02-07.

Virginia Electric and Power Company
Case No. PUR-2024-00184
City of Alexandria
Second Set

The following response to Question No. 9 of the Second Set of Interrogatories and Requests for Production of Documents propounded by City of Alexandria received on February 13, 2025, was prepared by or under the supervision of:

Rachel Hagerman
Senior Energy Market Analyst
Dominion Energy Virginia

Question No. 9

Please provide all documents in your possession explaining why past DSM and EE potential savings projections were missed.

Response:

See the Company's response to City Set 02-08.

Virginia Electric and Power Company
Case No. PUR-2024-00184
City of Alexandria
Second Set

The following response to Question No. 10 of the Second Set of Interrogatories and Requests for Production of Documents propounded by City of Alexandria received on February 13, 2025, was prepared by or under the supervision of:

Dan Feng
Principal Consultant
DNV

Michael T. Hubbard
Manager, Energy Conservation
Dominion Energy Virginia

As it pertains to legal matters, the following response to Question No. 10 of the Second Set of Interrogatories and Requests for Production of Documents propounded by City of Alexandria received on Feburary13, 2025, was prepared by or under the supervision of:

Nicole M. Allaband
McGuireWoods LLP

Question No. 10

Please provide all energy efficiency potential studies you conducted or that were conducted on your behalf over the last five (5) years.

Response:

The Company objects to this request as overly broad and voluminous. Notwithstanding and subject to this objection, the Company provides the following response.

See the latest potential study filed in Case No. PUR-2023-00227.

Virginia Electric and Power Company
Case No. PUR-2024-00184
City of Alexandria
Second Set

The following response to Question No. 11 of the Second Set of Interrogatories and Requests for Production of Documents propounded by City of Alexandria received on Feburary13, 2025, was prepared by or under the supervision of:

Joseph Bocanegra
Manager, Sales & Revenue
Dominion Energy Services, Inc.

Question No. 11

Please provide all sensitivity analyses or alternative DSM or EE scenarios created or considered in preparing your 2024 IRP that were not included therein.

Response:

The Company considered high/low sensitivities in its 2024 IRP forecast, which are described in Section 5.3, Sensitivity Analyses of the 2024 IRP. DSM was increased by 50% in the low load scenario and reduced by 50% in the high load scenario.

Virginia Electric and Power Company
Case No. PUR-2024-00184
City of Alexandria
Second Set

The following response to Question No. 12 of the Second Set of Interrogatories and Requests for Production of Documents propounded by City of Alexandria received on Feburary13, 2025, was prepared by or under the supervision of:

Nicole M. Allaband
McGuireWoods LLP

Question No. 12

Please provide all correspondence or communications between you and any third-party EE consultants or industry groups related to the Company's DSM adjustment, achievable energy savings or peak demand savings projections.

Response:

The Company objects to this request as overly broad, unduly burdensome, potentially voluminous and requiring original work to the extent it seeks "all correspondence or communication between [the Company] and any third-party EE consultants or industry groups related to the Company's DSM adjustment, achievable energy savings or peak demand savings projections." The Company also objects to this request as not relevant or reasonably calculated to lead to the production of admissible evidence in this proceeding.

Virginia Electric and Power Company
Case No. PUR-2024-00184
City of Alexandria
Second Set

The following response to Question No. 13 of the Second Set of Interrogatories and Requests for Production of Documents propounded by City of Alexandria received on Feburary13, 2025, was prepared by or under the supervision of:

Joseph Bocanegra
Manager, Sales & Revenue
Dominion Energy Services, Inc.

Question No. 13

Please explain how energy efficiency policies and targets at the local (city, county, town) level were incorporated into your 2024 IRP modelling.

Response:

As stated in Sierra Club Set 02-08 the Company incorporates energy efficiency and DSM as a reduction to load in its modeling process. Local energy efficiency policies and targets are included in the IRP modeling in so far as they influence customer behavior which would be reflected in the historical data that the Company uses to build its forecast models and form the basis of its evaluation and potential studies. See Appendix 2A.V of the 2024 IRP for additional details regarding the energy efficiency adjustment to the load forecast.

Virginia Electric and Power Company
Case No. PUR-2024-00184
City of Alexandria
Second Set

The following response to Question No. 14 of the Second Set of Interrogatories and Requests for Production of Documents propounded by City of Alexandria received on Feburary13, 2025, was prepared by or under the supervision of:

Rachel Hagerman
Senior Energy Market Analyst
Dominion Energy Virginia

Question No. 14

Please provide all internal documents, communications, or correspondences discussing challenges or objections to adopting city-level EE targets and incorporating those into the IRP modelling.

Response:

The Company does not incorporate local energy efficiency policies and targets in its integrated resource planning.

Virginia Electric and Power Company
Case No. PUR-2024-00184
City of Alexandria
Second Set

The following response to Question No. 15 of the Second Set of Interrogatories and Requests for Production of Documents propounded by City of Alexandria received on Feburary13, 2025, was prepared by or under the supervision of:

Rachel Hagerman
Senior Energy Market Analyst
Dominion Energy Virginia

Question No. 15

Please provide all internal cost-benefit analyses comparing DSM and EE resource investments with supply-side investments, such as generation capacity.

Response:

Please see Appendix 3K-1 of the 2024 IRP.

Virginia Electric and Power Company
Case No. PUR-2024-00184
City of Alexandria
Second Set

The following response to Question No. 16 of the Second Set of Interrogatories and Requests for Production of Documents propounded by City of Alexandria received on Feburary13, 2025, was prepared by or under the supervision of:

Nicole M. Allaband
McGuireWoods LLP

Question No. 16

Please provide all documents that explain the Company's capital planning priorities and how EE and DSM investments fit into your overall strategy.

Response:

The Company objects to this request as overly broad, unduly burdensome, potentially voluminous and requiring original work to the extent it seeks "all documents that explain the Company's capital planning priorities and how EE and DSM investments fit into [the Company's] overall strategy." Additionally, the Company objects to this request as not relevant or reasonably calculated to lead to the production of admissible evidence in this proceeding.

Virginia Electric and Power Company
Case No. PUR-2024-00184
City of Alexandria
Second Set

The following response to Question No. 17 of the Second Set of Interrogatories and Requests for Production of Documents propounded by City of Alexandria received on Feburary13, 2025, was prepared by or under the supervision of:

Dan Feng
Principal Consultant
DNV

As it pertains to legal matters, the following response to Question No. 17 of the Second Set of Interrogatories and Requests for Production of Documents propounded by City of Alexandria received on Feburary13, 2025, was prepared by or under the supervision of:

Nicole M. Allaband
McGuireWoods LLP

Question No. 17

Please provide all documents and information in your possession that show how rate structures impact customer EE and DSM adoption.

Response:

The Company objects to this request as overly broad, unduly burdensome, potentially voluminous and requiring original work to the extent it seeks "all documents and information in [the Company's] possession that show how rate structures impact customer EE and DSM adoption." Additionally, the Company objects to this request as not relevant or reasonably calculated to lead to the production of admissible evidence in this proceeding because it seeks information not used to develop the 2024 IRP. The Company is not seeking approval of any resources or rates in this proceeding. Notwithstanding and subject to these objections, the Company provides the following response.

While the most recent Virginia Energy Efficiency Potential Study did not specifically analyze how rate structures impact customer EE and DSM adoption, it does discuss the impact of the program benefit-cost to EE and DSM adoption. Please refer to the potential study report filed in Case No. PUR-2023-00227 for the Virginia Energy Efficiency Potential Study 2024 to 2033. See specifically:

- Section 1, the executive summary.
- Section 4 of the report describes the methodology for the study.
- Appendix A contains a more detailed explanation of the methodology.
- Appendix B describes the measures included in the analysis.

- Appendix C presents the economic inputs used for the analysis.
- Appendix D contains the load shape factors used to calculate peak demand impacts.
- Appendix E shows the measure inputs used for the analysis, including costs, savings, effective measure life, applicability, feasibility, and incomplete factor.

Virginia Electric and Power Company
Case No. PUR-2024-00184
City of Alexandria
Second Set

The following response to Question No. 18 of the Second Set of Interrogatories and Requests for Production of Documents propounded by City of Alexandria received on Feburary13, 2025, was prepared by or under the supervision of:

Dan Feng
Principal Consultant
DNV

As it pertains to legal matters, the following response to Question No. 18 of the Second Set of Interrogatories and Requests for Production of Documents propounded by City of Alexandria received on Feburary13, 2025, was prepared by or under the supervision of:

Nicole M. Allaband
McGuireWoods LLP

Question No. 18

Please provide all studies in your possession which show the effectiveness of your incentive programs on customer adoption of EE and DSM programs.

Response:

The Company objects to this request as overly broad, unduly burdensome, potentially voluminous and requiring original work to the extent it seeks "all studies in [the Company's] possession which show the effectiveness of [the Company's] incentive programs on customer adoption of EE and DSM programs." Subject to and notwithstanding this objection, the Company provides the following response.

Please see a list of the Company's evaluation studies in the most recently filed Evaluation, Measurement, and Verification report for program year 2023, filed in Case No. PUR-2022-00210. Specifically, see Appendix D including sub-sections 3.1.5 and 3.1.6.

Virginia Electric and Power Company
Case No. PUR-2024-00184
City of Alexandria
Second Set

The following response to Question No. 19 of the Second Set of Interrogatories and Requests for Production of Documents propounded by City of Alexandria received on Feburary13, 2025, was prepared by or under the supervision of:

Dan Feng
Principal Consultant
DNV

Michael T. Hubbard
Manager, Energy Conservation
Dominion Energy Virginia

Question No. 19

Please provide all studies in your possession which address the potential impact that local programs—marketing, distribution, etc.—could have on customer adoption of EE and DSM programs.

Response:

See the Company's response to City Set 02-10.

Virginia Electric and Power Company
Case No. PUR-2024-00184
City of Alexandria
Second Set

The following response to Question No. 20 of the Second Set of Interrogatories and Requests for Production of Documents propounded by City of Alexandria received on Feburary13, 2025, was prepared by or under the supervision of:

Dan Feng
Principal Consultant
DNV

Question No. 20

Please provide all elasticity assumptions used in determining your DSM adjustment for the 2024 IRP, including elasticity assumptions that went into the economic potential energy savings estimate in DNV's Virginia Energy Efficiency Potential Study 2024 to 2033 (the "VEEPS"), filed with the Commission in PUR-2023-00227 and incorporated into Dominion's 2024 IRP by reference at Appendix 3D of the 2024 IRP filing, page 9.

Response:

All assumptions used in the referenced Potential Study are documented within that filing. See Case No. PUR-2023-00227.

Virginia Electric and Power Company
Case No. PUR-2024-00184
City of Alexandria
Second Set

The following response to Question No. 21 of the Second Set of Interrogatories and Requests for Production of Documents propounded by City of Alexandria received on Feburary13, 2025, was prepared by or under the supervision of:

Dan Feng
Principal Consultant
DNV

Question No. 21

Please identify, provide, and explain all inputs that went into the technical potential for demand savings estimate, the economic potential for demand savings estimate, the achievable program potential in the 75% incentive scenario, and the achievable program potential in the 50% incentive scenario, all of which appear in the VEEPS.

Response:

All assumptions underlying the referenced Potential Study are documented within the filing (Case No. PUR-2023-00227). In particular, see:

- Section 4 of the report describes the methodology for the study;
- Appendix A contains a more detailed methodology;
- Appendix B describes the measures included in the analysis;
- Appendix C presents the economic inputs used for the analysis;
- Appendix D contains the load shape factors used to calculate peak demand impacts;
- Appendix E shows the measure inputs used for the analysis, including costs, savings, effective measure life, applicability, feasibility, and incomplete factor.

Virginia Electric and Power Company
Case No. PUR-2024-00184
City of Alexandria
Second Set

The following response to Question No. 22 of the Second Set of Interrogatories and Requests for Production of Documents propounded by City of Alexandria received on Feburary13, 2025, was prepared by or under the supervision of:

Rachel L. Hagerman
Senior Energy Market Analyst
Dominion Energy Services, Inc.

Joseph Bocanegra
Manager, Sales & Revenue
Dominion Energy Services, Inc.

Michael T. Hubbard
Manager, Energy Conservation
Dominion Energy Virginia

Question No. 22

You state in your 2024 IRP filing that the findings from the VEEPS "heavily influenced the Company's DSM adjustment as used in this 2024 IRP."

a. Please identify and explain all instances where a finding in the VEEPS was rejected for purposes of determining the Company's DSM adjustment in the 2024 IRP.

b. Please identify and provide other sources of influence on the DSM adjustment as used in the 2024 IRP.

Response:

Please refer to the 2024 IRP Appendix 2A.V for details on how the DSM adjustment was derived.

Virginia Electric and Power Company
Case No. PUR-2024-00184
City of Alexandria
Second Set

The following response to Question No. 23 of the Second Set of Interrogatories and Requests for Production of Documents propounded by City of Alexandria received on Feburary13, 2025, was prepared by or under the supervision of:

Michael T. Hubbard
Manager, Energy Conservation
Dominion Energy Virginia

Question No. 23

Please identify and provide any DSM/EE scenario or portfolio prepared by the Company as a contingency if the Commission orders Dominion to revise its 2024 IRP to meet statutory energy savings targets.

Response:

The Company has not prepared any "contingency" filings as contemplated in this request.

SCHEDULE 5

Execution Version

RENEWABLE ENERGY, ENERGY EFFICIENCY, AND ENERGY SUSTAINABILITY AGREEMENT

BETWEEN

THE CITY OF SARASOTA, FLORIDA

AND

FLORIDA POWER & LIGHT COMPANY

This Renewable Energy, Energy Efficiency, and Energy Sustainability Agreement (the "**Agreement**"), dated as of November 1, 2010 (the "**Effective Date**"), is entered into by the City of Sarasota, Florida (hereinafter, the "**City**"), located at 1565 1st Street, Sarasota, FL 34236, and Florida Power & Light Company (hereinafter, "**FPL**"), located at 700 Universe Boulevard, Juno Beach, Florida 33408 (Sarasota and FPL individually a "**Party**", jointly the "**Parties**").

W I T N E S S E T H

WHEREAS, the City is a significant consumer of electric power with land and facilities that may be available for renewable energy projects;

WHEREAS, FPL is the electric power utility serving the City; and

WHEREAS, each of the City and FPL is committed to expanding the use of renewable energy resources, in creating energy efficiencies, and in promoting and implementing measures and practices that will improve energy sustainability and independence of the City of Sarasota, the Sarasota community generally, and the State of Florida as a whole, in compliance with respective Federal and State energy policies and directives;

NOW, THEREFORE, for and in consideration of these premises, the mutual undertakings and agreements herein contained and assumed, and good and valuable consideration, the receipt and sufficiency of which the Parties hereby acknowledge, and subject to the terms and conditions hereinafter set forth, the City and FPL hereby covenant and agree as follows:

A. Background

The City and FPL are committed to providing clean, reliable and affordable energy to the citizens of Sarasota (the "**Citizens**") and are interested in promoting energy efficiency and renewable energy through state-of-the-art pilot programs and projects. In furtherance of these objectives, this Agreement sets forth the framework pursuant to which the City and FPL shall jointly develop, install, manage and maintain the energy conservation projects ("**EC Projects**") and renewable energy projects ("**RE Projects**") identified herein (the EC Projects and RE Projects jointly referred to as the "**Energy Projects**"),

and also sets forth other measures and commitments of the Parties to promote, encourage, and implement energy conservation, energy efficiency, renewable energy, and energy sustainability measures as contemplated herein.

The Energy Projects and other energy sustainability measures set forth herein would be developed and designed to provide the City and the Citizens with energy efficiency and renewable energy benefits on a long-term basis. Further, the Energy Projects shall be developed and installed on land, or at facilities, owned by the City and will utilize equipment, services and labor contributed by the City and FPL, as appropriate.

As detailed in Section B, Scope of Energy Projects, the Parties will adopt a "phased" approach in developing and implementing the Energy Projects and in achieving the energy efficiency and renewable energy goals and objectives. As detailed below, Phase 1 would consist of Energy Projects that could be implemented, subject to the City's support and cooperation, in the short term (i.e., six (6) to eighteen (18) months) and would require no (or limited) Florida Public Service Commission ("**FPSC**"), governmental or other regulatory approvals (the "**Required Approvals**"). Phase 2 would consist of Energy Projects that require more time to implement and would need, and be subject to, certain Required Approvals and/or the passage of enabling legislation.

B. Scope of Energy Projects

1. Phase 1 Energy Projects:

Phase 1 EC Projects and RE Projects will be implemented by FPL and the City in the short term and will be designed to provide the City with demonstrable, long-term energy efficiency and renewable energy awareness for its Citizens. FPL shall designate a liaison (the "**Liaison**") to the City who shall be responsible for the start up of Phase 1 activities and coordinating FPL's and the City's efforts to implement efficiently and effectively the Phase 1 Energy Projects consistent with the terms herein. Specifically, the Liaison shall: (i) coordinate, schedule and support project development and implementation activities (as such are set forth in this Agreement) between the City and FPL; (ii) assist in implementing the energy audits and in attaining the efficiency goals (as such are set forth below); (iii) promote renewable project development and energy efficient programs in the City. Phase 1 will focus on energy education and on implementing specific pilot programs pursuant to which FPL would test at City sites and facilities energy conservation programs and clean energy equipment to determine if such programs and equipment are appropriate for deployment on the FPL utility system.

Phase 1 Energy Projects shall consist of:

(a) Educational resources and programs to inform and instruct the City and its Citizens on issues related to energy efficiency and conservations programs and on the benefits and technology associated with renewable energy. Specifically, the Liaison shall coordinate and schedule with the City performances by Captain Conservation and

Professor WHYs at mutually agreed to City, and other public, sites and venues (such as public schools, the Van Wezel Performing Arts Hall, or GWiz).

- Captain Conservation Saves the Day is a program that teaches children to be heroes by conserving energy through fun, original and interactive songs. Captain Conservation is the world's only singing, guitar-playing, nature-conscious, costumed superhero.

- Professor Whys Powerful Adventure is a program that brings science to life through fun and interactive demonstrations. The entertaining and educational program helps to prepare students for the science FCAT and offers an exciting way for students to get enthusiastic about science.

(b) Energy audits for City facilities and Citizens.

- The energy audits to be performed by FPL (as detailed herein) will be designed to identify the maximum, cost-effective energy savings per audit and will take into account: (i) the customer's reasonable expectations in identifying the maximum, cost-effective energy savings per audit; (ii) all incentives available from FPL; and, (iii) if available, those incentives from state or federal governments and private foundations, including tax credits and other tax benefits from the City (and any other source identified by the City or FPL). Such Energy Audits will be consistent with, and commence promptly following the approval by the FPSC of, each applicable FPL's demand side management ("**DSM**") plan.

- Within thirty (30) days of the Execution Date, FPL and the City will meet to develop an agreeable energy audit schedule (the "**Schedule**") for City facilities and for large energy users located within the City. The Schedule will provide that, prior to December 31, 2015, FPL shall perform energy audits on: (i) all of the City's electric accounts (the "**City Accounts**"), and (ii) subject to the receipt of a customer consent related to the performance of an energy audit, the 100 largest electricity-consuming accounts (excluding the City's accounts) located in the City (the "**Customer Accounts**"). FPL will cooperate and work with the City in its efforts to obtain the consent of all such customers. Notwithstanding the foregoing, pursuant to FPL's DSM Plan and applicable regulation, FPL will remain obligated to provide energy audits to other customers and accounts as may be requested (the "**Additional Energy Audits**").

- After the completion of the first cycle of energy audits (as provided for above) throughout the Term and promptly following the approval of each succeeding DSM plan, FPL and the City will meet to develop an agreeable Schedule of energy audits related to the City Accounts and the Customer Accounts. FPL will, within five (5) years following approval of such Schedule, perform

energy audits on the City Accounts and fifty (50) of the largest Customer Accounts in a manner consistent with the procedures set forth above.

- Energy audits performed by FPL related to the City Accounts and Customer Accounts shall be without charge to the City or customers whose usage and facilities are audited. Additional energy audits shall be conducted pursuant to FPL's then-currently-approved energy conservation programs or tariffs, as applicable, including any charges to customers provided for in such program or tariffs. Subject to and within the overall time frames specified above, FPL and the City will cooperate to develop an agreeable energy audit schedule for City facilities and large energy users located within the City.

- FPL will offer energy savings strategies for Citizens to promote additional energy savings for residential, business, and institutional energy users and FPL incentives will be applied to such strategies where applicable. The City: (i) will develop and offer to Citizens additional incentives related to services not covered by FPL, and (ii) may offer additional incentives to supplement FPL's incentives for energy efficiency, energy conservation, and renewable energy measures and technologies identified as being appropriate by the City; provided, however, FPL will continue to make its incentives available without regard to whether the City is offering supplemental incentives to promote designated measures and technologies.

- FPL and the City will encourage Citizens to participate in the FPL Home Energy Survey, online, over the phone or in person. The Home Energy survey shall include the following: (i) a personalized, convenient and expert energy-saving analysis of a Citizen's energy use; (ii) specific ways to save money on electric bill and energy-saving recommendations; (iii) a convenient method to ascertain what home appliances have the highest operating costs and how much such appliances contribute to a household's electric bill; (iv) the ability to test energy efficiencies by using different thermostat settings; (v) an overall guide for an energy-efficient home; and (vi) a printable report detailing specific ideas on how to manage individual electric consumption.

- The City will facilitate the implementation of the energy audits by disseminating relevant information regarding the energy audit program and energy efficiency to the Citizens through its "conservation" page on the City's web site. Further, the City will cooperate with FPL in promoting the energy audits contemplated by this Agreement and by FPL's DSM Plan, including to the extent applicable, by making available to FPL the assistance of the City's Sustainability Manager or similar personnel with energy conservation responsibilities to assist in the efforts contemplated by this Agreement.

(c) "Green" buildings and design. FPL shall support the construction of energy efficient, sustainable buildings within the City by sponsoring and paying for complete LEED "Existing Building" certification classes for a City employee or, at the

City's option, the Green Building Basic course of study; provided, the cost of such sponsorship shall not exceed $2,000.00. Such instruction would assist the City in understanding the requirements in the various categories leading to LEED certification and could facilitate the adoption by the City of LEED construction standards for new or retrofitted City buildings.

(d) Establishing an educational testing facility (the "**ETF**") on a site approved by the City and reasonably acceptable to FPL, in which FPL shall test and demonstrate new renewable energy products and technology. Examples of such "tested" technology would be:

- New solar photo voltaic ("**PV**") panels
- Solar technology
- Energy efficiency product testing for DSM plan development

As part of the ETF, FPL would also provide within the City a demonstration facility utilizing electrical pole mounted solar panels incorporating "Smart Grid" technology. Specifically, FPL would install five (5) Petra Solar pole-mounted panels with Smart Grid capability. This demonstration project would be a precursor to the installation of Smart Grid technology throughout the City, which is anticipated to occur in a 2012 – 2013 timeframe. The City shall own, and be responsible for, all energy, and associated green attributes, generated by the ETF, except that FPL shall own, and be responsible for, the energy, and associated green attributes, generated by the Petra Solar pole-mounted panels.

(e) The development of a "**Solar School**". FPL would cause the installation of solar PV array (2 – 5 kW) at Booker High School (or such other, appropriate public school identified by the City and reasonably acceptable to FPL). The Solar School project would include a curriculum and training for teachers related to solar PV technology. Also, a website would be developed that would track and monitor the energy generated by the solar array. The City (or the appropriate governmental entity) shall own, and be responsible for, all energy, and associated green attributes, generated by the Solar School.

(f) The installation of five (5) Electric Vehicle ("**EV**") charging stations (the "**Original Stations**") and, on that date five (5) years from the original installation date, the installation of an additional ten (10) EV charging stations (the "**Additional Stations**"), at a parking garage or alternative site approved by the City and reasonably acceptable to FPL; provided, prior to the installation of the Additional Stations the City shall demonstrate to FPL's reasonable satisfaction that the demand for, and use of, the Original Stations warrants the installation of the Additional Stations. The EV charging stations would be designed to promote and educate the Citizens on the benefits of EVs. The initial installation would be the first deployment of an EV product of this type by FPL. FPL would also install solar panels associated with the EV charging

stations. This installation would utilize state of the art PV panels and be the "first of its kind" installed by FPL. FPL shall own, and be responsible for, all energy, and associated green attributes, generated by the EV charging stations; provided, the energy, and associated green attributes, generated by the PV panels installed as part of the EV charging stations will be contributed by FPL to the City and, provided, further, the City shall have the discretion to charge and collect a usage fee related to the EV charging stations.

(g) Home Energy Makeovers and Nonprofit Energy Makeovers. During the Term, FPL will provide to the City: (i) 1500 home energy makeovers pursuant to FPL's Home Energy Makeover Initiative ("**HEMI**"); and (ii) 15 nonprofit energy makeovers pursuant to FPL's Nonprofit Energy Makeover Initiative ("**NEMO**") ((i) and (ii) the "**Makeover Services**"). The Makeover Services will be provided to the City, and Citizen-recipients of the Makeover Services will be selected, in a manner consistent with the HEMI or NEMO programs (as applicable). Commencing in year 2011 and during the Term, FPL will schedule and complete (i) 1500 HEMI Makeover Services; and, (ii) fifteen (15) NEMO Makeover Service. FPL will consult with the City, and the City shall cooperate reasonably with FPL, regarding the scheduling of and the recipients receiving the Makeover Services.

During the Term and with regard to the ETF, the Solar School and the EV charging stations (the "**Identified Projects**"), FPL will, promptly at the end of the "useful life" of the renewable energy technology installed at the Identified Projects (the "**Upgrade Date**"), upgrade and replace such renewable energy technology (the "**Upgrade Service**"). Such Upgrade Service will consist of replacing or supplementing (as applicable) the installed renewable energy technology with then-current "state of the art" technology. Additionally, as part of the Upgrade Service, FPL will double the amount of renewable energy technology installed at the Identified Projects (the "**Additional Units**") or will install such Additional Units at an alternative site approved by the City and reasonably acceptable to FPL; provided, prior to the installation of the Additional Units the City shall demonstrate to FPL's reasonable satisfaction that the demand for, and use of, the Identified Projects warrants the installation of the Additional Units. The useful life of the renewable energy technology installed at the Identified Projects will be determined by FPL based on prudent utility practice and the original equipment manufacturers' representations and warranties regarding the useful life of the applicable installed technology; provided, the Parties acknowledge and agree that the useful life of the Original Stations will be ten (10) years.

For illustrative purposes only, a schedule related to the Phase 1 Energy Projects, the Upgrade Services, the installation of the Additional Units and the Makeover Services is attached at Exhibit A.

2. Phase 2 Energy Projects:

Phase 2 EC Projects and RE Projects will be longer term projects and subject to the receipt by FPL and the City of necessary Required Approvals and/or the passage of enabling legislation. Phase 2 projects would include:

(a) The development of a roof-top solar facility (the "**Solar Roof**"). FPL would cause the installation of large-scale roof-top solar PV array at a site appropriate for such solar technology, such installation and site as mutually agreed to by the Parties.

(b) The development and installation of a demonstration "LED" streetlight pilot program designed to facilitate the adoption by the City (and by the Citizens, as applicable) of energy efficient street and area lighting.

(c) The development of a "utility scale" solar generation project. FPL would seek to develop a five (5) to ten (10) MW solar generation facility (the "**SGF**") on a site owned by the City and appropriate for the development and operation of the contemplated SGF. The City and FPL would negotiate in good faith toward a long-term agreement for the purchase or lease by FPL of the site, including a purchase price or lease payment from FPL to the City reflecting the fair market value of the site. FPL would conduct due diligence on and consider the Verna Wellfield property as a possible site for the SGF. The Parties recognize and agree that any site related to the SGF must be suitable for the development of such a facility, have the necessary solar resource and that the arrangements must be otherwise competitive, from each Party's perspective, with alternative sites and solar projects that may be developed by either the City or FPL. Nothing herein shall preclude the City from developing a similar solar generation facility, including such a solar facility at the Verna Wellfield property, at the City's expense, to be owned by the City. Further, the City shall have the right to develop a solar generation facility independent of FPL if the City, in its sole discretion, determines that the independent development of such a solar facility is in the best interests of the City and the Citizens.

(d) The development of a downtown transportation connector. FPL would support reasonably the City's efforts in applying for a federal grant to provide electric rail service (or other appropriate transportation circuit) in the downtown area.

For illustrative purposes only, a schedule related to the Phase 2 Energy Projects is attached at Exhibit B.

C. Responsibilities.

Pursuant to the terms of this Agreement, the Parties will jointly develop and implement the Energy Projects identified in Section B. In furtherance of this objective, FPL and the City, to the extent their interests are aligned, agree to support and not obstruct the advancement of statewide renewable energy legislation and conservation efforts and to cooperate in the advancement of the Phase I and Phase II Energy Projects.

1. Phase 1 Energy Projects.

Subject to the receipt by FPL (or, if applicable, the City) of any Required Approvals, FPL shall develop and implement the Phase 1 Energy Projects in accordance with (i) the standards of care, diligence, skill and judgment normally exercised by professional firms and individuals with respect to services of a similar nature; (ii) recognized and sound renewable energy practices, procedures and techniques; (iii) the terms of this Agreement; and (iv) all applicable laws and regulations (collectively "**FPL's Performance Standard**"). The City will (i) cooperate reasonably with FPL in the developing and implementing the Phase 1 Energy Projects; (ii) provide promptly to FPL any relevant data, information regarding Citizen interest in energy conservation, efficiency, renewable energy, and energy sustainability measures and projects, information regarding incentives that the City makes available to the Citizens (if applicable), access (including, if necessary, access to appropriate project sites), and City personnel (including labor) necessary to fulfill the City's responsibilities that are necessary for FPL to effectively carry out its Phase 1 responsibilities under this Agreement; (ii) collect and provide to FPL data produced by, and related to, the Energy Project (e.g., Citizen participation and energy usage data); and, (iii) promote FPL's participation in the program by allowing appropriate signage and acknowledgement (the "**City's Contribution**"). The Parties shall use commercially reasonable efforts to have the Phase 1 Energy Projects developed and implemented within eighteen (18) months of the Effective Date of this Agreement.

2. Phase 2 Energy Projects.

The Parties shall develop and implement the Phase 2 Energy Projects consistent with FPL's Performance Standard and the City's Contribution; however, the Parties acknowledge and agree that successful implementation of the Phase 2 Energy Projects will require, be contingent upon the receipt of, and be subject to: (i) certain Required Approvals; (ii) enabling legislation favorable to the development of renewable energy projects; and, (iii) increased capital and resource commitment from each Party. Further, with regards to the development of the SGF, FPL and the City shall jointly study the technical and financial requirements of the SGF Energy Project including, without limitation: (i) the scope and potential site locations of the SGF; (ii) design and construction costs, and operations and life cycle requirement costs; and (iii) the amount of renewable energy that will be produced and the proposed disposition of any renewable energy credits. In order to undertake these studies, the Parties shall have the following responsibilities:

A. FPL shall use commercially reasonable efforts to perform the following tasks, and other such reasonable tasks that may be required to develop and implement the SGF Project:

(i) Participate in joint technical exchanges with the City, on a schedule and at locations as may be mutually agreeable, for the purpose of developing and implementing the SGF Project.

(ii) Provide to the City a plan describing the proposed SGF Project site plan (e.g., land and/or facilities required, access requirements, power distribution system interconnection), the proposed approach for designing, constructing, operating, and maintaining the SGF Project throughout its lifecycle, the project schedule and estimated costs, the responsibilities of each of the Parties for meeting project schedule milestones and for funding the costs of the project, an estimate of the amount of renewable energy that will be produced, and the proposed disposition of any renewable energy credits (the "**Project Plan**").

B. The City will use commercially reasonable efforts to perform the following tasks, and other such tasks as may be necessary to develop and implement the SGF Project:

(i) Participate in joint technical exchanges with FPL, on a schedule and at locations as may be mutually agreeable, for the purpose of developing and implementing the SGF Project.

(ii) Review and comment on each submitted Project Plan and, subject to the City's acceptance of a final Project Plan, perform required site assignment coordination, environmental determinations, and preparation of appropriate implementing agreements governing land and facility use, SGF Project operation and maintenance.

(iii) Provide available, relevant data to assist FPL in carrying out its responsibilities with respect to the SGF Project.

C. Once it is determined that a SGF Project is viable from a regulatory, legislative, technical and financial perspective, the structure, final configuration, and binding terms and conditions applicable to the SGF Project shall be reflected in a mutually acceptable, definitive agreement (the "**Definitive Agreement**") among the City and FPL. A Definitive Agreement would contain terms and conditions customary for a transaction of this type, including covenants, representations and warranties, and other mutually agreeable terms.

D. Work Product; Financial Arrangements; Responsibilities; Cooperation

1. FPL shall own and maintain the Energy Projects funded and provided by FPL pursuant to this Agreement (and, except as specifically provided for herein, the products generated thereby) and own all rights (including all intellectual property rights), title and interest to any and all work products resulting from the renewable energy and energy efficiency services or Energy Project development and implementation activities performed by FPL pursuant to this Agreement; provided, that FPL hereby grants the City a non-exclusive, royalty-free license to use such work products in connection with the applicable Energy Project, which license shall survive beyond the termination of this Agreement.

2. The City and FPL will each be solely responsible for and bear all of their own respective internal and external costs, including without limitation, expenses of legal counsel, consultants, accountants and other advisors, incurred at any time in connection with pursuing the Energy Projects set forth in this Agreement.

3. The City and FPL shall each be responsible for its own facilities, for protection of its own systems, and for ensuring adequate safeguards for FPL customers, the Citizens, and the personnel and equipment of the City and FPL.

4. To further its commitment to expanding the use of renewable energy resources, in creating energy efficiencies, and in promoting and implementing measures and practices that will improve energy sustainability, the City commits to cooperate with and support (and not oppose or disparage) FPL or FPL's efforts to have enacted legislation and related regulatory procedures enabling the development, ownership and operation of renewable energy projects in the state of Florida.

F. Default; Remedies

1. An "**Event of Default**" shall mean the failure by a Party (the "**Defaulting Party**") to perform any material covenant or obligation set forth in this Agreement, which failure has a material adverse effect on a the other Party's (the "**Non-Defaulting Party**") ability to perform its obligations under this Agreement, if such failure is not remedied within thirty (30) days after notice of such failure, which notice sets forth in reasonable detail the nature of the failure; provided, however, that if such failure is not reasonably capable of being remedied within the thirty (30) day cure period specified above, the Defaulting Party shall have such additional time (not exceeding an additional ninety (90) days) as is reasonably necessary to remedy such failure (the "**Cure Period**"), so long as the Defaulting Party advises the Non-Defaulting Party of its plan for such cure and promptly commences and diligently pursues such remedy.

2. If an Event of Default has occurred and is continuing (and after the expiration of the Cure Period) the Non-Defaulting Party may, at its option: (i) terminate this Agreement without penalty or further obligation by written notice to the Defaulting Party; and (ii) exercise any other right or remedy available to the Non-Defaulting Party under generally applicable law, under this Agreement or in equity. Further, the Parties acknowledge and agree that money damages may not be a sufficient remedy for any breach of this Agreement and that the Non-Defaulting Party shall be entitled to seek injunctive or other equitable relief, including specific performance, to remedy or prevent any breach or threatened breach of this Agreement. Such remedy shall not be the exclusive remedy for any breach of this Agreement, but shall be in addition to all other rights and remedies available at law or in equity. Notwithstanding anything contained in this Agreement, a Defaulting Party's liability to the Non-Defaulting Party in connection with this Agreement and any activities undertaken in connection with the Energy Projects shall be limited to direct damages and shall exclude any other liability, including without limitation liability for special, indirect, punitive or consequential damages in contract, tort, warranty, strict liability or otherwise.

G. Notice

All notices required under this Agreement shall be in writing unless expressly specified otherwise herein, and shall be delivered in person, by certified mail or by a nationally recognized overnight courier, return receipt requested, or by facsimile transmission with confirmation by voice or automatic answer-back service, as specified below:

SARASOTA:

Robert J. Bartolotta
City Manager
The City of Sarasota, Florida
1565 1st Street
Sarasota, FL 34236
(941) 954-4102 (voice)
(941) 954-4129 (fax)
E-mail: Robert.Bartolotta@sarasotagov.com

FPL

Vice President, External Affairs
Florida Power & Light Company
700 Universe Boulevard

Juno Beach, FL 33408
(561) 691-7114 (voice)
(561) 691-7786 (fax)
E-mail: Pamela_M_Rauch@fpl.com

With Copies to:

Fournier and Connolly, P.A.
City Attorney
The City of Sarasota, Florida
1 South School Ave., Suite 700
Sarasota, FL 34237

With Copies to:

Florida Power & Light Company
Law Department (Law/JB)
700 Universe Boulevard
Juno Beach, Florida 33408
Facsimile: (561) 691-7305
Attention: Managing Attorney

H. Miscellaneous

1. Term. The term of this Agreement shall be thirty (30) years from the Effective Date, subject to the termination rights set forth herein (the "**Term**").

2. Modifications. Any modification to this Agreement shall be executed in writing and signed by an authorized representative of each Party. Any modification that creates an additional commitment of City resources must be signed by the original City signatory authority or successor or a higher-level City official possessing original or delegated authority to make such a commitment.

3. News Releases and Publications. Any public notices to third parties and all other publicity concerning this Agreement, activities relating to this Agreement and to the Energy Projects, shall be jointly planned and coordinated by the Parties and neither Party shall act unilaterally in this regard without the prior approval of the other Party (such approval not to be unreasonably withheld), except where required to do so by law

or by the applicable regulations or policies of any governmental or other regulatory agency of competent jurisdiction or any stock exchange in circumstances where prior consultation with the other Party is not practicable.

4. Use of the City's or FPL's Name, Initials and Devices. FPL agrees to submit to the City for its written approval all promotional and advertising material that uses the City's names, initials, insignia, seal, or logotype prior to publication. The City agrees to submit to FPL for its written approval all promotional and advertising material that uses the FPL names, initials, insignia, seal, or logotype prior to publication. The Parties agree to work cooperatively with regard to news releases, publicity, signage, and other public announcements and materials to ensure that both FPL and the City receive fair and appropriate credit for their contributions to the mutual energy conservation, renewable energy, and energy sustainability measures contemplated by this Agreement.

5. Assignment. Neither Party may: (i) assign any of its rights or obligations under this Agreement, or (ii) sell, lease, assign, transfer or otherwise dispose of all or a portion of an Energy Project without the prior written consent of the other Party, which shall not be unreasonably withheld or delayed. Any attempt by a Party to make any assignment, sale, lease, transfer or other disposition described herein in violation of this provision shall be void ab initio and shall not be effective.

6. Disputes. In the event of any dispute, controversy or claim between the Parties arising out of or relating to this Agreement (collectively, a "**Dispute**"), the Parties shall attempt in the first instance to resolve such Dispute through friendly consultations between the Parties. If such consultations do not result in a resolution of the Dispute within fifteen (15) days after notice of the Dispute has been delivered to either Party, then such Dispute shall be referred to the senior management of the Parties for resolution. If the Dispute has not been resolved within ten (10) business days after such referral to the senior management of the Parties, then either Party may pursue all of its remedies available hereunder. The Parties agree to attempt to resolve all Disputes promptly, equitably and in a good faith manner.

7. Governing Law; Waiver. This Agreement shall be governed by, and construed in accordance with the laws of the State of Florida without regard to its conflict of laws provisions. All actions or proceedings relating to this Agreement (whether to enforce a right or obligation or obtain a remedy or otherwise) will be brought solely in the state or federal courts located in the State of Florida. Each Party hereby unconditionally and irrevocably consents to the jurisdiction of those courts and waives its rights to bring any action or proceeding against the other Party except in those courts. EACH OF THE PARTIES HERETO HEREBY KNOWINGLY, VOLUNTARILY AND INTENTIONALLY WAIVES THE RIGHT EITHER OF THEM MAY HAVE TO A TRIAL BY JURY IN RESPECT OF ANY LITIGATION BASED HEREON, OR ARISING OUT OF, UNDER OR IN CONNECTION WITH THIS AGREEMENT. THIS PROVISION IS A MATERIAL INDUCEMENT FOR THE PARTIES ENTERING INTO THIS AGREEMENT.

8. Structure. This Agreement is not intended to constitute, create, give effect to or otherwise recognize a joint venture, partnership or formal business organization, or agency agreement of any kind, and the rights and obligations of the Parties shall be only those expressly set forth herein. No Party shall have the right, except as expressly provided for in this Agreement, to bind the other Party with respect to any matter without the express prior written consent of the other Party.

9. Construction of Agreement. The Parties expressly agree that no provision of this Agreement should be construed against or interpreted to the disadvantage of any Party by any court or other governmental or judicial authority by reason of such Party having been deemed to have structured or dictated such provision.

10. Complete Agreement. This Agreement is intended as the complete and exclusive statement of the agreement between the Parties. Parol or extrinsic evidence shall not be used to vary or contradict the express terms of this Agreement and recourse may not be had to alleged prior drafts, negotiations, prior dealings, usage of trade, course of dealing or course of performance to explain or supplement the express terms of this Agreement.

11. Counterparts. This Agreement may be executed and delivered in counterparts, and may be delivered by facsimile transmission.

12. Severability. In the event that any provision of this Agreement shall be held invalid or unenforceable by a court of competent jurisdiction, the remainder of this Agreement or the application of the provisions hereof to persons or circumstances other than those as to which it is held invalid or unenforceable, shall not be affected thereby.

13. Non-Waiver. No waiver of any provision of this AGREEMENT shall be deemed to be nor shall constitute a waiver of any other provision whether or not similar, nor shall any waiver constitute a continuing waiver. No waiver shall be binding unless executed in writing by the Party making the waiver.

IN WITNESS WHEREOF, the Parties hereto have caused this Renewable Energy, Energy Efficiency, and Energy Sustainability Agreement to be executed and delivered by their duly authorized officers as of the date first written above.

THE CITY OF SARASOTA, FLORIDA

BY: _____

Kelly M. Kirschner

Mayor

ATTEST:

BY: _____

City Auditor and Clerk

APPROVED AS TO FORM AND CORRECTNESS:

BY: _____

City Attorney

FLORIDA POWER & LIGHT COMPANY, a Florida corporation

BY: _____

Pamela M. Rauch

Vice President, Corporate and External Affairs

City of Sarasota

Renewable Energy, Energy Efficiency, and Energy Sustainability Agreement

Phase 1 Energy Projects - Exhibit A

Energy Project		What	Where	Frequency
Education	B1a	Captain Conservation Professor Whys	Perfomances as agreed upon	As agreed upon
Energy Audits	B1b	Energy Audits performed by FPL to identify cost-effective energy savings	All city facitilies	every 5 years through 2040
Energy Audits	B1b	Energy Audits performed by FPL to identify cost-effective energy savings, with customers acceptance and agreement	Identify 100 largest electricity-consuming accounts (non-city)	1st cycle within 5 years
Energy Audits	B1b	Energy Audits performed by FPL to identify cost-effective energy savings, with customers acceptance and agreement	Identify 50 largest electricity-consuming accounts (non-city)	subsequent 5 yr cycles years 2015 - 2040
Home Energy Surveys	B1b	FPL and City to encourage Citizens to participate	on-line, phone, in person	on-going
Education	B1c	LEED Classes for City Employee		sponsorship up to $2000
Education Testing Facility		Demonstration of new renewable energy products and technologies to include:	site(s) selected by City, reasonable accepted by FPL	
	B1d	- Five (5) Petra Solar pole-mounted panels with Smart Grid capability (useful life - 20 years)	site(s) selected by City, reasonable accepted by FPL	2011 - Initial installation of 5 2021 - review technology and use for possible additional installation of 10 2031 - replace initial 5 placed in 2011and review for additional install of 5 2031 - review and replace/supplement additional installation subject to useful life determination
	B1e	- Install a DC solar PV array (5kWmax) at a School Site (useful life - 20 years)	school(s) selected by City and Sarasota County School Board reasonable accepted by FPL	2011 - Initial installation of (5kW max) array 2021 - review for use and possible additional installation of 2-(5 kW max) sites 2031 - replace initial installation of array
	B1f	- Five (5) Electric Vehicle ("EV") Charging Stations (useful life - 10 years)	site(s) selected by City, reasonable accepted by FPL	2011 - Initial installation of 5 stations 2016 - review technology and use for possible additional 10 stations 2021 - replace initial installation of 5 stations and determine useful life for subsequent replacement/supplement 2026 - replace additional 10 stations placed in 2016 and determine useful life for subsequent replacement/supplement 2031 - review and replace/supplement stations subject to useful life determination 2036 - review and replace/supplement stations subject to useful life determination
	B1g	Home Energy MakeOver Initiative (HEMI) - 1500 homes to include as needed, compact flourescent light bulbs, installation of On-Call equipment, weatherstripping, duct and insulation repairs	homes selected by City	2011 - 100 homes 2022 - 100 homes 2034 - 150 homes 2013 - 150 homes 2025 - 100 homes 2036 - 150 homes 2015 - 100 homes 2028 - 150 homes 2038 - 150 homes 2018 - 100 homes 2031 - 150 homes 2039 - 150 homes schedule flexible and subject to change
	B1h	Non-Profit Energy MakeOver (NEMO) - 15 sites to include as needed, compact flourescent light bulbs, installation of On-Call equipment, weatherstripping, duct and insulation repairs	sites selected by City	schedule to be determined

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City of Sarasota

Renewable Energy, Energy Efficiency, and Energy Sustainability Agreement

Phase 2 Energy Projects - Exhibit B

All Projects on this list will be longer term projects and / or subject to required approvals and passage of enabling State legislation.

Energy Project		What	Where	Comments
Solar Roof	B2a	Large scale roof-top DC solar PV array	As agreed upon	As agreed upon
LED StreetLights	B2b	demonstration "LED" streetlight pilot program, energy efficient street and area lighting	As agreed upon	As agreed upon
"Utility Scale" Solar Generation Project	B2c	Five (5) to ten (10) MW DC solar generation facility	As agreed upon	Consider Verna Wellfield property
Downtown Transportation Connector	B2d	FPL would support the City's efforts in applying for a federal grant		

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Respectfully submitted,

CITY OF ALEXANDRIA, VIRGINIA

By counsel

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Counsel for the City of Alexandria

CERTIFICATE OF SERVICE

I hereby certify that on this 28th day of February 2025, a copy of the foregoing was served by e-mail only to:

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Arlen Bolstad
Kiva Bland Pierce
Michael Zielinski
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