



City of Alexandria Green Building Policy: Preliminary Analysis and Recommendations Report

Prepared for:

City of Alexandria

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1. Executive Summary

Below is a summary of recommendations for the City of Alexandria to consider for effective approaches to updating the City’s Green Building Policy, with the goal of providing the greatest impact toward achieving the City’s environmental goals. Strategies are recommended based on relative impact as well as the City’s ability to implement each strategy.

Recommendations

Below is a recommended approach to each strategy.

Strategy A

Increase LEED or equivalent third-party green building certification standards for private development and prioritize specific green building elements in private development projects.

We recommend the City consider that all private projects, both commercial and residential, achieve LEED Silver as a minimum. In addition, we recommend projects be designed to meet the performance levels listed below.

Table 1: Summary of Strategy A Performance Targets

Energy	
Energy Performance - EUI targets*:	<ul style="list-style-type: none"> • < 35 kBTU/ft² for multifamily residential buildings • < 45 kBTU/ft² for commercial (with exceptions for hospitals, food service, and schools) • < 30 kBTU/ft² for schools • No specific EUI target for hospitals, food service, or other energy intensive industries, but a 30% improvement over a 90.1-2010 baseline should still be targeted.
Renewable Energy:	Buildings subject to DSUP should be designed to have 5% of their total energy be supplied by onsite renewable energy
Commissioning:	Achieve a minimum 3 points Enhanced Commissioning under LEED V4
Measurement and Verification:	Advanced Energy Metering for the whole building and any end uses making up over 10% of the building load.
Water	
Indoor water use	Reduction minimum 40% better than baseline (per LEED V4 baseline values)



Outdoor water use reduction	Show that the landscape does not require a permanent irrigation system beyond a maximum two-year establishment period. OR 50% reduction in landscape water requirement from the calculated baseline for the site's peak watering month.
Stormwater	
Stormwater management	No requirement over and above City's standard stormwater requirement, established April 2018.

Strategy B

New and Existing Public Buildings - Establish a separate green building standard for new public development, at a level more ambitious than required for private development and evaluating the feasibility of a net zero standard for new public development, including schools.

We recommend the City consider that all new public development projects, including schools should be certified at the LEED Gold level, to lead-by-example, as well as be designed to achieve the following performance requirements:

Table 2: Summary of Strategy B Performance Targets

Energy	
Energy Performance	Be designed to achieve net zero energy (NZE) through a combination of energy efficiency and renewable energy systems, either on-site or sited on other City properties.
Water	
Indoor water use	Reduction minimum 40% better than baseline (per LEED V4 baseline values)
Outdoor water use reduction	Reduce irrigation water use by at least 50% relative to the calculated baseline for peak watering month, and where possible, use plants that require no irrigation with potable water after a maximum two-year establishment period.
Stormwater	
Stormwater management	Meet 100% of the stormwater treatment requirements for sites with green infrastructure and evaluate options for overtreatment and/or detaining additional rainwater on site to the greatest extent technically feasible.

The City should consider the use performance-based procurement to incentivize higher levels of environmental performance while controlling costs.



Strategy C

New Private Development (not subject to site plan review) - Introduce voluntary green building practices for small buildings not subject to site plan review.

We recommend the City consider the below mechanisms for encouraging improved environmental performance for small buildings not subject to site plan review.

Home Rating and Labeling Programs

A home rating is made up of a series of measures that can be achieved to attain points for a higher rating: Education, Site, Energy, Water, Indoor Environmental Quality, Materials and Resources, and Innovations.

Education and Capacity Building

Education programs for industry, including developers, architects and engineers as well as internally for City staff can improve the baseline knowledge and local industry capacity to deliver high performance buildings.

Strategy D

Existing Private Buildings (Commercial, Multifamily, and Single Family) - Introduce voluntary green building practices for existing buildings (including historic).

We recommend the City consider the below mechanisms for encouraging improved environmental performance for existing buildings.

Challenge Programs and Benchmarking

Many jurisdictions have had success in promoting energy efficiency through voluntary challenge programs. We recommend that Alexandria join Richmond, Arlington, and other local governments in advocating for state enabling legislation to allow local benchmarking and energy disclosure programs for commercial, multifamily, and single-family buildings.

Educational Programs

Many building owners and managers don't know how to make their property greener. Educational resources from the local government can be very helpful.

Green Leases and Tenant Build-Out

Green leasing realigns the financial incentives of the landlord and tenant to support energy or sustainability goals in the lease documents. These leases overcome the principal-agent problem,



whereby landlords and tenants are dis-incentivized to undertake energy efficiency upgrades in a building, as neither realizes the full benefit of the upgrades.

Coordination with Utility Efficiency Programs

Dominion Energy is developing substantial new energy efficiency programs, that will be operated the next 10 years. Dominion has begun development of these programs and identified the City of Alexandria as a named stakeholder.

PACE

C-PACE is an innovative way to finance clean energy projects on commercial, multifamily, and non-profit buildings (excluding condos and properties with less than five dwellings).

Strategy E

Incentives for All New and Existing Privately-Owned Buildings - Establish incentives for private development to incorporate green building elements.

We recommend the City consider introduction of the below structural and financial incentives:

Floor area exclusions to accommodate passive design elements

This is a mechanism that allows additional floor area and height, form and setback relaxations for buildings that include passive design elements that have an impact on FAR or the building massing.

Density (FAR) and/or Height Bonus

There are areas of the city, such as Potomac Yards and Eisenhower East, where there is potential for additional density above current limits. In these areas, a FAR and/or height bonus for green construction could be very beneficial, so long as it stacks on top of affordability bonuses rather than replacing them.

Tax Incentives

Tax-based incentives provide a financial incentive to the applicant by way of a reduction in taxes.



2. Project Objectives

This report includes recommendations for effective approaches to consider in updating the City of Alexandria's Green Building Policy, with the goal of providing the greatest impact toward achieving the City's environmental goals. Strategies are recommended based on relative impact as well as the City's ability to implement each strategy. This draft report was prepared for review by the City of Alexandria's Green Building Policy Task Force and the public and represents a summary of our preliminary findings to date, as of January 16, 2019, and may be updated, amended, or contradicted by future analysis.

3. Background

The City of Alexandria's Green Building Policy, introduced in 2009, applies to new private development that is subject to development site plan review. The current policy requires non-residential buildings to achieve LEED Silver (or equivalent standard), and residential buildings to achieve LEED Certification, or equivalent standard such as LEED for Homes or ICC-700 2008 National Green Building Standard.

The City is electing to revise the Green Building Policy to ensure new and existing building projects contribute to achievement of the goals and targets in the Environmental Action Plan (EAP) Phase 1, adopted by City Council in June 2018. Further, the City is considering setting more stringent environmental performance targets for public projects (City-owned buildings).

The City hired Integral Group to recommend potential strategies for the City to consider to improve energy, greenhouse gas, water and storm water management performance in new and existing, public and private buildings ranging from single family homes to multifamily and large commercial and institutional development.

In this report we are proposing a pathway for each building type, along with estimated impacts of each proposed strategy. To measure impacts, we compared projected performance under an updated policy against both demonstrated performance of buildings constructed under the existing policy, and improvement over code or conventional design.

4. Examined Green Building Strategies

The scope of this project is to review, make recommendations, and measure potential impacts for five green building strategies. The five strategies were selected by the Green Building Policy Task Force established by the Alexandria City Council. The strategies vary by building type, whether the building is subject to development site plan review, whether the building is private or City-owned, and for new construction or existing buildings. Specific recommended strategies discussed in section 6 were selected based on potential environmental impact, and feasibility of implementation by the City of Alexandria. The selection and prioritization of the strategies as well as the approach to impact analysis are discussed in section 5.

Below is the list of the five green building strategies by building type:

- A. **New Private Commercial and Multifamily Development (subject to site plan review)** - Increase LEED or equivalent third-party green building certification standards for private development and prioritize specific green building elements in private development projects.



- B. **New and Existing Public Buildings** - Establish a separate green building standard for new public development, at a level more ambitious than required for private development and evaluating the feasibility of a net zero standard for new public development, including schools.
- C. **New Private Development (not subject to site plan review)** - Introduce voluntary green building practices for small buildings not subject to site plan review.
- D. **Existing Private Buildings (Commercial, Multifamily, and Single Family)** - Introduce voluntary green building practices for existing buildings (including historic).
- E. **Incentives for All New and Existing Privately-Owned Buildings** - Establish incentives for private development to incorporate green building elements.

5. Approach and Methods

5.1 Current State Review

Current Green Building Policy & Outcomes

To inform our analysis and recommendations, our team began by reviewing Alexandria's current Green Building Policy and the outcomes of the policy to date. The City provided the score cards and certifications for all buildings that have been subject to the Green Building Policy since its inception in 2009. Our team aggregated the available data on building certification levels and points or credits achieved and generated a summary report of the quantitative results of these building projects (see excerpt in Appendix B). We calculated average performance in energy, water and stormwater management. This average performance comprises the baseline results of Alexandria's current Green Building Policy and will inform the recommended performance targets for the revised Green Building Policy. See Appendix B for details on this analysis.

Document Review

The City of Alexandria provided a set of plans, policies and administrative procedures for review. This document review allowed us to understand the context under which the Green Building Policy exists, which inform recommendations for the future policy. Importantly, this review gave our team an understanding of the current administrative procedures in place to track, review and assess compliance for buildings subject to the Green Building Policy, including what is required by the applicant and by City staff and reviewers. Our recommendations are further informed by the energy, greenhouse gas emissions, water use reduction and storm water management targets in the City's Environmental Action Plan. We calculated the capacity for buildings to meet the proposed targets to support achievement of the targets established in the EAP Phase 1 document.

5.2 Best Practice Review

While the City of Alexandria has a clear idea of its desired future state in terms of environmental performance, per the Environmental Action Plan, a scan of existing best practices in other jurisdictions is useful in informing the approach to the new Green Building Policy. Our best practice review included



cities of a similar size, climate zone, administrative capacity, regulatory jurisdiction, type of development and/or similarly ambitious long-range environmental targets.

Strategies from other jurisdictions informed our recommendations in two ways: (1) We scanned performance targets from different jurisdictions to understand the range of energy, GHG, water and stormwater conservation and management practices being required of buildings in these jurisdictions. (2) We scanned the approach – the policy, regulatory, incentive or programmatic structure that either requires or encourages higher levels of environmental performance. We also considered the level of effort and administrative burden on behalf of both the applicant and the City.

The best practices review is summarized in Appendix A, along with a comparison of how Alexandria ranks in Green Building achievements relative to other cities with similar policies and of similar size or density to Alexandria (+/- 30% in size or density).

Table 3: LEED Policy Highlights for Peer Jurisdictions

City	Green Building Policy (bolded policies are discussed in Appendix A)
Seattle, WA	Aggressive EUI targets (<35 kBtu/ft²)
Berkeley, CA	LEED Gold for buildings in downtown area (LEED Certified elsewhere)
St. Paul, MN	LEED Silver or better, along with local priority credits
Washington, DC	International Green Construction Code with is equivalent to LEED Silver, Optional NZE Code Path, Stormwater Retention of 1.2"
Cambridge, MA	LEED Silver (buildings over 50,000 ft ²)
Alexandria, VA	LEED Silver for Commercial / LEED Certified for Multifamily
Boston, MA	LEED Certified plus local priority credits
Arlington, VA	Density Bonus for LEED Silver (0.25 FAR) through LEED Platinum (0.5 FAR), with additional bonus for local priority credits
Santa Monica, CA	Density bonus for non-residential projects that meet LEED Platinum along with other local requirements.
Sunnyvale, CA	Density bonus for LEED Gold Certification.

5.3 Impact Assessment

To measure the impact of key strategies, we reviewed the performance of buildings under the existing policy. This allowed us to establish a business-as-usual (BAU) case that reflected the median impact of the existing policy, and to ensure that the new policy would be demonstrably more aggressive.

When designing a building and getting points for energy use reductions, one measures the modeled performance against what the performance would be if built according to an energy code. While every state adopts its own codes, most base their codes on national model codes developed by the International Code Council (ICC) and the American Society of Heating, Refrigerating and Air-Conditioning



Engineers (ASHRAE). Most projects built in Alexandria under the current Green Building Standard used the LEED v2009 rating system, which used ASHRAE 90.1-2007 as the baseline code for energy performance. The new LEED v4 uses ASHRAE 90.1-2010 as its baseline reference for optimizing energy performance. In 2018, Virginia adopted a new energy code based on the International Energy Conservation Code (IECC) 2015 and ASHRAE 90.1-2013.

For energy and emissions, we reviewed studies by Pacific Northwest National Laboratory (PNNL) to determine typical Energy Use Intensity (EUI) for the 4A Climate Zone (which contains Virginia), under ASHRAE 90.1, versions 2007, 2010, and 2013.^{1,2} We also reviewed modeled EUIs under stretch codes for other jurisdictions in the 4A climate zone and the New York Stretch Code, for which modeling was done using the same 4A climate reference point (Baltimore).³ Given the average energy improvement for projects under the existing green building policy was 26% relative to 90.1-2007, we can estimate an average EUI for buildings built in Alexandria. In estimating a BAU scenario, we took the lower of this EUI, or the EUI under IECC 2015, for each building type.

Table 4: Typical Energy Use Intensities by building type in Climate Zone 4A, under various baselines

	90.1-2007 (LEED v2009 baseline) (kBtu/ft ²)	90.1-2010 (LEED v4 baseline) (kBtu/ft ²)	90.1-2013 / IECC 2015 – Current VA Energy Code (kBtu/ft ²)	New York Stretch Code (kBtu/ft ²)	Estimated average EUI achievement in Alexandria under existing policy (kBtu/ft ²)
Multifamily	62.4	53.0	50.7	56.2	46.1
Commercial (all)	71.9	59.2	54.6	45.7	53.2
Office	84.0	71.4	59.6	56.2	62.2
School	52.2	44.4	36.7	30.2	38.6
Hotel	67.3	57.2	46.9	39.8	49.8
Retail	107.3	91.2	70.3	56.5	79.4

Energy Codes have improved dramatically over time, with the energy use of a new building today being approximately half that of a building built to the 1980 code, as shown in Figure 1 from the American Council for an Energy-Efficient Economy.⁴

¹ <https://www.energycodes.gov/sites/default/files/documents/PNNL-22760.pdf>

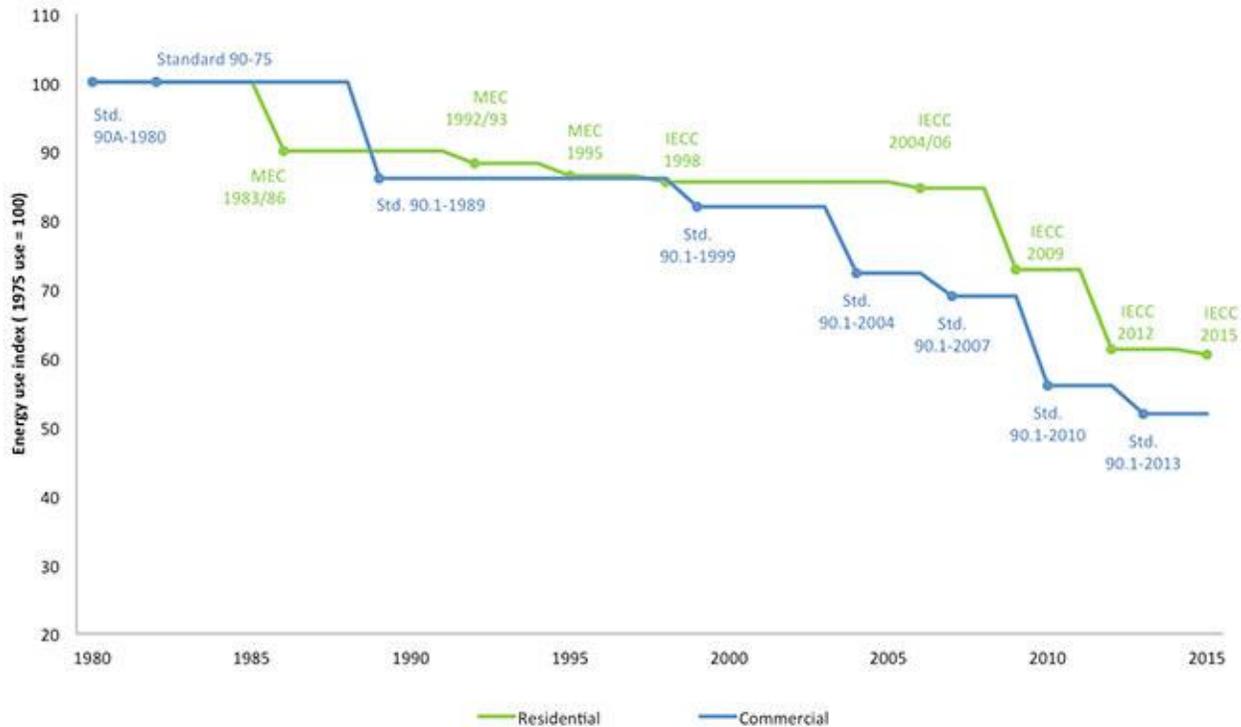
² https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-24269.pdf

³ <https://www.osti.gov/servlets/purl/1418063>

⁴ <https://aceee.org/blog/2016/02/take-ride-energy-slide-building-codes>



Figure 1: Improvements in model energy codes, 1980-2015



The new IECC 2015 and ASHRAE 90.1-2013 is in line with this trajectory. Because LEED v4 is keyed off an older code, a commercial building built to the new Virginia code will automatically achieve LEED points—this must be considered when setting new standards, as shown in Table 5. This table also shows our assumptions for the % of energy use coming from electricity vs. natural gas, which is critical for calculating greenhouse gas emissions.

Table 5: LEED point bonus provided by compliance with the Energy Code, and assumed gas/electric breakdown

Building Type	Average EUI in 4A under LEED v4 baseline (90.1-2010) (kBtu/ft ²)	Average EUI under new IECC 2015 / 90.1-2013 code (kBtu/ft ²)	% improvement of new code over 90.1-2010	LEED points to achieve code compliance	Assumed % electric ⁵	Assumed % Gas ⁶
Multifamily	53.0	50.7	4%	0	100%	0%
Commercial (all)	59.2	54.6	8%	2	85%	15%
Office	71.4	59.6	17%	6	100%	0%
School	44.4	36.6	17%	6	85%	15%
Retail	57.2	46.9	18%	7	85%	15%
Hotel	91.2	70.2	23%	9	66%	34%

⁵ Based on DC comparison for office and multifamily; PNNL data for other building types

⁶ Based on DC comparison for office and multifamily; PNNL data for other building types



We used these findings both to help set aggressive but achievable targets for new construction, and to model the energy and GHG impacts of such a policy. To project impacts, we used the following numbers for building floor area in Alexandria. Projects currently in development will not be subject to the new policy. Therefore, projected new policies were modeled as applying the growth forecast in the Small Area Plans (SAPs). The estimated growth for the small area plan zones is based on the City’s best guess of how these plans will develop at the time of this report.

Table 6: Existing and Anticipated Building Floor Area by Sector

Building Type	Existing Gross Floor Area (ft ²)	Gross Floor Area In development (ft ²)	Estimated Gross Floor Area Anticipated in Small Area Plans (ft ²)
Public Municipal	2.5 million	Under Review ⁷	0.4 million ⁸
Multifamily Residential	61.9 million	6.8 million	30.1 million
Office	21.8 million	1.7 million	15.7 million
Retail	11.4 million	362,000	4.4 million
Hotel	2.7 million	217,000	1.3 million
Other Commercial	1.9 million	317,000	0.7 million

5.4 Green Building Rating Systems: Equivalency Overview

Below is a concise overview comparing a selection of green building standards with the LEED standard, which is the basis of the current policy. The information and charts below are derived primarily from a U.S. DOE/PNNL study conducted for the U.S. General Services Administration in 2012. Because of the different approaches each standard takes, it is challenging to provide a guidance on how to achieve true equivalency amongst the various standards. However, it is possible to mandate equivalent performance for discreet building elements including energy/GHG, water, and storm water.

⁷ Under review by the City.

⁸ This is an estimate based on assuming that planned municipal buildings within Small Area Plan zones are the same size as existing typical City of Alexandria buildings of the same building type. We assumed that new fire stations are 13,000 ft², new recreation centers and community buildings are 15,000-20,000 ft², and new offices and civic buildings are 50,000 ft².



Table 7: Highlights of Reviewed Rating Systems

Standard	Typologies	Performance Areas	Levels of Certification
LEED⁹	LEED BD+C (New Construction and Major Renovation), O+M (Existing Buildings Operations and Maintenance), Zero (a new zero-carbon certification)	Sustainable site development, water savings, energy efficiency, materials selection, and indoor environmental quality	Certified, Silver, Gold, Platinum <i>LEED is regularly revised; both v2009 and v4 are discussed in this document; most projects certified in Alexandria did so under LEED v2009, but any new projects will certify under v4.</i>
Green Globes¹⁰	Green Globes NC (New Construction) and CIEB (Continual Improvement of Existing Buildings)	energy, indoor environment, site, water, resources, emissions, and project/ environmental management	One, two, or three globes
Living Building Challenge¹¹	Living Building Challenge has four typologies: Building, Renovation, Landscape or Infrastructure, Neighborhood	Site, water, energy, health, materials, equity and beauty	“Living Building Petal Certification” is available for projects that only meet the requirements in 3 or more areas (one of which must be energy, water, or materials)
Enterprise Green Communities¹²	Multifamily only	Integrative Design, Location + Neighborhood Fabric, Site Improvements, Water Conservation, Energy Efficiency, Materials, Healthy Living Environment, Operations + Maintenance + Resident Engagement	N/A
Earthcraft¹³	Multifamily, Homes (Single-Family)	Site Planning, Construction Waste Management, Resource Efficiency, Durability, High Performance Envelope, Energy Efficiency, Water Efficiency, Education and Operations	Certified, Gold, Platinum

⁹ LEED v4 BD+C: <https://www.usgbc.org/resources/leed-v4-building-design-and-construction-current-version>

¹⁰ Green Globes for New Construction: https://www.thegbi.org/files/training_resources/Green_Globes_NC_Technical_Reference_Manual.pdf

¹¹ <https://living-future.org/lbc/resources/>

¹² Enterprise Green Communities 2015 Criteria: <https://www.enterprisecommunity.org/sites/default/files/media-library/financing-and-development/grants/2015-green-criteria-2015-2-11.pdf>

¹³ Earthcraft Multifamily Version 5: <https://www.viridiant.org/wp-content/uploads/2016/02/ECMF-Technical-Guidelines.pdf>



Key Differences between Rating Systems:

- Green Globes has no points that are specifically required; thus, an examination of the points achieved on each individual project would be required in order to determine which requirements would be met by certification.
- LEED has minimum requirements that must be met before any level of certification can be attained (called prerequisites). The prerequisites do not add to the total number of points needed to achieve certification.
- The Living Building Challenge requires that buildings meet 100% of the system's design and operations strategies, and exceed requirements set by any other standard.
- Green Globes and Living Building Challenge use on-site auditors to augment the certification information received electronically, while LEED bases its certification solely on the information submitted electronically.
- LEED requires that new construction projects submit measured energy and water performance to the USGBC for five years following certification. The Living Building Challenge is designed to incorporate the results of at least the first year of a building's operations prior to certification, which means this system has the greatest emphasis on measured performance.
- Enterprise Green Communities and Earthcraft are only available to multifamily properties.

If Alexandria is to allow projects to certify through an "equivalent standards" provision, we recommend that regardless of rating system, all buildings meet the same energy, GHG, water efficiency, and stormwater management targets suggested for LEED in this document. For convenience, we have reviewed the other standards listed above and identified what the "equivalent" achievement in their standard would be, if it exists.

Conclusion:

- ✓ The Living Building Challenge exceeds all requirements and should be accepted as an alternative compliance path, as Living Building certification exceeds all recommended targets.
- ✓ The Living Building Petal Certification should be allowed as an alternate compliance path so long as buildings achieve both the energy and water petals.
- ✓ Enterprise Green Communities should be allowed so long as equivalent performance criteria and points are met or exceeded.
- ? Green Globes may be considered as an alternate path, provided the applicant achieves minimum three green globes, plus equivalent energy, water and stormwater performance as the Alexandria targets. A detailed staff review and verification (with cost recovery) may need to be conducted for areas where no equivalent criteria exist.
- × The City's Office of Housing subscribes to Earthcraft standards for affordable housing projects subject to VHDA requirements, and the Earthcraft standard has strong roots and market penetration in Virginia. However, we recommend that Earthcraft not be considered an equivalent standard at this time, as its current maximum points fall short of the minimum requirements recommended in this report for all identified environmental performance elements.



6. Findings and Analysis

6.1 Strategy A: Increase LEED or equivalent third-party green building certification standards for private development and prioritize specific green building elements in private development projects.

We recommend the City consider for private projects, both commercial and residential, achieve LEED Silver as a minimum. In addition, projects should be designed to meet the performance levels listed below. The setting of specific performance targets in addition to LEED is a growing best practice, as shown in Appendix A. Suggested targets are given to provide clarity and consistency over time, even as LEED is updated. For ease of communication and enforcement, a LEED v4 credit equivalent is provided. Please note that LEED v4.1 will be released in the coming years, and may shift the credits required to be equivalent to the suggested targets. The equivalent performance target for the other rating systems is also provided, if it exists; these are also only accurate for the current version at the time of publication—in particular, the Enterprise Green Communities 2020 standard will be more rigorous than the current (2015) standard. The calculations that went into the Optimize Energy Performance target are included in Appendix C.

ENERGY

Table 8: Full recommendations and equivalencies for energy use in new construction of private buildings

Past Performance	Suggested Target	LEED v4 equivalence	Other Equivalence
<p>Optimize Energy Performance: LEED v2009 measured savings against a baseline of ASHRAE 90.1-2007. The average achievement in Alexandria for LEED v2009 projects was 8 points, or 26% reduction vs. 90.1-2007. 3 projects <20% reduction 4 projects 20%-30% reduction 3 projects >40% reduction</p> <p>LEEDv4 offers points based on % reduction relative to 90.1-2010. The new Virginia energy code is based on IECC 2015 / ASHRAE 90.1-2013. According to modeling by PNNL, this means meeting the baseline Virginia energy code will net the average commercial building 7 points.</p>	<p>EUI targets: < 35 kBtu/ft² for multifamily residential buildings < 45 kBtu/ft² for commercial (with exceptions for hospitals, food service, and schools) < 30 kBtu/ft² for schools No specific EUI target for hospitals, food service, or other energy intensive industries, but a similar % improvement over baseline is still expected.</p> <p>This equates to:</p> <ul style="list-style-type: none"> • > 30% reduction relative to 90.1-2010 for both commercial and residential • 18-25% improvement over code (IECC 2015) for commercial • 30% improvement over code for multifamily residential 	<p>LEED V4 EA Optimize Energy Performance (p. 74-75): Minimum 12 points. 12 points are awarded for the following reductions relative to 90.1-2010 baseline:</p> <ul style="list-style-type: none"> • >29% EUI reduction for New Construction (non-healthcare) • >27% EUI reduction for major renovations (non-healthcare) • >26% reduction for Core and Shell • >24% EUI reduction for healthcare new construction • >22% EUI reduction for healthcare major renovations 	<ul style="list-style-type: none"> ✓ Living Building Challenge or Living Building Energy Petal: Minimum requirements exceed target. ✓ Green Globes: 60 points for Energy Performance ✓ Enterprise Green Communities: The full 12 points in criteria 5.2. × Earthcraft: the maximum number of points equate to a lower standard than the current energy code; any building using Earthcraft must meet the EUI thresholds.



<p>Onsite Renewable Energy One project achieved 13% onsite renewable energy. The remainder achieved 0%</p>	<p>Buildings subject to DSUP should be designed to have 5% of their total energy be supplied by onsite renewable energy</p>	<p>LEED V4 Onsite Renewable Energy 1 point = 1% of total energy cost supplied by renewable 2 points = 5% of total energy cost supplied by renewable 3 points = 10% of total energy cost supplied by renewable</p>	<ul style="list-style-type: none"> ✓ Living Building Challenge or Living Building Energy Petal: Minimum requirements exceed target. ✓ Enterprise Green Communities: 6 points in criteria 5.7b for 5% of total energy demand being met with onsite PV for buildings 4 stories or more, and 10% for buildings 2-3 stories × Green Globes: Only requires a feasibility study × Earthcraft: No renewable energy credits
<p>Enhanced Commissioning 5/10 LEED 2009 projects achieved this credit. The majority of earlier projects achieved the credit.</p>	<p>Achieve a minimum 3 points Enhanced Commissioning under LEED V4</p>	<p>LEED V4 Enhanced Commissioning, 3 points</p>	<ul style="list-style-type: none"> ✓ Living Building Challenge or Living Building Energy Petal: Mandatory ✓ Enterprise Green Communities: Mandatory × Green Globes: No mention × Earthcraft: no mention
<p>Measurement & Verification 5/10 LEED 2009 projects achieved the Measurement & Verification credit.</p>	<p>Advanced Energy Metering for the whole building and any end uses making up over 10% of the building load.</p> <p>In addition, Alexandria should work with private entities that that are deploying building management systems and energy data visualization to develop pilot programs that help building owners recognize the value of this metering investment.</p>	<p>LEED V4 Advanced Energy Metering, 1 point</p>	<ul style="list-style-type: none"> ✓ Living Building Challenge or Living Building Energy Petal: Mandatory ✓ Enterprise Green Communities: Mandatory, Criteria 5.6 × Green Globes: No mention × Earthcraft: No mention



WATER EFFICIENCY

Table 9: Full recommendations and equivalencies for water efficiency in new construction of private buildings

Past Performance	Suggested Target	LEED v4 equivalence	Other Equivalence
<p>Water Use Reduction LEED 2009 AVERAGE 16% reduction over baseline</p> <p>5 projects achieved 0% 5 projects achieved 30-35%</p>	<p>Indoor water use reduction Minimum 40% better than baseline</p>	<p>LEED V4 WEC2: Minimum 4 points or 40% better than baseline (*see table below).</p>	<ul style="list-style-type: none"> ✓ Living Building Challenge or Living Building Water Petal: Minimum requirements exceed target ✓ Green Globes: 24 points in Water Consumption 3.4.1 × Enterprise Green Communities: Maximum points for only 30% reduction over baseline (likely to be revised) × Earthcraft: No performance criteria
<p>Water Efficient Landscaping LEED 2009 AVERAGE 80% reduction in potable water use</p>	<p>Outdoor water use reduction Show that the landscape does not require a permanent irrigation system beyond a maximum two-year establishment period.</p> <p>OR 50% reduction in landscape water requirement from the calculated baseline for the site's peak watering month.</p>	<p>LEED V4 WEC1: Option 1. No Irrigation Required (2 points) Show that the landscape does not require a permanent irrigation system OR Option 2. Reduced Irrigation (1-points) Reduce the project's landscape water requirement (LWR) by at least 50% from the calculated baseline for the site's peak watering month.</p>	<ul style="list-style-type: none"> ✓ Living Building Challenge or Living Building Water Petal: Minimum requirements exceed target ✓ Enterprise Green Communities: 8 points in Criteria 3.5b for 50% reduction in irrigation water use × Green Globes: Only requires a Landscaping Irrigation Plan × Earthcraft: No mention

Table 10: LEED v4 baseline flow rates¹⁴

Fixture or fitting	Baseline (IP units)	Baseline (SI units)
Toilet	1.6 gpf	6 lpf
Urinal	1 gpf	3.8 lpf
Public lavatory faucet	0.5 gpm at 60 psi	1.9 lpm at 415 kPa
Private lavatory faucet	2.2 gpm at 60 psi	8.3 lpm at 415 kPa
Kitchen faucet	2.2 gpm at 60 psi	8.3 lpm at 415 kPa
Showerhead	2.5 gpm at 80 psi per shower	9.5 lpm at 550 kPa per shower

¹⁴ LEED V4 BD+C Reference Manual



STORMWATER MANAGEMENT

In 2014, the City of Alexandria updated its stormwater requirements for development and redevelopment projects to comply with Virginia Stormwater Management Program (VSMP) regulations. During this update, the City made the decision to keep its additional existing requirement for treatment of the water quality volume default (WQVD), which requires treatment of the first ½ inch of rainfall over the entire impervious area. This resulted in a stormwater treatment requirement that is more restrictive than those required by the VSMP regulations and other jurisdictions in the State. In addition, in April 2018, the City of Alexandria introduced new, additional stormwater management requirements for all new development. These new requirements ratchet up the environmental performance expected of new development above what was being achieved under the existing Green Building Policy. New development in Alexandria must meet the following additional requirements:¹⁵

- “A minimum of 65% of total phosphorus (TP) removal required by the Virginia Stormwater Management Program (VSMP) must be achieved using non-proprietary surface BMPs approved by the Virginia Stormwater BMP Clearinghouse.
- A maximum of 25% of the TP removal required by the VSMP may be achieved using [Manufactured Treatment Devices] MTDs and/or sand filters approved by the Virginia Stormwater BMP Clearinghouse.
- Any Approved BMP may be used to meet the balance of the Alexandria Water Quality Volume Default (WQVD).
- MTDs may not be used on single-family detached residential projects.”

Virginia law requires the management and treatment of the rainfall to meet specific pollution reductions, in addition to requiring that runoff rates cannot exceed pre-development levels. These new requirements, in practice, require that 65% of that rainfall be treated for nutrient removal using green infrastructure.

The City’s 2018 stormwater requirements were developed in close cooperation with private industry, and to change them less than a year later would be disruptive. After discussions with the City, we are not recommending any further increase in the required Stormwater practices for private development. However, new public development requirements are recommended below.

IMPACTS

Energy and GHG Impacts:

To calculate impacts, specific average EUIs were generated under both the business as usual and policy scenario cases for multifamily buildings, office buildings, hotels, retail buildings, schools, and miscellaneous commercial buildings. The business as usual scenario assumes that all new growth forecast in the area plans would achieve the energy performance specified in the new Virginia Energy Code, based on IECC 2015 and ASHRAE 90.1-2013.

¹⁵ City of Alexandria. 2018. “Memorandum to Industry No. 01-18” January 24, 2018.



The different building sectors were then modeled as achieving on average a 30% reduction in EUI relative to 90.1-2010, per the LEED v4 Optimize Energy Performance target recommended above. EUIs were split between electricity and gas based on current regional construction norms as identified in PNNL modeling for the District of Columbia and New York City. GHGs from electricity were based on the 2016 EPA eGRID GHG intensity for the Virginia-North Carolina sub region; natural gas GHG intensity used a flat national average that does not account for fugitive emissions.

The new EUI and energy performance targets will reduce the EUI of new buildings by between 18% and 33% depending on building type relative to the code and reduce the total energy use of the buildings forecast in the small area plans by 20%, and 592 billion BTU per year. The targets will reduce the GHGs from these buildings by over 63,000 metric tons per year; also 20% less than the BAU case. Compared to the current GHG emissions of Alexandria as a whole, and a BAU case where GHGs increase due to new construction but transportation emissions stay flat, these targets will reduce citywide GHG emissions by over 3%.

While this number does not sound significant, this is in line with the savings available for new construction policies in most jurisdictions. To take a particularly aggressive example, strategies for new construction included in the District of Columbia Clean Energy DC Plan are forecast to reduce citywide GHGs by 4.6% relative to BAU. This is a similar order of magnitude as the savings forecast for Alexandria, but it is ~50% more impactful because DC controls its own energy code and is aiming for a net zero energy code by 2026, with EUI reductions ranging from 65% to 80% depending on building type.

To truly meet the overall greenhouse gas reduction goals established in the EAP, Alexandria will need assistance from the Commonwealth and the utility companies to target existing buildings with a suite of policies to reduce energy use, to dramatically increase the renewable energy supply in Virginia, and to transition residents to electric vehicles, among other action areas.

A full discussion of the energy and GHG impacts of the energy standards is discussed in Appendix C, including all calculations and results.

Water Impacts:

To calculate water impacts, we looked at the average Water Use Intensities (WUI) for major building types nationally, measured in gallons per sq. ft. per year.¹⁶ Unlike with energy use or greenhouse gas emissions, these values do not vary significantly by geography or climate zone. The average energy use improvement over baseline achieved by buildings built under Alexandria's existing policy is 16% (see Appendix B). Our recommendation is that new buildings subject to the policy reduce their indoor water use by 40% relative to baseline. When applied across the forecast new floor area, this will avoid the use of at least 421 million gallons of water a year, or a 29% reduction in water use from new construction, relative to business as usual.

¹⁶ Commercial Building WUI numbers were sourced from the U.S. DOE 2012 Commercial Building Energy Survey: <https://www.eia.gov/consumption/commercial/reports/2012/water/>
Multifamily Building WUI numbers were source from a national survey conducted in 2012 by Fannie Mae: https://www.fanniemae.com/content/fact_sheet/energy-star-for-multifamily.pdf



Citywide water consumption figures were not available at the time of this report. However, if we assume that the multifamily and commercial buildings in Alexandria use water at the same rate as nationally, on average, then we can estimate that multifamily and commercial buildings in Alexandria currently use at least 3.3 billion gallons of water a year, and that the new policy will reduce the total water used by the multifamily and commercial sectors in Alexandria by 9% relative to BAU.

These water savings estimates are all underestimates, because they only account for reductions in indoor water use. The policy also has standards for reducing outdoor water use for irrigation. However, as reliable national metrics for irrigation water use were not available, the savings from these irrigation limits could not be calculated.

A full discussion of the water use impacts of the water standards is discussed in Appendix C, including all calculations and results.

6.2 Strategy B: Establish a separate green building standard for new public development, at a level more ambitious than required for private development and evaluating the feasibility of a net zero standard for new public development, including schools.

New Public Buildings

We recommend the City consider that all new public development projects should be (a) Certified at the LEED Gold level, to lead-by-example and (b) Designed to achieve net zero energy (NZE) through a combination of energy efficiency and renewable energy systems, either on-site or sited on other City properties.

In addition to the above, we recommend the City consider that public buildings meet the following performance requirements:

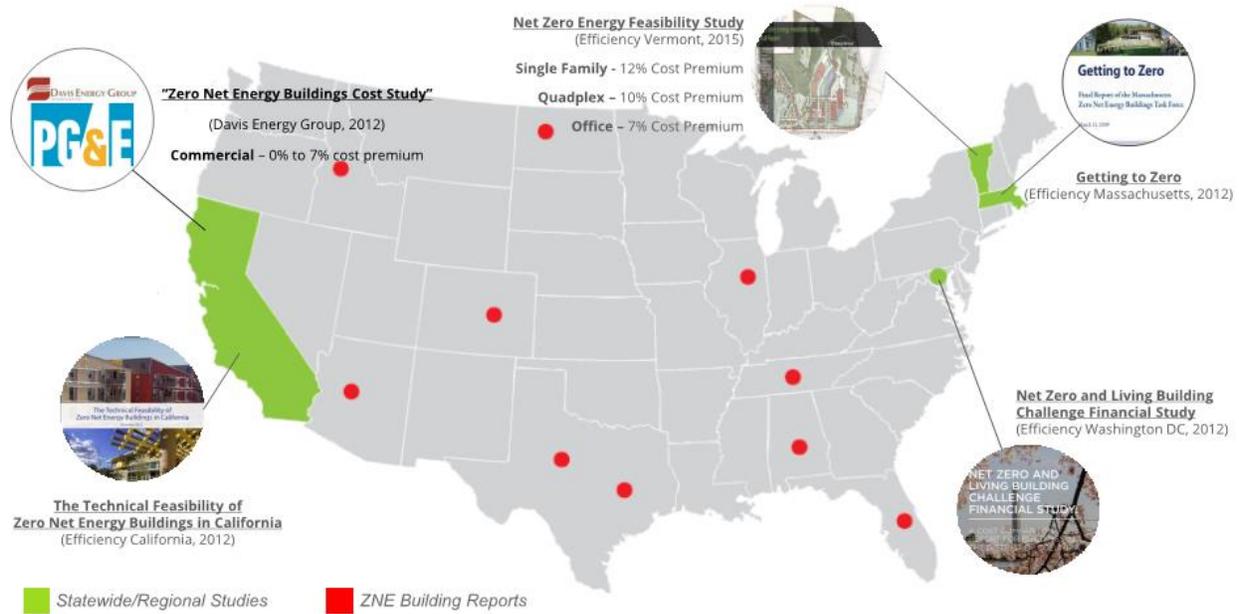
- Reduce indoor water use by 40% relative to the baseline
- Reduce irrigation water use by at least 50% relative to the calculated baseline for peak watering month, and where possible, use plants that require no irrigation with potable water after a maximum two-year establishment period.
- Treat 100% of rainfall up to a 1.2" event with green infrastructure to phosphorus.
- Use performance-based procurement to incentivize higher levels of environmental performance.

Net-Zero Energy

A Net-Zero Energy building is a highly energy-efficient building where 100% of the site energy use is met with renewable energy in net over the course of a year, either from on-site or off-site renewable energy. Designers of NZE buildings should maximize the energy efficiency potential and on-site solar generation potential of the building before supplementing with off-site renewable energy. The Environmental Action Plan Phase I target states that the updated Green Building Policy will set forth a path by FY 2020 for new City-owned building to meet a net zero standard. Studies have found that net-zero energy buildings can be delivered in a cost-effective manner, with first cost premiums for commercial NZE buildings ranging from 0% to 7%, but generally with positive net present values.



Figure 2: Net Zero Energy Studies in the United States



Generally, it is possible to meet the full energy needs of an NZE building on-site when the building is less than six stories (or has substantial additional areas where solar can be established such as on parking canopies), and the building will not contain any particularly energy intensive uses (such as data centers). With tall buildings in dense urban environments, it is often necessary to go off-site for additional renewable energy; however, by leveraging Power Purchase Agreements (PPAs), the building owner can ensure that the additional renewable energy represents an additional contribution to decarbonizing the electricity grid. (A Power Purchase Agreement is a legal contract between an electricity generator and a power purchaser (typically a utility or a large portfolio owner, but increasingly small virtual PPAs are being executed for single buildings).

However, should the City undertake a project where there is concern about engineering feasibility of NZE, the City could consider installing additional renewable electricity generating capacity on other properties in its portfolio to offset the additional load, or by entering a PPA to purchase off-site renewable electricity.

Water

We recommend that public facilities meet or exceed the water efficiency requirements set for private development above. In addition, public facilities should lead by example in Stormwater management. While private development must treat 65% of rainwater with green infrastructure, public facilities should meet 100% of the stormwater treatment requirements for the site, with green infrastructure and evaluate options for overtreating and/or detaining additional rainwater on site. This requirement may be waived if it is found to be infeasible or not cost effective.



Performance-based procurement

With performance-based procurement, the city issues an RFP stating the maximum budget and specific environmental performance goals for the project. Bidders responses detail what level of environmental performance their team can achieve within the stated budget. While performance-based procurement allows a city to set minimum environmental performance targets for projects, there is also the opportunity to encourage incrementally higher performance by articulating tiers of performance in the RFP.

- Tier 1: “Mission Critical” outlines performance targets that are required in all buildings and facilities
- Tier 2: “Highly Desirable” outlines performance targets that represent a more ambitious level of performance overall
- Tier 3 “If Possible” outlines performance targets that are considered “best in class” and that should be pursued when project parameters allow

The benefits of this approach include (a) the process guarantees a minimum standard environmental performance; (b) lowers the City’s risk by bestowing the contractual responsibility for performance on the design team; (c) encourages innovation and creativity; (d) reduces design and construction costs; (e) generally results in higher-performance buildings than a conventional procurement process.

One deficiency of this method is that it may be more challenging to adapt to community feedback, especially for the first such projects. Therefore, the approach may best be piloted in a new development area where there is community support for the required flexibility. We recommend that Alexandria consider use of performance-based procurement on a pilot project basis to procure its first NZE building in the near future, and, if successful, consider adopting this practice for more or all of its building procurement.

Solar + Storage Feasibility

We recommend that the City examine the feasibility, costs and benefits of installation of on-site solar and storage for all new projects. If the cost-benefit result is favorable, the project should go forward with investment in solar and storage. Recommend to use available tools such as [SolarResilient](#) to estimate the size of solar and associated storage needs, per [City of San Francisco’s](#) example.

Existing Public Buildings:

The EAP calls for a 20% reduction in energy use in existing public building portfolio by FY2023. This goal can be achieved through a combination of basic energy efficiency measures such as lighting retrofits and better operations and maintenance across the whole portfolio, combined with deep energy retrofits in select buildings.

Benchmarking is the act of measuring the energy performance of a building and comparing it to both its own past performance and peer buildings. It is an essential first step for energy management. The City already benchmarks all its facilities in ENERGY STAR Portfolio Manager, as valuable first step in energy management. Our experience is that benchmarking is highly valuable, but only if the data is then used and regularly checked for quality. A staff person or intern would need to be assigned each year to



review the data for Quality Control/Quality Assurance, and to review the ways the data is being used and how it could be used better. For high energy use buildings, we recommend that the city go beyond benchmarking and undertake retrocommissioning to ensure the buildings are operating as designed and at peak efficiency.

We further recommend that the City consider developing a Strategic Energy Management Plan (SEMP) for Portfolio Optimization. A SEMP should establish the City's ongoing approach to persistently identifying, assessing, prioritizing, and implementing energy and GHG reduction measures. Alexandria is working with the Rocky Mountain Institute (RMI) to leverage their Portfolio Optimization approach to improve building performance and bring better data analytics to bear on the problem, as discussed in EAP Phase 1, Energy Efficiency Action #1. This will then be aligned with the City's asset value approach (VFA) to prioritize green investments, such as HVAC replacement. It is important that the economic and environmental benefits of energy efficiency investments be properly prioritized in decision making.

Benchmarking can be done using the U.S. Environmental Protection Agency's free online tool, ENERGY STAR® Portfolio Manager®, which gives an Energy Use Intensity (EUI) to all buildings and a 1-100 score for several key building types such as schools and offices. All of Alexandria's buildings are currently benchmarked, though the integration with the utility data management needs fixing, and the benchmarking always benefits from regular QA/QC of the space use assumptions. We recommend that Alexandria also consider a public dashboard of energy data on its facilities and/or the results of the DOE Asset Score, to increase transparency and help building owners in the private sector see the value of advanced metering.

Strategic energy management is a focused, long-term approach to reducing energy use through efficiency and conservation, as well as taking other steps to reduce costs and GHG emissions. The SEMP should establish the City's ongoing approach to persistently identifying, assessing, prioritizing, and implementing energy and GHG reduction measures. It should specify any guiding policies, clarify roles and responsibilities, codify the methods used to evaluate potential opportunities, and identify and begin to resolve any organizational barriers. The SEMP should align with the scale of action called for in the balance of this report, particularly regarding a set of deep energy retrofits. It should act as a roadmap to ultimately drive City buildings towards net-zero-ready performance levels.

Following on benchmarking and portfolio planning, we recommend that the City of Alexandria consider a deep energy retrofit program for public facilities. Often, it is tempting to simply address the easiest "low-hanging fruit" of efficiency upgrades. However, this makes deeper retrofits that much more difficult. In the next few years, we recommend Alexandria consider target buildings for whole-building retrofits that aim to reduce building energy use by an average of 30%. By 2024, once the city has experience in operating NZE new buildings, we recommend the City begin to consider target NZE retrofits of existing buildings.

Simultaneously, we recommend the City continue a retrofit of City facilities and public lighting LED lighting to reduce costs, as identified in EAP Phase 1 Energy Efficiency Action#3. Outdoor LEDs should have a color temperature not more than 3000 kelvins, to reduce negative impacts on human health or wildlife.



6.3 Strategy C: New Private Development (not subject to site plan review) - Introduce voluntary green building practices for small buildings not subject to site plan review.

Home Rating and Labeling Programs

A home rating is made up of a series of measures that can be achieved to attain points for a higher rating: Education, Site, Energy, Water, Indoor Environmental Quality, Materials and Resources, and Innovations. The Home Energy Rating System (HERS) Index is an example of a nationally-recognized system. Certified HERS Raters conduct an energy rating on a home to measure its energy performance. The benefits of rating systems and labels are that homeowners understand how their house is performing and the extent to which there is room for improvement. It can be motivating to know there are energy cost savings and improvements that can be implemented to reduce bills and improve comfort. Labels and ratings are also disclosed at the time of sale of a building and, for the seller, a house with a high rating may derive more value than an inefficient house with a lower rating. The purchaser will have a better understanding of the relative efficiency of the home as they consider investing.

Given state limitations, we recommend that Alexandria pursue state enabling legislation to operate a home rating and labeling program. The City could also work with the regional MRIS to incorporate energy information into the home listing. The District of Columbia has been successful in working with MRIS to add this information to listings, in cooperation with the realtor industry, and this effort could be leveraged for Alexandria.

Education and Capacity Building

Industry/Private Sector Education: Education programs for industry, including developers, architects and engineers can improve the baseline knowledge and local industry capacity to deliver high performance buildings. The City can offer industry training programs, access to technical assistance, and online resources to support developers in achieving higher levels of building performance.

City/Public Sector Education: As the City continues to require or encourage higher standard of environmental performance in buildings, it is important that City staff working in planning, development and permitting remain up to date on green building standards, energy and water performance requirements, and other green design strategies required by and encouraged by the City. We recommend the City should training with each update to the Green Building Policy and record the training so that it is available and accessible to staff to review and for new staff to watch as they are on-boarded.

6.4 Strategy D: Existing Private Buildings (Commercial, Multifamily, and Single Family) - Introduce voluntary green building practices for existing buildings (including historic).

While the Commonwealth has not delegated authority to Alexandria to introduce mandatory requirements for existing buildings that do not qualify for development site plan review, there are many voluntary programs the City can operate to increase sustainability of existing buildings. Work on existing



buildings will be critical—without efficiency improvements in existing buildings, it will be impossible for the community to meet its greenhouse gas reduction goals. Brief descriptions of possible programs are provided below. Since many of these programs would require program development, these will likely not be full parts of the new Green Building Policy Update planned for June 2019. Rather, we recommend these ideas are provided to inform the mid-term actions for EAP Phase 2, or to be integrated into a further policy update in 2020-2021.

Challenge Programs and Benchmarking

Many jurisdictions have had success in promoting energy efficiency through voluntary challenge programs. The challenge can be between buildings in the community—an example is neighboring Arlington’s “green games” voluntary challenge program, which promoted energy efficiency and greenhouse gas reductions among office buildings through a voluntary label that offices could post.

Or the challenge can be between communities--the U.S. Department of Energy’s Better Buildings Challenge allows communities to join as partners, and the local government, usually in conjunction with a non-profit partner, works to get local businesses and buildings to join the challenge, share benchmarking data, and commit to reducing their energy use by 20%. These programs are most effective when they include networking events, best practice resources, and non-financial motivators like awards.

However, as more than 25 cities nationwide have found, there is also real benefit to having a mandatory program for benchmarking of energy use and public transparency. We recommend that Alexandria join Richmond, Arlington, and other local governments in advocating for state enabling legislation to allow local benchmarking and energy disclosure programs for commercial, multifamily, and single-family buildings.

Educational Programs

Many building owners and managers don’t know how to make their property greener. Educational resources from the local government can be very helpful. One notable local example is the [Sustainability Guide for Historic Properties](#) that was produced for the District of Columbia government. For single family homes, access to resources and information is a barrier to homeowners making improvements to their houses. Alexandria should develop or promote existing resources such as [Vancouver’s Green Home Renovation Guides](#). We recommend that Alexandria consider incorporating elements from these resources into their own sustainability and sustainable materials reports and guidelines for single family homes and for historic properties.

Green Leases and Tenant Build-Out

Lighting, controls, certain HVAC systems, and tenant-owned equipment (e.g., office/IT equipment, commercial kitchens) are routinely replaced at tenant turnover, and less frequently replaced at lease renewal. Many commercial tenant spaces, including office and retail, turn over an average of once every seven years. This makes tenant turnover a key opportunity to improve efficiency. Alexandria can encourage and incentivize the use of energy efficient equipment and practices during tenant build out, such as sub-metering of tenant spaces, use of energy-efficient lighting and HVAC, occupancy sensors, behavior programs, and/or LEED ID+C certification. The EPA ENERGY STAR program will be developing and launching a new rating system for tenant spaces by 2020. We recommend that Alexandria work to



drive early tenant adoption of this new system as a cornerstone of tenant awareness and action to improve efficiency.

Green, or energy-aligned, leasing is another way to align tenants and owners behind energy efficiency. Green leasing realigns the financial incentives of the landlord and tenant to support energy or sustainability goals in the lease documents. These leases overcome the principal-agent problem, whereby landlords and tenants are dis-incentivized to undertake energy efficiency upgrades in a building, as neither realizes the full benefit of the upgrades.

In a recent study, the Institute for Market Transformation (IMT) estimated that green leases could reduce energy consumption in U.S. office buildings by between 11% and 22%, reducing nationwide utility expenditures by commercial buildings by as much as \$0.51 per square foot. The potential savings for the U.S. market for leased offices ranges from \$1.7 billion to \$3.3 billion in annual cost savings.

We recommend that Alexandria consider providing education and resources for stakeholders such as brokers, lawyers, and commercial real estate companies, as well as building owners and tenants, to increase uptake of green leases. This can be done via round-table discussions, or by providing training. New York City has operated a good example of this sort of market assistance by promoting the “energy aligned clause” for commercial leases, which was developed in cooperation with the private sector and standardizes language and expectations to allow equitable sharing of investment costs and energy savings.¹⁷ We also recommend the City consider recognizing those leaders in the industry who participate in green leasing. The Green Lease Leaders program run by IMT and the U.S. Department of Energy recognizes these organizations, and this effort could be promoted to owners and tenants in Alexandria. The [Green Lease Leaders](#) website also includes resources for tenants and landlords, benefits and best practice examples of green leases.¹⁸

Coordination with Utility Efficiency Programs

As authorized by recent Commonwealth legislation, SB796, Dominion Energy is developing substantial new energy efficiency programs, that will be operated the next 10 years. Dominion has begun development of these programs and identified the City of Alexandria as a named stakeholder. City staff attended the kickoff on January 3, 2019 and are working with Dominion to identify meaningful programs that will benefit the Alexandria community and the Commonwealth as a whole.

PACE

The City of Alexandria is exploring introduction of a C-PACE program. C-PACE is an innovative way to finance clean energy projects on commercial, multifamily, and non-profit buildings (excluding condos and properties with less than five dwellings). The loans are designed to be long-term (up to 20+ years) and secured by a lien that has a priority status equal to a tax assessment. By setting up a C-PACE program, a locality can enable private sector loans for 100% of total project costs by placing a special assessment on the property that the owner repays over time as part of their tax bill from an amount equivalent to or less than the energy savings on the project. Virginia joined more than 30 states and the District of Columbia in adopting C-PACE legislation in 2009 (with amendments in 2015). Rather than

¹⁷ http://www.nyc.gov/html/gbee/downloads/pdf/eac_overview.pdf

¹⁸ <https://www.greenleaseleaders.com/>



operating a state-level C-PACE program, the Virginia law authorizes local governments to operate C-PACE programs. The EAP Phase 1 calls for the adoption of an ordinance by July 2020 to implement C-PACE in Alexandria. To ensure that C-PACE is successful, Alexandria would need to dedicate staff resources to crafting strong legislation, forming partnerships with private sector lenders, providing education to the community, and overseeing the program. C-PACE is often attractive to entities that have trouble getting sufficient credit on the private market, or who need more off-balance-sheet credit, such as small businesses, non-profits and public service institutions, affordable housing, and houses of worship. However, these sectors also need outreach and engagement; without strong staff support and public education, C-PACE programs may struggle to gain market share.

Legislative Agenda

As discussed above, there are several key items identified in this section that would require enabling legislation from the Virginia General Assembly:

- Provide local jurisdictions with enabling authority to require large private buildings to annually measure and disclose their energy performance to the jurisdiction and authorizing the city to make this data public. Enabling legislation should also authorize the local jurisdictions to make select policies based on this benchmarking data, such as requiring energy audits or retrocommissioning for poor performers.
- Enable local jurisdictions to require energy performance disclosure by home sellers to home buyers.
- Allow owners of large portfolios to install and interconnect solar systems on buildings that exceed 105% of the building's annual electricity demand, to serve other buildings in their portfolio.
- Make it easier of large users to purchase renewable energy directly from third parties via Power Purchase Agreements.
- Continue to adopt the most recent IECC code, without weakening amendments.

6.5 Strategy E: Incentives for All New and Existing Privately-Owned Buildings - Establish incentives for private development to incorporate green building elements.

Structural Incentives

Floor area exclusions to accommodate passive design elements

This is a mechanism that allows additional floor area and height, form and setback relaxations for buildings that include passive design elements that have an impact on FAR or the building massing. Any additional square footage demonstrated to be a result of a passive design element is excluded from the total floor area calculation. This could include insulation above and beyond code requirement, that increases the thickness of exterior walls or exterior rain screens that add extra thickness to exterior walls. Height relaxations, setbacks and depth of building requirements can be introduced to accommodate building features designed to reduce energy consumption.

See [Vancouver, BC passive design exclusions and guidelines](#) to accommodate projects pursuing Passive House certification.



Density (FAR) and/or Height Bonus

While FAR bonuses are widely used in other jurisdictions, this is not a priority recommendation for the City of Alexandria. The City's existing bonusing program in support of affordable housing is an effective mechanism for encouraging new affordable housing development. The introduction of an additional bonus structure stacked on to this existing bonus program is not advisable because (a) the scale of development in Alexandria is moderate and thus maximum densities are relatively limited and (b) in the residential sector, it is recommended the City avoid a circumstance in which a developer must select between either construction of affordable housing OR high performance environmental design. This would be at odds with the City's desire to promote both affordability and low-impact development in line with the EAP.

However, there are areas of the city, such as Potomac Yards and Eisenhower East, where there is potential for additional density above current limits. In these areas, a FAR and/or height bonus for green construction could be very beneficial, so long as it stacks on top of affordability bonuses rather than replacing them. Establishing such areas as a Green Zone might allow the clean application of these stronger incentives for green building. Green Zones could also be used to require District Energy Analysis for large development projects, as is done in Loudon County. The Commonwealth has enabled local jurisdictions to create such 'green zones.' A full examination of Green Zones is outside the scope of this report but is being analyzed by City staff.

Expedited Permitting

Expedited or accelerated review of building permitting (or first-in-line permitting) is used in many jurisdictions to reward projects with high environmental benefits with faster turnaround times for construction permitting, which in turn shortens the project timeline. This has been effective in other cities (see best practices Appendix A), where the standard building permit process can take a period of months. While the entire entitlement and site plan review process in Alexandria may take several months, the building permit review process in Alexandria is 15-20 business days for each submission. Therefore, expedited building permitting is not included in our recommendations to the City of Alexandria as the current building permit processing time in Alexandria is 15-20 business days, and likely cannot be further accelerated without sacrificing rigor.

Tax Incentives

Tax-based incentives provide a financial incentive to the applicant by way of a reduction in taxes. Tax incentives can be structured in a variety of ways depending on the desired scale of financial incentive, target audience, and other applicable factors. For smaller developments not subject to site plan review where structural incentives are less applicable, we recommend the City should adoption of a financial incentive such as a tax credit.

Per WSP's Preliminary Recommendations and Analysis for cost impacts, "the fiscal impacts of any type of tax credit mechanism need to be carefully considered, especially if it is a comprehensive policy such as the program in Montgomery County. A more limited-scale tax credit program could also be customized to help fill specific gaps remaining after other mechanisms and incentives have been deployed. In this manner, a tax credit mechanism could play a more complementary role as part of a broader set of mechanisms with reduced fiscal impacts to the City."



DRAFT



A. APPENDIX A: BEST PRACTICE SURVEY

This section details. Best practices in Green Building policy from selected North American local and regional governments. The table lists selected American cities with similar green building policies and of similar size and/or density (+/- 30% of Alexandria); further discussion on these, and other leading policy examples from North America, follows.

Table 11: Peer Cities Green Building Achievements

City	Population	Area [sq. mi.]	Density [ppl/sq. mi]	LEED Certified ¹⁹			Energy Star Certified ²¹			Green Building Policy (bolded policies are discussed below, among others)
				Activities	M sq. ft.	Sq. Ft. per capita	Buildings	M sq. ft.2	Sq. Ft. per capita	
Seattle, WA	724,745	83.8	8,651	400	88.78	122.5	234	65.4	90.2	Aggressive EUI targets
Berkeley, CA	122,324	17.7	6,915	44	2,407	19.7	21	1,292	10.6	LEED Gold for buildings in downtown area (LEED Certified elsewhere)
St. Paul, MN	306,621	56.2	5,458	37	6,786	22.1	55	13.15	42.9	LEED Silver or better, along with local priority credits
Washington, DC	693,972	68.3	10,155	1009	181.1	261.0	452	140.3	202.2	International Green Construction Code at LEED Silver level + Optional NZE Code Path
Cambridge, MA	113,630	7.1	15,937	198	18.35	161.5	49	7,713	67.9	LEED Silver
Alexandria, VA	160,035	15.5	10,325	87	12.64	79.0	99	15.67	97.9	<i>LEED Silver for Commercial / LEED Certified for Multifamily</i>
Boston, MA	685,094	89.6	7,644	377	100.1	146.1	187	70.79	103.3	LEED Certified plus local priority credits
Arlington, VA	234,965	26.0	9,037	212	48.42	206.1	124	37.29	158.7	Density Bonus for LEED Silver through LEED Platinum; additional bonus for local priority credits
Santa Monica, CA	92,306	8.4	10,963	63	6,747	73.1	46	6,196	67.1	Density bonus for non-residential projects that meet LEED Platinum along with other local requirements.
Sunnyvale, CA	153,656	22.7	6,772	99	18.43	119.9	50	5,465	35.6	Density bonus for LEED Gold Certification.

¹⁹ USGBC Green Building Information Gateway (GBIG). Numbers current as of January 17, 2019. <http://www.gbig.org/>



STRATEGY A

Path 1: LEED with Directed Credits

Arlington County, Virginia

Type: FAR (Floor Area Ratio) Bonus available to private buildings, one of set of LEED credits

Arlington County’s [Green Building Density Incentive Program](#) allows a density bonus for residential and commercial buildings that achieve **LEED** under the appropriate rating system.

Table 12: Arlington, Virginia Green Building Density Bonus

LEED version 4	Office or Residential	Two Arlington Priority Credits	Total Bonus FAR Available
Silver	0.25 FAR	+ 0.05 FAR	0.30
Gold	0.35 FAR	+ 0.05 FAR	0.40
Platinum	0.50 FAR	+ 0.05 FAR	0.55

An additional 0.025 FAR is available for projects achieving **one of eight Arlington priority credits**. Credit will be given for up to two credits. These [priority credits](#) include:

1. Optimize Energy Performance 9% – at least 9% improvement over the LEED prerequisite
2. Optimize Energy Performance 12% – at least 12% improvement over the LEED prerequisite
3. Enhanced Envelope Commissioning
4. Renewable Energy Production (1%+ of energy use annually from onsite RE)
5. Site Development – Protect or Restore Habitat
6. Bird Collision Deterrence Pilot Credit
7. Building Life-Cycle Impact Reduction (building materials reuse and salvage)

Path 2: LEED plus Independent Requirements

Chicago, Illinois

Type: Requirement for new development; combination of specific requirements not tied to LEED credits, but some points available from LEED or other rating systems.

Chicago Sustainable Development Policy

The new policy allows development teams to choose from a [menu](#) of strategies that can be tailored to fit the project’s characteristics. Each strategy is assigned a point value. New construction projects are required to achieve 100 points. Compliance form [here](#).



The updated policy provides two compliance paths. The first path (1) does not require the building to be certified through a listed building certification program. Projects choosing this path must meet the 100 points required through the strategies listed in the menu.

The second path (2) is for projects that are choosing to achieve building certification. Points are automatically given to these projects depending on the type of building certification being achieved, as well as the level of certification in some instances. Additional points are required except for projects that are being certified under the Living Building Challenge program.

Saint Paul, Minnesota

Type: Requirement for private buildings receiving >\$200k funding; similar requirements for municipal buildings.)

Sustainable Building Policy for Private Development

The city of St. Paul implements a [Sustainable Building Policy for Private Development](#). Any project, commercial or residential, **receiving more than 200,000 in City or HRA funding** (EX: CDBG funding, Low Income Housing Credits) is required to achieve LEED Silver or better, as well as specific measurable standards called the [Saint Paul Overlay](#). These standards include further city – specific requirements for water use, storm water management, indoor environmental quality, and energy through the Minnesota Sustainable Building 2030 Standard.

Boston, Massachusetts

Under [Article 37](#) incorporated into the Boston Zoning Code, any project that requires a building or use permit (required for buildings greater than 100,000 sq. ft.) must achieve, at minimum, LEED Certification under the appropriate LEED rating system.

The city advances city-specific goals by allowing up to four of the required LEED points to be obtained from the Boston Green Building Credits. This city-specific program offers sustainability points in four categories:

1. Modern Grid
2. Historic Preservation
3. Groundwater Recharge
4. Modern Mobility

Washington, DC

DC requires **LEED certification for all new construction or major renovation over 50,000 square feet**, and has adopted the [Green Construction Code \(IgCC\)](#), which sets energy performance expectations and is equivalent to requiring certain levels of credits in key categories.

The city also requires a storm water retention of 1.2 inches, in accordance with the [DC 2013 Stormwater Management Rule and Guidebook](#).



Path 3: No LEED Link

Vancouver, British Columbia, Canada

City of Vancouver Rezoning Policy:

Either:

- Near Zero Emissions Building Standard and Energy System Sub-Metering and Reporting, or
- LEED Gold - Building Design and Construction and Performance Limits (EUI or GHG intensity) and airtightness testing, enhanced commissioning, submetering and reporting, refrigerant and embodied emissions, and integrated rainwater management and green infrastructure.

Toronto, Ontario, Canada

[Toronto Zero Energy Building Framework](#) establishes Total Energy Use Intensity (TEUI), Thermal Energy Demand Intensity (TEDI), and Greenhouse Gas Intensity (GHGI) targets for all new buildings, in multiple tiers. Toronto also has a storm water retention requirement of 10-25mm.

Seattle, Washington

Seattle code establishes Energy Use Intensity (EUI) targets for all new commercial and multifamily buildings.

STRATEGY B

Establish a separate green building standard for new public development, at a level more ambitious than required for private development and evaluating the feasibility of a net zero standard for new public development, including schools.

Seattle, Washington

[Seattle's Sustainable Buildings and Sites Policy](#) for municipal buildings sets the following goals for City-owned properties:

- New construction and major renovations 5,000 square feet or greater must meet LEED Gold, as well as key performance requirements for energy and water efficiency, waste diversion and bicycle facilities:
 - Achieve an EUI that is a minimum of 15% more efficient than a baseline building meeting the 2009 Seattle Energy Code
 - Achieve a projected water use performance that is a minimum of 30% more efficient than the 2009 UPC
 - Achieve a waste diversion of 90% for construction and demolition
- Tenant Improvements 5,000 square feet or greater, with a scope of work that includes mechanical, electrical and plumbing, must meet LEED Gold, as well as water efficiency and waste diversion requirements.
- Small projects, either new construction, renovations or tenant improvements, are to utilize **Capital GREEN**, a green design and construction evaluation tool developed by FAS, in project planning and development.
- All new and existing sites projects shall follow best management practices.



St Paul, Minnesota

[Sustainable Building Policy for New Municipal and HRA Owned Buildings in The City Of Saint Paul](#)

[This policy](#) applies to any planning, design, construction, and commissioning, of municipal or HRA owned facilities financed by the City of Saint Paul or HRA and those buildings utilized by the City's Executive Departments, the Saint Paul Public Library, or the Saint Paul Parks and Recreation Department.

Commercial Projects options:

- LEED New Construction (NC) 3 Silver
- Green Globes, 2 globes
- State Guidelines Building, Benchmarking and Beyond (B3) compliant
- Saint Paul Port Authority Green Design Review (as applicable)

Residential Projects options:

- LEED for Homes (H) or LEED NC1 Silver
- Minnesota GreenStar, Silver

The following mandatory requirements, established in the 2009 Sustainable Building Policy as the "Saint Paul Overlay," must be met within the chosen rating system:

1. Predicted energy use shall meet Minnesota Sustainable Building 2030 (SB 2030) "Energy Standards" for new buildings. The conditions for meeting the "Energy Standards" are subject to the "Cost Effectiveness" Protocol of SB 2030.
2. Predicted use of potable water in the building must be at least 30% below EPA Policy Act of 1990.
3. Predicted water use for landscaping must be at least 50% less than a traditionally irrigated site using typical water consumption for underground irrigation systems standards.
4. Actual solid waste of construction materials, excluding demolition waste, must be at least 75% recycled or otherwise diverted from landfills.
5. Indoor Environmental Quality (IEQ) must be addressed through the following strategies:
 - a. Ventilation based on ASHRAE 62.1-2004 or meet the minimum requirements of Sections 4 through 7 of ASHRAE Standard 62.1-2007
 - b. Construction IEQ management plan
 - c. Low-emitting materials
 - d. Thermal comfort
6. Storm Water Management Requirements:
 - a. *Site Eligibility:* Sites with $\frac{1}{4}$ acre or more of total land disturbance
 - b. *Rate Control:* 1.64 cubic feet per second (cfs) /acres disturbed
 - c. *Water Quality Management:* For a 2 year, 24-hour rainfall event, provide treatment systems designed to remove 80% of the average annual post development Total Suspended Solids (TSS) and remove 60% of the average annual post development Total Phosphorus (TP), by implementing Best Management Practices (BMPs) outlined in "Urban Small Sites Best Management Practices"



handbook (Metropolitan Council), “Protecting Water Quality in Urban Areas” handbook (Minnesota Pollution Control Agency), or the “Minnesota Storm Water Manual” (Minnesota Pollution Control Agency). All BMP treatment systems for the subject site shall include safety factors, maintenance, and a back-up plan in case of failure. All manufactured devices require independent laboratory testing to confirm product claims.

- d. *Volume Control/Infiltration*: Maintain or increase infiltration rates from pre-project site conditions.
 - e. *Operation and Maintenance*: All practices must have an Operation and Maintenance plan.
7. Predicted greenhouse gas emissions must be reported to the Minnesota Sustainable Building 2030 database by the design team or building owner.
 8. Annually, actual energy data for the project must be submitted to the Minnesota Sustainable Building 2030 database by the building owner or by the building’s utility service provider(s) with permission of the owner.

Maryland

The [State of Maryland’s High Performance Green Building Program](#) requires all new State buildings, including schools funded entirely with state funds, that are 7,500 sq. ft. or greater, to achieve a minimum of LEED Silver or two Green Globes. In addition, the following LEED credits are mandatory:

1. Light Pollution Reduction
2. Water Efficient Landscape – 50% minimum reduction
3. Indoor Water Use Reduction – 35% minimum reduction over the minimum code
4. Optimize Energy Performance – 15% better than IECC
5. Construction Waste Management – 75% minimum reduction
6. Low Emitting Materials – 1 point minimum
7. IAQ During Construction
8. IAQ before Occupancy (v3 only)

Mississauga, Ontario, Canada

Green Building Standard (under development)

Procurement Mechanism:

Performance-based procurement to encourage net zero energy and highly-energy efficient new buildings.



STRATEGY C

Introduce voluntary green building practices for small buildings not subject to site plan review.

Arlington, Virginia

[Green Home Choice Program](#) is a free green home certification program.

Austin, Texas

[Austin Energy Green Building Single-Family Rating System](#)

Surrey, British Columbia, Canada

[Surrey, BC, Canada referencing BC Energy Step Code](#)

Three key aspects of the Step Code that distinguish it from current BC Building Code energy requirements are as follows:

1. Performance-based: Offering builders design flexibility, as opposed to a lengthy suite of prescriptive technical requirements for individual building components.
2. Envelope-focused: Recognizing the need to help ensure that the building envelope (e.g. walls, foundation, ventilation), which is unlikely to change or be upgraded over the building's life, is designed and constructed efficiently from the beginning.
3. Explicit about airtightness: The lowest cost way to improve building performance, but an area where buildings in BC lag the rest of the country.

STRATEGY D

Introduce voluntary green building practices for existing buildings (including historic). Also, advocate for legislative authority to add mandatory green building standards.

Arlington, Virginia

- Green Games – voluntary energy disclosure and competition

Better Building Challenge (National)

- National U.S. DOE energy competition, but multiple cities have run local challenges based on it; best practice examples include Atlanta, GA, Los Angeles, CA, and Chicago, IL

2030 Districts (Various cities in North America)

- Private sector led, government-supported programs in Central Business Districts or other commercial neighborhoods to encourage tracking and disclosure of energy use, technical assistance, knowledge sharing, and group purchasing
- 20 in U.S. and Canada

Educational Programs

- DC: Sustainability Guide for Historic Properties
- NYC: Building Energy Exchange (BE-Ex) provides technical assistance, training, and networking, and best practice showcases



- NYC: Retrofit accelerator; emissions performance standards
- VA: Weatherization Assistance Programs (for single family and multifamily); administered in Alexandria by Community Housing Partners

Mandatory Programs

- Commercial [Benchmarking in 25 jurisdictions](#)
- [Beyond benchmarking programs for audit, retrocommissioning, improvement mandates in 11 jurisdictions](#)
- Single-family home energy disclosure in 2 jurisdictions—Berkeley, CA and Austin, TX
- Public posting of energy performance in building lobby required in at least 3 jurisdictions—New York City, NY, Chicago, IL, and Austin, TX
- Performance standards under legislative consideration in DC and NYC

STRATEGY E

Establish incentives for private development to incorporate green building elements.

Many cities have adopted green building incentive programs. Incentives are based on strategies such as higher LEED certifications, onsite renewable energy, and/or greater energy efficiency. Incentives typically fall in to the following types:

- FAR or height bonus
- Expedited permitting
- Taxes

Surrey, British Columbia, Canada

[Surrey, BC, Canada referencing BC Energy Step Code](#)

Arlington, Virginia

[PACE](#): Arlington, VA (Virginia’s first C-PACE), Washington DC, Connecticut, and California C-PACE

Washington, DC

[Green Area Ratio](#)

San Jose, California

San Jose [Affordable Housing Investment Plan](#) offers priority consideration for financing to housing developers who put green building features into supportive and affordable housing units

Austin, Texas

[Downtown Density Bonus Program](#) allows for **25% increased FAR** if project achieves Austin Energy 3-Star rating or LEED Silver.



Sunnyvale, California

Multi-family: Achieve 110 points with Green Point Rater equals **5% increase in lot coverage, increase building height by 5' or receive a 5% density bonus.**

Commercial: **increase FAR by 10% or height by 10 ft** by achieving LEED Gold Certification.

Mountain View, California

FAR bonus for non-residential projects of the [North Bayshore Precise Plan](#) that meet LEED Platinum, exceed T24 by 10%, incorporate on-site renewable energy for 5% of building use (or achieve an additional 10% reduction in energy use), reduce potable water use by 40% indoors and 85% outdoors, divert 80% of construction waste, and plan to divert 90% of post-construction materials from landfill.

Boston, Massachusetts

Development Review Guidelines for commercial buildings in the Stuart Street area have a standard maximum height of 155 feet, but if a project is certified as LEED Gold, it is eligible for a height bonus up to a maximum height of 400 feet.

E+ Green Building Program, provides a development opportunity for builders and owners to design, build and sell green, net positive energy homes on city-owned parcels. "Energy positive" homes exceed LEED Platinum rating and supply excess energy to the grid. The city donates the land for development and provides subsidies to low-to-moderate income homebuyers. The E+ Program is an initiative of the Boston Environment Department, the Department of Neighborhood Development, and the Boston Redevelopment Authority.

Arlington County, Virginia: Density Bonus

Arlington County's [Green Building Density Incentive Program](#) allows up to 0.50 FAR for residential and commercial buildings who achieve LEED Silver under the appropriate rating system. An additional 0.025 FAR is available for projects achieving one of eight Arlington priority credits. Credit will be given for up to two credits. These [priority credits](#) include:

1. Optimize Energy Performance – at least 9% improvement over the LEED prerequisite
2. Enhanced Envelope Commissioning
3. Renewable Energy Production
4. Site Development – Protect or Restore Habitat
5. Bird Collision Deterrence Pilot Credit
6. Building Life-Cycle Impact Reduction

Seattle, Washington: FAR Bonus and Expedited Permitting

Height and floor increase possible through LBC full certification or Petal certification (if specific energy and water goals are met).

Priority Green program provides expedited permitting for projects pursuing Built Green (>4-Star), LEED >Gold, LBC Petal or NZE Certification, or Passive House. **Priority Green Facilitated** provides expedited permitting for master use permits where at least 10 pts on the Priority Green Facilitated Building Matrix



pursue the Living Building Pilot, meet the Seattle 2030 District performance targets, or achieve LEED Platinum/Built Green 5-Star.

Chicago, Illinois: Expedited Permitting

Permit applications that include green technologies such as green roofs, rainwater harvesting, solar panels, solar thermal panels, wind turbines, and geothermal systems are required to be submitted through a [Green Permit Program](#) Project Administrator and are eligible for expedited permitting and potentially lower permit fees. Commercial projects must meet LEED certification, residential projects must certify under the Chicago Green Homes Program or LEED for Homes, and all projects must meet city Green Menu Items.

San Diego, California: Expedited Permitting

Expedited permitting for projects meeting the city's [Sustainable Building Policy](#) for public buildings including: Meeting LEED Silver; Reducing energy use by 15% below T24; Reducing water use by 20%; using non-potable water for irrigation; complying with the Construction and Demolition Ordinance etc.

San Francisco, California: Expedited Permitting

[Expedited permitting](#) for projects meeting LEED Platinum, GreenPoint Rated, LBC/Petal/NZE certification, Certified Passive House or equivalent.

New York, New York: Tax

1-year tax abatement of \$4.50 per square foot for green roofs and 5 to 8 ¾ percent tax relief for solar panel-related expenditures.

Cincinnati, Ohio: Tax

Property tax abatements for residential and commercial buildings constructed or renovated to meet LEED certification standards.

Residential: 100% property tax abatement for 15 years (new construction) or 10 years (existing building retrofits) up to \$275,000 for Non-LEED certified and LEED-certified buildings; \$400,000 for LEED Silver buildings; and \$562,000 for LEED Gold buildings. No value limitation for structures that achieve LEED Platinum certification.

Commercial: 100% tax abatement (before payment in lieu of taxes) for 8-15 years depending on type and certification level. No cap on the value of improvements, except multi-unit (4 or more) residential buildings are limited to \$275,000 per dwelling unit. Owner must enter into an agreement with the local Board of Education district to pay the board an amount equal to 25% of the avoided property taxes, effectively making the tax abatement 75%. Additional provisions apply to commercial buildings using Community Reinvestment Area LEED abatements



C: APPENDIX C: IMPACT CALCULATIONS

Setting Standards

To both determine feasible energy and GHG standards, and to evaluate their impact, we began by developing a baseline of energy use intensities for different building types under different code standards.

Table 14: Existing and Anticipated Building Floor Area by Sector

Building Type	Existing Gross Floor Area (ft ²)	Gross Floor Area In development (ft ²)	Estimated Gross Floor Area Anticipated in Small Area Plans (ft ²)
Public Municipal	2.5 million	Under Review ²⁰	0.4 million ²¹
Multifamily Residential	61.9 million	6.8 million	30.1 million
Office	21.8 million	1.7 million	15.7 million
Retail	11.4 million	362,000	4.4 million
Hotel	2.7 million	217,000	1.3 million
Other Commercial	1.9 million	317,000	0.7 million

To ensure we were making fair comparisons, all our data was sourced from the Pacific Northwest National Laboratory (PNNL) energy code studies. These studies are done at regular intervals to determine the average impact of new energy codes. Alexandria is within the 4A climate zone. All studies contain data for the 4A climate zone, using Baltimore as the baseline. To double check this was a fair comparison for Alexandria, we compared the number of Heating Degree Days (HDD) and Cooling Degree Days (CDD) for Alexandria and Baltimore and found only a 1% variance in HDD and a 4% variance in CDD between weather stations for both cities.

The table below lists the modeled EUIs for key building types for 90.1-2007, 90.1-2010, and 90.1-2013. 90.1-2007 is the baseline used for comparison under LEED v2009. Per the analysis in Appendix B, the median building built in Alexandria under the existing Green Building policy improved 26% over the 90.1-2007 baseline. LEED v4 references 90.1-2010. Virginia has adopted the new IECC 2015 energy code for commercial properties, without any weakening amendments. IECC 2015 uses 90.1-2013. While it will take a few years to be in effect for all projects, we can reasonably assume that new buildings that would be subject to any updated Green Building standard would be subject to this new energy code.

²⁰ Under review by the City.

²¹ This is an estimate based on assuming that planned municipal buildings within Small Area Plan zones are the same size as existing typical City of Alexandria buildings of the same building type. We assumed that new fire stations are 13,000 ft², new recreation centers and community buildings are 15,000-20,000 ft², and new offices and civic buildings are 50,000 ft².



Table 15: Typical Energy Use Intensities (kBtu/ft²) by building type in Climate Zone 4A under various code baselines

Building Type	90.1-2007 (LEED v2009 baseline)	90.1-2010 (LEED v4 baseline)	90.1- 2013 (IECC 2015)	New York Stretch Code	Median projected achievement under existing green building policy (26% better than 90.1-2007)
Multifamily Housing	62.4	53.0	50.7	35.4	46.1
Commercial (All)	71.9	59.2	54.6	45.7	53.2
Office	84.0	71.4	59.6	56.2	62.2
School	52.2	44.4	36.7	30.2	38.6
Retail	67.3	57.2	46.9	39.8	49.8
Hotel	107.3	91.2	70.3	56.5	79.4

This means that depending on the building type, the average commercial building will get between 2 and 9 points just for complying with the energy code, and the average multifamily building will nearly meet the LEED prerequisite of a 5% improvement.

Table 16: LEED point bonus provided by compliance with VA energy code, and assumed fuel breakdown

Building Type	Average EUI in 4A under LEED v4 baseline (90.1- 2010)	Average EUI under new IECC 2015 / 90.1- 2013 code	% improvement of new code over 90.1- 2010	LEED points received just for code compliance	Assumed % electric (based on DC comparison for office and multifamily; PNNL data for other building types)	Assumed % Gas (based on DC comparison for office and multifamily; PNNL data for other building types)
Multifamily Housing	53.0	50.7	4%	0	100%	0%
Commercial (All)	59.2	54.6	8%	2	85%	15%
Office	71.4	59.6	17%	6	100%	0%
School	44.4	36.6	17%	6	85%	15%
Retail	57.2	46.9	18%	7	85%	15%
Hotel	91.2	70.2	23%	9	66%	34%

In order to ensure the new green building policy was stronger than the base code, it is thus necessary to require a higher level of performance, and to look at other standards being set by leading jurisdictions. The Vancouver and Toronto standards referenced in Appendix A rely heavily on the concept of “Thermal Energy Demand Intensity,” for which we had insufficient local data. However, the New York Stretch Code has had detailed modeling done for the 4A climate region, since New York City itself sits in 4A.



(While NYC is climatically different than Alexandria, all PNNL modeling for climate zone 4A, including this one, uses Baltimore as a reference.)

While EUIs vary between different types of commercial buildings, for simplicity we recommend one threshold for all commercial buildings, with a separate threshold for schools. Hospitals, food-service establishments, data centers, and other high energy use buildings should be exempt from any strict EUI targets but should still be subject to similar percent improvement expectations. The following table lists the new proposed targets.

Table 17: EUI recommendations

Building Type	recommendation	% improvement over 90.1-2010	% improvement over current energy code	LEED v4 Optimize Energy Performance Points required
Multifamily	35	34%	31%	12
Commercial	45	30%	18%	12
School	30	32%	18%	12

Modeling Impact

To model the impact of this policy, we looked at the amount of building forecast for Alexandria under the Small Area Plans, and projected what the EUI, total energy use, and total GHG emissions would be if those buildings were built to the IECC 2015 code. This was added to total citywide GHG emissions to estimate a BAU GHG emissions given grown in floor area.

We then estimated EUIs by building type based on the assumption of achieving a 30% improvement over the LEED v4 baseline of 90.1-2010 and calculated the policy scenario total energy use and GHG emissions.

The new EUI and energy performance targets will reduce the EUI of new buildings by between 18% and 33% depending on building type relative to the code and reduce the total energy use of the buildings forecast in the small area plans by 20%, and 592 billion BTU per year. The targets will reduce the GHGs from these buildings by over 63,000 metric tons per year; also 20% less than the BAU case. Compared to the current GHG emissions of Alexandria as a whole, and a BAU case where GHGs increase due to new construction but transportation emissions stay flat, these targets will reduce citywide GHG emissions by over 3%.

While this number does not sound significant, this is in line with the savings available for new construction policies in most jurisdictions. To take a particularly aggressive example, strategies for new construction included in the District of Columbia Clean Energy DC Plan are forecast to reduce citywide GHGs by 4.6% relative to BAU. This is a similar order of magnitude as the savings forecast for Alexandria, but it is ~50% more impactful because DC controls its own energy code and is aiming for a net zero energy code by 2026, with EUI reductions ranging from 65% to 80% depending on building type.



Table 18: EUIs and fuel splits in BAU and Policy Scenario

Building Type	BAU EUI under new VA energy Code (kBtu/ft2)			Total EUI with LEEDv4 12 points (kBtu/ft2)		
	Total EUI	Electricity EUI	Gas EUI	Total EUI	Electricity EUI	Gas EUI
Multifamily	50.7	50.7	0.0	37.1	37.1	0.0
Office	56.0	56.0	0.0	50.0	50.0	0.0
Retail	46.9	39.8	7.0	40.0	34.0	6.0
Hotel	70.3	46.4	23.9	63.8	42.1	21.7
Other	54.6	46.4	8.2	41.4	35.2	6.2

GHGs for Alexandria were taken from the U.S. Environmental Protection Agency's eGRID 2016 data for the SRVC sub-region, which includes Northern Virginia; this is standard reference source used for Greenhouse Gas inventories.²²

Table 19: Key Alexandria GHG metrics

Population	160,035
GHG Intensity Electric (tons/kBTU)	1.08E-04
GHG Intensity Gas (tons/kBTU)	5.31E-05
Citywide GHG, 2015	1.89E+06

Table 20: Energy Use from new buildings under BAU and policy scenarios

Building Type	Floor Area	BAU Energy Use (kBtu)			Scenario Energy Use (kBtu)		
		Total	Electricity	Gas	Total	Electricity	Gas
Multifamily	30,100,000	1.53E+09	1.53E+09	0.00E+00	1.12E+09	1.12E+09	0.00E+00
Office	15,652,611	8.77E+08	8.77E+08	0.00E+00	7.82E+08	7.82E+08	0.00E+00
Retail	4,392,742	2.06E+08	1.75E+08	3.09E+07	1.76E+08	1.50E+08	2.64E+07
Hotel	1,292,745	9.08E+07	5.99E+07	3.09E+07	8.25E+07	5.45E+07	2.81E+07
Other	3,761,902	2.06E+08	1.75E+08	3.08E+07	1.56E+08	1.33E+08	2.34E+07
Total	55,200,000	2.91E+09	2.81E+09	9.26E+07	2.31E+09	2.24E+09	7.78E+07
Avoided Energy					-5.93E+08		
Change in new construction energy/ GHG					-20%		

²² <https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid>



Table 21: Greenhouse Gas Emissions from New Buildings and Citywide under BAU and Policy Scenarios

Building Type	BAU GHG (tCO2e)	Scenario GHG (tCO2e)
Multifamily	1.64E+05	1.20E+05
Office	9.44E+04	8.43E+04
Retail	2.05E+04	1.75E+04
Hotel	8.10E+03	7.36E+03
Other	2.05E+04	1.55E+04
Total	3.08E+05	2.45E+05
Avoided GHGs		-63,037
New Construction GHG Reduction		-20%
Citywide GHGs	2.20E+06	2.13E+06
Citywide GHG reduction		-3%

Water Impacts:

To calculate water impacts, we looked at the average Water Use Intensities (WUI) for major building types nationally, measured in gallons per sq. ft. per year.²³ Unlike with energy use or greenhouse gas emissions, these values do not vary significantly by geography or climate zone. The average energy use improvement over baseline achieved by buildings built under Alexandria’s existing policy is 16% (see Appendix B). Our recommendation is that new buildings subject to the policy reduce their indoor water use by 40% relative to baseline. When applied across the forecast new floor area, this will avoid the use of at least 421 million gallons of water a year, or a 29% reduction in water use from new construction, relative to business as usual.

Table 22: Modeled Water Use Intensities

Building Type	National Average WUI	BAU WUI in Alexandria under current policy	Water Use Under New Policy
Multifamily	44.6	37.464	26.76
Office	14.6	12.264	8.76
Retail	12.6	10.584	7.56
Hotel	41.7	35.028	25.02
Other	20.3	17.052	12.18

²³ Commercial Building WUI numbers were sourced from the U.S. DOE 2012 Commercial Building Energy Survey: <https://www.eia.gov/consumption/commercial/reports/2012/water/>
 Multifamily Building WUI numbers were source from a national survey conducted in 2012 by Fannie Mae: https://www.fanniemae.com/content/fact_sheet/energy-star-for-multifamily.pdf



Table 23: Water Use from New Buildings under BAU and Policy scenarios

Building Type	Forecast New Floor Area	BAU Additional Water Use	Additional Water Use under New Policy
Multifamily	30,100,000	1,127,666,400	805,476,000
Office	15,652,611	191,963,621	137,116,872
Retail	4,392,742	46,492,781	33,209,130
Hotel	1,292,745	45,282,272	32,344,480
Other	3,761,902	64,147,953	45,819,966
Total	55,200,000	1,475,553,027	1,053,966,448
Avoided Water Use			421,586,579
Water Use Reduction vs. BAU in from new construction			-29%

Citywide water consumption figures were not available at the time of this report. However, if we assume that the multifamily and commercial buildings in Alexandria use water at the same rate as nationally, on average, then we can estimate that multifamily and commercial buildings in Alexandria currently use at least 3.37 billion gallons of water a year, and that the new policy will reduce the total water used by the multifamily and commercial sectors in Alexandria by 9% relative to BAU.

Table 24: Modeled Water Use from Commercial and Multifamily Buildings currents, under BAU, and under Policy

Building Type	Total Citywide Floor Area	Forecast New Floor Area	Current Modeled Commercial and Multifamily Water Use	BAU Commercial and MF Water Use	Commercial and MF Water Use under New Policy
Multifamily	61,900,000	30,100,000	2.76E+09	3.89E+09	3.57E+09
Office	21,846,868	15,652,611	3.19E+08	5.11E+08	4.56E+08
Retail	11,373,774	4,392,742	1.43E+08	1.90E+08	1.77E+08
Hotel	2,671,302	1,292,745	1.11E+08	1.57E+08	1.44E+08
Other	1,900,000	3,761,902	3.86E+07	1.03E+08	8.44E+07
Total	99,691,944	55,200,000	3.37E+09	4.85E+09	4.43E+09
Water Use Reduction vs. BAU in from new construction					9%

These water savings estimates are all underestimates, as they only account for reductions in indoor water use. The policy also has standards for reducing outdoor water use for irrigation. However, as reliable national metrics for irrigation water use were not available, the savings from these irrigation limits could not be calculated.