



# GREEN BUILDING

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**TABLE OF CONTENTS**

|       |   |     |
|-------|---|-----|
| 1     | Introduction.....   | 1   |
| 2     | Alexandria’s Green Building Efforts.....                          | 1   |
| 2.1   | Environmental Action Plan.....                                    | 1   |
| 2.2   | City’s Accomplishments.....                                       | 3   |
| 2.2.1 | Implemented Programs.....   | 3   |
| 2.2.2 | Community Outreach.....   | 4   |
| 2.3   | Green Building Policy.....  | 5   |
| 2.3.1 | Green Building Incentives.....                                    | 6   |
| 2.3.2 | Sustainable Building Goals.....                                   | 6   |
| 2.3.3 | Benchmarking.....   | 7   |
| 2.3.4 | Historic Retrofitting and Preservation.....                       | 8   |
| 3     | National Rating Program and Green Building Challenges.....        | 8   |
| 3.1   | National Rating Programs.....                                     | 8   |
| 3.1.1 | Green Globes to Globes.....                                       | 9   |
| 3.1.2 | Living Building Challenge.....                                    | 9   |
| 3.1.3 | Passive House.....  | 10  |
| 3.2   | Green Building Challenges.....                                    | 11  |
| 3.2.1 | Architecture 2030.....  | 11  |
| 3.2.2 | 2030 Districts Challenge.....                                     | 12  |
| 3.2.3 | Better Buildings Challenge.....                                   | 13  |
| 4     | Community Energy Policy and Initiatives.....                      | 13  |
| 4.1   | NYC Greener Greater Building Plan.....                            | 13  |
| 4.2   | Lights out Boston!.....   | 13  |
| 5     | Green Roofs and Storm Water Management.....                       | 14  |
|       | Appendix A Energy Use and Green Building Options Information..... | A-1 |
|       | Appendix B Sustainable Actions For Home owners.....               | A-2 |
|       | Appendix C: National Certifications.....                          | A-4 |

## 1 Introduction

Green building is the practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building's life-cycle: from siting to design, construction, operation, maintenance, renovation and deconstruction.<sup>1</sup> Green building is an important aspect of energy savings and reducing carbon emissions. Statistics show that in 2014, 41 percent of the total U.S energy consumption was consumed in residential and commercial buildings. According to Alexandria's Climate Action Plan, buildings alone made up over 60 percent of all local carbon emissions.<sup>2</sup>

The purpose of this policy brief is to provide recommendations related to green building. These recommendations will enable the City to lessen its environmental impact, improve air quality, and get closer to its goal of becoming carbon neutral. This brief discusses Green Building in terms of policies that the City of Alexandria is implementing and provides recommendations for improvement. In addition, it provides information on various national ratings programs the City can use to monitor its progress on new and retrofitted buildings, and opportunities for historic preservation, as well as green building incentives. Following policy recommendations, some examples of community energy ideas and green roofs as an opportunity to better manage storm water are given.

## 2 Alexandria's Green Building Efforts

### 2.1 Environmental Action Plan

*"Alexandria's government, businesses, and citizens impact our environment through the choices they make when renovating existing structures and constructing new ones. These choices manifest themselves in the quantity and types of energy we use, the impact we have on our water quality, the amount of waste we create, the amount and quality of green space available to us, and our public health."*<sup>3</sup>

The Environmental Action Plan (EAP) was adopted in 2009. The EAP lays out several green building goals and actions under Principle 2. The goals, preliminary and recommended actions under this principle include:

Targets by 2020:

- All new buildings to achieve LEED Gold standards.
- Sixty percent of all existing buildings achieve a 20 percent energy consumption reduction.

By 2025:

- Existing City buildings in the aggregate are 25 percent more energy efficient.
- All new buildings will achieve LEED Platinum standards.

By 2030:

- All new buildings will be carbon neutral.

Goal 1: Building on the City's Green Building Policy, all development, either new or renovation, should be constructed with the lowest ecological impact as is reasonably practical by advancing energy efficient green construction, sustainable building location, site design, and emerging technologies.

### Short-Term Actions (2009-2011) :

- Establish and promote green building standards for new commercial and residential development. Use nationally recognized criteria, such as those of the Leadership in Energy and Environmental Design (LEED) in establishing such standards.

### Long-Term Actions (2021-2030):

- Require all new construction by 2030 to be carbon neutral.
- Upgrade all existing City buildings to be 25% more efficient by 2025.
- Require that when seeking to replace existing roofs property owners either integrate alternative energy systems into the space or otherwise ensure that each rooftop maximizes its productive space (e.g., green roofs or urban agriculture) by 2030.
- Require that when property owners are retrofitting surface parking lots, they maximize its productive space (e.g., green infrastructure) by 2030.

Goal #2: Expedite the Commonwealth's adoption of further green building standards/building codes and expansion of local government authority to adopt green building ordinances, programs, and policies.

### Mid-Term Actions (2012-2020)

- Seek local authority to adopt additional green building regulations and require energy efficient technologies such as smart metering technology and energy audits at time of sale or legal transfer.

Goal #3: Promote green building practices, share information and provide educational, technical, and financial assistance to the building industry, businesses, and residents

- Promote green building practices, share information and provide educational, technical, and financial assistance to the building industry, businesses, and residents.

### Short-Term Actions (2009-2011)

- Identify a local non-profit that can provide green building information and technical assistance to citizens.

Goal #4: The City will lead by example in green building practices.

### Short-Term Actions (2009-2011)

- All new construction and renovation of City buildings, where feasible, will meet a LEED Silver rating or performance-based standards such as those of the Passive House Institute US, as a minimum.

### Mid-Term Actions (2012-2020)

- All new construction and renovation of City buildings, where feasible, meet a LEED Gold, passive house rating, or equivalent standard.

## 2.2 City's Accomplishments

The City has made great strides regarding energy and green building since the completion of the EAP. In 2010, the City was awarded the Local Governments for Sustainability milestone by ICLEI for completing a greenhouse gas emissions inventory.<sup>4</sup> The City has also achieved many green building and energy conservation projects. These include:

- The substantially completed construction of the Eisenhower Fire Station 210 which is expected to be certified for LEED Gold in 2015.
- More than 19 percent of the City government's electricity use was offset or generated by renewable energy in 2014.
- The City carried out LED lighting retrofits at the Beatley Library, Duncan Library, Burke Library, Chinquapin Recreation Center, Ramsay House, Black History Museum, and the Lyceum.
- The 2014 Alexandria Earth Day was very well attended and featured free bus rides to the event along Duke Street provided by the Alexandria Transit Company.

Additionally, green roofs were developed on T.C. Williams High School, James Duncan Branch Library, Alexandria Health Department, and the Cora Kelly School for Math, Science, and Technology.

Alexandria has also created programs and initiatives to work towards the goals set out in the Environmental Action Plan. These programs include:

- Home Energy Star Preference Program
- Solarize Program
- Department of Energy Weatherization Innovation Pilot Program

### 2.2.1 Implemented Programs

#### 2.2.1.1 Home Energy Star Preference Program

The Home Energy Star Preference is a program that provides energy audits to those households considering home retrofitting. The program has been ongoing for three years and has benefited over 500 residents. Given that there are 26,000 homes in Alexandria, there are still many opportunities to perform more audits.

#### **Recommendations:**

A good opportunity to improve the Energy Star Preference program is to hold green building seminars. The City of Charleston, SC, for example, holds a monthly seminar open to all building design and construction professionals<sup>5</sup> to learn about sustainability in their fields. Having professionals go to these events ensures that the advice they give to home-owners is accurate and up-to-date. As an incentive to get professionals to attend the seminar, Charleston provides Learning Unit and Continuing Education credits for AIA members and licensed professional engineers.

Alexandria should also attempt to partner with professionals and businesses, such as Lowe's and Home Depot, to provide residents with design workshops. In this way, citizens can learn how to implement insulating and weatherization strategies in their homes.

### **2.2.1.2 Solarize Program**

Solarize is a program that allows neighborhoods to come together and jointly purchase solar panels for community use. Doing a co-op makes solar energy more affordable and accessible to all members of the community.

#### **Recommendations:**

Alexandria should consider establishing programs, like DC Sun, that promote community solar energy. In the U.S, only 25 percent of residential rooftops are suitable for solar panels. In recognition of this, Washington, D.C decided to establish a community solar energy program called D.C Sun.<sup>6</sup> In the District, 65 percent of residents are renters and many of them live in condominiums and apartment buildings; these citizens, therefore, don't have their own roof. However, DC Sun allows these citizens to still access solar energy. In this program solar panels are put onto homes and buildings that do have suitable roofs and then residents sign up for virtual metering. The electricity residents receive from accessing the solar energy offsets the amount of money they pay on their electricity bill.

In addition to community solar energy, there are also opportunities to have combined heat and power district energy systems. There are plans to implement this type of system in Arlington's Crystal City and Pentagon City . In this type of system, an underground pipe network delivers hot and chilled water to buildings from a central location.<sup>7</sup> This method of distribution is expected to be 35 percent more efficient than the current method of distribution.

Additionally, the City should also require solar energy use for those buildings above a certain square footage.

### **2.2.1.3 Weatherization Pilot Project**

The City's Brent Place Apartments participated in the Department of Energy's Weatherization Innovation pilot project. The 207-unit building, which serves lower income Alexandrians, was selected to participate in this program, which looked at water and energy conservation. The energy saving improvements are expected to save \$226,000 over 10 years.

## **2.2.2 Community Outreach**

In 2011, the City hosted a series of Green Building Workshops.<sup>8</sup> Topics discussed in these workshops included:

- Workshop #1 - Greening Your Home and Small Business
- Workshop #2 - Energy Audits for Your Home and Small Business
- Workshop #3 - Green Landscaping for You and the Chesapeake Bay
- Workshop #4 - Green + Historic Buildings = Best of Both!
- Workshop #5 - Renewable Energy Systems and Green Power
- Workshop #6 - Green Operations for Retail, Restaurants, and Small Office

Alexandria should look into having these workshops on a more regularly basis.

The City’s website also has several resources available to residents and developers. Residents can easily get information about assessing their utility bills and the condition of HVAC systems. There is also information relevant to home owners, renters, and those living in multi-family residences with regards to energy use and green building options (See Appendix A)

**Recommendation:**

It would be beneficial for Alexandria to create and implement a public communication plan to educate the public. This would be a good job for a sustainability coordinator, which Alexandria can hire if and when the budget allows.

**2.3 Green Building Policy**

As suggested by EAP, the City unanimously adopted in 2009 Alexandria’s Green Building Policy (GBP). Like the EAP, it lays out sustainability goals regarding:

- Energy efficiency
- Water conservation
- Storm-water runoff
- Carbon footprint
- LEED Gold standards
- Energy consumption
- Carbon neutrality

This is a good starting point for the City. However, as recognized by the EPC in a previous assessment, there are missing items in this policy when compared to neighboring municipalities’ green building policies (see Table 1).

**Table 1: Alexandria’s Green Building Policy Compared to Peer Jurisdictions**

| City/Municipality  | LEED or Equivalent Policy/Goal | Incentives Offered | Residential Single Family Home Program | Encourage Energy Efficiency Best Practices in New Homes |
|--------------------|--------------------------------|--------------------|--|---|
| Alexandria         | ✓                              | None               | None                                   | None  |
| Washington D.C.    | ✓                              | ✓                  | ✓                                      | ✓   |
| Arlington County   | ✓                              | ✓                  | ✓                                      | ✓   |
| Fairfax County     | ✓                              | ✓                  | ✓                                      | None  |
| Charlottesville VA | ✓                              | ✓                  | ✓                                      | None  |

Recommendations that will make the GBP stronger include incorporating sustainable building goals, developing a public outreach and education plan, and establishing benchmarking tools to ensure buildings are maintaining their sustainability goals beyond LEED and other certifications. There is also a need to have more actions available that residents can take. Many Alexandrians want to have more sustainable homes, but may not know how to go about achieving this. LEED for homes has a list of actions that can be easily implemented by home-owners<sup>9</sup> as well as the District’s Guide to Green Buildings (See Appendix B).<sup>10</sup>

### 2.3.1 Green Building Incentives

Although critical to the green building industry, green building incentives are missing from the current GBP. Incentives should not be the only reason developers implement sustainable building methods. However they are viewed as a way to acknowledge developers' efforts when they do build green.

Not surprisingly, many incentives include some way of saving developers money. In Charlotte, NC, buildings that meet energy efficiency standards receive a 50 percent reduced tax rate for one year.<sup>11</sup> Also, buildings that have solar energy equipment are exempted from paying taxes on the equipment. Lastly, in Charlotte, a 50 percent reduction of the building permit fee is available for those who build a green (vegetative or solar) roof.

In Baltimore, MD buildings that achieve LEED ratings receive a tax credit off the project's property tax.<sup>12</sup> The amount of the tax is based on the level of performance and is available for five consecutive years.

- LEED certified Silver 50 percent
- LEED certified Gold 60 percent
- LEED certified Platinum 80 percent

Washington D.C's Green Building Code also includes green building incentives, including:

- Expedited permit review for green buildings
- Funded by green building fund
- Hired green building inspector and green building development ambassador

#### **Recommendations:**

- Create an incentive that provides tax deduction in accordance with the energy performance of the building.
- Allow for faster permit review of green buildings.
- Increase floor-to-area (FAR) ratio for developers who go above and beyond the minimum LEED standards.
- Require that developers also create more affordable housing units to get additional FAR.
- Hire a green building inspector/specialist who would be knowledgeable in current green building practices.

### 2.3.2 Sustainable Building Goals

*"To construct sustainable buildings, projects must set sustainable building goals during the early stages of the project. Goals can differ according to a project's function, climate zone, or scope. Each project team member should be instructed on the goals of the project and held accountable for his or her actions."* - Sustainable Cities website.

The City has already laid out sustainable building goals, but more specificity is needed. Sustainable building goals allow for this. Sustainable goals include:

- Reduction in water consumption
- Reduction in energy consumption
- Infill development
- Reduction of potable water use
- Improved indoor air quality
- Use of more sustainable materials
- Walkability
- Reuse and recycling
- Renewable energy generation
- Increased durability

Sustainable goals give green building a more holistic effect; they would seek not only to reduce energy use but would also promote and enhance the experience of the neighborhood surrounding the building. Green Building is much more than energy efficiency; it is creating comfort for building occupants without causing harm to the environment.

Within the next iteration of the GBP, it is recommended that goals be categorized along with the correspondent building type. Within the new construction categories, there should be goals -such as integrated design- from the beginning of the design process. This will get architects, engineers, and developers working together. Sustainable sites should also fall under this new construction category. This is similar to infill development, but also encompasses brown and grey field development. Goals should also include building in close proximity to transportation and housing and using permeable pavement on site to reduce runoff. Both new construction and renovations should seek to obtain materials from a maximum distance of 500 miles from the project site.

### 2.3.3 Benchmarking

Benchmarking plays an important role in green building. Becoming LEED certified is a great achievement, but it is only a representation of the building once construction is done. The life of an average commercial building is around 50 to 60 years, give or take a decade or two depending on the type and quality of construction. With that in mind, the upkeep, or lack thereof, of the building has a great impact on the city it is in.

The current GBP states that *“All building projects in the City should be monitored to report the effectiveness of this policy to the Planning Commission and City Council on an annual basis.”* That is a great goal to have; however it needs to be decided how to best monitor buildings throughout their lifespan.

In DC, all buildings over 50,000 gross square feet are required to report annual energy usage. Owners pay a fine if they do not. DC uses a Pepco benchmarking system called Resource Advisor that is free and available online.<sup>13</sup> The information is then put into an energy star portfolio manager.<sup>14</sup>

Tracking energy usage includes tracking water, gas, and electricity use as well as building temperature throughout the year. In Chicago, smart meters are used to give more control over energy and water consumption. It is a two-way system; households get charged only for what they actually use, rather than being charged for what the power companies feed to the home. Powerwise is another online tool that is available for tracking this information.<sup>15</sup>

As noted, if the City wants to monitor its buildings' energy use, benchmarking is necessary. Once the data have been collected and analyzed, then Alexandria will be able to tell which buildings need the most work in terms of green retrofitting as well as which new buildings are living up to their LEED certifications. Keeping track of data should inform decisions on what energy source is best to use for a given building and passive design solutions can be implemented. These solutions may include the introduction of a trombe wall, awnings, operable windows, sky lights, and rain water collection systems.

### 2.3.4 Historic Retrofitting and Preservation

Alexandria has many historic buildings. It is important to also retrofit these to be as green as possible. Simple things that can increase energy efficiency include:

- Constructing green roofs
- Operable shutters
- Adding awning to reduce heat gain
- Operable windows
- Retrofitting windows through weather stripping, jamb insulation, and trim repair.
- Use energy efficient appliances

A great example of a historic building that was retrofitted is The Brighton Branch Library in Boston, Massachusetts. This 160-year old building was able to achieve LEED Silver after retrofitting.<sup>16</sup>

## 3 National Rating Program and Green Building Challenges

### 3.1 National Rating Programs

The EAP calls for *“All new construction and renovation of City buildings, where feasible, meet a LEED Gold, passive house rating, or equivalent standard.”*<sup>17</sup> Currently, the city plans to have all new construction meet at least LEED Silver standards. However, there are other certifications the City should consider like Green Globes to Globes, the Living Building Challenge, and Passive Houses. Additional national certification systems are listed in Appendix C. Note that most current ratings programs can trace their origins back to the Building Research Establishment Environmental Assessment Method (BREEAM). This system started in the United Kingdom in 1990 and it is still widely used outside of North America.<sup>18</sup>

### 3.1.1 Green Globes to Globes

The American National Standards Institute (ANSI) started the Green Building Initiative, GBI.<sup>19</sup> Started in 2005, the purpose of the GBI is to “Accelerate the adoption of building practices that create energy efficient, healthy, and environmentally sustainable buildings.”<sup>20</sup> To accomplish these ends, the GBI developed the Green Globes assessment and certification.

Green Globes to Globes is a web-based alternative to LEED for commercial buildings and a questionnaire based spin-off of BREEAM. This certification can be used to certify both new and existing buildings.<sup>21</sup> Additionally, it provides methods to check the performance of the building throughout its lifespan, not just at the completion of the building.

The certification can be tailored to the City’s goals. With this system, a building needs to achieve at least 35 percent, or 350, of the 1,000 points to be eligible for certification; this earns 1 out of 4 Green Globes. With LEED certifications, there are only 110 points that a project can receive.

This system is used by many federal agencies such as the Department of Interior, Department of Health and Human Services, State Department General Services Administration, and the Department of Veterans Affairs. Note that Green Globes allows for peer review and public comment. Since this system helps the nation reach its environmental goals, qualifying buildings receive tax incentives.

Here in Alexandria, the ASCD Building on N. Beauregard Street was certified with 3 Green Globes in 2012. Similarly, The Lynhaven, on East Reed Avenue, was certified this year with 1 Green Globe. Compared with the six buildings that Arlington has certified, all with 3 Green Globes, there are opportunities for Alexandria to catch up.

#### **Recommendations:**

- Use Green Globes NC to certify new construction commercial buildings
- Use Green Globes CIEB, continual improvements of existing buildings, to certify existing buildings
- Take advantage of the personnel certification training offered to have a Green Globes Professional in the city

### 3.1.2 Living Building Challenge

A living building has been defined as “an environmentally sound structure [that] generates its own energy, captures and treats all of its water, operates efficiently, and is aesthetically pleasing.”<sup>22</sup> The Living Building Challenge is seen as the smartest long term choice economically.<sup>23</sup> The upfront costs have decreased significantly since the start of the challenge in 2005. With this certification, the building must track its energy and water usage for 12 months before it can receive the certification. The challenge consists of achieving seven unique petals. These include:

1. Site
2. Water
3. Energy

4. Health
5. Materials
6. Equity
7. Beauty

While all seven petals must be met to be considered a living building, there are certifications available for each petal earned.

### **Recommendations:**

If living building certification is considered, Alexandria should focus on the first three of the seven petals listed since these are most in line with the City's sustainability goals. To get the site petal, the project must be built with a proximity to transportation, be in a walkable neighborhood, and be mixed use in its design. It also must be constructed on a previously developed site, grey field, or brown field. Any landscaping done on the site must only consist of native plants.

The water petal requires that the building be net zero water. This means that 100 percent of the water must come from the site. This is done through rain water collection and onsite water treatment.

To achieve the energy petal, the building must obtain 100 percent of its energy on site. This can be done by using renewable energy sources such as solar power, wind (where possible) and geothermal.

### **3.1.3 Passive House**

Passive House is a building standard that is "energy efficient, comfortable, affordable, and ecological at the same time."<sup>24</sup> It is a construction concept that can be applied to buildings of various scales. Passive House buildings are also affordable and durable; more money is spent on high quality materials and design instead of expensive mechanical systems. It can be applied to both new and existing buildings using smart design decisions. A building should be very well insulated, air tight, take advantage of northern and southern sun for heat gain, and orient itself to allow for cross ventilation, to name a few.

There are case studies of Passive Houses done through the Department of Energy's Solar Decathlon. Empower House in Washington, D.C is one such example.

### **Recommendations:**

Use Passive House standards to retrofit existing buildings, including:

- Super insulation
- Air tight construction
- Optimize passive solar heating gains and shading
- Minimize thermal bridges
- High performance windows and doors<sup>25</sup>

Pilot a passive house retrofit in one of the city's municipal buildings.

## 3.2 Green Building Challenges

There are several national green building challenges the City should participate. These include Architecture 2030, 2030 Districts Challenge, and Better Buildings Challenge. Participating in these events creates a sense of accountability.

### 3.2.1 Architecture 2030

Several cities are already participating in Architecture 2030. This challenge is a pledge to have all new buildings and major developments meet performance standards 70 percent below the national level for green house gas emissions and be completely carbon neutral by 2030.

Manassas Park Elementary School was built in 2009 as a part of this challenge. Alexandria's T.C. Williams High School was certified LEED Gold that same year. However, there are still 17 other K-12 schools in the City that have the opportunity to take part in this challenge.<sup>26</sup>

#### **Recommendations:**

Alexandria can start implementing energy saving devices to help meet the 2030 goal of being carbon neutral.

- **HVAC:**
  - Pre-treatment and total energy recovery for ventilation air,
  - BAS-optimized system operation (building automation system),
  - Natural ventilation mode, and high-volume low-speed fans in double-height spaces; and
  - BAS and dedicated outside air systems with both sensors.
- **Lighting:**
  - Day-lighting, efficient fixture and lamp selections,
  - Occupancy- and BAS-controlled light switching; and
  - Day-lighting controls with dimming ballasts for 41% of the connected interior lighting power.
- **Envelope:**
  - Solar-selective glazing,
  - Tubular skylights,
  - A high-albedo white roof,
  - Window overhangs,
  - Reflecting louvers and light shelves; and
  - Spray polyurethane foam insulation.
- **Controls:**
  - Operable windows,
  - Ground-source heat pumps; and
  - Variable-speed pumping.
- **Energy Highlights:**
  - Water heating energy is minimized by the use of low-consumption fixtures and kitchen equipment,

- The kitchen utilizes a gas water heater with 98 percent combustion efficiency. Elsewhere, mini-tank water heaters are located close to the fixtures served. Energy Star appliances are used throughout,
- Interior and exterior installed lighting are 38 percent and 54 percent less than ASHRAE 90.1 energy standard requirements respectively; and
- Overall, the building is expected to consume 52.7 percent less energy than the baseline design and meet the 2030 Challenge.

### **3.2.2 2030 Districts Challenge**

The 2030 Districts Challenge has the same goal as Architecture 2030, but on a larger scale. This idea can be combined with EcoDistricts to have carbon neutral, ecologically, and pedestrian friendly districts. There are also possibilities to have carbon neutral regions of cities started working together.

An example of how the City can start reducing its carbon emissions in every sector comes from Cleveland, Ohio; a 2030 Districts Challenge participant.<sup>27</sup> Their goals are:

Existing Buildings and Infrastructure Operations:

- Energy Use: A minimum of 10 percent reduction below the national average by 2015 with incremental targets, reaching a 50 percent reduction by 2030.
- Water Use: A minimum of 10 percent reduction below the District average by 2015 with incremental targets, reaching a 50 percent reduction by 2030.
- CO<sub>2</sub>e of Auto and Freight: A minimum of 10 percent reduction below the current District average by 2015 with incremental targets, reaching a 50 percent reduction by 2030.

New Buildings, Major Renovations and New Infrastructure:

- Energy Use: An immediate 60% reduction below the national average with incremental targets, reaching carbon neutral by 2030.
- Water Use: An immediate 50% reduction below the current District Average.
- CO<sub>2</sub>e of Auto and Freight: An immediate 50% reduction below the current District Average.

Other participating cities include Dallas, Seattle, Denver, Pittsburgh, Toronto, and San Francisco.

#### **Recommendations:**

- Implement the challenge into one of the developing small area plans.
- Work with Arlington and/or Fairfax to development a regional carbon neutral plan.

### 3.2.3 Better Buildings Challenge

In 2011, President Obama announced the Better Buildings Initiative to make commercial and industrial buildings 20 percent more energy efficient over the next 10 years.<sup>28</sup> Arlington County has already committed 1.9 million square feet to have the 20 percent reduction over the next 10 years.

#### **Recommendation:**

Given that the Better Buildings Challenge is consistent with two of EAP's long-term actions: *require all new construction by 2030 to be carbon neutral and upgrade all existing City buildings to be 25% more efficient by 2025*, the City should become part of the challenge by committing all public schools to be energy efficient.

## 4 Community Energy Policy and Initiatives

The City should consider initiatives that can be implemented now without needing any new policies implemented. Examples include the New York City Greener Greater Building Plan and Lights Out Boston!

### 4.1 NYC Greener Greater Building Plan

New York City's NYC Greener Greater Building Plan requires all public and commercial buildings to meet the state minimum energy standards.<sup>29</sup> All buildings must also report annual energy and water use. This policy is significant in that it mandates green building.

In Virginia, the energy code states that all state owned facilities/institutions over 5,000 gross square feet, and renovations of over 50 percent, must meet IECC (International Energy Conservation Code) standards and be at least as efficient as LEED Silver or Green Globes to Globes.<sup>30</sup>

#### **Recommendations:**

- Start with requiring municipal and public institutions in the city to comply with Virginia's energy code.
- Begin petitioning to have legislation passed that will require commercial buildings to also follow Virginia's energy code.

### 4.2 Lights out Boston!

A program that should be evaluated and implemented now is Lights Out Boston. In this program building owners and managers turn off or dim all architectural and internal lighting between 11 p.m. and 5 a.m. during the spring migratory bird season which begins March 1<sup>st</sup> and ends June 1<sup>st</sup>. This produces easily tracked energy savings and gives the City a better idea of how much energy it is using compared with how much it could be saving.

It also is something residents can physically see right away and can generate the excitement necessary to get residents pushing for other sustainable initiatives.

## 5 Green Roofs and Storm Water Management

Green building encompasses more than energy efficiency. There are many opportunities to influence other aspects of sustainability through green buildings such as storm water. Storm water run-off is created because of all the impervious surfaces new construction creates.

Green roofs include vegetative, solar, and roofs of a lighter color to reflect the sun. Vegetative roofs have the benefits of:

- Mitigating the heat island effect
- Reducing storm water runoff, and
- Regulating interior temperatures.<sup>31</sup>

There are two types of green roofs: intensive and extensive. An intensive green roof costs between \$15-\$25 per square foot and it is intended for many people to be able to occupy it. An extensive green roof is cheaper, at \$10-\$15 per square foot, but is not meant for many people to congregate. While both types cost more to build than traditional roofs, they also increase the lifespan of the roof since it protects from the sun and the elements. Additionally, green roofs require relatively low maintenance. The plants are low growing so no trimming is necessary; one just has to weed the roof and replant any dead plants.

Arlington County has a storm water management program called Storm Water Wise Landscapes. The County provides funding to residents who participate in the program. There are multiple ways to participate. Conservation landscapes are a conversion of a lawn or other landscape back to native plants by removing any invasive species. It must cover a minimum of 150 square feet and a reimbursement of up to \$750 is available. Pavement removal is another option. Impervious pavement is removed and replaced with a permeable alternative. It also must cover at least 150 square feet and the reimbursement is for up to \$1500. Lastly, rain gardens can be constructed, which are also reimbursed up to \$1500.

### **Recommendations:**

Alexandria can put vegetative roofs on municipal buildings and institutions, as it has already started doing. With the construction of these green roofs, the City can also participate in the Green Rooftops program.<sup>32</sup> This program grows vegetables on the roofs to donate to local food banks. This would be a great way to get residents involved with the possibility of giving tax write offs for participants for donating to a charitable cause.

## Appendix A Energy Use and Green Building Options Information

1. Energy Assessment Program<sup>33</sup>
  - Utility bill assessment
  - Envelope insulation assessment
  - Air leaks within envelope inspection
  - Check if ducts are sealed
  - Assess mechanical duct insulation
  - Verify thermostat set points
  - Assess HVAC filters & coils
  - Check water heater temperature
  - Inventory electronics & light bulbs
  - Check hot water faucets for leaks
  
2. Residential Resource Center<sup>34</sup>
  - A. Owner:
    - Solar Power
    - Insulation
    - Composting and growing vegetables
    - Measure energy use
    - Rewards for saving on utilities
      - Earn points with earth aid enterprises when usage lowered
      - Comparisons with neighbors
      - Access to usage history
    - Passive solar design
    - Rain barrels
  - B. Renter
    - Rechargeable opportunities
    - Low flow aerators on faucets
    - Programmable thermostats
  - C. Multi-family
    - Solar power
    - Storm water management
    - Low VOC paints for better air quality
    - House plants (air purifier)
    - Toilet water conservation
    - Window treatments

### Appendix B Sustainable Actions For Home owners

According to LEED and the District's Guide to Green Buildings<sup>35</sup>

- Rainwater Management
    - Green roof
    - Cistern
  - Water Efficiency
    - Install meter to track usage
  - Water use
    - Water sense label on faucets and aerators
    - Faucet water flow not to exceed 1.5 gallons per minute
    - Shower head flow no more than 1.75 gallons per minute
    - Toilet flush no more than 1.1 gallons per flush
    - Energy star washer
  - Energy
    - Space heaters
    - Windows sealed
    - Lighting (LED)
    - 64 Watts per socket for incandescent
    - Efficient hot water heaters
    - Install whole house gas and electric meters
    - PV panels
    - Direct solar hot water heating
    - Envelope insulation
    - Furring out CMU walls
1. Integrated design
    - Collaboration between architects, engineers, interior designers, etc.
  2. Sustainable sites
    - proximity to transportation and housing
    - permeable pavement
  3. Water efficiency
    - low flow faucets
    - on-site waste treatment
    - use appropriate plants to eliminate irrigation
    - rain water collection
  4. Energy & Atmosphere

- *“Replacing one incandescent light bulb with an energy-saving compact fluorescent bulb RESULTS IN a 1,000 POUND CARBON DIOXIDE SAVING” – EPA*
  - est. minimum level of energy efficiency for building and incorporate high efficiency mechanical systems
  - use commissioning agent to ensure proper installation of mech. Equip
  - track energy usage over time
  - passive design: natural ventilation, daylighting, solar orientation for PV
5. Materials & Resources
- The U.S. building industry generates 272 million pounds of building debris per year: 75 percent of which is burned or sent to landfills – EPA
  - construction waste management plan to recycle/reuse materials
  - use materials that can be obtained within 500 miles from site
  - use materials that have been recycled
  - Reduce extra material by eliminating ornamental finishes, drop ceilings, etc.
6. Indoor Air Quality
- Indoor air pollution consistently ranks among the top five environmental risks to public health – EPA
  - create spaces that connect occupants to open spaces and natural light
  - low emitting materials and paints (earn 3 LEED points)
  - exceed min. ASHRAE requirements
  - non-toxic cleaning supplies
  - smoking areas at least 25’ from entrances
  - operable windows

### Appendix C: National Certifications

Other national certifications include:

- LEED for commercial Interiors<sup>36</sup>
- The National Association of Home Builders<sup>37</sup>; Residential
- Green Home Choice (Arlington, VA)<sup>38</sup>; Residential

Solar Energy Ideas:

- Contact mapdwell for a creation of a map of the City; shows all buildings and their potential/cost for solar energy; already being used in DC and Boston.<sup>39</sup>
- Concentrated Solar Energy:<sup>40</sup>
  - Case Study in Gila Bend, AZ
  - The plant is expected to generate 280 MW of electricity annually
  - In the long term, this could be a solution to doing away with Alexandria's coal-burning GenOn plant which produces 482 MW of electricity annually.
- Implementation of photo voltaic panels that follow the sun; 25% more efficient than stationary panels.<sup>41</sup>

Public Outreach

- Charleston Wise Program<sup>42</sup>
  - Provides expert recommendations and construction services to make your home energy upgrade easy and affordable.
  - Energy-saving recommendations by certified experts.
  - Best-in-class contractor services and management of your energy upgrade.
  - Knowledgeable assistance on financing options.

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