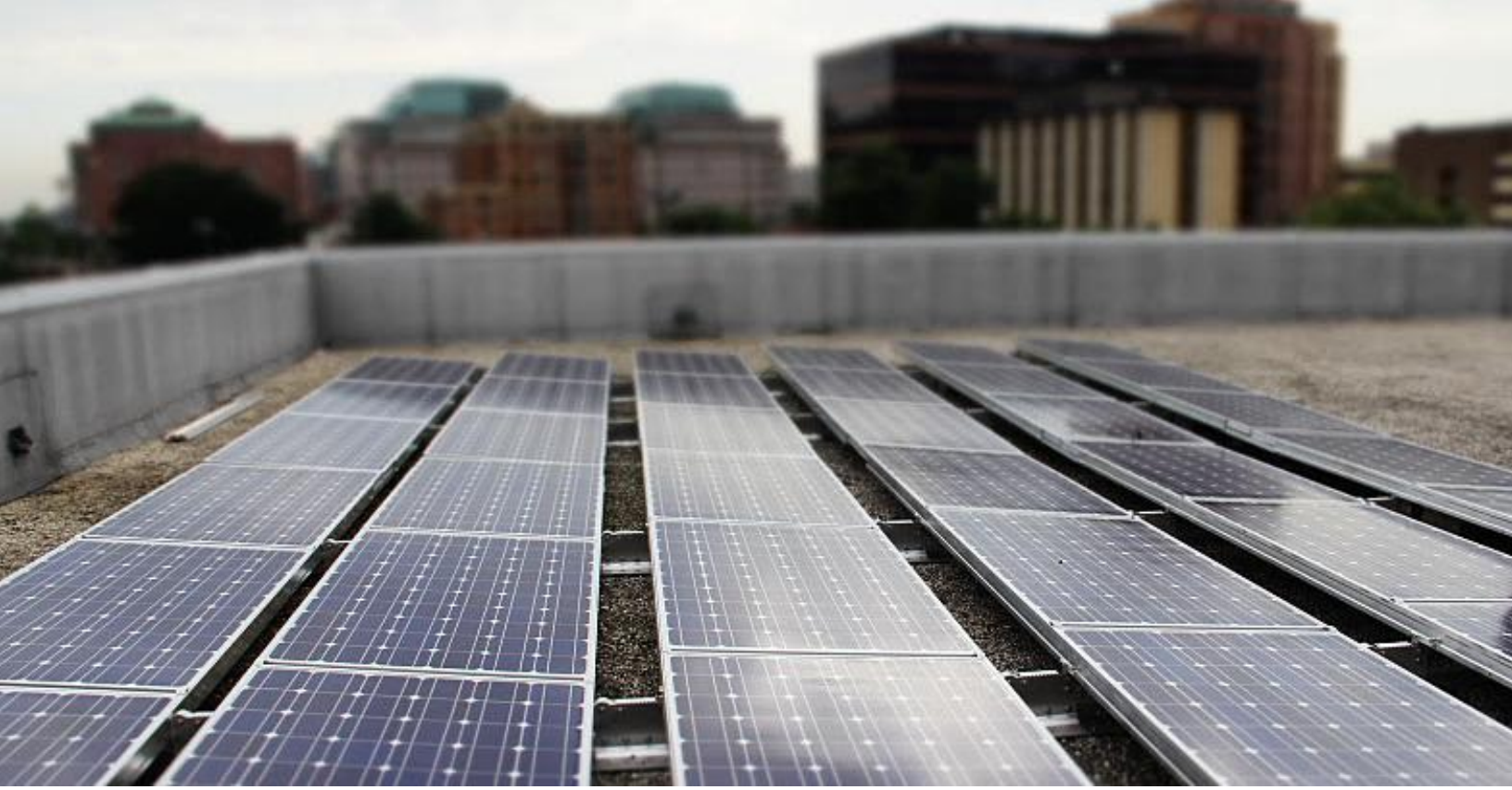
ARLINGTON COUNTY, VIRGINIA

Community Energy Plan

ARLINGTON
VIRGINIA

AN ELEMENT OF ARLINGTON COUNTY'S
COMPREHENSIVE PLAN
ADOPTED - JUNE, 2013



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Chapter 1: Context for the Plan

Vision Statement

To become a sustainable community, Arlington must rethink the way it uses, generates, and distributes energy.

Energy is fundamental to our lives and livelihoods. Energy use keeps us warm in winter and cool in summer. Energy powers technologies that preserve food, provide health care, and entertain us. Energy powers many of our transportation options, and energy is essential to economic transactions. Without energy, our modern economic system would collapse.

Still, our present use of energy leaves us vulnerable to multiple risks:

- The burning of fossil fuels is a major contributor to global climate change, which threatens to alter our economy and way of life.
- Severe weather is causing more frequent electric power outages.
- Rising demand for electricity is straining our regional power grid.
- International affairs cause significant fluctuations in the price of electricity, oil, and other fossil fuels.
- Rising global demand and shrinking availability of fossil fuels dictate long-term energy price increases.

This Community Energy Plan (CEP) seeks to mitigate those risks by (a) improving the reliability of energy sources by localizing energy generation, (b) reducing price volatility and the long-term cost of energy through efficiency and diversification, and (c) reducing the environmental impact of energy use through efficiency and cleaner sources of energy.

This CEP can be a catalyst for new economic development and sustainable growth in Arlington. A growing number of businesses are focused on the energy sector, on both the supply and demand sides of the equation. Clean energy and innovations in efficiency are among the fastest growing economic sectors today; this sector can be an important element of a diversifying and sustainable economic base for Arlington. Our vision is to distinguish Arlington and create the most desirable and competitive commercial, residential, and retail market in the region or country. The sustained implementation of this plan is intended to provide a competitive development environment, lower operating costs, enhanced energy reliability, and fewer service disruptions for businesses.

The Arlington Community Energy Plan is a roadmap for transforming how we obtain and use energy in all respects. The CEP envisions an Arlington in which our residents and businesses save money by owning and operating more energy efficient buildings; in which we breathe healthier air by using cleaner sources of energy and a variety of alternatives to driving; in which electricity is more reliable and energy prices are less volatile; and in which new businesses and residents are attracted to a higher quality of life supplied by cleaner and more reliable energy.

Purpose of the Plan

The purpose of this Community Energy Plan is to define the energy goals and describe the energy policies that will help Arlington remain economically competitive, environmentally committed, and have secure energy sources. Arlington County has set a carbon emissions target of 3.0 metric tons (mt) of carbon dioxide equivalent (CO_2e) emissions per capita per year by 2050, to match current emissions world benchmark cities such as Copenhagen. CO_2e emissions are used as a proxy for energy productivity. The Plan establishes the framework for reducing greenhouse gas (GHG) emissions in the County from 2007 carbon emissions level of 13.4 mt CO_2e/capita/year, a reduction of over 70%.

The CEP serves as the Energy element of Arlington's Comprehensive Plan, which sets forth the broad goals and policies of a sustainable community over the next thirty to forty years. It is intended to assist in ensuring that development in the County occurs in a coordinated, economically competitive, energy secure, and environmentally committed manner that best promotes the health, safety, prosperity and general welfare of the County's residents and businesses. Accompanying the CEP is the Community Energy Plan Implementation Framework (CEP Implementation Framework). The CEP Implementation Framework lays out the strategies that the County will deploy as well as the tools – both existing and potential – that could be used to advance the goals and policies of the CEP. The County will work with stakeholders to ensure CEP implementation improves Arlington's economic competitiveness, energy security, and environmental commitment.

This Comprehensive Plan element will be updated as conditions warrant. At a minimum, the element will be reviewed and revised as necessary once every five years.

The CEP and CEP Implementation Framework employ the following terms:

Goals are the six primary areas around which the County will implement the Community Energy Plan and form the basis of the CEP and CEP Implementation Framework;

Policies are the statements of intent or commitments made by County leadership governing the implementation of the CEP-related projects. Policies are explained in detail in the CEP, whereas in the CEP Implementation Framework the policies are provided in summary format for context;

Strategies, explained in the CEP Implementation Framework, represent approaches for implementation of policy and should evolve over time as new tools emerge, new processes are designed, and the benefits and risks associated with a concept change in response to changes internal or external to the County; and

Tools provide the mechanisms to carry out the strategies. Examples of existing and potential tools are explained in the text of the CEP Implementation Framework and a longer list of tools is summarized in Appendix B of the CEP Implementation Framework. However, neither list of tools is intended to be exhaustive or prescriptive; they are an illustrative set of examples of how the strategies could be accomplished. The tools described herein will require the application of resources—whether human or capital—to realize the CEP's goals.

Background on the Plan's Development

Arlington's History of Energy and Environmental Leadership

Arlington County has been at the forefront in responding to the challenges and opportunities that energy presents. It is a national leader in innovative local government planning, sustainability, and climate action.

Transit-oriented development around Metro corridors and high quality transit service has been a foundational policy for the County for more than 50 years. This foundation led to the County's current General Land Use Plan and the birth of urban villages around each Metro node, followed by a strong focus on pedestrian-friendly streetscapes, and implementation of a green building incentive program for the private sector. Arlington maintains a rich variety of vibrant businesses, stable neighborhoods, and quality schools, and received the Environmental Protection Agency's highest award for "smart growth" in 2002.

"Green buildings," which incorporate land use, building design, and construction strategies that reduce the environmental impacts buildings have on their surroundings, has been a growing trend since the 1990s. Arlington County government and Arlington developers are leaders when it comes to incorporating green building features into building and site design.

In October 1999, Arlington's County Board adopted a Pilot Green Building Incentive Program to evaluate special exception site plan requests for bonus density and/or height. Numerous builders have taken advantage of the incentives offered, providing Arlington residents and tenants with high quality, sustainable buildings. The program has been updated over time as green building practices have become more the norm than the exception.

In 2007, the County launched the Arlington Initiative to Reduce Emissions (AIRE) program. AIRE was created to reduce the carbon footprint of County government operations and to educate businesses and residents about improving energy performance while reducing GHG emissions. AIRE set an ambitious target to reduce Arlington County government's carbon emissions by 10% by 2012, compared to 2000 levels.

The program achieved this target by improving energy efficiency in the County government's buildings, vehicles, and infrastructure; using alternative fuels and green power; and conserving water. The success of the AIRE program has set the stage for expanding ambitious energy targets to other sectors of the community.

The Community Energy Plan Project

Building upon the successful implementation of land use and transportation planning efforts, green building programs and the AIRE program, and in response to the challenge of current and forecasted energy issues, the Arlington County Board launched the Community Energy Plan project on January 1, 2010.

The Community Energy and Sustainability (CES) Task Force, composed of a wide range of noted community leaders, worked from January 2010 through March 2011 to develop a report that recommended a

transformative approach to energy use in the community. A comprehensive civic engagement process included two Energy Town Hall Meetings and multiple targeted meetings with stakeholder groups.

The CES Task Force report compared Arlington's 2007 GHG emissions of 13.4 mt CO_2e/capita/year to neighboring and international jurisdictions emissions in 2008 (see Figure 1). Arlington's per capita carbon emissions were comparable to similar American localities, but substantially higher than several economically productive jurisdictions around the world.

At its May 2011 meeting the County Board accepted the Task Force Report, including a 2050 target of 3.0 mt CO_2e/capita/year, and adopted a set of Policy Determinations. This Plan, along with a companion CEP Implementation Framework, builds directly upon the County Board Policy Determinations.

Country or Locality	GHG Emissions (mt CO2e/capita/year)
USA	22.2
Canada	22.1
Iowa City, IA	20.5
Washington, DC	19.7
Denver, CO	19.4 (2005)
Loudoun County, VA	14.2
Frankfurt, Germany	13.7 (2005)
Arlington County, VA	**13.4**
Los Angeles, CA	13.0 (2005)
Portland, OR	12.4 (2005)
Germany	11.7
Toronto, Canada	11.6 (2005)
New York City, NY	10.5 (2005)
Beijing, China	10.1 (2006)
Hamburg, Germany	9.7 (2005)
London, United Kingdom	9.6 (2005)
Paris, France	5.2 (2005)
Tokyo, Japan	4.9 (2006)
Copenhagen, Denmark	**3.0**

Figure 1: 2008 Greenhouse Gas Emissions (metric tons CO_2e)

Chapter 2: Current Conditions

Sources of Arlington's Energy

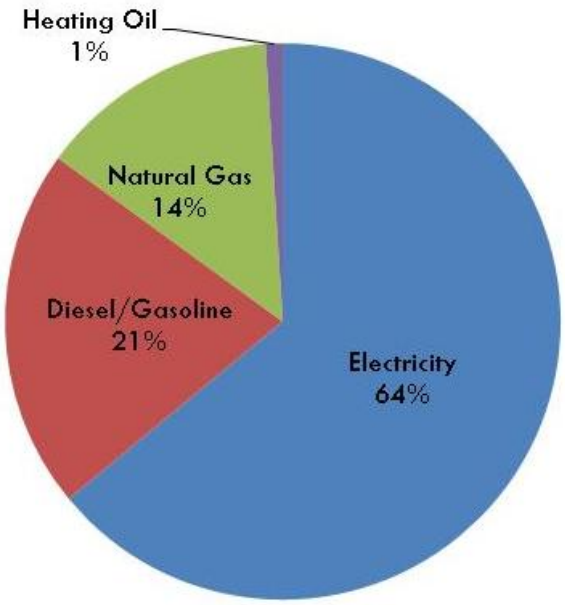

Figure 2: 2007 Arlington Energy Sources

Nearly two-thirds of the energy used in Arlington is in the form of electricity, the vast majority of which is produced outside the County and transmitted via the electric grid (see Figure 2). 21% of the energy used in the County is supplied by gasoline and diesel which power most of the cars, trucks, and buses used within County borders. The remaining 15% is from natural gas and heating oil, primarily used for space and water heating in homes, businesses, and other building types.

Unfortunately, approximately 65% of the United States' electricity source is wasted in the generation and transmission of the electricity before it even enters a house, apartment, or office (see Figure 3). This means that Arlington residents and businesses may be only getting around 35 cents' worth of energy for every dollar they spend on it when they use electricity.

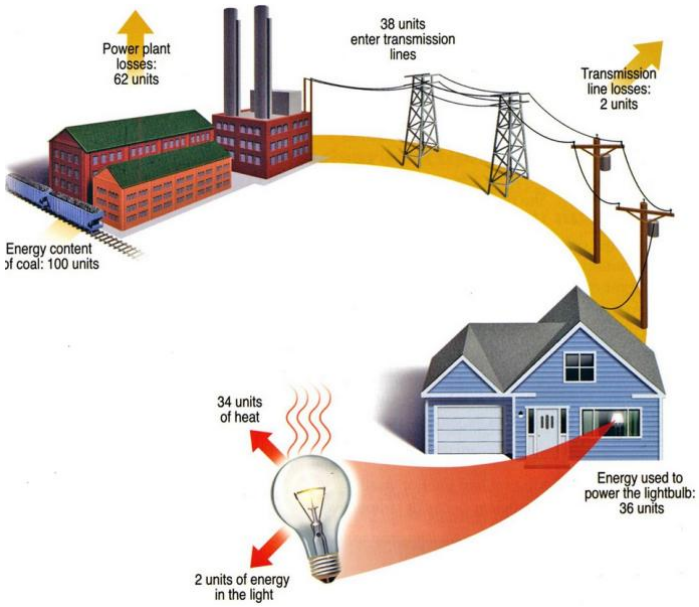

Figure 3: Energy Losses During Generation and Transmission[1]

Reliance upon electricity makes businesses and homes vulnerable to price volatility due to factors beyond the County's control because the electricity is distantly generated. In addition, dependence upon energy supplies from distant sources carries the risk of supply interruptions from storms and other natural and man-made disasters, with potentially disastrous effects on businesses and the County's most vulnerable residents. Electricity is vital for public health and safety. With information technology now at the core of business and security practices around the world, interruptions in electric power supply can be catastrophic for businesses and residents alike.

[1] Reproduced with permission from "What You Need to Know About Energy, 2008" by the National Academy of Sciences, Courtesy of the National Academies Press, Washington, D.C.

Arlington's Energy Use Profile

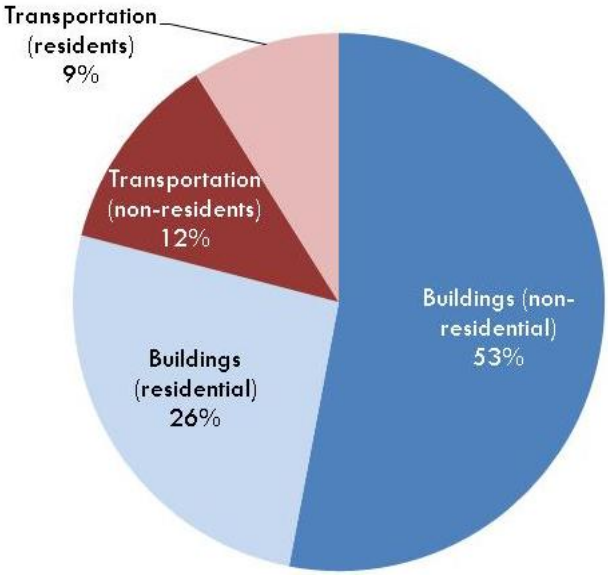

Figure 4: 2007 Arlington Energy Use

The majority of energy in Arlington – over three-quarters of Arlington's energy – is consumed in buildings, including homes, workplaces, and shopping areas (see Figure 4).

Arlington's built environment includes a rich variety of housing types and commercial spaces. These differing building styles and uses will require different approaches to achieve improved energy performance.

Arlington is an urban county with award-winning transit-oriented development and innovative transportation demand management programs. As a result, only 21% of its energy is used for transportation including personal and commercial vehicles, buses, and rail. A negligible amount is used for transportation infrastructure such as streetlights and traffic signals. These figures do not include Federal installations in Arlington such as the Pentagon or Ronald Reagan Washington National Airport.

Energy use in transportation is as varied as in buildings, with substantial contributions from personal vehicles, commercial fleets, rail, and bus transit. Of the energy use related to transportation, over half is from non-residents who commute to jobs in Arlington, travel through the County, or travel to one of the County's numerous retail options. Arlington's "smart growth" planning with its compact, transit-oriented development has resulted in lower vehicle ownership by residents than in many other jurisdictions, with a substantial portion of trips made by transit, walking and/or bicycling.

Nonetheless, Arlington's energy density per capita is about twice as high as modern European cities, revealing inefficiencies in the use of energy resources. This energy inefficiency costs Arlington residents and businesses about $280 million each year.

The Benefits of a Community Energy Plan

Economic Competitiveness

The Community Energy Plan can improve economic competitiveness at the local level in several ways. Improved energy efficiency results in lower utility bills and other benefits to building owners and homeowners. Communities that can show they have lower costs of doing business and have a healthy workplace may be able to attract new businesses, residents, and motivated employees.

Second, energy efficiency creates net new jobs. Every $1 million invested in building energy efficiency improvements supports approximately 20 jobs. This is a better "bang for the buck" than if that same money had been invested into the economy as a whole.

Third, energy efficiency supports economic growth by generating savings. Businesses and citizens that spend less on energy have more to invest in other activities that boost local economies.

Environmental Commitment

Energy efficiency is the cheapest, fastest, and cleanest way to reduce greenhouse gas pollution in the near term. In 2008, Americans avoided greenhouse gas emissions equivalent to those of 29 million cars through choices they made with energy-saving measures and energy-efficient homes.

Additionally, reducing energy usage means cleaner local air, which will make Arlington a healthier, more pleasant place to live and work.

Energy Security

Energy efficiency measures can improve the reliability of a local electric system by lowering peak demand and reducing the need for additional generation and transmission assets. Energy efficiency also diversifies utility resource portfolios and can be a hedge against uncertainty associated with fluctuating fuel prices and other risk factors.

District energy (DE) and combined heat and power (CHP) improve energy security by generating electricity, heating, and cooling locally, thus taxing the electric grid less. Additionally, a variety of fuel sources such as natural gas, biomass, and solar thermal are available for CHP generation. This fuel flexibility means more stable prices, since consumers can react to price shocks by choosing other fuel options.

Renewable energy, especially solar photovoltaics (PV), helps flatten the demand on the electric grid because the sun tends to shine brightest when electricity demand is the highest. This results in increased capacity for local power plants. Photovoltaics also reduce stress on the grid by generating electricity locally.

Chapter 3: Approach

The goal of 3.0 mt CO2e/capita/year by 2050 is ambitious, and to achieve it Arlington will need a comprehensive approach. Improvements must be made in all areas of energy use, in how County government addresses energy issues, and in the broadening of energy literacy across all segments of the community.

To better understand and address Arlington's energy use, four primary goal areas are carved out – buildings, district energy (defined in Chapter 4), renewables, and transportation – with supporting goal areas in County government activities, and education and human behavior. Arlington County conducted a greenhouse gas inventory to quantify the community's carbon footprint. Then, modeling was done to come up with a roadmap to achieve the 2050 CO_2e goal. The result is the "wedge graph" (Figure 5.) Arlington's target CO_2e levels are also show in tabular format in Figure 6.

While the wedge graph represents the best known approach at the time it was created, it should be updated periodically to account for new information and new technologies. All elements of the plan must be addressed in some combination in order to achieve the transformational goal recommended by the CES Task Force and adopted by the County Board.

Year	Target per capita CO_2e emissions
2007 (baseline)	13.4 mt
2020	9.3 mt
2030	5.8 mt
2040	4.1 mt
2050	3.0 mt

Figure 6: Arlington County Per Capita GHG Milestones

The remainder of this document details the goals and policies within each goal area needed to reach 3.0 mt CO2e/capita/year by 2050.

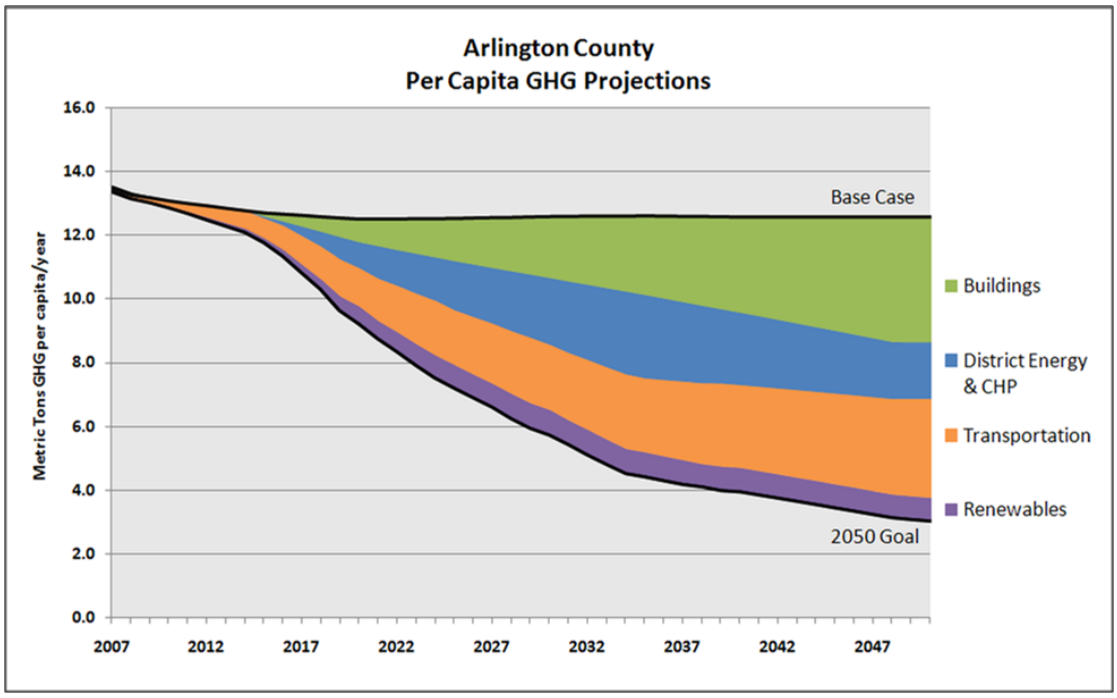

Figure 5: Arlington County Per Capita GHG Projections

Chapter 4: Goals and Policies

Buildings

Goal 1 (G1): Increase the energy and operational efficiency of all buildings

Residential and non-residential buildings currently use about three quarters of all energy in Arlington. 26% is consumed by residential homes and 53% is used by commercial buildings. The single largest improvement that can be made to ensure the County meets its greenhouse gas emission reduction goals will be improving the overall energy efficiency of the construction and operation of buildings. Reducing energy use will also reduce utility costs for businesses and residents.

Policy 1 (P1.1): By 2050, residential buildings should use 55% less energy on average (per square foot) as compared to 2007 levels of energy use (63 kBTU per square foot). *Milestones include:*

- ***2020:*** *5% less on average than 2007 levels*
- ***2030:*** *25% less on average than 2007 levels*
- ***2040:*** *40% less on average than 2007 levels*

*Policy 2 (P1.2): By 2050, the non-residential building stock should use 60% less energy on average (per square foot) as compared to 2007 levels of energy use (*98 kBTU per square foot). *Milestones include:*

- ***2020:*** *5% less on average than 2007 levels*
- ***2030:*** *25% less on average than 2007 levels*
- ***2040:*** *45% less on average than 2007 levels*

By 2015, the applicable building code for residential and non-residential buildings is likely to be the International Energy Conservation Code (IECC) 2012, which will ensure that new buildings and major renovations, in the aggregate, are approximately 30% more efficient than the 2004 Virginia building code. Future building codes are likely to continue improving energy efficiency requirements. Typically, 2-3% of the nation's building stock is renovated each year. On that basis, by 2050 all or most of Arlington's existing residential and non-residential buildings will be expected to have been either renovated or demolished. Coupled with innovations in technology, building code upgrades will play a significant role in achieving the CEP goals.

Energy efficiency improvements are achieved through careful design and selection of building envelopes, windows, insulation, lighting, and heating, ventilation, and air conditioning (HVAC) systems. Because it is generally easier to optimize these efficient technologies into commercial office buildings (due to centralized HVAC systems and overall control of building operations and management), the efficiency targets for non-residential buildings are slightly more ambitious than for residential construction (multi-family and single-family buildings). Effective landscaping, site design and other factors can also help reduce building energy usage.

Each sector of the building stock requires a different approach. For example, residential buildings owned or rented by senior citizens,

people with disabilities and lower-income Arlingtonians may pose unique challenges.

The use of advanced design, materials, and renewable energy technologies can dramatically improve the energy performance of buildings. It may be possible for a building to be connected to the power grid yet capable of generating enough energy from renewable sources to compensate for the project's own energy use. To this end, Arlington County will facilitate creation of a net-zero energy development to demonstrate net-zero energy concepts in a relatively large-scale project.

Policy 3 (P1.3): Reduce the amount of carbon produced from energy use from buildings, using source energy as the standard measure

There are two ways to measure total energy use in buildings. "Site" energy is defined as the amount of energy (electricity, natural gas, and fuel oil) consumed by a building as reflected in the property's utility bills. "Source" energy represents the total amount of raw fuel that is required to operate the building (i.e., fuel used to generate electricity at the power plant, as well as natural gas and fuel oil burned on site). Thus, the source energy calculation incorporates all the transmission, delivery, and production losses involved in generating and delivering the electricity to the building. Source energy calculations provide a more complete assessment of a building's energy costs and carbon emissions. Throughout this Plan it is source energy, not site energy, that is the reference point.

The amount of greenhouse gas attributable to a building is directly related to the types of fuel used to heat, cool, and power the building. The factors that contribute to a building's carbon generation due to energy use include: 1) The type of fuel(s) used to provide the building's electricity, (e.g., coal, natural gas, nuclear, and/or renewable energy); and 2) How much of a fuel source's total energy potential is actually used by the building for heating, cooling, and electricity.

Reducing the carbon emissions associated with buildings can be achieved in several ways. First, using lower carbon fuels at the power plant, (e.g., switching from coal to natural gas) reduces the overall carbon generated by electricity production across the grid.

Second, selecting building equipment (furnaces, boilers, etc.) based on energy efficiency and fuel source impacts carbon emissions from building operations. For example, buildings that heat and/or cool using natural gas generate fewer carbon emissions than buildings heating and cooling with electricity. Also, renewable systems, such as solar photovoltaic arrays and solar hot water systems generate carbon-free electricity and hot water onsite.

Finally, generating power specifically for a building onsite with a combined heat and power (CHP) system nearly eliminates transmission losses and allows the use of residual heat for building heating and cooling. This can be established on an individual building basis or on a broader community basis by developing a local district energy system. CHP and district energy systems can operate using lower carbon fuels (e.g., use of biomass and solar thermal energy in the St. Paul (MN) district energy system) thus reducing carbon emissions further.

District Energy

Goal 2 (G2): Increase local energy supply and distribution efficiency in Arlington using district energy

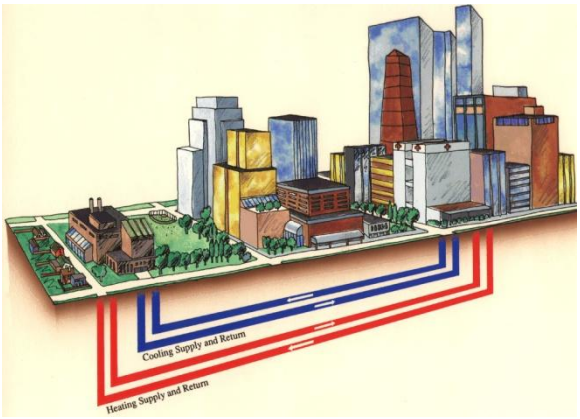

Figure 7: Conceptual Layout of a District Energy System[2]

<u>Policy 1(P2.1)</u>: Facilitate the installation and use of district energy in areas with the highest probability for district energy (DE). Have at least 450 megawatts[3] (MW) of District Energy and 104 MW of Combined Heat and Power[4] (CHP) by 2050.

<u>Policy 2 (P2.2):</u> Plan and build infrastructure in appropriate locations to facilitate district energy distribution and future connections

District energy systems allow for the efficient use of the heat from local CHP generation, greatly reducing the fuel waste normally associated with making electricity. As shown previously in Figure 3, approximately 65% of the energy involved in electric generation and distribution is lost before it arrives at a home or commercial building.

By using district energy to share hot and cold water created as a by-product of locally-created electricity, Arlington County strives to increase its energy system efficiency in areas with DE from 30% to 80% or better. By using district energy, Arlington not only gets more energy per dollar, it would also benefit from redundant, reliable sources of energy. CHP has the potential to provide a net global and regional reduction in GHG emissions by increasing the local production of electricity. (It should be noted, however, that local energy production has some local emissions associated with it).

There are a few buildings in Arlington County that are connected in order to share heating and cooling resources. However, Arlington County's goal is to build district energy at a broad scale, connecting a large number of buildings in a district energy system. To facilitate this, many things need to occur. For instance, a local district energy entity (DEE) is needed to operate and maintain local district energy systems (DES). There are many possible forms of DEE ownership in the Commonwealth of Virginia including 100% public, 100% private, or a public-private arrangement, and it remains to be seen what the Arlington DEE ownership structure would look like.

District energy systems require pipes to be installed underground to convey hot and cold water to customer buildings. The County is in a unique position to plan and coordinate pipe installation with other County projects. This plan, and the installation of pipes underground, will help facilitate the creation and installation of district energy systems in Arlington.

[2] Illustration: International District Energy Association
[3] Peak connected load of buildings measured over a given calendar year
[4] Design electrical capacity of cogeneration equipment. This could also include the development of combined cooling heat and power (CCHP).

Renewable Energy

Goal 3 (G3): Increase locally generated energy supply through the use of renewable energy options

Policy 1 (P3.1): Become a solar leader with installation and use of 160 megawatts (MW) of solar electricity by 2050.

Policy 2 (P3.2): Increase the use of renewable energy technologies in the public, private, and non-profit sectors.

The use of renewable energy, particularly solar photovoltaics (solar electricity) and solar water heating (solar thermal) can reduce operating costs for businesses and homes. Solar energy contributes zero greenhouse gas emissions. In addition, since solar photovoltaics (PV) generate electricity largely coincident with summer cooling demands, the use of solar PV helps reduce the summer peak demand for electricity.

Many technology options could lead to shaving peak electric demand, such as thermal energy storage and solar PV. In addition to horizontal rooftop systems, solar PV can also reduce peak electric demand when mounted on vertical south- and west-facing facades. At today's PV panel efficiencies, generating 160 MW would require about 14 million square feet of surface area; however, solar panel efficiencies are improving rapidly and the surface area needed for this target will likely be smaller. Arlington's buildings provide ample opportunities for mounting solar PV in a variety of configurations, both horizontal and vertical.

For sense of scale of power output, according to Dominion Virginia Power, the 'average' residential customer has a peak demand of about 4 kW. Therefore, 160 MW is equivalent to the peak power needs of about 40,000 households. However, much of the solar PV installations are likely to be on larger, multistory buildings, where large roof and wall surfaces are available and unobstructed by trees and other shading.

In addition, the County could provide zoning incentives to support the use of various renewable energy technologies, including solar thermal water and space heating systems, and increased use of daylighting in architecture. Small-scale wind power generation is generally not effective in Arlington, but advances in technology may make that more feasible, and the County may help remove barriers.

Transportation

Goal 4 (G4): Refine and expand transportation infrastructure and operations enhancements

Policy 1 (P4.1): Reduce the amount of carbon produced from transportation to 1.0 mt CO2e/capita/year by 2050. Milestones include (vs. 3.7 mt in 2007):

- ***2020**: 2.7 mt CO_2e/capita/year*
- ***2030**: 2.0 mt CO_2e/capita/year*
- ***2040**: 1.7 mt CO_2e/capita/year*

Reducing Arlington's transportation-related carbon emissions from 3.7 to 1.0 mt CO_2e/capita/year by 2050 represents a 73% decrease in CO_2 emissions from transportation sources. This may seem like an ambitious target, but if vehicles drove 20% less, were 75% more fuel efficient, and used fuels that produced 30% less carbon by 2050 it could be achieved.

Arlington County has been and continues to be a national leader in transit oriented development and increasing transportation efficiency. Many of the CEP transportation sector strategies and tools track closely with the County's Master Transportation Plan (MTP). For instance, Goal #2 of the MTP, *Move More People Without More Traffic*, seeks to reduce the number of single-occupant-vehicle trips by providing residents and workers with more travel choices, such as transit, walking, bicycling, carpooling, and telecommuting. Consistent with its philosophy of "affordable living" Arlington will remain mindful of the unique needs of each portion of the population. For example, low-income Arlingtonians may not have access to credit cards, and therefore are ineligible for bike- or car-sharing services.

In addition, transportation fuels (e.g., gasoline, diesel, natural gas) contain differing amounts of carbon, sometimes referred to as the fuel's carbon content. Each fuel type has different carbon content. When fuel is burned, the carbon turns into CO_2, which is a greenhouse gas. The lower the carbon content of a fuel, the fewer greenhouse gas emissions it produces. The new Corporate Average Fuel Economy (CAFE) standards will nearly double vehicle fuel economy by 2025 to 54.5 miles per gallon. All else being equal, the new standard will reduce oil consumption and greenhouse gas emissions.

County Government Activities

Goal 5 (G5): Integrate CEP goals into all County Government activities

Policy 1 (P5.1): Reduce County government CO_2 emissions by 76% by 2050, compared to 2007 levels, and improve energy security throughout County operations. Milestones include:

- ***2020**: 25% below 2007 CO_2e level*
- ***2030**: 42% below 2007 CO_2e level*
- ***2040**: 59% below 2007 CO_2e level*

Policy 2 (P5.2): Integrate Community Energy Plan policies into County planning, policy development, and other activities

Policy 3 (P5.3): Take advantage of CEP implementation to ensure Arlington's long term economic competitiveness

Arlington County recognizes the need to institutionalize the changes recommended in the CEP. In fact, the County believes that County government should lead the way in CEP implementation. Doing so will require work across all County departments and with numerous partners throughout the community.

To ensure that County government is adequately implementing the energy plan, all County departments will need to incorporate energy considerations into policy development, project planning, and other processes. For instance, the annual budgeting process and the biennial Capital Improvement Program process should indicate how they relate to CEP implementation. In addition, the annual legislative agenda will need to reflect the priorities of the County in implementing the CEP. The County will also need to partner with other jurisdictions and regional organizations to proactively address energy issues affecting the region.

Throughout implementation, the CEP will interact with other elements of the County's comprehensive plan such as the Master Transportation Plan, General Land Use Plan, Historic Preservation Master Plan, and Urban Forest Master Plan. In these instances, County staff will work to align the CEP with other comprehensive plan elements.

Implementation of the CEP will result in more reliable energy supplies at more stable prices, which will position Arlington well for businesses in the future. In addition, a number of innovative companies are already working in the clean energy sector in Arlington. Implementation of the CEP will help define Arlington as a center of excellence in energy issues, and attract firms consistent with Arlington's vision for a healthy business environment for 'smart jobs.'

Education and Human Behavior

Goal 6 (G6): Advocate and support personal action through behavior changes and effective education

Policy 1 (P6.1): Engage and empower individuals to reduce energy use

Policy 2 (P6.2): Enhance level of professional expertise and work force in the community related to energy

Policy 3 (P6.3): Ensure recognition of extraordinary efforts made to help the community reach the CEP goals

To achieve the CEP's ambitious energy and carbon emissions targets, Arlington County must engage, educate, and empower the community to take personal action to reduce energy usage. New technologies, more efficient buildings, cleaner sources of energy, and more efficient and cleaner sources of transportation continue to be made available, but individuals must embrace these new opportunities for Arlington to realize its full energy potential. To reach Arlington's diverse population, outreach efforts will be needed using a number of different methods involving person-to-person contact, social and print media, and a variety of effective messaging.

Because the vast majority of buildings in the County are privately owned, education plays a crucial role in encouraging building owners and managers to make energy upgrades and improve behavior. Similarly, while the County continues to improve its transportation options, residents must increasingly take advantage of these options. Finally, in addition to the short-term energy savings, educational efforts will help yield longer-term benefits by helping build support for future energy policies and the CEP.

Residential buildings account for over one-quarter of building energy demand in Arlington. The County must ensure its residents are aware of the energy savings opportunities that are available to meet its ambitious targets and to help residents save on their energy bills. Education efforts are especially important because behavioral changes and no- and low-cost improvements can have a sizable impact on residential energy usage.

Arlington's business community and workforce must be prepared to meet a growing demand for energy improvements, and to do so our skilled workforce must be equipped to facilitate energy improvements. As such, the County must encourage adequate energy training for workers.

While Arlington's energy and carbon dioxide goals are achievable with existing technologies, there is always opportunity for innovation. The County must continue to recognize those who are innovative and make outstanding efforts to address energy issues. Providing appropriate recognition for successful innovation and implementation will help to ensure that energy generation, transmission, storage, and use continue to be in the forefront of public understanding.

GLOSSARY OF TERMS

The following is a summary of selected terms and abbreviations used in the Community Energy Plan; the list is not exhaustive. In some cases, terms are defined in the body of the text and may not be repeated here

Term	Definition
Air Pollutants	In addition to greenhouse gases, these include sulfur dioxide (SO2), nitrogen oxide (NOx), hydrogen chloride (HCl), hydrogen fluoride (HF), carbon monoxide (CC), and non-methane volatile organic compounds (NMVOC).
Btu	British thermal unit (BTU or Btu) is a unit of energy defined as the amount needed to heat one pound of water one degree Fahrenheit. For the purposes of the Community Energy Plan, 1,000 Btus are labeled kBtu, while 1,000,000 Btus are labeled MM Btu.
Building Code	Legally required construction practices.
Carbon Dioxide	(CO_2) The most common greenhouse gas, carbon dioxide is produced in large amounts when fossil fuels are burned. Worldwide, over 70% of man-made greenhouse gas emissions are from the use of energy; in Arlington, over 98% of our GHG emissions are from the use of energy.
Carbon Dioxide Equivalent	Where the "e" in CO_2e is used to denote the term "equivalent": Greenhouse effect of the other five greenhouse gases identified in the Kyoto Treaty expressed in equivalents of carbon dioxide. This unit of measure is used to allow the addition of or the comparison between gases that have different global warming potentials (GWPs). Since many greenhouse gases (GHGs) exist and their GWPs vary, the emissions are added in a common unit, CO_2e. To express GHG emissions in units of CO_2e, the quantity of a given GHG (expressed in units of mass) is multiplied by its GWP.
CHP	See "Cogeneration."
Clean and Renewable Energy	This phrase is used to indicate some combination of renewable energy and cogeneration (CHP) energy sources.
CO_2	See "Carbon dioxide"
CO_2e	See "Carbon dioxide equivalent"
Cogeneration	Generating electricity in such a way that most of the heat produced is also used purposely, such as space heating or generating chilled water. A common definition is that an average minimum overall fuel efficiency of 70% is expected. Peak efficiency would typically exceed 90%. Also known as "CHP."

Combined Heat and Power	See "Cogeneration."
Commercial Buildings	Non-residential buildings; often owned or operated by for-profit entities, including offices, retail stores, restaurants, and warehouses.
Community Energy Project	Project that led to the CES Task Force Report and now this Community Energy Plan that provides high-level goals and policies for energy generation, distribution, storage, and use in the greater Arlington community from now to the year 2050.
Daylighting	Designing buildings to maximize the use of natural daylight to reduce the need for electricity.
DEE	See "District Energy Entity"
District Cooling	Cooling services delivered via district energy systems.
District Energy	Networks that deliver heating or cooling to energy consumers carried through the medium of chilled or hot water, or (in older systems) steam. Heating and cooling is transferred to the home or buildings via a heat exchanger.
District Energy Entity	While individual buildings that are customers in a district energy network are owned by property owners and developers, a District Energy Entity (DEE) would operate and maintain the district energy network, i.e., the horizontal infrastructure of district energy piping and equipment. The DEE can also wholly or partially own the district energy network and can be publicly owned, privately owned, or a public-private partnership.
District Heating	Heat services delivered via district energy systems.
ENERGY STAR®	Joint U.S. Environmental Protection Agency and U.S. Department of Energy programs **http://www.energystar.gov/** supporting energy efficiency as a cost-effective way to reduce greenhouse gas emissions in home, buildings, industry and equipment.
EU	European Union
EV	Electric Vehicle
Fossil Fuels	Combustible material obtained from below ground and formed during a geological event. For purposes of the Community Energy Plan, examples of such fuels include coal, oil and natural gas.
GHG	See "Greenhouse Gases"

Greenhouse Gases	A greenhouse gas absorbs and re-radiates heat in the lower atmosphere, trapping heat on Earth that would otherwise be radiated to outer space. The main greenhouse gases are carbon dioxide (CO_2), methane (CH_4), chlorofluorocarbons (CFCs) and nitrous oxide (N_20), sulphur hexafluoride (SF_6), hydrofluorocarbons (HFC) and perfluorinated carbons (PFC). The most abundant greenhouse gas is carbon dioxide (CO_2).
IECC	International Energy Conservation Code - a model energy building code produced by the International Code Council (ICC). The code contains minimum energy efficiency provisions for residential and commercial buildings, offering both prescriptive- and performance-based approaches. The code also contains building envelope requirements for thermal performance and air leakage. Primarily influences US and Latin American markets.
Institutional Buildings	Nonresidential buildings generally owned by public administration, education, public or private healthcare facilities and other not-for-profit entities.
kBtu	See "Btu"
Kilowatt	A unit of power equal to 1,000 watts.
kW	See "Kilowatt"
Megawatt	A unit of power equal to one million watts.
Metric Ton	Unit of weight equal to 1,000 kilograms. Often used in the Community Energy Plan as a measure of greenhouse gas emissions. 1 mt = 1.102 US ton.
mt	See "Metric Ton"
MW	See "Megawatt"
Per Capita	For each person in the total population being considered; generally referred to as a resident.
PV	See "Solar Photovoltaic Systems"
Renewable energy	Energy generated from sources that are naturally occurring and replenishable through natural forces over a short period of time, most commonly sun, wind, water and various animal and plant derived fuels.
Site Energy	See "Source Energy"
Solar Photovoltaic Systems	Systems that directly convert sunlight into electricity either for use locally or for delivery to the electric grid.
Solar Thermal (water heating) Systems	Systems that directly convert sunlight into heat, generally for domestic hot water though they can also be used to produce space heating.

Source Energy	The total amount of raw fuel that is required to operate an energy-using device or facility. Source energy includes all transmission, delivery, and production losses, thereby enabling a complete assessment of energy efficiency in a building. On the other hand, "Site Energy" is the amount of heat and electricity consumed by a building as reflected in utility bills.
Sustainability	Meeting the needs of the present generation without compromising the ability of future generations to meet their own needs.
TOD	See "Transit-Oriented Development"
Transit-Oriented Development	Land development that takes into account transportation choices as a means of reducing oil and other energy use. Typically it would combine public transit with walkable, mixed-use communities, and approaches to minimize the impact of individual vehicles and commuting.

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