

SUSTAINABLE ENERGY PLANNING IN NORTHERN VIRGINIA—2.0



In 2013, the City of Falls Church became the first EPA Green Power Community in Virginia. (Photo: City of Falls Church)



Loudoun County Youth Shelter's new buildings are LEED Gold-rated. (Photo: Lorie Flading, Loudoun County Pub. Aff. & Comm.)



Fairfax County Public Schools was a 2017 Energy Star Partner of the Year awardee. (Photo: Karen Bolt, FCPS)

Drivers of Sustainable Energy Planning in Northern Virginia

Today, now more than ever, sustainable development in Northern Virginia (NOVA) depends on the successful implementation of regional energy planning and coordination. For decades, NOVA has been associated with steady growth, economic stability, and concern for the environment. To protect the region's long-term economic vitality, its ecology and communities, the governments of NOVA must renew their commitments to work together to sustain and strengthen energy planning that mitigates emissions of greenhouse gases (GHG), supports new and existing renewable energy sources, promotes energy efficiency (especially in homes and buildings) and supports infrastructure policies and job growth.

The urgency to act now is difficult to overstate. US federal climate and energy policies are inconsistent and NOVA continues to grow faster than 37 US states. The massive demographic dynamic has already elevated GHG emissions from electricity consumption from 26,409,633 MT CO_{2e} to 27,240,147 MT CO_{2e} for the period 2005 to 2012.¹ The projected growth in demands for household electricity means that business-as-usual efforts will have to be pushed aside for more effective technical and policy energy innovations. Moreover, localities of the region are already suffering from the effects of climate change that have already made the region warmer, stormier, and wetter. Studies suggest that the number of days with maximum daytime temperatures over 95°F (35°C) recorded at Reagan National Airport could increase by 7-9 days by the 2020s and to between 30-45 days by the 2050s.²

In a globally interconnected economy in which even local development is tightly tied to energy

planning, the governments of NOVA who overlook coordinated regional energy management do so at their own peril. This is particularly the case for this region and economic assets such as its vast number of data centers. It is estimated that NOVA currently hosts more than 70% of all global Internet traffic. As far back as 2007, it has been suggested that data centers consumed 1.5% of all electricity in the US.³ This trend is expected to rise. It is currently estimated that GHG emissions tied to data centers already account for approximately 2% of the global emissions total—almost equivalent to the global aviation sector.⁴

Despite these challenges, NOVA is equipped with the proper constellation of political will and human and economic attributes necessary to address these dual climate and energy challenges. Already, many localities have set emissions reduction targets of 20% below 2005 levels by 2020. Since 2007, the decline of natural gas and fuel uses and accelerated efficiencies of the electrical grid systems helped cut GHG emissions across the greater metropolitan Washington region by 0.5% from 2005. Coordinated energy planning across NOVA stands to propel job growth and economic development. According to E2/E4, more than 61,000 Virginians are *already* employed in the energy efficiency and clean-energy markets—18,300 alone in NOVA, despite the Commonwealth's standing at 33 among the 50 US states for energy efficiency policies and programs. It is also worth noting that the Advanced Energy Economy indicated that 2,000MW of renewable energy capacity could be attained if large companies in Virginia sourced just 15% of their capacity, resulting in over \$3.6 billion in new investment.⁵

Greenhouse Gas Emissions (2005-2012) (MTCO_{2e})¹

Emission Source	2005	2012	Difference	Percent Change
Electricity	26,409,633	27,240,147	+830,514	+3.1%

Figure 1: The increase in NOVA's greenhouse gas emissions points to the urgency of sustainable energy planning.

Energy Planning in NOVA: 2008 to 2014

The early roots of NOVA's energy programs extend to a handful of environmental and sustainability initiatives undertaken by various localities. Arlington County was the first in January 2007 with the launch of the Arlington Initiative to Rethink Energy—a chairman's initiative to act on energy and GHG emissions. The program was then institutionalized, funded by a modest residential utility tax. The City of Alexandria followed with the start of its Eco-City Alexandria program that wove together energy and climate change planning into a mosaic of water, health, and related sustainability initiatives. Concurrently, Alexandria, as a member of the US Conference of Mayors, signed the "Mayors Declaration on Climate," a non-binding declaration to move the City towards reducing GHG emissions by 7% from 1990 levels by 2012—targets suggested for the United States in the Kyoto Protocol. In June 2007, Fairfax County and King County, Washington followed to co-launch "Cool Counties"—an equivalent nation-wide voluntary initiative for counties aspiring to curb emissions of GHG 80% below 2005 levels by 2050 (which Arlington also joined).

Equivalent state-wide and regional initiatives were not far behind. In 2008, the Metropolitan Washington Council of Governments (MWCOG) assessed the energy and climate challenges across the Washington metropolitan region and reported on region-wide climate and energy trends. Desires to address the ties between energy and GHG emissions fueled the initiation of 's energy and climate programs, including the Climate, Energy and Environment Policy Committee, and development of the first regional GHG inventory. At the state level, former Governor Tim Kaine formed in 2008 the first "Virginia Climate Commission," which framed a state-wide energy and GHG reduction plan and targeted reductions of 30% below the business-as-usual projection of emissions by 2025.⁶

But as localities across the region started inventorying their own GHG emissions, signs emerged that their innovative efforts were insufficient to meet their policy aspirations. Too much effort was focused on emissions only from government sources and too little was focused on promoting comprehensive integration of land-uses (especially transportation), energy efficient housing and building measures, or renewable energy. Less was being done to develop short- and long-term quantitative targets and benchmarks.

Institutionally, the region's localities were facing additional policy headwinds beyond their control. A 2017 report by the American Council for an Energy Efficient Economy, "Utility Energy Efficiency Scorecard," developed metrics to reflect how 51 utilities from across the United States performed in a

range of utility-sector energy efficient areas. The study scorecard ranked categories such as energy efficiency program performance, program diversity, and energy efficiency-related regulatory issues.⁷

Dominion Energy finished second to last at 49.

Transformative change for the nation and the region's energy efforts occurred in 2009 in the form of the US Government's "American Recovery and Reinvestment Act" which included funds through the US Department of Energy to assist states and localities with long-term energy and GHG mitigation planning. The "Energy Efficiency and Conservation Block Grant" (EECBG) program for Virginia funded localities to develop long-term comprehensive energy plans and inventory of locality-wide GHG emissions. One of the first EECBG-funded programs in NOVA was launched in the summer of 2009 in Loudoun County. Three years later Arlington County followed. The union of these two programs laid the foundation for what is now commonly referred to as "Community Energy Planning" (CEP) in NOVA.

The CEPs of Loudoun and Arlington counties were transformational in that they concurrently operationalized **six core principles** of energy planning exercised among most of the local governments today⁸. These include:

1. **World Class Energy Efficiency.** In NOVA, homes and buildings account for more than 40% of all primary consumption. To reduce demand, CEPs emphasize energy efficient standards for buildings and housing that are upwardly adjusted, energy efficient improvements in buildings and homes (lighting, heating, ventilation, air conditioning systems), energy performance standards, efficient ventilation and air conditioning, as well as building labels.
2. **Planning That Integrates Land-use and Transportation.** In NOVA, the movement of people and goods accounts for approximately 30% of total energy consumed. To avoid waste of energy in transportation, CEPs of the region promote density, walking, biking, public transit, and transportation alternatives such as electric cars.
3. **Efficient Energy Conservation and Heat Recovery.** In NOVA, approximately 50% of electricity is produced by coal-burning power plants which consume far more energy to make unused heat than useful electricity. These plants often operate at only 40% efficiency and are not proximate to urban centers and therefore do not recapture waste heat. CEPs of NOVA

- advocate better use of fossil fuels through efficient capture and distribution of heat via district energy systems and appropriate energy supply zoning policy (i.e., heat mapping).
4. **Multi-Fuel Flexibility and Renewable Energies.** CEPs possess large-scale and cost-effective deployment of renewable energy, especially solar. The CEPs also call for multiple and distributed fuel sources that blend renewables with conventional fuels such as gas, coal, and municipal wastes.
 5. **Integrated Utility Approach and Energy Distribution.** CEPs of the region promote integrated management of energy supplies, including delivery, and heating and cooling via district energy networks, as well as electricity, gas, water, and sewage services.
 6. **Scale.** CEPs in NOVA depend on large-scale development within 5-50 acres to promote higher performance results and efficiencies.

Case Studies of NOVA Energy Projects Reflecting CEP Qualities

The following summarize a very modest handful of outstanding energy projects in NOVA that embrace the CEP principles and represent the strong future for energy planning in the region.

Loudoun County Youth Shelter Expansion Project.

Loudoun County's 12-bed Youth Shelter now hosts 119 photovoltaic (PV) panels and rain barrels as well as an energy efficient HVAC system. The two new buildings on this three-building campus were designed for maximum daylight using passive solar fundamental design methods. A US Green Building Council (USGBC) LEED Gold rating was achieved with the solar panels. These new buildings outperform current code buildings in energy efficiency by 48%. The energy solution in the new Youth Shelter and Dining/Kitchen buildings includes numerous energy saving architectural components and construction techniques and the installation of a 10kW PV panel system on the Youth Shelter roof that also provides 12.5% of the building's electricity needs. Ground-source geothermal heat pumps for heating and cooling the project reduce the demand for natural gas to heat both new buildings by over 30%, and electricity needed for cooling both buildings by 15%.

Arlington County Zero Net Energy Discovery Elementary School. Discovery Elementary School (see image this page) is the first zero net energy school in the Mid-Atlantic region. Completed in September 2015, the 97,588 square-foot school integrates sustainable design features and learning. Zero net energy was identified by the design team as a primary project goal—meaning the amount of energy produced onsite using renewable energy sources would equal the amount of energy used over a 12-month period. Discovery has over 1,700 solar panels that produce 496 kW of electricity and a solar thermal system that provides hot water for the school's kitchen. In addition, underneath the school's playing fields, a geothermal well field provides the heating and cooling needs for the school. Low-flow plumbing fixtures save 36% more water than standard-flow fixtures and the school makes use of 100% LED lighting. The school is a living laboratory and features a dynamic online energy dashboard as part of its

educational curriculum. The energy savings are projected to reduce the school's energy costs by over two-thirds compared to traditional elementary schools.



Figure 2: Solar array on the roof of the Discovery Elementary School in Arlington County, Va. (Photo: VMDO Architects)

Alexandria Renew Wastewater Treatment Plan. For decades, the Alexandria Renew's wastewater treatment plant has worked to comply with US federal regulations to reduce nutrient pollution and mitigate the degrading effects of oxygen depletion in an energy and cost-efficient manner. Since 2007, Alexandria Renew has applied a unique patented biological process to remove nitrogen from wastewaters with high ammonia concentrations via the DEamMONnification (DEMON®) system. The successful application of the DEMON system required 60% less energy, reduced dependence on methanol, and cut sludge residues by 90%. In 2011, the US National Association of Clean Water Agencies recognized the Alexandria Sanitation Authority in the "Research & Technology" category of its annual *National Environmental Achievements Program* for "enhancing nitrogen removal and increasing sustainability with innovative sidestream treatment" using the DEMON process.

Partnerships & Building Blocks for Energy Planning in NOVA in 2017

A critical, but overlooked element contributing substantially to the success of NOVA's energy programs over the past decade has been the use of partnerships to facilitate the deliberate transfer and application of energy policy and technical innovations from Germany to NOVA. It is an understatement to say that Germany is a global energy and sustainability pioneer that continuously redefines national- and local-level climate and energy policies. Finding and suitably applying those innovations in NOVA has been central to Northern Virginia Regional Commission's (NVRC's) climate and energy business model. It is no exaggeration to suggest that the CEP process started at a day-long retreat at the German Embassy in March 2009. At the retreat, the region's elected officials and their technical staff came together for an overview of comprehensive energy planning in cities and regions such as Mannheim and Stuttgart. The workshop initiated dozens of group and peer-to-peer technical and policy exchanges to Germany that substantially influenced and informed the growth of the CEPs and related projects across NOVA.



Figure 3: Former Virginia Governor Tim Kaine and German Environment Minister Sigmar Gabriel signing the “Joint Declaration to Support the Exchange and Application of Mutually Beneficial Sustainable Energy and Climate Change Policies Between The Federal Republic of Germany and The Commonwealth of Virginia” April 2009. (Photo: Germany.info)

Energy Planning in NOVA: The Present

To put into perspective the success to date of NVRC's and its partners' energy programs, it helps to look at a 2007 study by the Virginia Center for Coal and Energy Research. In 2007, it was assessed that there was less than **100kW** of renewable electricity from solar PV AND wind energy produced in **all** of NOVA⁹. Today, NOVA's installed capacity of solar PV exceeds 6 MW and the Commonwealth of Virginia is regularly in the top ten states in the nation for USGBC-certified buildings.¹⁰

The following highlights several of the current large-scale and high-value programs of NOVA:

Solarize NOVA. In 2014, moved by the inspiring performance of cities such as Bottrop or Markgroeningen, Germany and the declared solar objectives of Arlington and Loudoun counties (50 MW each by 2050 under their respective CEPs), NVRC launched the Solarize NOVA program. Solarize NOVA is a non-profit, community-based outreach initiative sponsored by the NVRC and the Local Energy Alliance Program (LEAP) in which local governments support the expansion of solar PV. The core of Solarize NOVA is the facilitation of solar PV installation through bulk purchasing and free solar site assessments. A key feature of Solarize NOVA is the “Solar Map.” This feature of Solarize NOVA was

created by the NVRC in partnership with George Mason University and the university's computing facilities, to demonstrate to homeowners and business owners how much solar energy can be generated by the rooftop of their home and/or business. The map is the first of its kind in NOVA. Working with LEAP, NVRC has incentivized solar applications by taking the leg- and guess-work out of whether solar is right for individual homeowners. A Federal Investment Tax Credit of 30% further incentivizes the purchase of solar.

Solarize NOVA has helped propel Virginia from 44th to 20th in the United States in total installed capacity solar PV. The Advanced Energy Economy suggests that 2,000 MW of renewable energy capacity could be attained if large companies in Virginia sourced just 15% of their capacity, resulting in over \$3.6 billion in new investment.¹¹

NVRC/MWCOG Joint Greenhouse Gas Inventory (2005-2012). In 2015, NVRC and MWCOG teamed together to inventory emissions of GHG for the greater metropolitan region to assist localities to more strategically evaluate efforts that promote energy efficiency.

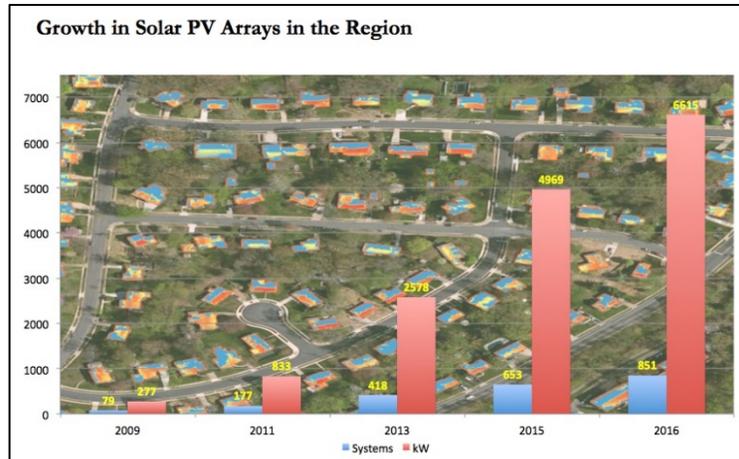


Figure 4: The number of solar arrays in NOVA have more than doubled from 2013 to 2016.

Falls Church Green Power Community Award. In 2013, the City of Falls Church became the first EPA Green Power Community in Virginia. As part of the program, through Renewable Energy Certificates, Falls Church agreed to buy green power representing at least 3% of the city's total electricity use. The program also includes outreach efforts to the City's residents and businesses designed to encourage the purchase or generation of renewable energy. The City matches 5% of its electricity use and offsets over 541,000 kilowatt hours of electricity via green power. This effort aligns with the City's goal of reducing GHG emissions by 80% by 2050 from 2005 levels.

Prince William County "Gas to Energy Project." In 2014, Prince William County (PWC) initiated a methane recapture effort. Ninety percent of methane emissions captured at the County landfill is conveyed to five converted 2,230 horsepower diesel engines that produce electricity for approximately 5,000 residences. PWC invested \$10 million in a partnership with the renewable energy company Fortistar to oversee production and management of operations. The project generates approximately \$130,000 annually to the County.

Arlington Initiative to Rethink Energy (AIRE). Launched January 1, 2007, AIRE helps County residents and businesses reduce energy use, apply solar energy, undertake home energy efficiency and energy audits, and other simple actions to reduce GHG emissions. AIRE laid the foundation for Arlington County's CEP adopted by the County Board in 2013 as an element of the Arlington Comprehensive Plan. This energy plan aims to reduce GHG emissions across the community by about 80% by 2050. AIRE now leads implementation of that CEP. In addition to continuing efficiency upgrades in County operations, AIRE is working in the community on a commercial Property Assessed Clean Energy program and four

programs for residences: 1) Home Energy Rebates, 2) Green Home Choice for new construction and renovations, 3) a Solar Co-op, and 4) an Energy Lending Library that is being copied by other jurisdictions nationwide.

Alexandria Old Town North Small Area Plan. Alexandria's planning efforts for the revitalization of the City's Old Town North call for the creation of an Eco-district that identifies potential targets and attainment strategies for reductions in energy consumption, GHG emissions, and water consumption. The Plan assesses potential energy and GHG reductions for current and future buildings, the potential application of rooftop solar, and evolution for a district energy system. If successfully executed, the reductions of energy use by 2040 could be as high as 53% and the drop in GHG as much as 65%.¹²

Fairfax County Public Schools. In 2017, Fairfax County Public Schools (FCPS) was recognized as an 2017 Energy Star Partner of the Year Energy Management Award winner for its efforts to improve the energy efficiency of its buildings and facilities. Since 2014, FCPS has tracked the use and cost of energy using EPA's Energy Star Building Benchmarking system. Controls have been established for heating, ventilation, and air conditioning systems operations. Over 190 buildings and 16 schools have been benchmarked against a national database and are monitored monthly. FCPS's Get2Green program engages students in environmental action such as recycling, composting, building wildlife and native plant habitats, conserving energy, and growing food. FCPS is a charter member of the Green Schools Alliance District Collaborative, a group of 21 large districts combining their collective power to support greener, more efficient solutions to environmental sustainability.

Results from Energy Efficiency Programs

	Completed	Savings in kWh reduced	Annual Savings in kWh Reduced	Pounds of CO ₂ Not Emitted
Home Energy Checkups	630	453,600	\$49,896	702,788
Weatherization Projects	15	262,945	\$28,923	407,395
Combined			\$78,819	1,110,183

Figure 5: Energy efficiency projects resulting from NVRC's Solarize Program have a substantial positive impact in reducing energy usage and provide recurring savings to the consumer.

Quo Vadis? Energy Planning in NOVA to 2030

NOVA's substantial human, political, environmental, and institutional attributes, when properly coordinated and channeled, position it for an exceptional energy future. Realizing the region's sustainable energy future to 2030 and beyond will rely on the following:

Solarize Solsmart Advisor. Permitting, zoning, and planning can represent as much as 64% of the total installed residential system price. Finding solutions to reduce these "soft costs" is a priority for NVRC. Within the context of the US Department of Energy Sunshot Initiative, NVRC has partnered with the National League of Cities and the Solar Foundation and has agreed to host, for six months, a PV technical expert to provide technical and policy advice to the City of Alexandria, the City of Fairfax, and Arlington County. Funded entirely by the Solar Foundation, the expert will study and make recommendations about efficient planning, zoning, and other administrative measures that can contribute to streamlining the application of solar PV systems.

Property Assessed Clean Energy (PACE).

Applications of renewable energies, building retrofits, or financing energy efficient lighting are often slowed in NOVA by the absence of long-term, no-money-down finance tools. Through legislation passed in 2015, the Virginia General Assembly approved the application of PACE financing in the Commonwealth. PACE loans are intended to be long term (20-plus years), secured by a lien that has a priority status of a tax assessment to support clean energy projects on commercial buildings (e.g., buildings, condominiums, or religious structures). Presently, Arlington County is the only locality in the Commonwealth developing a program. Arlington County has approved support for a full-time PACE program administrator and is working to develop a County-wide ordinance for the PACE program.

Electrify America. It is generally acknowledged that by 2025, approximately 20% of NOVA's vehicles will be electric vehicles (EV). However, there is insufficient "fast-charge" infrastructure to manage this rising demand. Financed via the national diesel emissions consent decree, VW/Electrify America will work with NVRC and other regional partners to fund the planning and placement of over 1,500 EV charging stations and to reach the goal of 300 EV charging stations per million people in the NOVA region. To date, NVRC and other Electrify America partners have identified more than 1,500 potential EV charger locations in the greater Washington Metropolitan region.¹³

Heat Recapture and Conveyance from Data Centers.

As global energy consumption from data centers is projected to double approximately every four years and NOVA is host to over 70% of global Internet traffic, the region clearly stands at the epicenter of policy and technical innovation concerning climate change mitigation. For 2017-2018, NVRC will start to assess opportunities that will mitigate the costs and stresses of energy consumption from data centers by increasing the amount of renewable energy via conveyance of heat through district energy. NOVA has immense opportunities to promote efficient recovery and heat from data centers into some of the largest transit-oriented developments in the United States planned around the construction of the Metro Silver lines. German cities such as Darmstadt and Munich have successfully built modern energy systems in which thermal sources from entities such as data centers is captured and channeled efficiently via district-heating systems.

Energy Efficiency and Benchmarking. According to the American Council on Energy-Efficient Economy, revenue generated from the energy efficient sector is approximately \$1.5 billion (up from \$300 million in 2013). To sustain this trend, and elevate the Commonwealth's status from 33rd in the US for energy

efficiency, NVRC will work with its partners to support opportunities for benchmarking energy efficient performance of state, local, and commercial buildings. Arlington County is recognized as a state-wide model for the use of its “Green Games” and Portfolio Manager Tool to benchmark energy and water performance.¹⁴

Renegotiating Virginia Energy Purchasing Governmental Association (VEPGA) Rates with Dominion Power. As organized under state law, VEPGA was formed in 2002 to negotiate electricity rates and other electricity related matters with Dominion Virginia Power now known as Dominion Energy. In 2018 the contract that establishes the rates will be up for renegotiation. This provides an opportunity for VEPGA members to advocate for

improved processes and rates related to the installation of LED street lights and an increased mix of renewable energy sources in the electricity provided to local governments without an increase in rates to its members.

Partnerships. Much of NVRC’s energy success has been attainable through partnerships with the region’s academic, commercial, and nongovernmental institutions such as George Mason University and MWCOG. NVRC will sustain and strengthen this by working with institutions such as MWCOG (GHG inventory) German Embassy (pump storage), Northern Virginia Community College (workforce), and Northern Virginia Technology Council (among many others).

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³ US Environmental Protection Agency, Report to Congress on Server and Data Center Energy—Public Law 109-431, August 2, 2007. Online: energystar.gov/ia/partners/prod_development/downloads/EPA_Datacenter_Report_Congress_Final1.pdf. Accessed July 20, 2017.

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⁵ Advanced Energy Economy Roadmap for Virginia: How the Next Governor Can Make Virginia’s Energy System More Secure, Clean and Affordable—and Drive Economic Development, June 22, 2017. Online: info.aee.net/hubfs/AEE%20VA_Energy%20Transition%20Memo_6.22.17.pdf. Accessed July 20, 2017.

⁶ Governor’s Commission on Climate Change Final Report: A Climate Change Action Plan. December 15, 2008. The Honorable L. Preston Bryant, Jr., Secretary of Natural Resources Chair, Governor’s Commission on Climate Change. Online: sealevelrisevirginia.net/docs/homepage/CCC_Final_Report-Final_12152008.pdf. Accessed July 20, 2017.

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⁹ Renewable Electric Power Sector Net Generation by Source. Virginia Center for Coal and Energy Research, June 2017. Web. 16 June 2017. energy.vt.edu/vept/renewables/renew_gen.asp. Accessed July 20, 2017.

¹⁰ U.S. Green Building Council Releases Annual Top 10 States for LEED Green Building; usgbc.org/articles/us-green-building-council-releases-annual-top-10-states-for-leed-green-building. Accessed July 20, 2017.

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¹² City of Alexandria Old Town North Small Area Plan Eco-District, Smithgroup JJR. Online: alexandriava.gov/uploadedFiles/planning/info/Old_Town_North_SAP_2015-2017/OTNEcoDistrictStudy013117.pdf. Accessed July 20, 2017.

¹³ Partners for a Zero Emission Future—Proposal to Volkswagen/Electrify America. January 2017.

¹⁴ Virginia Energy Efficiency Council, Why Energy Efficiency Is a Smart Investment for Virginia, May 2017. Online: vaeec.org/wp-content/uploads/2017/05/VAEEC-2017-Report-FINAL.pdf. Accessed July 20, 2017.