Fairfax County Green Bank Gap and Feasibility Analysis

November 2022

ICF

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Contents

List of Acronyms

$M	Million U.S. Dollars
ACEEE	American Council for an Energy Efficiency Economy
AFLEET	Alternative Fuel Life-Cycle Environmental and Economic Transportation
ARRA	American Recovery and Reinvestment Act
ATB	Annual Technology Baseline
BEV	Battery Electric Vehicle
BIL	Bipartisan Infrastructure Law
BRIC	Building Resilient Infrastructure and Communities
C-PACE	Commercial Property Assessed Clean Energy
CBECS	Commercial Building Energy Consumption Survey
CDFI	Community Development Finance Institution
CEA	Clean Energy Advantage
CEG	Clean Energy Group
CEFA	Clean Energy Financing Authority
CESA	Clean Energy State Alliance
CECAP	Community Energy and Climate Action Plan
CLEER	Commercial Loan for Energy Efficiency and Renewable (Montgomery County Green Bank loan product)
CNG	Compressed Natural Gas
CO2e	Carbon Dioxide Equivalent
DCFC	Direct Current Fast Charging
DESEU	Delaware Sustainable Energy Utility
DMV	D.C., Maryland, and Virginia
DOE	Department of Energy
EE	Energy Efficiency
EECBG	Energy Efficiency and Conservation Block Grant
EIA	Energy Information Administration
EV	Electric Vehicle
EVSE	Electric Vehicle Supply Equipment
FEMA	Federal Emergency Management Agency
FGB	Fairfax Green Bank
FY	Fiscal Year
GHG	Greenhouse Gas
GW	Gigawatt
HEV	Hybrid Electric Vehicle
HVAC	Heating, Ventilation, and Air Conditioning
ICE	Internal Combustion Engine
IIJI	Infrastructure Investment and Jobs Act
IPC	Inclusive Prosperity Capital
IRC	Internal Revenue Code
IRS	Internal Revenue Service
ITC	Income Tax Cost
kW	Kilowatt
kWh	Kilowatt-hour
LBNL	Lawrence Berkely National Laboratory
LDV	Light-Duty Vehicle
LEAP	Low-Income Energy Assistance Program
LMI	Low- to Moderate-Income
LPO	Loan Programs Office
MHD	Medium- and Heavy-Duty
MMBTU	Million British Thermal Units

MMSF	Million Square Feet
MMT	Million Metric Tons
MPG	Miles per Gallon
MUD	Multi-Unit Dwelling
MW	Megawatt
MWh	Megawatt-Hour
NGEN	National Green Energy Network
NGO	Non-Government Organization
NPV	Net Present Value
NOVEC	Northern Virginia Electric Cooperative
NREL	National Renewable Energy Laboratory
OECC	Office of Environmental and Energy Coordination
OWAP	Offshore Wind Accelerator Project
PEA	Philadelphia Energy Authority
PGCC	Philadelphia Green Capital Corporation
PHEV	Plug-in Hybrid Electric Vehicle
PM	Particulate Matter
PPA	Power Purchase Agreement
PRI	Program Related Investment
PV	Photovoltaic
R-PACE	Residential Property Assessed Clean Energy
RE	Renewable Energy
REC	Renewable Energy Certificate
RGGI	Regional Greenhouse Gas Initiative
RPS	Renewable Portfolio Standard
SREC	Solar Renewable Energy Credit
TOC	Total Organic Carbon
TCO	Total Cost of Ownership
VCC	Virginia Community Capital
VCEA	Virginia Clean Economy Act
VEO	Virginia Energy Office
VOC	Volatile Organic Carbon
VPA	Virginia PACE Authority
WAP	Weatherization Assistance Program

Executive Summary

Fairfax County's Board of Supervisors recently approved a set of ambitious targets for climate action through their Community Energy and Climate Action Plan (CECAP), one of which is the goal of carbon neutrality for the county by 2050. The CECAP was designed to develop a roadmap for Fairfax County to reduce GHG emissions, allowing citizens and local stakeholders to contribute to the climate planning process to address local priorities and needs while reducing GHG emissions. The CECAP takes a multi-level approach to tackling climate change by setting forth recommendations for efforts taken by the community, individuals, and organizations, programs enacted by the Fairfax County government, and policies advocated for at the state and federal levels of government. It includes a variety of climate focused investments in energy efficiency, transportation electrification, renewable energy, and storage, that could benefit from programs, and financing vehicles to supplement existing program delivery and sources of capital.

The CECAP sets aggressive long term, interim, and sector specific goals. These goals include a carbon neutrality goal for 2050 with 87% coming from GHG emissions reductions and interim goals in 2030 (50% reduction) and 2040 (75% reduction) to ensure the county is making significant progress toward the carbon neutrality goal. Relevant sector specific goals include a commitment to green building design and performance, a target of 100,000 retrofits of housing units with energy efficiency measures by 2030, a commitment to increasing transit and nonmotorized commuting, and a target of increasing the share of plug-in hybrid electric vehicles or battery electric vehicles to 15% of all light-duty vehicles registered in Fairfax County by 2030.

To facilitate implementation of the CECAP, Fairfax County is exploring the opportunities available through the creation of a local clean energy financing entity (a "Fairfax Green Bank" or FGB). Fairfax County engaged ICF Consultants ("ICF") in developing a document aimed at understanding how a full range of impacts associated with a green bank. As a first step in exploring such an entity, Fairfax County needs to estimate the clean energy investment market in the county (Section 1), document gaps and needs from stakeholder feedback (Section2) and understand the legal implications of establishing a FGB (Section 3). In addition to gathering and preparing this information, ICF provided a set of next steps and considerations (Section 4) for the county and its various stakeholders to consider as they move this work from concept to implementation.

Green Bank Potential in CECAP

The establishment of a clean energy financing entity, or a green bank, is tied to several recommended strategies in the CECAP. Strategy 1, to 'increase energy efficiency and conservation in existing buildings' is recommended to be supported by a local green bank, financing program, or property assessed clean energy (PACE) program. This includes continued support of the Commercial property assessed clean energy (C-PACE) program and the potential to set up an R-PACE program for residential projects, allowing for tax assessment financing in residential buildings if barriers to implementation that currently exist in federal policy lessen. Strategy 4, to 'increase renewable energy in the electric grid' similarly recommends a county level green bank to support county-wide renewable energy projects and programs. Programs that help fund the installation of residential solar are offered by green banks in other areas and Fairfax County sees this as a potential financing avenue for increased renewable energy generation in the county.

A clean energy financing entity on a larger scale is also discussed as an action for state and federal stakeholders in support of Strategy 2, 'the electrification of existing buildings'. A statewide entity could support various measures, or provide incentive programs through grants, rebates, and tax credits needed to take on electrification projects which can be utilized by Fairfax County to meet their goals for this strategy. The idea of a statewide green bank is also discussed in Strategy 7, to 'increase electric vehicle

adoption', as an action for state and federal government to lower barriers for the adoption of electric vehicles (EVs). This could be done through new financing programs and property tax credits for home charging infrastructure. While these strategies are recommended for a statewide green bank, the establishment of a local or regional clean energy financing entity could also support these strategies.

The CECAP also recommends several potential actions and strategic investments that Fairfax County can make to help further progress on GHG reduction efforts. Such investments could include electric vehicles, public transportation, and active transportation infrastructure, and funds toward energy efficiency improvements, renewable energy generation, and energy storage. While many of these strategies have upfront costs that require potentially high levels of investment, paybacks beyond GHG reductions make these investments economically beneficial to take on as well in the long term, including increased economic activity, the creation of jobs, reduced long term costs, public health, and equity.

Other Significant Legislation and Regulations

The CECAP is also important to situate within the context of multiple commonwealth and regional policies supporting clean energy investments. The key policies that complement the CECAP are included in the list below and are referenced throughout the document. Additional information on these policies is available in the Appendix.

- **Virginia House Bill (HB) 1919**[1], which passed in 2021 and is authorized by law through Code of Virginia § 15.2-958.3:1, provides authority to develop local green banks (referred to in this document as the "Green Bank Statute").
- **Virginia Clean Economy Act (VCEA) (HB 1526**[2] **and SB 851**[3]**),** was passed in 2020 and creates a renewable portfolio standard (RPS) and an energy efficiency standard. The two investor-owned electric utilities, Dominion Power and Appalachian Electric Power are required to generate 100% renewable electricity by 2045 and 2050 respectively.
- **The Regional Greenhouse Gas Initiative (RGGI)** is a regional GHG emissions cap and trade regimen which results in revenues collected from power generators purchasing emissions allowances being allocated back to Virginia to support the clean energy economy and climate resilience.
- **Commercial Property Assessed Clean Energy (C-PACE)** was approved through an ordinance in Fairfax County in 2019. C-PACE financing tool designed to provide upfront capital to building owners for energy-saving, water-saving, and resiliency improvement projects, which is then repaid through a special assessment connected with the property's taxes.

Summary of Results and Recommendations for Next Steps

The Clean Energy Market Assessment modeled results for four different market segments, Residential Buildings, Commercial Buildings, Electric Vehicles, and Solar and Storage. Together, these market segments demonstrated:

- A significant addressable market, with investment potential of $650 million over five years through potential Fairfax Green Bank programs.
- Economically favorable investments for participants in all market segments.
- The potential for significant GHG reductions, job creation and air quality improvements from clean energy investments.

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[1] https://lis.virginia.gov/cgi-bin/legp604.exe?211+fuh+HB1919+700057
[2] https://lis.virginia.gov/cgi-bin/legp604.exe?201+sum+HB1526
[3] https://lis.virginia.gov/cgi-bin/legp604.exe?201+sum+SB851

To better understand green banks, ICF conducted a best practice review, profiling five regional clean energy financing entities to understand their funding, programs and resources. Further, a review of potential funding sources and partners were reviewed, including available state and federal sources; this review included mission, programs, funding, partnerships and specifics on each organization's low- and moderate-income approach.

A centerpiece of the work behind this document was stakeholder outreach ICF completed discussions with state and local agencies, private sector lenders, service providers as well as other partners, with a focus on local entities. Feedback was received on stakeholders' perceived barriers and opportunities in the county's clean energy market. The main outcomes from this effort aligned with many national trends, but Fairfax-specific items were also identified.

Table ES-1 Gaps, Barriers and Opportunities in Fairfax Market

Gaps and Barriers	Opportunities
• Large upfront costs and project prioritization • Technical and financial uncertainty • Misaligned financial incentives • Contractor constraints • Creditworthiness	• Contractor Pre-qualification • Marketing and Promotion Assistance • Focus on Low- and Moderate-Income Marketplace • Focus on Multifamily Residential and Retail Commercial Marketplace

A review of legal and organizational structures was completed, evaluating how a green bank could be structured, with an emphasis on providing recommendations for County leadership. Four different organization types were evaluated (a public entity, a quasi-public entity, a non-profit and a depositary bank). The non-profit structure was recommended based on its ability to meet legal requirements, incur debt, and meet the overall public purpose.

Lastly, a set of next steps and considerations were outlined for the County. Stakeholder-informed recommendations were provided including how an organization could build its mission and focus, key partnerships, and high potential programs. Three types of organizations were profiled, depending on initial capital availability, structure, and impact:

- **Lean Approach**- A startup approach to a FGB with a small, agile staff that would prioritize financial sustainability over time and a few targeted programs that support organizational development.
- **Growth Approach**- A medium-sized, origination-focused organization that would provide several Fairfax-specific lending programs built on existing offerings from various partners that provide financial services.
- **External Capital Approach**- A fully capitalized organization, which would rely on significant outside resources to provide a robust set of lending services including subsidized LMI and equity-focused offerings.

ICF also provided a list of next steps, both from a business planning perspective and a legal perspective, needed to establish a green bank.

Clean Energy Market Assessment

Overview of Section

This section sets the framework for and describes the methodology and data used in the clean energy market assessment. It begins with a profile of the county's energy markets, continues with an overview of the data sources and clean energy investments used in the assessment, a review of the process and methodology, and a summary of the results. The purpose of a clean energy market assessment is to quantify the investment potential of various market segments given the existing technical, economic and market constraints. Clean energy market assessments are useful to decision makers as they can help identify opportunities for programs and serve as a basis for evaluating the costs and benefits of those opportunities.

Fairfax County Energy Market Profile

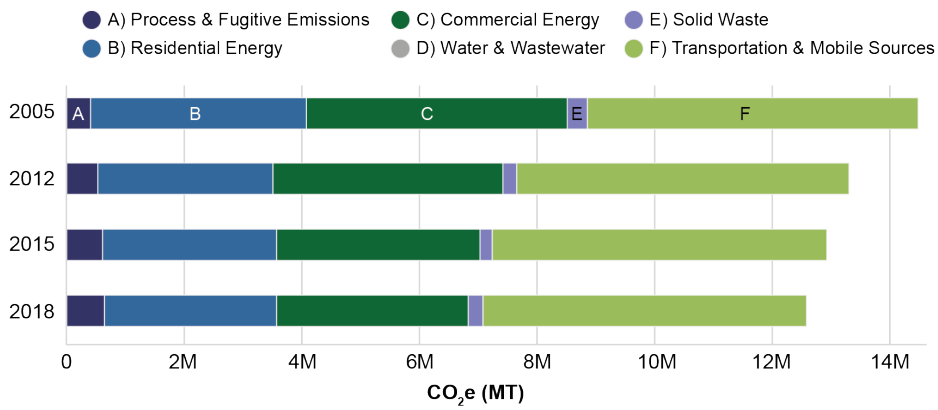
Energy Profile

Fairfax County's electricity is primarily provided by Dominion Energy, a commonwealth regulated electric utility; and Northern Virginia Electric Cooperative (NOVEC) serves part of the county, under more limited state regulation. Virginia law grants electric utilities monopoly franchises in their defined service areas, which limit customers' ability to choose how they receive their electricity. Virginia's power generation is primarily supplied by natural gas, making up 60% of net power produced, followed by 30% from nuclear power, 6% from biomass and renewables, and 4% from coal. Dominion offers customers its Green Power program, in which they can opt to obtain renewable power for a portion or all their consumption; it does not deliver renewable power to the customer site, but rather purchases Renewable Energy Certificates (RECs) on the customer's behalf from solar and wind facilities in Virginia and the surrounding region.

Current Emissions

In 2018, 12.6 million metric tons of carbon dioxide equivalent (MMT CO2e) were emitted in Fairfax County. More than 90% of these greenhouse gas (GHG) emissions were the result of energy consumption in residential and commercial buildings and transportation. Between 2005 and 2018, the county population grew 15% to nearly 1.2 million people. Despite this growth, total GHG emissions decreased 13% from 14.52 million metric tons (MMT) CO2e in 2005 to 12.56 MMT CO2e in 2018. Per capita emissions decreased 24% from 14.5 metric tons of CO2e (MT CO2e) per capita in 2005 to 11.0 MT CO2e per capita in 2018 as seen in Figure 1 which was prepared for the Fairfax CECAP. Growth in population and associated residential and commercial development tend to drive up emissions, but improved energy efficiency, a less carbon-intensive electricity grid, and more fuel-efficient vehicles can offset increases and these results in Figure 1 show that GHG emissions can be reduced even as the community and economy of Fairfax County grow.

Figure 1: Fairfax County GHG Emissions by Activity Over Time



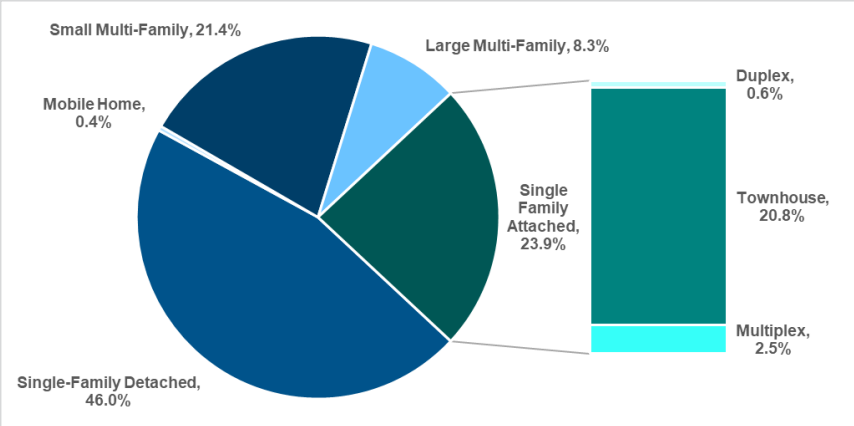
Source: CECAP

Building Inventory and Emissions

Residential

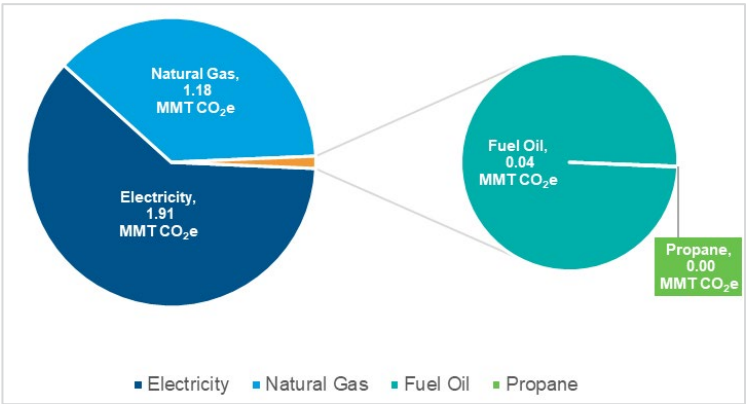
Fairfax County has a total of 433,415 housing units consisting of 199,393 single-family detached units, 1,758 mobile homes, 103,492 single-family attached units (consisting of 90,083 townhouses, 10,811 multiplexes, and 2,598 duplexes), 92,833 small multi-family units in 1 to 4 story buildings, and 35,939 multi-family units in buildings with 5 or more stories. The percentage of housing units of each type can be seen in Figure 2. These data come from Fairfax County's 2020 demographic reports.

Figure 2: Breakdown of Housing Units in Fairfax County



Of these housing units, 28.5% of units are occupied by low-income households and 30.6% by moderate-income households.[4] Residential units emitted 1.91 MMT CO2e from electricity usage, 1.18 MMT CO2e from natural gas usage, 0.04 MMT CO2e from fuel oil usage, and negligible emissions from propane usage in 2020 as seen in Figure 3.

Figure 3: Building Energy Emissions in Residential Buildings in Fairfax County (MMT CO_2e)



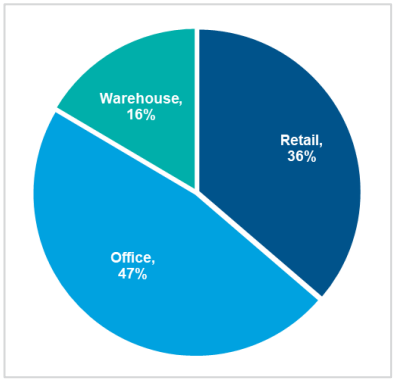
Commercial

Fairfax County has a total of 275.7 million square feet (MMSF) of commercial space consisting of 100.1 MMSF of retail space, 130.1 MMSF of office space, and 45.5 MMSF of warehouse space. Commercial facilities were disaggregated into these three categories based on characterization from the 2020 Fairfax County Demographic Report.[5] The percentage of each commercial building type can be seen in Figure 4.

[4] Low-income household is defined as a family of four living at or below $77,400. Family of four living at or below $82,300 is defined as moderate-income households (Fairfax 2022).

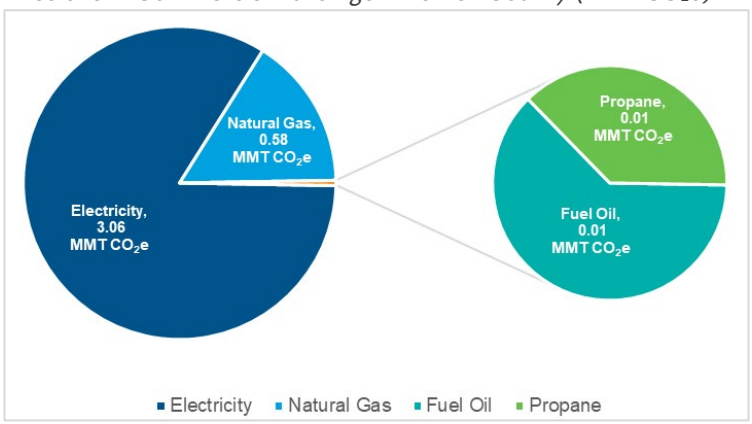
[5] https://www.fairfaxcounty.gov/demographics/sites/demographics/files/assets/demographicreports/fullrpt2020.pdf

Figure 4: Breakdown of Commercial Square Footage in Fairfax County



Emissions from commercial buildings in 2020 include 3.06 MMT CO2e in electricity usage, 0.58 MMT CO2e from natural gas usage, 0.01 MMT CO2e from fuel oil and 0.01 MMT CO2e from propane usage as seen in Figure 5.

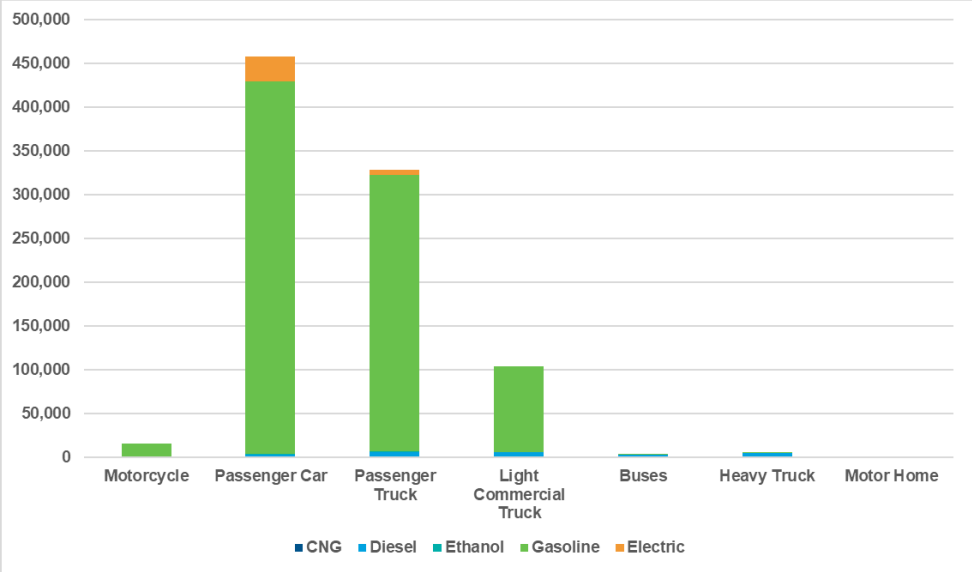
Figure 5: Building Energy Emissions in Commercial Buildings in Fairfax County (MMT CO_2e)



Vehicle Inventory and Emissions

As of 2020, Fairfax County has a vehicle population of 915,163 vehicles. Most vehicles (93%) are gasoline-fueled and of these, 458,046 are passenger vehicles, the most common vehicle type. Electric vehicles (including plug-in hybrid electric vehicles (PHEVs), battery electric vehicles (BEVs), and Hybrid Electric Vehicles (HEVs) make up 3.81% of vehicles in the County, with the balance fueled by diesel, compressed natural gas (CNG), or ethanol.

Figure 6: Vehicle Count by Vehicle Type and Fuel



In 2020, it's estimated that vehicles traveled 10.7 billion miles in Fairfax County (including both vehicles registered in the county and those passing through it). Vehicles traveling in Fairfax County emitted a total of 4.6 MMT CO_2e in 2020.

Data and Clean Energy Interventions used in the Clean Energy Market Assessment

In coordination with the County staff, ICF developed an assessment of specific aspects of the clean energy market using a variety of data sources. County staff provided ICF with an initial set of data sources for developing the market assessment, primarily focused on energy use and Census demographics. Using these as well as other regional and national data sources, ICF developed a model of 21 types of investment packages of energy- and/or carbon-reducing measures that a clean energy financing entity might promote and assist with financing. These investment packages span residential and commercial energy efficiency, electric vehicle, and solar PV market segments.

Residential Energy Efficiency Intervention Investment Packages

1. Single-Family Equipment Energy Efficiency
2. Single-Family Equipment Efficiency plus Envelope Efficiency
3. Single-Family Electrification plus Envelope Efficiency
4. Small Multi-Family Equipment Energy Efficiency
5. Small Multi-Family Equipment Efficiency plus Envelope Efficiency
6. Small Multi-Family Electrification plus Envelope Efficiency
7. Large Multi-Family Energy Efficiency
8. Large Multi-family Energy Efficiency and Electrification

Commercial Energy Efficiency Intervention Investment Packages

9. Office Equipment Energy Efficiency
10. Office Equipment Energy Efficiency and Electrification
11. Retail Equipment Energy Efficiency
12. Retail Equipment Energy Efficiency and Electrification
13. Industrial Energy Efficiency
14. Industrial Energy Efficiency and Electrification

Electric Vehicle Intervention Investment Packages

15. Multi-family EV Charging
16. Fleet Electric Vehicles + Charging

Solar and Storage Intervention Investment Packages

17. Single-Family On-Site Solar
18. Commercial On-Site Solar
19. Single Family Energy Storage
20. Commercial Energy Storage
21. Residential Community Solar

Process and Methodology

The clean energy market assessment aimed to determine two sets of results for viewing the potential of the market for various clean energy investments a green bank could help facilitate:

The Addressable Market: The scale of financial opportunity in each market segment for a given set of investments. The addressable market was calculated through two methods; a stock turnover model which determines the volume of equipment and component replacements based useful lives of technology packages, and a technology adoption model which projects stock turnover that could be converted into financial investments.

Relative Economic Performance: A pro forma financial model based on the incremental costs and energy savings for intervention investment packages (as seen in Table 1) was used to analyze project costs and energy savings and then calculate net present value, payback period, and estimated return on equity. Key assumptions for the economic analysis can be found in Appendix B: Clean Energy Market Methodology in Table 30.

The intervention Packages that were modeled as part of this market assessment are seen in Appendix B: Clean Energy Market Methodology.

Table 1 Clean Energy Market Assessment Intervention Investment Packages

Clean Energy Market Assessment Intervention Investment Packages		
Residential Energy Efficiency	Option A[6]: Equipment Energy Efficiency	Includes replacing existing heating, ventilation, and air conditioning (HVAC), lighting, and other home appliances with high-efficiency alternatives at the end of equipment lifetimes
	Option B: Building Envelope Efficiency	Focuses on replacing a home's windows with high-efficiency alternatives, plus air sealing and insulation measures to reduce heating and cooling costs
	Option C: Electrification	Focuses on full electrification of a home's HVAC system and other household appliances, including water heaters
Commercial Energy Efficiency	Option A: Energy Efficiency	Replacing HVAC, lighting, and other equipment with high-efficiency alternatives at the end of the product's lifetime
	Option B: Electrification	Full electrification of a commercial building's HVAC system and other equipment, including air conditioners and heat pumps
Electric Vehicles	Electric Vehicle Charging	Electric vehicle charging stations installed at multifamily buildings
	Electric Vehicles	Adoption of vehicles for fleets owned and operated by commercial enterprises or public organization in the county

[6] Three different residential energy efficiency options and two different commercial energy efficiency options were assessed in this document.

Solar	Residential On-Site Solar	On-site solar PV for Residential single-family homes in the county
	Small to Medium-Sized Commercial Solar	On-site solar PV for Small to medium-sized commercial buildings in the county
	Community Solar	Community Solar with a target market of all residential customers, with 30% of subscriptions from qualified low- to moderate-income (LMI) customers
Energy Storage	Residential Energy Storage	Residential on-site battery storage for a portion of residential solar PV adopters only
	Commercial Energy Storage	Commercial on-site battery storage for a portion of commercial solar PV adopters only

The methodology for determining the addressable market and the relative economic performance for these intervention investment packages, including baseline development, foundational data sources, modeling assumptions, and modeling process is discussed in Appendix B: Clean Energy Market Methodology.

Results and Outcomes

This section includes the summary of ICF's forecast of the clean energy market size in Fairfax County that forms the basis of the investment potential for FGB. The total investment potential was developed for the five years between 2023 and 2027, based on an economic analysis for year 2025 at the project-level, and applied to eligible market potential estimates during that period. Total addressable market potential was estimated and is presented for residential and commercial energy efficiency, EV charging and fleet conversions, on-site solar PV, energy storage and community solar. Figure 7 shows a visualization of the addressable market as a subset of the total market but is not shown to-scale. However, the addressable potential for clean energy within a five-year period will necessarily be much smaller than total market size. Definitions for each analytical tier provide further context for this section's findings:

Total Fairfax County Market represents the estimated overall market size for all potential interventions across all market segments. This number is not fully realizable due to various technical, economic, and adoption barriers, as described above, but provides the countywide scale of clean energy project activity.
Technical potential represents the estimated total project investment value for all technically feasible projects. This excludes projects from the total market size that cannot be realistically deployed with current technology or are likely to have constraints on the ability to install the measures en masse within the planned time horizon for this assessment of 5 years. (E.g., insulation could improve onsite efficiency and reduce carbon emissions, but a wall cavity space for insulation was too small to allow for its installation and could not be altered.)
Economic potential represents the estimated total project investment value if all economically viable clean energy investments were made based on current and forecast costs for solutions and potential project savings. This excludes projects from the technical potential that are likely to increase costs to buyers or does not pay for itself over any period, even with currently available incentives.

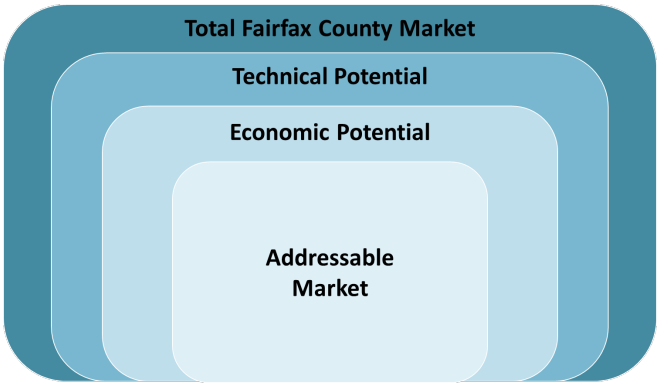
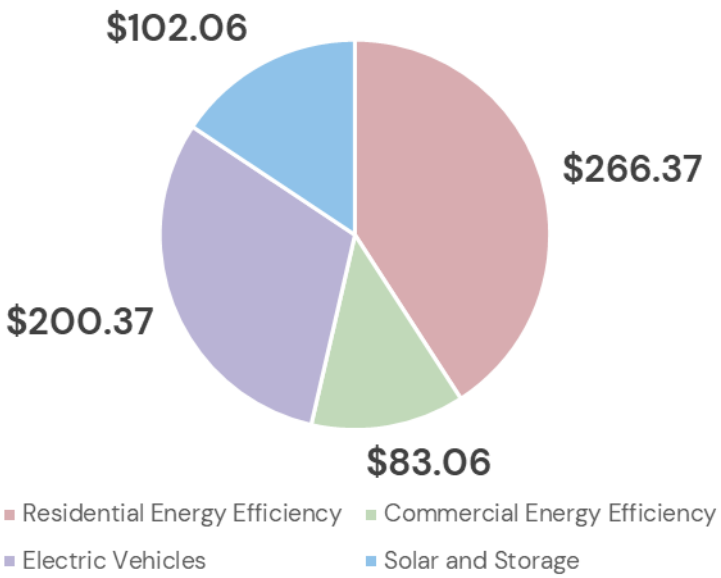


Figure 7: Diagram of marker size estimate (Illustrative only and not to scale)

Addressable market represents the estimated investment potential based on behavioral and adoption trends for clean energy projects that could be realistically targeted when deployed by a green bank over the 5-year forecasted period. This is a subset of the total economic potential and uses industry and clean energy program historical averages for establishing adoption and investment estimates.

The results were modeled for 2025 and extrapolated between 2023 and 2027 to provide a five-year total. The results summarized Figure 8 show a total maximum addressable market potential for all clean energy-related project types within the scope of this forecast. The totals are indicative of the entire investment needs, although FGB is likely to select a well-defined set of opportunities for funding and program support. Cumulative results show robust investment needs in all market segments, including an addressable investment potential of over $125 million in 2025 alone, and a five-year total addressable investment potential of over $650 million. These investments show the largest amounts in residential energy efficiency and electric vehicles but have significant potential in all market segments.

Figure 8: Five-Year Addressable Market Financing Potential (full installed costs) ($ Millions)



These results, with the economic analysis results shown below, can be used to prioritize financial opportunities and market targets for the proposed Fairfax Green Bank. As financing options are developed, the County will look to the most promising market segments and the associated investments that are most in need of financing, are most cost effective, and have the highest impact. Because many of the individual interventions would be pursued starting from small or almost non-existent activity levels currently, FGB's efforts should plan for significant up-front effort to help move the market forward. This would include setting realistic annual targets for participation and budgeting resources to help develop market awareness and tailoring financing products to increase adoption.

In developing these results, economic analysis for all investments were conducted, using either a representative project instance (for example, a household energy retrofit, or a solar installation) or on a per

square foot basis. Using a combination of economic and market metrics, in addition to feedback from local stakeholders, this information can help Fairfax County develop effective programs that maximize the County's ability to meet its energy and climate goals through in clean energy financing.

Residential Energy Efficiency

Results for the residential energy efficiency market analysis showed cost effective investments for all the equipment and envelope energy efficiency investments modeled, with better economics seen for smaller projects, such as equipment energy efficiency, compared to deeper energy retrofits that include envelope upgrades. Because of the modeling, investments would be prioritized at the end of life for major equipment or at the time of sale, when renovations are most likely to occur.

Residential Energy Efficiency Example

Results showed a typical Fairfax County single family residential home could be outfitted with a full set of energy efficiency measures for including efficiency HVAC, appliances, lighting and cooking equipment for a total cost of $11,200 dollars. That investment would pay for itself after four years and provide a total NPV (based on today's value of money) of $29,800.

Electrification investments faced more challenging economic results with only the small multi-family equipment energy efficiency, envelope and electrification package showing a positive net present value. A full set of results is found in Table 2; residential results are shown on a per household basis. The modeling outputs show a potential number of retrofit projects in 2025 amounts to fewer than one percent of all housing types: 2,031 single family homes, 619 small multifamily housing units, and 240 large multifamily housing units.

Table 2: Residential Energy Efficiency Package Economics Results

Intervention Investment Packages	Net Present Value	Simple Payback (100% Cash only)	Estimated Return on Equity
1. Single-Family Equipment Energy Efficiency	$29,798.72	Year 4	29%
2. Single-Family Equipment Energy Efficiency plus Envelope	$6,059.01	Year 7	11%
3. Single-Family Electrification plus Envelope	-$12,115.13	Year 7	10%
4. Small Multi-Family Equipment Energy Efficiency	$23,794.56	Year 4	24%
5. Small Multi-Family Equipment Energy Efficiency plus Envelope	$33,524.40	Year 6	15%
6. Small Multi-Family Electrification plus Envelope	-$4,100.64	Year 7	9%
7. Large Multi-Family Energy Efficiency	$15,487.81	Year 6	13%
8. Large Multi-Family Energy Efficiency and Electrification	-27,896.26	Year 8	2%

Total investment values, energy savings and one-year greenhouse gas savings were calculated. A summary of Residential sector Investment results can be found in Table 3.

Table 3: Residential Energy Efficiency Investment Results

Intervention Investment Packages	Electricity Savings (MWh)[a]	Natural Gas Savings (MMBtu)	Incremental Costs ($M)	Total one-year Costs ($M)	One Year GHG Savings ($MTCO_2e$)[a]
1. Single-Family Equipment Energy Efficiency	4,320.03	14,776.38	$6.48	$22.74	1,251.64
2. Single-Family Equipment Energy Efficiency plus Envelope	8,565.24	38,054.04	$44.40	$67.60	2,648.33
3. Single-Family Electrification plus Envelope	-1,738.97	61,024.22	$20.02	$27.21	-149.00

4. Small Multi-Family Equipment Energy Efficiency	500.48	2,638.95	$2.10	$7.37	157.09
5. Small Multi-Family Equipment Energy Efficiency plus Envelope	1,137.08	4,490.45	$6.90	$12.16	348.40
6. Small Multi-Family Electrification plus Envelope	-1,882.81	18,948.13	$8.98	$14.70	-427.74
7. Large Multi-Family Energy Efficiency	193.75	1,021.63	$1.81	$2.48	60.82
8. Large Multi-Family Energy Efficiency and Electrification	-1,141.79	7,335.48	$2.67	$3.34	-282.89

[a] Negative savings indicates an increase in electricity consumption.

In these tables, the total volume of investments for like building types represents the addressable market of that investment package. However, the addressable market total was arrived at through a mix of those investments. To arrive at single-year and five-year totals, ICF assigned an allocation factor for each technology package. A higher factor was given for equipment energy efficiency, given its cost effectiveness and low market barriers, as compared to lower factors for building envelope and electrification measures, whose cost-effectiveness and market barriers are more challenging. These factors can be seen in Table 4 below.

Table 4: Allocation Factors and Five-Year Investment Total Results

Intervention Investment Packages	5 Year Incremental Costs ($M)	5 Year Total Costs ($M)	Implementation Factor (Technology Allocation)
1. Single-Family Equipment Energy Efficiency	$19.43	$68.22	60%
2. Single-Family Equipment Energy Efficiency plus Envelope	$55.49	$84.51	25%
3. Single-Family Electrification plus Envelope	$38.61	$52.48	39%
4. Small Multi-Family Equipment Energy Efficiency	$6.31	$22.10	60%
5. Small Multi-Family Equipment Energy Efficiency plus Envelope	$8.63	$15.20	25%
6. Small Multi-Family Electrification plus Envelope	$6.74	$11.02	15%
7. Large Multi-Family Energy Efficiency	$8.15	$11.17	90%
8. Large Multi-Family Energy Efficiency and Electrification	$1.33	$1.67	10%
Subtotal		**$266.37**	

Commercial Energy Efficiency

Results for the commercial energy efficiency segments showed cost effective investments for all of the energy efficiency and electrification investment packages modeled, with better economics were shown for energy efficiency-only measures. Because of the modeling, investments would be prioritized at the end of life for major equipment or at the time of commercial fit out, when renovations are most likely to occur in commercial buildings. A full set of results based on the addressable market is found in Table 5.

Commercial Energy Efficiency Example

A typical 50,000 retail commercial building could be outfitted with a set of energy efficiency measures including efficient HVAC, water heating and lighting for a total cost of $200,000 dollars. That investment would pay for itself after three years and provide a total NPV (based on today's value of money) of nearly $850,000.

All commercial results are shown on a per square foot basis. Based on modeling values, retrofits in 2025 represent about 0.67 percent of commercial floorspace: 867,574 square feet of Office space, 667,066 square feet of Retail space and 303,094 square feet of Industrial space in one year of the Green Bank. This one year of intervention is equivalent to 4-5 large (10 story or larger) office buildings, 10-20 restaurants and one large warehouse (considered an industrial building per Fairfax County's demographics report).

Table 5: Commercial Energy Efficiency Economics Results

Intervention Investment Packages	Net Present Value ($/Sq. Ft)	Simple Payback (100% Cash only)	Estimated Return on Equity
9. Office Equipment Energy Efficiency	$16.97	Year 3	38%
10. Office Equipment Energy Efficiency and Electrification	$64.43	Year 5	19%
11. Retail Equipment Energy Efficiency	$22.18	Year 6	15%
12. Retail Energy Equipment Efficiency and Electrification	$144.05	Year 6	17%
13. Industrial Energy Efficiency	$22.17	Year 6	15%
14. Industrial Energy Efficiency and Electrification	$109.51	Year 6	15%

Total investment values, energy savings and one-year GHG emissions savings are summarized in Table 6.

Table 6: Commercial Energy Efficiency Financial Investment Results

Intervention Investment Packages	Electricity Savings (MWh)[a]	Natural Gas Savings (MMBtu)	Incremental Costs ($M)	Total one-year Costs ($M)	One Year GHG Savings ($MTCO_2e$)
9. Office Equipment Energy Efficiency	1,349.15	265,522.53	$0.96	$3.50	1,884.39
10. Office Equipment Energy Efficiency and Electrification	-3,724.44	1,314,060.07	$17.86	$18.83	6,371.00
11. Retail Equipment Energy Efficiency	1,906.08	174,812.93	$4.34	$6.29	1,529.78
12. Retail Energy Equipment Efficiency and Electrification	-1,937.27	1,113,734.29	$21.05	$23.00	5,746.15
13. Industrial Energy Efficiency	611.83	79,429.53	$1.97	$2.86	622.86
14. Industrial Energy Efficiency and Electrification	-1,145.49	392,412.92	$9.56	$10.45	1,893.10

[a] Negative savings indicates an increase in electricity consumption.

Each investment package for a given building type represents the total impact from projects comprising the addressable market for that package. However, the addressable market total across the whole market segment was arrived at through a mix of those investments. To arrive at single year and five-year total values, ICF thus assigned an allocation factor for each technology package, by assuming a higher implementation rate for energy efficiency than electrification packages based on current market trends. Details on allocation factors are shown in Table 7.

Table 7: Implementation Factors and Five-Year Investment Total Results

Intervention Investment Packages	5 Year Incremental Costs ($M)	5 Year Total Costs ($M)	Allocation Factor (Technology Allocation)
9. Office Equipment Energy Efficiency	$4.34	$15.76	90%
10. Office Equipment Energy Efficiency and Electrification	$8.93	$9.41	10%
11. Retail Equipment Energy Efficiency	$19.53	$28.30	90%
12. Retail Energy Equipment Efficiency and Electrification	$10.52	$11.50	10%

13. Industrial Energy Efficiency	$8.87	$12.86	90%
14. Industrial Energy Efficiency and Electrification	$4.78	$5.22	10%
Subtotal		**$83.06**	

EV Charging

Results for electric vehicle charging at multifamily units showed strongly cost-effective investments for this segment. This is in large part because the investment only includes the cost of charging and not the cost of an EV, which is assumed to be borne by the multifamily resident. Results are found in Table 8; results are shown on a per-EVSE installed basis. The results estimate 535 EVSE projects installed in 2025.

Table 8: EV Charging Economics Results

Individual Measures	Net Present Value	Simple Payback (100% Cash only)	Estimated Return on Equity
15. Multi-Family EV Charging	$80,119.42	Year 3	43%

Total investment values, energy savings and one-year greenhouse gas savings are found in Table 9.

Table 9: EV Charging Investment Results

Individual Measures	Electricity Savings (MWh)	Gasoline Savings (Gallons)	Incremental Costs ($M)	Total one-year Costs ($M)	One Year GHG Savings ($MTCO_2e$) Unscaled
15. Multi-Family EV Charging	-7,240	200,553	$5.41	$5.41	8,921.55

Five-year investment totals are shown in Table 10. These are the same as the incremental costs because this is a new technology that does not have an alternative option.

Table 10. Five-Year Investment Total Results

Individual Measures	5 Year Incremental Costs ($M)	5 Year Total Costs ($M)
15. Multi-Family EV Charging (model 1)	$16.49	$16.49

Electric Vehicles

Results for county-based fleet electric vehicles showed challenging economics despite the prioritization of those vehicles with positive total cost of ownership. High capital costs for new EVs and associated EVSE hurt the economics of this investment package; moreover, the total cost of ownership metric doesn't account for the time value of money. Thus, despite a positive total cost of ownership, the investments results in a negative net present value. EV technologies and costs for EVs were based on today's prices, and with the rapidly developing market, it's likely that economic results will improve. Modeling results are found in Table 11 below. Electric vehicle fleet results in Table 11 are shown on a per vehicle basis in alignment with EVSEs installed based on assumptions in the modeling methodology. Modeling results represent 993 fleet EVs purchased, the majority of which are Light Duty Passenger Vehicles and Medium Duty Pickups.

Table 11: Electrics Vehicles Economics Results

Individual Measures	Net Present Value	Simple Payback (100% Cash only)	Estimated Return on Equity
16. Fleet Electric Vehicles + Charging	-$73,818.05	Year 7	9%

Total investment values, energy savings and one year greenhouse gas savings can be found in Table 12.

Table 12: Electric Vehicles Investment Results

Individual Measures	Electricity Savings (MWh)	Gasoline Savings (Gallons)	Diesel Savings (Gallons)	Incremental Costs ($M)	Total one-year Costs ($M)	One Year GHG Savings ($MTCO_2e$) Unscaled
16. Fleet Electric Vehicles + Charging	-12,942	381,678	552,196	$23.18	$36.75	5,344.07

Five-year investment total and incremental costs are shown in Table 13.

Table 13. Five-Year Investment Total Results

Individual Measures	5 Year Incremental Costs ($M)	5 Year Total Costs ($M)
16. Fleet Electric Vehicles + Charging	$116.02	$183.88

On-Site Solar and Energy Storage

Results for on-site solar projects show differing economics for each market sector with long project paybacks for residential installations and shorter paybacks for commercial investments. Economies of scale for this technology play a significant role in the cost effectiveness of the measures, as seen in the commercial sector. Storage results were not modeled for cost effectiveness since costs and benefits are typically not based solely on energy savings, but instead on resiliency outcomes and co-benefits. A set of results can be found in Table 14 below. All commercial results are shown on a per project basis. Based on modeling values, the results show the potential for 3.7 MW of residential solar over 620 installations, 0.76 MW of commercial solar over ten installations in 2025 plus 50 residential storage projects and one potential commercial storage project.

Table 14: On-Site Solar and Energy Storage Economic Results

Individual Measures	Net Present Value	Simple Payback (100% Cash only)	Estimated Return on Equity
17. Single-Family On-Site Solar	-$1,781.84	Year 17	4.6%
18. Commercial On-Site Solar	$86,916.33	Year 8	13.2%
19. Single-Family Energy Storage	n/a Not Modeled	n/a	n/a
20. Commercial Energy Storage	n/a Not Modeled	n/a	n/a

Total investment values, energy savings and one year greenhouse gas savings were calculated. A summary of On-Site Solar and Energy Storage results can be found in Table 15 below.

Table 15: On-Site Solar and Energy Storage Investment Results

Individual Measures	Electricity Savings (MWh)	Incremental Costs ($M)	Total one-year Costs ($M)	One Year GHG Savings ($MTCO_2e$)
17. Single-Family On-Site Solar	4,838	$6.91	$6.91	883.89
18. Commercial On-Site Solar	972	$1.02	$1.02	177.57
19. Single-Family Energy Storage	-0.003	$0.23	$0.23	-0.0001
20. Commercial Energy Storage	-0.004	$0.01	$0.01	-0.001

Five-year investment totals are shown in Table 16. These are the same as the incremental costs because this is a new technology that does not have an alternative option.

Table 16. Five-Year Investment Total Results

Individual Measures	5 Year Incremental Costs ($M)	5 Year Total Costs ($M)
17. Single-Family On-Site Solar	$34.50	$34.50
18. Commercial On-Site Solar	$5.09	$5.09
19. Single-Family Energy Storage	$42.92	$42.92
20. Commercial Energy Storage	$0.13	$0.13
Subtotal		**$102.06**

Community Solar

Results for community solar show the potential for a significant project development activity. Community Solar economic at the subscriber level were assumed to be a net savings for customers and results were at the developer level were only modeled for total project costs to estimate investment capital needs. Model results can be found in Table 17 below. Based on the assumptions and calculations, there is potentially 4 MW of new community solar projects in Fairfax County in 2025.

Table 17: Community Solar Investment Results

Individual Measures	Electricity Savings (MWh)	Incremental Costs ($M)	Total one-year Costs ($M)	One Year GHG Savings ($MTCO_2e$)
21. Residential Community Solar	6,034	$4.83	$4.83	1,714.07

The five-year investment total is shown in Table 18. This is the same as the incremental cost because this is a new technology that does not have an alternative option.

Table 18. Five-Year Investment Total Results

Individual Measures	5 Year Incremental Costs ($M)	5 Year Total Costs ($M)
22. Residential Community Solar	$19.43	$19.43

Co-Benefits – Air Quality

Changes in levels of air pollutant emissions as a result of the various investment packages are estimated in Table 19. Increased energy efficiency investment packages show a significant decrease in emissions of carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). However, electrification investment packages such as the electrification of single and multi-family homes, electric vehicle charging and energy storage increases the emissions of CO_2, CH_4, and N_2O due to the increased use of electricity.

In addition, overall emissions of nitrogen oxides (NO_x), ozone season NO_x, sulfur dioxide (SO_2), total particulate matter (PM), total organic carbon (TOC), volatile organic compounds (VOC), and lead also decreased. This is primarily driven by the switch to improved energy efficiency and electrification products, which not only utilizes less energy but, in the case of electric vehicles, is also utilizes a cleaner fuel source.

Table 19. Summary of Co-Benefits from Improved Air Quality

Intervention Investment Packages	CO_2e (MT)	SO_2 (MT)	N_2O (MT)
Single-Family Energy Efficiency	1,251.64	0.34	0.56
Single-Family Energy Efficiency plus Envelope	2,648.33	0.68	1.10
Single-Family Electrification plus Envelope	(149.00)	(0.12)	(0.22)

Small Multi-Family Energy Efficiency	157.09	0.04	0.06
Small Multi-Family Energy Efficiency plus Envelope	348.40	0.09	0.15
Small Multi-Family Electrification plus Envelope	(427.74)	(0.14)	(0.24)
Large Multi-Family Energy Efficiency	60.82	0.02	0.02
Large Multi-Family Energy Efficiency and Electrification	(282.89)	(0.09)	(0.15)
Office Energy Efficiency	1,884.39	0.18	0.17
Office Energy Efficiency and Electrification	6,371.00	0.06	(0.48)
Retail Energy Efficiency	1,529.78	0.20	0.25
Retail Energy Efficiency and Electrification	5,746.15	0.15	(0.25)
Industrial Energy Efficiency	622.86	0.07	0.08
Industrial Energy Efficiency and Electrification	1,893.10	0.01	(0.15)
Multi-Family EV Charging	8,921.55	(0.40)	3.56
Fleet Electric Vehicles + Charging	5,344.07	(0.91)	21.94
Single-Family On-Site Solar	1,374.30	0.38	0.62
Commercial On-Site Solar	276.09	0.08	0.13
Single-Family Energy Storage	(0.00)	(0.00)	(0.00)
Commercial Energy Storage	(0.00)	(0.00)	(0.00)
Residential Community Solar	1,714.07	0.47	0.78

[a] Negative values indicate an increase in emissions.

Detailed methodology can be found in the appendix.

Co-Benefits – Job Creation

To estimate the number of jobs created through the implementation of the investment packages, a methodology developed by the American Council for an Energy Efficient Economy (ACEEE) was utilized. Through this methodology, it is estimated 792 additional construction jobs will be created on a one-year investment. A summary of job creation from each intervention package can be found in Table 20.

Table 20. Summary of Co-Benefits from Job Creation

Intervention Investment Packages	Net Jobs on One Year Investment
Single-Family Energy Efficiency	68
Single-Family Energy Efficiency plus Envelope	203
Single-Family Electrification plus Envelope	82
Small Multi-Family Energy Efficiency	22
Small Multi-Family Energy Efficiency plus Envelope	36
Small Multi-Family Electrification plus Envelope	44
Large Multi-Family Energy Efficiency	7
Large Multi-Family Energy Efficiency and Electrification	10
Office Energy Efficiency	11
Office Energy Efficiency and Electrification	56
Retail Energy Efficiency	19
Retail Energy Efficiency and Electrification	69
Industrial Energy Efficiency	9
Industrial Energy Efficiency and Electrification	31
Multi-Family EV Charging	16
Fleet Electric Vehicles + Charging	70
Single-Family On-Site Solar	21
Commercial On-Site Solar	3
Single-Family Energy Storage	1

Commercial Energy Storage	0
Residential Community Solar	15
Total	**793**

Detailed discussion regarding job creation can be found in Appendix B: Clean Energy Market Methodology.

Programmatic and Financing Gap Assessment

Overview of Section

As the County develops an understanding of the opportunities available through a green bank, it has sought robust stakeholder feedback on the gaps in existing financing options. ICF and the County met with a variety of contacts representing a range of different views and experiences on how clean energy financing and programs could help expand the County market for clean energy investments.

The purpose of this section is to summarize the feedback received from over two dozen Fairfax County stakeholders and provide an overview of the programs, lending offerings and entities that can serve as models for Fairfax County. The section also reviews existing sources of clean energy financing, an overview of stakeholder process and feedback, a summary of best practices from existing green financial institutions, and an outline of potential programs and lending opportunities.

Existing Clean Energy Lending Options

There are several existing clean energy lending sources that offer financing in the Commonwealth and in Fairfax County. In many cases these product offerings can be currently accessed by Fairfax residents and businesses if they know where to find them. Many of the organizations below are partners with other green financial institutions and could serve as partners to a Fairfax clean energy financing entity.

Public

Virginia Community Capital (CDFI) offers a flexible clean energy loan product for a variety of different project types including renewable energy and energy efficiency.

Virginia Community Capital was established in 2006 as a Community Development Financial Institution (CFDI) with an initial investment of $15 million from the governor to leverage initial investment for an economic return to underserved areas. VCC is well known for the ability to combine national, state, and local socially-minded investors who are often the first to act on innovative projects designed to positively impact communities. VCC has an experienced management team, support of local governments, and trust from private banks and partner organizations to utilize investment dollars towards areas of greatest need with successful projects.

Clean Energy Financing Terms

Loan-to-value up to 75% (up to 90% for solar projects)

10-year term with longer terms available for PPAs

Loans repaid from solar renewable energy certificates or power purchase agreements

Options for PACE loans

Potential projects:

- Solar energy generating equipment
- HVAC equipment
- Lighting upgrades
- Building automation controls
- Building envelope

Virginia Community Capital's Clean Energy Lending program is dedicated to investing in clean, renewable methods of power generation to reduce water and air pollution and create high-paying jobs. VCC's clean energy lending products support increasing access to clean energy and renewable power projects. This is done through a variety of financing options in the energy efficiency and renewable energy market segments.

To date VCC has closed more that $9 million in clean energy loans for utility-scale and small business, and PPA projects statewide.

Private

Clean Energy Credit Union offers a variety of residential focused loan products including energy efficiency, electric vehicles, and rooftop solar loan products.

The Clean Energy Credit Union was started by a group dedicated to promoting clean energy to protect the environment and improve the economy. Unlike a green bank the clean energy credit union offers a cooperative model in a credit union to propagate the benefits of both clean energy and cooperatives. These benefits include mitigating climate change, reducing pollution for public health, creating jobs, building community wealth, promoting democratic organizations, improving national security through energy independence, and promoting personal financial independence. The clean energy credit union particularly focuses on developing affordable financing when purchasing clean energy products and services so that more people can afford to participate in growing clean energy markets. This is done by making it easier for everyone to afford to use clean energy or conserve energy by providing loans with competitive terms (partly through the economies of an online-only institution). The clean energy credit union additionally wants to make it easier to invest in clean energy by offering impact investment opportunities that are federally insured, available to non-accredited investors, available with low minimum investment thresholds (as low as $5), and possible to understand without sophisticated investment expertise or specialized understanding of the clean energy marketplace.

What projects do the Clean Energy Credit Union support?

Clean energy products, technologies, and services are those that utilize renewable energy, reduce energy consumption, improve energy efficiency, and/or improve energy consciousness while also reducing pollution, greenhouse gases, water usage, and/or toxic waste.

Clean Energy Projects Include:

- Solar electric systems
- Electric vehicles
- Insulation/weatherproofing
- Net zero energy homes
- Geothermal heat pumps
- Electric-assist bicycles

Virginia PACE Authority manages Virginia's CPACE program.

The Virginia PACE Authority (VPA) is a nonprofit organization providing Virginia counties and cities with C-PACE administration services, specifically in Fairfax County, Loudon County, and the City of Petersburg. C-PACE is free to local governments and equips commercial property owners with new ways to finance upgrades to an existing building or to reduce costs in new developments. VPA seeks to offer localities with comprehensive services at low cost and with total transparency. VPA aims to assist in stimulating the local economy and tax base, integrate C-PACE into the area's economic development strategies, and facilitate the increased financial and environmental performance of commercial and multifamily properties.

The VPA assists in the development of C-PACE programs by educating communities on the benefits of C-PACE financing, developing local priorities in conjunction with local officials, working with advocates to pass C-PACE ordinances, designing the C-PACE Program while incorporating local needs and state best practices, and marketing and training contractors, lenders, and building owners on how to use C-PACE.

The VPA currently administrates the C-PACE program in Fairfax County and provides resources where potential applicants can learn about the C-PACE program and get started on applying for C-PACE funding. C-PACE in Fairfax County was approved by ordinance in March of 2019. Currently the Fairfax C-PACE program is supported by 25 lenders, and over 80 contractors.

Inclusive Prosperity Capital offers a variety of clean energy financing products.

Inclusive Prosperity Capital is a not-for-profit investment fund scaling clean energy financing solutions that channels investment capital to program partners in the communities that need it most. IPC works toward expanding access to clean energy, especially in underinvested neighborhoods and underserved markets. IPC engages with communities most impacted by climate change by investing in clean energy and resilience in partnerships with local initiatives and organizations to provide energy security, climate justice, and economic growth.

IPC partners with mission aligned organizations (including a number of established green banks), collaborators, partners, foundations, and capital providers investing in underserved markets nationally. Partners actively collaborate with IPC staff to solve common impact-related problems through the application of scalable and inclusive financing solutions. These partners include green banks and green capital investors and funders, programmatic partners, and other collaborative membership organizations.

Financing solutions provided by the IPC have been developed for several market segments including commercial, community solar, nonprofit and government, multifamily, single family, and infrastructure and grid-tied projects.

Catalyst Term Loans

The Catalyst Term Loan supports energy improvement projects for low- and moderate-income multifamily properties and community based non-profit organizations. Loans are repaid from energy cost savings. This loan provides lightly secured financing for new construction and renovation projects

Smart-E Program

A standardized product offering though a network of local lenders and vetted contractors to finance over 40 eligible green energy home improvement projects. Smart-E uses NGEN to streamline and create transparency in the application process. Leverages the years of experience CT and MI have running this program at scale. Provides benefits for lenders, borrowers, and contractors.

Solar PPA/Solar + Storage Financing

Provides building owners to go solar with no money down with immediate electricity savings with agreed-upon rates often at a significant discount to the power grid.

Specific funds have been allocated for the accelerated deployment of solar and storage projects for urban resiliency in low-income communities

Navigator Pre-Development Loan

Lightly secured line of credit for the financing of pre-development projects in affordable and market rate properties. This enables owners to select and manage technical service providers who specialize in the analysis, design, and implementation of energy improvements.

Interconnection Bridge Financing

Special gap financing to fill immediate cash flow needs to speed up utility interconnection processes, which frequently constrain forward looking project development and investment.

Clean Energy Group supports thought leadership on climate change with a specific focus on clean energy finance and innovation.

The Clean Energy Group is a national nonprofit organization that works at the forefront of clean energy innovation to enable a just transition amidst the urgency of the climate crisis. CEG fills critical resource gaps in support of communities, nonprofit advocates, and government leaders working on the frontlines of the clean energy transition. CEG collaborates with partners across the private, public, and nonprofit market segments to accelerate the equitable deployment of clean energy technologies, and the development of inclusive clean energy program, policies, and finance tools. CEG is a thought leader in advancing new energy initiatives with their trusted expertise and independent analysis, providing resources and assistance related to emerging technology trends, transformative policy, regulatory, and market approaches. The CEG also manages the Clean Energy State Alliance (CESA) which allows for deep cooperation between leading state energy organizations to advance the rapid expansion of clean energy technologies and bring the benefits of clean energy in a just and equitable manner to all.

Clean Energy Group Active Project Areas

CEG's projects concentrate on climate and clean energy issues at the state, national, and international levels as it works with stakeholders from governments, the private, and nonprofit market segments.

Clean Energy Finance

Clean energy finance projects seek to develop solutions to funding and finance challenges in clean energy markets, accelerating clean energy economic and community development through new learning networks of key public finance officials.

Resilient Power Project

The Resilient Power Project works to provide technology and policy solutions to reduce impacts and dangers of power outages in communities now and in the future.

Energy Storage

The energy storage projects aim to advance effective energy solutions to give flexibility not only to improve the current electric power system but re-envision how power is produced and delivered in support of national and international climate goals.

Offshore Wind Accelerator Project (OWAP)

The OWAP's goal is to support and facilitate the development of responsible offshore wind development in the United States through policy advocacy and technical expertise.

Existing Fairfax County Government Capacity

Fairfax County Office of Environmental and Energy Coordination

The Office of Environmental and Energy Coordination leads Fairfax County's cross-organizational development and implementation of effective environmental and energy policies, goals, programs, and projects. The OEEC engages County departments, authorities, businesses, and residents to advance environmental and energy priorities and address community needs.

The OEEC's three primary focus areas include climate planning and action, energy management, and sustainability and innovation.

The office also conducts education and outreach programs that span a range of topics and issues. Major initiatives of the OEEC include:

- Development and implementation of climate planning initiatives, such as the CECAP and Resilient Fairfax, which address GHG emissions reductions and the impacts of climate change.
- Education and outreach on actions community members can take to reduce their energy use and emissions through programs like HomeWise (which is targeted to low- and moderate-income residents) and Carbon-Free Fairfax, which is more broadly focused.
- Implementation of Fairfax's County's Operation Energy Strategy, including goals and targets to help County operations reach energy carbon neutrality by 2040.

Overview of Stakeholder Outreach Process

A series of meetings were convened with several stakeholders, both internal and external, with the aim of understanding the state of clean energy financing programs, both in the region and with leading organizations in the clean energy financing and programmatic support space. Stakeholder meetings were also held with state and local agencies, service providers, NGOs, and lenders in the area to get a sense of the work and programs that were already developed or could be leveraged in the creation of the Fairfax clean energy financing entity. These conversations were designed to be both avenues for gathering information of existing programs and services as well as a way of introducing the prospective Fairfax clean energy financing entity to potential partners and advisors.

Examples of Existing Green Banks and Clean Energy Financing Entities

Existing Green Banks and Financing Entities	
Montgomery County GreenBank — Your partner for clean energy	ENERGIZE DELAWARE
PGCC PHILADELPHIA GREEN CAPITAL CORP — ACCELERATING OUR CLEAN ENERGY FUTURE	PHILADELPHIA ENERGY AUTHORITY

Stakeholder outreach was conducted with several existing green banks and clean energy financing entities to understand their existing programs and product offerings. Stakeholder meetings with these existing clean energy financing entities consisted of introductions between the Fairfax team and the representative of the existing clean energy financing entity, and overview of that entity's current services and support with the aim of determining why these products were chosen, how they are implemented (including administration needs, costs, and operations), and how these programs might be successful in Fairfax County. Discussing the partnerships that were established by these entities, both with governments and private or other organizations was an important aim of these discussions, either to leverage for Fairfax County or as a model to look to when determining partnerships for the Fairfax clean energy financing entity. These discussions would also include insight into the governance and legal structure of the entities, including if they were founded in legislation and their legal structures (i.e., nonprofit, state sponsored program, etc.). Stakeholder discussions with these entities also delved into the challenges and barriers that these entities face or faced and what solutions were implemented to overcome these challenges.

Local and Other Select Stakeholders

Stakeholder discussions were intended to identify the activities already underway in Fairfax County. These discussions were used to give organizations an overview of a clean energy financing entity and also provided Fairfax County staff the opportunity to learn more about the stakeholders, their footprint in Fairfax County, and how stakeholder programs and offerings may intersect with a Fairfax green bank. This outreach additionally sought to identify the gaps in financing, programmatic support, and product offerings that the clean energy financing entity would seek to fill.

State and County agencies provided background on existing initiatives, legislation relevant to their work, and challenges they face in the implementation of legislation, statutes, and government initiatives. Discussions with County government stakeholders focused on the needs of Fairfax County residents and businesses, and what types of projects could be jumpstarted with clean energy financing funds, especially in LMI communities.

Discussions with lenders focused on identifying the clean energy financing vehicles that already exist for Fairfax County residents and businesses and the impact of financing specifically in Fairfax County given the socio-economic makeup of the county.

Stakeholder conversations with service providers, both those providing energy (i.e., Dominion) and those offering contracting services for energy efficiency building projects, focused on existing efforts to stimulate energy efficiency and electrification projects in the future, including needs to incentivize activity. Discussions also focused on the type of projects that are currently underway in the county, including incentive and financing structures and what types of projects would need additional support both from a programmatic and financial standpoint.

Stakeholder Discussion Summary and Gap Analysis

Through the discussions with Fairfax County's stakeholders, ICF gained an understanding of both gaps and growth opportunities for clean energy investments in the county. There were many common themes, some aligning with larger industry issues and others more specific to Virginia, or Fairfax County. These items are cataloged in the sections below along with recommendations for programs and financing made by stakeholders.

Industry-wide Barriers and Gaps

In synthesizing the information from Fairfax stakeholders, several common themes emerged that are consistent with those widely recognized within the clean energy project investment profession.

Large upfront costs and project prioritization barrier

Climate and clean energy focused investments typically require large upfront costs, which limit participation by some parties. Individuals and businesses often have competing priorities and may not be able or willing to outlay large capital or sustain the significant development time and effort needed to prioritize completion of investments such as energy efficiency, renewable energy, and vehicle electrification. In some types of properties, and often in owner-occupied LMI properties, building health and safety issues, such as mold, asbestos, and leaks need to be addressed before energy project investments can be made. Such conditions can preclude projects investments from being made even when Weatherization Assistance Program (WAP) or other funding programs are available.

Technical and financial uncertainty

Even when individuals and organizations want to complete a climate or clean energy focused project, there are gaps in understanding of the project value and the types of investments needed. Developing and implementing a climate project could include engineering, financing, and/or construction expertise. Planning for projects costs must account for changes in technologies, materials, and labor which can be volatile depending on market conditions. The availability of incentives and energy prices also factor in depending on the duration of the project. Together these factors provide uncertainties to decision makers and hurt project realization. Technical assistance from account or project managers associated with the FGB could help address this barrier.

Misaligned financial incentives barrier

While climate and clean energy investments often reduce operating costs, in some instances the cost savings of the investments are not aligned with those who are empowered to invest in the property. This split incentive is common in multifamily housing, as well as commercial office and retail markets where tenant bills would be reduced by an investment from the landlord, or vice versa. Those looking to reduce their energy costs may not always be empowered to do so.

Contractor constraints

While some contractors such as solar installers and insulation contractors are focused on climate or clean energy type investments, much of the project work may need to be completed by general, mechanical, plumbing, or electrical contractors. Between a tight labor force for skilled trade work, and supply chain issues associated with the pandemic (and especially related to solar panel and heat pumps) there are significant constraints on contractors. Additionally, smaller contractors may lack access to working capital which limits their work to smaller projects, while larger contractors may avoid small projects since they may not be large enough to be profitable. Lastly, while Fairfax has many knowledgeable contractors, some may lack the education to install certain types of technologies and may steer individuals to older technologies they feel more comfortable with.

Creditworthiness

For some looking to develop and implement climate or clean energy projects, financing can be a challenge due to existing credit issues. For LMI homeowners and some smaller businesses issues such as existing debt, poor credit, or the lack of established credit could pose barriers to borrowing. Traditional borrowing often doesn't allow the securitization of energy efficiency technologies, which means that investments must be collateralized against an asset such as the property.

Local Context

There are several local factors that influence Fairfax County's program potential, especially as it relates to other localities with clean energy financing entities. While Virginia's energy policy ecosystem is mature and the Commonwealth has recently passed the VCEA, Virginia's utility rebates and other incentives to enable deeper retrofits are not as significant as other nearby jurisdictions such as Maryland and Washington DC. Available incentives have covered simple energy efficiency measures, such as easy lighting changeouts, low flow shower heads, etc., and many of the larger efficiency measures for building envelope or equipment upgrades are not cost-effective in the utility regulatory framework, and so are not eligible for incentives. More robust energy efficiency, renewable energy, or electric vehicle investments often require advanced levels of technical support, engineering, and ideally additional support to off-set the cost through incentives.

Some programs such as C-PACE have been established to address such barriers. While C-PACE has been established in the Commonwealth and enabled in the county, it has been slow to take off as a preferred financing vehicle. Incentives and C-PACE both play heavily into other markets, helping to enable energy projects in Maryland, DC, and other nearby states.

Fairfax Specific Barriers and Gaps

Fairfax County also has its own specific barriers and circumstances to consider as programs are being designed. In the residential sector, Fairfax County is one of the wealthiest counties in the United States on a household average income basis, and many high-income households already have the resources to implement climate investments without the aid of financing products. In discussions with service providers, most outlined that very few of their customers seek loan products currently. Additionally, most service providers believe the opportunity for low- and moderate-income households is significant, which outlines the need for programs focused on that demographic. Multifamily residential and retail commercial were both highlighted at sectors where both financial and technical assistance would be essential for making headway given that multifamily building managers and small business owners often operate with few support staff. Throughout all the measures, education, technical assistance, and marketing of products and services were highlighted as a strong need.

Feedback on Fairfax Specific Opportunities

Market Segments

- Low- and moderate-income households
- Multifamily residential
- Retail commercial

Services and programs

- Financial and technical assistance
- Education and marketing

Financing Challenges with Mobile Home Energy Efficiency Retrofits

As of 2020 there were approximately 1,800 mobile or manufactured home units in Fairfax County. This type of housing comes with some financing challenges that are unique compared to traditional single family housing.
There have been recent DOE efforts to establish energy conservation standards for new manufactured housing. However, this does not cover existing units and still lags behind standards for site-built housing, leaving residents, especially those with lower-income with high energy usage and costs.
While there are resources available through federal agencies and non-profits that aid those looking to purchase new manufactured housing, gaps remain in providing adequate financial and programmatic assistance to those looking to retrofit existing manufactured housing.
This is an area where a Fairfax Green Bank can work to develop products to support this underserved group of residents and building type, focusing on high impact retrofits on manufactured housing including:

- Energy efficient windows and doors
- Addition of insulation to a manufactured house's belly, walls, skirting, and roof
- Installation of a belly wrap and/or a roof cap
- General repairs (caulking, ducts, etc.)
- Energy efficient appliances

Opportunities

As Fairfax County looks to design a clean energy financing entity, it can look to grow participation by two ways:

1) **Enable Participation**: By growing the pool of project participants who currently want clean energy investments (or the associated benefits they provide), but do not have the financial or technical resources to realize them.
2) **Grow Participation:** By encouraging new potential project participants to seek clean energy investments.

Part of a green bank's role would be to address barriers, but there are significant opportunities to both enable and grow participation in the market segments studied and discussed. Through stakeholder outreach, many ideas and opportunities were shared that could help to shape future programs and financing offered by a green bank.

Feedback on Residential Opportunities

Feedback from stakeholders outlined several ways that a green bank could support residential climate investments with both general concepts and more specific recommendations.

Contractor Pre-Qualification. A green bank could serve as an entity that pre-qualifies installers, engineers, and contractors, which would provide confidence to members of the public. A pre-qualification process could also place a priority on supporting local businesses and workers, or other County priorities. For many energy efficiency investments, engineering and audit work might be needed, highlighting the need for quality contractors.

Marketing and Promotion Assistance. Marketing and promotion of climate investments was nearly universally identified as a driver of local installer businesses. In creating marketing materials, stakeholders outlined the need to market benefits beyond climate and costs. In the residential energy efficiency sector, for example, the motivation for many customers stems from the desire for increasing comfort in their homes. By broadly promoting climate investments to the public, nearly all vendors would benefit. In this way, the green bank organization would be supporting a variety of climate investment contractors, regardless of whether they participate in the green bank programs. Additionally, marketing could speak to a diverse array of customer needs, such as comfort, with secondary benefits of costs and carbon reduction.

Focus on Low- and Moderate-Income Households. LMI communities were a significant focus of stakeholder feedback as they were uniformly identified as outside of the existing participation pool. Similarly, multifamily housing was identified as being currently under resourced. Stakeholders suggested that partnerships and outreach with several specific LMI housing providers could yield opportunities for climate investments. Lastly, multiple participants identified the need to connect green bank work with the training of local code officials. As projects move forward and differing technologies such as storage and new types of heat pumps are installed, local officials will need to be able to keep up with the market.

Specific Recommendations for the Residential Sector

- *Efficiency and Solar Incentives:* create and direct incentives from the County via a green bank. Incentives, even small ones, help drive business and create a buzz. Incentives are most effective when they include a deadline.
- *Keeping Lending Simple:* Mortgage-backed lending might be challenging for some. Lending should be made simple! Approval and sales need to be able to happen at the kitchen table, as long application processes create barriers to folks.
- *Focus on Electrification:* Heat pumps should be the next step for residents looking to go beyond both solar and insulation.
- *Focusing Financing Offerings:* Lower interest financing for market rate participants is not worthwhile as those who don't need it might take advantage when they would have spent the money anyway. It's much better to focus money on getting an uptick in consumer demand and LMI financing offering.
- *Leveraging Federal Funding:* Money available through the WAP for LMI homes should be leveraged beyond weather sealing and attempt to get to deeper energy-saving investments.

Feedback on Commercial Opportunities

Feedback for commercial opportunities contained similar feedback as residential regarding the need for marketing, technical assistance, and broad education on the benefits. Stakeholders were interested in how a green bank could play a project development role for commercial work by networking with business groups and providing technical support. This approach, which is used extensively by the nearby Montgomery County Green Bank, would allow the green bank to quickly screen good projects, support project development, and then line them up for using green bank financing. In addition to this approach, stakeholders targeted new construction and major renovation projects as key opportunities to have lower interest C-PACE financing or lending support as part of the capital stack associated with bigger projects.

Throughout the commercial marketplace, stakeholders prioritized having the green bank build strong connections to the local development community to find and implement opportunities.

Specific Recommendations for the Commercial Sector

- *Support for Commercial Solar:* Financing could significantly help with commercial solar in Fairfax County. Power Purchase Agreements and complex project financing structures are not always a great fit for a commercial organization.
- *Areas of focus:* Food service businesses have significant opportunities for energy efficiency but can be hard to reach as they are often small business owners with tight margins and little bandwidth with explore building improvements. Building conversions from office to multifamily housing present a unique local opportunity within the county to enhance climate investments.
- *Realize the potential for C-PACE:* C-PACE creates significant opportunities for Fairfax County, however commercial developers have not yet used the program. A green bank should actively market this tool and ensure that C-PACE's low interest lending be incorporated into Fairfax projects.

Feedback on Electric Vehicle and EVSE Opportunities

Stakeholders had limited experience or direct feedback related to Electric Vehicle and EVSE investments opportunities. Much of the feedback received focused on how the measure did not easily fit in with LMI priorities due to the high initial costs of EVs. Finance for private and commercial vehicles is widely available in the market due to the ability to secure financing by using the vehicle as collateral. Additionally, stakeholder provided feedback that additional demand for charging infrastructure would be met once more EVs were on the road. While not explicitly stated, market education could support a better understanding of EVs and EVSE. Additionally, outreach targeted at groups with experience with EV financing might provide more actionable information.

Market Support for Contractors

In addition to support for residents and businesses seeking climate investments, several stakeholders emphasized the importance of supporting trade-allies (e.g., contractors). Growing the service providers who perform clean energy improvements helps them to lower overall costs and increase their business. In return, contractors are often a green bank's strongest promoters. A green bank can help contractors in a variety of ways:

- Help alleviate supply chain issues with specialty equipment such as high efficiency heat pumps or solar panels by enabling bulk purchasing.
- Provide lines of credit to create better working capital for contractors who are installing climate investments in Fairfax County.
- Improving terms and conditions for contractors who are providing loans to homeowners.

Additionally, significant opportunities were raised regarding growing, training, and maintaining the workforce critical to installing measures. There are significant obstacles to getting qualified tradespeople ready for work and a green bank could help create workforce programs (in some cases connected to creating employment opportunities for underemployed of out-of-work individuals) that drive individuals toward climate investment implementation work.

Climate Resilience

While not a direct focus of this study, several entities discussed the need to secure funding or financing related to climate resilience and adaptation investments. Such investments would reduce risks associated with the physical impacts of climate change, including increased intensity of storms and increased incidence of high heat and high precipitation events. ICF did not attempt to quantify the marketplace for

such investments, however a green bank could provide this type of financing. No specific ideas were provided by stakeholders for this work, however the county may want to consider further exploration given funding opportunities from both the state and federal sources are currently available. For example, programs such as C-PACE are expanding into the resilience space, and there may be opportunities to link energy efficiency efforts with resilience co-benefits to local applications to the FEMA Building Resilient Infrastructure and Communities (BRIC) grant process. In our discussions with existing green banks and financing entities, many expressed an interest in resilience investment, however no specific loan products were being offered. Potential opportunities for a green bank's support in this area could include:

Financial instruments

- Providing first-loss capital to de-risk private investments in infrastructure upgrades, hardening, and/or flood risk management efforts that reduce the sensitivity of housing or commercial buildings to climate risks.
- Bundling investments in resilient infrastructure to enable capitalization via capital markets (e.g., resilience bonds, other models).
- Explore options for offering or connecting county stakeholders with risk transfer financial instruments such as parametric insurance.

Capacity building and advocacy:

- Providing guidance to community entities seeking to understand and quantify their exposure to projected climate change risks and associated impacts - including risks to infrastructure, supply chains, and workforce (eg. Reduced productivity due to extreme heat).
- Providing guidance to lenders to help incorporate climate risk consideration into loan financing terms to provide preferential options for projects including resilience upgrades.
- Promote and enable climate investments in energy efficiency and demand response strategies such as microgrids and islanding that have resilience co-benefits.

Best Practice Review

Trends in Green Banks

National Green Bank and Sustainable Accelerator Legislation

Green banks and clean energy financing entities have become a focus at the federal level with bills introduced in the House and Senate regarding the establishment of a national green bank that would "finance climate change mitigation and adaptation projects at the state and local level by capitalizing regional, state, and municipal green banks."[7] This national green bank would be funded by "green bonds" from the U.S. Treasury with an initial capitalization of $10 billion and additional capitalization of up to $50 billion. This would be paired with the founding of a Green Bank Establishment Fund to help new green banks in starting up.

The Senate Bill S.283 – National Climate Bank Act specifies that a national climate bank would be an "independent, nonprofit bank [that] must invest in clean energy technologies and infrastructure to reduce greenhouse gas emissions."[8] The Senate bill also directs a national climate bank to facilitate affordable investment including in low-income communities, communities of color, and in key project areas such as renewable energy or climate resiliency. This bill also directs the national climate bank to support the

[7] H.R.3423 – National Green Bank Act of 2019
[8] S.283 – National Climate Bank Act

creation of new green bank on a state or other political subdivision level. These new banks would be required to be public or nonprofit specialized financial entities that work to mitigate climate change and allows the national bank to finance these new banks.

Along with bills to establish national green banks, additional legislation is also being considered to establish a clean energy and sustainability accelerator which would "make capital available to state, territorial, or local green banks. The banks must be public or nonprofit specialized finance entities that use finance tools to mitigate climate change. The accelerator may also provide technical assistance and funding to states and other political subdivisions that do not have green banks to establish such banks."[9] This accelerator would also prioritize investing in climate-impacted communities. This accelerator also calls out the establishment of a program to provide low and zero interest loans to schools, planning organizations, and nonprofits for the acquisition of zero emission vehicles or associated infrastructure. Additionally, the accelerator seeks to explore clean energy transition support to expedite the transition to zero emissions power generation facilities, and the transition away from carbon intensive activities.

National Coordination of Green Banks and the American Green Bank Consortium

Beyond pending federal legislation, national coordination of green banks has also been a trend for existing green banks and clean energy financing entities. Many green banks share information and coordinate as part of the American Green Bank Consortium. The American Green Bank Consortium is an organization led by the Coalition for Green Capital with member organizations dedicated to collaboration in support of the expansion and acceleration of innovative clean energy investment. The consortium brings together green banks and mission-driven clean energy finance organizations to network, share know-how, and other services to build a strong community of practice. The consortium facilitates knowledge sharing to replicate innovating financial structures and pair them with capital at scale.

American Green Banks Consortium Drives Investment

2020 was the strongest year for the green bank model for clean energy investment generated; reaching **$1.69 billion** with **$442 million** coming from green bank funds.

From 2011 to 2020 members of the green bank consortium facilitated **$7 billion** in investments with **$1.9 billion** of direct green bank investment, mobilizing **$3.7** of total investment for every **$1** invested by green banks.

The consortium works with capital providers, lenders, and other potential funding organizations to design blended clean energy investment vehicles to be utilized by the entire network of green banks and clean energy financing entities. The consortium connects green banks with developers, technology companies and other market actors to provide opportunities for green banks to make investments and allow green banks to push the envelope on what types of projects are being funded and supported. The consortium also seeks to help expand the green bank network, working with policymakers, NGOs, and foundations to provide connections with established green banks, advocate for their establishment, and share information with prospective green banks.

Overview of CEFA Preliminary Market Assessment Report

In response to HB 1919, the Commonwealth of Virginia's Energy Office ("Virginia Energy") released a preliminary market assessment report[10] for the creation of the "Clean Energy Financing Authority" (CEFA) in January of 2022. The CEFA would be a statewide entity focused on increasing investments in clean energy, clean transport, and climate resilience projects. While HB 1919 is focused on green banks founded by local governments, as a statewide effort the CEFA would intend to overcome barriers that may

[9] H.R.806 – Clean Energy and Sustainability Accelerator Act
[10] CEFA Preliminary Market Assessment Report Jan2022.pdf (virginia.gov)

preclude smaller and rural jurisdictions from successfully running a green bank. Barriers include loan volume constraints that result in interest earned being too low to cover operating costs or attract private capital investments, which constrains potential scale of activity. For jurisdictions that are large enough to found their own green bank, the CEFA could be complementary to those efforts and vice versa.

The report covers gaps and opportunities in the following priority segments: existing buildings, transportation, industry, and rural opportunities. It also focuses on how it could complement existing policies and programs. Virginia Energy conducted interviews and collected survey results to inform the report.

Overview of Green Banks Evaluated

Montgomery County Green Bank

Located in Maryland, the Montgomery County Green Bank is a publicly chartered nonprofit working to promote energy efficiency and clean energy investments to support the County's GHG reduction goals. The Green Bank enables residents and businesses to access financing to support projects that save energy, reduce GHG emissions, and create healthier environments. Funding for the Green Bank comes from lending partners, philanthropic partners, and renewable and energy efficiency contractors. In 2022, the Montgomery County Council passed a law establishing a dedicated annual source of funding for the Green Bank, estimated at $17 million/year beginning in FY2023.[11]

The Montgomery County Green Bank's residential program, or Clean Energy Advantage program (CEA), allows homeowners to access financing from the Green Bank's partner lending institutions to carry out energy efficiency and renewable energy projects. Energy efficiency projects can include improvements to air leaks, insulation, duct sealing, heating, ventilation, air- conditioning, hot water, and EV charging installations. Renewable energy projects include solar PV, geothermal, and energy storage solutions.

The Green Bank also has programs for commercial applicants to finance energy efficiency and renewable energy projects. These programs are available to commercial and industrial property owners, including nonprofits, common ownership community associations, multi-family properties, and tenants of commercial properties with consent of the property owner.

Philadelphia Green Capital Corp and Philadelphia Energy Authority

Philadelphia Green Capital Corp (PGCC) is the green bank affiliate of the Philadelphia Energy Authority (PEA). The PEA aims to develop the clean energy economy in Philadelphia by supporting energy efficiency projects for public schools, businesses, city buildings, and affordable residential buildings.

PGCC's two residential programs focus on financing the installation of new solar capacity for LMI households and communities. On the business side, PGCC provides loans for developing energy projects in nonprofit and multi-family properties, energy efficiency and renewable energy projects for nonprofits, residential or mixed-use properties serving LMI communities, energy efficiency, water conservation, and renewable energy projects for commercial properties, tax-exempt organizations, commercial portions of mixed-use buildings, and new construction projects, and lastly, solarization projects for commercial properties.

New York Green Bank

The New York Green Bank (NY Green Bank) is a State-sponsored organization that works with the private sector to address barriers in clean energy capital markets for entities that are already pursuing clean energy.

[11] Montgomery County Green Bank 20220201_10B.pdf (montgomerycountymd.gov)

The NY Green Bank offers warehousing and aggregation credit facilities, term loan and investments, credit enhancements, construction finance, and construction finance with term loan and investments to support sustainability infrastructure, low carbon technologies, climate change mitigation, and economic growth. More specifically, the NY Green Bank focuses on clean energy generation, energy efficiency, clean transportation, energy storage, sustainable agriculture, and sustainable water infrastructure projects.

Delaware Sustainable Energy Utility (Energize Delaware)

The Delaware Sustainable Energy Utility (DESEU) is a nonprofit organization working to support energy efficiency solutions, clean energy, and air pollution reduction programs through funding, financing, and educational programs for residents and businesses in all market segments.

The DESEU offers programs for residential applicants that include improving energy efficiency and comfort in homes, renewable energy upgrades to existing buildings and new construction, personalized energy saving strategies, solar panel installation, and recommendations for energy efficient appliances and products.

Commercial programs offered by the DESEU support businesses, farms, and public/nonprofit organizations. These programs include financing for energy improvements, energy efficient HVAC and lighting, water efficiency improvements, and general energy saving projects.

University of Virginia Community Credit Union (PowerSaver Loans)

The University of Virginia Credit Union's PowerSaver Loans support improvements to energy efficiency in homes, businesses, and vehicles.
PowerSaver Loans for the home target improvements for heating and cooling systems, insulation, duct sealing, solar panels, appliances, and home energy audits. Vehicle PowerSaver Loans provide reduced loan rates for the purchase of hybrid, electric, and other vehicles that meet green standards. Business PowerSaver Loans support green capital expenses and green improvements for real estate, small businesses, and businesses in the City of Charlottesville.

Additional Stakeholder Conversation Insights

Importance of developing a capital and administration base in the first years of the bank.
RGGI and IIJA funds should be leveraged as an important funding mechanism, either initially or a continuing source of funding. Green banks should also be proactive in courting additional funding sources from federal, state, and local government, or non-profits and businesses.

Understanding Regional Priorities
The needs of the region, and regulatory levers should define the structure and offerings of the green bank. However, not being fully tied to a municipal government allows for more flexibility in approach and offerings.

Strength of Partnerships
Green banks should look to leveraging existing resources by connecting with establish entities to utilize existing programs (i.e., utility incentives), to help shape the program model and programs (i.e., LEAP model programs), or as partners in administration of program aspects such as underwriting or C-PACE administration. Green banks can be flexible in what roles they take in programmatic and financial spaces.

Larger green banks look to fund programs instead of individual loans, allowing contractors to be the customer facing agents, while the green bank funds to animate private capital for increased overall impact.

Potential Complications

If the organization aims to be officially a bank, there could be complications with state and federal laws that need to be contended with.

While many green banks set out with the idea that they will be funded by return from projects, this is unlikely without significant initial size. To mitigate this, green banks should be flexible both in how they fund projects and what metrics they justify taking on a project with (i.e., energy savings vs. cost savings).

Emerging Trends

Green banks are shifting the types of programs they support, the audiences they target, and the goals they have. Many green banks initially targeted large commercial and residential customers with low hanging fruit projects such as lighting and insulation with the aim to show the financial viability of environmentally conscious investments. There is a shift in the thought leadership toward deeper energy efficiency retrofits, renewable energy, electric vehicles, and climate resilience with an emphasis on equity, setting up specific program to assist LMI communities, allowing for disadvantaged communities to take advantage of programs and pathways for decarbonization projects.

Observations from Discussions with existing Green Banks

ICF held discussions with the five existing green banks described above and multiple lending providers across the region. These conversations helped uncover five important categories of findings applicable to the planning and design of a successful Fairfax Green Bank.

1. Mission and Resources
2. Programs
    a. Project Financing and Lending Products
    b. Lead Generation and Technical Support
3. Funding
4. Partnerships
5. LMI Approach

Mission and Resources

The first finding was that there are three different models for green banks, depending on their characteristics, mission, financing sources and role on the market. Fairfax should carefully consider the options and align the selected model or models with an appropriate organizational structure and funding levels.

1. **Lending institution** – this model includes large-scale underwriting and lending services at both the project level and for aggregated portfolios. The prime example for this model is the New York Green Bank with a target range of $5M to $20M for individual programs.
2. **Partnership-focused financing and program administrator** – this model entails working with established loan providers and underwriters to structure targeted offers that may include a variety of lending structures, subsidies, and lead generation. An example of this model is the Montgomery County Green Bank.

3. **Catalyst organization** – this model functions as a trusted advisor, educator, and lead generator for an individual or group of financing partners and technology solution providers.

Programs

The second finding included identifying the various types of financing products and lead generation activities that a green bank, with partners, may offer. These focus areas will help the FGB to develop an appropriate suite of offers in the short- and mid-term that can be supported by available funding sources. The individual products, target market segments, and activities can be found in Table 21 and Table 22.

Table 21: Project Financing and Lending Product Area Options for a Fairfax Green Bank

Project Financing and Lending Product Areas	
Clean Energy and Climate Resilience Technologies	Renewable energy
	Energy efficiency
	Electric vehicles and charging infrastructure
	Climate resilience-related upgrades
Loan Product Collaborations with External Partners	Predevelopment loans (unsecured based on financial history of applicant)
	Secured loans (mortgage secured home equity loans for homeowners, equipment secured for commercial entities)
	Unsecured term loans (underwritten on energy savings and financial history)
	Commercial renewable project lending (in lieu of a PPA)
	Open ended lending solicitation for contractors
	Working capital lending for contractors
	C-PACE – Program administrator and/or lender
	Loan loss reserves to decrease risks and costs for other lenders
	Buying down interest rates to decrease risks and costs for other lenders
	Extending the maturity of product loans
	Technology subsidies and incentives to reduce total project costs
Internal underwriting and origination	Full service internal capabilities
	Focused on gap areas where alternatives are not available in the local market
	Portfolio warehouse lending

Table 22: Lead Generation Activities and Technical Support Options for a Fairfax Green Bank

Lead Generation and Technical Support Activities	
Lead Generation	Customized outreach programs for partner organizations
	Solarize Campaigns for increased adoption
	Recruiting for participants in virtual power plant platforms
	Promotion and marketing for existing programs and financial offers
Technical Support	C-PACE – technical support role for assessment and origination
	LMI-focused loan program design, outreach, and education
	Workforce training programs

Funding

The third finding is related to the potential sources of green bank funding and capital. This is an essential element for successful start-up and long-term viability for the FGB and there are multiple sources that could be combined to meet the needs of the organization. Government funding sources can be found in Table 23 for local sources, Table 24 for federal sources and Table 25. Philanthropic sources of funding are presented in Table 26. Additionally, the program can partially fund itself with fees for origination services and lead generation services as is seen in Table 27.

Table 23: Potential Local Government Sources of Funding for a Fairfax Green Bank

Local Government Sources of Funding	
Municipal Budgets	Municipal budgets can be an initial and ongoing source for green bank funding, although they are typically limited in the amounts that are available.
Settlements or other one-time sources of funding	Settlements or other one-time sources of funding could be deployed for green bank funding but are not common.
Dedicated Revenue Streams through Fees	Dedicated revenue streams for funding green banks or related program activity may be possible through fees that are assessed or allocated from sources including utility bills, activity fees, or local taxes.

Table 24: Potential Federal Government Sources of Funding for a Fairfax Green Bank

Federal Government Sources of Funding		
Infrastructure Investment and Jobs Act (IIJA) – Public Law 117-58 **Also referred to as the Bipartisan Infrastructure Law - BIL - program Funds**	Energy Efficiency and Conservation Block Grant Program (EECBG)	Fairfax County will receive a formula grant under the EECBG program; such funds can be used to support financing and related programming; could be ideal for starting up the FGB operation and creating credit enhancements, e.g. interest rate buydowns.
	Electric Vehicles	Fairfax County can apply for funding to support EV charging infrastructure, purchase electric school buses, and Fairfax Connector electric buses.
	Weatherization	Increased WAP funding could be tapped to provide incentives that improve the economics of deals financed by the FGB in low- and moderate-income housing.
DOE Loan Programs Office (LPO)	Innovative Clean Energy Loan Guarantee Program (Title 17)	$3 billion in loan guarantee authority focused on projects that deploy clean energy technology not widely commercially deployed in the U.S., and avoid, reduce, or sequester GHG emissions. The program is divided into fossil, nuclear, and renewable energy, and energy efficiency sub-sections. It is not clear whether the county will be able to leverage LPOs main options, however there are discussions underway to assess the potential for a 'virtual powerplant' funding scheme that could pool a large volume of building-scale EE and RE projects.
	Tribal Energy Loan Guarantee	Offers partial loan guarantees for tribal energy development.

Federal Government Sources of Funding		
	Advanced Technology Vehicles Manufacturing Loan Program.	Direct Loan Authority to support manufacturing of clean technologies
Energy Efficiency Revolving Loan Fund	Capitalization Grant Program	Provides $250 million via state allocations "to provide capitalization grants to States to establish a revolving loan fund under which the State shall provide loans and grants for energy efficiency audits, upgrades, and retrofits to increase energy efficiency and improve the comfort of buildings." This is a potential opportunity to seek start-up capital via State requests.

Table 25: Potential State Government Sources of Funding for a Fairfax Green Bank

State Government Sources of Funding	
State Energy Program	Virginia Energy will be getting increased funding though IIJA, and the County may be able to capture and deploy some of that funding, depending on how the state agency plans to use the funds.
RGGI Funding	The state has received over $200 million in RGGI allowance revenues to date. By statute, about half the funds are to be used for low-income weatherization and related housing innovation grants, and the other half for local government climate resilience/flood control grants. Though these funds are currently in limbo as the new administration seeks to leave the RGGI program, it is not clear that these funds could be returned, so there remains a fair likelihood that they will ultimately be disbursed. The County could use the weatherization funds to support projects in low- and moderate-income housing; combined with financing, this could enable deep retrofit investments in affordable housing.
Partnership with Virginia Clean Energy Advisory Board	The green bank could create a local pilot program for disbursing loans or rebates for the installation of solar energy infrastructure in low-income and moderate-income households through the "Low-to-Moderate Income Solar Loan and Rebate Fund".
Pilot Program with Dominion Energy	As the utility creates and rolls out new targeted programs and offers, the green bank would create local pilot projects to increase awareness and adoption within the County.

Table 26: Potential Philanthropic Sources of Funding for a Fairfax Green Bank

Philanthropic Sources of Funding	
Grants	Large non-profit organizations may be willing to provide grants that can be deployed to address specific areas of interest to their mission and could be used for either engagement activities or potentially for initial capital funds.
Program Related Investments	Non-profits with a significant interest in investing their funds to improve living conditions and energy-related programs, may be willing to provide capital for direct investing in project-level financing products.

Table 27: Potential Sources of Funding from Origination Services and Lead Generation Payments for a Fairfax Green Bank

Sources of Funding from Origination Services and Lead Generation Payments	
Percentage of New Contracts	Origination of new loans and/or contracts for partners could create a modest fee as a percentage of the contract value or as a flat fee, in arrears. This arrangement would need to be established in advance by the green bank and partner organizations.
Outreach/Lead Generation Fees	Outreach activities that yield qualified new leads for partner organizations could create a modest fee that is provided to the green bank. This arrangement would need to be established in advance.

Based on the sources and amounts of funds that the green bank can secure, that capital can then be deployed and used for a wide variety of products and programs. The targeted market segment, technology type, project/program characteristics, and partnership approach will weigh heavily in the design of specific offers. The list of potential options is described in the first finding above. However, additional operational expenses will also be incurred by the Fairfax Green Bank and should be included in the planning and budgeting process. Costs for operations can be significant and include:

- Staffing for green bank administration
- Office space and expenses
- Program design and implementation
- Program tracking and administration
- Marketing and promotion of programs
- Partner and sub-contractor costs
- Technology setup and ongoing fees
- Costs of financing and banking
- Risk management and reporting
- Travel expenses

Partnerships

The fourth finding was the potential for effective partnerships and educational opportunities with external lending institutions and industry advocates. As the green banking sector grows and evolves, there are lessons and examples that can be incorporated into the Fairfax Green Bank's plans along with opportunities for collaboration with other entities that are seeking ways to expand their impact.

LMI Approach

Potential Programmatic and Educational Partners

- Existing traditional banking institutions in the region and nationally when already partnered with a green bank
- Existing green banks, including those that were interviewed and others as they emerge
- Local credit unions and related entities
- Energy-focused lenders including the Clean Energy Credit Union and Inclusive Prosperity Capital
- PACE Lenders such as the Virginia PACE Administration
- American Green Bank Consortium

The fifth finding was the importance of developing tailored approaches to LMI programs and incorporating equity considerations info both the planning process and program design. There are dedicated local and regional organizations that can provide input and guidance on how to engage with underserved members of the community on clean energy-related finance programs. Information about successful efforts from around the country can be applied to the Fairfax Green Bank, as well as lessons from struggling programs. Fortunately, increased awareness and funding opportunities for the needs of frontline communities can be deployed to help Fairfax provide meaningful impact.

Resources for Developing and Funding LMI and Equity-Focused Programs

- One Fairfax policy and related resources
- Combined funding opportunities (federal WAP, RGGI, Dominion incentives) with Green Bank funding to create compelling and unique programs
- Virginia Clean Energy Advisory Board LMI solar pilot program

Legal and Organizational Structure

Overview of Section

This section of the report reviews options and provides recommendations for the structure and legal implementation of the Green Bank. In making recommendations this section considers the statutory authority for formation of the Green Bank, the goals of the County as determined by County leadership, and the County's expressed interest in collaborating with other neighboring jurisdictions in pursuit of those goals.[12] Based on the review outlined below we recommend that the County incorporate the Green Bank as a non-stock corporation that is qualified under section 501(c)(3) of the Internal Revenue Code ("IRC") as a charitable organization and section 509(a)(3) of the IRC as a support organization for the County. Such a nonprofit corporation could be structured to include other neighboring jurisdictions, either now or at a later date.

Statutory Authority

The formation of a County green bank is authorized by the Green Bank Statute. The statute permits any locality to "by ordinance, establish a green bank to promote the investment in clean energy technologies in its locality and provide financing for clean energy technologies."[13] The Green Bank Statute permits the locality to determine whether the green bank will be established in one of four ways. As a:

1. Public Entity;
2. Quasi-Public Entity;
3. Nonprofit Entity; or
4. Depositary Bank.[14]

The Green Bank Statute permits a green bank to engage in a wide variety of finance and consumer protection activities and "any other activity as needed to support the mission of the green bank." In addition, the statute requires the locality to "offer private lending institutions the opportunity to participate in the green bank. . ."[15] We concur with County staff that this latter provision can be satisfied by permitting and encouraging lending institutions to participate in financing programs created by the Green Bank.

Choice of Entity Structuring Options

In reviewing the suitability of the four types of entities permitted by the statute we considered several factors in the context of existing Virginia legislation:

- Is the entity suitable for achieving public purposes?

[12] This section of the report reviews a variety of matters of Virginia and federal statutory law. It is intended as general guidance and not as a legal opinion. It should not be relied upon as authority for taking any legal action without further advice of counsel.
[13] The Green Bank Statute, subsection A.
[14] The Green Bank Statute, subsection C.
[15] The Green Bank Statute, subsection D.

- Does the entity have the necessary powers?
- Does the entity have a well-defined governance structure?
- Is the entity able to incur debt and issue bonds?
- Other factors specific to the type of entity.

The results of that review are presented in the following sections and outlined in Table 28.

Table 28 Overview of Green Bank Structure Options

	Public Entity	Quasi-Public Entity	Nonprofit Entity	Depository Bank
Suitable for achieving public purposes?	✓	✓	✓	
Have the necessary power?		✓	✓	✓
Well-defined governance structure?		✓	✓	✓
Can incur debt and/or issue bonds?	✓		✓	
Other factors (notes)	Would not have separate legal existence and could not easily provide services outside the county	Taxing powers likely not politically appropriate for benefits that are not necessarily evenly shared	A non-profit entity meeting certain criteria could qualify as a "63-20 corporation" under IRS rules with power to issue tax-exempt bonds	The County could only play a role in governance if it was a depositor

Public Entity

An existing or new County government department formed for the purpose would qualify as a public entity. Such an entity would clearly be suitable for advancing public purposes. However, because Virginia is a Dillon's Rule jurisdiction, it is likely that a governmental body would be constrained in its activities to those specifically set forth in the Green Bank Statute,[16] which would substantially limit its flexibility. Its "governance" would be as permitted to county bodies in Virginia law but would not include any persons other than elected or appointed officials of the County. It would have no separate legal identity and would be an integral part of the County government for liability and contracting purposes. It could incur debt only for the purposes permitted to counties,[17] such as energy efficiency for county buildings, but not for other purposes contemplated by the Green Bank Statute such as lending to citizens of the county. It could not easily provide services outside the county.

Quasi-Public Entity

The only potentially applicable quasi-public entity appears to be a special district. Virginia Special District Legislation provides that special districts can be formed for purposes which include:

[16] *See*, Local Government Autonomy and the Dillon Rule in Virginia, http://www.virginiaplaces.org/government/dillon.html

[17] *See*, Va. Code Ann. § 15.2-2600 *et seq*.

> "heat, light. . . and power and gas systems. . . economic development services; promotion of business and retail development service . . .transportation and transportation services within a service district."[18]

The latter could include Electric Vehicle ("EV") charging stations. The districts seem to be primarily for the creation of infrastructure, and to this end they can impose taxes within their service district and acquire and own real property, facilities and equipment.[19] The powers do not specifically include the direct power to issue debt or finance improvements for third parties but suggest that service districts can do so though the auspices of other agencies.[20]

There is limited structural guidance on district governance, but broad ability to structure. The founding locality may: "create and terminate a development board or other body to which shall be granted and assigned such powers and responsibilities with respect to a special service district as are delegated to it by ordinance adopted by the governing body of such locality or localities. Any such board or alternative body created shall be responsible for control and management of funds appropriated for its use by the governing body or bodies. . ."[21]

On balance, the powers of a Special District do not appear to fit well with the intended operation of a green bank. We do not expect that taxing powers would be politically appropriate for benefits that are not necessarily evenly shared.

The Code of Virginia also allows counties to establish various sorts of authorities, such as water and wastewater and parking authorities,[22] but none of them appear to be suited to operate as a green bank.

Nonprofit Entity

Virginia non-stock corporations are general purpose entities that can take any legal action consistent with their purposes and any restrictions set forth in their articles of incorporation.[23] Their powers include buying owning and selling property, borrowing and lending money, making contracts and making donations for the public welfare or for charitable purposes.[24] They need not have members.[25] A non-stock corporation is not limited to being a nonprofit corporation, but by adopting certain related restrictions in its articles of incorporation, including a limitation on the distribution of profits to private parties, it can qualify as a 501(c)(3) charitable organization under the internal revenue code ("IRC").[26] 501(c)(3) charitable organizations are not subject to income taxation and can accept tax deductible charitable contributions, for example from foundations.[27] They can make loans or investments as "program related investments." These generally must be made to serve the organization's purposes and at below market rates or otherwise on more favorable terms than bank loans or private investments.[28]

A nonprofit entity meeting these qualifications can be formed for a public purpose, and its sole obligation is to pursue that purpose. It has an extremely broad range of powers, and the non-stock corporation law provides full but flexible instructions for governance. It can incur debt. A 501(c)(3) charitable organization can also qualify as a 509(a)(3) support organization under the IRC in support of the County government.[29]

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[18] Va. Code Ann. § 15.2-2403 1. and 2.
[19] Va. Code Ann. § 15.2-2403 6.
[20] Va. Code Ann. § 15.2-2403 12.
[21] Va. Code Ann. § 15.2-2403 9.
[22] *See*, https://law.lis.virginia.gov/authorities/
[23] Va. Code Ann. § 13.1-825.
[24] Va. Code Ann. § 13.1-826.
[25] Va. Code Ann. § 13.1-837.
[26] IRC § 501(c)(3).
[27] *See generally*, https://www.irs.gov/charities-non-profits/charitable-organizations
[28] *See generally*, https://www.irs.gov/charities-non-profits/private-foundations/program-related-investments
[29] IRC § 509(a)(3). *See*, https://www.irs.gov/charities-non-profits/section-509a3-supporting-organizations

To qualify it must (a) provide benefits to the supported organization (the County), in this case advancing County policies for energy efficiency and renewable energy and providing direct assistance to low-income citizens of the County in furtherance of those goals and (b) the County should have the power to regularly appoint or elect a majority of the directors or trustees. Support organization status makes transactions in which the County supports the green bank, or the green bank supports the County, less subject to scrutiny, it makes it easier to obtain 501(c)(3) status, and it avoids the nonprofit organization being classified as a private foundation.

A non-profit entity meeting the criteria specified above could potentially qualify as a "63-20 corporation" under IRS rules[30] with power to issue tax-exempt bonds. This would allow it to issue bonds for County projects or local government projects within the county. Title to projects financed in this manner must vest in the local governments when bonds are repaid. It also could potentially serve as a crowd-funding vehicle for county residents (or others) to help fund its activities. As a 501(c)(3) organization it would not generally be subject to federal securities laws.

Depositary Institution

Virginia Law authorizes formation of many types of depositary institutions. Most of them are for-profit entities which are not well suited to carrying out public purposes. They could not accept gifts, their income is taxable, and the County would have limited ability to fund them. The one exception is a credit union, which is defined as a cooperative nonprofit.[31] A credit union, by contrast, can certainly make market rate loans and issue debt and elsewhere in the report we note that several credit unions have been formed specifically to do clean energy lending. While such credit unions would make good partners, a credit union is probably not a good vehicle for all the activities that the County would hope a green bank to engage in. It could not accept charitable contributions or make grants to low-income citizens but might make sense as an affiliated entity. It must be operated by and for its members and must have a specified field of membership.[32] the County could only play a role in governance if it was a depositor. Other than being a depositor the County's ability to fund a credit union may be limited. It is subject to state banking regulation, which adds a layer of administrative complexity. A credit union might eventually make sense as an affiliated entity of the green bank but could also be perceived as a competitor by partner credit unions.

Intergovernmental Cooperation

Section 15.2-1300 of the Code of Virginia, Joint exercise of powers by political subdivisions, provides:

> Any power, privilege or authority exercised or capable of exercise by any political subdivision of this Commonwealth may be exercised and enjoyed jointly with any other political subdivision of this Commonwealth having a similar power, privilege or authority except where an express statutory procedure is otherwise provided for the joint exercise.

Considerations for a Regional Entity

- There are no legal constraints on the creation of a regional green bank as opposed to one bound by the county.
- During organization of a Fairfax Green Bank, the County should consider flexible governance to allow for the potential for a regional entity (Northern Virginia or beyond) at some point in the future after Fairfax County proves the concept

[30] So named because it meets qualifications set forth in IRS Revenue Ruling 63-20 to issue bonds "on behalf of" its governmental beneficiary (the County).
[31] Va. Code Ann. § 6.2-1300, *et seq.*
[32] Va. Code Ann. § 6.2-1327 B. This could include residence in the county or another "common bond," which could potentially include interest in the Green Bank's mission.

It seems clear that other jurisdictions could join with the County in forming a green bank, or that the green bank could be formed on behalf of the County but structured so that other jurisdictions could join in the future. The Code of Virginia § 15.2-1300 statute provides for entering into an intergovernmental agreement and empowers funding of the joint activity. Since all the entities have the power to form a green bank as a nonprofit entity they can agree to do so jointly and separately agree on funding and other related matters.

We also note that the Northern Virginia Regional Commission[33] would have the power "when requested to do so by a member locality or group of member localities, (i) to participate in the creation or organization of nonprofit corporations to perform functions or operate programs in furtherance of the purposes of this chapter;".

Funding the Green Bank

The Code of Virginia gives counties the power to fund a variety of specific activities, including fairly broad powers to fund charitable organizations and intergovernmental cooperation, discussed below. However, the Green Bank Statute does not give specific power to provide funds to green banks,[34]

1. A locality may make like gifts and donations to any nonprofit organization that is exempt from taxation under § 501(c)(3) of the Internal Revenue Code that is engaged in providing energy efficiency services or promoting energy efficiency within or without the boundaries of the locality.[35] The same provision permits funding to any nonprofit association or organization furnishing services to beautify and maintain communities or to prevent neighborhood deterioration.[36]
2. Any locality may make appropriations of public funds, of personal property or of any real estate and donations to. . . any charitable institution or association, located within their respective limits or outside their limits if such institution or association provides services to residents of the locality; however, such institution or association shall not be controlled in whole or in part by any church or sectarian society.
3. Preservation of existing housing in safe and sanitary condition and the production of new housing for persons of low and moderate income are public purposes and uses for which public money may be spent, and that such preservation and production are governmental functions of concern to the Commonwealth. Therefore, the governing body of any locality may provide by ordinance that such locality may make grants or loans to owners of residential rental property occupied, or to be occupied, following rehabilitation or after construction if new, by persons of low and moderate income, for the purpose of rehabilitating or producing such property.[37] Energy efficiency improvements should qualify as rehabilitation. This provision speaks to direct governmental action but could be done by the green bank as agent for the County and funded by the County. It requires, similar to the Green Bank Statute, that the County offer financial institutions the opportunity to participate in the loan programs.

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[33] *See*, https://www.novaregion.org/
[34] Counties may give lend or advance funds to authorities, Va. Code Ann. § 15.2-1205, but as discussed above the Green Bank does not appear to be an authority for these purposes.
[35] Va. Code Ann. § 15.2-953 A. Note that the language does not specifically restrict funding to energy efficiency but to an organization that provides energy efficiency services.
[36] Va. Code Ann. § 15.2-953 B.
[37] Va. Code Ann. § 15.2-958.

4. A county may locate and operate a retail fee-based electric vehicle charging station on property the locality owns or leases.[38] This activity could be performed by the Green Bank on behalf of the County and funded by the County.

In addition to these County-specific provisions, the County has several sources of authority to fund intergovernmental entities and programs.

1. If the County is or becomes a member, of any organization or association which has as its principal objective development of concerted action among participating localities for the benefit thereof and for the benefit of the region as a whole, is authorized to appropriate funds to such organization or to provide goods and services to such organization, all for the purpose of advancing the welfare and economic interests of such locality and the citizens thereof.[39]
2. As discussed above under Intergovernmental Cooperation, two other provisions of Virginia law relating to intergovernmental cooperation would provide general authorization for funding a multijurisdictional green bank.

Governance

Board of Directors Structure

All the types of entities discussed above, other than a division of County government, would be required or empowered to establish a board of directors to manage the organization. Members of the board who are County officials can keep a connection for the County to the management of the Green Bank and speak for the County's objectives. Other members can bring in additional finance and programmatic expertise and make connections to other parts of the community. Our experience, and the experience of other green banks suggests that a mixture of the two is desirable. They can be appointed in a single process or by different processes. For example, County officials could serve *ex officio* or just be appointed from time to time by the County. IRC Section 509(a)(3) status, which we recommend seeking, would require County appointment of a majority of the board, but for non-governmental appointees that could be done on the advice of a Green Bank board nominating committee. Choices on appointment process will be reflected in the articles of incorporation of the Green Bank, which can stipulate that the requirements cannot be amended without County consent.

Duty of Directors

The Virginia Code provides:

> The members of the governing bodies of any locality or political subdivision *and the members of boards, commissions, agencies and authorities thereof and other governing bodies of any local governmental entity*, whether compensated or not, shall be immune from suit arising from the exercise or failure to exercise their discretionary or governmental authority as members of the governing body, board, commission, agency or authority which does not involve the unauthorized appropriation or misappropriation of funds. However, the immunity granted by this section shall not apply to conduct constituting intentional or willful misconduct or gross negligence.[40] (*Emphasis supplied.*)

This would certainly cover a governmental or quasi-governmental body and appears to be broad enough to cover the Green Bank, especially if it is a support organization. It would likely not cover a credit union. Directors of a charitable organization have a duty to faithfully carry out the purposes of the organization, and a fiduciary duty with respect to funds donated to the organization, although the statute quoted above

[38] Va. Code Ann. § 15.2-967.2.
[39] Va. Code Ann. § 15.2-1304 A. and B.
[40] Va. Code Ann. § 15.2-1405.

may provide them with more protection than would ordinarily be the case. The directors of a credit union must generally serve the interests of their member depositors, although if it is founded to work in the renewable energy and energy efficiency space that could serve as the unifying category of membership. Either a nonprofit corporation or a credit union would acquire directors' and officers' insurance.

Public Meetings and Freedom of Information

The meetings and records of a governmental or quasi-governmental body would clearly be subject to the Virginia Freedom of Information Act.[41] This act also governs "other organizations, corporations or agencies in the Commonwealth supported wholly or principally by public funds."[42] Accordingly, a nonprofit corporation's status would depend on its funding. A credit union would probably not be subject to these laws depending on the status for these purposes of deposits, if any, made by the County.

[41] Va. Code Ann. § 2.2-3700 *et seq.*
[42] Va. Code Ann. § 2.2-3701, (definition of Public Body).

Next Steps and Considerations for Establishing a Fairfax Green Bank

Following review of the clean energy market, conversations with stakeholders and a review of governance and structuring options, ICF developed a set of stakeholder-informed next steps and considerations for the County to consider. Input from stakeholders thus far has provided valuable insight on the need for such an organization and the kind of products and services it could provide. Prior to implementation and establishment of a green bank the County additional work should be done to ensure that a range of voices are heard to continue to inform how the organization could function. In developing recommendations, ICF also worked to understand how the organization could start and reach a position of financial sustainability.

Mission and Focus

Core to any organization is a strong mission and focused purpose. A mission statement helps shape how organizations grow and ensures that their scope of services does not drift from their original intent. Stakeholders throughout the process outlined the types of focus areas for a new Fairfax Green Bank. They sought an organization that:

- Advances the clean energy marketplace in Fairfax and serve as its voice, in effort to drive climate investments;
- Creates models for market transformation through programs and loan products; and
- Serves as a conduit to financial services.

An emphasis should be put on enabling participation, particularly for low- and moderate-income homeowners and renters, many of whom have barriers to participation. In this way, a Fairfax Green Bank can transform the marketplace, while allowing private lenders to scale and grow participation in climate investments. An outcome of this approach is an organization that works collaboratively and with existing financing providers, rather than competitively for origination and financing.

Key Partnerships

Partnerships are key to the success of nearly every existing green bank. Existing organizations have established financial models which help remove known barriers by leveraging these partnerships. A Fairfax Green Bank should take advantage of these existing models by partnering with providers who are already offering financing products in the local market but need support with origination and marketing. By focusing green bank activity on origination services and using existing loan products for underwriting and lending, a green bank can ensure that the local marketplace is growing and using products, instead of scaling their own operations in underwriting and loan officer roles. This is particularly important in the early years of the entity where resources are scarce. From stakeholder discussions, it was noted that there is already a robust collaboration with existing green banks and scaling their successful models, programs, and partnerships will maximize value to the County. Specific mention was provided to the Clean Energy Credit Union and Inclusive Prosperity Capital, who provide a variety of loan products to existing green banks in the residential and commercial marketplaces respectively.

In addition to collaboration with lending partners and other green banks, creation of a Fairfax Green Bank should allow for opportunities for regional collaboration, first for a Northern Virginia-based green bank and eventually for among DMV regional entities. If possible, financing products with common traits could be offered across borders allowing developers, trade allies, homeowners, and businesses to all access similar resources. Through such collaboration, common marketing and educational programs could be built to allow for both efficiencies and broader scale.

High-Potential programs

Based on feedback received and research of existing banks, a handful of specific programs and loan offerings could be considered by a new organization. As the Fairfax Green Bank looks to develop programs it has an opportunity to serve as a one-stop shop for clean energy programs and information in the community. Growing and enabling the clean energy investment market depends not just on the financing product, but the overall program design. Outreach, marketing, technical assistance, and transaction support are key to moving the needle relative to the baseline.

- **Commercial Lending:** A commercial loan product has been made available by most existing green banks to support the energy efficiency and renewable energy implementation. These loan products have been offered with an origination fee to provide financial resources to the green banks. Examples include: Montgomery County's CLEER- secured loan based on equipment or PGCC's unsecured Catalyst loan.
- **Residential Lending:** A residential loan product is also typically made available by existing green banks to support implementation. These products could be linked to existing programs such as Solar United Neighbors and Solarize Nova. Examples include Montgomery County's residential loan program, which could be offered through the Clean Energy Credit Union or another local credit union.
- **Focused program offerings:** Stakeholders were interested in an organization that provided both focused technical support and financing to underserved market segments. These include low- and moderate-income populations, small businesses, non-profits, affordable housing developers, and EVSE for multifamily dwelling units. All represent areas of the market which could benefit from financing products and technical support programs to better enable and grow clean investments. Example programs include: PGCC's program for LMI solar, which monetizes SREC early in the process to support financing.
- **C-PACE management:** Local C-PACE management is provided in several green banks as an anchor product that has potential to support commercial clean investments. Virginia's C-PACE program is managed by the Virginia PACE Authority but has yet to close a loan in Fairfax County. Local management or a partnership with the Virginia PACE Authority for the program could create more activity and provide a fee to support a Fairfax Green Bank. Examples include: C-PACE programs from the Philadelphia Energy Authority and Montgomery County Green Bank.

In addition to loan products and financing offerings, the importance of educational work in the community was emphasized by stakeholders and existing green banks. Foundational educational work on both the benefits of climate investments and the specifics of products offered by the green bank.

Type of Organizations and Related Startup Approaches

ICF's recommended approach for a Fairfax Green Bank is highly dependent on the level of available funding and the organization's priorities to be established by the County. As described in the Programmatic and Financing Gap Assessment chapter, green bank organizations can provide a range of purposes and services. County stakeholders will need to determine the green bank's goals along a spectrum of options (for example: allocating funding to either increase the total volume of interventions or provide a special emphasis on underserved low- and moderate-income populations). Organizational priorities also need to meet financial realities.

A new green bank in Fairfax County will need to establish financial sustainability to ensure that it can remain in operation and continue to provide programs, loans, and educational services. During the ramp-up phase, funding will be needed for both operational expenses and initial tranches of funding for programs. The required financial resources are likely to come from both the County and external sources, depending on the model and the ability of the County to establish financial partnerships. Once the Fairfax Green Bank is established and operating, the majority of the financial resources would be allocated to

program financing with a smaller portion going to administration, marketing, and ongoing operating expenses. In larger clean energy financing entities, these ongoing expenses could be largely covered by earnings from financing operations (e.g. earned interest and origination fees), while in smaller entities, they may need to be covered in part by continued County budget allocations. As part of Table 29 below, ICF provided a range of information for consideration related to costs and scope of a FGB, however, without specific details on the type of programs, it is difficult to provide specifics on the ongoing funding ranges. Similarly, it is challenging to provide a specific impact (in terms of dollar values, GHG emissions reductions or other co benefits) without more specific program selections.

In reviewing existing green banks, all had some level of initial capital, and each relied in part on ongoing funding from a sponsor governmental entity (or reoccurring dedicated revenue from a tax, which is the case for Montgomery County Green Bank). Additionally, in some cases, initial funding was provided over a period of 2-3 years, to allow for initial planning and program design upfront. In the current context, this type of approach would allow the organization to prepare for federal funding related to the IIJA and other opportunities that may arise for capital infusions for clean energy financing entities. Over time and at sufficient scale, financing programs generate incremental revenue, such that government sponsorship and funding would primarily focus on new service offerings and expanded investment capital, as opposed to ongoing administration functions for existing programs.

Figure 9 represents the conceptual trajectory for potential capital sources for clean energy financing institutions in the Growth Approach model described below over the first five years of operation.

Figure 9: Potential Capital Infusions by Operational Year and Source

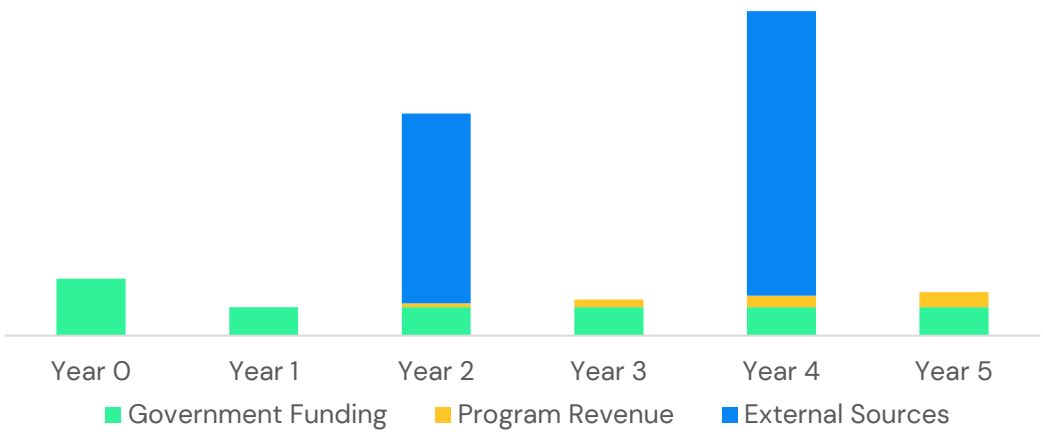

Table 29 provides an outline of three organizational approaches for consideration, based on initial capital availability, structure, and impact. These approaches can be described as the following:

Lean Approach

The Fairfax Green Bank would operate as a startup company and rely largely on initial seed capital and small allocations of operating dollars. Funding would be used almost exclusively for operations and administration. The small staff would prioritize building an organization that is financially sustainable over time and initially focus on project origination while leveraging small programmatic fees and funding opportunities to reach a point of long-term solvency.

Growth Approach

The Fairfax Green Bank would operate using initial seed capital that provides a runway for several years of operations as it grows and impact. With a larger amount, it could be used for both operations and administration, but also to create lending products. The organization would be very focused on origination services with key partners providing lending services, but it would have the ability to run some focused LMI and equity focused programs.

External Capital Approach

The Fairfax Green Bank would operate at a full level with a large initial capital or ongoing investment from state or local resources. After launch, the organization would be able to quickly offer a range of lending services and programs including subsidized LMI and equity focused offers. The organization would use strategic partnerships to provide comprehensive clean energy lending products.

Table 29: Potential Pathway Attributes

	Lean Approach	Growth Approach	External Capital Approach
Example Organization		Montgomery County Green Bank	Energize Delaware (DESEU)
Initial Funding (over several years)	$0.5 to $2 Million	$3 to $12 Million	Over $20 Million
Ongoing Funding Sources	County-provided operational funds and some lead generation revenue	County-provided funds, partner direct investments over time, state, or federal funding	Some local funds, but primarily external including RGGI, state, federal, and market sources
Staffing Approach	1-2 Positions Would need an active and engaged board to support some functions	3-10 Positions Strong organizational leadership needed, but the organization would have some redundancy	10-20 Positions Staff could include lending officers and loan analysts for underwriting
Initial LMI Programs	Minimal programs, since focus would be on pursuing a financially sustainable model	Some programs, likely through partnerships and credit enhancement products	Extensive programs, dependent on funding
Education and Marketing Resources	Minimal. Need to rely on partner organizations or County resources.	Dedicated individual for all marketing, education, and promotion	Dedicated resources for sector level marketing, education, and promotion (commercial, residential, LMI residential, etc.)
Lending Services	Origination Only	Origination, credit enhancement products	Origination, credit enhancement products, underwriting and some loan servicing

Scale of Impact	Limited opportunities for impact	Strong ability to drive activity for selected programs	Maximum impact and ability to attract national partners
Financing Partner Examples	Established providers, i.e. Clean Energy Credit Union	State and regional partners, green banks, community development financial institutions	Institutional investors, large banks, national-scale solution providers
Philanthropy Partnerships	Limited opportunity beyond coordination on outreach and potentially receiving grants for operations	Able to focus on distributing grants and potentially program related investments (PRIs) for programs	Able to focus on distributing grants, utilizing PRIs, and pursuing programmatic funding opportunities

Implementation Steps

This final section outlines the steps that the county would need to take to establish a green bank as a nonprofit organization and reviews additional work needed prior to its establishment.

Additional Predevelopment

While this document can serve as a guide to establishing a green bank in Fairfax County additional groundwork is needed, particularly with decision makers to ensure a green bank is designed in such a way as to match organizational mission and goals, with the priorities of County leaders and the long-term budgetary realities. In collaboration with leaders, an organizational mission statement, business plan, multi-year budget (including an outline of revenues and contributions from the County) and initial partnerships should be developed. This work can happen either before, or in conjunction with the legal steps outlined below to incorporate a Green Bank.

It is recommended that County leadership review options for the board of directors including whether to include key leaders from the County as ex officio members of the board and the variety of backgrounds that would be most helpful to the board's mission. Organizations have found it valuable to include a range of legal, financial and community members in their board makeup to provide guidance and expertise that is needed for a successful clean energy financing entity.

Finally, additional market research and outreach to stakeholders will likely be needed. In some market segments, such as EVs and EV charging infrastructure, little information was gathered about how a green bank might be able to change the market. Any new green bank will need to constantly adapt to the marketplace, but if there is a significant gap in time between the finalization of this study and the launch of the entity, information contained here may become outdated. Targeted outreach to markets where feedback was not plentiful would allow for a more complete analysis, particularly for groups with EV financing experience and low-income multifamily housing.

Steps to enable operations

Once additional definition on the organization is complete, there are a handful of actions required by the County in order to establish the organization as a legal structure. These are outlined in the steps below:

Step 1: Hold a Public Hearing

The Green Bank Statute provides specific requirements about noticing and conducting a public hearing.[43]

[43] Va. Code Ann. § 15.2-958.3:1 E.

Step 2: Adopt a County Ordinance

The County should adopt an ordinance to authorize creation of the Green Bank by incorporating a nonprofit corporation to act as the Green Bank. It should empower the Green Bank to undertake any or all of the functions specified in the Green Bank Statute and specify that it will offer private lending institutions the opportunity to participate in Green Bank programs. It can authorize expansion of the Green Bank to include other jurisdictions. It can authorize provision of services to County residents and businesses as the County's agent that the County could itself perform (such as assistance for low-income housing) and permit County staff to aid the Green Bank. It should authorize County officials to enter into a mutual support agreement with the Green Bank and to amend it from time to time without further authorization. If the County has, or plans to adopt, a Green Roof Incentive Program,[44] it could authorize the Green Bank to provide marketing or administrative services to the program.

Step 3: Incorporation

County staff (or an attorney or agent) acting as incorporator should incorporate the Green Bank by filing articles of incorporation with the Corporation Commission. The articles must include language required for 501(c)(3) and 509(a)(3) organizations and the manner in which directors are appointed (e.g. *ex officio,* appointed by the County, or elected by the incumbent board members). The articles may name the initial directors, or they can be named subsequently by the incorporator (to the extent not serving *ex officio*).

The incorporator should apply for a federal Employer Identification Number for the Green Bank and name the initial board if not done in the articles.

The board should adopt initial resolutions that establish bylaws, appoint officers, and authorize establishment of bank accounts. It should adopt a conflict-of-interest policy. It should appoint board committees.

The officers should file an application with the IRS for 501(c)(3) status. That application will include the election to be treated as a 509(a)(3) support organization.

Step 4: Staffing Plan, Hiring Employees and Operational Actions

The board should adopt an initial budget which will include a staffing plan. To the extent that funding for the start-up is coming from the County that would be a shared discussion between County officials and the designated 501(c)(3) board members. The board hires the Executive Director (however titled), and the Executive Director hires the balance of the staff. The County can consider having County staff provide support during start-up.

During startup, additional organizational actions should be taken including:

- Purchase insurance, including directors' and officers' insurance.
- Make a contract for payroll functions.
- Adopt personnel policies.
- Establish an office and acquire needed equipment, software and supplies.
- Hire accountants.
- Adopt a Freedom of Information policy (if it is determined that one is needed).

Step 5: County Support Agreement

The County should consider having a support agreement that outlines services expected to be provided by and to the Green Bank, any staffing support from the County and any specific funding arrangements. Such an agreement can provide for streamlined adoption of new program initiatives. If the County will provide office space, that can be covered.

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[44] Va. Code Ann. § 15.2-977.

Appendix A: Details of Related Clean Energy Policy

Green Bank Authorization

The formation of a local green bank was proposed under Virginia House Bill (HB) 1919, passed in 2021 and authorized by law through Code of Virginia § 15.2-958.3:1, Local green banks (the "Green Bank Statute"). The following were notable additions to the law from the original bill: a depositary bank option for establishing a green bank, infrastructure as a type of clean technology, and consumer protection standards to ensure transparency. The statute authorizes a locality to establish, through ordinances, to establish green banks to promote investments in clean energy technologies and provide financing for clean energy technology. HB 1919 establishes certain powers and functions of a green bank including:

- The development of the rules and procedures of the green bank
- The ability to finance and provide loans for clean energy projects through the green bank entities
- The ability to stimulate demand for renewable energy

HB 1919 requires that green banks be a public entity, quasi-public entity, depositary bank, or nonprofit entity. Localities are required to hold a hearing and publish notice prior to establishing a green bank. Additional guidance on Green Bank Authorization can be found in the Legal and Organizational Structure chapter of this report.

Virginia Clean Economy Act (VCEA) (HB 1526 and SB 851)

The VCEA puts Virginia on the path to a carbon neutral electricity sector. It mandates new measures to promote energy efficiency, sets a schedule for closing old fossil fuel power plants, and requires electricity provided by the state's largest utilities to be generated from 100% renewable sources, such as solar and wind. These targets are set for 2050 for the whole state, and 2045 for most of Fairfax County. To help meet these targets, the VCEA dictates that Virginia utilities develop 5.2 gigawatts (GW) of offshore wind generation, 16.1 GW of solar and onshore wind generation, and 3.1 GW of energy storage.

The VCEA also creates new funding for lower income residents that will be managed by the Department of Housing and Community Development. The VCEA mainly impacts the building energy sector and will continue to have a larger impact as buildings become more electrified, however this also impacts the transportation sector significantly as more vehicles transition to electricity as a fuel source.

Regional Greenhouse Gas Initiative

The Regional Greenhouse gas Initiative (RGGI) is a partnership of states designed to cap and reduce carbon emissions from fossil fuel-fired power plants by putting a price on the carbon emissions. It requires power plants to purchase allowances and then revenues are channeled back to the states to be used for purposes specified by law. In Virginia, funding is authorized for low-income energy efficiency programs, the new Community Flood Preparedness Fund, and overall program management.

Commercial Property Assessed Clean Energy Program (C-PACE)

Fairfax County's Commercial Property Assessed Clean Energy (C-PACE) program is a clean energy financing tool designed to provide long-term private funding to building owners for energy-saving, water-saving, and resiliency improvement projects within commercial properties. The C-PACE program provides 100% upfront capital to commercial property owners, contractors, and others to facilitate the financing of renewable energy, energy efficiency and resiliency projects on both existing buildings and new developments. The private loans are repaid via a special assessment connected to property taxes. This lending model enables building owners to undertake large-scale projects and improvements with minimal initial capital outlays, preserving cash flow and producing near-term operational savings.

C-PACE in Fairfax County was approved by ordinance in March of 2019 and is administered by the Virginia PACE Authority (VPA) which provides resources for potential applicants to learn about the C-PACE

program and apply for C-PACE funding. Further discussion on VPA and its role in Fairfax County can be found in the Programmatic and Financing Gap Assessment chapter of this report.

Appendix B: Clean Energy Market Methodology

This section provides an overview of the process and methodology ICF used to model the various intervention investment packages noted above. In section 1.5, two different sets of results are provided: (1) the estimated size of the addressable market for each package, and (2) the relative economics of each investment type.

The addressable market is the scale of financial opportunity in a given market segment for a given set of investments. Two methods were combined to calculate the addressable market: a building equipment stock turnover model and a technology adoption method. The stock turnover model was used to determine the annual volume of equipment and building component replacements, using typical annual turnover rates based on each technology package's estimated useful life. The technology adoption method was used to project a realistic fraction of the stock turnover that could be converted into financeable investments.

To estimate the economic performance of each intervention investment package in each market segment, a pro forma financial model was used to analyze project costs and energy savings, and then calculate net present value, payback period, and estimated return on equity. The incremental costs and energy savings for each intervention investment package (i.e., the difference in costs and energy usage by replacing equipment with high-efficiency versus standard-efficiency units) were used as the input variables in the pro forma analysis. Key assumptions for the economic analysis are listed in Table 30.

Table 30: Economic Analysis Assumptions

Input Variable	Residential	Commercial	Electric Vehicles
Equipment Lifetime	15 years[a]	20 years[b]	10 years
Annual Adjustment for Electricity Costs	3%	3%	3%
Annual Adjustment for Natural Gas Costs	3%	3%	NA
Annual Adjustment for Gasoline Costs	NA	NA	3%
Electricity Rate[c]	$0.123/kWh	$0.117/kWh	$0.080/kWh
Natural Gas Rate[c,d]	$1.23/therm	$1.23/therm	NA
Charging Fee	NA	NA	$0.30/kWh
10-year Loan Interest Rate	4%	9%[b]	9%
Discount Rate	3%	6%[b]	6%

NA = Not Applicable.

[a] Blends estimated service lives of HVAC equipment and appliances. Also applies to office intervention investment packages.

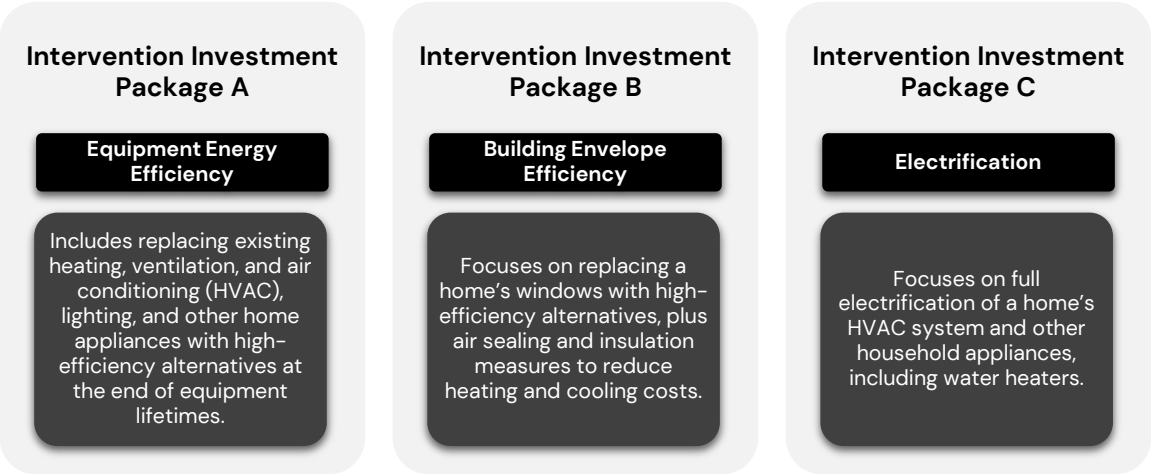
[b] Also applies to multifamily residential intervention investment packages.

[c] Calculated specifically for Fairfax County.

[d] 2020 residential value used (source data in dollars/thousand cubic feet). https://www.eia.gov/dnav/ng/NG_PRI_SUM_DCU_SVA_A.htm

Residential Energy Efficiency

Within the residential segment, the following clean energy investment packages were modeled as part of the market assessment:



To model the energy savings and cost implications of the residential single family and multifamily equipment energy efficiency investments packages described above, two baseline scenarios were developed. Energy usage and costs were estimated for both scenarios and then compared between these investments. Two baselines were required to account home heating fuel types, which include both electric heat pumps and natural gas furnaces as primary heating sources. The following equipment types were analyzed for each baseline scenario:

Baseline	Electric Equipment	Natural Gas Equipment
Baseline A	• Air Conditioner • Clothes Washer • Refrigerator • Dishwasher • Lighting	• Gas Furnace • Water Heater • Cooking Stove • Clothes Dryer
Baseline B	• Electric Heat Pump • Clothes Washer • Refrigerator • Dishwasher • Lighting	• Water Heater • Cooking Stove • Clothes Dryer

The three investment packages were modeled against each baseline. Each investment package was analyzed for energy consumption and cost and compared to the baseline scenarios. Cost estimates were based on the difference in costs from replacing standard-efficiency equipment with high-efficiency units, or replacing fuel-fired equipment with electric powered units. In this framework, the cost of the efficient choice is the incremental equipment cost above the baseline standard-efficiency unit. Other installation costs such as labor were assumed to be the same for both packages.

For Investment Packages A and B, the difference in energy use and costs was compared to both Baselines A and B. Investment Package C was only compared to Baseline A as Baseline B already includes electric HVAC equipment. A weighted average of relative savings from both of these comparisons was calculated

using the percentage of County homes with electric heat pumps or gas furnaces as their primary heating source.[45]

The market potential was then analyzed by scaling the per-household cost and energy savings estimates to the addressable market within the county. Using an annual turnover rate of about 7% (based on an average equipment life of 15 years as shown in Table 30), the total number of replacement projects (for single-family, small multi-family, and large multifamily) was used as an upper-limit estimate for total potential annual market size. Of this potential market, an assumed adoption rate was applied for each investment package, based on field experience from similar program types around the U.S. Applying this adoption rate yields an addressable potential for the volume of projects and their associated costs and savings that a Green Bank effort could realistically achieve.

Commercial Energy Efficiency

Within the commercial sector, the following investment packages were modeled as part of the clean energy market assessment:

Intervention Investment Package A

Energy Efficiency

Replacing HVAC, lighting, and other equipment with high-efficiency alternatives at the end of the product's lifetime.

Intervention Investment Package B

Electrification

Full electrification of a commercial building's HVAC system and other equipment, including air conditioners and heat pumps

While commercial buildings come in a wide variety of occupancy types, for the purposes of this simplified analysis the commercial building stock in Fairfax County was grouped into the categories of "Retail", "Office", and "Industrial," as defined by the Commercial Building Energy Consumption Survey (CBECS).[46] The energy efficiency investment packages above were analyzed for each building type.

To model the energy savings and costs of the packages described above, two baseline scenarios were used to compare with each package. The following equipment types were included in the baseline scenarios:

Baseline	Electric Equipment	Natural Gas Equipment
Baseline A	• Air Conditioner • Lighting	• Furnace/Boiler (gas) • Water Heating
Baseline B	• Heat Pump (Cooling) • Heat Pump (Heating) • Lighting	• Water Heating (gas)

Once the baseline scenarios were modeled for cost and energy savings, each intervention package was then analyzed and compared to the baseline scenarios. Similar to the method used for residential equipment, costs were estimated as the incremental equipment cost for high-efficiency units above standard efficiency units, or for electric vs. fuel-fired equipment.

[45] As reported by RECS (2015) https://www.eia.gov/consumption/residential/
[46] CBECS (2018). https://www.eia.gov/consumption/commercial/building-type-definitions.php.

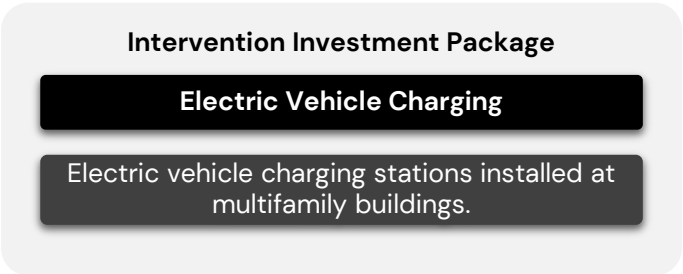
For Investment Package A, the difference in energy use and costs was compared to both baselines A and B. Investment Package B, these differences were only compared to baseline A, because baseline B already contains electric equipment. These comparative costs and savings were then averaged and normalized per square foot of floor space, because floor space is the most appropriate basis for estimating potential in commercial market segments.

After calculating the economic potential for each commercial investment package, the market potential was estimated by scaling the per-square footage cost and energy data to the addressable market within Fairfax County. Using an equipment turnover rate of 15 years for office buildings and 20 years for retail and industrial buildings, the total commercial floorspace in the county was scaled down to calculate an annual potential market size for equipment replacement. Of this potential market, an assumed adoption rate was applied for each investment package, based on field experience of similar programs around the U.S. The resulting addressable market potential represents the annual volume of energy retrofit investments and the associated energy savings that a Green Bank could realistically expect to achieve.

Electric Vehicles

EV Charging

For Electric Vehicle Charging, the following intervention investment package was modeled as part of the clean energy market assessment:



The market assessment estimated changes in County transportation sector GHG emissions and electricity use based on increasing electric vehicle (EV) adoption indirectly, by financing new electric vehicle supply equipment (EVSE) in multifamily buildings. Multifamily EVSE was selected as the preferred investment target because it is a market segment in which County action could effectively address market barriers. EVSE for single family homes was not deemed to be a priority, as existing EV sales and home electrical systems have been shown to exhibit fewer market barriers, and those are shrinking as EV costs continue to decline. Multifamily dwellings typically present more barriers to the installation and maintenance of EVSE given the inherent landlord-tenant investment challenge in which landlords are responsible for the upfront capital investment of the EVSE installation while tenants (EV drivers) experience the operational savings of using an EV. For this reason, public investment in multifamily charging can be an impactful example for the purposes of this market assessment.

To model energy consumption and cost implications of multifamily EVSE investments, a baseline scenario was developed and then compared against the investment package using the assumptions found in Table 31.

Table 31: Baseline Assumptions for Electric Vehicle Charging Modeling

Baseline Assumptions		
	Multi-unit dwelling number of vehicles	Because available vehicle ownership data does not differentiate between single- and multi-family households, the baseline assumes that multi-unit dwelling (MUD) residents own a County-average

Vehicle Population Assumptions		number of vehicles per household, noting that this likely overstates the actual market situation.
	Multi-unit dwelling internal combustion engine to EV/PHEV ratio	The ratio of internal combustion engine (ICE) vehicles to EVs and PHEVs was assumed to be the county average.
	Vehicle adoption/growth rates	It was assumed that vehicle adoption/growth rates in the county are consistent with US Energy Information Administration (EIA) Middle Atlantic rates for all new car sales, EVs, and PHEVs from 2016 to 2027. This assumption is likely conservative, though it also offsets the likely overestimate of current MUD vehicle populations.
EV Charging Assumptions	EV to EVSE port ratio	It was assumed that there is a 1:1 EV to EVSE port ratio in the county, although typically there is a higher ratio of EV to EVSE ports. While it would be expected that this ratio would grow as more EVs are adopted over time and EVSE is shared by more vehicles, this 1:1 ratio was used to create a more "conservative" approach that illustrates the near-term conditions of EV charging when adoption is low.
	EV charging costs in multi-unit dwellings	It was assumed that the charging stations would not be free to use for multifamily dwelling residents. In the scenario, use of the EVSE will cost the EV driver $0.30/kWh.
Vehicle Use Assumptions	Light-duty vehicle travelled miles and fuel efficiency	It was assumed that light duty vehicles (LDVs) are traveling 12,400 miles per year on average with an MPG of 30.9[a]

[a] Argonne National Laboratory. 2020. "AFLEET Tool." Retrieved from https://greet.es.anl.gov/afleet

Once the baseline scenario was modeled, the investment package was analyzed and compared to the baseline scenario. Costs for the intervention package were estimated as the costs for charging equipment and installation and the costs of increased electricity consumption. For EVSE investments, there is no existing equipment replacement market that an FBG effort would seek to address; rather, EVSE investments would be new projects in all cases. This means that the incremental cost method used in the buildings equipment market segments does not apply here; rather, the full cost of EVSE equipment is the investment package cost in all cases.

After the economic potential was calculated for the EVSE package, the market potential was analyzed by projecting EVSE costs based on local demographics and assumptions on future ownership of EVs. The market potential represents the annual project volume and the associated total amount of project financing that would be needed from the Green Bank, and the associated gasoline energy and GHG emission savings.

Electric Vehicles

Fleet vehicles are groups of vehicles owned and operated by commercial enterprises or public organizations in the county. Fleet vehicles were selected as a target segment because of the scalable emissions and cost savings benefits of incentivizing the electrification of fleets rather than individual privately owned vehicles. Similar to the multifamily dwelling EVSE scenario, County action could effectively address market barriers for fleets in a meaningful way. In this scenario, Fleet EVs and the required EVSE to support those vehicles were modeled. The following investment packages were modeled as part of the clean energy market assessment:

New electric vehicles for those fleet vehicles that showed a positive Total Cost of Ownership (TCO) over their useful life. TCO cost inputs include the purchase price of the vehicle, vehicle financing, depreciation, fuel, diesel exhaust fluid (if applicable), maintenance and repairs, insurance, license, and registration. If a TCO for an EV is positive, it means that the total capital and operational costs of the EV over its lifetime are lower compared to an internal combustion engine vehicle over the same timeframe.

Positive TCO Vehicle Types

Light Duty Passenger Vehicles

Medium Duty Pickups

Transit Buses

Refuse Trucks

EVSE to support the charging requirements of the fleet vehicles that showed a positive TCO over their useful life. Because of the nature of fleet operations, this scenario assumes a 2:1 ratio of vehicles to Level 2 (L2) charging ports and a 4:1 ratio of vehicles to direct current fast charging (DCFC) ports. The type of charging varies by vehicle class:

- Light Duty Passenger Vehicles are assumed to use L2 only, while all other MHD vehicle types assume the use of DCFCs for fleet applications. L2 chargers can typically be installed within the capacity of existing building/facility wiring, using a 240-volt circuit, and so require only modest installation costs. DCFCs, by comparison, typically require additional utility-grid connection support for their higher-voltage characteristics.
- For each vehicle type's total system cost, the charger equipment and installation costs are included in proportion with the relevant vehicle to charging port ratio.
- Fuel Savings Assumptions
    - It was assumed that 33.7 kWh displaces 1 gallon[47] of gasoline and 40.7 kWh displaces 1 gallon of diesel.
    - Lifetime fuel savings, GHG savings, and electricity consumption are spread evenly across the 10-year period.

Solar and Storage

On-Site Solar

For on-site solar photovoltaic (PV) the following investment packages were modeled as part of the clean energy market assessment:

Solar Investment Package	Solar Investment Package
Residential	**Small to Medium-Sized Commerical Solar**
On-site solar PV for Residential single-family homes in the county	On-site solar PV for Small to medium-sized commercial buildings in the county

To model energy savings and cost implications of these investment packages, a baseline scenario was developed based on annual installed systems and cumulative solar capacity through 2020 (using the latest available data from NOVEC and assuming an annual growth rate of 20%) with an estimate for 2021.

The market potential for 2023 to 2027 was forecasted based on existing adoption trends, with an assumed acceleration rate from improving project economics as costs for installed solar goes down and

[47] AFDC:Alternative Fuels Data Center: Fuel Prices (energy.gov) "Electricity… is converted to GGEs at a rate of 33.7 kWh per GGE (per AFDC)."

avoided electricity costs rise. Assumptions for on-site solar project economics and market forecasting for residential adoption can be found in Table 32. On-site solar project economics and market forecasting was completed using the process shown in Figure 10:

Figure 10: Residential On-Site Solar Modeling Methodology

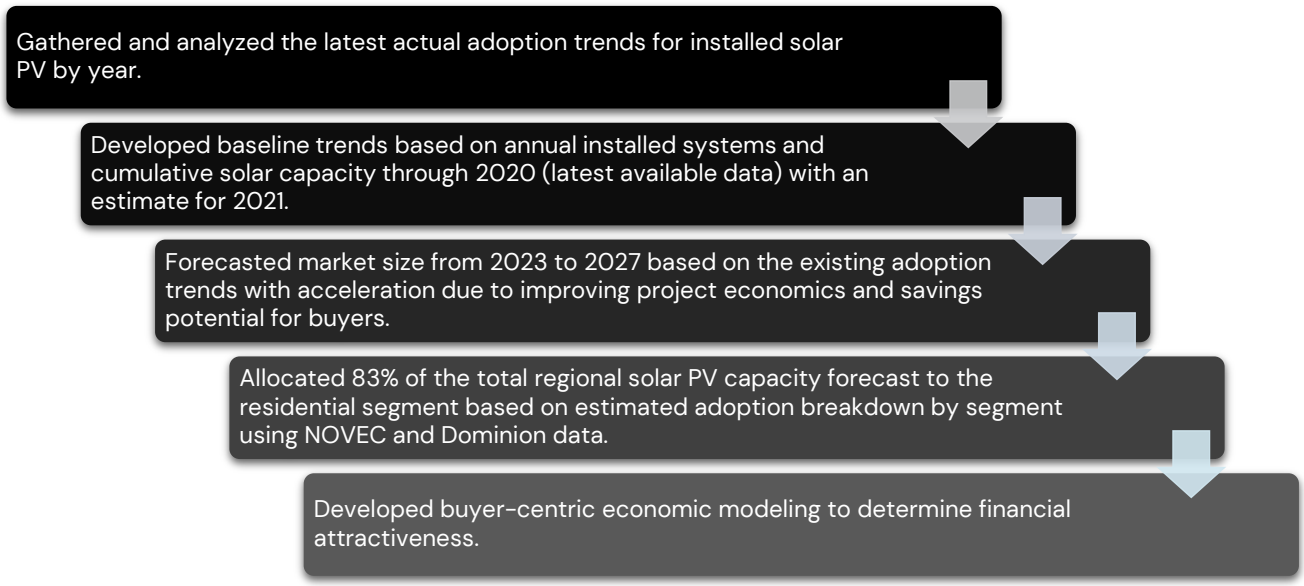


Table 32: Residential Solar Modeling Assumptions

Residential On-Site Solar Modeling Assumptions	
Average Solar PV System Size	6.0 kW
Planned System Lifetime	25 years
Annual Solar Performance Degradation	0.5%
Forecasted Total System Cost Basis	NREL ATB 2021[a]
Annual Maintenance Costs Basis	NREL ATB 2021 and inverter replacement in year 15
Solar Production Forecasts Basis	Typical residential system designs and local weather data using PVWATTS
Avoided Utility Rates Basis	Current Dominion residential tariffs and increased annually at 3% per year
Electricity Savings Basis	Forecasted residential utility rates when applied to solar PV output forecasts
Income Tax Benefits and Costs Basis	Existing individual federal and state rates, but no ITC was included beyond 2023 due its planned expiration in that year
Solar Renewable Energy Credits (SRECs)	No value was assigned to SRECs generated by the solar system

[a] More information on the NREL Annual Technology Baseline can be found at: https://atb.nrel.gov/electricity/2021/data

Small and medium commercial project economics and adoption were based on assumptions found in Table 33 and the methodology seen in Figure 11:

Figure 11: Small and Medium Commercial On-Site Solar Modeling Methodology

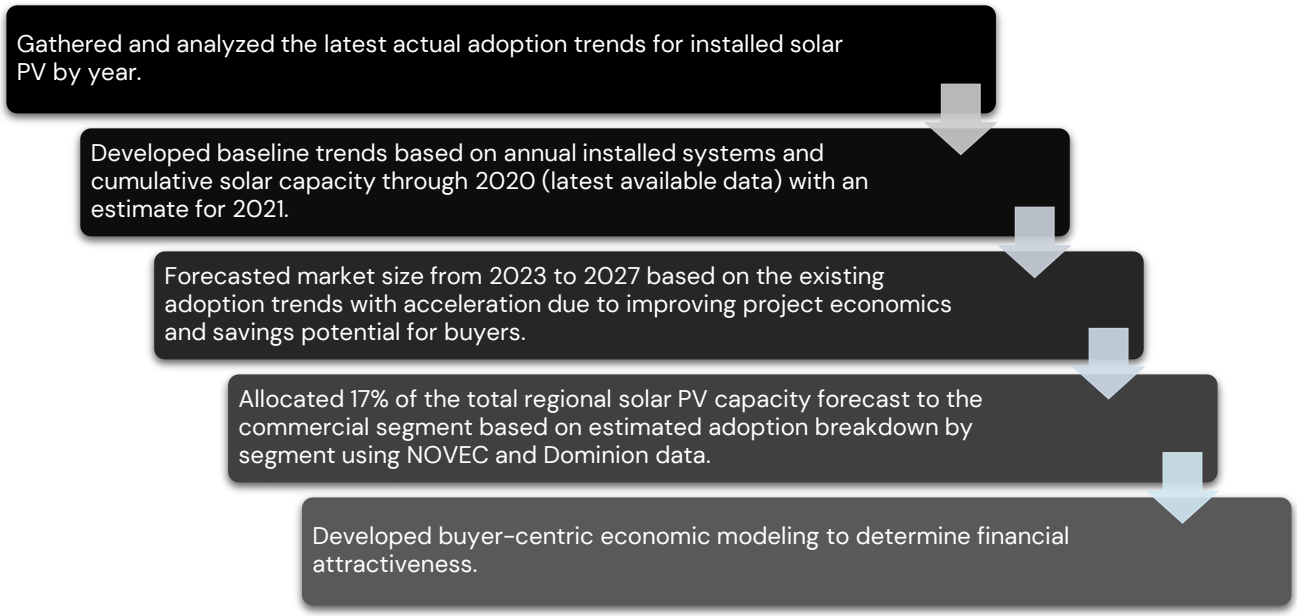


Table 33: Small and Medium Commercial On-Site Solar Modeling Assumptions

Small and Medium Commercial On-Site Solar Modeling Assumptions	
Average Solar PV System Size	75.0 kW
Planned System Lifetime	25 years
Annual Solar Performance Degradation	0.5%
Forecasted Total System Cost Basis	NREL ATB 2021
Annual Maintenance Costs Basis	NREL ATB 2021 and inverter replacement in year 15
Solar Production Forecasts Basis	Typical residential system designs and local weather data using PVWATTS
Avoided Utility Rates Basis	Current Dominion residential tariffs and increased annually at 3% per year
Electricity Savings Basis	Forecasted commercial utility rates when applied to solar PV output forecasts
Income Tax Benefits and Costs Basis	Existing commercial federal and state rates, and ITC was included at 10% for commercial buyers
SRECs	No value was assigned to SRECs generated by the solar system

Community Solar

For community solar investment potential, the target market of community solar subscribers was assumed to comprise all residential customers, with 30% of subscriptions from qualified low- to moderate-income (LMI) customers. The assumptions and approach for establishing the community solar market size were based on the following actions:

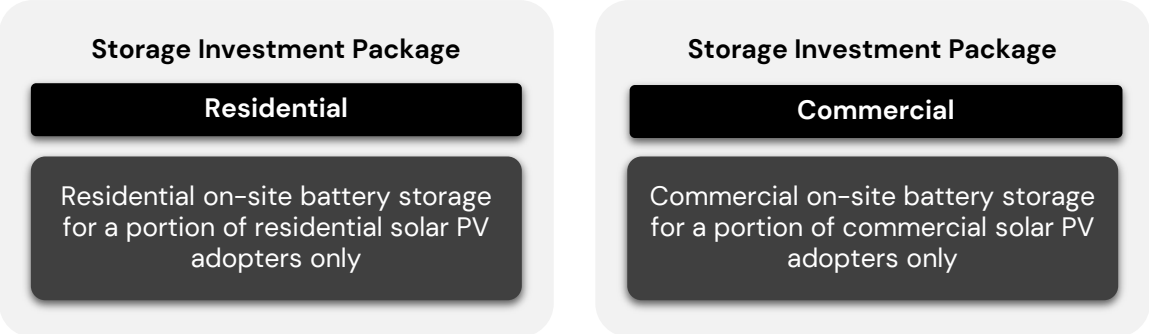
- Gathered current and forecasted residential electricity accounts for all of Fairfax County.
- Determined average annual electricity consumption for residential accounts.

- Researched planned community solar program in Virginia to determine potential for subscriber cost savings and determined that it may be possible to save roughly 10%.
- Based on the savings assumptions, all available community solar program capacity is highly likely to be developed and subscribed.
- Allocated statewide community solar program capacity (200MW) to Fairfax County (12.1%) pro-rata based on estimated annual load served in Fairfax County compared to entire state.
- Estimated annual solar output based on typical small utility scale projects assumptions for regional deployment using PVWATTS[48]
- Developed an annual adoption forecast based, starting in 2024 and being fully subscribed by 2029.
- Allocated 30% of all residential subscriptions to qualified LMI customers based on state program guidelines.

To model energy savings and cost implications of the community solar intervention investment package, an annual adoption forecast was developed, starting in 2024 and fully subscribed by 2029. As with EVSE equipment, there is no baseline stock-turnover market against which to measure project economics or adoption rates.

Energy Storage

For energy storage, the following investment packages were modeled as part of the clean energy market assessment:



No standalone battery storage (without solar PV) was included due to poor economic returns and lack of existing market activity for this technology.

The market potential for residential and commercial storage were forecasted based on residential and commercial solar adoption forecasts and applied escalating annual storage attachment rates. The total investment value was calculated using Lawrence Berkeley National Laboratory (LBNL) cost estimates for residential and commercial battery storage systems. As with EVSE and community solar investments, there is no baseline stock-turnover market against which to measure project economics or adoption rates. The energy-storage economic analysis and forecasting were based on the following approach and assumptions:

- Evaluated national trends for behind-the-meter battery storage adoption and drivers.
- Considered individual residential and commercial storage project economics and determined that there was not an independent basis for adoption of standalone storage.
- Determined that the primary adoption motivator for storage is when combined with solar PV and utilized an "attachment rate" approach.
- Based the residential storage capacity forecasts on the residential solar adoption forecasts and applied an escalating annual storage attachment rate from 2% to 8%.
- Used an average residential battery storage system capacity of 7.5kW and 20.25kWh.

[48] More information on the PVWATTS can be found at https://pvwatts.nrel.gov/

- Calculated annual usage for residential storage applications with the assumption that the primary use case is for occasional grid outages.
- Based the commercial storage capacity forecasts on the commercial solar adoption forecasts and applied an escalating annual storage attachment rate from 1% to 4%.
- Used an average commercial battery storage system capacity of 60kW and 120kWh.
- Calculated annual usage for commercial storage applications with the assumption that the primary use case is for peak load management.
- Net electrical load increases with use of battery storage due to round-trip efficiency losses estimated at 15% of the annual utilization of the storage capacity.
- Calculated the total investment value using LBNL cost estimates for residential and commercial battery storage systems.

Co-Benefits

Air Quality Co-Benefits

Changes in levels of air pollutant emissions as a result of the various investment packages were estimated in terms of annual emissions of nitrogen oxides (NO_x), ozone season NO_x, sulfur dioxide (SO_2), total particulate matter (PM), total organic carbon (TOC), volatile organic compounds (VOC), lead, and greenhouse gases such as carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O).

NO_X such as nitrogen dioxide (NO_2), are a group of respiratory irritant gases resulting from the combustion of fossil fuels that react in the atmosphere with VOCs to create ground level ozone and smog on hot days. SO_2 and PM are also respiratory irritants that can result from the burning of fossil fuels. Air-borne lead can be produced from coal combustion and is a toxin that can affect many aspects of the body, including the nervous, immune, reproductive, developmental, and cardiovascular systems.

Air pollutant emissions were estimated to show the impacts of increased electrification and decreased natural gas consumption separately. The results of those separate analyses were then combined to show the net impact of electrification and decreased natural gas consumption on air pollutant levels. Pollutant levels decreased where the emission savings from reduced consumption of fossil fuels such as natural gas, gasoline, and diesel, were greater than the emissions produced from increased electricity production on the current electricity grid.

The Equipment Energy Efficiency and Equipment Efficiency Plus Envelope intervention packages for Single-Family and Small Multi-Family Residential buildings resulted in decreased levels of all air pollutants. The Electrification Plus Envelope intervention for Single-Family buildings increased levels of CO_2, annual NO_x, ozone-season NO_x, and SO_2. The Electrification Plus Envelope intervention for Small Multi-Family buildings and the Energy Efficiency and Electrification intervention for Large Multi-Family buildings increased levels of the same pollutants as Single-Family Electrification Plus Envelope intervention, with the addition of increasing methane slightly. The largest overall decrease in CO_2e was seen for the Single Family Equipment Efficiency Plus Envelope investment package.

For the Commercial sector, Energy Efficiency interventions decreased levels of all air pollutants for the three Commercial building types in this analysis. However, the Energy Efficiency and Electrification intervention increased levels of annual NO_x and ozone season NO_x for each Commercial building type, while decreasing levels of the other air pollutants. The largest overall decrease in CO_2e was seen for the Office Energy Efficiency and Electrification intervention investment package.

The Multi-Family EV Charging intervention and the Fleet Electric Vehicles + Charging intervention decreased levels for all air pollutants except for ozone season NO_X and SO_2. Changes to TOC and lead levels were not calculated for these interventions.

Changes to air pollutant emissions were only calculated for CO_2, methane, N_2O, annual NO_x, ozone season NO_x and SO_2 for the On-Site Solar, Energy Storage, and Community Solar market segments. The On-Site Solar sector saw decreases for all air pollutants for both the Single-Family On-Site Solar and Commercial On-Site Solar interventions. The Single-Family Energy Storage and Commercial Energy Storage interventions in the Energy Storage sector saw a very slight increase for all air pollutant levels. Lastly, the Residential Community Solar intervention saw decreases in all air pollutant levels.

Table 34 summaries all the pollutants avoided by investment packages.

Table 34. Total Emissions Avoided by Intervention Investment Packages (MT)

Intervention Investment Packages	CO_2	CH_4	N_2O	CO_2e[a]	Annual NO_X	Ozone Season NO_X	SO_2	PM[b]	TOC	VOC
Single-Family Energy Efficiency	1,244.06	0.10	0.02	1,251.64	0.56	0.65	0.34	0.01	0.02	0.01
Single-Family Energy Efficiency plus Envelope	2,623.93	0.23	0.06	2,648.33	1.10	1.30	0.68	0.13	0.19	0.09
Single-Family Electrification plus Envelope	(165.85)	0.02	0.05	(149.00)	(0.22)	(0.26)	(0.12)	0.21	0.30	0.15
Small Multi-Family Energy Efficiency	155.54	0.01	0.00	157.09	0.06	0.08	0.04	0.01	0.01	0.01
Small Multi-Family Energy Efficiency plus Envelope	345.34	0.03	0.01	348.40	0.15	0.17	0.09	0.02	0.02	0.01
Small Multi-Family Electrification plus Envelope	(431.04)	(0.02)	0.01	(427.74)	(0.24)	(0.29)	(0.14)	0.06	0.09	0.05
Large Multi-Family Energy Efficiency	60.21	0.01	0.00	60.82	0.02	0.03	0.02	0.00	0.00	0.00
Large Multi-Family Energy Efficiency and Electrification	(283.57)	(0.02)	0.00	(282.89)	(0.15)	(0.17)	(0.09)	0.02	0.04	0.02
Office Energy Efficiency	1,798.25	0.30	0.26	1,884.39	0.17	0.20	0.18	0.90	1.30	0.65
Office Energy Efficiency and Electrification	5,959.65	1.26	1.27	6,371.00	(0.48)	(0.56)	0.06	4.44	6.43	3.21
Retail Energy Efficiency	1,471.60	0.22	0.18	1,529.78	0.25	0.29	0.20	0.59	0.86	0.43
Retail Energy Efficiency and Electrification	5,395.76	1.10	1.08	5,746.15	(0.25)	(0.29)	0.15	3.76	5.45	2.72
Industrial Energy Efficiency	596.79	0.10	0.08	622.86	0.08	0.09	0.07	0.27	0.39	0.19
Industrial Energy Efficiency and Electrification	1,770.31	0.38	0.38	1,893.10	(0.15)	(0.17)	0.01	1.33	1.92	0.96
Multi-Family EV Charging	8,890.43	0.31	0.08	8,921.55	3.56	(1.10)	(0.40)	1.94	-	6.34
Fleet Electric Vehicles + Charging	5,331.14	0.08	0.03	5,344.07	21.94	(1.96)	(0.91)	1.68	-	1.78
Single-Family On-Site Solar	1,367.34	0.11	0.02	1,374.30	0.62	0.73	0.38	-	-	-
Commercial On-Site Solar	274.69	0.02	0.00	276.09	0.13	0.15	0.08	-	-	-

Single-Family Energy Storage	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	-	-	-
Commercial Energy Storage	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	-	-	-
Residential Community Solar	1,705.39	0.14	0.02	1,714.07	0.78	0.91	0.47	-	-	-

[a] Calculated in CO_2e.
[b] Includes PM_{10}, and $PM_{2.5}$.

Job Creation Co-Benefits

The job creation methodology is developed by the American Council for an Energy-Efficient Economy (ACEEE). On average, $1 million spent on the U.S. economy supports a total of 17.3 total jobs. Investments directed towards a specific industry may support greater or fewer jobs depending on industry as shown in Table 35. For example, a $1 million investment into the construction industry will bring about 20.3 jobs, while a $1 million in the energy industry would only bring about 9.9 jobs.

Table 35. Jobs per Million Dollars of Revenue by Key Sectors of the U.S. Economy

Industry	Jobs/ $ Million
Economy Wide Average	17.3
Energy	9.9
Manufacturing	13.8
Construction	20.3
Trade- Services	18.8
Government	21

Source: ACEEE 2011

Job creation from investment packages is calculated in two folds. First, the number of jobs created from investments in the construction of clean energy investments was calculated. This was determined by taking the difference between the number of jobs the construction industry will support and the average number of jobs economy wide created with a $1 million investment (i.e., 3 jobs per $1 million). This net number of jobs was then multiplied against the incremental investment per each investment package to get the net number of jobs created on year one.

The second part was to calculate the net jobs created from electricity, natural gas or fuel savings or generation over the lifetime of the investment package. With the improvements from investment packages, costs from electricity, natural gas and fuel decreases over the useful lifetime of the investment. These electric and natural gas savings will be spent elsewhere in the economy, which will create additional jobs. To calculate the number of jobs created, the difference in job creation between the economy wide average and the energy industry was found and multiplied against the annual savings. Finally, multiplying by the useful lifetime of the investment packages to determine the number of jobs created over the useful lifetime of the investment.

Table 36 summarizes the overall number of jobs created.

Table 36. Jobs Created from Intervention Investment Packages

Intervention Investment Packages	Net Jobs from Construction	Net Jobs from Savings	Net Jobs on Total Investments
Single-Family Energy Efficiency	68	98	100
Single-Family Energy Efficiency plus Envelope	203	209	82
Single-Family Electrification plus Envelope	82	74	31
Small Multi-Family Energy Efficiency	22	20	25
Small Multi-Family Energy Efficiency plus Envelope	36	39	15

Small Multi-Family Electrification plus Envelope	44	0	9
Large Multi-Family Energy Efficiency	7	7	13
Large Multi-Family Energy Efficiency and Electrification	10	(10)	0
Office Energy Efficiency	11	29	35
Office Energy Efficiency and Electrification	56	142	20
Retail Energy Efficiency	19	27	42
Retail Energy Efficiency and Electrification	69	173	24
Industrial Energy Efficiency	9	12	19
Industrial Energy Efficiency and Electrification	31	61	9
Multi-Family EV Charging	16	286	302
Fleet Electric Vehicles + Charging	70	231	300
Single-Family On-Site Solar	21	Not Calculated	21
Commercial On-Site Solar	3	Not Calculated	3
Single-Family Energy Storage	1	-	1
Commercial Energy Storage	0	-	0
Residential Community Solar	15	Not Calculated	15
Total	**792**	**1,397**	**2,190**