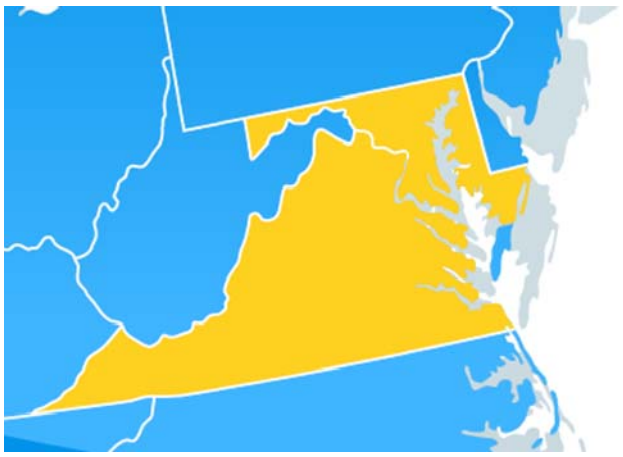
CHESAPEAKE CRESCENT INITIATIVE

energy | life sciences | security

Linking, Leveraging and Aligning Communities Across the Chesapeake Crescent Region of Maryland, Virginia and the District of Columbia



Prepared by
Garforth International llc
and the
Northern Virginia Regional Commission

INTRODUCTION

Local authorities possess a crucial role in driving energy efficiency cost savings and reducing greenhouse gas emissions and related economic development, in large part in response to recent challenges at the national level. Indeed, because of a lack of agreement on comprehensive national and international climate policies, the burden of achieving energy security, energy efficiency, greenhouse gas emissions reductions, and "green" job creation falls squarely on the shoulders of state and local authorities. Several cities and counties are rising to this challenge. These communities have recognized the need to plan and promote sustainable, affordable energy and emissions reductions policies tied to regional economic development strategies. These plans must manage the risks of rising energy prices, supply uncertainties and possible greenhouse gas penalties. This is no easy challenge in the middle of our current economic challenges.

Several energy-related, environmental and economic studies suggest that comprehensively addressing these challenges will become increasingly important for the cities in the region. Reports, such as the Virginia Governor's 2008 Climate Commission, and the 2007 Maryland Climate Commission, suggest that under a "business as usual" scenario, energy supply will become less reliable, energy will be more costly, and greenhouse gas emissions, with their deleterious environmental effects, will increase. Clearly, a "business as usual" approach is not a sustainable pathway to economic prosperity.

The "Chesapeake Crescent" region – the Commonwealth of Virginia, State of Maryland and District of Columbia – is home to several community-based approaches that are demonstrating remarkable resilience, leadership, vision and hope when addressing these challenges. As just one example, Loudoun County, Virginia, developed the nation's first long-term comprehensive Community Energy Strategy, recently recognized by the National Association of Counties as a national model.

PAPER PURPOSE AND APPROACH

The Chesapeake Crescent Initiative (CCI) engaged Garforth International and the Northern Virginia Regional Commission (NVRC) to develop a paper outlining existing discrete community energy planning efforts, their potential for energy/environmental impacts as well as their economic development potential. It is hoped that the paper will provide an effective basis for further discussions on the value proposition for linking, leveraging and aligning these efforts across the broader Chesapeake Crescent region, how potentially the region could work together to accelerate the achievement of energy efficiency goals, spur clean energy-related economic and workforce development opportunities, develop alignment with the Federal government's approaches and identify emerging cross-sectoral partnership opportunities.

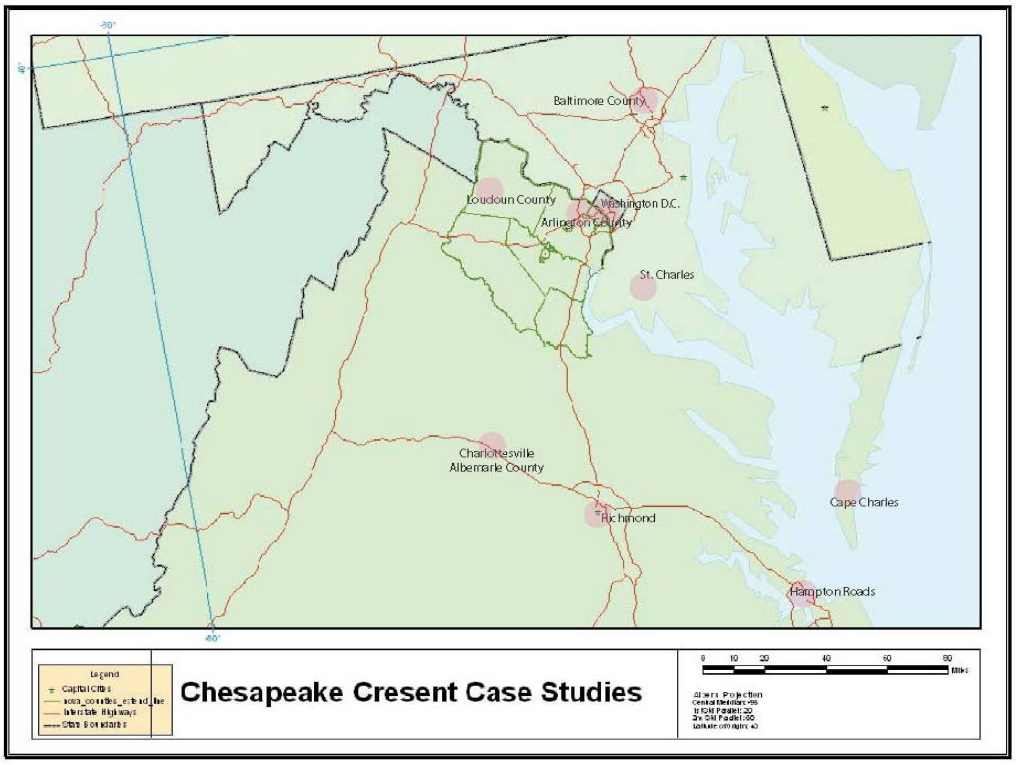
Thus, this paper is grounded in the following principles:

- Inclusion. Community-based energy strategies start with conversations that include and incorporate multiple issues, partners and approaches of a community
- Benchmarking. Community-based energy strategies rely on identifying and applying global and regional best practices and benchmarks
- Leveraging. By linking, leveraging and aligning community efforts across the region, the region as a whole may accelerate achievement of its energy savings and economic development objectives.

This survey examines selected "representative" communities from the Chesapeake Crescent region engaged in community energy development to determine their goals and aspirations, as well as their political processes for moving forward. It reviews the experiences of these communities in their efforts to create green jobs as well as to accelerate deployment of energy efficient and low-carbon technologies, practices and policies. The paper looks at the impacts on the economic development objective of increasing overall attractiveness of the community as a place to live and work and of creating attractive investment incentives and opportunities for business. A major focus is the importance of initiatives scaled to the community-level and the degree to which the examples are demonstrating the value of "scale" in implementation.

The communities reviewed in this paper include:

- Washington DC (10th Street Task Force)
- Baltimore County, Maryland
- St. Charles, Maryland
- Arlington, Virginia
- Loudoun County, Virginia
- Charlottesville, Virginia
- Albemarle County, Virginia
- Hampton Roads, Virginia
- Cape Charles, Virginia
- Richmond, Virginia



OVERVIEW OF REGIONAL ENERGY, CLIMATE AND ECONOMIC CHALLENGES

As is the case with the rest of the nation, the Chesapeake Crescent region performs well below international benchmarks in terms of maximizing energy efficiency, especially in the context of the built environment and associated transportation. Measured against global best practices, the region also lags in promoting and developing a clean and renewable energy supply and in adopting more efficient transportation alternatives.

ENERGY CONSUMPTION

The region is a significant consumer of energy when compared to the rest of the world. According to the U.S. Energy Information Administration, annual per capita energy consumption in Virginia is 345 million BTU's compared to Germany's 176 million BTUs or France's 182 million BTUs.[1] As another example, a recent energy study for Loudoun County indicated that annual energy use per square meter of residential and commercial space in Loudoun County was about 700kwh per square meter, a level at least twice that of comparable European communities.

At least part of this consumption can be attributed to energy inefficiency. In Loudoun County, a recent energy study found that approximately one-half of all energy used by the County was due simply to conversion and transmission losses in electricity generation.

Regional energy consumption is only expected to increase as population increases. The metropolitan Washington DC region alone must plan for the addition of over 1.5 million new residents in the next 30 years, placing enormous demands on housing, mobility, and energy. The Metropolitan Washington Council of Governments (MWCOG) estimates energy consumption in the metro Washington region will rise by 40 percent by 2050.

Increased energy consumption and demand will strain the region's energy infrastructure, grid and networks. It will also pose threats to our economic stability and prosperity if energy prices rise as they did between 2000 and 2005 when energy prices increased 14 percent for electricity, 53 percent for natural gas, and 68 percent for gasoline.

GREENHOUSE GAS EMISSIONS

The region is a significant emitter of greenhouse gas emissions (GHGs). A 2008 Metropolitan Washington Council of Governments (MWCOG) study reported that the District of Columbia emits over 19 metric tons of CO_{2e} per person, while Maryland and Virginia generate approximately 20 metric tons per person of CO_{2e} per person (MWCOG 2008).[2][3] By comparison, Germany and Denmark emit less than 10 metric tons of CO_{2e} per person. The Brookings Institution quantified transportation and residential GHGs for the 100 largest U.S. metropolitan regions. The Washington-Arlington-Alexandria-DC region ranked 100, Baltimore-Towson ranked 91, and Virginia Beach-Norfolk ranked 77 (Brookings 2008[4]). These poor results are largely due to the reliance on coal-based electricity, car-dependent transportation systems and inefficient homes and buildings.

Switching to current renewable energy options alone is not a viable solution to reducing GHG emissions because of the increasing demand for energy. For example, in Virginia, a study by the Virginia Center for Coal and Energy Research indicates that there is less than 300kW of renewable electricity from solar photovoltaic and wind energy produced in all of Virginia.

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[1] The gap is even wider, since the Virginia numbers do not included national defense, air traffic, maritime and national industrial emissions. The French and German numbers include these aspects.

[2] http://www.mwcog.org/environment/climate/Documents/Climate_Change_Report_Public_Review_Draft%207_9_08.pdf

[3] Metric tons and tons, with or without the CO_{2e} qualifier referring to greenhouse gas emissions in carbon dioxide equivalent, will be used interchangeably throughout the paper. CO_{2e} refers to the warming effect of the six GHG listed in the Kyoto Protocol

[4] http://www.brookings.edu/reports/2008/05_carbon_footprint_sarzynski.aspx

The transportation aspects of greenhouse gas emissions are critical elements in the D.C metro area. The number of vehicle miles traveled and the fuel use per mile have increased over the past few years. Technological improvements in transportation will not be sufficient to reduce emissions enough to meet target goals.

There are similar opportunities and challenges with respect to buildings due to the rate of growth in this area. In the US, there are currently 20,000 registered buildings under the U.S. Green Buildings Council (USGBC)'s LEED rating system. However, the rate of certifying new buildings and retrofitting existing buildings would have to increase logarithmically to cover a significant portion of approximately 129 million homes and 10 million commercial buildings in the U.S. within a reasonable period of time. There is strong evidence that simply relying on voluntary rating systems, such as LEED, to create sustained high levels of energy efficiency may not be effective. Even the USGBC recognizes this fact in its recent revisions of LEED.

GOVERNMENTAL RESPONSE

Local Level

Many governments in the region have recognized these challenges and have declared goals to reduce greenhouse gas emissions for their entire communities. Some have signed the Sierra Club's Cool Counties initiative declaring 80 percent reductions by 2050 from levels occurring somewhere between 1990 to 2005. Others have signed the U.S. Conference of Mayor's Climate protection agreement calling for similar reductions. However, the actual scope of most of these initiatives is either confined to emissions from government activities or to small demonstration projects at the scale of individual buildings, homes or a few handfuls of vehicles. Arlington County, Virginia represents the typical amount of energy use by local government – usually less than 5 percent of the community total – which highlights the challenges of scale in these approaches. [5]

State/DC

The governments of Virginia, Maryland and the District of Columbia have also responded to these energy related challenges through plans of their own.

The Commonwealth of Virginia.

In 2008, Governor Kaine organized a Climate Commission to assess GHG sources and establish an emissions target, which was set at a 30% emissions reduction below the business as usual projection by 2025. At 161 million metric tons of carbon dioxide equivalent ($MmtCO_{2e}$) this works out to be slightly below the State's 2000 emission level of 163 $MmtCO_{2e}$. Virginia also announced a voluntary renewable portfolio standard that targets investor-owned utilities to procure 15% more electricity by 2025 from renewable energy, from a baseline of year of 2007.

There are no concrete implementation plans linked to short- and long-term goals, large-scale integration of land-use, transportation, energy efficient housing and buildings, cogeneration, renewable energy, and more efficient use of grids and networks.

Recognizing the necessity of fusing economic development with sustainable energy policies, Governor Bob McDonnell in 2010 pledged to make Virginia "The Energy Capital of the East Coast."[6] To promote green job growth, he initiated the "Universities Clean Energy Development and Economic Stimulus Foundation", as well as the Virginia Offshore Wind Development Authority. In addition, Governor McDonnell has pushed ahead a $500 tax credit for each green job created in the Commonwealth, and proposed legislation to reward investor-owned electric utilities for wind energy. The Governor also

[5] http://www.mwcog.org/uploads/committee-documents/tlhWW1o20070126091653.pdf

[6] 2010 VA Energy Plan - http://www.dmme.virginia.gov/DE/VAEnergyPlan/VEP-2010.shtml

signed legislation authorizing localities to place liens equal in value to the loan against any property where clean energy systems are being deployed. This will allow access to secure loans for the initial acquisition and installation of clean energy improvements.

The State of Maryland.

In 2007, Governor Martin O'Malley established the Maryland Commission on Climate Change.[7] A Plan of Action was developed to address the causes of greenhouse gas emissions, identify actions to prepare for impacts on Maryland and establish goals and timetables for implementation.

Electricity use is the largest source of emissions (38%); transportation is second (32%); followed by residential and commercial and industrial activities (20%). The State emits over 115 $MmtCO_{2e}$, about 20 metric tons per capita. The Commission targeted reductions of 10% below 2005 levels by 2012, 15% by 2015, 25 to 50% by 2020 and 90% by 2050.

Maryland has an obligatory renewable portfolio standard that requires electricity suppliers to use renewable electricity for a portion of their retail sales reaching 20% by 2022. Maryland is also a member of the Regional Greenhouse Gas Initiative (RGGI), a regional cap-and-trade program covering Northeastern States aiming to reduce emissions from power generators.

Maryland's FY2012 budget clearly focuses investments on the expansion of Maryland's "green job" sector, by putting $7 million in Strategic Energy Investment Funds geared toward clean, renewable energy grants, and $1 million to support climate change programs. In addition, the FY2012 budget provides $6 million for weatherization grants, enough to improve the energy performance of nearly 4,300 low income homes, and $4.7 million for other energy efficiency programs primarily to assist low- and moderate-income Maryland families.[8] In 2011, Governor O'Malley aims to promote and expand Maryland's "green jobs" sector though legislation that promotes the purchase and use of electric vehicles in Maryland.

District of Columbia.

In 2010, Mayor Adrian Fenty released "A Climate Action Plan".[9] This created an emissions inventory indicating a per capita emissions level of 18 metric tons, below that of Denver (18.9) and above Baltimore (14.4). Buildings represent the greatest source followed by transportation, the latter exacerbated by a "head wind" of 400,000 daily commuters.

The District's Climate Plan aims to control emissions from local government operations, which at 720,000 metric tons are 6% of DC's total. The goal is to reduce emissions by 20% by 2012, 30% by 2020 and 80% by 2050, primarily through building efficiency retrofits and enhanced use of public transit.

In the realm of "green jobs", the DC Climate Action Plan calls for development and implementation of the "Clean and Affordable Energy Act of 2008" (CAEA), which would redirect existing utility assessment fees to a new Sustainable Energy Trust Fund to promote and catalyze energy efficiency projects throughout the city.

MOVING FORWARD

The region faces significant challenges and can expect further bumps in the road ahead. Prior approaches which have attempted to tackle the issue at the level of the individual building or through unintegrated, piecemeal efforts will not be able to meet the expected demands of the future or the goals set by state-level actions. Achieving the proper scale of initiatives is key. Comprehensive community-level approaches may provide an important element of the answer.

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[7] Maryland Commission on Climate Change - http://www.mdclimatechange.us/

8 http://baltimore.citybizlist.com/1/2011/1/21/Governor-Martin-OMalley-Outlines-FY12-Budget-Focused-on-Job-Creation.aspx

9 http://green.dc.gov/green/cwp/view,A,1231,Q,460764.asp

GLOBAL APPROACHES

As communities of the Chesapeake Crescent develop and implement individual energy plans, lessons may be drawn from the forty years of pioneering community energy management in countries such as Germany and Denmark. The continental divide of the Cold War, damaging environmental impacts from acid rain and the energy crises of the 1970s, triggered some European countries to successfully meet energy security and environmental challenges with policies and practices that systematically integrate energy efficiency, heat recovery, renewable energies, flexible energy distribution, transportation, and land-use development, increasingly referred to as Community Energy Planning (CEP).

Successful community energy plans incorporate these attributes:

- Consistent implementation over decades supported by all political parties
- World-Class energy efficiency in homes, buildings and vehicles
- Planning that integrates land-use and efficient transport choices
- District Energy systems enabling efficient energy conversion and waste heat recovery
- Multi-Fuel flexibility including renewable energies
- Integrated (Multi) utility approach both technically and institutionally
- Large scale development or redevelopment to gain early scale of new paradigms
- Community engagement informed by quantitative benchmarks

Since the early 1980's, Germany and Denmark have incrementally increased energy efficiency code requirements for new and existing homes and buildings at a national level. These codes were recently reinforced with required energy performance labeling. Energy markets are steadily being freed of many anti-competitive constraints to encourage efficiency and innovation. To accelerate clean and renewable energy availability, feed-in tariffs for biomass, solar, wind, other renewable energy and cogeneration have been established. District energy along with integrated transportation and urban development planning has been encouraging both with incentives and policies. Increasingly, these national policies and approaches are being adopted at the EU level, resulting in continent-wide efficiency gains and emissions reductions.

At the municipal level, cities such as Freiburg, Germany and Copenhagen, Denmark are good examples of successful community energy planning.[10] Land-use and transportation policies have successfully promoted residential and employment density, encouraging transportation options, and district heating and cooling at the neighborhood – and ultimately the city – scale. The current and future energy profiles of these cities rest less in the development and support of a few specific technologies or singular policies, but more on a planned and integrated approach to their energy and climate systems.

Energy sustainability in these international cities will be driven by balanced approaches that maximize energy efficiencies of existing systems, use of district heating and cooling, and transit-oriented urban development patterns, complemented targeted application and effective deployment of new technologies and practices.

Between 1990 and 2007, Denmark and Germany's energy efficiency gains have outpaced economic growth. Energy consumption per capita is no higher today than in 1990. At the same time, increased use of electricity from clean and renewable sources has increased to 15% of total. In aggregate, they have cut total emissions by 10 percent below 1990 levels.[11]

MID-ATLANTIC CASE STUDIES

[10] See Appendix 1 for more details

[11] EU Transport & Energy Directorate – http://ec.europa.eu/dgs/energy_transport/figures/trends_2030/index_en.htm

ARLINGTON COUNTY, VIRGINIA

Background

Arlington County is an urban county of approximately 26 square miles located directly across the Potomac River from Washington DC. The County's proximity to Washington DC, its public transportation network, and its highly skilled labor force have attracted an increasingly varied residential and commercial mix.[12] The County's current estimated population is 212,300, and forecasted to grow to 247,600 by 2040. Arlington's economy revolves around the US Government and service industries consulting to the US Government.

Sustainability Goals

In 2010, Arlington started to develop one of the nation's first long-term comprehensive Community Energy Plans which is expected to complete in the first half of 2011. Benchmarked against global best practices, the CEP has three overarching goals:

- Enhance Arlington County's economic competitiveness
- Ensure reliable and affordable energy supplies
- Demonstrate the County's long-term commitment to reducing its greenhouse gas emissions.

All sectors of the community are actively engaged in the development of the plan – commercial, governmental, academic and non-governmental. Using energy-related greenhouse gas emissions per resident as a surrogate for energy productivity as a whole, a core goal of Arlington is to cut its per capita emissions to at least 4.5 metric tons from the current 13.4 metric tons over the next 40 years.

The preliminary recommendations to meet the goal in ways that are economically viable and improve energy supply quality fall into four categories:

- Governance of the CEP implementation
- Specific targets and policies regarding built environment
- Specific targets and policies regarding transportation
- Enabling cross-cutting initiatives

The governance recommendations include organizational aspects at the city and neighborhood level, and regular reporting of results including energy costs, investments and jobs created and environmental performance. In addition, under cross-cutting initiatives the CEP calls for the creation of "high-quality green jobs" to implement the recommendations. Efficiency targets have been established for both existing and new construction and evolve over time.

Energy and Climate Performance

The CEP includes an inventory of energy consumption, use and supply as well as greenhouse gas emissions. Of all the energy used County-wide, 53 percent was used in non-residential buildings and 25 percent in homes. The transportation needs of residents consumed 9 percent and those of non-residents consumed 12 percent. Since homes and buildings consume 75 percent of all energy, the efficiency and supply of the built environment are the major focus of the Arlington CEP. By energy type, the generation and use of electricity accounts for 64 percent of all the fuel consumed, followed by gasoline and diesel fuel at 21 percent and natural gas at 14 percent.

Energy Supply Security

[12] http://www.arlingtonva.us/departments/cphd/planning/data_maps/cphdplanningdataandmapsprofile.aspx

Reducing the overall loss in the production and distribution of electricity strongly influences the Arlington CEP recommendations. Arlington has already recognized the challenge of transportation energy use, and through a multi-pronged approach including transit-oriented development, has achieved a making this a lower portion of its total emissions, and lower than the US average.

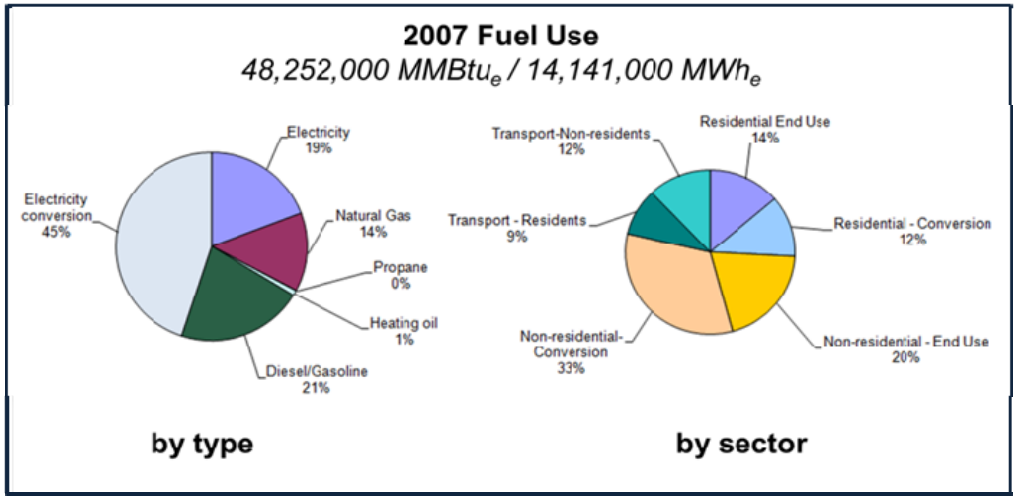

Figure 1: Arlington County 2007 Energy Overview

Arlington has a long history promoting density in urban planning and transit-oriented development, especially along the Ballston-Rosslyn corridor and Crystal City. As a result, the Arlington CEP has assessed that District Energy could be a viable option in much of the County. It is proposed in the Arlington CEP that high-density areas such as Crystal City and the Ballston-Rosslyn Corridor have the potential to economically transition towards large-scale District Energy systems starting as early as 2015. This will enhance energy supply security, improve property values and reduce environmental impacts.

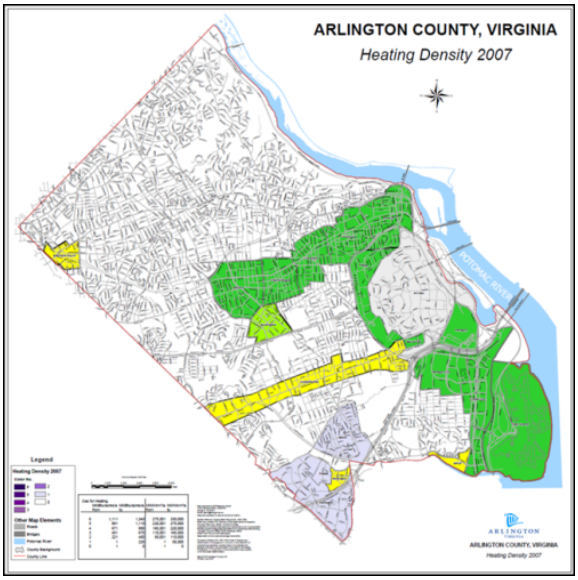

Figure 2: Arlington County Possible District Energy Zones

The CEP also calls for about 150 MW of distributed cogeneration to both reduce the peak loads on the wider grid and to generate heat for the District Energy system. To both reduce the summer peak and

further reduce GHG emissions, the CEP further recommends installing about 160 MW of Solar PV by 2035.

Strategic Approach and Leadership

A "Community Energy and Sustainability" (CES) Task Force was set up in early 2010 to guide the development of the CEP. Its membership reflects the diversity of the Arlington community and includes officials from local, state and federal governments, NGOs, academia, property development and management, other businesses and gas and electric utilities. The plan itself was developed by a team including County staff and consultants with US and European experience, ensuring a blend of local and global perspectives and benchmarking.

The public outreach and comment period for the CEP is extensive and accompanies the development of the plan from start to finish. The preliminary recommendations of the Task Force were released in September of 2010. These have been refined and are scheduled for final approval in April 2011.

Once the plan is completed, the recommendations also call for the introduction of new administration and governance processes designed to sustain the vision. Specifically, the plan recommends that the County Administration establish a "County Energy Team" and create an "Implementation Plan" to ensure that the CEP is reflected in all general plans.

Programs in Place

Arlington's CEP did not evolve in a vacuum. In 2007, the Arlington Initiative to Reduce Emissions[13] (AIRE) was started with the aim of reducing emissions from local government operations by 10 percent from 2000 to 2012. The AIRE program was designed to: (a) recognize, assist and encourage businesses to reduce emissions and energy needs, (b) partner with federal Energy Star programs, (c) encourage residents to reduce their energy usage, (d) reduce Arlington County government's emissions via energy saving retrofits, and (e) increase recycling in County facilities, homes and businesses.

Arlington was the first local government on the East Coast to purchase energy-efficient hybrid-electric vehicles (Arlington's Green Fleet);[14] currently 57 percent of Arlington's fleet of 1,148 vehicles. These vehicles are cleaner, improve the air quality, and have reduced reliance on foreign sources of oil. The County has long been considered a national model for transit-oriented development and has won multiple planning and transportation awards.

Successes to Date Against all Goals

The eight-month life of the Arlington CEP has been a model of analytic development and public participation and ownership. It is too early to say what results it will finally deliver, but indications are that it will be very successful.

Future Challenges and Lessons Learned

Key lessons of the Arlington CEP[15] to date are:

- Plan a timeline to ensure adequate analysis and public support. Compressing the plan and limiting public input risks confusion and delays with implementation.
- Remain flexible in during the development of the Plan.
- Require a high level of sustained political and community support as a prerequisite to develop a credible plan.

[13] http://www.arlingtonva.us/portals/topics/aire/Climate.aspx

[14] http://www.arlingtonva.us/portals/topics/ClimateGovernment.aspx

[15] http://www.arlingtonva.us/departments/DES-CEP/CommunityEnergyPlan/CommunityEnergyPlanMain.aspx

- Do not allow current challenges to overwhelm the transformative creativity needed to develop a breakthrough plan.
- Build clear bridges from planning to large-scale implementation.

BALTIMORE COUNTY, MARYLAND

General Background

Baltimore County is located in central Maryland and is considered to be part of the greater Baltimore-Washington area. In 2009, its population was approximately 789,814.[16] It is home to several world-class industrial manufacturing companies, including URS Corporation, building and transportation design company projects, GM Baltimore Transmission Plant, Lockheed Martin, Black & Decker, and Servestal Sparrows Point. Baltimore also has several university campuses, including two campuses of the University of Maryland, Towson University, Goucher College Stevenson University (formerly Villa Julie College), as well as the Community College of Baltimore County.

Sustainability Planning

Baltimore County also has a history of sustainable development, starting with land-use controls institutionalized via the 1967 urban / rural demarcation line (URDL) to identify the areas that had or would receive public water and sewer infrastructure, and would accommodate urban residential, commercial and employment development.[17] There is a County Office of Sustainability and a "Sustainability Network" established in 2008.

The network has recommended adopting a 10 percent emissions reduction goal by 2012.[18] In November 2009, the County Executive accepted a "Top-12" list of recommendations identified by the Sustainability Network regarding County operations, planning, and facilities management. The twelve recommendations have been grouped into four categories:

- Baseline Information and Policy Adoption
- Energy Efficiency and Conservation Process Implementation with Employees and County Operations
- Implementation of Audits, Building and Landscaping Standards
- Employee Commute Options

Greenhouse Gas Inventory

A Greenhouse Gas Inventory[19] of Baltimore County and County Government was performed in 2007. This inventory covered emissions from six sectors: (1) Residential, (2) Commercial, (3) Industrial (RCI), (4) Transportation, (5) Waste and (6) Other. The County generated 11.5 MMT of CO_{2e} in 2006. Transportation was the largest contributor followed by the Residential, Commercial, Industrial and Waste Sectors. By energy type, electricity is the largest source followed by gasoline and natural gas.

[16] http://quickfacts.census.gov/qfd/states/24/24005.html
[17] http://www.baltimorecountymd.gov/Agencies/planning/masterplanning/smartgrowth.html
[18] http://www.baltimorecountymd.gov/Agencies/executive/sustainability/sustainabilitynetwork.html
[19] http://www.awma.org/files_original/4_Brady.doc

Year	2002	2003	2004	2005	2006
Residential	3,268,817	3,392,356	3,413,804	3,530,181	3,195,697
Commercial	2,296,482	2,235,746	2,415,026	2,477,361	2,331,496
Industrial	926,726	989,726	1,012,129	1,018,325	956,473
Transportation	4,765,753	4,892,024	4,876,428	4,905,985	4,897,796
Waste	165,712	177,180	174,389	159,402	166,805
Metric Tons eCO_2	**11,423,490**	**11,687,033**	**11,891,774**	**12,091,254**	**11,548,267**

Figure 3: GHG Emissions by End-use, 2002 – 2006.[20]

Year	2002	2003	2004	2005	2006
Metric Tons eCO_2	11,423,490	11,687,033	11,891,774	12,091,254	11,548,267
Population	768,697	774,811	780,022	782,885	787,762
Per capita emissions	14.86	15.08	15.25	15.44	14.66

Figure 4: Baltimore County per Capita Emissions, 2002 – 2006.[21]

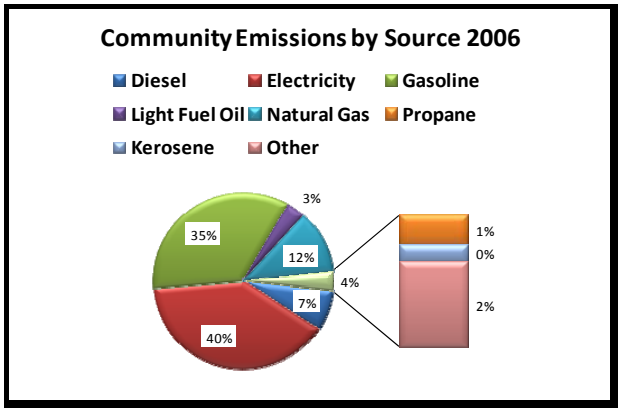

Figure 5: GHG 2006 Emissions by Source.[22]

Green Jobs

Green jobs are a priority for the County. The Green Jobs Coalition is charged with examining the green labor market, identifying the needs of businesses, developing training programs, and working to move the City's unemployed and under-employed into gainful employment opportunities.

One of the tools used to stimulate green job growth is the Maryland Clean Energy Center Technology Incubator. This new business incubator located at UMBC provides affordable space and assistance with business plan, marketing, and management of intellectual property for start-up companies focused on a clean or renewable energy product, service or technology.

The County also has created a "Maryland Green Center" to model environmental best management practices, provide environmental programs for the community, and help schools engage in site-based environmental education and is working towards a Maryland Green School recognition. The Maryland

[20] http://www.awma.org/files_original/4_Brady.doc
[21] http://www.awma.org/files_original/4_Brady.doc
[22] http://www.awma.org/files_original/4_Brady.doc

Green Center recognition is a component of the Maryland Green School Award Program and is sponsored by the Maryland Association for Environmental and Outdoor Education (MAEOE).[23]

Future Challenges and Lessons Learned

The key lessons of Baltimore have been the thought and effort in utilizing its universities as assets in green job creation. The Green Jobs Coalition and the provision of worker-training programs can serve as a regional model for other cities and counties working to merge clean energy development and workforce development.

CAPE CHARLES, VIRGINIA

General Background

Cape Charles, Virginia[24] is a town of 1,130 at the south-western edge of the Delmarva Peninsula. The Town's economy was grounded in fishing and food processing. It was also a transportation hub for freight trains between the eastern and western shores of the Chesapeake Bay that were shuttled by ferry. In the 1970s and 1980s, over-fishing and environmental degradation accelerated the closure of the three food processing plants. Within a decade, over 1,500 workers in Cape Charles were made redundant. By 2000, per capita income was $13,790, and approximately 28% of the Cape Charles population was at or under the federal poverty level – placing it among the poorest in the nation.

Sustainability Goals

The decline of fishing and food processing compelled Cape Charles to consider new approaches to reinvigorate the economy and the environment. In 1993, Northampton County Board of Supervisors took the unusual step of appointing a Sustainable Development Task Force responsible for overseeing the "Sustainable Development Initiative" in Cape Charles. The town created and hired a sustainable development planner and concurrently formed a Citizens Task Force to coordinate the Initiative.

In 1995, Virginia Governor George Allen designated Northampton County a "Virginia Enterprise Zone," and extended a broad package of state tax and other incentives for industrial development and investment in the County. Over the following five years, the Town applied for and received over $8M in grants from State and Federal agencies including the National Oceanic and Atmospheric Administration, the US Department of Commerce, and the US Environmental Protection Agency. These grants were used to study sustainable economic development, to perform contaminated site assessments and to develop a sustainability plan that would be based on "measurable, achievable tasks that build the economy and preserve the assets on which they depend." The plan targeted the recruitment of low-emission industries that would have a limited impact on the environment and local waterways.

The Sustainable Development Action Strategy was developed through an intensive, collaborative process involving community workshops, task forces, meetings, and events, with special assistance from the University of Virginia. The Town and County involved a variety of its citizens in the strategy development process. From this planning process emerged the Sustainable Technology Industrial Park (STIP) and accompanying ecological Industrial Park Master Plan for 200-acres of land in Cape Charles. The plan also outlined the "Sustainability Principles of Cape Charles."

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[23] http://resources.baltimorecountymd.gov/Documents/Environment/education/greensschoolsmap.pdf

[24] Multiple sources: http://www.sog.unc.edu/programs/cednc/stbi/cases/pdf/cape_charles.pdf
http://www.epa.gov/brownfields/success/showcase/sc_capechrl.htm
http://www.greatersalisbury.org/userfiles/files/CapeCharlesCompPlan1999.pdf
http://www.allbusiness.com/legal/laws-government-regulations-environmental/118365-1.html
http://www.smartcommunities.ncat.org/business/ecoparks.shtml
http://www.eda.gov/ImageCache/EDAPublic/documents/pdfdocs/capecharles_2epdf/v1/capecharles.pdf

The STIP was to serve as a hub from which industrial employment opportunities would evolve for existing local businesses. It would also attract ecologically compatible businesses and even create new industries, offering a national model for environmentally sound coastal development. The STIP was to be designed to enhance the town's historic character and historic landscape. The STIP also was to implement "Industrial Ecologies" and "Zero Emissions" protocols while also helping promote Cape Charles as a "Solar Town."

Notable design features of the STIP were the constructed wetlands to manage storm-water, a "gray-water" collection system that collects and the redistributes water back to businesses, and a 42kWh solar PV array. The process leading to STIP was accompanied by a design effort for the Town Harbor and the preservation of at least 50 percent of the area as natural habitat, accessible to the public with trails and walkways. The first facility was launched in March 1999, supported by a $4.6 million County bond. It was 30,000 square foot of industrial space.

The goal was that the plan and park would lure approximately 10 new "sustainable industries" and create over 400 new jobs for the town. There were some initial successes for the STIP, including the relocation of Energy Recovery and Solar Building Systems – two energy manufacturing, research and solar PV firms respectively. Anecdotal evidence suggests that Solar Building Systems was attracted to Cape Charles because the dexterity of the unemployed crab pickers matched the skill set necessary for the construction of the solar panels. However in 2007, there were no firms working in the STIP. Anecdotal evidence attributes this fact to the severe "green" requirements of businesses seeking to work in the STIP.

Energy and Climate Performance

There are no Town-specific energy and climate performance indicators or targets.

Energy Supply Security

The Town and County paid particular interest to lure renewable energy companies, especially in the wind energy sector. In 2000, the plan was to develop a 7 MW wind farm. Northampton County and Cape Charles have been developing and revising land-use ordinances to encourage offshore wind.[25]

Community Cost Management Goals and Economic Development

There are no current energy cost management goals for Cape Charles.

Strategic Approach and Leadership

A key aspect of the "Sustainable Development Action Strategy" was leveraging private investment and development focused on renewable energy firms. In addition to Energy Recovery and Solar Building Systems, Cape Charles nearly lured Proventa, a German wind turbine manufacturing company. In the first few years, STIP leveraged approximately $8 million from private companies locating there and created more than 65 new jobs.

Successes to Date Against all Goals

In 2005, several businesses at STIP closed. The Town and County have struggled to replace them. Proventa was discredited because of fraud. The list of sustainability criteria for business operations at the Park were blamed for being too stringent and discouraging business retention or new investment.

[25] see http://www.capecharles.org/minutes/documents/20090505PCRS.pdf) and http://www.eda.gov/ImageCache/EDAPublic/documents/pdfdocs/capecharles_2epdf/v1/capecharles.pdf

However, in 2006, at the peak of the Park's struggle to exist, the Chamber of Commerce partnered with Eastern Shore Community College and the Nature Conservancy to develop a certification course in eco-tourism. Graduates can receive "exclusive access to Nature Conservancy-owned barrier islands and can offer a more expensive and exclusive experience to their customers." This course has contributed to Town government and local business operations.

Future Challenges and Lessons Learned

A lesson from Cape Charles's experiences includes ways in which environmental adversity can lead to economic opportunity - when expectations are balanced. The Town and County's poverty coincided with generous amounts of State and Federal assistance dedicated to developing a strategy for economic growth and environmental protection.

The well-intentioned and ambitious plans and ultimate lack of success raised questions about whether the planning was balanced or properly benchmarked. In other words, it is possible that the effort to make Cape Charles distinct from its neighbors was overly ambitious and not properly grounded in the implementation. A possible lesson learned is the necessity of the surrounding community to be committed enough to develop its own energy strategies such that it would serve as "customer of first resort" for any incoming investor.

ALBEMARLE COUNTY & CITY OF CHARLOTTESVILLE, VIRGINIA

General Background

Albemarle County, Virginia, and the City of Charlottesville are located approximately 110 miles southwest of Washington DC, and 70 miles west of Richmond. The County has 95,000 residents, of which 40,000 live in Charlottesville, the County Seat. The economy of Charlottesville and the surrounding area relies on a mix of services, manufacturing, education, retail, tourism, trade and technical and professional services. In 2004, it was ranked the best place to live in the US in the book Cities Ranked and Rated by Bert Sperling and Peter Sander.[26]

Charlottesville is home to the University of Virginia with over 20,000 students and 3,000 faculty members. It is regularly ranked among the top universities in the United States. The City has a range of cultural and natural assets. Twenty miles west of the City is the Shenandoah National Park and the Blue Ridge Parkway. The area has rail connections via Amtrak, a regional bus network, a regional airport and a Virginia Rail Express connection. A unique asset is the Downtown Mall - one of the longest outdoor pedestrian malls in the US.

Strategic Approach and Leadership

Albemarle County and Charlottesville's energy management leadership emanates from a range of factors. A key factor is the size and prestige of the University of Virginia and Piedmont Virginia Community College. These two institutions inform the County and City's sustainability efforts, especially in design, architecture, planning and engineering. Charlottesville's civic leadership reflects many attributes of European cities such as Freiburg or Salzburg. Like Charlottesville, these cities benefit from the combination of civic leadership, quality universities and natural assets as the basis for sustainable development.

Sustainability Goals

Albemarle County and Charlottesville strive to be national models for sustainable planning. In 2003, the City passed a resolution committing to "building a distinctive, world-class, small city with a vision of ensuring the quality and sustainability of our natural and built environment. The City of Charlottesville

[26] http://www.charlottesville.org/Index.aspx?page=158

is committed to continuously improve environmental management practices and to become a world-class model of environmental performance and stewardship." An outcome was the development of an environmental management system to measure and report on sustainability benchmarks. In 2007, Charlottesville created the Citizens Committee on Environmental Sustainability[27] and launched a greenhouse gas emissions inventory project in tandem with ICLEI. The City also launched its "Council Vision 2025," which committed the City to sustainable approaches to development, which affirms that the City "has facilitated significant mixed and infill development within the City".[28]

Energy and Climate Performance

In 2007, Charlottesville with ICLEI launched its Community Climate Protection Initiative. This involved developing a greenhouse gas emissions baseline, summarized below.[29]

Year	Energy Use (MMBTU)	Total EC0s Emissions (Tons)	Per Capita Emissions (Metric Tons)	Per Capita Emissions (Metric Tons) Based on Student Population as Resident 0.75 of year
2000	6,903,433	868,952	19.7	22.5
2006	6,706,718	910,991	20.6	23.9
2020	8,681,799	1,119,049	24.5	28.6

Figure 6: Summary of GHG Emissions – Totals 2000, 2006 and 2020

Commercial	Transportation	Residential	Municipal	Industrial	Waste	Other
51%	18%	20%	3%	1%	2%	5%

Figure 7: Summary of GHG Emissions by Sector – Totals 2000, 2006 and 2020

Charlottesville signed the US Conference of Mayors Climate Protection Agreement with commitments to reduce greenhouse gas emissions 7 percent below 1990 levels by 2012. The baseline report acknowledges that "reducing greenhouse gas emissions directly involves cutting energy use and therefore cutting financial costs." [30] Charlottesville also has an online emissions calculator to estimate individual and household greenhouse gas emissions.[31]

Energy Supply Security

In the follow-up to the development of the County and City's greenhouse gas baseline, each has undertaken a range of innovative community climate protection initiatives that touch on efficiency and supply security. These include the introduction of 45 alternatively fueled vehicles used by the City, a City-wide building retrofit project and a partnership with Virginia Dominion Power to install approximately 46,500 "smart meters" in the City and Albemarle County.[32]

Community Cost Management Goals and Economic Development

The County and City have explicit commitments to social inclusion. This is reflected in the Charlottesville's "Dialogue on Race," and cost management goals focusing on the promotion of affordability through energy efficiency.[33] In addition, Charlottesville's economic development recognizes the value of a trained workforce. This is seen in the City's Strategic "Vision 2025," which

[27] www.charlottesville.org/greencity
[28] http://www.charlottesville.org/Index.aspx?page=2098
[29] Source: *Charlottesville Emissions Baseline Report (2008)*
[30] http://www.charlottesville.org/Index.aspx?page=2142
[31] http://www.charlottesville.org/Index.aspx?page=2257
[32] http://www.charlottesville.org/Index.aspx?page=2257
[33] http://www.charlottesville.org/Index.aspx?page=567

commits Charlottesville to "an effective workforce development system that leverages the resources of the University of Virginia and Piedmont Virginia Community College to provide ongoing training and education opportunities to our residents."

Programs in Place

Both Albemarle County and the City of Charlottesville have a range of sustainable development initiatives underway that relate the region's long-term energy management. These include:

- In 2008, Albemarle County signed the "U.S. Cool Counties Climate Stabilization Initiative," committing itself to 80% reductions of greenhouse gas emissions by 2050. Current emissions are 19.2 tons per capita.[34]
- Albemarle County has developed a range of energy audits for County facilities and installed a solar thermal system at the 5th Street County Office Building in Charlottesville.
- Charlottesville has instituted a free curb-side recycling initiative.
- Charlottesville has started restoring Meadow Creek. The work will begin in summer or fall 2011 and involve restoring over 9,000 feet of degraded stream, preserving 12 acres of wetlands, over one mile of the Rivanna Trail, and a total of 76 acres of land.

Future Challenges and Lessons Learned

Charlottesville has gained national recognition for the development and implementation of its environmental plans. The policy "bones" of the City are maturing. This has been the case since the approval of the sustainable development proclamation. However, Charlottesville still lacks a long-term comprehensive energy framework. The focus on individual buildings or pilot projects is commendable, but insufficient if the City is to attain its target of greenhouse gas reductions and overall sustainability objectives.

LOUDOUN COUNTY, VIRGINIA

Background

Loudoun County is approximately 25 miles west of Washington, DC. Regularly ranking as one of the top ten fastest growing jurisdictions in the United States,[35] it has a current population of 290,000. It is home to several world headquarters of internet-related and high-tech companies, including Verizon Business, Telos Corporation, Orbital Sciences Corporation, and Paxfire. Seven college and university campuses also call Loudoun County home. It has been one of the most successful regions in the US in attracting new jobs. Local employment is expected to grow to 305,000 jobs by 2040 from 140,000 in 2007. Population is expected to grow to 458,000 from 270,000 over the same time. This will require adding 75,000 homes to the current 100,000 and adding 73 million square feet of non-residential buildings to the existing 69 million square feet.[36]

Sustainability Goals

In 2009, Loudoun County developed and adopted a comprehensive long-range County Energy Strategy. The CES vision underlines the importance of energy to Loudoun County's overall economic development goals. Success will be measured in many ways summarized in the five key Goals of the CES:

- Loudoun County will be recognized as a location of choice for investment in part because of its innovative energy strategy.
- Loudoun County will strive to have consistently lower energy costs relative to surrounding areas.

[34] County of Albemarle, VA Emissions Baseline Report, February 2009
[35] http://www.loudoun.gov/Default.aspx?tabid=1345
[36] Loudoun County Energy Strategy, December 2009 http://www.loudoun.gov/Portals/0/docs/Energy/Energy%20Strategy.pdf

- Loudoun County will have greenhouse gas emissions among the lowest in the Country.
- Loudoun County will be recognized as a regional, state, and national role model of effective energy and climate management.
- All major investments will visibly contribute to meeting the CES goals.

Energy and Climate Performance

In 2007, the County used 70,753,000 million Btu of energy of all types; 34% in homes; 38% in commercial and public buildings of all types; and about 28% in transportation.

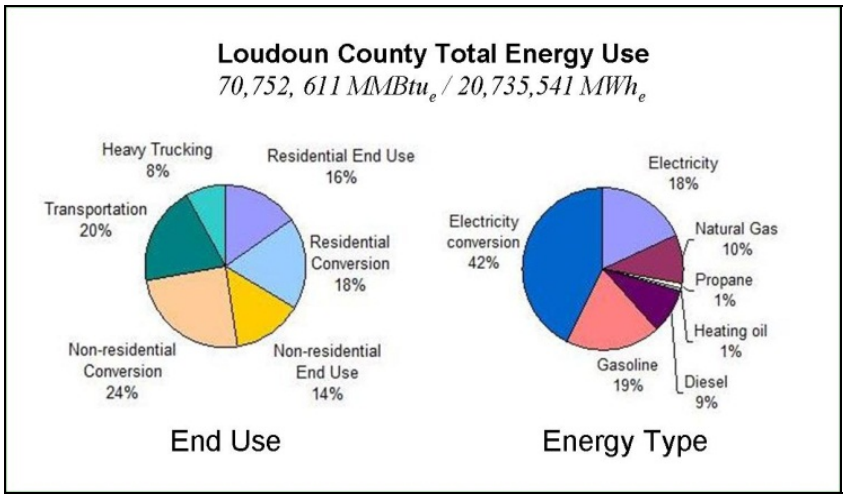

Figure 8: Loudoun County 2007 Energy Use by End-use and Type

Of the total energy supplied, 60% is related to the use, distribution and generation of electricity, 28% is from gasoline and diesel fuel, and the balance from natural gas and propane and oil for heating and hot water for homes and buildings. All electricity for the County is generated outside the County resulting in about 70% conversion and transmission inefficiencies.

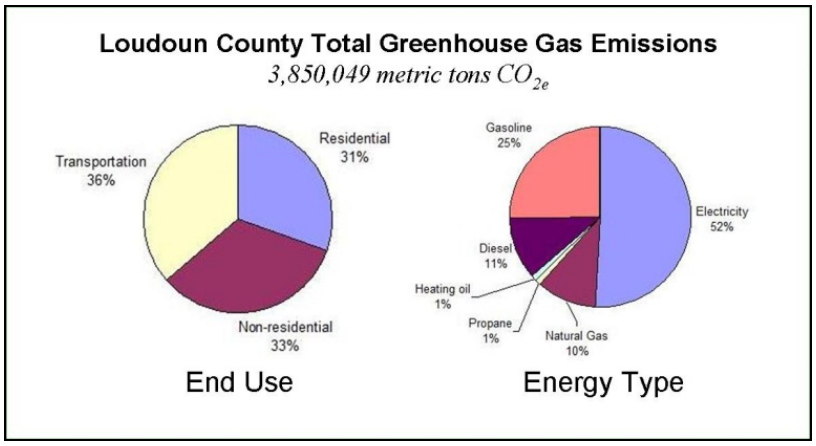

Figure 9: Loudoun County 2007 Emissions by End-use and Type

The County emits 3.85 million metric tons of energy related greenhouse gas emissions. These are broken down[37] as 31% from home energy use, 33% from buildings and 36% from transportation. By energy type, electricity accounts for 52% of all emissions, gasoline and diesel fuels for 35%, with the remaining 12% from natural gas and other heating fuels. Per capita emissions are 14.2 tons with a 2040 goal to reduce this to 6.6 tons.

[37] Idem

Community Energy Strategy

In the summer of 2009, with support of funds from the US Department of Energy's "Energy Efficiency and Conservation Block Grant" (EECBG) program, Loudoun County outlined a 30-year comprehensive roadmap with goals for energy use, distribution, and supply for the County as a whole. Both short- and medium-term implementation approaches were recommended. The recommendations include strategies to ensure the efficient construction, renovation and operation of homes and buildings. The CES also addressed ways to incorporate clean and renewable energy generation, distributed in clean and economical ways. The CES highlights the energy opportunities presented by higher-density mixed-use developments such as Moorefield Station and other large-scale compact developments to be built around the planned Metro station.[38]

The CES addressed three main areas of energy opportunity – homes and buildings, transportation and clean and renewable energy supplies. The CES assessed that the energy needs of the employment and housing growth for the County can be provided through efficiency of both new construction and retrofitting existing homes and buildings. Specifically, these can be attained by:

- Encouraging all new construction to meet Energy Star levels from 2011, or about 30% more efficient than current code;
- Encouraging all major retrofits to be at least 25% more efficient than the current County average;
- Incrementally increasing these targets every four years by about 4%;
- Reducing outbound commuting through the successful growth of local employment;
- Developing of mixed-use neighborhoods to encourage shorter commutes, walking and cycling;
- Developing of transit-oriented mixed-use neighborhoods encouraging the use of mass-transit and local walking and cycling or short drives to the two new Metrorail stations;
- Encouraging smaller vehicle use through urban design and parking strategies.

Large Neighborhood Scale Pilot Projects are recommended as a key part of the successful reduction of emissions. District Energy is another critical recommendation to meet reduction goals.

Programs in Place (County-wide)

Loudoun County has a number of innovative energy and sustainability initiatives in place. These include the Loudoun County Home Improvement Program and the Loudoun Green Business Challenge which encourage businesses to reduce energy use in a competitive format. Loudoun County also has approved a series of energy conservation measures at several County facilities, including the Claude Moore Recreation Center, the Department of Information Technology, the Fire & Rescue Training Building, the Loudoun County Government Center, the Shenandoah Building and the Courts Complex, to include the Judicial Center and historic Courthouse. Measures include installing high-efficiency lighting; reprogramming controls to limit electric demand and more efficiently deliver outside air to heating and cooling systems; improving weatherization; and conserving water.[39]

Successes to Date Against all Goals

- The CES was approved in 2009 in the face of significant political challenges.
- The CES was nominated in 2010 as a US National Role Model by NACO.
- The first scale project is proceeding to detailed planning in early 2011.

Future Challenges and Lessons Learned

[38] Loudoun County Energy Strategy, December 2009
[39] http://www.loudoun.gov/Default.aspx?tabid=2363#green

The success of the CES will rest in the effectiveness of implementation of the plan, including the ability to sustain the County leadership support long after the flow of federal support slows in 2011. To date, the development and first implementation steps have relied on funding from the US Department of Energy's EECBG grant program.

The presence of local political resistance, albeit a vocal minority, may not bode well for the decades of sustained implementation needed to deliver world-class results.

RICHMOND, VIRGINIA

Background

Richmond, the capital of the Commonwealth of Virginia, has a population of 200,000 and is the third largest city in the State. The Richmond metropolitan region has a population of 1,212,977.[40] The economy is primarily driven by the state, local and federal governments (especially the US Court of Appeals and the Federal Reserve Bank). There are several national-level financial, legal, banking, and energy service firms.

City Government – Sustainability Initiatives

Mayor Dwight C. Jones has developed the "Triple Bottom Line" of sustainability with a focus on:

- An improved quality of life for residents;
- A healthy environment;
- An enhanced economic development and job creation opportunities.[41]

Efforts are currently framed around the development of a "Sustainability Plan." The City Council appointed a Green City Commission to provide expertise and information to support the City's sustainability initiatives.

The City's sustainability efforts focus on the built environment, transportation, land use, economic development, waste management and education and outreach.[42][3] The policy is to build and renovate City facilities over 10,000 sq. ft. to a LEED Silver standard. Currently, four new schools and one new fire station fall into this provision.

US DOE EECBG funds were used to hire a Sustainability Manager and Energy Manager to develop a comprehensive sustainability and energy management program for the City to reduce energy use and GHG emissions and to realize cost savings. The cost savings will come from energy education along with creating an energy accounting information system that will provide energy data to implement cost effective energy initiatives to support the "Triple Bottom Line". Initiatives will be measured and validated to determine the overall impact.

Building optimization programs for City-owned facilities are already in progress, including retrofitting City Hall, the Richmond Waste Water Treatment plant (WWTP) and branch libraries.

Additional programs already implemented or in progress include:

- iPower programs to reduce energy and resource use by remotely controlling PCs;
- A pilot project to install solar powered street lights in the Randolph West Subdivision and in Ancarrow's Landing public park;
- A "Conservation Program" to reduce existing utility customers' energy costs, to make businesses more competitive, and to reduce Richmond's carbon footprint, offering two types of financial

40[1] http://www.census.gov/popest/metro/tables/2007/CBSA-EST2007-01.xls
41[2] http://www.richmondgov.com/sustainability/index.aspx
42[3] http://www.richmondgov.com/sustainability/index.aspx

rebates to customers: 1) incentive rebates for energy audits to help pay for energy audits and 2) incentive rebates for retrofit equipment to help replace inefficient heating equipment;

- Deployment of new LED traffic lights and conversion of existing incandescent traffic signals to LEDs for greater efficiency;
- Digester Gas Recovery at Waste Water Treatment Plant to capture and use the excess digester gas currently being flared, resulting in enhanced efficiency and cost savings.

Richmond is one of the few localities in the State with a separate storm-water utility. It offers both a commercial and residential credit program to encourage property owners to offset fees with green infrastructure. The first two Green Alleys have been created to reduce storm water runoff. Richmond has built its first green roof on one of its WWTP facilities.

There is some focus on multi-modal transportation alternatives. In May 2010, Mayor Jones created the Pedestrian, Bicycling and Trails Planning Commission to recommend ways to incorporate bicycling and walking as viable methods of transportation in Richmond. In 2011, the City will begin developing a Strategic Multi-Modal Transportation Plan to study current and future transportation issues and recommend ways to move toward alternative transportation modes.

To enhance fuel efficiency and cost savings, the City's diesel garbage truck fleet of 37 trucks has been replaced with 25 natural gas powered trucks. Finally, Richmond has been selected by Ford as one of nineteen launch cities for the Focus Electric Vehicle. The City also plans a pilot program to use four electric vehicles for the motor pool fleet.

Greenhouse Gas (GHG) Emissions Inventory

In 2008, Richmond developed a baseline greenhouse gas (GHG) emissions inventory.[43] Using the ICLEI Local Governments for Sustainability Protocol, Richmond conducted both a community-wide inventory and a government operations inventory. Richmond emits approximately 3 million tons, or about 15 tons per capita of greenhouse gases.

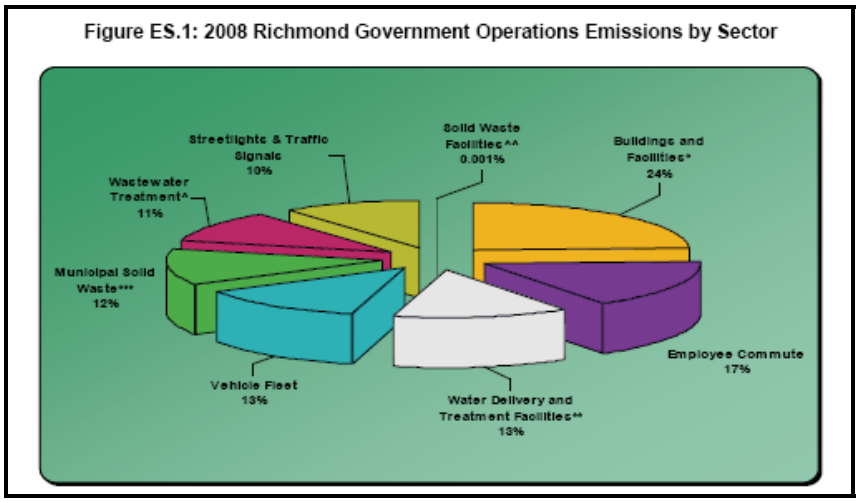

Figure 10: Richmond 2008 Emissions from City Operations

[43] City of Richmond 2008 Greenhouse Gas Emissions Inventory, March 2010

Table 4.3: Community Emissions Summary by Sector

Sector	Greenhouse Gas Emissions (metric tons CO2e)
Commercial / Industrial	1,320,995
Transportation	868,373
Residential	748,191
Waste	47,773
Wastewater	2,359
TOTAL	2,987,651

Figure 11: Richmond 2008 Total GHG Emissions by End-use Sector

Energy Supply Security

After developing its baseline GHG emissions inventory, the City implemented a number of initiatives to enhance efficiency and energy supply security including the development of an energy management program for City facilities; the replacement of its diesel garbage truck fleet with compressed natural gas (CNG) vehicles; and an electric vehicle pilot program for its City fleet.

Community Cost Management Goals and Economic Development

Richmond's sustainability goals include the enhancement of economic development and job creation opportunities. Green/clean tech jobs are a focus area for business development for the City's Department of Economic and Community Development. Additional goals will be developed as part of the Sustainability Plan.

Strategic Approach and Leadership

In 2011, the City will lead the Richmond community in the development of a comprehensive Sustainability Plan. The Plan will set GHG reduction targets for the community and government operations. It will also determine sustainability goals for the community. After the Plan is developed, the City will report annually on the progress of the Plan.

Programs in Place

Virginia Commonwealth University has a campus District Energy system fed by a 375,000-pound-per-hour steam boiler plant. It serves approximately 50 customers including the Medical College of Virginia at VCU and the State Capitol buildings. An upgrade is currently being undertaken aimed at increasing the number of business customers. Recent metering enhancements combined with loss reduction resulted in increased revenues of over $1 million.

The City also works with other area universities and their sustainability programs including the University of Richmond and J. Sargeant Reynolds Community College. In addition, the Richmond Region Energy Alliance is a non-profit organization working to bring residential energy efficiency retrofits to scale in the Richmond region. The Sustainable Transportation Initiative of Richmond is a non-profit composed of local business leaders whose vision is to see the Greater Richmond Region as the national model in building an innovative, sustainable transportation system that moves people in a "greener" way.

Successes to Date Against all Goals

Richmond has successfully implemented a number of sustainability initiatives. It will develop formal goals as part of the Sustainability Plan.

Future Challenges and Lessons Learned

Richmond's challenge is to develop a comprehensive framework for its sustainability and energy management program that will allow it to systematically redefine its energy footprint over the coming decades.

St. CHARLES, MARYLAND

General Background

St. Charles is a planned community of 33,000 in Charles County, oriented around five villages. Construction of St. Charles started in 1965 by St. Charles City Inc., and is approximately 50 percent completed. [44] Two of the villages are completed (Smallwood and Westlake), a third (Fairway) is under development and two are still being planned (Piney Branch and Wooded Glen). Each village has or will contain walking paths, swimming pools, lakes, and playgrounds. A key element is the 1,200,000 square foot St. Charles Town Center shopping area. The Town hosts many US Air Force families due to the proximity to Andrews Air Force base.

Strategic Approach, Leadership and Goals

A key project in St. Charles is the 4,000 acre development from American Community Properties Trust intended to be "the most comprehensive smart, green community development project in the United States today." In addition to developing 4,000 acres for 11,000 new homes and 5 million square feet of commercial development, schools and community centers, American Community Properties plans to retrofit 12,000 existing homes, and create in the process over 20,000 new jobs – 3,000 alone in 2009 - via a "green jobs opportunity zone."

St. Charles is working to position itself as an "Innovative Green City Initiative" that is a "living laboratory for new technologies, products and services" and a model for the world. St. Charles intends to build the largest combination of "clean energy infrastructure in the United States, including a 640 megawatt natural gas powered plant, a 10 MW 75-acre solar farm, and apply geothermal systems, a biomass gasification technology plant for methane recapture. St. Charles also will build a 625-mixed-unit community called Homefield in accordance with LEED standards and seek LEED certification or the equivalent for all of its neighborhoods and buildings and a small summer farmers market.

Energy and Climate Performance

The core of St. Charles' energy plans revolves around the 640 Megawatt combined cycle, natural gas powered plant. When finished in 2011, this should generate enough electricity to power 600,000 homes. The $400M plant will create 350-400 local construction jobs. In operation it will have 30 long-term jobs with an average salary of $55,000. St. Charles will also build the 10 megawatt 75-acre CPV Piney Reach Solar Farm to support the 2022 Maryland goal of 1,500 MW. In partnership with PEPCO, St. Charles will install and test 1,000 smart electricity meters. Combined these efforts are expected to reduce the St. Charles's footprint, despite substantial population growth.

Energy Supply Security

The addition of substantial amounts of clean and renewable energy sources nearby the community, combined with a reasonably systematic approach to efficiency will definitely enhance the supply security making the community less dependent on the regional electricity grid. However, it will become

[44] Source: http://www.charlescounty.org/green/plan.pdf
Source: http://www.charlescounty.org/green/FacilityBenchmarking.pdf
Source: http://www.prnewswire.com/news-releases/st-charles-maryland-to-become-international-model-green-city-78143767.html
Source: http://www.cpv.com/pdf/pressrelease7.25.07.pdf
Source: http://greensource.construction.com/news/2010/100325Maryland.asp
xx

more dependent on the natural gas network through the use of gas-fired generation. The absence of a structured heat plan, including District Energy seems to be a missed opportunity.

Community Energy Cost Management Goals and Programs in Place (County-wide)

Charles County has developed an Energy Action Plan for County facilities in 2010. It focuses only on government operations and ties into Governor O'Malley's August 2007 program "Em-power Maryland" - a State-wide energy efficiency effort that requires energy consumption reductions in State and County facilities to be reduced 10-15% by 2015.

Charles County is analyzing energy use for all County facilities using Energy Watchdog, a web-based program that assists the Energy Manager in visualizing, conveying, and auditing utility bills, tracking energy usage, and reporting results for all County facilities. The County has adopted the Building Automation System (BAS), and an "Employee Energy Conservation Educational Awareness Program."

Progress to Date

The private-sector led large-scale development of American Community Properties and the development of the 640 Megawatt Power plant reflect ideal conditions for long-term energy sustainability St. Charles. Combined with the commitment to large-scale renewable energy, adherence to energy efficient building codes will serve as a useful community-scale model in many aspects.

Future Challenges and Lessons Learned

St. Charles' success has the chance to be the "tail that wags the County dog" in the realm of energy management. However, the lack of a comprehensive heat plan, and the associated assessment of District Energy and deep efficiency measures seems to be a missed opportunity. The best lesson learned from the benchmark cities would be to move to develop a 30- to 50-year integrated energy master plan for the entire community – existing and new, that would take the energy performance to higher levels. This could truly serve as a regional and national role model.

At present, most County initiatives appear to be focused at the level of government operations. St. Charles' work will ideally be replicated across the County, especially if it can be adjusted to be even more comprehensive.

TENTH STREET ECO DISTRICT INITIATIVE, WASHINGTON, DC

General Background

The Tenth Street "Eco-District" is a 15-block, 110-acre neighborhood sandwiched between Washington DC's southwest Potomac River Waterfront and the National Mall.[45] Mostly built in the 1960s, it suffers from sterile large-scale concrete landscapes, empty plazas and a dysfunctional street grid that frames large "super-sized blocks" of federal and commercial office space. The neighborhood hosts U.S. Federal Agencies including the Departments of Energy, Housing and Urban Development, Agriculture and Education. Over 70,000 people work in the District, but few live in the area. In the evening, the aging, dysfunctional and desolate concrete landscape lacks vitality.

Strategic Approach and Leadership

The National Capital Planning Commission (NCPC) plans to redevelop the area into a modern, mixed-use and multi-functional "Eco-district" that will stand as a showcase for sustainability and ecological development. The NCPC has created a "Tenth Street Corridor Task Force" comprised of six Federal agencies, three local agencies and the Smithsonian Institution. The Task Force will coordinate the development and implementation of a revitalization plan and implementation of Presidential Executive

[45] http://www.ncpc.gov/ncpc/Main(T2)/Planning(Tr2)/SouthwestEcodistrict.html

Order #13514 - "Federal Leadership in Environment, Energy, and Economic Performance." A critical element of the planning process has been the consideration of a District Energy system to further enhance energy and fuel efficiency and deeply reduce greenhouse gas emissions.

Sustainability Goals

Due to the high concentration of US Government properties, the Tenth Street Corridor goals are closely tied to Federal Executive Order 13514, calling for the reduction of greenhouse gases, pollution prevention, and construction and operation of sustainable buildings on Federal properties. The NCPC also has developed its own set of objectives and include: restoring important viewsheds and enhancing the public realm; increasing the variety of uses and reclaiming the street grid; improving the setting for future memorials and museums; and establishing a multi-modal transit center.

The Corridor's development goals are also tied to goals of the District of Columbia. The District has signed the US Conference of Mayors Climate Protection Agreement. This is the basis of several sustainability objectives of the District of Columbia, including the "Climate Action Plan for the District of Columbia," which calls for a reduction in greenhouse gas emissions of 20% below 2006 levels by 2012, 30% below 2006 levels by 2020 and 80% below 2006 levels by 2050.

Energy and Climate Performance

Washington DC conducted an inventory of emissions[46] in 2010. District-wide greenhouse gas emissions totaled 10.5 million metric tons, equivalent to 18 tons per capita. The emissions of greenhouse gases by energy end-use are broken out in the following table

Vehicles	Transit-Metro	Waste	Residential	Federal	Non-residential
22%	2%	2%	14%	9%	51%

Figure 12: Washington DC 2010 DC GHG Emissions by End-use

If no action is taken, greenhouse gas emissions are expected to rise 14% by 2020 and 35% by 2050 due to population growth. In addition to making the built environment and energy supply cleaner and more efficient, a key challenge is the 400,000 daily commuters, among the largest percentage daytime population increase in the Country.

Programs in Place

The District of Columbia has committed itself to aggressive greenhouse gas reduction goals. The core programs in place will support this including the DC Green Building Act, 2008 Construction Goals, that calls for more LEED and Energy Star certified buildings than any location in US of equivalent size. The District actively encourages the increased use of transit and currently 39% of all residents commute by mass transit[47], a trend that must be amplified if the emissions impact of the "headwind" of daily commuting is to be managed.

Successful implementation of efforts such as the 10th Street Corridor will provide the neighborhood scale examples needed to deliver the goals for DC as a whole.

Future Challenges and Lessons Learned

Washington, DC is facing the basic challenge to deliver sustainable energy results in a largely built-up infrastructure. This is a very similar challenge to those embraced by many European cities starting in the

[46] http://green.dc.gov/green/cwp/view,A,1231,Q,460764.asp
[47] http://www.ncpc.gov/ncpc/Main(T2)/Planning(Tr2)/SouthwestEcodistrict.html; http://www.ncpc.gov/ncpc/Main(T2)Planning(TF2)SouthwestEcodistrict.html; http://www.ncpc.gov/DocumentDepot/Presentations/10th_St_Public_Meeting_2_10.pdf

1970s and some useful benchmarking might be helpful. The role of scale projects such as the Corridor cannot be understated, and the need for long-term integrated energy master planning is clear, and currently lacking.

HAMPTON ROADS, VIRGINIA

General Background

Virginia Beach-Norfolk-Newport News, or "Hampton Roads" (HRPD), is a US Metropolitan Statistical Area with a 2007 population of 1,658,754[48] expected to be 2 million from the 2010 census.

The military has a large presence in the region. Military facilities include Camp Peary in York County, Fleet Training Center Dam Neck in Virginia Beach, Fort Eustis in Newport News, Langley Air Force Base in Hampton, Naval Amphibious Base Little Creek in Virginia Beach, Fort Monroe in Hampton (to be closed in 2011), Norfolk Naval Shipyard in Portsmouth, Naval Station Norfolk, Naval Air Station Oceana in Virginia Beach, the Coast Guard Integrated Support Command Portsmouth, Saint Julian Creek Naval Depot Annex in Chesapeake, Fort Story in Virginia Beach, and Naval Weapons Station Yorktown in York County.

The Federal government also has two major research laboratories in Hampton Roads on the northeast edge of Hampton, near Poquoson. The Department of Energy's Thomas Jefferson National Accelerator Facility conducts cutting edge physics research in Newport News. The lab hosts the Continuous Electron Beam Accelerator Facility (CEBAF)[10] and a kilowatt-class Free-Electron Laser.[11]

Sustainability Goals

The HRPDC is not yet committed to long-term regional energy planning. However, they are applying for a HUD Sustainable Communities Planning Grant to allow them to advance regional planning in a variety of areas including environmental and land-use decision making, as well as infrastructure. Clearly, many of these overlap with strategic energy aspects.

Several localities within the Hampton Roads area have engaged in various levels of sustainability planning. The City of Chesapeake has an Environmental Sustainability Program known as "Go Green Chesapeake: the Sustainable Chesapeake Initiative". This was launched by a resolution that acknowledged current accomplishments of the City to become more sustainable while establishing the necessary policy framework to develop a more comprehensive approach to environmental sustainability.

The City of Virginia Beach currently has an Alternative Energy Task Force[49] with the stated goals to:

- increase energy independence, with an emphasis on conservation and clean fuel technologies;
- reduce current municipal government energy consumption 15 percent by 2025;
- increase indigenous energy production 20 percent by 2025;
- expand residential/business energy education to overcome barriers to implementing energy-efficiency and conservation actions;
- reduce greenhouse gas emissions 30 percent by 2025; and
- capitalize on economic development opportunities through business expansion and increased research and development in areas of strength, including alternative energy development.

Strategic Approach and Leadership

[48] "Virginia Beach-Norfolk-Newport News, VA-NC MSA Population and Components of Change". Real Estate Center at Texas A&M University. 2008. http://recenter.tamu.edu/data/popm00/pcbsa47260.html.

[49] http://www.vbgov.com/file_source/dept/clerk/Mayor/Mayor's%20Energy%20Taskforce/Presentations/040710MAETFPresentation.pdf

In January 2003, the Environmental Education Publications Clearinghouse[50] was conceived at a joint meeting of the Hampton Roads Chesapeake Bay Committee, Regional Storm-water Management Committee, and the Hampton Roads Tributary Strategies Project Steering Committee. It was recommended that the Hampton Roads Planning District Commission (HRPDC) develop an environmental education clearinghouse of materials and resources for use by all. This is an existing framework that could be built upon to encourage the exchange of information on best practices in energy efficiency, District Energy, and the reduction of greenhouse gases.

Jobs

The Region has some established tools to support the creation of jobs in technical, educational, and research related fields. All are potentially relevant to supporting jobs in sustainable energy areas.

The Hampton Roads Green Jobs Alliance[51] was created to coordinate the resourcing, training, and associated support for the development of an evolving energy efficiency and renewable energy industries workforce with a goal of economic independence for individual workers, including those who seek a pathway out of poverty. As an example, their research shows that a 1% market penetration of energy efficient retrofits in housing could create 784 local jobs with about a $20 million payroll, and energy savings of 22,572 MW.

The Hampton Roads Research Partnership (HRRP) is a collaborative with a goal of increased regional prosperity through technology-based economic development. It coordinates research efforts among its members and with industry; leverages state-of-the-art facilities; and engages the intellectual capital of 2,000 HRRP-affiliated scientists and engineers. Three "clusters" of local scientific expertise have been identified by the HRRP: bioscience, modeling and simulation, and sensors. HRRP supports the use of technology clusters - a unique mix of scientific talent, business acumen and existing infrastructure to fuel growth, an upwards cycle of technology transfer and wealth creation.

Old Dominion University has created Innovation Research Park[52], a unique enterprise zone that co-locates world-renowned scientific talent and research capabilities with high-tech, private-sector expertise. The Park resides in the 75-acre, mixed-use University Village on the ODU campus.

Local Community Asset - BASF Site

The approximately 43 acre developed site of the former BASF Super Absorbent Polymers Plant is a waterfront site located along the Elizabeth River in the industrial area of Portsmouth referred to as West Norfolk. The plant has been demolished; the foundation slabs remain and can accommodate heavy equipment for most types of construction and industrial use. The property is now available for a long-term ground lease through LMR Inc. Primary 23 kV feeders and a standby transformer are fed by Dominion Virginia Power. Four membrane lined ponds are on the property and provide a series of reservoirs to retain surface storm-water runoff. This is a potential site to develop a large-scale project based on integrated energy plans.

Local Community Asset - Light Rail

"The Tide" light rail system is under construction. It will extend 7.4 miles from the East Virginia Medical Center through downtown Norfolk, continuing along the Norfolk Southern right-of-way, adjacent to I-264, to Newtown Road. [53] Eleven stations will be constructed along the route with four park-and-ride locations that provide access to major areas such as Norfolk State University, Tidewater Community College (Norfolk Campus), Harbor Park, City Hall, MacArthur Center, and the Sentara Norfolk General

[50] http://www.hrpdc.org/PEP/PEP_PubClearinghouse.asp
[51] http://greenjobsalliance.org/about.html
[52] http://www.irpodu.com/
[53] http://www.ridethetide.com/

Hospital. The estimated ridership is to be between 6,000 - 12,000 riders per day. It is a potential spine for a transit oriented development based on sustainable energy planning.

CONCLUSIONS

This paper has attempted to give a flavor of the varied and creative ways communities in the Chesapeake Crescent are addressing the challenges and opportunities in efforts to promote sustainable development. These efforts are taking place in the relative absence of coherent National-level energy and climate policies and legislation. Communities are producing valuable results through admirable creativity, but often struggle to find the necessary specialist skills and resources to both plan and implement their initiatives. However, when viewed as a whole, the Chesapeake Crescent has the basis of several world-class energy and climate programs such as those reviewed in this paper.

These initiatives, and many others like them across the region, are characterized by a serious acknowledgement of a strategic energy and climate challenge by the local government, businesses, and other environmental and civic leadership. They have generally completed an inventory and assessment of current energy and emissions performance, and gained an understanding of the current status of buildings and other energy consuming structures. They all have developed some general, or in some cases more specific, plans to address some aspect of energy sustainability.

This paper also identified several major challenges from these case studies that could stall long-term comprehensive energy and climate planning in the region unless they are addressed with some urgency. One of the more common was an over-reliance on small-scale activities focused on local government operations and assets, accompanied by inadequate attention to jurisdiction-wide strategies supported by quantitative goals and benchmarks to measure progress. Another common feature was an over-reliance on the results that could be achieved by technical "silver bullet" remedies, without addressing the need for the large-scale enhancement and maximizing of efficiencies of existing (and large-scale) systems. Very few of the plans addressed the challenges of sustained political and community leadership over decades and the associated changes in policy and institutional and market structures that may be needed.

On the whole, the effect of Community Energy Planning on "green" job creation in the Chesapeake Crescent is most noticeable in the retrofits of homes and buildings. This is documented in data collected in the context of a survey by the "Green Jobs Alliance". With 1 percent market penetration of energy efficiency retrofits in the residential housing sector, Northern Virginia stands to gain approximately 1,150 jobs.[54] With an equivalent market penetration of energy efficient retrofits in residential housing in the Greater Richmond Region, 476 jobs might be created. Under these scenarios, the payroll created in Northern Virginia could be between $28,000,000 and $40,000,000 and in the Greater Richmond region between $12,000,000 and $16,000,000. Under a 10% market penetration scenario, approximately 1,700 new jobs could be created in Northern Virginia and over 1100 in the Greater Richmond region.

Community Energy Plans can be the core of meaningful gains in energy competitiveness, greenhouse gas emissions reductions and substantial green job creation in the Chesapeake Crescent, but these will not be realized with the present fragmented approaches. The case studies reviewed were impressive but revealed local jurisdictions will have to focus more aggressively on the following aspects, and could accelerate their efforts through cooperation across the Chesapeake Crescent.

CRITICAL ROLE OF SCALE

[54] www.greenjobsalliance.org

The growing visibility and promotion of "green" building is highlighted in all the case studies. However, success of "green" building is all too often defined by a handful of stand-alone showcase buildings. For communities to deliver their goals in the Chesapeake Crescent, consistent and large-scale development needs to take place at a neighborhood scale. The approaches being developed in St. Charles or Crystal City in Arlington County are examples of thinking beyond the building. Scale projects like these allow the integration of land-use, heat recapture, renewable energies, energy-efficient building, smart controls and grids, and transportation alternatives that can be implemented to achieve much higher levels of performance. Implementing multiple similar projects within a single community eventually create new community realties and transform the energy performance of the entire community.

Along those lines, jurisdictions in Northern Virginia have begun initial discussions looking toward a "Green Corridor" from the Potomac to and through Dulles Airport. The hypothesis driving those discussions is that the scale of multiple jurisdiction planning, combined and coupled with major new transit systems, major urban redevelopment, transit-oriented development and regional branding, can over time drive not only improved energy consumption performance but also scaled economic development and a larger pool of "green jobs".

This hypothesis, if extended to the larger Chesapeake Crescent footprint and if capable of execution, provides the rationale for aspiring to significant, scaled climate change, business attraction and other economic development opportunities created by the prospect of competitively-lower energy costs for business, government and residents.

SUSTAINABLE ENERGY MANAGEMENT AS A 30-YEAR PROCESS

There are no quick fixes to redefining the energy performance of a community where extensive built-infrastructure already exists, and the Chesapeake Crescent is no exception. The approaches taken by cities such as Copenhagen rely on incrementally maximizing the efficiency, reliability and flexibility of multiple existing systems to achieve world-class results. They do not rely solely on individual technical "silver bullets" such as wind or solar PV at the expense of building retrofits, efficient, construction codes, District Energy or good energy housekeeping. These efforts will not deliver results overnight and require as much focus on governance, policy and market structure changes as on technology and education. The world-class benchmark cities worked consistently over decades to attain their current energy performance, a valuable lesson for the communities of the Chesapeake Crescent. Planning over a 30-year time horizon corresponds to capital investment cycles in public infrastructure and replacement or major renovation of existing building stock. The alignment of investment cycles across sectoral and public-private lines requires sustained, consistent clarity and persistence over long time periods – enabling business owners and entrepreneurs to invest with knowledge of where the energy goal "puck" is going to be rather than where it is today.

EFFICIENT ENERGY CONVERSION AND HEAT RECOVERY PRIORITIZATION

The Chesapeake Crescent reflects the US as a whole with approximately 50 percent of electricity coming from coal-burning power plants, which produce much more unused heat than useful electricity. These plants rarely operate with more than 30 percent efficiency and are neither configured nor located to capture and use waste heat. A further 5 to 10 percent of produced electricity is lost bringing electricity from generally rural sites to urban consumers. Failing to address these conversion losses makes the greenhouse gas reduction targets pretty well impossible to achieve. Many of the cities and developments reviewed in this paper have the potential to make better use of fossil fuel through efficient generation, capture and distribution of heat. Many cities like Copenhagen and Freiburg, and developments in China and Korea, have large-scale efficient, cost-effective District Energy systems. These take "waste" heat from large utilities, existing industrial sources and local cogeneration and deliver it efficiently to homes and buildings through District Heating and District Cooling systems.

Urban planning aimed at promoting density and mixed-use is increasingly common in the Chesapeake Crescent region, and is an ideal basis for encouraging the development and expansion of District Energy systems. Ideally, this should be supported by appropriate energy supply zoning policies. It is time to overcome the legacy of the older US District Heating systems from the first half of the twentieth century, mostly using inefficient steam distribution, that have been largely abandoned after decades of neglect. St. Charles, Maryland, CVU, 10th Street, Moorefield Station and Arlington County all can serve as laboratories for the application of these District Energy approaches. They can do this at the scale that will make for powerful short-term results and will test market regulatory and instructional models as well as the technical implementation.

MULTI-FUEL FLEXIBILITY AND RENEWABLE ENERGY

Renewables are less than 7 percent of the US energy system. The lack of a coherent range of financial and policy incentives with long-term certainty in most States and regions tend to make for uneven deployment of CHP and renewable energies. They also often lack basic tracking systems to monitor the deployment and effectiveness of clean and renewable energies. A core element of many of the examples of Community Energy Planning in the Chesapeake Crescent is a vision of large-scale, cost-effective deployment of clean and renewable energies. These are sometimes tailored to the climatic and topographic attributes of a city or region. They are often recommended for very practical reasons such as reducing summer peaks or improving reliability, completely changing the economic evaluation. St. Charles, Arlington, or Cape Charles, among others, all have ambitious renewable energy policies for solar, biomass, or wind. They should also be developed with an eye towards multiple and distributed fuel sources that blend renewables with conventional fuels such gas, coal, and municipal wastes, along with more efficient conversion from CHP.

COMMUNITY ENGAGEMENT INFORMED BY QUANTITAIVE BENCHMARKS

The successful development and implementation of Community Energy Plans depends upon informed leadership and citizens. It should be based on a decision-making process that draws from international and quantitative benchmarks. Opinion and enthusiasm are valuable elements of any good energy strategy, but must never be seen as a substitute for data. Transparency is necessary to communicate results and in ways in which technical information is broadcast in laymen's terms to facilitate inclusion at all levels. Visible "Energy Performance Labels" showing energy and GHG emissions performance for buildings and automobiles are some of multiple ways that community energy management in Denmark and Germany is informed by quantitative benchmarks; these are relatively easy approaches to adopt. The data should also track the effectiveness in the creation of new jobs and overall energy affordability.

PROBLEM-FOCUSED AND GOAL-SPECIFIC POLICY TRANSFER

Transferring best practices and policies tends to work best when it stays clear of abstract processes and attached to problem-focused and goal-oriented efforts. As each community takes on the scale implementation and challenging goals, someone, somewhere in the world, will almost certainly have successfully found answers to similar challenges. However, they are only relevant after the effort has been made to understand how and why the lessons can be applied to a particular locale. The answers being developed across the Chesapeake Crescent region are both relevant and adaptable and can accelerate the development of the region as a National example of energy sustainability. This effort must avoid cookie-cutter generalizations and recognize the specific state- and local-level conditions to which other experiences can be adapted.

In conclusion, this paper urges that

- communities engage in community energy planning on a long-term, persistent and scaled basis,

- adjacent communities develop consistent and aligned goals even as flexibility for differential local implementation based on local political structures, processes and attitudes differ, and
- communities across the Chesapeake Region periodically convene to compare goals and processes and to develop common advocacy strategies in order to build the region-scale branding and economic development opportunities inherent in being known as the most energy efficiency region in the country.

APPENDIX 1

European City Examples of Community Energy Planning

Copenhagen, Denmark

Copenhagen, Denmark's capital has a population of over 500,000. Copenhagen is recognized for its good quality of life, mainly due to its seamless urban planning, which integrates development and transportation concerns, encourages a bicycle culture, and promotes green public spaces.

In 1973, oil prices dramatically increased and supply stoppages were a concern. Copenhagen was particularly vulnerable since it relied on imported oil not only for heating and transport, but also for electricity. This challenging event triggered multiple actions to increase the energy efficiency of buildings, use existing fuels more efficiently through the widespread use of District Heating and to diversify the fuel supply, including making a strategic commitment to renewable energy. Thirty years later, Denmark uses less energy per unit of GDP than any other country in the world. In 2009, Copenhagen decided to be the world's first carbon-neutral city by 2025.

Copenhagen has among the world's most efficient buildings. Buildings are certified to guarantee and maintain their energy performance. Building efficiency performance standards themselves are regularly reviewed, typically once every five years. This systematic approach to building codes and performance labeling was adopted by the whole of the European Union.

In the 1970's, a small steam system delivered heating to the city center. Instead of being neglected and ultimately closed as has been the case in many US and Canadian cities, it was upgraded and extended. It now serves most of the City and the suburbs with heating, hot water and cooling. This large network allows the heat typically wasted in electricity generation to be used.

Today, the City and surrounding suburbs are effectively zoned for heating. The network also utilizes multiple energy sources to be combined into a convenient, efficient system. The City uses a range of fuels for heat and electricity generation including coal, natural gas, oil, municipal waste, wood chips, solar and wind. The network optimizes the use of boilers, incinerators, chillers, distributed generation and other energy equipment across the City. District Cooling is rapidly being added to the network to make use of the available heat in the summer when it would otherwise be wasted.

The community energy system is run by a consortium of neighborhood cooperatives bound together by mutual cooperation agreements and a common dispatching system with common technical standards. In recent years, there has been an increasing focus on rain-water recovery and reuse systems, combining the increasing deployment of so-called grey-water systems, to reuse a portion of domestic water use for non-potable applications. The main driver of this is less to conserve water in an absolute sense, but more to reduce the energy and chemicals used in water processing and transportation.

Measures to minimize the use of personal cars and to maximize the use of walking, mass transit and bicycles were implemented. All measures were relatively well-documented. These measures include creating more mixed-use areas, densification of dwellings and activities, designing streetscapes for visual and social interest, implementation of traffic calming measures, investment and prioritization of mass transit, and integration of green spaces into the core urban design.

In addition to creating a highly efficient community, Copenhagen and its surroundings have become a recognized center for efficient architecture, construction technologies and consulting, as well as a magnet for investment and high-quality employment.

Freiburg, Germany

Freiburg is recognized as a global leader in sustainable development for its comprehensive energy planning, water conservation and high transportation modal splits. [55] The City's success in merging design, transportation and ecology are reflected in its expanding trophy case of European and global sustainability awards, and is living proof that sustainable planning is moving from the marginal to the mainstream.

It is a City with approximately 220,000 inhabitants. Its combination of topography, climate, leadership and history has merged to make it a pioneer in renewable energy, environmental protection and transportation planning. The proliferation of renewable energy, clearly defined landscape plans and urban forests, vibrant public transportation system, and environmentally designed housing demonstrate how environmental protection, economic growth and social inclusion are inter-related, not mutually exclusive. Freiburg has achieved these measures against a sustained, steady and continuous population growth for over 30 years.

Freiburg's success shows that ambitious environmental and energy initiatives can be economic development opportunities. Freiburg used three key aspects of the City – the relatively high concentration of sunlight, its rural isolation at the base of the Black Forest, as well as the development of a comprehensive energy program – to create a comparative advantage for the City.

These advantages were used to help Karl-Albrecht University and its 32,000 faculty and students become the largest employer for the City and a catalyst for environmental industries. Over the past 25 years, the City and the University have placed Freiburg at the center of science, research and development for solar energy and other environmental technologies. These include the Fraunhofer Institute for Solar Energy Systems, the Solar-Info-Center and the International Solar Energy Society. More than 450 solar and renewable energy companies call Freiburg home.

The City has also efficiently utilized conventional energy systems, such as co-generation, combined heat and power, and District Energy systems in tandem with increased energy efficiency codes for new and existing homes and buildings, the promotion of biomass, solar, wind, and other renewable energies and an integrated transportation, spatial, and urban development planning program.

During World War II, 80 percent of the inner-city was destroyed. Land-use planning in Freiburg and the surrounding region concentrated on the preservation and protection of the remaining historic environmental, cultural and architectural assets.

Transportation planning aimed to reduce auto-dependency and to put biking and pedestrians on an equal footing with cars. The center-city is a car-free zone. Elsewhere, a 30 kilometer per hour speed limit is in force on all residential streets. Thirty percent of trips are by bike and 15 percent on foot. Motor traffic throughout the City fell from 6 percent over the last 17 years, and residents own fewer cars than the German average.

In the 1970s, the City decided to re-introduce the tram system. Since then, 17 miles of light rail and 168 miles of bus network have been developed. Three quarters of commuters use trams. Zoning ensures that most of the population is within 500 meters of a tram stop. The local public transport authority is financially solvent and recovers over 88 percent of costs from the operation of the tram - among the highest in Germany.

[55] Medearis, D., Daseking, W., and Beatley, T. (forthcoming), 'Freiburg – A Model for Sustainable Development', in Green Cities of Europe: Models for the U.S. Washington, D.C., Island Press

The first long-term energy plan was developed in 1992. Energy conservation, renewable energy and the development of environmentally friendly technologies and transportation formed the three pillars of Freiburg's Energy and Climate Strategy. Solar, wind, hydro and biomass were the core components of the City's efforts to reduce energy consumption by 10 percent. In 1996, the City added an additional goal of reducing emissions to 25 percent below 1992 levels by 2010.

The Energy Strategy was linked to the City's economic development initiatives, particularly solar technology, research and development. The University built upon these economic development initiatives, which led to a proliferation of renewable energy and solar research institutions. A full-time "Solar Manager" was hired to coordinate economic development activities. Freiburg's solar synergies have become a model of industrial ecology, with 450 renewable energy and solar companies employing over 10,000 people. This commitment is reflected in the "Solar Region Freiburg," a long-term vision to promote the region's renewable energy programs and innovation.

The regional utility, Badenova, is jointly owned by Freiburg and neighboring cities, and manages gas, electricity, District Energy, and water and waste-water services. The utilities offer a wide range of incentives to encourage energy efficiency and the increased use of clean and renewable energy.

Freiburg's focus on energy policies are also oriented to enhance existing energy systems, such as combined heat and power. Neighborhoods, such as Rieselfeld and Vauban, use District Energy systems in dense, transit-oriented development organized around the efficient movement of heat and electricity produced via cogeneration.

Additionally, the City also has relied on construction of very advanced energy efficient buildings. All new homes from 2012 are to be built to the Passive Home (Near Zero Energy) standards.