



## ARLINGTON COUNTY, VIRGINIA

**County Board Agenda Item  
Meeting of May 14, 2011**

**DATE:** May 6, 2011

**SUBJECT:** Community Energy and Sustainability Task Force Report

**C.M. RECOMMENDATIONS:**

- A. Adopt the attached resolution (Attachment 1) accepting the Community Energy and Sustainability Task Force Report (Attachment 4) and Report Appendices (Attachment 5) and directing the County Manager to submit to the County Board a Community Energy Implementation Workplan and the final Community Energy Plan to be adopted by the County Board as a new element of the County Comprehensive Plan;
- B. Adopt the County Board Policy Determinations (Attachment 2) to guide County actions and provide direction to the County Manager in preparing the Community Energy Implementation Workplan and the final Community Energy Plan; and
- C. Adopt the Charter for the Community Energy Advisory Group (Attachment 3) to be appointed by the County Board to advise the County Manager and staff on the development of the Community Energy Implementation Workplan and the final Community Energy Plan.

**ISSUES:** Some stakeholders have asked for more details and specifics about the Community Energy Plan's implementation. The details currently available are in the Community Energy and Sustainability Task Force Report. Additional information will be gathered, analyzed, and provided to stakeholders during the proposed implementation plan phase.

**SUMMARY:** The draft Community Energy Plan (CEP), identified throughout this report as the Community Energy and Sustainability (CES) Task Force Report (Attachments 4) with its Appendices (Attachment 5), provides an overall vision for how Arlington should use, generate, distribute and store energy between now and the year 2050. The Report recommends that Arlington reduce greenhouse gas emissions from today's 13.4 metric tons carbon dioxide equivalent per capita per year to 3.0 metric tons per capita per year by 2050. If an effective regional energy plan is put in place, the Task Force

County Manager:

County Attorney:

Staff: Richard Dooley, Laura Conant, Joan Kelsch, John Morrill DES, Environmental Management Bureau

**40.**

advocates achieving 2.2 metric tons per capita per year.

The Report addresses energy use associated with buildings and the transportation sector. The Report contains eighteen (18) recommendations and strategies that, if implemented, are designed to achieve the three primary long-term goals of economic competitiveness, energy supply security, and environmental protection, with each goal linked to specific metrics. The recommendations and strategies cover many energy-related issues, including:

- **Improving energy efficiency** of new and renovated residential and non-residential buildings;
- **Managing building operations** to reduce energy costs;
- **Deploying district energy** and combined heat and power systems in Arlington's high-density areas;
- **Investing in alternative energy** sources such as solar photovoltaics; and
- **Transportation enhancements** consistent with our adopted Master Transportation Plan.

**BACKGROUND:** Arlington County has long been a national leader in transit-oriented development, pedestrian-friendly streetscapes, and green building density incentives. The Arlington Initiative to Reduce Emissions (AIRE) climate action program, launched in 2007, aimed to reduce the “carbon footprint” of County operations, while educating businesses and residents about reducing their own energy costs and carbon emissions.

Building upon this history, the current community energy project aims to chart a course to ensure a healthy, viable, sustainable Arlington for generations to come. In January 2010, the Arlington County Board appointed the Community Energy and Sustainability (CES) Task Force. The 29-member Task Force included community leaders representing many sectors, including residents; businesses; educational institutions; energy industries; local, state and federal government; non-profit groups and associations; and regional transportation authorities. In addition Liaisons were named, representing many of the organizations with interest in the project, who served to keep these organizations informed and shared their valuable perspectives. A Technical Working Group (TWG) of project consultants and County staff provided technical support. The members of the Task Force, the Liaisons, and the TWG are listed at the beginning of the Report (Attachment 4).

The Task Force was charged with recommending countywide goals for long-term, mid-term and short-term reduction of greenhouse gas (GHG) emissions as well as developing key strategies and actions to meet those goals. The Community Energy and Sustainability (CES) Task Force Report is the culmination of a 15-month community process that successfully brought a wide variety of stakeholders to agreement on a proposed framework to transform the way we use, generate, distribute, and store energy in Arlington. The Report is, in essence, a draft Community Energy Plan.

**Community Process:** Public participation and community dialogue were critical in gauging community support and in forging a new direction in community energy planning. The CES Task Force met every other month beginning in January 2010. All meetings were open to the public and all CES Task Force materials and project documents were made available during the project on the County website. In March 2010, the Task Force made the important decision that it would recommend a transformational energy strategy that would go beyond incremental improvements in community energy efficiency to aspire to global benchmarks. After completing comprehensive community energy modeling, the TWG

provided the Task Force with strategies to achieve the transformational goals, which, after much discussion, the Task Force approved at its March 2011 meeting. .

In addition to the Task Force meetings, two Energy Town Hall Meetings were held in the spring and fall of 2010 to facilitate the public discussion and further engage the community. The TWG also conducted multiple targeted meetings, including meetings with the development community, businesses, and persons interested in outreach and education efforts. Additionally, presentations have been provided to numerous County commissions and other interested stakeholder groups. Additional comments are expected from community organizations, commissions, and the public in the coming weeks. Table 1 below lists more than 70 meetings held between January 2010 and May 2011.

<b>Date</b>	<b>Stakeholder</b>
Jan-10	Community Energy and Sustainability (CES) Task Force
Mar-10	Virginia Tech Sustainability & Environmental Policy Class
Mar-10	Chamber of Commerce
Mar-10	Pentagon
Mar-10	Metropolitan Washington Airports Authority
Mar-10	Developers
Mar-10	CES Task Force
Mar-10	Community Energy Town Hall Meeting
Apr-10	Developers
May-10	Fairfax County
May-10	CES Task Force
Jun-10	Pentagon
Jun-10	Vornado: Crystal City Integrated Energy Master Plan (IEMP)
Jun-10	George Mason University
Jun-10	International District Energy Association conference
Jun-10	Kojo in Your Community
Jun-10	American Council of Engineering Companies of VA
Jul-10	Veolia
Jul-10	National Association of Counties
Jul-10	Property Development and Management Industry Sector Meeting
Jul-10	Chesapeake Crescent Initiative
Jul-10	CES Task Force
Aug-10	Rosslyn Renaissance
Aug-10	National Capital Planning Commission
Sep-10	Long Bridge Park Design Advisory Committee
Sep-10	International Council for Local Environmental Initiatives (ICLEI) Annual Conference
Sep-10	Committee of 100
Sep-10	CES Task Force
Oct-10	German Embassy
Oct-10	Metropolitan Washington Council of Governments Energy Advisory Committee
Oct-10	Northern VA Regional Energy Summit
Oct-10	Joint Arlington County / Arlington Public Schools (APS) Meeting
Oct-10	Joint Alexandria / Arlington County Board Meeting
Oct-10	VA Governor's Conference on Energy
Oct-10	White House Council on Environmental Quality Symposium
Oct-10	NAIOP MD/DC and Northern VA Building Industry Association

<b>Date</b>	<b>Stakeholder</b>
Oct-10	Arlington Green Games Launch Event
Oct-10	OPOWER
Oct-10	Skanska USA
Oct-10	Community Energy Town Hall Meeting
Nov-10	Education and Outreach Sector Meeting
Nov-10	Monday Properties; Tolk Engineering
Nov-10	Economic Development Commission
Nov-10	CES Task Force
Dec-10	Chamber of Commerce
Dec-10	Pepeco Energy Services; Shooshan Company
Dec-10	Department of Human Services Resiliency Summit
Jan-11	Rosslyn Renaissance
Jan-11	Transportation Commission
Jan-11	Bean, Kinney & Korman, PC; Carr Properties
Jan-11	CES Task Force
Feb-11	Planning Commission
Feb-11	Asst. Secretary of Commerce, Commonwealth of Virginia
Feb-11	Science class at H.B. Woodlawn School
Feb-11	Transportation Commission
Mar-11	European Delegation
Mar-11	Economic Development Commission
Mar-11	Housing Commission
Mar-11	Transportation Commission
Mar-11	Civic Federation - Environmental Committee
Mar-11	Urban Forestry Commission
Mar-11	Information Technology Advisory Commission
Mar-11	Arlingtonians for a Clean Environment Green Living Expo
Mar-11	CES Task Force
Mar-11	NAIOP MD/DC and Northern VA Building Industry Association
Mar-11	Environment and Energy Conservation Commission
Mar-11	Parks and Recreation Commission
Mar-11	Long Range Planning Committee
Apr-11	Leadership Arlington
Apr-11	George Mason University (Arlington Campus) Earth Day Event
Apr-11	Metropolitan Washington Council of Governments Air and Climate Advisory Committee
Apr-11	Arlington Interfaith Council
May-11	U.S. Combined Heat & Power Association conference

**Table 1 – List of CEP Meetings with Stakeholders from January 2010 to May 2011**

**DISCUSSION:** Collectively, the Report and associated documents for County Board consideration constitute a comprehensive long-term energy planning vision for Arlington and provide a framework to implement this vision. The discussion below outlines the Report’s recommendations and strategies.

**Headline Target:** The metric of “greenhouse gas emissions per capita” (reported as carbon dioxide equivalent or “CO<sub>2</sub>e” per capita) is a widely used measure of energy efficiency and energy productivity, and the term is used as a key metric in the Report. Using this common metric, Arlington can compare its progress against communities worldwide. Greenhouse gas emissions for Arlington today are 13.4 metric tons (mt) CO<sub>2</sub>e per capita annually, about four times the global benchmark established by Copenhagen, Denmark. The Task Force is recommending that Arlington adopt as its target, reduction of Arlington’s annual GHG emissions to 3.0 metric tons CO<sub>2</sub>e per capita per year by 2050. If an effective regional energy plan is put in place, the Task Force advocates lowering the target to 2.2 metric tons CO<sub>2</sub>e per capita per year. These targets, if they were achieved today, would place Arlington among the current global leaders in greenhouse gas emissions reductions. Even in the time frame of 2050, these are truly ambitious targets.

**Buildings Recommendations:** Improving the energy efficiency in residential and non-residential buildings is the single biggest contribution toward meeting the CES Task Force goals. Buildings currently use approximately three-quarters of all energy in Arlington. The four building-related recommendations highlight the importance of increasing the energy efficiency in existing and new buildings. They also emphasize the need for better operations and maintenance of buildings. In addition, going beyond single energy efficient projects, the Report describes how developing demonstrative “scale projects” consisting of multiple buildings on the neighborhood level is a more effective way of achieving community-wide energy efficiency in a timely manner.

**District Energy Recommendations:** Installation of district energy systems capable of using energy generated by a wide range of energy sources would be one of the most significant changes in Arlington’s energy future. District energy systems facilitate the efficient use of heat by linking multiple buildings in high-density areas with underground pipes carrying hot and cold water for heating and cooling. In addition, the heat generated by power plants located hundreds of miles away is currently wasted – dumped into water or the air. Using local combined heat and power systems (generating electricity in addition to hot/cold water) can greatly increase Arlington’s energy efficiency by using both the electricity and the heat. This scenario would create a district energy system tailored to the specific needs of each neighborhood and retain flexibility to adapt to changing technologies and markets long into the future. The creation of a new, local District Energy Company(ies) is also recommended to operate and manage the district energy systems.

**Renewable Energy Recommendations:** Approximately one-quarter of Arlington’s energy use is in low density, residential neighborhoods where district energy is unlikely to be a viable option. In addition to the energy efficiency goals for new construction and renovation, homes in these neighborhoods should consider solar thermal water and space heating systems, solar daylighting, and ground-source heat pumps, as well as rooftop photovoltaic systems in their neighborhood energy plans. Solar photovoltaics (PV) generate electricity largely coincident with maximum summer cooling demand. To eliminate the summer peak electricity demand and reduce overall GHG emissions, the Task Force Report

recommends that 160 MW of solar photovoltaic (PV) electricity generation be installed in Arlington by 2025. In addition to horizontal rooftop systems, solar PV is also effective on vertical south- and west-facing facades.

**Transportation Recommendations:** Transportation activities consume about one-quarter of all energy used in the County, which is a much lower share for this sector than in most other communities, due in large part to our transit-oriented land use and innovative transportation planning. The County has been very successful in reducing individual vehicle miles traveled. Arlington’s Master Transportation Plan calls for enhancing public transit in areas targeted for concentrated development, developing walkable mixed-use neighborhoods, and working with employers to encourage cycling, walking, public transit, and vehicle pooling. The Task Force Report recommends continuing these strategies. Two more Task Force Report recommendations include supporting efforts to increase the energy efficiency of vehicles and to reduce the carbon content of vehicle fuels as additional means of achieving the County’s GHG emissions goals.

**Enabling Strategies:** The Task Force recommends seven (7) Enabling Strategies to ensure the success of Arlington’s energy transformation. Through a combination of governance and community engagement, these strategies are designed to facilitate long-term implementation of the CES Task Force recommendations. These strategies include integrating the Report’s recommendations and strategies into County policies and processes, increasing energy literacy throughout the community, ensuring a technically proficient workforce, and creating a regional energy plan.

### **Commission Meetings:**

**Transportation Commission:** The Transportation Commission heard this item at its April 28, 2011 meeting. The Commission voted unanimously to recommend that the County Board adopt the Resolution, Policy Determinations, Charter, and other related action items.

**Planning Commission:** The Planning Commission heard this item at its May 2, 2011 meeting. The Commission voted unanimously to recommend that the County Board adopt the Resolution, Policy Determinations, Charter, and other related action items. The motion for the Charter included the following suggested changes:

- The scope of work for the Technical Work Group should be outlined in the Charter.  
*Staff Response:* The Charter is for the Advisory Group, not for the County’s Technical Work Group. Therefore, staff has included the suggested Technical Work Group scope of work in the body of the County Manager’s report (see Next Steps).
- The “Community Energy Advisory Group” name should be changed to indicate that the group will disband after the 18-month Implementation Workplan creation effort. The name should be changed to the “Community Energy Working Group.”  
*Staff Response:* The suggested name would be too similar to the County’s “Technical Work Group.” As an alternative, staff will add text to the “Timeline” section of the Charter to explain that the group will disband after the County Board approves the final CEP.

**NEXT STEPS:** Completion of the Task Force’s work and its Report constitutes the first step toward

meeting the ambitious goals of ensuring Arlington's economic competitiveness and energy supply security while protecting the environment. The proposed next step is to develop a Community Energy Implementation Workplan, which will thoroughly investigate and detail how the goals should be achieved.

The County Manager will create a Technical Work Group consisting of County staff from multiple departments and consultants. The general scope of the work of the group will include:

- Preparing the Community Energy Implementation Workplan and final Community Energy Plan;
- Participating in periodic meetings with the Community Energy Advisory Group, as outlined in the Advisory Group Charter;
- Conducting periodic meetings with relevant advisory commissions including, but not limited to, the Planning Commission, Environment and Energy Conservation Commission, and the Transportation Commission to brief commission members and seek their feedback on the progress of the Technical Work Group and the implementation tools under consideration.

Staff anticipates completing the Implementation Workplan by November 2012. One of the products of this Workplan will be to build on the draft Community Energy Plan that is contained in the Report to create a final Community Energy Plan that can be brought to the County Board to adopt as an element in Arlington's Comprehensive Plan.

Staff anticipates completing the outline of the final Community Energy Plan and bringing it and a public review process to the County Board by November 2012. The process of creating the final Community Energy Plan and Implementation Workplan will continue to engage numerous partners and stakeholders throughout the community, including quarterly meetings with the proposed Community Energy Advisory Group. Staff will develop a Communications Plan detailing the process to be used to engage the community during this phase, to include ad hoc working groups as needed, and briefing relevant advisory commissions, e.g., Environment and Energy Conservation Commission, Transportation Commission, Planning Commission to report on Implementation Workplan progress and to seek feedback.

**FISCAL IMPACT:** Long-term implementation of the Task Force Report likely will yield significant savings in energy consumption and economic competitiveness. The development of a Community Energy Implementation Workplan and the final Community Energy Plan is a logical next step in the community energy planning process. Funding for development of these two documents was included in the FY 2012 budget in the form of one-time funding of \$365,000 for consulting services in FY 2012 and \$204,000 for a 2-year limited-term position beginning in FY 2012.

**CONCLUSION:** Bold decisions and commitments made by community leaders 40 years ago were instrumental in Arlington's sustainability successes to date. We now have the opportunity to take the next step through long-term energy planning. The recommendations contained in this CES Task Force Report are ambitious yet practical and proven. The Task Force has concluded that the Arlington community has the foresight and the capacity to embrace and support these recommendations and strategies in order to transform and secure Arlington's economic, energy, and environmental future. Therefore, it is recommended that the County Board adopt the attached resolution accepting the CES Task Force Report and directing the County Manager to submit to the County Board a Community

Energy Implementation Workplan and the final Community Energy Plan to be adopted by the County Board as a new element of the County Comprehensive Plan, adopt the policy determinations, and adopt the Community Energy Advisory Group Charter.

## Attachment 1

### **Resolution to Accept the Community Energy and Sustainability Task Force Report and to Direct the County Manager to Prepare a Community Energy Implementation Workplan and the Final Community Energy Plan**

**Whereas**, the County Board appointed the Community Energy and Sustainability Task Force (“the Task Force”) in 2010 to recommend “countywide goals for long-term, mid-term and short-term reduction of greenhouse gas (GHG) emissions as well as key strategies and actions to be taken by government, the private sector, the non-profit sector and individuals to meet those goals”; and

**Whereas**, the use of energy is the predominant source of greenhouse gas (GHG) emissions in Arlington; and

**Whereas**, the Task Force used greenhouse gas (GHG) emissions as a measure of overall energy productivity, in terms of carbon dioxide equivalent (CO<sub>2</sub>e), where a lower number indicates lower energy use, and has recommended a GHG emissions target of 3 metric tons CO<sub>2</sub>e/capita/year by 2050, and a 2.2 metric tons CO<sub>2</sub>e /capita/year target in the event a regional energy plan is established; and

**Whereas**, the Task Force worked closely with the Technical Working Group, composed of County staff and consultants, over a fifteen-month period to develop a Task Force Report that provides recommendations and strategies; and

**Whereas**, the Task Force engaged a broad range of people representing civic organizations, educational institutions, non-profit organizations, advocacy groups, business and industry, governments and other entities through numerous targeted community meetings, two Energy Town Hall Meetings, and by making all project materials and documents available throughout the process on the County website; and

**Whereas**, on March 11, 2011, the Task Force unanimously approved its Report and submitted it to the County Board for consideration; and

**Whereas**, the Task Force Report fulfills the County Board’s charge to the Task Force to produce a community energy plan based on science, community values and discourse;

*Now, therefore be it resolved that after receiving public comment regarding the recommendations and strategies of the Community Energy and Sustainability Task Force, the County Board hereby accepts the Task Force Report and Report Appendices, dated March 11, 2011, and thanks the Task Force for its far reaching vision and dedication to the effort;*

**Be it further resolved that the County Board directs the County Manager to:**

- 1. Develop a Community Energy Implementation Workplan within 18 months, which identifies actions necessary to move forward on the Report’s strategies and recommendations; and*

2. *Prepare a proposed final Community Energy Plan (CEP) to be adopted by the County Board as a new element of the County Comprehensive Plan; the proposed final CEP together with a recommended public review process shall be submitted to the County Board within 18 months.*

## **Attachment 2**

### **County Board Policy Determinations**

Arlington County is a national leader in innovative local government planning, sustainability, and climate action. The decision to organize community development around Metro corridors and provide high quality transit service has been a fundamental County policy for more than 40 years. Bold decisions and commitments to such policies were made by previous community leaders forty years ago and these choices have been instrumental in Arlington's sustainability successes to date and provide us a good head-start on the future.

Now is the time for today's community leaders to take action that will form the foundation of Arlington's energy future by building on the work of the Community Energy and Sustainability (CES) Task Force. Therefore, the County Board sets forth the following policy determinations – drawn directly from the recommendations and strategies put forth in the CES Task Force Report - to guide County actions, as well as provide direction to the County Manager in developing a Community Energy Implementation Workplan and preparing a final Community Energy Plan for County Board approval. Specific recommendations and strategies from the Task Force Report are referenced in parentheses:

1. Adopt as a goal for Arlington County a greenhouse gas (GHG) emissions<sup>1</sup> rate of 3 metric tons carbon dioxide equivalent per capita per year (3 mt CO<sub>2</sub>e/capita/year) by 2050. (HT1)
  - a. For tracking purposes and to help Arlington County reach its 2050 goal, intermediate emissions goals include:
    - 11.4 mt CO<sub>2</sub>e/capita/year by 2016,
    - 9.3 mt CO<sub>2</sub>e/capita/year by 2020,
    - 5.8 mt CO<sub>2</sub>e/capita/year by 2030, and
    - 4.1 mt CO<sub>2</sub>e/capita/year by 2040.
  - b. Furthermore, the goal should be changed to a rate of 2.2 mt CO<sub>2</sub>e/capita/year by 2050 if a regional energy plan is established.
2. Transform the built environment by significantly increasing the energy efficiency of existing and new residential and non-residential buildings, on the order of 30% to 50%. (B1, B2, B3)
3. Develop or facilitate the development of a mixed use, net-zero energy scale project. (B4)
4. Strive to establish district energy systems where appropriate, owned and operated by a District Energy Company. (DE1)

---

<sup>1</sup> The Task Force uses greenhouse gas (GHG) emissions as a measure of overall energy productivity, in terms of carbon dioxide equivalent (CO<sub>2</sub>e), where a lower number indicates cleaner, more efficient energy use. In 2007 the Arlington community produced 13.4 metric tons CO<sub>2</sub>e/capita/year.

5. Aim to become a national leader for use of solar photovoltaic and other clean and renewable sources. (RE1, RE2)
6. Continue implementation of Master Transportation Plan policies that effectively reduce vehicle miles traveled. (T1)
7. Increase vehicle efficiency and reduce the carbon content of vehicle fuels. (T2, T3)
8. Institutionalize long-term energy planning through regular reporting on key measures of energy performance and related metrics, and incorporation of energy considerations into County plans and activities. Promote energy efficiency and performance by developing guidelines for energy improvements and energy system standardization and interoperability. (S1)
9. Establish a voluntary energy performance labeling program for residential and nonresidential buildings with the County leading by example. (S2)
10. Promote community energy literacy through education, training, and outreach efforts. (S3, S4)
11. Identify and promote appropriate and effective financial incentives to improve energy efficiency. (S5)
12. Create a program to register and publicly report GHG emissions performance and reflect the monetary value of GHG emissions performance, as appropriate. (S6)
13. Coordinate with neighboring jurisdictions, State and Federal agencies, and regional entities to develop a regional energy plan. (S7)

Attachment 3  
**CHARTER**  
**COMMUNITY ENERGY ADVISORY GROUP**

*May 6, 2011*

**Purpose:** The Community Energy Advisory Group (“Advisory Group”) is charged with advising the County Manager and staff on the development of a Community Energy Implementation Workplan (“Implementation Workplan”) and preparation of the final Community Energy Plan. The Implementation Workplan will identify the specific actions necessary to finalize the Community Energy Plan, which will be adopted by the County Board as a new element of the County Comprehensive Plan.

**Members:** The Advisory Group will consist of any and all of those members of the Community Energy & Sustainability Task Force who are interested in continuing their engagement with this activity, as well as additional community members appointed by the County Board.

**Technical Work Group:** The County Manager will organize a Technical Work Group (TWG), composed primarily of County staff from multiple Departments and consultants to do this work. County Departments represented would include, but not be limited to:

- Economic Development;
- Community Planning, Housing & Development; and
- Environmental Services.

The County Attorney’s Office will also participate.

**Scope:** The Advisory Group will:

1. Meet with the Technical Work Group, on a quarterly basis, to receive briefings on the progress of the Implementation Workplan;
2. Offer guidance on the appropriateness of mechanisms and policies under development in the Implementation Workplan;
3. Advise the Technical Work Group on its interpretation of the goals, recommendations and strategies from the Task Force Report, and their prioritization;

4. Advise the Technical Work Group on the transformation of the Community Energy and Sustainability Task Force Report into the final Community Energy Plan, consistent with the Policy Determinations adopted by the County Board; and
5. Provide support for the final Community Energy Plan and the Implementation Workplan as they are introduced to the community.

**Timeline:** The Advisory Group will be appointed at the May 2011 County Board meeting, with the first Advisory Group meeting with the TWG anticipated in June 2011. Quarterly meetings and electronic material exchange will ensue through completion of the Implementation Workplan, anticipated in November 2012, and the final Community Energy Plan to be adopted by the County Board as a new element of the County Comprehensive Plan. The Advisory Group will remain in existence until the County Board adopts the new Comprehensive Plan element.



ARLINGTON  
VIRGINIA

ARLINGTON COUNTY  
COMMUNITY ENERGY & SUSTAINABILITY  
**TASK FORCE REPORT**



**FINAL DRAFT**  
MARCH 11, 2011

# TABLE OF CONTENTS

<b>Table of Contents</b> .....	<b>ii</b>
<b>List of Figures</b> .....	<b>iv</b>
<b>Acknowledgements</b> .....	<b>vi</b>
Arlington County Board .....	vi
Community Energy and Sustainability Task Force .....	vi
Community Energy Project Core Technical Working Group .....	viii
Additional Arlington County Staff Team Members.....	viii
Community Energy and Sustainability Task Force Liaisons.....	ix
<b>Executive Summary</b> .....	<b>ES-1</b>
<b>Chapter 1: Introduction</b> .....	<b>1</b>
History of Sustainability in Arlington .....	1
Purpose of the Report.....	1
CES Task Force Process and Methodology.....	2
Goals for Arlington’s Sustainable Energy Future .....	2
<b>Chapter 2: Embracing Energy and Climate Challenges</b> .....	<b>5</b>
Current Energy Situation.....	5
Global Pressure on Energy Demands .....	5
Energy Use in the .....	7
United States.....	7
Energy Use in Virginia .....	8
Virginia Energy and Climate Change Policy.....	10
Energy Use in Arlington County .....	10
Population and Economic Growth .....	11
Quality of Life .....	11
Climate Data.....	11
<b>Chapter 3: Calculating Arlington’s Baseline Energy Use</b> .....	<b>13</b>
2007 County Energy Baseline.....	13
2007 County GHG Emissions Baseline .....	14
Residential and Non-residential Buildings’ Energy Use Baseline.....	16
Transportation Energy Baseline .....	17
Estimation of Future Energy Needs .....	17
<b>Chapter 4: Framing a Greenhouse Gas Emissions Goal</b> .....	<b>20</b>
Energy Strategies to Meet Transformational Goals.....	20
Structured Framework for Energy Planning .....	22
Benchmarks and Examples .....	22

<b>Chapter 5: Energy Policy Recommendations</b> .....	<b>25</b>
Overview .....	25
Headline Target .....	25
Buildings .....	25
Neighborhood Strategies .....	30
Renewable Energy .....	34
Peak Reduction and Supply Security .....	35
Transportation .....	36
<b>Chapter 6: Enabling Strategies</b> .....	<b>39</b>
Overview .....	39
<b>Chapter 7: Implementing District Energy</b> .....	<b>50</b>
Energy and Greenhouse Gases by Energy Planning Areas.....	50
Scale Projects .....	51
District Energy Strategies and Structure .....	52
Creation of a District Energy Company That Shares District Energy Investments and Benefits.....	54
Development of District Energy Services .....	55
<b>Chapter 8: Conclusion</b> .....	<b>58</b>
Energy Efficiency .....	58
Greenhouse Gas Reductions .....	60
Economic and Social Benefits .....	61
<b>Glossary of Terms</b> .....	<b>65</b>

# LIST OF FIGURES

Figure ES.1: 2007 Baseline Energy Use by Type and by Sector .....	ES-2
Figure ES.2: 2007 Greenhouse Gas Emissions Inventory Results.....	ES-3
Figure ES.3: Total Projected Greenhouse Gas Emissions to 2050.....	ES-4
Figure ES.4: Seven key metrics will allow Arlington to measure progress.....	ES-8
Figure ES.5: Total Energy Projections for Arlington .....	ES-10
Figure ES.6: Annual per capita greenhouse gas emissions rates based on modeling assumptions .....	ES-11
Figure 1.1: Sustainable Energy Future Benefits.....	3
Figure 2.1: Worldwide Use of Energy from 1850 to 2000 .....	5
Figure 2.2: 2008 Economic and Energy Indicators by Major Regions .....	6
Figure 2.3: Greenhouse Gas Concentrations and Global Temperatures.....	7
Figure 2.4: National Greenhouse Gas Emissions .....	8
Figure 2.5: Virginia Natural Gas Pricing Trends .....	8
Figure 2.6: Seasonal Heating and Cooling .....	11
Figure 3.1: Source Energy Use by Type and Sector .....	13
Figure 3.2: Typical Losses from Electricity Transmission, and Distribution.....	14
Figure 3.3: GHG Emissions by Type and Sector .....	14
Figure 3.4: Residential Building Indicators .....	15
Figure 3.5: Non-Residential Building Indicators .....	16
Figure 3.6: Transportation Indicators by Sector.....	16
Figure 3.7: Transportation Indicators by Type .....	17
Figure 3.8: 2007 to 2050 Base Case Energy Use.....	18
Figure 3.9: Projections in GHG Emissions.....	19
Figure 4.1: Four Levels to Transformation .....	20
Figure 4.2: Arlington’s Energy-Related Initiatives .....	21
Figure 4.3: Arlington’s Energy Planning Priorities .....	22
Figure 5.1: Illustration of 30% Aggregate Improvement in Energy Performance .....	26
Figure 5.2: Investments in Existing Buildings Yield Large Returns .....	27
Figure 5.3: Net-zero Village and Passive House .....	30
Figure 5.4: District Energy System.....	31
Figure 5.5: Possible District Energy Areas .....	32
Figure 5.6: Examples of CHP Installations .....	32
Figure 5.7: District Energy-Ready .....	33
Figure 5.8: Seasonal Electricity Demand in Arlington.....	36
Figure 6.1: Examples of EPLs .....	42
Figure 7.1: Typical Arlington Neighborhoods .....	50
Figure 7.2: Selected Energy Planning Areas .....	51
Figure 7.3: Map of Energy Densities for Energy Planning Areas .....	51
Figure 8.1: Arlington’s Pathway to Energy Transformation .....	58
Figure 8.2: Total Energy Use by Sector.....	59
Figure 8.3: Per Capita Energy Use by Sector .....	60
Figure 8.4: Total GHG Emissions Projections by Sector.....	61
Figure 8.5: Per Capita GHG Emissions Projections by Sector .....	62
Figure 8.6: Total GHG Emissions by Strategy.....	63
Figure 8.7: Per Capita GHG Emissions by Strategy .....	63

# ACKNOWLEDGEMENTS

Arlington County thanks the following individuals and organizations for contributing to this project. This report could not have become a reality without the time and effort of numerous people.

## ARLINGTON COUNTY BOARD

Christopher Zimmerman, Chairman  
Mary Hynes, Vice-Chairman  
Barbara Favola, Member  
Jay Fisetete, Member  
J. Walter Tejada, Member

## COMMUNITY ENERGY AND SUSTAINABILITY TASK FORCE

### Businesses:

Brian Coulter, JBG, Chief Development Officer  
Scott Brideau, Little Diversified Architectural Consulting, Studio Principal  
Tom Grumbly, Lockheed Martin, Vice President for Civil & Homeland Security, Washington Operations  
Scott McClinton, Marriott International, General Manager, Crystal City Marriott  
Colleen Morgan, SRA International, Director of Sustainable Environmental & Energy Resources  
Chris Mallin, Turner Construction, Sustainability Director  
Jim Cole, Virginia Hospital Center, President and Chief Executive Officer  
Mitchell Schear, Vornado/Charles E. Smith, President

### Citizens:

Larry Finch, Arlington Civic Federation, Chair of Environmental Affairs Committee  
Shannon Cunniff, Environment & Energy Conservation Commission, Chair  
Scott Sklar, Environment & Energy Conservation Commission, Member  
Inta Malis, Planning Commission, Member

### Educational Institutions:

Patrick Murphy, Arlington Public Schools, Superintendent  
Saifur Rahman, Virginia Tech Advanced Research Institute, Professor of Electrical and Computer Engineering

### Energy and Energy Technology Industry:

Deborah Johnson, Dominion Virginia Power, Senior External Affairs Manager  
Martha Duggan, United Solar Ovonic (Uni-Solar), VP of Government and Regulatory Affairs  
Melissa Adams, Washington Gas, Division Head, Sustainability and Business Development

### Local, State and Federal Government:

Barbara Donnellan, Arlington County, County Manager  
Jay Fisetete, Task Force Chair  
Bradley Provanca, Pentagon, Deputy Director, Defense Facilities Directorate  
Mary Margaret Whipple, Commonwealth of Virginia Senate, State Senator  
Tim Torma, US EPA Smart Growth Program, Senior Policy Analyst\*

### Nonprofits/Associations:

Brian Gordon, Apartment and Office Building Association (AOBA), Virginia Vice President of Government Affairs  
Phil Keating, Arlington Chamber of Commerce, Chair  
Nina Janopaul, Arlington Partnership for Affordable Housing (APAH), Executive Director  
Dean Amel, Arlingtonians for a Clean Environment, Honorary Board Member  
Tim Juliani, Pew Center on Global Climate Change, Director of Corporate Engagement  
Regional Transportation Authorities:  
Margaret McKeough, Metropolitan Washington Airports Authority (MWAA), Executive Vice President and Chief Operating Officer\*\*  
Nat Bottigheimer, Metropolitan Washington Area Transit Authority (WMATA), Assistant General Manager, Planning and Joint Development

\* Also serving as a liaison to the Transportation Commission

\*\* Also serving as a liaison to the Arlington Economic Development Commission

## In Memoriam

Mr. Phil Keating, who represented the Arlington Chamber of Commerce on the Task Force, passed away on January 18, 2011 of a heart attack. His valued input and participation in the Task Force was an example of Phil's well-known commitment to his community. We appreciate the time and effort he spent working with Chamber of Commerce members, Task Force colleagues, and the Technical Working Group to help shape and improve this plan for Arlington's energy future. We will keep Phil's positive and constructive style in our hearts and minds as we work to implement the vision he helped to create.

## COMMUNITY ENERGY PROJECT CORE TECHNICAL WORKING GROUP

<p><b>Arlington County:</b>                  Laura Conant, Arlington County, Energy &amp; Climate Analyst                  Richard Dooley, Arlington County, Project Manager                  Joan Kelsch, Arlington County, Green Building Programs Manager                  John Morrill, Arlington County, Energy Manager</p> <p><b>Consulting Team:</b>                  Peter Garforth, Garforth International llc, Principal                  Cindy Palmatier, Garforth International llc, Business Manager/Administrator                  Timothy Grether, Owens Corning Inc., Project Manager                  Dr. Stefan Blüm, MVV decon GmbH, Head of Department Clean Energy</p>	<p>Gerd Fleischhammer, MVV decon GmbH, Energy and Environmental Engineering Consultant                  Ole Johansen, MVV decon GmbH, Senior Consultant and Project Manager                  Norbert Paetz, MVV decon GmbH, Senior Consultant                  Dale Medearis, Ph.D, Northern Virginia Regional Commission, Senior Environmental Planner                  Aimee Vosper, R.L.A., Northern Virginia Regional Commission, Director of Planning and Environmental Services                  Samantha Kinzer, Northern Virginia Regional Commission, Environmental Planner                  John Palmisano, eTrios Commodities, Senior Vice-President</p>
---	---

## ADDITIONAL ARLINGTON COUNTY STAFF TEAM MEMBERS

Adam Denton*	Jack Belcher	Neil Thompson
Adam Segel-Moss	James Gilliland	Peter Connell
Ann Alston	Jennifer Ives	Richard Tucker
Anthony Fusarelli	Jennifer Smith	Robert Brosnan
Carl Newby	Jessica Abralind	Robert Griffin*
Charles Hilliard	Kelly Zonderwyk	Sarah O'Connell
Chris Hamilton	Larry Slattery	Sarah Slegers*
Cindy Richmond	Lisa Grandle	Shahriar Amiri
Claude Williamson	Liza Hodskins	Shannon Whalen McDaniel
David Morrison	Lou Michael	Sindy Yeh
Dennis Leach	Marc McCauley	Susan Bell
Diana Sun	Marlene Courtney	Terry Holzheimer
Dinesh Tiwari	Marsha Allgeier	Tom Bruccoleri
Elizabeth Craig	Mary Beth Fletcher	Tom Miller
Erik Beach	Mary Curtius	Victoria Greenfield
George May	Michael Brown*	Viswanadhan Yallayi
Greg Emanuel	Michael Collins	Wayne Wentz
Helen Reinecke-Wilt	Myllisa Kennedy	William O'Connor
Ina Chandler		

\*Former County Employee

## COMMUNITY ENERGY AND SUSTAINABILITY TASK FORCE LIAISONS

<p><b>Businesses/Business Improvement Districts (BIDs)</b>                  Ballston Partnership, Pamela Kahn, Executive Director                  Crystal City BID, Angela Fox, President/CEO                  E*TRADE Financial Account/CB Richard Ellis   Global Corporate Service, Patrick Andriuk, Senior Facilities Manager                  Main Event Caterers, Joel Thévoz, Chef / Partner                  NAIOP Northern Virginia, Eric Dobson, Director-- Government Relations and Communications                  Rosslyn BID, Cecilia Cassidy, Executive Director                  Columbia Pike Revitalization Organization, Takis Karantonis, Executive Director</p> <p><b>Citizens</b>                  Arlington County Green Party, Steve Davis, Member                  Historical Affairs and Landmark Review Board (HALRB), Isabel Kaldenbach, past chairman                  Housing Commission, Michelle Winters, Member                  Information Technology Advisory Commission (ITAC), Joe Pelton, Chair                  Rock Spring Congregational United Church of Christ, Rev. Dr. Janet L. Parker, Pastor                  Wooster &amp; Mercer Lofts Association, Eric Tollefson, President</p> <p><b>Local, State and Federal Government</b>                  City of Alexandria, William Skrabak, Director, Office of Environmental Quality                  City of Falls Church, Brenda Creel, General Manager for Environmental Services                  Fairfax County, Kambiz Agazi, Environmental Coordinator                  Loudoun County, Andrea McGimsey, Supervisor, Loudoun County Board of Supervisors                  U.S. Department of Commerce, Ryan Mulholland, Renewable Energy Trade Specialist                  VA Department of Mines, Minerals and Energy, Steve Walz, Director</p>	<p><b>Educational Institutions</b>                  Arlington Public Schools, Sally Baird, Board Chair                  Arlington Public Schools, Scarlet Jaldin, Student, Washington-Lee High School                  Arlington Public Schools, Thomas O’Neil, Member, Facilities Advisory Council                  Arlington Public Schools, Clarence Stukes, Assistant Superintendent, Facilities &amp; Operation                  APS Advisory Council on School Facilities and Capital Programs, Thomas O’Neil, Member                  George Mason University, Dann Sklarew, Associate Professor/Associate Director                  George Mason University, Potomac Environmental Research and Education Center and Lenna Storm, Sustainability Manager                  Marymount University, Dr. Sherri Hughes, Provost                  Northern Virginia Community College, Dana Kauffman, Director, Community Relations                  Westwood College, Sean Murphy, Director of Campus Operations</p> <p><b>Non-Profits</b>                  American Association of University Women (AAUW), Marcy Leverenz, Member                  Arlington Heritage Alliance, Edwin Fountain &amp; Tom Dickinson, Board Members                  Leadership Arlington, Betsy Frantz, President &amp; CEO                  Metropolitan Washington Council of Governments (COG), Stuart Freudberg, Environmental Programs Director                  Northern VA Regional Park Authority, Martin Ogle, Chief Naturalist                  Sierra Club VA Chapter, Mt. Vernon Group, Rick Keller, Energy Chair                  The Nature Conservancy, Peter Hage, Director of Resources, Technology and Information Systems                  Virginia Sustainable Building Network, Annette Osso, Executive Director</p>
--	---

# EXECUTIVE SUMMARY

## ROADMAP FOR COMMUNITY SUSTAINABILITY

Arlington County recognizes that our world faces critical energy challenges in the coming years. With these challenges come opportunities. We must find ways to reduce our dependence on the inexpensive fossil fuels that have fueled our progress since the Industrial Revolution in favor of efficiency and

cleaner, more sustainable energy sources and systems.

Arlington County is preparing for our energy future with innovative solutions that benefit our citizens, our business

“Between 1950 and 2000, worldwide energy use grew five-fold. Energy demand is expected to double again by 2030.”

community, and the environment. Arlington is developing a comprehensive, long-range **Community Energy and Sustainability (CES) Task Force Report** as a roadmap to prepare for the challenges ahead.

This draft Community Energy Plan – identified throughout this document as the Community Energy and Sustainability Task Force Report (“Report”) - describes the approach to take and recommendations and strategies that Arlington should implement to meet three explicit goals:

- Ensure economic competitiveness
- Provide energy supply security
- Protect the environment



The Report is designed to ensure that Arlington’s citizens have cleaner, reliable, affordable energy in the years ahead and that our County remains a competitive place for business and an attractive place to live and work. Further, it respects that Arlington must be adaptable to changing technologies, legislation, and market conditions.

## MEETING GLOBAL ENERGY CHALLENGES

Between 1950 and 2000, worldwide energy use grew five-fold. Energy demand is expected to double again by 2030, straining global energy supplies, prices, and delivery systems. Continuing to depend heavily on these energy sources poses threats to our competitiveness, security, and our environment. Overwhelming scientific evidence indicates carbon dioxide from the combustion of fossil fuels is the major contributor to climate change.

Recognizing the importance of establishing a baseline from which to work, Arlington created a Countywide energy use baseline in 2007. The baseline showed that Arlington County used 48,252,000 million British thermal units (BTU) of energy in 2007 (**Figure ES.1**). At 220 million BTU per person, this is about twice the level of the European Union. The cost for that energy is approximately \$560 million.

The Report supports Arlington’s Vision to be “a diverse and inclusive world-class urban community with secure, attractive residential and commercial neighborhoods where people unite to form a caring, learning, participating, sustainable community in which each person is important.”

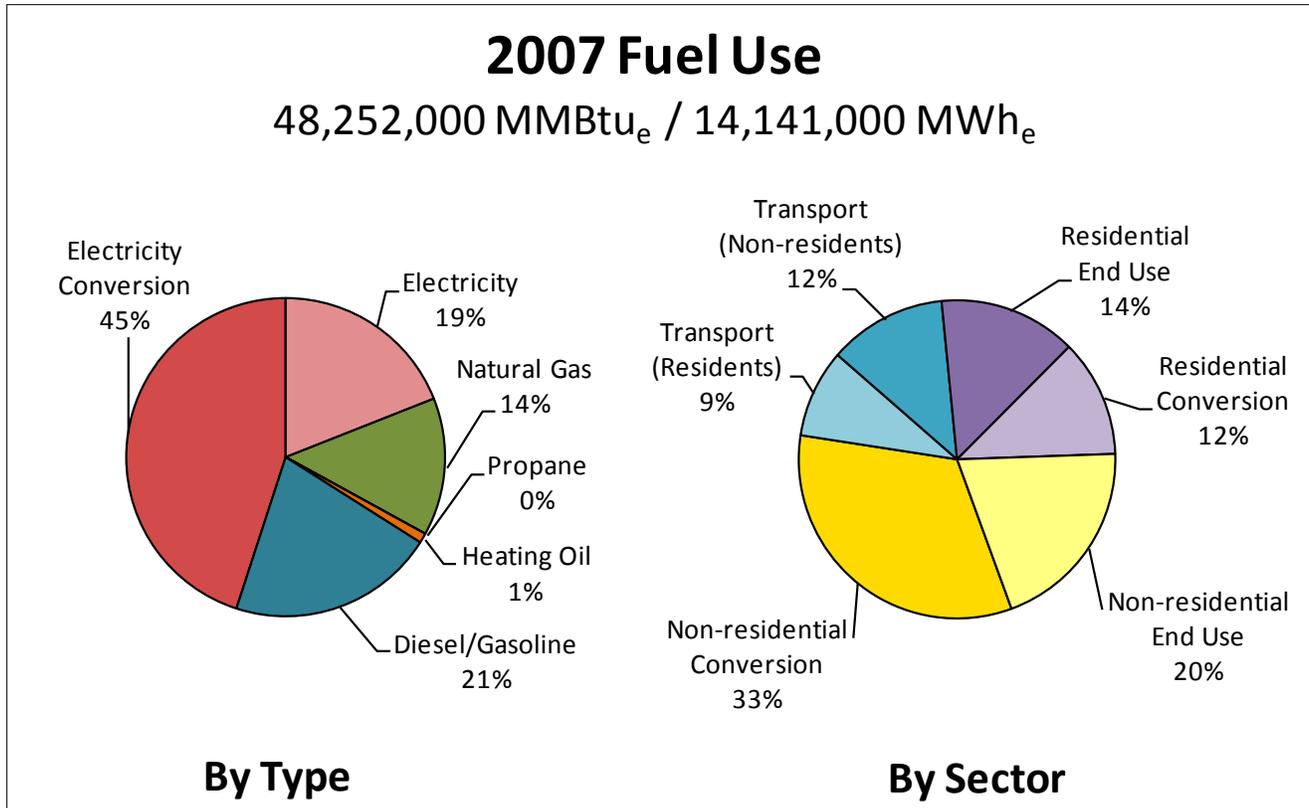


Figure ES.1: 2007 Baseline Energy Use by Type and by Sector

*“After reviewing global best-practices, and Arlington’s data, the Task Force recommends that Arlington create a transformational Community Energy Plan that goes far beyond incremental*

Buildings use more than three-quarters of Arlington’s energy demand, and transportation uses the rest.

This energy use caused about 2.7 million tons of greenhouse gas emissions (Figure ES.2).

By energy type, electricity use creates 56% of all emissions, followed by transport fuels at 29%, and natural gas at 14%.

## THE PROCESS IS ALREADY UNDERWAY

Arlington has already begun to address our energy challenges. We are planning and implementing better transportation systems. In 2007 we launched the Arlington Initiative to Reduce Emissions (AIRE) program to reduce greenhouse gas emissions from the County-owned facilities and fleet. Many Arlington businesses and residents are working together with utility partners at Dominion Virginia Power, Washington Gas, and other organizations to reduce their energy use. The recommendations and strategies in this Report build on these ongoing efforts.

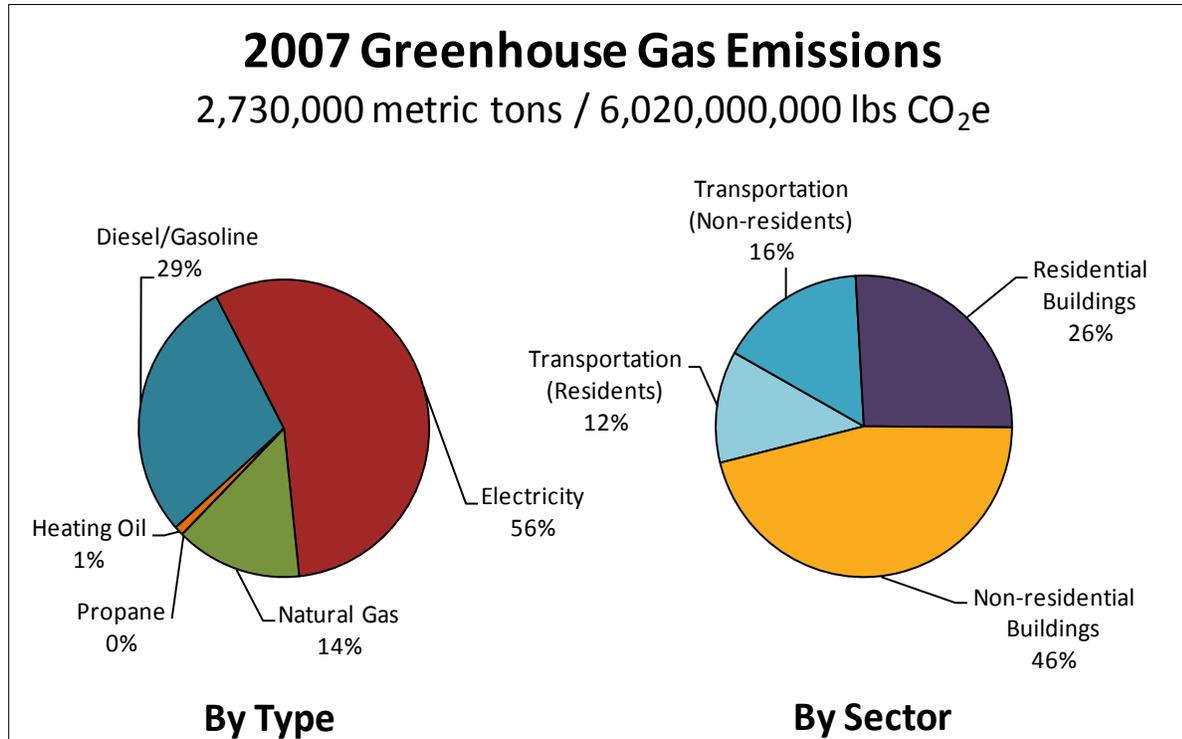


Figure ES.2: 2007 Greenhouse Gas Emissions Inventory Results

## TRANSFORMING ARLINGTON'S ENERGY USE: ENERGY POLICY RECOMMENDATIONS

After reviewing global best-practices, energy modeling data and Arlington-specific information, the Task Force recommends that Arlington create a transformational Community Energy Plan that goes far beyond incremental improvements. Specifically, the Task Force recommends a reduction in Arlington greenhouse gas emissions per capita from the current 13.4 metric tons to no more than 3.0 metric tons by 2050.

“Efficiently used, clean, cost-effective energy supplies will help ensure our energy security, while reducing environmental impact.”

The Task Force is recommending eleven specific energy policies. These recommendations are grouped as:

- Headline Target (HT1);
- Buildings (B1 - B4);
- District Energy (DE1);
- Renewable Energy (RE1 and RE2); and
- Transportation (T1 - T3)

The Task Force further recommends seven enabling strategies (S1 – S7).

### HEADLINE TARGET

Greenhouse gas emissions are an effective measure for both the quantity of energy consumed and the carbon intensity of fuels used. They are a good indicator of both energy productivity and environmental impact.

**HT1: Reduce Arlington's annual GHG emissions to 3.0 mt CO<sub>2</sub>e per capita by 2050. If an effective regional energy plan is put in place, achieve 2.2 mt CO<sub>2</sub>e per capita per year.**

“Greenhouse gas emissions per capita” is a widely used measure for not just energy use, but also energy efficiency, and is used as a key metric in this



Report. Using this, Arlington can compare its progress against communities worldwide. Total greenhouse gas

emissions for Arlington today are 13.4 metric tons per resident annually, about four times the global benchmark.

Despite some efficiency gains in new construction, under a “business as usual” scenario, overall greenhouse gas emissions in the County will increase by 2050 as both jobs and population grow.

Figure ES.3 shows this trend and compares it to projections resulting from the Report recommendations.

The key recommendations in the Report will reduce greenhouse gas emissions over two-thirds by 2050.

## BUILDINGS

Making Arlington’s buildings more energy efficient is the biggest step towards meeting our targets. Residential and non-residential buildings currently use approximately three-quarters of all of the County’s energy.

**B1: From 2015, renovated residential buildings should operate at least 30% more efficiently on average compared to the 2007 baseline average. Non-residential buildings being renovated should operate at least 50% more efficiently than the 2007 baseline average.**

Most of today’s buildings will still be standing in 2050. The Task Force recommends that, beginning in 2015, all residential buildings undergoing major renovation should operate 30% more efficiently than the 2007 baseline average. Renovations of commercial buildings offer even more opportunities for efficiency and should operate 50% more efficiently than the 2007 baseline average. After

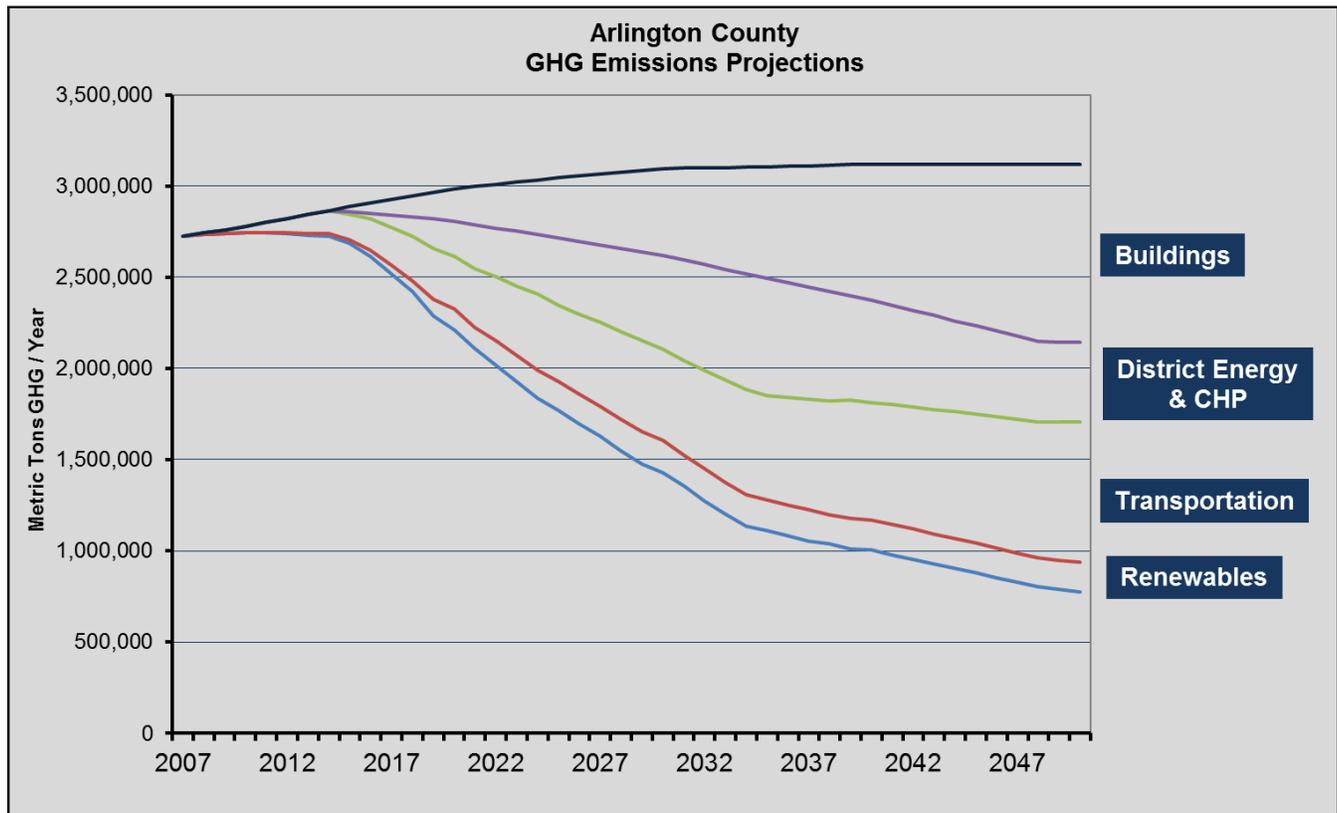


Figure ES.3: Total Projected Greenhouse Gas Emissions to 2050

2015, the efficiency of renovation needs to increase steadily. By 2050, renovated residential buildings will be 50% more efficient, and renovated non-residential buildings should be 70% more efficient when compared to 2007 baseline averages. Though seemingly dramatic, these targets are achievable through improved insulation and air sealing; more efficient lighting, heating, and cooling systems; high efficiency appliances; and improved building operation and day-to-day actions by residents and occupants.

In a typical year, 2%-3% of all types of buildings undergo significant renovation. By 2050, almost all of Arlington's existing residential and non-residential buildings will have been renovated or replaced.

**B2: From 2015, all new residential and non-residential buildings should operate at least 30% more efficiently than current code expectations. From 2025, ongoing new residential and non-residential building construction should operate 1% more efficiently every year through 2050.**

The Task Force is recommending that all new buildings be substantially more efficient than today's averages, and should operate at least 30% more efficiently than today's building code requirements from 2015 through 2025. After 2025, additional small year-to-year efficiency gains will be needed to meet the 2050 targets.

**B3: Emphasize that home and building operations must be effectively managed day-to-day to control energy costs.**

At least half of the energy efficiency needed in all buildings can be achieved from conservation, lifestyle choices, and day-to-day attention to effectively managing their operations.

**B4: Create a mixed-use, net-zero energy scale project.**

The CES Task Force recommends the development of at least one "scale project" with multiple residences to demonstrate the potential for highly energy efficient homes. This should be a small mixed-use neighborhood containing at least 100 homes built to energy standards outlined by the Passive House Institute.

## **DISTRICT ENERGY**

The CES Task Force Report includes a step-wise approach to creating cleaner and more cost-effective energy supply structures that produce fewer emissions. District energy systems, commonly found in other parts of the world, facilitate the efficient use of the heat from local combined heat and power (CHP) generation, greatly reducing the fuel waste normally associated with making electricity. District energy systems can be tailored to the specific needs of each neighborhood and retain flexibility to adapt to changing technologies and future demands.



**DE1: Establish in high-density areas district energy systems owned and operated by a new District Energy Company.**

Arlington uses half of all its energy in areas with high densities of residential and commercial buildings, and many of these areas are zoned for potentially greater future density. The population and employment density in these areas will continue to increase in the coming years. Areas with particularly high energy densities include Crystal City; Pentagon City; Rosslyn; Courthouse; parts of Columbia Pike; and Ballston/Virginia Square.

Beginning in 2015, these areas of high energy density should migrate to district energy for heating, cooling, and hot water services. The Task Force also recommends forming a District Energy Company to invest in the systems and manage these energy services.

## RENEWABLE ENERGY

The existing electricity grid is increasingly stressed by the rising summer peak cooling demand. Building efficiency and CHP will reduce this significantly. Solar electricity generation can further reduce the summer peak electricity demand and greenhouse gas emissions.

### RE1: Install 160 MW of solar photovoltaics by 2025 Countywide.

Solar photovoltaic systems should be installed on municipal, commercial and residential buildings, using a mix of large and small rooftop units, decorative wall panels, and parking shade structures. At today's efficiency levels, this would require 14 million square feet of solar panels.

### RE2: In lower-density neighborhoods, at least 50% of all domestic hot water needs and 20% of the space heating needs not supplied by district energy should be from clean and renewable sources by 2050.

Arlington has many neighborhoods with lower energy densities unsuited to district energy. In these areas the use of individual renewable energy systems for both electricity and heating is recommended. These should include installation of rooftop PV panels, as well as solar hot water and geothermal systems. At least 50% of domestic hot water needs and 20% of space and pool heating should be provided by these renewable sources.

## TRANSPORTATION

Transportation accounts for about one-quarter of Arlington's energy use, lower than most U.S. communities where transportation accounts for one-third of energy use or more. This has been the result of highly successful transit-oriented development that has been occurring for decades.

### T1: Reduce vehicle miles traveled by continuing to develop Complete Streets, high-capacity transit corridors, and transit-oriented development.

The County has been more successful than other jurisdictions in reducing the total individual vehicle miles traveled. Arlington's Master Transportation Plan calls for enhanced public transit in areas targeted for concentrated development, developing



walkable mixed-use neighborhoods, and working with employers to encourage cycling, walking, public transit, and vehicle pooling. The Task Force recommends continuing these strategies.

The County uses various transportation strategies to reduce vehicle miles traveled (VMT), such as targeting transportation modes, departure time, trip reduction, and site design. Arlington will continue to plan and implement "Complete Streets," high-capacity transit corridors, and transit-oriented development. However, continued reductions in single-occupancy vehicle use during peak periods are needed to further reduce VMT in Arlington. Since a high percentage of single-



occupancy vehicles traveling during peak periods originate outside Arlington, the County should continue to work with neighboring jurisdictions to create regional transportation strategies.



**T2: Continue to support federal efforts to increase vehicle fuel efficiency.**

Increasing the fuel efficiency of passenger vehicles is critical to decreasing greenhouse gas emissions. From 1990 to 2007, the Federal Corporate Average Fuel Economy (CAFE) standard for passenger vehicles remained unchanged at 27.5 mpg. In 2010 the federal government increased the average new vehicle fleet standard to 35.5 mpg by 2016, a 29% increase over the current standards.

The range and costs of fuel efficient vehicles is changing rapidly. Innovations in engine technology, electric drives, hybrids, lightweight materials, along with alternative fossil fuels such as natural gas and low-sulfur diesels, are underpinning this accelerating trend to a more efficient pool of vehicles. The Task Force recommends supporting these federal efforts and encouraging general awareness of the growing range of efficient options.

**T3: Continue to support the reduction of carbon content in vehicle fuels.**

Biofuels are blended with gasoline and diesel fuels to reduce the carbon content of fuels. The Task Force recommends that the County encourage the use of biofuels in situations where their use helps reduce carbon emissions.

## TRANSFORMING ARLINGTON'S ENERGY USE: RECOMMENDED ENABLING STRATEGIES

The CES Task Force recommends seven key Enabling Strategies (S1 through S7) to ensure the success of Arlington's energy transformation. Through a combination of governance and community engagement, these strategies are designed to facilitate long-term implementation of Arlington's CES Task Force Report.

**S1: Take steps to institutionalize long-term energy planning and processes.**

Implementing the Task Force's recommendations will require work across all County departments and with numerous partners throughout the community. The County Manager should have the overall accountability for its implementation.

The Task Force recommends that Arlington develop a detailed Community Energy Implementation Plan that would integrate the Report's recommendations and strategies into the County's policies and processes and further identify financing options.

The Implementation Plan would ultimately serve to achieve the three explicit goals of ensuring economic competitiveness, providing energy supply security, and protecting the environment. Seven metrics will be used to measure the progress toward meeting those energy and sustainability goals. These are shown in **Figure ES.4**.

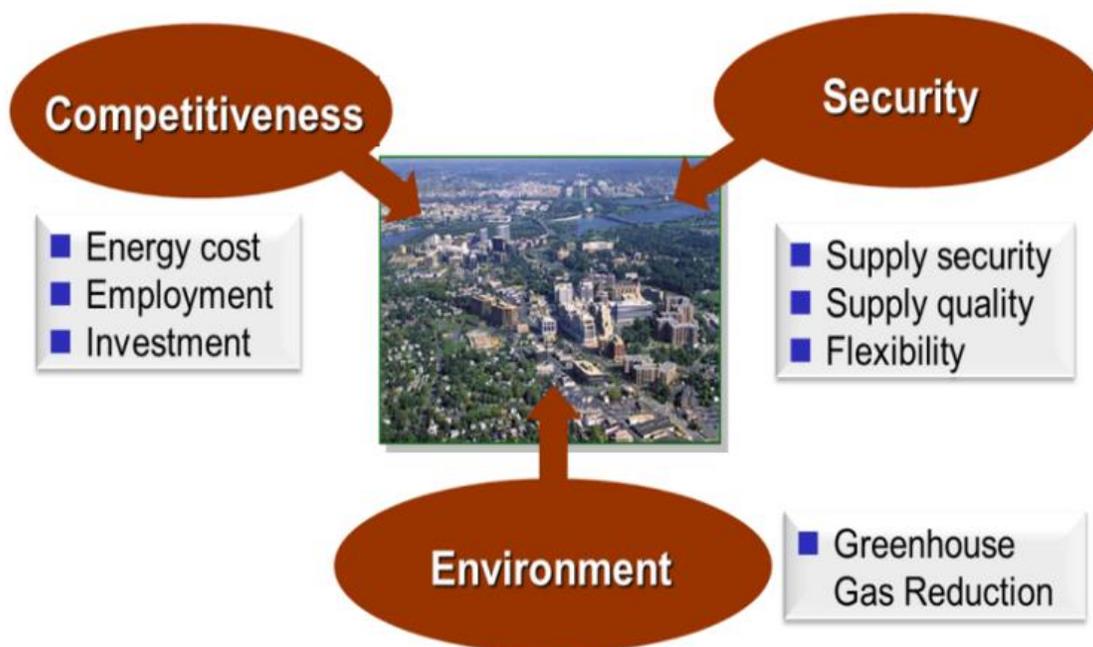


Figure ES.4: Seven key metrics will allow Arlington to measure progress in meeting the plan’s economic competitiveness, energy supply security and environmental protection goals.

These metrics reflect the benefits that transformational changes in Arlington’s energy use will bring. These benefits range from new jobs created as a direct result of the County’s energy strategy to greenhouse gas reductions that address global environmental concerns. These metrics track the three primary goals of the overall project, namely economic competitiveness, energy supply security, and environmental protection.

**S2: Create and implement an Energy Performance Labeling program.**

The Task Force recommends that Energy Performance Labels (EPL) be available for all buildings in Arlington. These building labels will compare actual energy performance and greenhouse gas emissions to similar buildings and to Arlington’s efficiency standards. Ideally, they should be available any time a building is sold or rented to give information on recent energy costs and usage.

They should be displayed in larger buildings used by the public. The County could lead by example and start displaying Energy Performance Labels in their municipal facilities.

**S3: Gather community input and improve energy literacy on an ongoing basis.**

Recent community surveys show that many Arlingtonians have a good understanding of many environmental issues such as recycling and transit options, but could benefit from better information on energy issues and how their individual decisions significantly affect energy use at home and work. Raising energy literacy is a critical component of the success of Arlington’s energy transformation. Measuring public awareness is important to ensure that appropriate information is delivered to specific audiences.

**S4: Provide education and training to all stakeholders.**

By adopting the recommendations in this Report, Arlington will attract high-quality jobs. These will demand new skills and greater numbers of qualified

“We must make changes in all areas of energy efficiency and supply for Arlington’s economy and quality of life to remain vibrant over the coming decades.”

workers, simply to make it happen.

The Task Force recommends that Arlington continue to work with public and private schools and universities to identify energy-related workforce needs and develop training to fill them. The training needs will include areas as diverse as finance, urban planning, and architecture, as well as the more traditional technical and operational occupations associated with energy use.



**S5: Identify and promote financial incentives to improve energy efficiency.**

There are several federal, state, foundation and local incentives available to encourage energy efficiency and greenhouse gas reduction in all buildings and transportation. In addition to incentives for efficient construction, incentives for appliances, lighting, renewable energy systems, etc. are also available. The Task Force recommends that the County develop a database for these incentives and promote their use to building owners, developers, builders and residents.

**S6: Acquire, register, and report greenhouse gas emissions data and monetize as appropriate.**

It is important to have credible, independently verified greenhouse gas emissions data. The Task Force is recommending that independently verified greenhouse gas emission levels for the County are established. This will ensure consistent, comparable and credible performance measurement of the headline goal.

Among other benefits, this will also ensure that carbon reductions credits can be tracked for potential monetization which could result from future climate change legislation or market demands.

**S7: Work with neighboring jurisdictions on a Regional Energy and Climate Plan.**

Numerous jurisdictions in the DC Metro region are discussing challenges and opportunities related to community energy issues. The first workshops for this effort have already been held, with the Metropolitan Washington Council of Governments (MWCOG) and the Chesapeake Crescent Initiative spearheading such efforts. Where state-level support will accelerate success, Arlington should work closely with state officials.

In addition, Arlington should play a leadership role in collaborating with other jurisdictions to develop a regional energy plan to gain the benefits of scale both economically and politically.

## **RESULTS THAT TRANSFORM OUR FUTURE**

The recommended integration of building and transportation efficiency, district energy, low-carbon and renewable fuels, and energy supply will achieve the transformational goals set by the Task Force and transform Arlington's energy and emissions profile.

## **ENERGY EFFICIENCY AND COST REDUCTION**

The total projected reduced energy consumption for Arlington in 2016, 2025 and 2050 is shown below for the three main energy uses: residential buildings, non-residential buildings, and transportation (**Figure ES.5**).

By implementing the recommendations of the Task Force, Arlington can absorb population and job growth and still use less than 50% of today's energy. At today's energy prices this would save \$280 million per year.

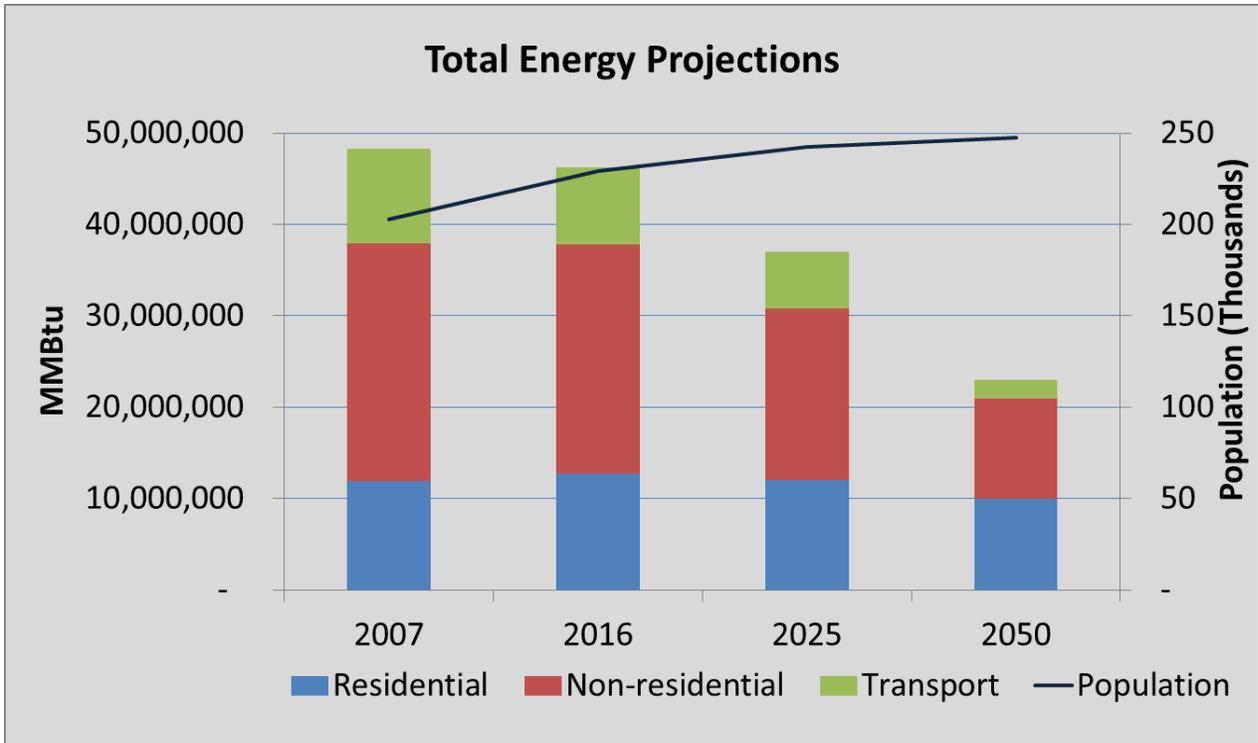


Figure ES.5: Total Energy Projections for Arlington

If the County implements the Task Force recommendations and strategies, on a per capita basis, greenhouse gas emissions could decrease from today’s 13.4 metric tons to 3.1 metric tons by 2050 (Figure ES.6). After considering the assumptions the modeling and analysis was based upon, and the reasonable uncertainties surrounding any projection 40 years into the future, the CES Task Force recommended rounding the 2050 target to 3.0 mt/capita.

As strategies are put in place over the next 5 years, a 15% greenhouse gas emissions reduction is achievable by 2015. Thereafter reductions start to accelerate such that by 2025, they are already nearly 50% below today’s level.

### ENHANCED RELIABILITY AND FLEXIBILITY

By implementing the recommendations in this Report, the resulting local supply of solar electricity,

CHP, and district energy will account for 20% of all the buildings’ energy use in the County and an even higher percentage of total electricity needs. As a result the summer electricity peak would be eliminated. The overall effect will be to improve reliability with less risk of brownouts or blackouts due to local distributed supply.

### SOCIAL AND ECONOMIC BENEFITS

Residents and businesses will benefit from lower and less volatile energy costs, making housing more affordable and businesses more competitive. Lower energy operating costs and reduced greenhouse gas content will be attractive to existing and new businesses, employees and residents, who wish to live, work, invest, learn, and visit in Arlington.

The expertise the County will gain through implementing its own energy transformation will be highly valuable to other communities across North America, further enhancing future opportunities.

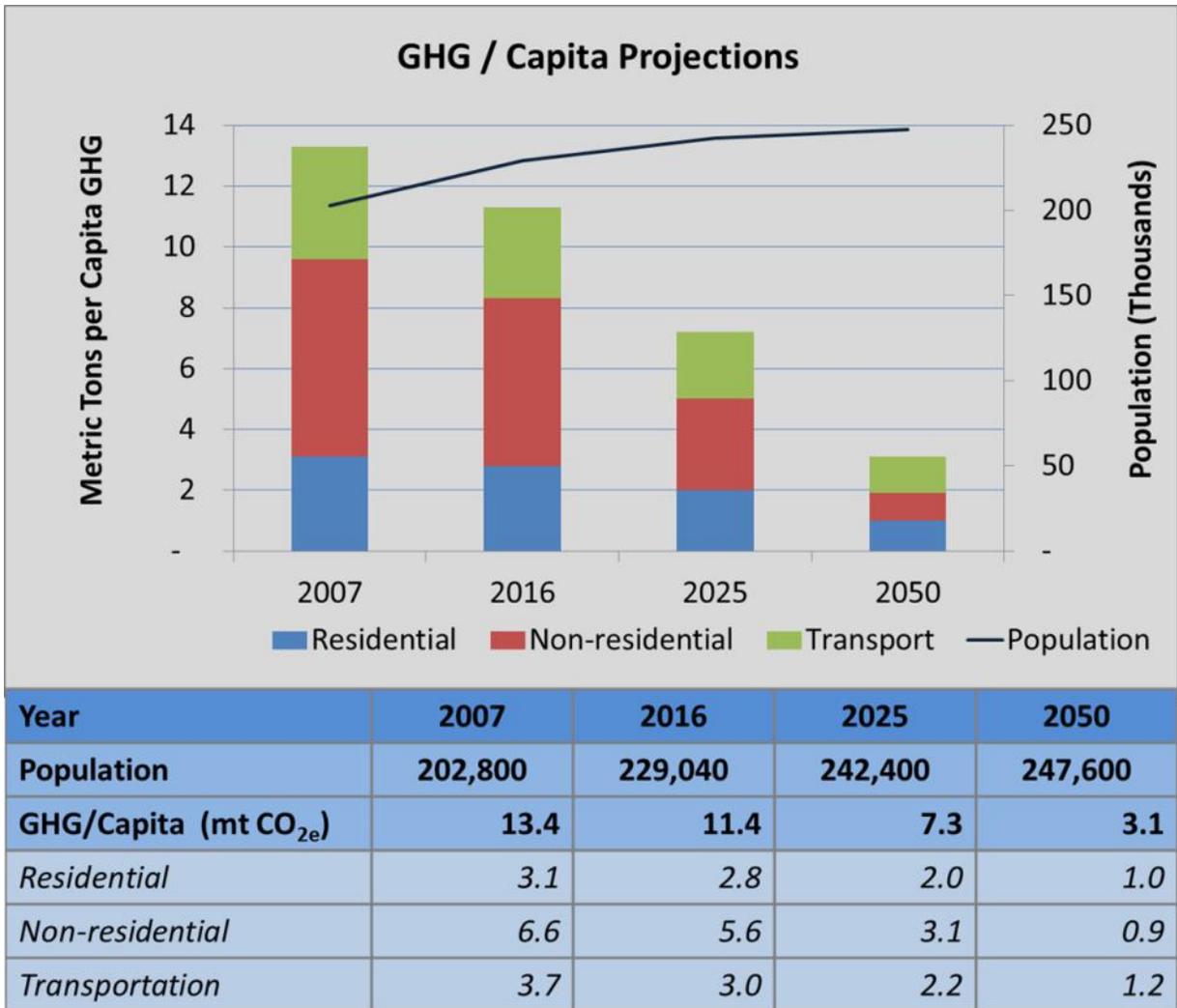


Figure ES.6: Annual per capita greenhouse gas emissions rates for Arlington based on modeling assumptions

## ENERGY PLANNING: THE NEXT PHASE OF SMART GROWTH

We can learn from Arlington’s smart growth history. The goals discussed in the 1960s to redevelop the commercial corridor focusing on developing mixed-use areas within walking distance to the new Metro stations seemed equally daunting and hard to grasp. The idea that public transit could be an impetus for the redevelopment of a suburban area proved a success and is generally well-known today, but in the 1960s the concept was brand new and untested in the U.S., although well-developed elsewhere in the world. In many ways, this parallels the transformational energy goals and recommendations in this Report looking out to 2050.

## ARLINGTON’S ENERGY COMMITMENT

Bold decisions and commitments made by community leaders forty years ago were instrumental in Arlington’s sustainability successes to date and give us a good head-start on the future. The recommendations contained in this CES Task Force Report are ambitious yet practical and proven. The Arlington community has the opportunity and the capacity to embrace and support these recommendations and thus to transform and secure Arlington’s economic, energy, and environmental future.

# CHAPTER 1: INTRODUCTION

## HISTORY OF SUSTAINABILITY IN ARLINGTON

Arlington County was originally part of the 10-mile-square parcel of land surveyed in 1791 to be the Nation's Capital. It is the geographically smallest self-governing County in the U.S., occupying slightly less than 26 square miles. Arlington maintains a rich variety of stable neighborhoods, quality schools, and enlightened land use, and received the Environmental Protection Agency's highest award for "smart growth" in 2002.

Arlington County is a national leader in innovative local government planning, sustainability, and climate action. The organization of community development around Metro corridors and high quality transit service has been a foundational policy for the



County for more than 40 years. This foundation led to the County's current General Land Use Plan and the birth of urban villages around each Metro node, followed by a strong focus on pedestrian-friendly streetscapes, implementation of a green building density incentive program for the private sector, and the creation of Arlington's Initiative to Reduce Emissions (AIRE) climate action program in 2007, originally aimed at reducing the "carbon footprint" of County operations and educating businesses and residents about reducing emissions and energy needs.

Through the AIRE initiative, Arlington has embraced many best practices concerning energy and climate action, including:

- pursuit of world-class energy efficiency and energy management in County operations;
- transparency of information on energy use;
- deployment of alternative fuels and non-carbon sources of energy where and when feasible and appropriate; and
- active outreach, education, and programming aimed at energy- and carbon-reduction activities throughout the community.

## PURPOSE OF THE REPORT

Arlington County recognizes that our world faces critical energy challenges in the coming years. With these challenges come opportunities. We must find ways to reduce our dependence on finite fossil fuels in favor of efficiency and cleaner, more sustainable energy sources and systems.

While Arlington County has done much to date, we recognize that as a growing urban community we cannot sufficiently meet our economic and environmental needs and goals decades into the future without a community-wide plan and a new level of commitment.

On January 1, 2010, the Arlington County Board established the Community Energy and Sustainability (CES) Task Force and charged the Task Force with:

*"Recommending Countywide goals for long-term, mid-term and short-term reduction of greenhouse gas (GHG) emissions as well as key strategies and actions to be taken by government, the private sector, the non-profit sector and individuals to meet those goals. Energy use is the predominant cause of GHG emissions and is therefore the primary focus of this effort."*

A new energy future would support and strengthen Arlington County's existing Vision:

Arlington will be a diverse and inclusive world-class urban community with secure, attractive residential and commercial neighborhoods where people unite to form a caring, learning, participating, sustainable community in which each person is important.

### CES TASK FORCE PROCESS AND METHODOLOGY

The CES Task Force, composed of a broad representation of the community, met bi-monthly from January 2010 through March 2011. In addition, two Energy Town Hall Meetings were held to further engage the community in the process. Multiple targeted meetings were held, including meetings with the development community, businesses, and persons interested in outreach/education efforts. All meetings were open to the public and all CES Task Force materials and project documents have been made available throughout the process on the County website at [www.arlingtonva.us/energyplan](http://www.arlingtonva.us/energyplan).

After announcing this initiative, many individuals and organizations expressed their interest in participating, thus over 35 official "Liaisons" to the CES Task Force were identified - representing civic organizations, educational institutions, non-profit organizations, advocacy groups, business and industry, governments, and other entities. These individuals observed CES Task Force meetings and provided input into the development of the report. Broad stakeholder involvement was deemed essential to envisioning, formulating, and implementing any fundamental changes in community-scale energy systems and GHG management.

This draft Community Energy Plan – identified throughout this document as the Community Energy and Sustainability (CES) Task Force

Report ("Report") - was prepared by the project's Technical Working Group with guidance and direction from the CES Task Force and the general public. The project consultants worked under contract with Arlington County. On March 11, 2011, the Task Force unanimously approved its Report and submitted it to the County Board for consideration.

The CES Task Force recognized that GHG emissions are a good indicator of both energy productivity and environmental impact. The measure of GHG emissions per resident is becoming a relatively common index, and is used as the standard metric for the overall progress in implementing the CES Task Force recommendations and strategies.

For the purpose of the CES Task Force Report, the recommended measures were compared to a modeled Base Case scenario where all new buildings would be built exactly to 2010 Virginia Code levels of efficiency and existing building and transportation energy efficiencies would remain steady and unchanged. The Base Case also assumes the overall energy supply structure for gas, electricity and transport fuels would remain unchanged. Selecting a "steady-state" Base Case for comparison allows the impact of each CES Task Force recommendation to be clearly visible. In reality, there will be building and vehicle efficiency gains and energy supply changes regardless of CES Task Force recommendation implementation. These assumed changes are described in this report.

### GOALS FOR ARLINGTON'S SUSTAINABLE ENERGY FUTURE

The CES Task Force recommendations and strategies are designed to achieve the three primary, long-term goals regarding economic competitiveness, energy supply security and environmental protection, with each goal linked to specific metrics. The benefits that flow from a successful implementation of the CES Task Force recommendations and strategies will touch all stakeholders in the community (**Figure 1.1**)

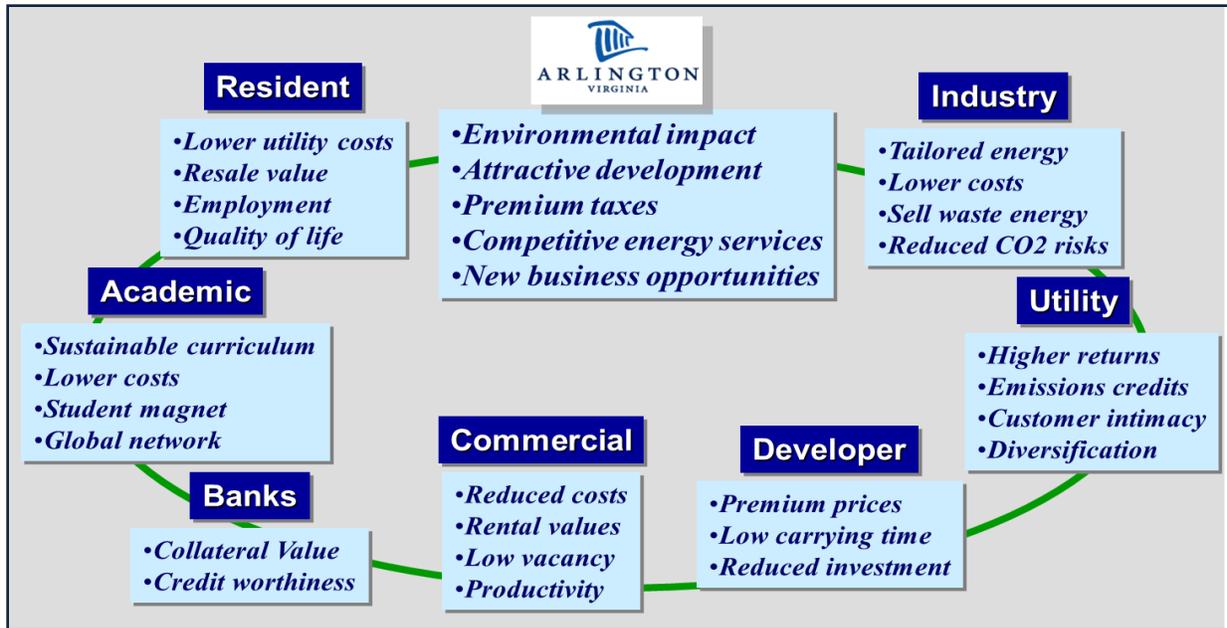


Figure 1.1: Sustainable Energy Future Benefits

**1. Ensure economic competitiveness**

**Implementing this energy strategy will make Arlington an attractive target for businesses offering high-quality employment while remaining a highly desirable community in which to live, work, learn and play.**

Lower energy operating costs with higher reliability than competing communities could be attractive to existing as well as new businesses. As well as yielding higher margins, a community whose energy system produces less GHG emissions could also attract businesses mindful of their environmental footprints. The recommendations and strategies contained in this Task Force Report portray Arlington as a community that could attract companies interested in developing North American clean energy businesses with clients well beyond County borders.

Low energy costs combined with Arlington’s attractive neighborhoods would attract new residents, and existing residents could see resale values on property exceed those of surrounding communities. In evaluating the CES Task Force recommendation, affordability will be measured on the basis of indexed average costs for businesses and households relative to

national and global benchmarks. Commercial property owners and developers could benefit from higher rental values, premium selling prices and higher occupancy rates. This could increase the asset value of homes and properties, reducing risks for financing institutions.

The cost of energy, while important to all businesses and residents, is especially critical to those living in affordable housing. Rent and/or mortgage payments are only one of the costs of living in a home. Ongoing utility and transportation costs must be considered as well. Any potential increase in rents or property values could be offset by lower energy bills. In addition, residents commuting within the County could have a range of cost-effective, convenient, energy-efficient travel choices without the need to own a car.

Along with new businesses, energy management and renovation of properties could create new employment opportunities, as well as a new demand for academic training for energy professionals. Arlington County colleges and universities could become magnets to students in these fields as well as living laboratories for sustainable curricula.

## 2. Provide energy supply security

**Through a combination of efficiency, technical flexibility and reconfigured energy distribution, Arlington's energy costs and reliability should be consistently competitive on a worldwide and national basis.**

Although many market factors affecting energy costs cannot be controlled, County residents and businesses could be better positioned to get lower and more predictable energy prices. They could also be better sheltered from the likelihood of electrical brownouts and blackouts, and from the uncertainty of energy price fluctuations.

As an indication, a 50% reduction in energy use within the County would be worth about \$280 million annually at 2007 pricing. It would also reduce the risks around future energy price fluctuations. This level of savings and the inherent price risk avoidance are sufficiently attractive to justify the cumulative investments of billions of dollars between now and 2050, such as redevelopment projects, energy efficiency upgrades, and district energy system development.

Reliability will be measured by how close Arlington comes to providing high quality energy services to the entire County, even in times of wider regional supply failures or extreme weather. Technical flexibility will be measured by the ability of the system to adapt to differing efficiency, fuel and supply mixes depending on the cost, availability and environmental pressures at the time.

## 3. Protect the environment

**Arlington County will manage energy use to systematically reduce GHG emissions to meet its long-term commitments.**

Greenhouse gas (GHG) emissions are a good measure of environmental impact and are a proxy for energy productivity across the transportation, commercial, industrial, and residential sectors. GHG emissions are also intimately related to the efficient use of fossil

fuels and other energy supply alternatives. GHG emissions are a metric widely-used worldwide and will allow Arlington to evaluate its progress against other communities. For the reasons noted above, the CES Task Force uses GHG emissions as a metric against which to measure progress.

Man-made greenhouse gas emissions have been linked to global climate change. By using our fossil fuels more efficiently we can reduce humans' role in global climate change<sup>1</sup> and the various impacts related to such change.<sup>2</sup>

For instance, reducing GHG emissions in turn improves air quality. Efficient use of fossil fuels reduces other pollutants such as mercury, particulates and various nitrous and sulfurous emissions. Reducing air pollution translates into other environmental benefits, such as fewer instances of acid rain and eutrophication, which helps improve water quality and reduces adverse impacts on crops and forests.

Not only do the Task Force recommendations forecast substantial reductions in anticipated emissions, but they also guide the creation of new energy infrastructure and business models. This in turn allows for the exploration of other options that might reduce emissions beyond the targets presented in this report.

This recommended reduction in GHG emissions approaches the present performance of some communities in Germany and Scandinavia with comparable complexity and urban structure to Arlington resulting in significant environmental benefits.

---

<sup>1</sup>[http://www.ipcc.ch/publications\\_and\\_data/ar4/wg1/en/contents.html](http://www.ipcc.ch/publications_and_data/ar4/wg1/en/contents.html)

<sup>2</sup>[http://www.ipcc.ch/publications\\_and\\_data/ar4/wg2/en/ts.html](http://www.ipcc.ch/publications_and_data/ar4/wg2/en/ts.html)

# CHAPTER 2: EMBRACING ENERGY AND CLIMATE CHALLENGES

## CURRENT ENERGY SITUATION

Energy is a crucial foundation of our world today. Readily available, affordable supplies have driven unprecedented growth in the global economy, raising lifestyle expectations, and creating vast new businesses. At the same time, global competition for fossil fuel-based energy supplies is creating new uncertainties about cost and availability. In addition to these challenges, GHG emissions from fossil fuel combustion are negatively impacting our environment and climate. Our energy future is changing, and it is going to be fundamentally different than what it has been in the past.

## GLOBAL PRESSURE ON ENERGY DEMANDS

Worldwide energy demand grew five-fold between 1950 and 2000 (Figure 2.1), and could double again by 2030<sup>3</sup>. The fast growing economies of China and India have made them major global energy consumers with increasing

imports, a trend that is likely to accelerate.

The U.S. continues to be a major oil importer, and the European Union (EU) imports about 50% of its energy needs. Finite regional energy supplies have led to both globalization and volatility in pricing. Supply security and its impact on economic competitiveness are growing threats.

In fact, world production of conventional crude oil peaked in 2006, according to the International Energy Agency.<sup>4</sup> As global demand for oil continues to grow, the disparity between crude oil supplies and demand must be met by unconventional oil sources, such as tar sands and oil shale production. Developing these unconventional sources is more expensive and more damaging to the environment than conventional sources. Although the recent economic recession has obscured some of the effect, this passing of “Peak Oil” strongly suggests the era of inexpensive oil is over.<sup>5</sup>

The way countries, communities, businesses

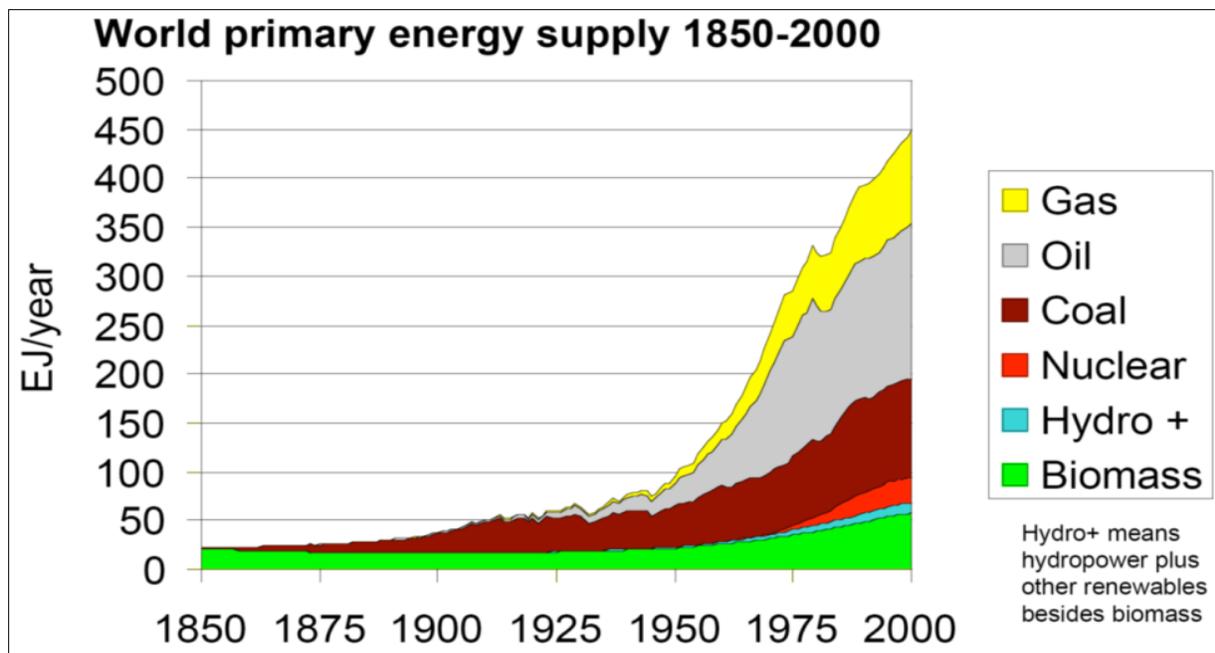


Figure 2.1: Worldwide Use of Energy from 1850 to 2000

and individuals use energy is becoming critical in a competitive global economy. Energy efficient communities and economies have an immediate competitive advantage and will be at an even greater advantage as energy prices rise. **Figure 2.2** highlights energy productivity differences between major countries in the world economy.<sup>6</sup>

The U.S., with just 4.6% of the world’s population, creates 18.9% of global Gross Domestic Product (GDP), using 19.5% of the entire world’s energy to do so. By comparison, the European Union, with 7.5% of the world’s population, generates 25.1% of the world’s GDP using only 14.8% of the world’s energy to do so. This means that the U.S. is using 100 units of energy to make \$1 of GDP, while the EU uses only 57 units, or 43% less energy, to make the same \$1 of GDP. At the scale of the total U.S. economy, this roughly translates into a \$500 billion competitive disadvantage for the United States.

While China and India use more energy relative to GDP than the U.S. today, they are fast

improving their energy efficiency as they modernize and grow. To remain strategically competitive and to ensure a reliable, high quality energy supply, the U.S. must become substantially more energy efficient.

Energy use accounts for roughly 70% of these GHG emissions worldwide, with the remainder caused by industrial processes, land use changes and deforestation.

Since the start of the Industrial Revolution, there has been a substantial rise in the concentration of atmospheric GHG, largely due to the use of fossil fuels. The International Panel on Climate Change, an organization consisting of the world’s leading climate scientists, as well as most major national climate research bodies, attribute the increase in average global temperatures to the increased use of fossil fuel, along with major changes in land use (**Figure 2.3**)<sup>7</sup>. There is substantial evidence this is already causing more severe and more frequent extreme weather events.

Region	Population	GDP	Energy	Energy /Capita	Energy /GDP
USA	4.6%	18.9%	19.5%	100	100
EU	7.5%	25.1%	14.8%	47	57
Japan	1.9%	8.8%	4.3%	52	47
China	20.0%	4.5%	16.3%	19	355
India	17.0%	1.5%	4.9%	7	317
World	100%	100%	100%	23	97

Figure 2.2: 2008 Economic and Energy Indicators by Major Regions

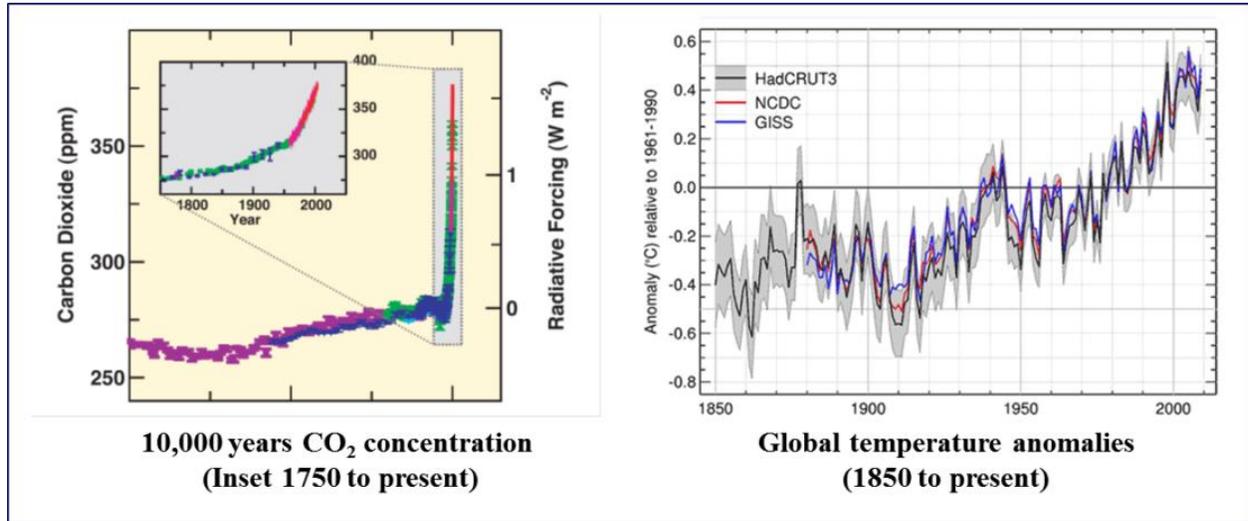


Figure 2.3: Greenhouse Gas Concentrations and Global Temperatures

Nearly 200 countries worldwide have signed the Kyoto Protocol to the United Nations Framework Convention on Climate Change. Over 1,050 U.S. cities<sup>8</sup> and counties<sup>9</sup> have made commitments to substantially reduce GHG emission reductions to slow, and ultimately reverse, the impacts of climate change.

Efficiently using energy and existing fuels, along with the integration of cost-effective alternative energy supplies, not only reduces GHG emissions but also lowers operating costs. Reducing fossil fuel use also has a positive impact on air quality and other environmentally positive outcomes, such as slowing landscape degradation from mining.

## ENERGY USE IN THE UNITED STATES

In 2007, the U.S. spent more than \$1.2 trillion on energy.<sup>10</sup> About half was spent on transportation fuels. In terms of primary energy, over 40% of all energy was used in residential and non-residential buildings, about 28% on transportation, and the balance in industry. Cities consume about 70% of energy used in the U.S., the majority in the built-environment (home, buildings and fixed infrastructure), with most of the balance consumed by transportation in all forms.

For much of its industrial history, the U.S. was an oil exporter, but is now dependent on imports for 60% of its oil needs.<sup>11</sup> Despite recent domestic discoveries, the country imports more natural gas than it exports<sup>12</sup>. Other countries' energy imports of commodities such as coal are also impacting U.S. energy costs as prices globalize. Rising energy costs combined with high levels of volatility are likely to become standard for the U.S. into the future.

A long-period of under-investment in the electric grid, domestic oil refining, rail infrastructure for hauling coal, as well as limitations on the exploration and production of natural gas constrain domestic resource and supply availability. Power outage events have more than doubled<sup>13</sup> since 1990 and are about ten times the levels seen in Germany and Japan<sup>14</sup>. More severe weather events including hurricanes, tornadoes, heat waves, and drought exacerbate temporary blackouts and prolong outages. Managing supply reliability and quality will be a growing necessity for communities and business for the foreseeable future.

As shown in **Figure 2.4**, the U.S. has the highest per capita GHG emissions among nations, with 22.2 metric tons carbon dioxide equivalent (mt CO<sub>2</sub>e) per capita.<sup>15</sup> Most of the national CO<sub>2</sub>e emissions are from the use of fossil fuels.

**National Greenhouse Gas Emissions Per Capita Per Year, 2008  
(metric tons CO<sub>2</sub>e)**

<b>USA</b>	22.2
<b>Canada</b>	22.1
<b>Russian Federation</b>	15.8
<b>Belgium</b>	12.6
<b>Denmark</b>	11.9
<b>Germany</b>	11.7
<b>United Kingdom</b>	10.3
<b>Japan</b>	10.1
<b>Italy</b>	9.1
<b>France</b>	8.6

Figure 2.4: National Greenhouse Gas Emissions

The dependence on fossil fuels and high GHG emissions per capita indicate substantial opportunity for savings and economic returns.<sup>16</sup>

**ENERGY USE IN VIRGINIA**

Virginia has substantial primary energy resources, mainly coal and natural gas.<sup>17</sup> However, these account for less than half of the energy consumed in the Commonwealth. Like the country as a whole, Virginia also relies on energy imports of gasoline, diesel, natural gas, and uranium (for two nuclear power generating plants). Electricity is also purchased from

neighboring states, although much of that is from power plants owned by Virginia utilities.<sup>18</sup>

According to the U.S. Energy Information Administration, Virginia spent nearly \$35 billion on energy in 2008. This is equivalent to roughly 9% of the State Gross Domestic Product (GDP). Because of its fossil fuel energy use, Virginia produced 16.6 mt of energy related CO<sub>2</sub>e per capita<sup>19</sup>, a number that does not include most emissions from aviation, maritime and national defense which benefit every Virginia resident.

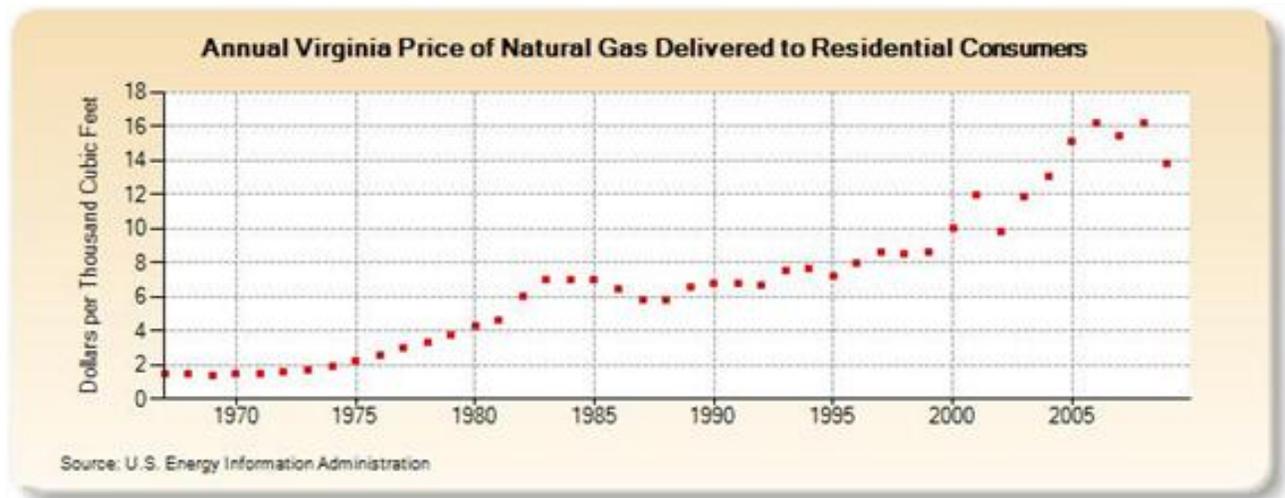


Figure 2.5: Virginia Natural Gas Pricing Trends

Energy used in Arlington's buildings is provided primarily by Dominion Virginia Power (DVP) and Washington Gas. Both companies provided gas and electricity consumption data by end-use categories of residential (including single-family and multi-family units) and non-residential (includes office, retail, hotel, institutional and County government buildings) for use in the Task Force Report analysis.

Virginia historically has enjoyed some of the lowest electricity prices in the U.S., which has generally discouraged strategic investments in new generation and efficiency. DVP delivers electricity under public service regulations set by the Commonwealth, which include allowed investments, retail pricing and service quality.

Recently, electricity prices have risen, but are still slightly below the U.S. average.<sup>20</sup> The cost of upgrading the electricity transmission and distribution grid, along with reducing emissions and increases in global fuel costs, makes the future picture of electricity pricing uncertain.

Like the rest of the nation, natural gas prices in the Commonwealth have become more volatile over time. Since 1990, natural gas prices for residential consumers have more than tripled with periods of significant price volatility, along with a substantial increase in uncertainty. Like the rest of the U.S., gas prices peaked shortly after Hurricane Katrina and are currently at a relatively low level, with a high degree of uncertainty about future levels. In general, historically low prices for energy have masked the inefficiencies in conversion or use, or both. Historically low prices for natural gas and electricity, as well as the lack of an open competitive electric marketplace, have also served to stymie alternative energy supply implementation. This is highlighted in the 2010 Virginia Energy Plan which states: "Some technologies are not cost-competitive against traditional fuels."<sup>21</sup>

Virginia has over 3,300 miles of coastline and many low lying urban and industrial centers that are prone to flooding and erosion. The State has already lost thirteen coastal islands.<sup>22</sup>

At the same time, the Virginia coastline and the excellent offshore wind quality are another potential source of in-State energy supplies.

Electric utility restructuring legislation passed in the 2007 Virginia General Assembly established a voluntary Virginia renewable portfolio standard. The standard is available for electric utilities that show a reasonable expectation of achieving 12% of base-year electric energy sales from renewable energy sources by 2022. Under the program, a utility that meets renewable energy goals earns an incentive that increases the established rate of return. It also earns an enhanced rate of return on the construction costs of renewable energy generation facilities used to provide the renewable energy. Electricity generated from solar or wind is given double credit toward the goal.<sup>23</sup>

The Virginia Energy Plan proposes a higher target of 20%. Many states have enacted mandatory renewable portfolio standards of 20% by 2020 and 25% by 2025. Most of this renewable capacity is expected to come from wind. For a non-U.S. reference, the EU achieved 16% renewable electricity in 2006, with a target for all 27 member states to reach 21% this year (2010), and 30% by 2020.<sup>24</sup>

Washington Gas delivers natural gas under tariffs that are regulated by the State Corporation Commission. Washington Gas customers may choose to buy the natural gas commodity from either Washington Gas or an unregulated marketing company. While regulated delivery rates for natural gas have remained relatively level, gas commodity prices under a more liberalized market structure are still subject to public service regulations set by the Commonwealth. Historically, natural gas prices have been on a steady upward trend with a high degree of volatility.<sup>25</sup>

The future outlook for gas prices is uncertain due to possible large-scale discoveries entering the global market, although the environmental impact of some recent large discoveries, such as the Marcellus Shale in the Eastern United States, have not yet been resolved. The

consensus is that prices will continue to climb accompanied by significant short-term unpredictability.

There is no consolidated Arlington database for the consumption of petroleum products in buildings. Estimates were made for propane, kerosene, and fuel oil use in buildings based on U.S. Census data and U.S. Department of Energy statistics. Likewise, there is no County database for non-municipal transportation fuels.

Estimates for that sector were based on data and surveys from the Metropolitan Washington Council of Governments (MWCOG)<sup>26</sup>, the Arlington County Transportation Division, and the U.S. Department of Energy.

## **VIRGINIA ENERGY AND CLIMATE CHANGE POLICY**

There are two frameworks in Virginia that shape energy and climate change policy. This Arlington CES Task Force Report fits well within the scope of both.

Energy policy is guided by the September 2007 Virginia Energy Plan, an implementation document designed to demonstrate how the General Assembly-enacted state energy policy would be executed<sup>27</sup>. The Plan frames energy generation, supply, conservation and efficiency measures in Virginia and includes energy policy statements and objectives:

Ensure the availability of reliable energy at costs that are reasonable and that advance the health, welfare, and safety of Commonwealth residents.

Establish sufficient energy supply and delivery infrastructure, including that needed to support the availability of natural gas, in the Commonwealth.

Facilitate development of low-cost energy resources located both within and outside the Commonwealth, including development of clean coal resources.

Facilitate development of energy sources that are less detrimental to the Commonwealth's air and water, and electric generation technologies

that do not increase GHG emissions and contribute to climate change.

Develop energy resources and facilities that do not impose a disproportionately adverse impact on economically disadvantaged or minority communities.

Ensure that energy generation and delivery systems are located in places that minimize impacts to pristine natural areas and other significant onshore natural resources, and that are as near as possible to compatible development.

On climate change, in 2007 Governor Kaine issued Executive Order 59, establishing the "Governor's Commission on Climate Change" that would:

Inventory the amount of, and contributors to, Virginia's GHG emissions, and projections through 2025.

Evaluate impacts of climate change on Virginia's natural resources, the health of its citizens, and the economy, including the industries of agriculture, forestry, tourism, and insurance.

Identify what Virginia needs to do to prepare for the likely consequences of climate change.

Identify the actions (beyond those identified in the Energy Plan) that need to be taken to achieve the 30% reduction goal.

Identify climate change mitigation strategies being pursued by other states, regions, and the federal government.

This Commission developed two groups of recommendations. The first group addresses GHG emissions and provides estimates of possible reductions and cost effectiveness. The second group consists of strategies to guide Virginia's response to climate change, including how to plan for and adapt to changes that are likely unavoidable.

## **ENERGY USE IN ARLINGTON COUNTY**

Arlington has no significant energy production within its boundaries and imports all of its

energy. Arlington County spent an estimated \$560 million<sup>28</sup> on energy in 2007. The County is as economically vulnerable to energy-supply reliability and energy price volatility as the rest of the state and the nation. Energy supply reliability questions<sup>29</sup> are beginning to be a factor in investment discussions, potentially affecting future employment.

## POPULATION AND ECONOMIC GROWTH

Arlington County anticipates a 23% growth in population from 203,000 in 2007 to 250,000 in 2050. Over the same period, the number of jobs will grow at a faster rate, increasing by 42%. This growth in employment will generate a significant demand on transportation from non-residents, since more workers will enter the County than reside within its borders, driving up emissions.

Economic and population growth also places a strain on energy supply. Energy supply reliability can be a factor for a business when deciding whether to stay in or relocate to Arlington County.

## QUALITY OF LIFE

Arlington is home to a unique blend of suburban neighborhoods and urban transit-oriented, mixed-use communities. With growth, neighborhoods will change, and the challenge will be to retain and enhance the attractiveness of these neighborhoods through continued smart growth planning, transportation enhancements, and community engagement. Increasingly, these neighborhood plans will include energy solutions of one kind or another to support the quality of life and affordability, while greatly reducing the environmental impact.

## CLIMATE DATA

Climate is a key factor in building energy use, predominantly for heating and cooling. The County has 4,055 heating degree days (HDD65) and 1,531 cooling degree days (CDD) per year referenced to a 65 degree F outside temperature<sup>30</sup>.

Figure 2.6 indicates the heating and cooling trend over a full year. The climate is somewhat challenging with significant winter heating

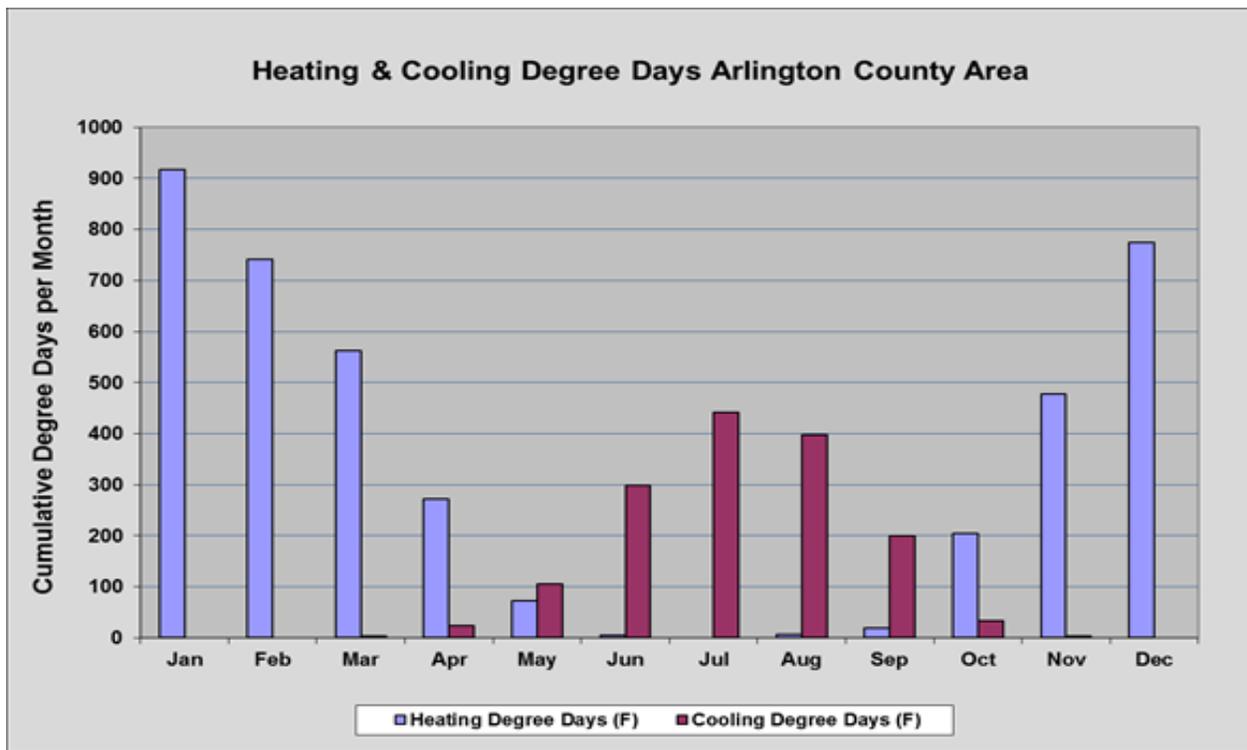


Figure 2.6: Seasonal Heating and Cooling

needs, along with substantial summer cooling needs in combination with relatively high humidity.

According to the National Renewable Energy Laboratory<sup>31</sup>, Arlington County's wind speeds at a height of 50 meters are considered "poor to marginal" for utility-scale wind generation.

NREL data on solar irradiance<sup>32</sup> is between 4 to 5 kWh per square meter for latitude tilt collectors. This is the solar resource available to a flat plate photo-voltaic (PV) collector oriented due south at an angle from horizontal equal to the latitude of the collector location, a typical installation approach. This is a relatively attractive level of solar insolation; in comparison, solar irradiance in Arizona is between 5 to 6 kWh/m<sup>2</sup>, Michigan is between 2 and 3 kWh/m<sup>2</sup>, and Germany, which arguably has the most successful solar market in the world, has insolation levels that range from 2.5 in Hamburg to 3.0 in Munich.

---

<sup>19</sup> <http://www.epa.gov/reg3artd/globclimate/ccghg.html>

<sup>20</sup> [http://www.eia.doe.gov/electricity/epm/table5\\_6\\_b.html](http://www.eia.doe.gov/electricity/epm/table5_6_b.html)

<sup>21</sup> <http://www.dmme.virginia.gov/DE/VAEnergyPlan/2010-VEP/Section6.pdf>

<sup>22</sup> <http://www.vcerc.org/VCERC%20%20climate%20change%20factsheet.pdf>

<sup>23</sup> Page 109 of the 2007 Virginia Energy Plan - <http://www.dmme.virginia.gov/DE/VAEnergyPlan/2007VEP-Full.pdf>

<sup>24</sup> [http://ec.europa.eu/energy/publications/doc/statistics/part\\_2\\_energy\\_pocket\\_book\\_2010.pdf](http://ec.europa.eu/energy/publications/doc/statistics/part_2_energy_pocket_book_2010.pdf)

<sup>25</sup> <http://www.eia.doe.gov/dnav/ng/hist/n3010va3a.htm>

<sup>26</sup> MWCOC operates sophisticated regional transportation data collection and analysis for regional transportation planning and related air quality impacts.

<sup>27</sup> <http://lis.virginia.gov/cgi-bin/legp604.exe?061+sum+SB2625>

<sup>28</sup> Energy expenditure calculated from 2007 County Inventory energy use by source and EIA Virginia fuel costs ([www.eia.doe.gov/states/\\_seds.html](http://www.eia.doe.gov/states/_seds.html))

<sup>29</sup> GIL interview with AED leadership - 2010

<sup>30</sup> <http://www.sercc.com/cgi-bin/sercc/cliMAIN.pl?va89061971-2000> National Climatic Data Center Normals

<sup>31</sup> [http://www.windpoweringamerica.gov/images/windmaps/va\\_50m\\_800.jpg](http://www.windpoweringamerica.gov/images/windmaps/va_50m_800.jpg)

<sup>32</sup> <http://swera.unep.net/index.php?id=solar>

---

<sup>3</sup> IIASA plus updates from BP, IEA, EIA et al

<sup>4</sup> [http://www.worldenergyoutlook.org/docs/weo2010/WEO2010\\_ES\\_English.pdf](http://www.worldenergyoutlook.org/docs/weo2010/WEO2010_ES_English.pdf)

<sup>5</sup> [http://www.netl.doe.gov/publications/others/pdf/Oil\\_Peaking\\_NETL.pdf](http://www.netl.doe.gov/publications/others/pdf/Oil_Peaking_NETL.pdf)

<sup>6</sup> IEA 2008 World Energy Statistics adjusted for 2008 exchange rates

<sup>7</sup> Sources – UK Met Office; NASA; NOAA, UNFCCC

<sup>8</sup> <http://www.usmayors.org/climateprotection/map.asp>

<sup>9</sup> <http://www.conservationalleaders.org/cool.counties.htm>

<sup>10</sup> [http://www.eia.doe.gov/aer/pdf/pages/sec3\\_11.pdf](http://www.eia.doe.gov/aer/pdf/pages/sec3_11.pdf)

<sup>11</sup> <http://www.eia.gov/>

<sup>12</sup> <http://www.eia.gov/>

<sup>13</sup> <http://tli.umn.edu/blog/security-technology/the-rising-tide-of-power-outages-and-the-need-for-a-smart-grid/>

<sup>14</sup> <http://tli.umn.edu/blog/security-technology/the-rising-tide-of-power-outages-and-the-need-for-a-smart-grid/>

<sup>15</sup> United National Statistics Division, [http://unstats.un.org/unsd/environment/air\\_greenhouse\\_emissions.htm](http://unstats.un.org/unsd/environment/air_greenhouse_emissions.htm)

<sup>16</sup> [http://www.epa.gov/climatechange/emissions/downloads10/US-GHG-Inventory-2010\\_ExecutiveSummary.pdf](http://www.epa.gov/climatechange/emissions/downloads10/US-GHG-Inventory-2010_ExecutiveSummary.pdf)

<sup>17</sup> <http://www.dmme.virginia.gov/DMR3/naturalgas.shtml>

<sup>18</sup> <http://www.dmme.virginia.gov/DMR3/energyresources.shtml>

# CHAPTER 3: CALCULATING ARLINGTON'S BASELINE ENERGY USE

Tracking and evaluating Arlington's progress in meeting the goal established in the CES Task Force Report requires an accurate accounting of its current emissions.

In early 2010, Arlington County completed a comprehensive GHG emissions inventory<sup>33</sup> for 2000 and 2007 that accounted for energy consumption and emissions in the County's building, transportation, industrial, residential sectors. The methodology and assumptions used in creating the inventory are described in detail within that inventory document. The CES Task Force uses 2007 as the baseline year for its analyses and recommendations.

No energy use or emissions from Washington Reagan National Airport, the Pentagon, or the Department of Defense (DoD) Joint Base facilities were included in the inventory because data from these sources were not available when the inventory was completed. We expect to include energy use and emissions from these facilities in future analyses and inventories.

## 2007 COUNTY ENERGY BASELINE

In 2007, the County consumed 48,252,000 million Btue (14,141,000 MWh<sub>e</sub>) with an estimated cost of \$560 million (Figure 3.1). This is 220 million Btue (70 MWh<sub>e</sub>) per capita. This is about average for the U.S. For comparison, it is about twice the energy consumed per capita in the EU.

The energy used by type breaks into two distinct parts. The energy directly used within the County in the form of electricity, transportation fuels, and natural gas and heating oil comprises 55% of the total. The remaining 45% is consumed outside the County and represents the conversion energy resulting from generating and transporting electricity to the County. This conversion energy is included since it is a direct result of Arlington's activities. It is made up of the unrecovered heat in the power plant and the transmission and distribution line losses (see Figure 3.2)<sup>34</sup>.

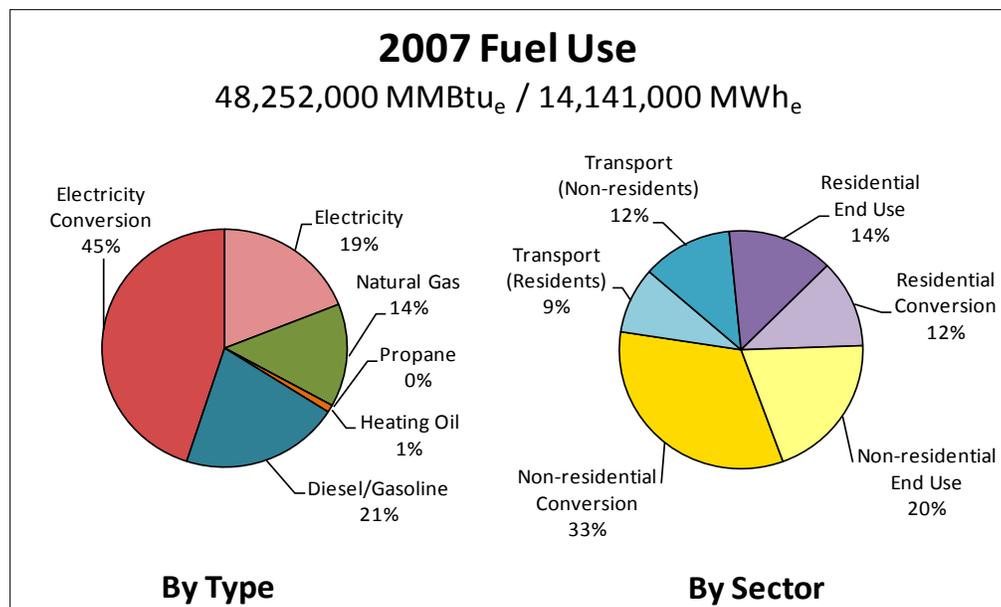


Figure 3.1: Source Energy Use by Type and Sector

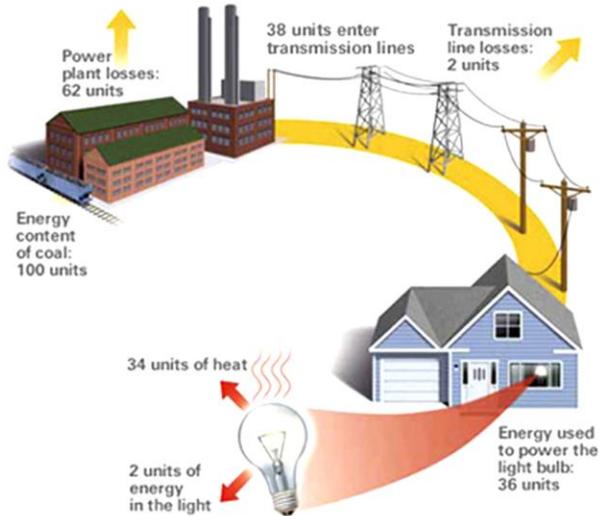


Figure 3.2: Typical Losses from Electricity Transmission, and Distribution

As indicated above, about 70% of the energy involved in electric generation and distribution is lost before it arrives at a home or commercial building. This contrasts with a 10% energy loss that occurs in the natural gas extraction and delivery system.

These conversion losses represent valuable fuel that has been paid for by the consumer. This report explains measures that can be used to reduce some of these losses through the use of

clean and renewable energy sources.

The County’s residential housing accounts for 26% of all energy used. A further 53% serves non-residential buildings. Collectively, residential and non-residential buildings account for over 79% of all energy consumed.

The remaining 21% of energy in the County is used in transportation, mostly from individual vehicles. Well over half of transportation use is from vehicles operated within the County but owned by non-residents coming for work or other purposes. The relative impact of non-residents will grow in future.

There are no significant industrial or agricultural uses of energy in Arlington County.

### 2007 COUNTY GHG EMISSIONS BASELINE

In 2007, total energy-related GHG emissions were 2.73 million mt CO<sub>2</sub>e (Figure 3.3)<sup>35</sup>.

GHG emissions were 13.4 mt per capita in 2007. This excludes any impacts from agricultural, forestry, industrial, defense, mining, extraction, shipping and airline activities that are typically accounted for elsewhere, but which clearly benefit the County’s residents. When these are taken into account, Arlington would be slightly

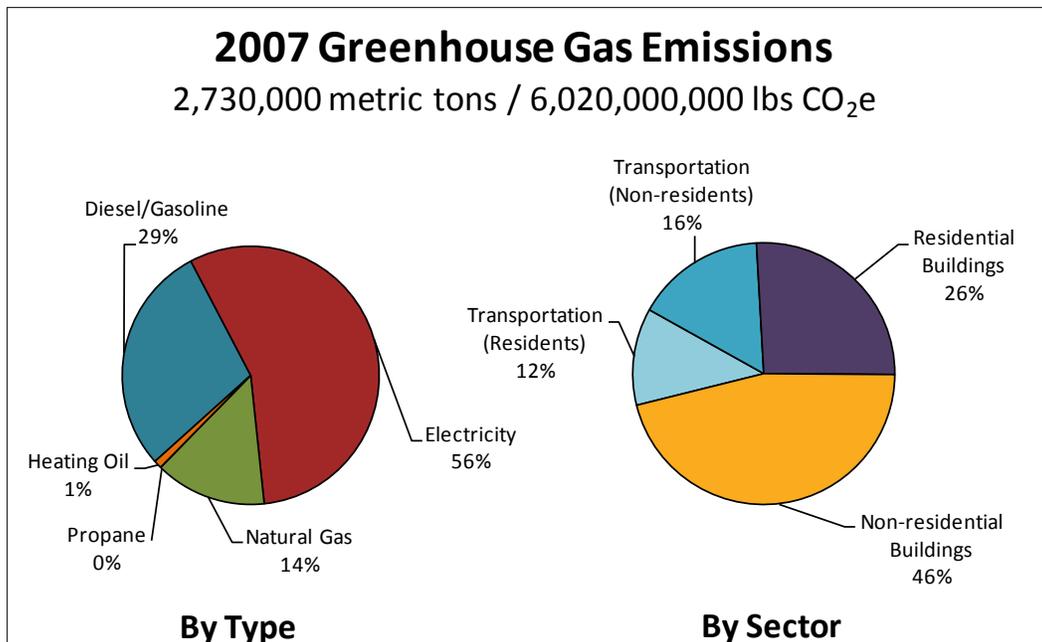


Figure 3.3: GHG Emissions by Type and Sector

below the U.S. national average of 21.7 mt per capita, which is about twice the level of the EU.

Total emissions have increased 10% since 2000, due to increases in housing and commercial space. Transportation emissions have remained virtually flat since 2000, despite population and business growth. This is a result of reduced vehicle miles traveled due to transit-oriented development patterns and excellent commuter services.

Most GHG emissions (56%) are from electricity. Fuels for heating and hot water, predominantly natural gas, make up 15% of the total emissions. Fuels for transportation including diesel, gasoline, compressed natural gas, and some biofuels account for the balance of 29%. Solid waste and other sources are negligible in the total emissions profile.

By end use, nearly half of all emissions come from non-residential buildings, underlining the impact of Arlington’s employment mix. Residential buildings of all types create about a quarter of total emissions. All transportation accounted for 28% of total emissions, with non-resident vehicles (largely those who work in Arlington or pass through Arlington en route to work) contributing 16% of total emissions. Emissions from residents’ travel were about 12% of total emissions.

At a global level, about 30% of all human-induced GHG emissions are caused by changes in forestry and land use. As a predominantly

urban community with minimal agriculture or large scale forestry, this is not relevant to the Arlington’s carbon footprint. Also, Arlington already has an active program to increase its urban forestry cover. Increasing shade reduces electricity for cooling and its emissions. Overall, more trees will increase the absorption of carbon dioxide as a result of sequestration. While beneficial, these impacts have not been modeled in the CES Task Force Report.

Currently, there are few federal or state regulatory limits on GHG emissions. In early 2010, the U.S. EPA, under its Clean Air Act “tailoring rule,” required states to develop approved plans that include requirements for issuing air permits. From January 2011, large GHG emitters, mostly refineries, power plants, and cement production facilities with plans to build new facilities or make major modifications to existing ones must identify and implement best available control technologies to reduce their GHG emissions. At the state level, California is moving ahead to establish cap-and-trade emissions reduction market. In the Northeast, the Regional Greenhouse Gas Initiative (RGGI), which also uses a cap-and-trade approach to restrict the GHG emissions of major power producers in ten Northeastern U.S. states, is into its third year of operation. In addition, many industries voluntarily report emissions for a wide variety of business reasons.

Arlington Residential Consumption and Emissions						
Sector	Area Estimate MM sf	Estimated Energy Use			GHG Emissions	
		Total MMBtu/year	Per sf kBtu/year	Per Capita MMBtu/year	Total mt/year	Per Capita mt/year
Single Family Detached	50.8	3,390,000	67	17		
Singe Family Attached	16.3	770,000	47	4		
Multi-Family	51.1	1,950,000	38	10		
<b>Residential Total (site)</b>	<b>118.2</b>	<b>6,110,000</b>	<b>52</b>	<b>30</b>		
<i>Benchmarks (Site)</i>						
Mid-Atlantic			52	45		
United States			44	37		
Arlington Electricity Conversion		5,820,000				
<b>Residential Total (Source)</b>	<b>118.2</b>	<b>11,930,000</b>	<b>101</b>	<b>59</b>	<b>627,000</b>	<b>3.1</b>

Figure 3.4: Residential Building Indicators

Arlington Non-Residential Consumption and Emissions						
Sector	Area Estimate MMsf	Energy			GHG Emissions	
		Total MMBtu/year	Per sf kBtu/year	Per Capita MMBtu/year	Total mt/year	Per Capita mt/year
Office & Other	46.6	7,150,000	153	35		
Retail	9.6	1,480,000	155	7		
Hotel	7.1	1,450,000	204	7		
<b>Non-Residential Total (Site)</b>	<b>63.3</b>	<b>10,080,000</b>	<b>159</b>	<b>50</b>		
<b>Benchmarks (Site)</b>						
Mid-Atlantic			100	26		
United States			91	22		
Arlington Electricity Conversion		15,850,000				
<b>Non-Residential Total (Source)</b>	<b>63.3</b>	<b>25,930,000</b>	<b>409</b>	<b>128</b>	<b>1,318,000</b>	<b>6.5</b>

Figure 3.5: Non-Residential Building Indicators

## RESIDENTIAL AND NON-RESIDENTIAL BUILDINGS' ENERGY USE BASELINE

There is great potential to reduce energy use in residential and non-residential buildings. Based on the energy consumption data in the County GHG emissions inventory and information on the size of the housing stock, Arlington's housing uses an estimated 51,700 Btu of energy per square foot (Btu/sq ft) of conditioned space per year. When the conversion losses (mostly from electricity) are included, each home uses about 101,000 Btu/sq ft of primary energy. While this is typical for the Middle Atlantic Region, data from the U.S. Department of

Energy's Residential Energy Consumption Survey (RECS) database indicates that current U.S. best practice or EU normal practice would be at or below 40,000 Btu/sq ft per year<sup>36</sup>.

Since it was not possible to further breakdown the utility-metered energy use by building type, energy modeling of building types and total areas were aligned to the total utility data for the residential and non-residential sectors. The energy models were developed for each of the six building categories in Figures 3.4 and 3.5. To include the effect of less efficient older construction, they were also further split into older and newer construction.

To validate the "top-down" modeling, a "bottom-up" check was completed by

Arlington Transportation Consumption and Emissions (By Type)				
Type	Estimated Energy Use		GHG Emissions	
	Total MMBtu/yr	Per Capita MMBtu/year	Total mt/year	Per Capita mt/year
Passenger Cars/Motorcycles	4,900,600	24	347,280	1.7
Light Duty Vehicles (SUV, pick-up, van)	3,380,800	17	239,900	1.2
Heavy-Duty Vehicles	1,274,100	6	102,290	0.5
Busses	520,300	3	23,180	0.1
Rail	253,200	1	40,540	0.2
<b>Transportation Total</b>	<b>10,329,000</b>	<b>51</b>	<b>753,190</b>	<b>3.7</b>
<b>Benchmarks</b>				
Virginia	768,200,000	99	56,560,000	7.4
United States	28,009,500,000	93	2,024,870,000	6.7

Figure 3.6: Transportation Indicators by Sector

comparing samples of actual building energy consumption with the modeled averages. The energy use per square foot for a number of specific buildings in Arlington matched very well with office, hotel and multifamily estimates.

These numbers include all the electricity used including items like entertainment systems, computers, office equipment and appliances. Even though new equipment is becoming significantly more efficient, the trend is to use more devices in buildings, with the addition of second and third refrigerators, televisions, computers, etc.

## TRANSPORTATION ENERGY BASELINE

The transportation sector can be broken down to reveal how the transport energy is consumed and where emissions are generated. Overall, the larger component of both energy and GHG is non-resident transportation followed by resident private transportation. The overwhelming contribution is from passenger cars, SUVs and other light duty vehicles. Public transportation and government vehicles contribute a smaller amount.

Arlington’s energy and GHG emissions per capita from transportation are both substantially lower than Virginia and U.S.

averages based on the U.S. DOE State Energy data<sup>37</sup> publications and U.S. EPA’s GHG data<sup>38</sup> (Figures 3.6 and 3.7). The U.S. and State data includes civil aviation, marine, off road and shipping fuels that are not included in Arlington County’s figures. Even accounting for these, lower energy use and emissions are expected given the transportation options already in place for Arlington County residents and workers.

## ESTIMATION OF FUTURE ENERGY NEEDS

To assess the potential of various strategies for the CES Task Force Report, a Base Case for energy and GHG emissions over the next 40 years was established. This projected a business-as-usual scenario in Arlington County into the future. The assumptions used for the CES Task Force Report Base Case are described below.

### ASSUMPTIONS

The CES Task Force Report Base Case is based on the 2007 Arlington County inventory data for both primary and secondary energy use and associated GHG emissions.

Existing energy sources and networks for natural gas and electricity used for residential and non-residential buildings are assumed to be

Arlington Transportation Consumption and Emissions (By Sector)				
Sector	Estimated Energy Use		GHG Emissions	
	Total MMBtu/yr	Per Capita MMBtu/year	Total mt/year	Per Capita mt/year
Private Transport Residents	3,374,300	17	237,930	1.2
Public Transportation	759,200	4	75,390	0.4
Transportation of waste	8,200	0	550	0.0
Private Transport Non-Residents	5,842,300	29	428,230	2.1
Government Traffic	345,000	2	11,090	0.1
<b>Transportation Total</b>	<b>10,329,000</b>	<b>51</b>	<b>753,190</b>	<b>3.7</b>
<b>Benchmarks</b>				
<i>Virginia</i>	<i>768,200,000</i>	<i>99</i>	<i>56,560,000</i>	<i>7.4</i>
<i>United States</i>	<i>28,009,500,000</i>	<i>93</i>	<i>2,024,870,000</i>	<i>6.7</i>

Figure 3.7: Transportation Indicators by Type

the same in the future. The mix of primary fuel sources for both Washington Gas (WGL) and Dominion Virginia Power (DVP) are held constant over the modeling timeframe.

The energy needs for new construction were estimated for new residential and non-residential buildings based on the County projections for each building type, combined with new construction replacing demolished buildings. Both of these estimates of new construction assume the same average unit size for each type of building. The Base Case assumes a demolition rate based on historical data for the County. This ran from a low of less than 0.1% per year for single-family homes to a high of 1.2% per year for hotels. The Base Case also assumes that demolished buildings would be replaced with new ones of the same size and function. Since the number of existing buildings will be reduced over time and the remaining existing buildings will continue to use the same amount of energy, this category will see an overall reduction in total energy use.

All future construction is assumed to abide by the current code in place today with no changes over time. As today, heating and cooling is assumed to be provided by individual boilers, furnaces, and chillers. The split between electricity, natural gas and oil for heating is assumed to remain constant.

The Base Case assumptions for transportation are two-fold. The first holds the 2007 transportation energy use per capita and emissions per capita constant over the 40-year timeframe. This assumes that the customer choice of transport type and the energy efficiencies of each transport type remain unchanged. It assumes that the average journey length is unchanged as a result of either choice of residence, work location, or urban design. The second assumption is that the number of jobs will increase faster within the County than the population, increasing the related energy and emissions. The increase in jobs is a transportation “headwind” that will make substantial reductions more challenging.

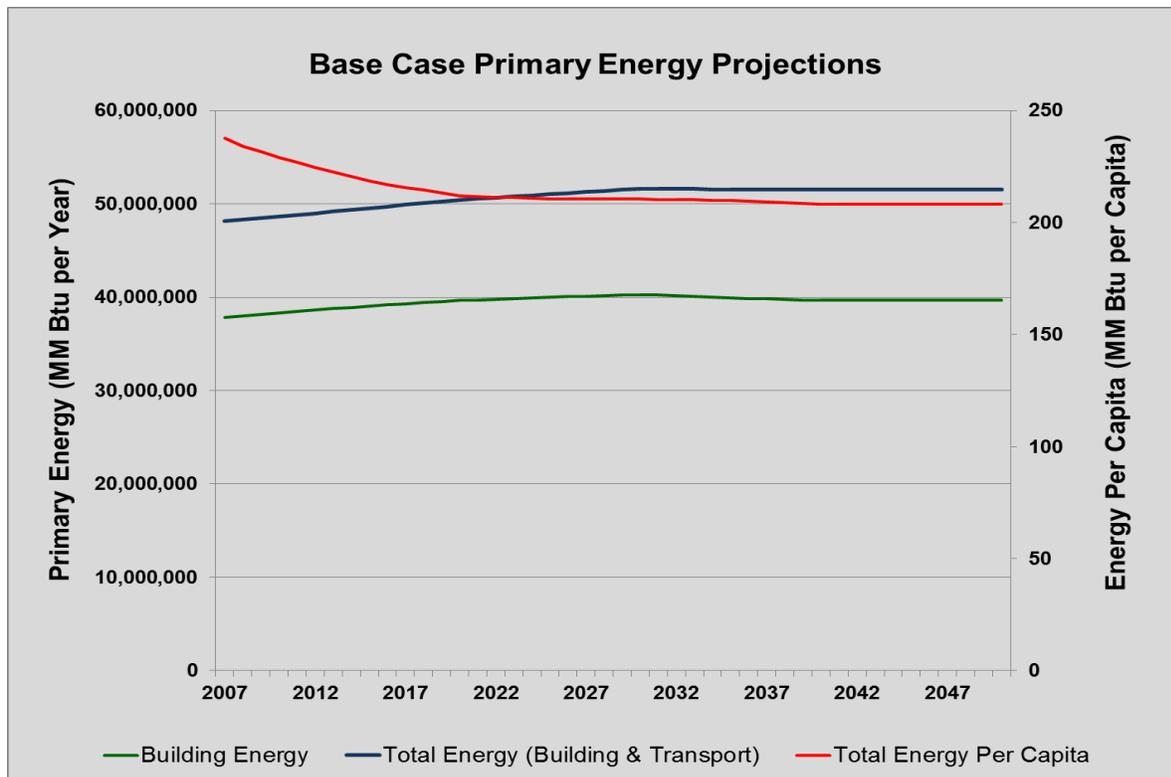


Figure 3.8: 2007 to 2050 Base Case Energy Use

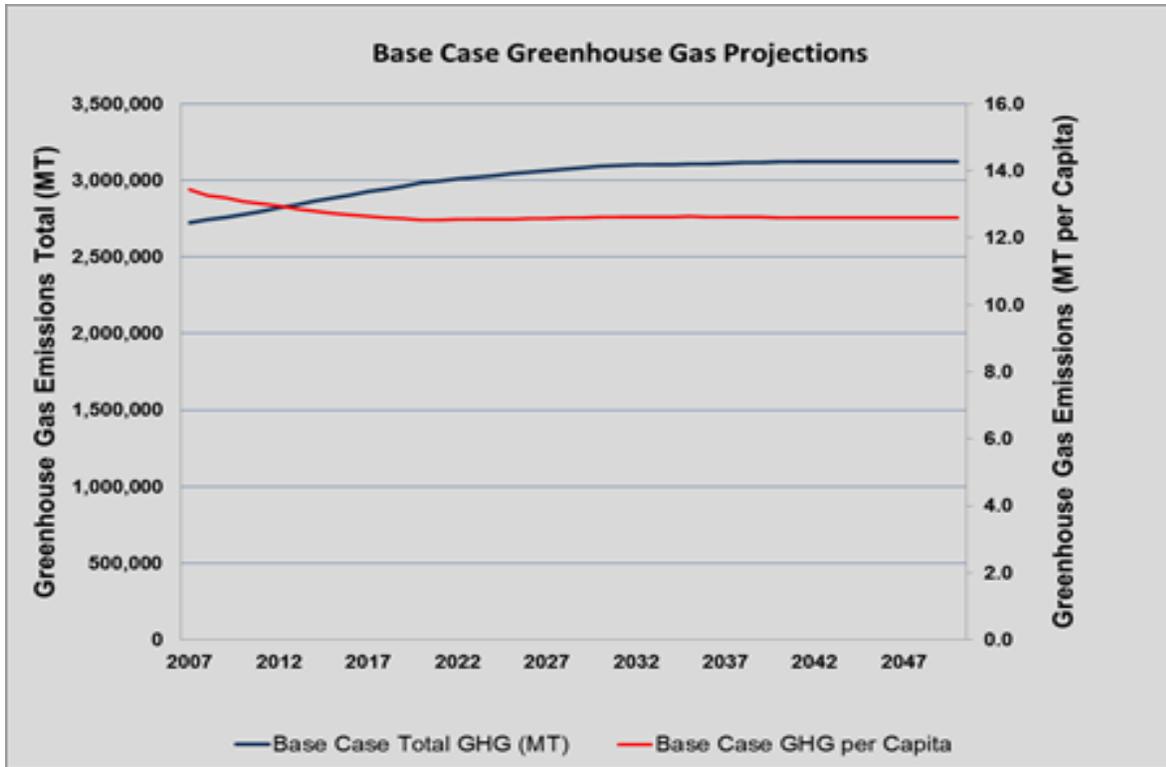


Figure 3.9: Projections in GHG Emissions

As already mentioned, in reality there will be gains in both building and vehicle efficiency and in the reduced impact of energy supply with or without the implementation of CES Task Force recommendations. These gains are spelled out in each of the relevant parts of the report. However, combined they would not deliver the world-class energy performance to which Arlington is committing.

Using these assumptions, the Base Case projection<sup>39</sup> of energy use is shown in **Figure 3.8**.

Primary energy used by in Arlington for all buildings and transportation, including the energy used to generate and deliver electricity, is estimated to increase from approximately 48,000,000 million Btue to 51,500,000 million Btue. The energy used in buildings increases modestly. Energy use per capita is estimated to drop from 238 million Btue to about 200 million Btue even as the number of residents and jobs increases. The Base Case GHG emissions projection is shown in **Figure 3.9**.

Total GHG emissions are estimated to increase from 2.7 to 3.1 million mt CO<sub>2</sub>e, with emissions per capita dropping slightly from 13.4 to 12.6 mt CO<sub>2</sub>e.

<sup>33</sup> <http://www.arlingtonva.us/departments/DES-CEP/CommunityEnergyPlan/documents/file75754.pdf>

<sup>34</sup> Reprinted from “What you need to know about energy,” 2008, by the National Academy of Sciences, Courtesy of the National Academic Press, Washington, D.C.

<sup>35</sup> Figure 8.4 later in this report provides incremental GHG emissions projections for years 2016, 2025 and 2050.

<sup>36</sup> Typical examples in:  
[http://re.jrc.ec.europa.eu/energyefficiency/greenbuilding/pdf%20greenbuilding/The%20European%20GreenBuilding%20Programme%202006\\_2009%20Evaluation.pdf](http://re.jrc.ec.europa.eu/energyefficiency/greenbuilding/pdf%20greenbuilding/The%20European%20GreenBuilding%20Programme%202006_2009%20Evaluation.pdf)

<sup>37</sup> [http://www.eia.doe.gov/emeu/states/hf.jsp?incfile=sep\\_sum/plain\\_html/sum\\_btua\\_tra.html](http://www.eia.doe.gov/emeu/states/hf.jsp?incfile=sep_sum/plain_html/sum_btua_tra.html)

<sup>38</sup> <http://www.epa.gov/reg3artd/globclimate/ccghg.html#Per%20Capita%20Emissions>

<sup>39</sup> See Appendix D for additional detail on Base Case assumptions.

# CHAPTER 4: FRAMING A GREENHOUSE GAS EMISSIONS GOAL

## ENERGY STRATEGIES TO MEET TRANSFORMATIONAL GOALS

Meeting the long-term goals established by the Task Force for Arlington County will require implementation of a wide array of activities. Current initiatives already underway are impressive, and will certainly lead to substantial gains. However, without additional work Arlington will fall short of the transformative energy future the CES Task Force is recommending (Figure 4.1).

This transformation would be the result of successfully and consistently delivering results in four distinct levels of activity. The activities

are mutually supportive and must be implemented together.

At the first level, Arlington already has many community initiatives<sup>40</sup> which were started long before this CES Task Force effort was conceived. The County already engages large segments of the population and delivers impressive examples of how relatively modest investments in time and money can yield significant energy efficiencies (see Figure 4.2).

Level 1 activities (see Figure 4.2) are mostly voluntary and require minimal policy changes to be successful. However, it is critical that every citizen and business be engaged to achieve this first 25% of the transformational goal.

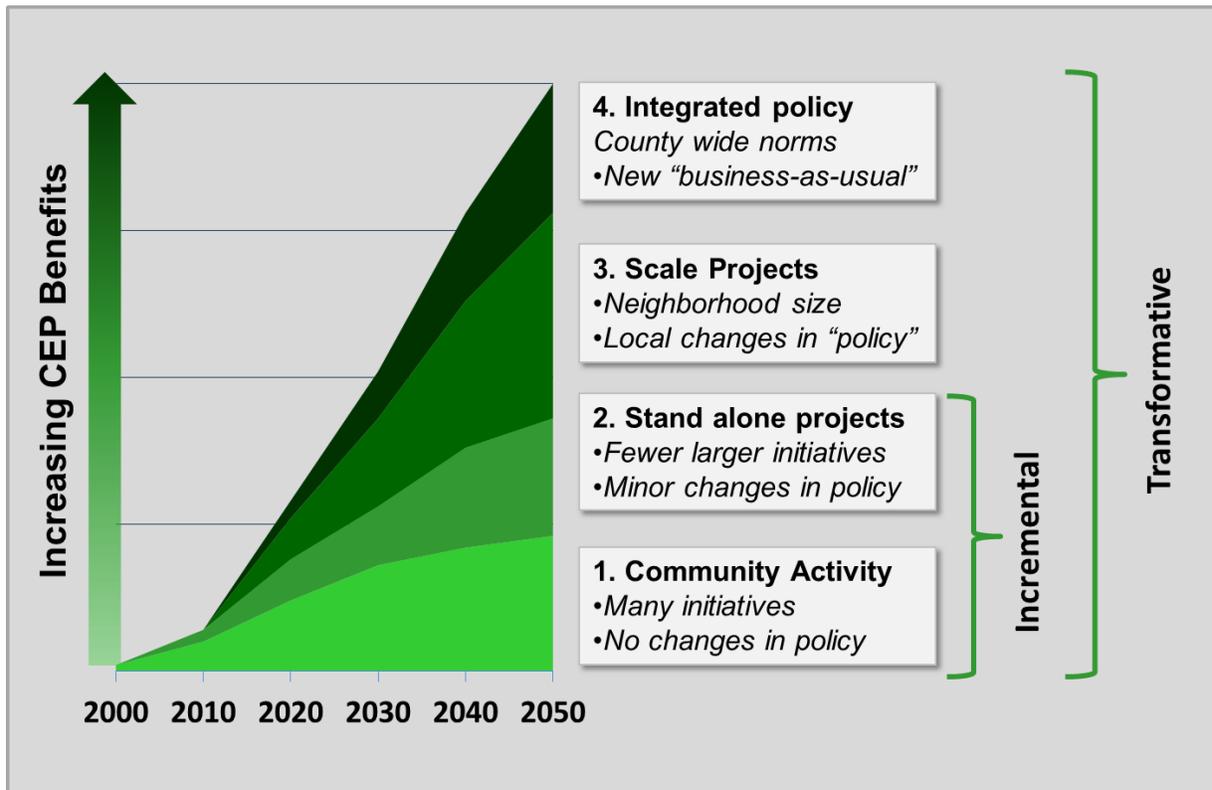


Figure 4.1: Four Levels to Transformation

### Arlington County Energy-Related Initiatives

- AIRE Goal: Arlington will reduce GHG emissions from government operations 10% below 2000 levels by 2012
- Energy efficiency projects, including the energy-saving performance contract at the Justice Center, and energy upgrades at dozens of other facilities.
- County fleet of energy-efficient hybrid-electric vehicles.
- Business and resident outreach on energy & emissions reduction, including the Arlington Green Games launched in October 2010 ([www.arlingtongreengames.com](http://www.arlingtongreengames.com))
- Extensive relamping of traffic signals and streetlights to LED technology
- Arlington County Commuter Services, WALKArlington, and BIKEArlington
- Arlington Transit (ART) buses use compressed natural gas
- Commercial LEED & Residential Green Home Choice programs
- Reducing the urban heat island effect through shading and evapotranspiration
- Implement the Telecommunications Master Plan to increase worker productivity while reducing vehicle miles traveled

**Figure 4.2: Arlington’s Energy-Related Initiatives**

Activities in Level 2 generally are specific projects that require planning and investment and are usually aimed at upgrading vehicle fleets, individual residential and non-residential buildings, business equipment or domestic appliances. These actions would include smaller scale clean and renewable energy supply projects typically aimed at a single building. To be successful, they may require relatively minor changes in policy, usually in areas within the authority of the County.

Level 2 projects are usually voluntary, mostly driven by potential economic benefits and occasionally by environmental or supply quality objectives. Funding is critical. With appropriate encouragement, education and incentives, successful implementation of Level 2 activities could account for up to 25% of the GHG reduction goal.

Many community efforts are limited to Level 1 and 2 programs, the more successful of which achieve impressive results and are to be applauded. They do, however, fall short of Arlington’s transformational goal.

Successful implementation of Level 3 activities is the key to achieving transformative results. Level 3 represents projects covering entire neighborhoods or substantial campus-like areas. Because of their size, these “Scale Projects” will involve many parties in ownership and decision making. They also will cross both public and private boundaries, and may need a deeper level of engagement, either in terms of new County State policies or voluntary changes from all of the project participants. Level 3 projects are challenging, but success is a prerequisite to achieving the scale needed to drive transformation to the community level. Multiple Level 3 projects should be identified early, with the best projects put into motion as soon as possible.

A critical element of successful neighborhood strategies will be smart metering for all types of energy, along with intelligent controls to manage energy both inside buildings and across neighborhoods. Ultimately, some of these neighborhood strategies will coalesce, making inter-operability standards critical to success. The Community Energy Implementation Plan

will include specific guidelines to ensure that future inter-operability is possible.

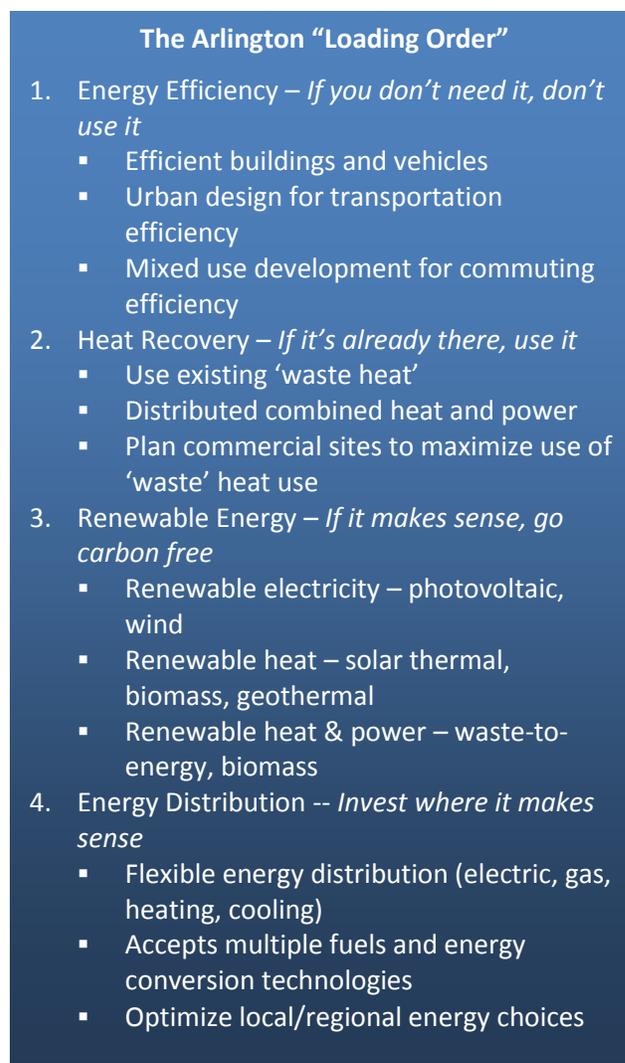
Level 4 activities represent the phase where the first three levels collectively become the “new normal” for the ways energy is managed in the County. At this level, established policies and procedures would be in place with operational efficiencies and energy productivity building on one another. Benchmark cities like Copenhagen are now endeavoring to achieve zero emissions, and are effectively starting the transformation process over again, a point at which Level 4 projects become the new Level 1 projects. In many ways, the County’s successful transit-oriented development over the past decades is an example of successful migration from Level 3 scale project to an integrated “new normal.”

## STRUCTURED FRAMEWORK FOR ENERGY PLANNING

For the report, Arlington County’s energy performance was compared with communities such as North Vancouver and Guelph, Canada, and Mannheim, Germany. These cities are recognized for their high quality of life, competitive energy costs, and low GHG emissions. This provided an opportunity to compare the interplay of various energy strategies and technology options. Common themes that create a successful combination of livability, competitiveness and environmental performance emerged.

These successful communities followed a structured priority or “loading order” to develop energy strategies and prioritize investment and implementation (**Figure 4.3**). In all cases, efficiency was the number one priority. This was followed by various approaches to reduce heat waste in all forms. Renewable energy options are a valuable part of an integrated solution, but are not an answer in their own right.

Successful communities have recognized that the historical relationships and structure regarding regional energy supplies can be substantially more efficient, flexible, and cost



**Figure 4.3: Arlington’s Energy Planning Priorities**

effective. This has created fundamental rethinking of structure and management of many sources and distribution structures of energy, including district energy (heating and cooling). Success also came from a clear decision by the community to remain committed to the overall goals and large scale, long-term implementation. This is measured in decades and remains in place despite political and administrative changes.

## BENCHMARKS AND EXAMPLES

### GLOBAL BENCHMARKS

The EU, especially Germany and Scandinavia, has many examples of cities where a systematic

implementation of the loading order has resulted in vastly lower energy densities than seen in the U.S.. As one example, Mannheim, a highly industrialized city in southern Germany, has a population of 300,000, which is larger but comparable to Arlington County. It has per capita GHG emissions of less than half of Arlington County's, despite heavy reliance on coal-fired electricity and major industrial activity in the surrounding areas.

Copenhagen has five times the population of Mannheim and is widely recognized as a global benchmark with emissions of less than 3 mt per capita. For a comparably sized community, emissions in the Washington DC Metro Area are about 19 mt per capita<sup>41</sup>.

This difference is substantial even when allowing for lifestyle and climatic differences. In 2009, Copenhagen was ranked as the second most livable city in the world<sup>42</sup> with a thriving, innovative economy combined with an attractive, competitive lifestyle. Copenhagen exemplifies the fact that energy productivity and competitiveness can go hand in hand.

Both Mannheim and Copenhagen have highly reliable, technically flexible, and competitively priced energy. They have succeeded in integrating efficient buildings, served by a mix of electric and gas utilities including district energy networks for both heating and cooling. Energy is supplied from a wide variety of clean and renewable and traditional energy sources, with distribution managed by municipality.

Transportation energy use is reduced through efficient urban design combined with multi-modal transport options including the efficient use of private vehicles. Copenhagen in particular is now investing in the community-wide infrastructure needed to support widespread use of electric vehicles, as much to take advantage of the nighttime production of wind-generated electricity as to avoid GHG emissions.

### **NORTH AMERICAN EXAMPLES**

The European examples show results when efficiency, flexible distribution and efficient fuel use are combined in an entire city. There are no comparable examples in North America. However, there are examples of communities with similar planning visions. These communities are already making significant changes that will result in transformative changes in their energy and carbon footprints. One U.S. and one Canadian example are highlighted here.

#### **North Vancouver, British Columbia<sup>43</sup>**

North Vancouver has developed a comprehensive 100-year Sustainability Vision, which includes reducing GHG emissions to zero within the next century, supported by short-term goals for both City operations and the community at large. Through a range of incentives and local laws, all new developments and construction must be significantly more efficient than current codes. The land-use planning approach encourages mixed-use, walkable neighborhoods supported by a reinvigorated transit system.

The City has established a municipal district heating company, Lonsdale Energy Corporation (LEC), which runs a modern system that delivers high-efficiency heating services to about 3 million square feet of office and residential space. LEC was recently given an expanded franchise to cover the entire City, and the City passed a law requiring LEC to connect all new buildings over 10,000 square feet. LEC has plans to add solar, geothermal and biomass heating sources to its existing high-efficiency natural gas-fired sources.

British Columbia has established a Provincial Climate Action Plan,<sup>44</sup> which provides a wider framework within which the City of North Vancouver operates. British Columbia is the first major jurisdiction in North America to introduce a carbon tax aimed at reducing GHG emissions.

### St Paul, Minnesota<sup>45</sup>

In 2010 St. Paul adopted a Comprehensive Plan that emphasizes sustainability, and includes a particular focus on reducing GHG emissions. Like many such plans, the land use and planning approaches encourage densification, mixed-use neighborhoods, and transit-oriented developments, including the reinstatement of light rail decades after previous systems were demolished. St. Paul has a required Green Building Policy for its own facilities, and actively encourages private development to follow suit through a multi-faceted incentive and advisory approach.

Recognizing the economic and environmental benefits of modern urban district energy, St Paul has been steadily expanding heating services managed by the municipal company, District Energy St. Paul. Energy is supplied through a mix of efficient and renewable sources including combined heat and power (CHP), oil and coal-fired boilers and biomass. The system currently serves 187 non-residential buildings and 300 residential units, with over 30 million square feet. In recent years, it has also expanded its downtown district cooling services, further enhancing the year-round efficiency and reducing peak demand on the wider electrical grid. It is a profitable business contributing to the City's revenues, while offering heating and cooling services at rates lower than neighboring Minneapolis. St Paul is also committed to the long-term deployment of solar electricity, and is developing a range of approaches to become one of North America's Solar Cities.

These four examples from two continents are increasingly typical. Communities are recognizing that their quality of life and competitiveness will be significantly influenced by how effectively they manage their energy and water needs. Many cities are also realizing that the goods and services needed to support the transition to higher levels of energy productivity are important to creating and retaining high quality green jobs.

---

<sup>40</sup> See Appendix C for further detail on community initiatives.

<sup>41</sup> <http://www.iied.org/climate-change/media/cities-produce-surprisingly-low-carbon-emissions-capita>

<sup>42</sup> <http://www.monocle.com/sections/affairs/Magazine-Articles/The-Worlds-top-25-most-liveable-cities/>

<sup>43</sup> <http://www.cnv.org//server.aspx?c=3&i=484>

<sup>44</sup> <http://www.livesmartbc.ca/government/plan.html>

<sup>45</sup> <http://www.stpaul.gov/index.aspx?NID=429>

## CHAPTER 5: ENERGY POLICY RECOMMENDATIONS

### OVERVIEW

The following recommendations outlined by the Task Force are economically viable, improve energy supply quality, and can be achieved with existing technologies. The eleven energy policy recommendations have been grouped as the following targets and policies:

- Headline Target (HT1)
- Buildings (B1 through B4)
- District Energy (DE1)
- Renewable Energy (RE1 and RE2)
- Transportation (T1 through T3)

### HEADLINE TARGET

The total greenhouse gas emissions rate for Arlington in 2007 was 13.4 metric tons per capita per year, about four times the global benchmark. Despite some efficiency gains in new construction, under a “business as usual” scenario, overall greenhouse gas emissions in



the County will increase by 2050 as both jobs and population grow. The CES Task Force recommends implementing recommendations and strategies (Chapters 5 and 6) to reduce Arlington’s annual GHG emissions to 3.0 mt CO<sub>2</sub>e per capita. If an effective regional energy

plan is put in place, the Task Force recommends a more challenging 2.2 mt CO<sub>2</sub>e per capita per year. Implementing the CES Task Force recommendations and strategies are designed to reduce Arlington’s total GHG emissions by more than 70% from 2007 levels by 2050.

**HT1: Reduce Arlington’s annual GHG emissions to 3.0 mt CO<sub>2</sub>e per capita by 2050. If an effective regional energy plan is put in place, achieve 2.2 mt CO<sub>2</sub>e per capita per year.**

As noted in Chapter 1, GHG emissions are a good measure of environmental impact and are a proxy for energy productivity across the transportation, commercial, industrial, and residential sectors. As Arlington’s population and job market continues to grow, a per capita metric will be a fair representation of the County’s success in improving efficiencies and reducing emissions.

### BUILDINGS

The single largest contributor to meeting the CES Task Force goals will be the overall efficiency of the construction and operation of buildings. Residential and non-residential buildings currently use about three quarters of all energy in Arlington. The four key strategic recommendations that apply to buildings are outlined below:

#### RENOVATIONS

**B1: From 2015, renovated residential buildings should operate at least 30% more efficiently on average compared to the 2007 baseline average. Non-residential buildings being renovated should operate at least 50% more efficiently than the 2007 baseline average.**

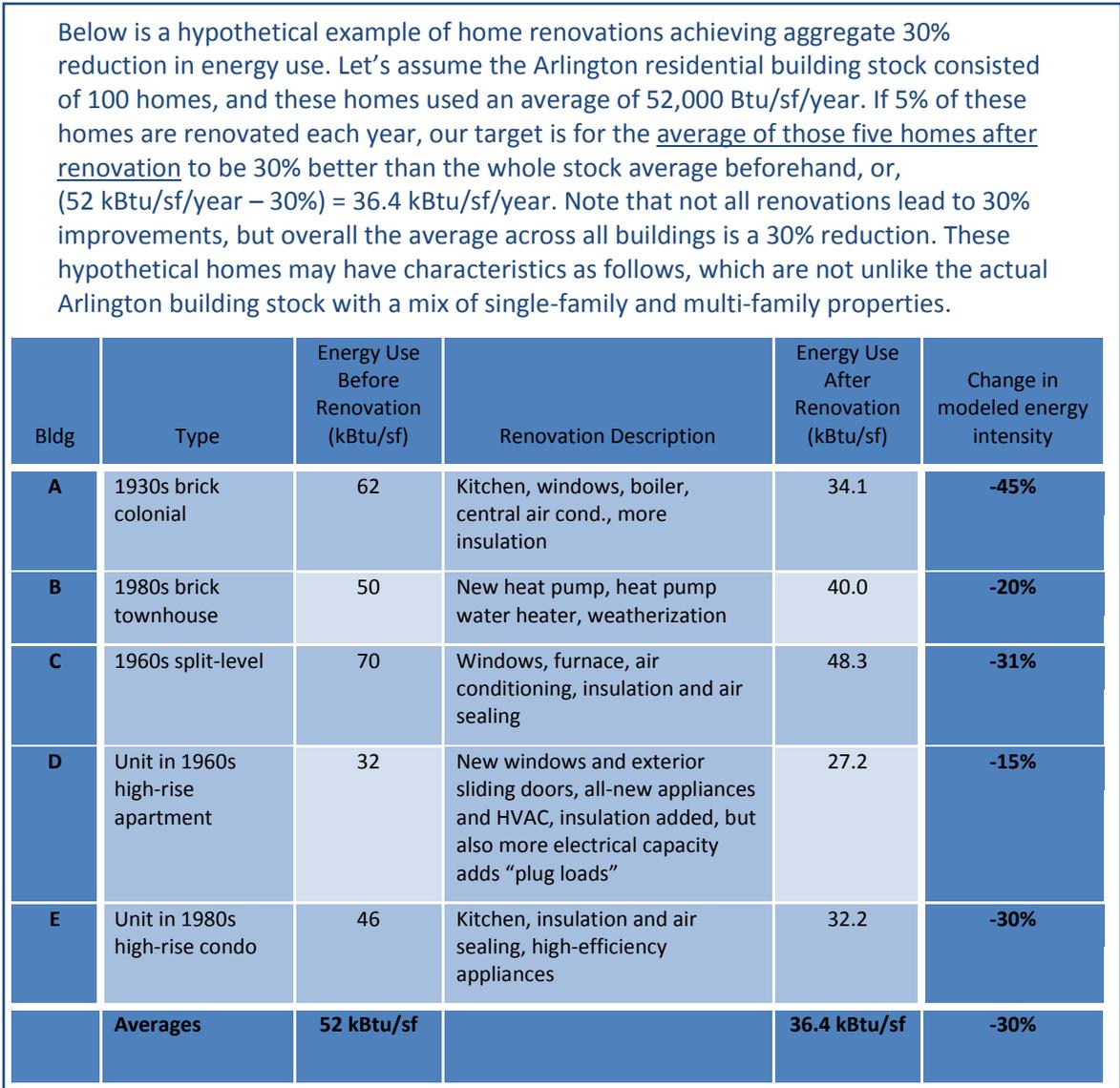


Figure 5.1: Illustration of 30% Aggregate Improvement in Energy Performance

Most buildings already in place today will still exist in 2050. Over 90% of single-family homes will remain. When multifamily residential buildings are included, about 75% of existing homes will remain. For non-residential buildings, over 60% are likely to remain in 2050. Existing buildings will remain inefficient without substantial focus on changes in operation and renovation. While it is important to ensure that new construction is as efficient as it can be, it is critical that the existing building stock is made more efficient through energy specific retrofits or as part of planned renovations.

Typically 2-3% of residential and non-residential buildings are renovated annually. By 2050 the CES Task Force assumes all of Arlington’s existing residential and non-residential buildings will either have been renovated or demolished. To meet the CES Task Force goals, from 2015, renovated residential buildings should operate at least 30% more efficiently on average as compared to the 2007 baseline average of 52 kBtu /sq ft. Given the uncertainties over future energy prices, and the need to retain adequate affordable housing in Arlington, efficient renovation is a key part of

housing affordability for lower income residents.

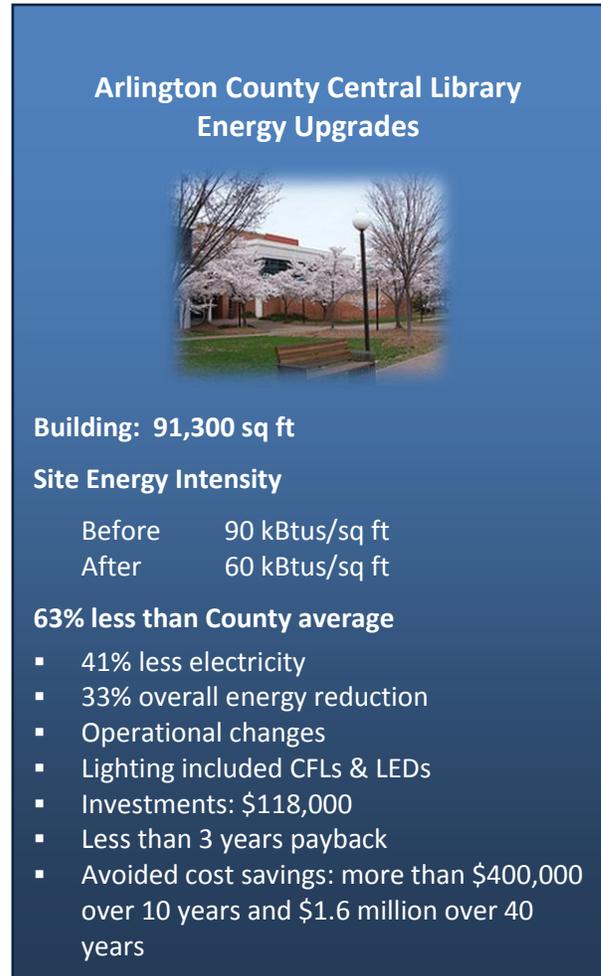
These efficiencies should increase in subsequent years, such that by 2050, residential buildings would be renovated to operate at least 50% more efficiently than the 2007 baseline and non-residential buildings would operate approximately 78% more efficiently than the baseline average. The Arlington County Central Library is an example of a cost effective renovation that exceeds the 2015 target and nearly meets the 2020 goal (see **Figure 5.2**). Further examples of building renovation are in Appendix E.

Using energy at 159,000 kBtu/sq ft, Arlington’s average commercial buildings operate 60% less efficiently than the current Mid-Atlantic average, making these targets very achievable.

The CES Task Force recommends asking developers submit significant renovation planning requests to include a narrative as to how they plan to meet these higher levels of energy efficiency. Developers willing to commit to agreed levels of energy performance may be allowed density or property tax incentives.

Efficiency after renovation will come from a combination of efficient reconstruction, improved operation, and more efficient equipment including furnaces, chillers, water heaters, controls, appliances, entertainment systems, computers, office equipment and lighting. In many cases, improved operations through controls, combined with equipment changes, could achieve the recommended targets without the need to significantly alter the envelope of the home or building. Occupant and contractor awareness and training should be a key factor in renovation efficiencies.

If the CES Task Force Report is accepted, specific guidelines and accountability practices should be created for building owners, developers and builders. This task will be relatively straightforward since a wealth of information exists from national and local sources. These guidelines would also apply to



**Figure 5.2: Investments in Existing Buildings Yield Large Returns**

any extensive tenant build-outs in the case of non-residential buildings.

By 2015, building guidelines for all types of buildings should be developed that provide specific criteria and expectations for existing structures. Retrofit guidelines should lay out both operational and construction options and early adopter examples. Uniform methods of measurement both before and after renovation should be recommended to track progress. These guidelines should cover building efficiency, clean and renewable energy supply options, and district energy considerations.

## **NEW CONSTRUCTION**

**B2: From 2015, all new residential and non-residential buildings should operate at least 30% more efficiently than current code expectations. From 2025, ongoing new residential and non-residential building construction should operate 1% more efficiently every year through 2050.**

From 2015, all new residential buildings will be expected to operate at least 30% more efficiently than current code expectations, at a level that is likely to be state code at that time. From 2025, ongoing new home construction should operate 1% more efficiently every year through 2050. As with renovation, this will reduce utility costs for lower income residents.

Starting in 2015, a similar profile of annual increases in the operating efficiency of non-residential buildings should be expected. Most owners and operators of high-quality commercial property are already close to meeting the levels recommended by the CES Task Force for recently constructed buildings, because they recognize that the business benefits outweigh the relatively minor costs involved.

As part of goals for building new buildings and renovating existing buildings, the CES Task Force recommends that Energy Performance Labeling (EPLs) be one of the Enabling Strategies (see Chapter 6). As there are no national programs for EPC implementation, the initial EPL program will be a voluntary community level project. Relative to more aggressive global benchmarks, such as the prevailing German or Scandinavian Codes and practices, or various U.S. voluntary ratings, the new US building code (IECC 2012 code) represents less than the best possible commercial practices, indicating that further updates to the codes are likely in the coming decades.

Many programs exist that encourage better-than-code energy performance. For the residential sector, the DOE Builder's Challenge<sup>46</sup> and the National Association of Homebuilders

National Green Building Program<sup>47</sup> both have the capability to target 30% or better than the current code. For commercial buildings, ASHRAE has produced the Advanced Energy Design Guides<sup>48</sup>, which set targets of 30% and 50% better than ASHRAE 90.1, while the U.S. Green Building Council's LEED NC<sup>49</sup> includes standards that would exceed code efficiency by 30% or more. For those builders wishing to get close to the best-in-class performance, the Passive House Institute has appropriate recommendations. The County should draw on all these sources in establishing new construction guidelines.

By 2015, the applicable Code is likely to be IECC 2012, which meets the CES Task Force 30% target, so a major portion of the guidelines should focus on ensuring construction quality and on ensuring that the buyer or strategic tenant and the builder are familiar with practices that ensure efficient operations. Also, since the CES Task Force recommendations and the likely codes will continue to require higher levels of efficiency, the guidelines should also focus on "getting ahead of the curve." There are efforts at the federal level that support more energy efficient buildings. President Obama's Better Buildings Initiative will commit resources to help make commercial buildings 20% more energy efficient over the next decade by catalyzing private sector investment through a series of incentives to upgrade offices, retail establishments, schools, municipal buildings, universities, hospitals, and other commercial buildings.

## **BACKGROUND ON BUILDING CODES FOR RESIDENTIAL AND NON-RESIDENTIAL BUILDINGS**

The current energy-related building code in Virginia is based on the 2006 International Code Council (ICC) International Energy Conservation Code (IECC) and the ASHRAE 2004 for new commercial construction. When compared to the rest of the U.S., these codes are mid-range standards.

In 2010, the Virginia Board of Housing and Community Development adopted the IECC 2009 and IRC 2009 for use across the State. The new code is expected to be in full effect in early 2011. Improvements from the 2006 to the 2009 codes will increase energy efficiency of new buildings by an estimated 15%.

In late 2010, the updated IECC 2012 recommendations were formally adopted as national guidelines. These are expected to increase energy efficiency by an additional 15% over the 2009 code. The national guidelines could be adopted as State Code in 2014, bringing Virginia codes in the range of the current California codes, the U.S. best practice, but still behind current practice in the EU.

None of IECC Codes is specifically aimed at improving the energy efficiency of existing buildings, although the general practice is to require the application of current code on any renovated areas whenever building envelopes are significantly altered.

It is less certain how the building codes will develop beyond this. The pattern of a revision of the IECC Code approximately every three years is likely to continue, probably with smaller percentage efficiency increases. ASHRAE and the U.S. federal government are aiming to set targets of 30% to 50% reductions for new construction in the decades to come.

Unlike the EU's 2008 recast of the Energy Performance in Building Directive,<sup>50</sup> the IECC recommendations do not address the GHG emissions caused by buildings' energy use.

### **BUILDING OPERATIONS AND OCCUPANT BEHAVIOR**

#### **B3: Emphasize that home and building operations must be effectively managed day-to-day to control energy costs.**

Achieving at least one-half of the proposed efficiencies is feasible at modest cost through improved construction with good quality control. Most come from the ways in which buildings are lived in and maintained. Improved building operations will only be achieved with a

significantly heightened public awareness of conservation, the impacts of lifestyle choices, and day-to-day attention to effectively managing the operation of residential and non-residential buildings.

For years, energy professionals and others have drawn a distinction between the terms "energy efficiency" and "energy conservation." Energy efficiency is usually regarded as physical improvements in buildings, equipment, and appliances to obtain the same energy services (e.g. heat, light) at reduced energy cost. Energy conservation is usually defined as behavior practices (e.g. turning down a thermostat, or turning off a light) that reduce energy costs through a reduction in energy services. We regard both strategies as important components of energy demand management (EDM). Smart energy demand management should be practiced by residents and occupants of buildings, as well as by the professionals operating large residential and non-residential buildings.

In Arlington in a typical year, one-third of all energy used in residential and non-residential buildings (see [Figure 5.4](#)) comes from lighting, appliances, entertainment equipment, computing devices and miscellaneous electrical uses. More than half of the energy used in buildings is for heating, and the remaining one-eighth of energy used is for air-conditioning.

The impact that homeowners can have on both the overall energy use and their own energy costs through a range of individual actions is substantial. Purchasing energy efficient appliances, installing programmable thermostats, using high-efficiency lighting and weather-proofing homes are all relatively low-cost measures that have substantial impacts. Even lower cost solutions can be achieved by changing a few habits including planning trips to minimize car use; setting back heating and cooling temperatures a degree or two; not leaving appliances in stand-by mode; and switching off unused lights. In addition to these energy reduction measures, homeowners and

property managers should be encouraged to preserve mature trees and plant young trees on their property to further enhance the tree canopy, which provides shade and reduces the energy needed to cool their buildings.

Fuel efficiency and GHG emissions should be at least one major factor considered when purchasing a vehicle. Similarly, many homeowners will renovate a portion of their homes every few years. These occasions offer opportunities to upgrade windows, to make different heating and cooling choices and to add insulation at relatively low incremental costs.

More than half of the entire County’s energy use is in non-residential buildings, and proper building operations can have major



Figure 5.3: Net-zero Village and Passive House

impacts on overall energy use. Buildings should be heated, cooled and lit only as much as is needed. Preparing buildings based on the anticipated weather can also have substantial efficiency benefits.

Information gathering, sharing details about energy use, and recognition for individual and team successes through a wide range of creative approaches has been shown to be extremely effective in permanently changing energy habits.

## NEIGHBORHOOD STRATEGIES

In addition to ensuring that individual buildings are constructed, operated and renovated as efficiently as possible, each neighborhood

should be configured to be as efficient as feasible. There are distinctive characteristics to each part of the County, and this is reflected in differentiated recommendations for the various neighborhoods.

### MIXED-USE, NET-ZERO ENERGY SCALE PROJECT

#### B4: Create a mixed-use, net-zero energy scale project.

The home and building efficiency targets outlined earlier are challenging, but examples from other jurisdictions and countries show that more is possible. In fact, even since the start of developing the CES Task Force Report in early 2010, the building code has closed the gap between the CES Task Force targets and future codes.

As an additional aspect of ensuring Arlington is at the cutting edge of community energy solutions, the CES Task Force recommends the development of at least one scale project with multiple residences to illustrate the next generation’s energy future.

**Defining “Net-Zero Energy” and “Scale Project”**

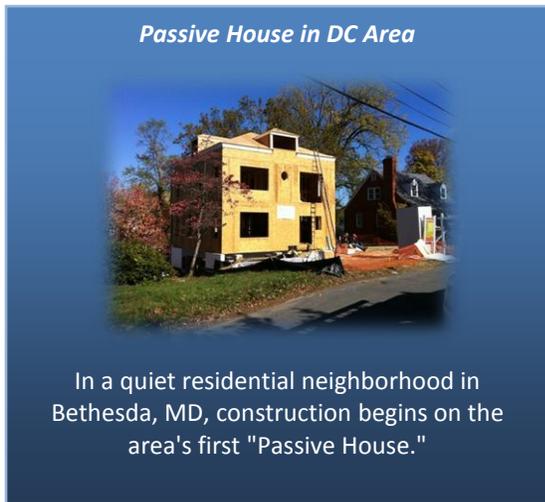
- **Net-Zero Energy:** In general, a net-zero energy building produces as much energy as it uses over the course of a year. Net-zero energy buildings are very energy efficient. The remaining low energy needs are typically met with on-site renewable energy.
- **Scale Project:** A large-scale neighborhood project with a high probability of complete, integrated energy solutions being implemented, including energy use, distribution and supply. The identified scale projects may ultimately inter-connect, leading to the overall energy transformation of Arlington County.

Arlington should create a mixed income residential development containing at least 100 homes with some service retail built to at least the Passive House Institute<sup>51</sup> standards of efficiency.<sup>52</sup>

These Passive House buildings should be supplied with a fully integrated 100% renewable

electrical and thermal system, with near-zero use of fossil fuels. The energy demand and supply system could be managed with a fully automated community micro-grid. This total integration of demand, supply and smart management would be unique in the U.S.

In the current real estate market, this would require both premium marketing and some financial support. It could be both a national and community example of what can be achieved in terms of an attractive, comfortable building with very low energy use.



This Passive House buildings would serve to encourage developers and remodelers to consider adopting some of these near-zero approaches in their normal construction and extensive renovations to accelerate the gain in efficiency in the community.

### **DISTRICT ENERGY FOR HIGH-DENSITY AREAS**

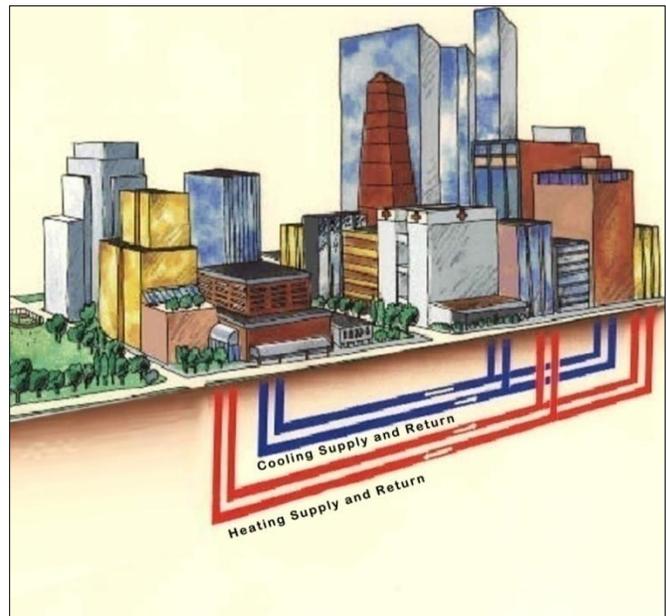
**DE1: Establish in high-density areas district energy systems owned and operated by a new District Energy Company.**

In addition to energy efficiency, the CES Task Force supports a step-wise approach to creating clean and renewable energy supply structures that are cost-effective and produce fewer emissions. District energy systems facilitate the efficient use of heat from local CHP generation, greatly reducing the fuel waste normally associated with making electricity. This will

create a district energy system tailored to the specific needs of each neighborhood and retain flexibility to adapt to changing technologies and markets long into the future. (Note that this chapter offers brief insights into district energy with a focus on the recommendations surrounding district energy. Chapter 7 goes into greater detail regarding the implementation of district energy systems in the County.)

Unlike many parts of the U.S., Arlington has significant areas of high-density residential and non-residential buildings, many of which will become more dense as the County grows in the coming decades. Initial estimates suggest that up to 50% of Arlington's current energy use is in areas with sufficient density to make the supply of heating, cooling and hot water via district energy feasible. **Figure 5.4**<sup>53</sup> shows how underground pipes link buildings together in a district energy system.

The green and yellow areas in **Figure 5.5** indicate areas of high heating density in Arlington in 2007. To meet CES Task Force goals, starting in 2015, high-density areas should migrate to district energy, focusing only on multi-family residential and non-residential buildings.



**Figure 5.4: District Energy System**

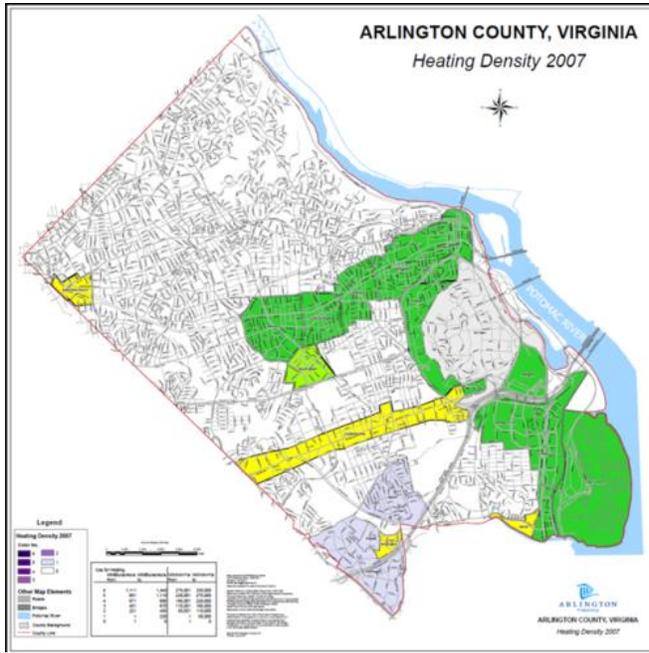


Figure 5.5: Possible District Energy Areas

Starting in 2015 and finishing by about 2030, it is expected that approximately 146 MW of CHP will be distributed to serve district energy-preferred areas. These district energy systems would be sited in multiple locations as demand for district energy increases, and would initially be a mix of natural gas<sup>54</sup> engines and small turbines, possibly supplemented by fuel cells as they become more affordable and more reliable. With good design and planning, distributed CHP is a clean, reliable and acceptable solution

Modern systems meet the most stringent noise and emissions standards in the world and make good neighbors. There are many examples of attractive installations in urban settings as indicated in Figure 5.6. These can be stand-alone energy facilities or can be located within buildings themselves.

The photo on the left in Figure 5.6 is a small neighborhood heat station in the Potsdam, Germany system which now serves over 60% of all the household and commercial property in the city.<sup>55</sup> It

started in 1967 with the first 700 meter pipe and now covers the entire city.

The middle photo is One Penn Plaza that has 6.2 MW of CHP located inside the building footprint. This shows that CHP is a good neighbor in a high-density urban environment, and the building itself could act as a node in a wider district energy system in the future. If ConEdison upgrades the Manhattan steam network, this could be a ready-made future node.<sup>56</sup>

The photo on the right is the large-scale municipal waste-to-energy CHP plant in Vienna near the university and next to many highly desirable commercial buildings. It was designed by the famous Architect Friedensreich Hundertwasser and is owned and operated by the city utility<sup>57</sup>. A New York Times article praised this as a tourist attraction.<sup>58</sup>

Several of the CES Task Force Priority Scale Projects are potential district energy areas, including Crystal City, Rosslyn, Columbia Pike, and East Falls Church. Additionally, the Pentagon is a possible source of heat for Long Bridge Aquatic Center currently being planned, which could create a short district energy heating axis for potential future expansion.

Planning and construction guidelines for district energy-preferred areas, including how to make buildings district energy-ready, should be part of the Community Energy Implementation Plan (see Figure 5.7).



Figure 5.6: Examples of CHP Installations

### What Does District Energy-Ready Mean?

#### ***A new building should be district energy-ready if it is:***

- In a DE area designated in the Task Force Implementation Plan where the completed feasibility study has recommended implementation of DE

#### ***To be district energy-ready, do not preclude connection to a future DE network:***

- Locate central plant in areas that could connect to a future DE network and could allow the plant to share/exchange loads with a future DE network
- Design a clear route for possible connection to future DE network
- Consider possible future DE network when designing new building heating and air-conditioning systems, in order not to preclude possible future DE connection
- Provide adequate design space within the central plant for future heat exchangers to be installed by DEC for a DE network
- Consider CHP as long as it is not cost prohibitive and is viable within building design and economics
- Design new base building heating and cooling systems and infrastructure in a way that could allow ownership and operation of the central plant systems by a DEC without adversely affecting building operations or energy usage

#### ***If Existing Building is:***

- In a DE-designated area and at least 25,000 sq. ft. single facility, and
- Due for a major renovation that includes replacement of heating or cooling plant

#### ***Then renovate and:***

- Consider connecting to district energy network
- Identify, if possible, a route for possible connection to future DE network
- Consider possible future DE network when designing replacement heating and air-conditioning systems, to create a future DE connection if feasible
- Consider designing replacement base building heating and cooling systems and infrastructure in a way that could allow ownership and operation of the central plant systems by a DEC without adversely affect building operations or energy usage
- Consider selling plant to the DEC to accelerate upgrades and network connection

*The concepts detailed above are intended to be illustrative only. The actual components of what it means to be district energy-ready will be determined during the development of the Implementation Plan.*

**Figure 5.7: District Energy-Ready**

The legal framework for Arlington’s District Energy Company (DEC) should be created immediately after CES Task Force Report acceptance. Operating standards, appropriate energy services expertise, capital investment, and cooperation among the County, WGL, and DVP are required. Depending on the detailed migration plan for a specific neighborhood, the

DEC may acquire existing heating and cooling plants and support conversion costs to make buildings district energy-ready, to capture market share and avoid pressure for mandatory district energy zoning.

To achieve CES Task Force goals through renovation and the steady expansion of district

energy networks, about 70% of all relevant buildings should be district energy-ready and most should be district energy-connected by 2050.

A positive feature of district energy is the ability to use energy that is typically difficult or impossible to use. The district energy network will initially use mostly natural gas and some grid electricity. By 2050 at least 10% of all the energy requirements could come from biofuels and waste heat recovered from various existing sources. There should be consideration of using energy (heat and power) from municipal waste incineration to further reduce pollution, remove waste from landfills, and improve community economics.

Another factor the County should include in its analysis is the relationship between the permitting of district energy system equipment and National Ambient Air Quality Standards since the Washington, DC-MD-VA Region is a nonattainment area for NO<sub>x</sub> and fine particulates. The County should work closely with the Metropolitan Washington Air Quality Committee (MWAQC) to ensure that any potential combined heat and power plant equipment will not inhibit the region's quest to come into attainment.

The County recognizes that district energy is relatively new in the U.S., and, due to poorly maintained old technology steam systems, may not have a positive image for use in more modern communities. As an early action, the County should coordinate a major awareness program to enhance stakeholder understanding of the features and benefits of modern district energy and distributed generation.

### RENEWABLE ENERGY

#### RE1: Install 160 MW of solar photovoltaics by 2025 Countywide.

Solar PV generates electricity largely coincident with maximum summer cooling demand. To eliminate the summer peak and reduce overall GHG emissions, 160 MW of solar photovoltaic (PV) electricity generation should be installed in Arlington by 2025. In addition to horizontal

rooftop systems, solar PV is also effective on vertical south- and west-facing facades. At today's PV panel efficiencies, generating 160 MW would require about 14 million square feet of surface area, however, solar panel efficiencies are improving rapidly and the surface area needed for this target will likely be smaller. Arlington's buildings provide ample opportunities for mounting solar PV in a variety of configurations, both horizontal and vertical.

For sense of scale of power output, according to Dominion Virginia Power, the 'average' residential customer has a peak demand of about 4 kW.<sup>59</sup> Therefore, 160 MW is equivalent to the peak power needs of about 40,000 households. Of course much of the solar PV installations are likely to be on commercial and institutional buildings, where large roof and wall surfaces are available and unobstructed by trees and other shading.

In Arlington's climate, a rule of thumb would be that every watt of installed PV capacity can reduce the summer peak by about 0.7 of a watt. The effective economic returns are likely to be positive under today's conditions, and should improve over the timeframe of the CES Task Force Report. The benefits will be a complex combination of factors, summarized below:

- Avoided cost of conventional peak electricity generation which is typically the highest cost for the traditional electrical utility
- Avoided capital for the utility through the avoided peak
- Market price of the PV modules themselves, a number that is falling rapidly as the world market scales up
- Value of the avoided GHG emissions
- Available incentives

Based on reasonable estimates of investment, peak electricity value and carbon costs, the internal rate of return of this at a community level is about 10% to 15%.

Developing a plan to finance, install and operate a large amount of PV should be developed pending the CES Task Force Report

acceptance. The operating and ownership options could include a combination of District Energy Company, Dominion Virginia Power, a dedicated photovoltaic energy services company, or individual home and building owners.

Meeting its solar PV installation goals will not interfere with the County's concurrent expansion of its tree canopy. Both solar PV and tree canopy provide substantial reductions in GHG emissions, particularly during summer peak consumption. The County has established programs such as the Tree Canopy Fund to encourage residents to plant trees on their property. Trees lower ambient air temperatures and reduce the energy needed for cooling homes by as much as 30%. In addition to their shading benefits, trees reduce GHG emissions by sequestering CO<sub>2</sub>, reduce and filter stormwater runoff, and enhance neighborhood property values.

Multi-story buildings (both commercial and multi-family residential) provide a substantial untapped market for solar installations at heights that do not interfere with the tree canopy, so building owners can take advantage of both strategies.

### **FLEXIBLE HEATING AND COOLING SYSTEMS FOR LOWER-DENSITY NEIGHBORHOODS**

**RE2: In lower-density neighborhoods, at least 50% of all domestic hot water needs and 20% of the space heating needs not supplied by district energy should be from clean and renewable sources by 2050.**

At least half of Arlington's energy use is in lower density, mostly residential neighborhoods where district energy is unlikely to be a viable option. In addition to the energy efficiency expectations for new construction and renovation, homes in these neighborhoods should consider solar thermal water and space heating systems, solar daylighting, and geothermal (ground-coupled) heat pumps, as well as rooftop photovoltaic systems in their neighborhood energy plans.

However, many of these same homes realize energy savings and other benefits associated with a healthy tree canopy. Solar systems should be used by those homes not shaded by trees. For homes where shade would make solar systems less effective, increased emphasis on energy efficiency and the use of geothermal systems for heating and cooling (to the extent it does not compromise tree health) should be encouraged. By 2050, at least 50% of all domestic hot water needs and 20% of the space heating needs not supplied by district energy should be from clean and renewable sources.

Over a typical year, more than half of all the electricity requirements of Arlington could be generated within the County. This could have significant reliability benefits both for the County and the existing grid operator.

The poor local wind quality combined with built-up nature of the County make utility scale wind generation unlikely with current technology. However, small-scale wind generation at a building or site level may be viable as technologies become cheaper and incentives are available.

## **PEAK REDUCTION AND SUPPLY SECURITY**

Supply security will be enhanced with distributed generation and peak reduction. The cost and reliability of the existing electricity grid is increasingly stressed by rising summer peak cooling demand. This is set to increase with the impending effects of climate change along with the continued development of the County. The efficiency expectations of the CES Task Force will already reduce the peak substantially in the longer term.

The upper line in **Figure 5.8** is the estimated electricity demand after efficiency<sup>60</sup>. The district energy network is supported by about 146 MW CHP running continuously, which reduces the demand from the regional grid to the lower (pink) line. The remaining summer peak is about 75 MW, which should be eliminated through the use of Solar PV.

## TRANSPORTATION

Arlington is a national leader in the reduction of vehicle miles traveled (VMT). The County will continue to reduce VMT through enhanced land use and demand-side management strategies. Historically, Arlington has successfully managed the modal share distribution by focusing on denser development in the Metro corridors and during the past twenty years, by also implementing strategies that support transit, bicycle and pedestrian activity<sup>61</sup>.

Strategies to reduce transportation energy use and associated GHG emissions are in three key areas: reducing vehicle miles traveled, increasing passenger vehicle efficiency, and reducing carbon content of fuels. Federal and state regulations are the primary drivers behind improved fuel efficiency and reduced carbon content of fuels. Progress continues to be made in these areas as new technologies and products are developed and marketed.

## REDUCTION OF VEHICLE MILES TRAVELED (VMT)

**T1: Reduce vehicle miles traveled by continuing to develop Complete Streets, high-capacity transit corridors, and transit-oriented development.**

Demand-side transportation strategies reduce vehicle miles traveled (VMT) and typically target mode, departure time, trip reduction, and location design. Arlington will continue to develop Complete Streets, high-capacity transit corridors, and transit-oriented development. However, reducing single-occupancy vehicles and increasing throughput during peak periods are the primary methods to reduce VMT in Arlington. Since a high percentage of single-occupancy vehicle traffic during peak periods comes from outside Arlington, the County should work with other jurisdictions to create regional demand-side management strategies.

Arlington’s current approach to reducing VMT involves working with employers to provide transportation incentives that encourage

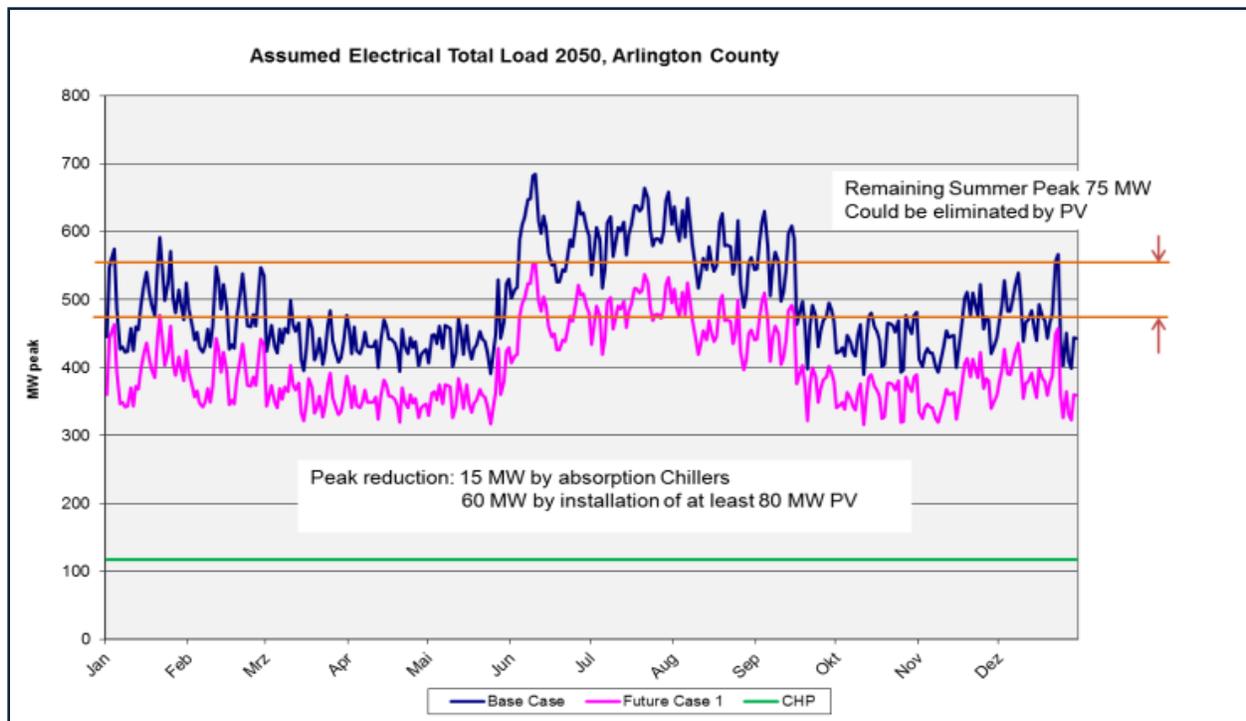


Figure 5.8: Seasonal Electricity Demand in Arlington

employees to travel to work by walking, biking, carpooling, or by using vanpools or transit. Smart growth planning strategies that include land use, transit and travel demand management policies and programs are projected to reduce regional VMT between 3% and 25%. The VMT projection for Arlington would be the equivalent of an annual decrease in emissions of 15%.

The County actions to reduce VMT could include:

- Financial incentives and targeted pricing systems to encourage fuel and time-efficient travel choices.
- Advanced smart growth land use patterns.
- Parking price strategies to discourage single-occupancy vehicles and encourage carpools and vanpools.
- Working with regional jurisdictions and private partners to improve the regional transit systems, with a specific emphasis on housing growth areas and historical travel flow patterns.

## **INCREASE IN PASSENGER VEHICLE EFFICIENCY**

### **T2: Continue to support federal efforts to increase vehicle fuel efficiency.**

Increasing the fuel efficiency of passenger vehicles is critical to decreasing GHG emissions. During the past two decades, there has been no increase to the Corporate Average Fuel Economy (CAFE) standards in the U.S. These standards are designed to improve gas mileage across each automaker's lineup and therefore, the nation's entire fleet of new vehicles. In 2007, the standard for passenger vehicles was 27.5 miles per gallon (mpg), unchanged since 1990. Recent federal decisions enacted in 2010 will increase the average new vehicle fleet standard to 35.5 mpg by 2016, a significant 29% increase over the current standards. For the first time, the CAFE standards also had GHG targets measured in emissions per mile.

The U.S. Department of Transportation (U.S. DOT) and the U.S. EPA indicate that by 2025,

### **Defining "Complete Streets"**

Complete streets are designed and operated to enable safe access for all users. Pedestrians, bicyclists, motorists and transit riders of all ages and abilities must be able to safely move along and across a complete street.

new vehicles may need to meet even more stringent standards ranging from 47 mpg to 62 mpg. It is therefore reasonable to forecast that a 60 mpg fuel efficiency standard should be in place by 2050. These fuel mileage gains would be the equivalent of an annual decrease in CO<sub>2</sub> emissions of at least 50%. Industry information on the impacts of new drive trains and lighter materials supports this evolution. The County actions necessary for enhanced vehicle efficiency should include:

- Supporting legislation that increases passenger vehicle fuel efficiency.
- Ensuring that taxicab certificate holders maintain at least CAFE-average fuel efficiency.
- Increasing the use of electric vehicles Countywide.
- Ensuring that the County vehicle fleet maintains at least CAFE-average fuel efficiency.
- Ensuring that the ART bus fleet maintains buses that achieve high fuel efficiency.
- Developing incentives for residents to purchase fuel efficient vehicles.
- Developing incentives for public vehicle service providers (such as shared vehicle suppliers) to purchase fuel efficient vehicles.

Arlington has direct influence over the fuel efficiency of County vehicles, ART buses and taxicabs. Arlington was the first local government on the East Coast to purchase energy-efficient hybrid-electric vehicles. These vehicles are widely used by County staff for various work functions, and combine high-

efficiency gasoline engines with an electric motor and rechargeable batteries to achieve high gas mileage. The County should continue to look for ways to increase the use of hybrid-electric and all-electric vehicles to help further increase its fleet's overall vehicle fuel efficiency. The County should also identify and implement policies and programs to facilitate the community's use of electric vehicles, which will likely include policies surrounding electric vehicle charging infrastructure.

## **REDUCTION IN CARBON CONTENT OF FUELS**

### **T3: Continue to support the reduction of carbon content in vehicle fuels.**

The federal government influences decisions affecting transportation, and the regulation of biofuels blended with gasoline and diesel fuels is just one example. The two primary types of biofuels, ethanol and biodiesel, are used in varying blends to replace gasoline and diesel fuel, respectively. Derived from biomass, biofuels produce virtually zero CO<sub>2</sub> emissions.

Recent studies suggest that corn-based ethanol and biodiesel produce about 15% less life-cycle GHG emissions than gasoline and diesel. Reduction of carbon content of vehicle fuels would be the equivalent of an annual decrease in overall transportation GHG emissions of approximately 10%.

Other opportunities for GHG reduction exist by replicating the success of the ART bus program. Compressed natural gas can also be utilized in heavy duty vehicles like trash trucks, as is being done in Montgomery County, Maryland. On a per gallon equivalent basis, natural gas is significantly less polluting and less expensive than gasoline and diesel.

---

<sup>50</sup> [http://ec.europa.eu/energy/efficiency/buildings/buildings\\_en.htm](http://ec.europa.eu/energy/efficiency/buildings/buildings_en.htm)

<sup>51</sup> [http://www.passiv.de/07\\_eng/index\\_e.html](http://www.passiv.de/07_eng/index_e.html)

<sup>52</sup> Figure 5.3 references:

<http://www.webwire.com/ViewPressRel.asp?ald=120049> and

<http://www.prnewswire.com/news-releases/groundbreaking-on-dc-regions-first-passive-house-101176084.html>

<sup>53</sup> <http://www.districtenergy.org/what-is-district-energy/>

<sup>54</sup> Note that although natural gas is the most likely fuel source, other sources could be used to power the engines in the future.

<sup>55</sup> <http://www.swp-potsdam.de/swp/de/stadtwerke-potsdam/home.php>

<sup>56</sup> <http://www.nytimes.com/2009/02/25/realestate/commercial/25cogen.html>

<sup>57</sup> <http://www.wienenergie.at/we/ep/channelView.do/channelId/-22026/pageTypeId/11894>

<sup>58</sup> <http://green.blogs.nytimes.com/2010/04/13/the-incinerator-as-eye-candy/>

<sup>59</sup> Personal communication, Michael Hubbard, Manager, Energy Conservation, Dominion Virginia Power, February 21, 2011

<sup>60</sup> No time interval data was available – this estimate is based on consultants' experience and neighboring county data

<sup>61</sup> [http://www.co.arlington.va.us/departments/EnvironmentalServices/dot/planning/mplan/mtp/MTP\\_Draft.aspx](http://www.co.arlington.va.us/departments/EnvironmentalServices/dot/planning/mplan/mtp/MTP_Draft.aspx)

---

<sup>46</sup> <http://www1.eere.energy.gov/buildings/challenge/builders.html>

<sup>47</sup> <http://www.nahbgreen.org/>

<sup>48</sup> <http://www.ashrae.org/technology/page/938>

<sup>49</sup> <http://www.usgbc.org/DisplayPage.aspx?CMSPageID=220>

## CHAPTER 6: ENABLING STRATEGIES

### OVERVIEW

The CES Task Force recommends seven key enabling strategies (S1 through S7). Through a combination of governance and community engagement, these strategies will facilitate long-term energy plan and process implementation for Arlington County.

### GOVERNANCE

A well-informed, engaged community that understands the many benefits of successfully implementing the CES Task Force recommendations and strategies is a prerequisite for success. Of great importance will be the widespread understanding and awareness of the efforts underway and transparency of the progress achieved. In addition to community awareness, it is crucial to have an adequate pool of suitably qualified civic leaders, managers and workers with the skills to implement the CES Task Force recommendations and strategies. This combination of community commitment to those recommendations and strategies and awareness, combined with a range of skill sets and knowledge, will be attractive to investors interested in establishing clean energy and sustainability businesses. This will be a source of further value as these companies pursue opportunities beyond Arlington.

#### **S1: Take steps to institutionalize long-term energy planning and processes.**

Arlington County recognizes the need to institutionalize the changes recommended in this report. Implementing the energy policy recommendations will require work across all County departments and with numerous partners throughout the community. In addition to the initial implementation efforts, the County will need to build in a process of continuous improvement to meet the changing needs of staff and the community. Two levels of ongoing governance are recommended -- Arlington County Government Actions and Neighborhood

Engagement, -- with the following roles and responsibilities:

### ARLINGTON COUNTY GOVERNMENT ACTIONS

- The County Board should adopt a resolution accepting this CES Task Force Report as the basis for the County's long-term energy strategy.
- The County should create and adopt an Implementation Plan, and ensure that the CES Task Force recommendations and strategies and its Implementation Plan are reflected in all general plans.
- Annual reporting of progress should be made against seven key measures of success: energy cost; energy related employment; energy supply flexibility; energy supply quality; energy supply security; GHG emissions reductions; and investments caused by the County's energy policies.
- Integrate the Community Energy Plan into the County's Comprehensive Plan, as needed.
- County should review and update the Community Energy Implementation Plan as needed and coordinate alignment with surrounding jurisdictions.
- Building on strong community input and leadership from the CES Task Force, a Community Energy Advisory Group (Advisory Group) should be formed that represents the major interests of the County. It should advise the County Manager in the development of the Implementation Plan, facilitate implementation of best practices, help attract new investments and clean energy businesses, and act as a sounding board and offer guidance for the County and neighborhood teams throughout this effort.
- Establish an energy efficient procurement policy for all County purchases.
- The County Manager should be accountable for the overall Community Energy Implementation Plan, supported by County staff.

## **NEIGHBORHOOD ENGAGEMENT**

The County and the Advisory Group should encourage the formation of local implementation teams, to further the CES Task Force goals. These teams will facilitate sharing best practices, and ensure that neighborhood energy plans proceed accordingly. Given the diversity of neighborhoods in Arlington, each energy plan will have unique characteristics that will require different approaches to energy reduction efforts. Typically these teams would build on the existing organizations such as Civic Associations and Business Improvement Districts (BIDs). Each team will be encouraged to develop detailed energy plans for their local neighborhood. County staff will work with the neighborhoods to pursue and secure integrated energy planning expertise as well as financial and other support from a variety of local and national programs.

Specifically, the CES Task Force is calling for the development of Integrated Energy Master Plans for Crystal City, Columbia Pike, Rosslyn and East Falls Church. In the case of Crystal City, the first steps are being taken under the leadership of Vornado in cooperation with the County and local utilities. The IEMP Scope of Work for Crystal City was finalized during the preparation of the CES Task Force Report and is included as Appendix H to this report. This can serve as a framework to create IEMP Scopes of Work for other comparable high-density areas.

The Rosslyn Business Improvement District and the Columbia Pike Revitalization Organization are key players in developing neighborhood energy plans. East Falls Church is another neighborhood for which a neighborhood energy plan should be considered.

The neighborhoods should also make use of energy guidelines and education for neighborhoods with assistance from County staff. Preparing these resources will form part of the early stage implementation of the CES Task Force recommendations and strategies. They will encourage voluntary energy efficiency and zoning guidelines, especially if there is

potential implementation of community micro-grids. Neighborhood accomplishments should be recognized and celebrated at a County level.

## **EXISTING COMMUNITY ASSETS**

Arlington already has substantial energy and environmental resources within its borders. These are all valuable assets that can be mobilized to ensure the support and successful implementation of this overall energy strategy. They include the successful County government programs such as Fresh AIRE, County facilities & fleet operations, green building and transportation initiatives, as well as solid waste programs, and tree planting programs. Private firms, utilities and non-profits have a strong synergy in promoting and supporting both sustainable and energy efficient practices. Local and federal agencies, such as the National Science Foundation, the Defense Advanced Research Projects Agency, the various DoD agencies, as well as institutions of higher learning are all engaged in supporting the County's energy goals. There are numerous examples, and they are detailed in Appendix C.

## **EARLY ADOPTERS**

The role of early adopters as both educational and implementation leaders will be crucial to the CES Task Force Report's success. These should come from both the public and private sectors and should include property developers, managers and owners willing to adapt their practices and to commit to sharing their experiences with the community at large. The following are already role models, and over time the County will endeavor to add to this list:

- AIRE Champions – Since 2007, 47 businesses, organizations, and institutions have been recognized by Arlington County for reaching milestone achievements in energy management, such as ENERGY STAR-labeled buildings, 100% green power purchases, and exemplary commuter benefits programs.<sup>62</sup>
- DoD – Pentagon – Renovation of the world's largest office building addresses

energy performance and other key environmental factors.<sup>63</sup>

- Arlington County – The County displays actual building energy use, in terms of site energy intensity, source energy intensity, and greenhouse gas emissions for all of its government buildings on its website. These programs will be the springboard for energy performance labeling of government buildings.
- Vornado/Charles E. Smith - Vornado/CES was the first Arlington company to benchmark their buildings in the ENERGY STAR Portfolio Manager system, and the only company to have ENERGY STAR-labeled buildings in Arlington prior to 2005. By 2010, Vornado had twelve ENERGY STAR properties in Arlington, and was joined by 19 other companies in Arlington, each with one labeled building.

## **ENERGY PERFORMANCE LABELS**

### **S2: Create and implement an Energy Performance Labeling (EPL) program.**

An extensive voluntary Energy Performance Label (EPL) program could be initiated based on a building's energy and GHG performance, reflecting both site and source energy use. Energy Performance Labels should be posted in buildings to help inform visitors, prospective buyers or renters about the actual energy and GHG performance of an existing property or the expected performance of a new one. Voluntary EPLs should be available for significant real estate transactions, to both test market feedback and gain acceptance. The EPL could also include information on operations and

maintenance tasks that are planned to help improve the building's energy and GHG performance.

The EPLs should compare the building's actual energy performance to the CES Task Force goals and to comparable buildings. If the CES Task Force Report is accepted, the County is poised to lead by example by initiating an EPL program for County-operated buildings.

Experience in other jurisdictions where EPLs have been adopted shows there is a steady improvement in the energy efficiency, often exceeding local codes or targets. Following successful voluntary trials in Denmark and Germany, the EU made EPLs mandatory beginning in 2007 for all properties. The availability of EPLs in real estate transactions is rapidly becoming accepted and expected practice.

In the U.S., ASHRAE and DOE are planning a voluntary labeling program on a national basis. EPLs for buildings can be considered similar to a miles-per-gallon (mpg) rating for vehicles - somewhat imprecise, but nonetheless useful, indicators of performance. The EU has also adopted a similar format for vehicles based on the greenhouse gas performance per kilometer traveled, which is now considered expected practice in all vehicle transactions in the EU.

At this stage, no particular format is being recommended for the Arlington EPL. That decision should be made as part of subsequent implementation planning. Some examples from Germany, the UK and the U.S. are shown in **Figure 6.1**.

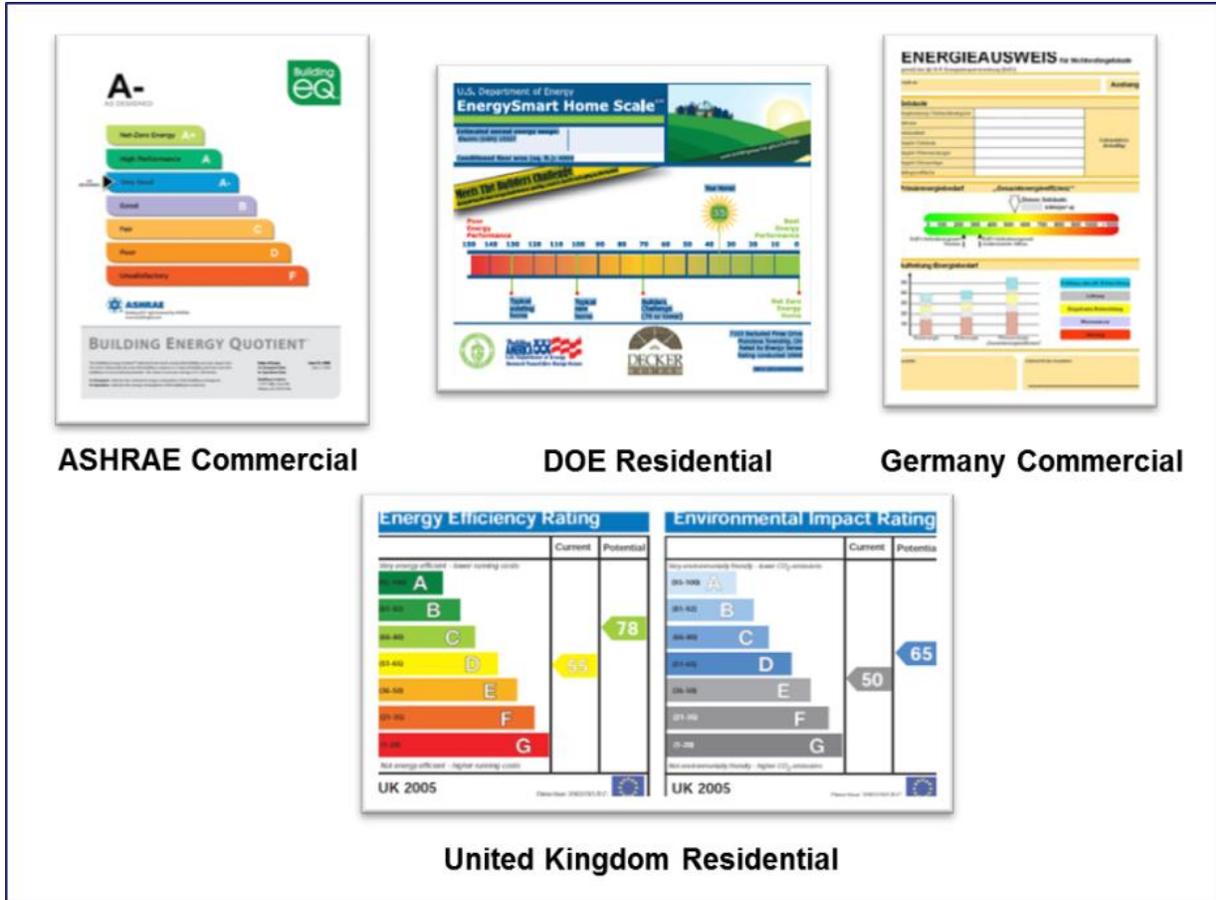


Figure 6.1: Examples of EPLs

Following the first few years of the implementation EPLs in Europe, a study was completed summarizing the situation in all the member states at the end of 2008. This report is available at the EU’s Build up website<sup>64</sup>. This website also has further background on the approaches used by each Member State to increase building efficiency. The ASHRAE Building Energy Quotient<sup>65</sup> labeling initiative is at an early stage of evaluation, and reflects many aspects of the EU program.

Whatever the final decision on format, the EPL should meet the following criteria:

- Be intuitively interpretable in terms of higher or lower performance.
- Communicate clearly the energy and GHG performance in numerical/quantitative terms and the ties to CES Task Force goals.

- Compare the performance against peer properties.
- Include recommendations for cost-effective energy performance.
- Be very low cost to implement.
- Be available on request to buyers and renters.
- Include a credible rectification guarantee if performance falls short.

An effective, voluntary EPL program needs many stakeholders to be engaged along with a number of parallel initiatives:

- Provide information and education to residents, realtors, mortgage lenders, property developers and builders about the benefits of EPLs and Arlington’s program.
- Ensure consistency by issuing County-recommended voluntary EPL guidelines for both new and existing properties. If possible, align these guidelines with nearby

Loudoun County, which has adopted a similar provision in its Energy Strategy.

- Commit all County-operated buildings to publicly post EPLs, along with an explanation for the public. These tend to encourage individuals to ask for similar EPLs on their future property purchases or rentals.
- Seek out early adopters including major property owners, developers, and builders as well as from the major property renters. These could include institutional as well as private properties.
- Team with construction financing and mortgage providers to offer financing when the energy performance meets CES Task Force targets, backed by a valid EPL.
- Incorporate EPLs in all Scale Projects and neighborhood energy plans.
- Offer the County as a state or national prototype of successful EPL implementation, both to attract special incentives and to gain possible regulatory exemptions.
- Share success stories from Arlington.

### **COMMUNITY INPUT GATHERING**

#### **S3: Gather community input and improve energy literacy on an ongoing basis.**

In order to successfully develop programs to educate citizens about energy generation, transport, distribution, and use, Arlington should continue to assess the public's knowledge of energy issues. In 2009, the AIRE program conducted an initial community survey<sup>66</sup> assessing awareness of sustainability, energy and climate change issues in general, and of the AIRE program in particular. In 2010, the National Academy of Sciences conducted a national survey<sup>67</sup> addressing similar issues. Both surveys concluded that the public has a relatively good understanding of recycling issues and transportation choices. However, the results indicate large gaps in understanding about energy use in homes and buildings, the impacts of energy efficiency measures, and an overall lack of "energy literacy." Results from a

small survey of participants who attended the March 2009 Community Energy Town Hall meeting indicated a strong interest in implementing programs focused on improving energy efficiency in homes and buildings, and increasing the generation of and incentives for renewable energy sources (wind, solar, and combined heat and power).

### **ENERGY LITERACY**

Improving energy literacy throughout the community is critical to achieving the goals of the CES Task Force. Energy literacy refers to the general knowledge about the complexities of energy. People need to know where energy comes from, how it is distributed, how much energy is used in homes and buildings, how it is measured, and how energy consumption can be reduced in homes, buildings, and transportation. Energy is intrinsically related to personal decisions about many long-term and day-to-day decisions involving home location, transportation choices, and appliance and equipment purchases and use.

Arlington, together with the region as appropriate, should continue to assess the public's understanding of energy issues. A process to measure public understanding should be established and sustained over time to help guide ongoing public education and training.

### **PROVIDING EDUCATION AND TRAINING**

#### **S4: Provide education and training to all stakeholders.**

Education and training of all citizens should be an ongoing and evolving process. As people learn the basics of energy literacy, programs can begin to focus on more complex concepts to enable more sophisticated decision making about energy use. Teaching and training all segments of the population is critical to the success of the program.

Because of the 40-year time horizon addressed by the CES Task Force Report, it is critical that programs address all segments of the

population. Engaging multiple educational resources is required for a comprehensive education program. Today's adults will initiate the energy transformations that will be inherited and adapted in the future by today's students. Educational approaches must adapt as technology and opportunities evolve. This will require continuing oversight to ensure that education programs continue to support the overarching goals of the CES Task Force Report and adjust as necessary. The County should ensure that ongoing programs monitor, assess, and adapt educational and workforce training programs to meet the established goals.

### **ARLINGTON'S PUBLIC AND PRIVATE SCHOOLS ENGAGEMENT**

Schools have a unique ability to shape energy education, individual choices, career opportunities, and even future policy. Engaging students in managing energy in school buildings would provide cross-curricular hands-on learning opportunities. The Arlington Public Schools Career Center offers courses and apprenticeships in the applied trades (heating and air conditioning, plumbing, carpentry, etc.). Extracurricular Green Teams in many public schools focus on environmental issues and some have already investigated energy issues. Arlington Public Schools and private K-12 schools in the County should be engaged in these ongoing energy education efforts and should ensure that their curricula and activities fully meet the energy literacy needs of Arlington's students.

### **COLLEGES AND UNIVERSITIES ENGAGEMENT**

Specific higher education and workforce training programs focused on energy issues should be continued and expanded. Arlington is home to several universities and academic institutions that support education in energy policy, law, business, scientific research, and technology development. Several of these institutions already have specific programs in climate research, energy and efficiency. There are several initiatives already underway at

universities within Arlington, including Virginia Tech University, George Mason University, Marymount University, and Northern Virginia Community College. In addition, the National Science Foundation conducts research at the national and international level on issues related to energy, climate change.

Institutions of higher learning could play a vital role in supporting the success of the CES Task Force Recommendations. Additional information is included in Appendix C.

### **ENGAGEMENT WITH OTHER OUTREACH AND EDUCATION ASSETS**

Arlington has other valuable community education resources including the Energerium at the Potomac Overlook Regional Park, Arlington Public Libraries, faith organizations, and nonprofit organizations (such as Arlingtonians for a Clean Environment and the Virginia Sustainable Building Network). More information on community resources is included in Appendices C and F.

### **WORKFORCE RETRAINING**

Arlington's energy reduction goals will only be achieved when the energy impacts of civic, business and personal decisions are fully understood and adjusted appropriately. There will be an immediate need for qualified and trained professionals in multiple sectors, including construction, building operations, finance, planning, energy services, and law. The need for this enhanced expertise will not be limited to Arlington and should be coordinated with other regional training efforts.

Arlington should work with the community to develop a comprehensive approach to achieve broad community understanding and workforce restructuring. The effort should be sustained by a network of voluntary, academic and public and private professional resources, including non-governmental organizations, and trade and business associations. Wherever possible, this could be achieved by realigning and reprioritizing existing programs and resources, both to create consistency and to minimize

incremental costs. Areas that require significant changes from current practice can be targeted for focused education, outreach and workforce development programs. Areas of workforce development include:

### ***Developing Professionals' Knowledge of Homes and Non-residential Buildings***

- Enhance plan review, building code approvals, and building inspections to include review of ongoing energy performance
- Expand the architecture and building trades to include new specialties such as district energy interconnections and site preparation, rooftop and wall-cladding solar PV, passive building construction, testing and applying Energy Performance Labels (EPLs), and commissioning new and renovated buildings.
- Educate building management staff to optimize costs and environmental performance, maintain continuous improvement, manage on-site clean and renewable energy supplies, and maintain current EPLs.
- Work with realtors and banks to recognize energy performance in assessing risks in financing and marketing property.

The way a building is operated typically impacts at least 15% of its overall energy use. A structured approach to training building owners, operators, tenants, and facility managers should be developed using a variety of voluntary and professional resources and programs. Both new construction and renovation guidelines should address the need for metering and sub-metering to ensure the availability of accurate and timely operational data.

Arlington County government should lead by example and demonstrate the use of best management practices in all County facilities. Best practice sharing of successful energy efficiency projects and outcomes should become a regular occurrence in Arlington

County, with individual and group recognitions being given wide visibility and recognition.

### ***Enhancing Knowledge of Efficient Communities***

- Civic Associations, Business Improvement Districts (BIDs), and other neighborhood partnerships should enhance awareness of the role that local neighborhood organizations play in creating, supporting and implementing local energy master plans.
- Architectural, development and planning teams will need to strengthen their expertise regarding energy-related aspects of neighborhood planning. This could include management of density and development of energy master plans. The needs will be distinct for each neighborhood, and should include a mix of public and private resources.

### ***Educating Partners about District Energy and Renewable Energy Supplies***

- Urban planning, architectural, mechanical design, and specialist trades should increase expertise on the design, installation and operation of district energy networks, energy supply systems (including combined heat and power (CHP)), and large scale solar photovoltaic (PV) and solar hot water systems).
- District Energy Companies should increase expertise on legal and marketing frameworks supporting energy zoning and consumer choice, investment, district energy services management and quality control.
- Property owners, residents and the public should increase awareness of the economic, environmental and supply flexibility benefits of a mixed portfolio of distributed clean and renewable energy supply and distribution.

### **Strengthening Knowledge Regarding Efficient Transportation Systems**

- Business owners, residents, and the public should increase awareness about the cost, incentives, and availability of transportation alternatives.
- Urban planners, architects and construction trades should focus on transportation programs including electric vehicle infrastructure, parking management, and urban design for multi-modal optimization.

### **FINANCIAL INCENTIVES**

#### **S5: Identify and promote financial incentives to improve energy efficiency.**

There is a wide and growing range of incentives to encourage energy efficiency and GHG reduction in residential and non-residential buildings and transportation. Over the next forty years, these can be expected to change substantially. Ensuring that residential and non-residential building owners, developers, builders and residents are aware of the incentives available at any given time will accelerate the creation of more efficient, cost-effective residential and non-residential buildings.

In addition to incentives for efficient construction, appliances, lighting and other equipment, incentives are available to support energy planning. Given the importance of effective neighborhood energy planning to the success of the CES Task Force recommendations and strategies implementation, these could also be valuable accelerators.

Incentives include tax rebates, discounts and grants associated with the purchase of energy efficient home appliance, commercial office equipment, computing devices, and even vehicles. Other incentives defray some of the costs of training tradespeople in efficient construction and facility teams in efficient building operation. These are important since at least half of the anticipated energy savings in residential and non-residential buildings will come from improved operation and day-to-day equipment purchase decisions.

There is also a growing range of incentives aimed at supporting the installation and operating costs of the clean and renewable energy supplies. Some incentives are in the form of avoided costs, such as free energy assessments.

There are numerous grants, tax and other financing incentives available today from federal, state, utility and other sources, including component number of private philanthropy and vendor or commercial financing products incorporating energy efficient premiums.<sup>68</sup> Too often, projects proceed without the knowledge of the available incentives. It is common to see incentive programs closed out with unused balances.

### **INFORMATION ON ENERGY INCENTIVES**

Overall, County staff should ensure that current information on energy incentives is readily available and should facilitate the following guidance and activity:

- Create an up-to-date and comprehensive database on the available financial incentives.
- Provide information on rules and limitations of energy-related financing in general, including mechanisms like energy-efficient mortgages and performance contracting.
- Make energy efficiency financing and financial incentives information available for residents, realtors, mortgage lenders, property developers and builders.
- Make cost offsets or market incentives available for projects that implement improved energy performance meeting or exceeding CES Task Force goals for developers and owners.
- Seek early adopters from major public or private property owners, civic associations, or other community groups to promote their success in utilizing incentives.
- Team with construction financing and mortgage providers to offer premium financing when energy performance meets CES Task Force targets and is backed by a valid EPL.
- Evaluate, ordinances, policies and/or programs that establish effective financial incentives.

- Share stories of successful use of financial incentives or financing structures from Arlington, the Washington metro region, the U.S. and elsewhere.
- Work with owners, developers and others to engage decision makers early in a project to help ensure required energy narratives include the financial aspects.
- Create financial incentives that allow affordable housing developers to be early adopters of energy efficiency technology without negatively impacting the County's affordable housing goals.

The incentives database and associated services should initially be created by County staff with a structure that could allow shared costs between public and private sources.

Examples of existing incentive programs are described in the Appendix F.

### **DEVELOPMENT OF LOCAL FINANCIAL AND OTHER INCENTIVES**

Under Virginia's Dillon Rule, Arlington County has limited legislative freedom of action.<sup>69</sup> However, under current (2010) conditions, Virginia could allow the County to offer certain incentives if the County chooses to take the necessary actions. These include Property Assessed Clean Energy (PACE) financing, where efficiency and clean energy loans are made by the County and repaid in property taxes. However, at this time, mortgage finance enterprises Fannie Mae and Freddie Mac oppose the PACE financing program. Other incentives the County could enact are reduced property taxes and a solar tax exemption. These are described in the Appendix F.

The County would also be free under current legislation to extend or adapt the current green building density Incentive to projects that clearly meet or exceed relevant CES Task Force goals. Other planning related incentives can be considered.

Any incentives offered by Arlington should focus on the areas of greatest challenge. These include, but are not limited to developing scale

through neighborhood energy planning and implementation, developing district energy, large scale distributed clean and renewable generation, and widespread community outreach and workforce development.

The CES Task Force recognizes that potential incentives, if they are provided at all, could possibly be short-lived and vulnerable to changes in public opinion or political leadership.

### **GREENHOUSE GAS EMISSIONS**

#### **MANAGEMENT AND MONETIZATION**

**S6: Acquire, register, and report greenhouse gas emissions data and monetize as appropriate.**

Arlington's County's energy use in 2007 created 2.73 million mt CO<sub>2</sub>e GHG emissions. In many countries, legislation exists to limit emissions. In the U.S. [2010] federal legislation or regulation is being debated with significant uncertainty as to the final outcomes. The level of GHG emissions is one of the seven key measures for the County's energy performance. The County should acquire, register, and report emissions data and monetize as appropriate.

#### **INDEPENDENT REGISTRATION AND VERIFICATION OF GHG EMISSIONS**

It is important to have credible, independently verified GHG results. Any legislation that includes cap-and-trade provisions puts a market value on GHG reductions, potentially adding value to the local economy. For these reductions to be tradable, they must be verified, registered and tracked.

The CES Task Force recommends that the County's emissions be registered with The Climate Registry<sup>70</sup> which is recognized by 42 U.S. States, 6 Mexican States and 10 Canadian Provinces. The Registry offers systems for tracking both emissions levels and emission reductions using widely recognized methodologies. Certifying emission reductions in this recognized way creates credibility and can allow emissions reductions to be qualified for trading purposes.

Arlington's emissions could be registered in three groups:

**Group 1: County Operations**

The County has been tracking energy and other data on its own buildings, including APS facilities, and its vehicle fleet since 2007 at a level sufficient to be registered and certified by the Climate Registry. This should be updated and verified annually.

**Group 2: Selected Scale Projects**

Where a Scale Project is supported by a detailed Integrated Energy Master Plan with clear operational boundaries (as is likely to be the case with Crystal City), the recommendation is to formally register these projects' baselines, with annual updates and verification.

**Group 3: County-wide Emissions Balance**

The Registry allows a member to use the Registry data tools to track an emissions profile that does not have the necessary details or ownership suitable for verification. The recommendation is to use the Registry as a repository for the balance of Arlington's GHG footprint (i.e. everything not included in Groups 1 and 2). This could be done using the ICLEI Harmonized Emissions Analysis Tool (HEAT) using gateway energy data, average emissions factors, transportation planning estimates and waste practices.<sup>71</sup>

The management of this process could be coordinated by County staff. The registration of Scale Project results could be managed by the consortium that develops and implements the Project IEMP.

**EVALUATION OF EMISSIONS REDUCTIONS FOR POTENTIAL MONETIZATION**

Emissions reductions registered in Groups 1 and 2 above can be verified and converted into Climate Reserve Tons (CRTs)<sup>72</sup>, which are tradable securities. In 2010, CRTs traded at very modest prices in a voluntary market. Depending on future legislation and market demand, their

value may rise. The CES Task Force is not currently recommending any County level process to monetize CRTs. The Task Force suggests that emissions data be independently verified and could be monetized if the emissions market were to become more attractive financially. This recommendation should be reviewed annually by County staff.

**REGIONAL COOPERATION AND PARTNERSHIPS**

**S7: Work with neighboring jurisdictions on a Regional Energy and Climate Plan.**

Numerous jurisdictions in the DC Metro region are discussing challenges and opportunities related to community energy issues. The first workshops for this effort have already been held, with MWCOG and the Chesapeake Crescent Initiative spearheading such efforts. Where State-level support will accelerate our success, Arlington should work closely with State officials. In addition, Arlington and other jurisdictions should catalyze a regional approach to gain the benefits of scale both economically and politically. The Northern Virginia Regional Commission (NVRC) has taken a leadership role in coordinating energy planning for Northern Virginia jurisdictions. Organizations such as NVRC, MWCOG, the Chesapeake Crescent Initiative and WMATA could serve as integral partners to address regional transportation, energy and sustainability issues.

Given the growing links and benchmarking exercises with Germany via the Transatlantic Climate Bridge, the Task Force further recommends expansion of learning opportunities with Germany and other European regions. This could include strengthening the existing work and economic relations between NVRC, Northern Virginia and Stuttgart and introducing new efforts with European regions that are experienced in regional energy planning, such as Rhein-Neckar, Frankfurt-Main, Berlin and Hamburg.

---

<sup>62</sup> See:

<http://www.arlingtonva.us/portals/topics/ClimateBusinesses.aspx>

<sup>63</sup> See:

<http://www.epa.gov/epp/pubs/case/penren.htm>

<sup>64</sup> See <http://www.buildup.eu/publications/8111>

<sup>65</sup> See <http://buildingeq.com/>

<sup>66</sup> AIRE Frequency Questionnaire, November, 2009;  
conducted by Greenberg Quilan Rosner Research

<sup>67</sup> <http://www.aceee.org/research-report/e105>

<sup>68</sup> See Appendix F for further detail on incentives.

<sup>69</sup> [http://www.vbgov.com/file\\_source/dept/library/Document/DillonHomeRule.pdf](http://www.vbgov.com/file_source/dept/library/Document/DillonHomeRule.pdf)

<sup>70</sup> <http://www.theclimateregistry.org/>

<sup>71</sup> <http://heat.iclei.org/ICLEIHEAT/portal/main.jsp>

<sup>72</sup> <http://www.climateactionreserve.org/>

## CHAPTER 7: IMPLEMENTING DISTRICT ENERGY

District energy, along with its associated recommendations, was initially explained in Chapter 5. Since the addition of district energy would be one of the largest and most significant changes to Arlington’s energy future, a well thought out implementation plan would have to be developed to support such an approach. The following chapter is devoted to focusing on some of the actual implementation aspects of district energy.

### ENERGY AND GREENHOUSE GASES BY ENERGY PLANNING AREAS

To further understand where and how energy is used within the County, twenty geographic locations were defined as Energy Planning

Areas.<sup>73</sup> These were selected to be representative of the wide variety of neighborhoods within the County, included the following:

- High-density areas with mixed building use around transit hubs
- High-density areas with single-use buildings
- Medium- to low-density areas with mixed use
- Low-density areas with mostly single-family homes

Energy use was modeled for each of these 20 areas by estimating building type areas and using the same building models used for the entire County (**Figure 7.2**).



Figure 7.1: Typical Arlington Neighborhoods

Energy Planning Area	Land Area (sf)	Energy Planning Area	Land Area (sf)
Crystal City	17,084,306	Trades	1,828,288
National Airport	36,766,895	Shirlington	1,921,525
Pentagon City	11,076,979	Rosslyn	13,167,064
Pentagon	7,608,725	Court House	10,475,359
Arlington Cemetery	41,319,188	Clarendon	9,134,646
Joint Base	11,456,763	Virginia Square	8,276,467
Navy Annex	1,222,019	Ballston	14,429,776
Columbia Pike	24,327,661	Buckingham	6,160,051
Nauck	11,796,727	East Falls Church	4,035,817
Fairlington	18,322,060	WPCP	2,125,922

Figure 7.2: Selected Energy Planning Areas

The energy intensities for the Energy Planning Areas are shown in Figure 7.3. Darker colors mean higher energy use per geographic area. These 20 areas in total represent 67% of energy used in Arlington County, while covering only 35% of the County’s land area. Their energy use accounts for 70% of building GHG emissions.

The remaining parts of the County generally have relatively low energy usage with approximately 85% of the square footage being residential buildings. These areas consume 33% of energy yet cover 65% of total area. Their GHG emissions are about 30% of the buildings total.

Optimal community energy solutions depend on neighborhood characteristics. The evaluation of these areas has led to two distinct sets of energy strategies addressing high- and low-density neighborhoods.

### SCALE PROJECTS

Implementing all of the CES Task Force recommendations and strategies will transform the energy

use and GHG emissions of Arlington, delivering a world-class competitive and attractive community. To be truly successful, the challenge for any plan is to move beyond individual buildings and begin to address neighborhoods where energy supply and land

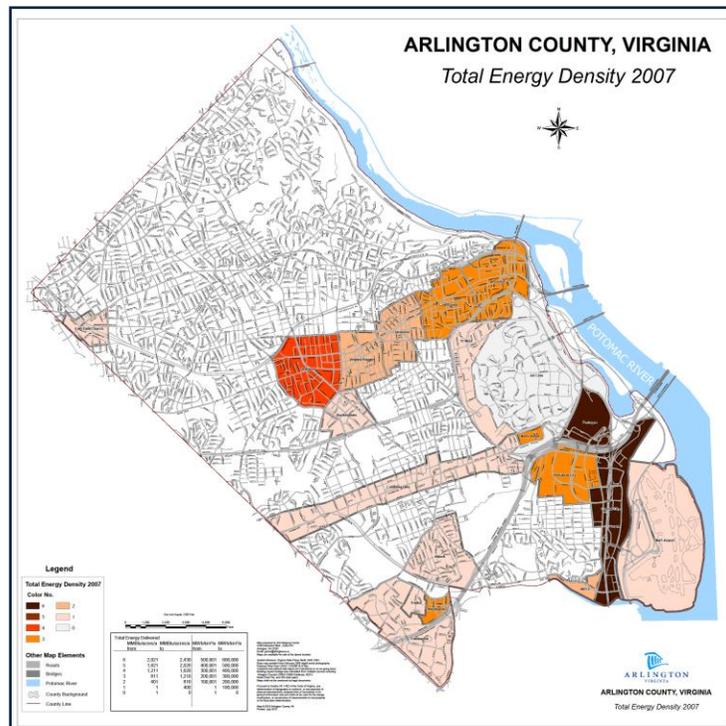


Figure 7.3: Map of Energy Densities for Energy Planning Areas

planning can now be employed. This is the Level 3 implementation referred to in Chapter 3.

CES Task Force Scale Projects address entire neighborhoods in the County. They represent developments with the size and timing such that guidelines in line with the CES Task Force Report can be applied within relatively large, but contained boundaries. They are large enough to address both energy demand and supply within a single project. They are also projects where the number of decision makers is small. Over time, multiple Scale Projects blend together. This “connecting the dots” creates the County-wide energy transformation agreed upon by the Task Force.

Typical Scale Projects could include transit-oriented developments, employment-oriented neighborhoods, retail and entertainment focused corridors, academic campuses, military campuses, mixed-use villages, and revitalized urban centers.

During the preparation of the CES Task Force Report, a list of potential Scale Projects was identified in areas where there is the possibility to engage with local stakeholders to implement integrated efficiency, energy distribution and clean and renewable energy supply solutions. Four high priority possible Scale projects, Crystal City, Rosslyn, Columbia Pike and East Falls Church, are described more fully in Appendix G. Each will need to develop a detailed Integrated Energy Master Plan (IEMP) as part of the next stage to analyze the feasibility of district energy and provide specific and measurable evidence upon which potential future investors in a district energy system can base their decisions. Brief descriptions for the remaining possible 20 scale projects are also included in Appendix G.

## **DISTRICT ENERGY STRATEGIES AND STRUCTURE**

### **ESTABLISHMENT OF A DISTRICT ENERGY COMPANY**

Arlington County should designate areas of the County recommended to be serviced by district

energy. A District Energy Company’s (DEC) first priority could be to develop these areas.

The DEC should be granted the right to supply heating, cooling and domestic hot water services via district energy systems on an exclusive basis anywhere within Arlington for at least 20 years, subject to meeting satisfactory service quality levels. Arlington County would be able to withdraw this right if there were significant quality issues.

The DEC should be free to pursue other energy service related businesses on a competitive basis. Last, the DEC should operate on a for-profit basis, with profit sharing based on ownership and mutually agreed commercial conditions.

### **DISTRICT ENERGY COMPANY OWNERSHIP STRUCTURE**

While the CES Task Force is not making any firm recommendation on the ownership structure of the DEC, there are some basic approaches that have been successful around the world. They each have different advantages and challenges.

#### **Option 1: Publicly Owned**

In this example, the DEC would be owned and operated by the County as a Public Corporation delivering services on a commercial basis, with any profits flowing to the County government. The obvious advantage is the strategic alignment with the community need for reliable, quality services and community ownership. Possible disadvantages include using public financing for all investment along with the potential lack of innovation performance stimulus that can come from public ownership. However, cities like Heidelberg, Germany have successfully implemented this model<sup>74</sup>. Stadtwerke Heidelberg is owned by the city and delivers district energy, natural gas, electricity, water and even runs the parking and public swimming pools of the city. It also teams with neighboring communities to create a regional services approach.

Many successful municipal electric utilities in the U.S. such as the Sacramento Municipal

Utility District<sup>75</sup> and Austin Energy<sup>76</sup> also demonstrate there is no inherent conflict between a publicly managed community energy service company and high quality innovative services. The City of North Vancouver, through its wholly owned subsidiary, Lonsdale Energy Corporation<sup>77</sup>, is a good example of a North American city creating district energy services using a Public Corporation as the vehicle.

### Option 2: Public-Private Partnership

Under this option, the DEC would be jointly owned by the County and private investors. Investments and profit sharing would be in proportion to the ownership shares.

The investors would typically include strategic investors with a long-term interest in the Arlington's district energy opportunity and could include existing regional utilities, property owners and ethical investors. These may be combined with a portion of ownership traded on the stock exchange.

The obvious advantages are that the risks are shared between the community and private capital, and that the private partners may be more motivated to develop both extended innovative energy services, and to expand their activity beyond the County. Potential challenges may come from differing public and private motivations relative to acceptable financial returns and public service priorities.

There are many examples of very successful city energy service companies that operate with this ownership model. Excellent examples are Mannheim, Germany<sup>78</sup> and Stockholm, Sweden. Both offer a range of energy services including extensive district energy services and both have profitable activities that extend beyond the home city.

St Paul, Minnesota, which has a modern district heating system serving the downtown, also has a public-private ownership model. The district energy distribution system is a non-profit cooperative co-owned and managed by the city and customers. The Board is structured with equal representation from both with a tie-

breaking Director selected unanimously by the balance of the Board. On the supply side, separate for-profit entities have been established to run CHP, biomass and similar facilities, each with long-term supply agreement with the district energy distribution company.

In all cases, there needs to be structure that ensures the priority to deliver acceptable services to Arlington is never jeopardized. This is usually achieved by the community retaining a majority ownership or having over-proportional (greater than 50%) voting rights.

### Option 3: Investor-owned Company

The DEC under option 3 would be 100% owned by private investors, effectively operating under license from the County to deliver district energy services.

The obvious advantage is that the financial risks are carried by private owners, with the possibility that Arlington would not automatically benefit from profit sharing. This could be mitigated by a licensing fee. The potential challenge remains to ensure the balance between being a long-term public service provider and a profitable investor-owned entity.

The city utility in Berlin, Germany, which is responsible for district energy and much of the gas and electricity services, is a large example of this model, being owned by Vattenfall AB<sup>79</sup> from Sweden. In the U.S., the investor-owned Con Edison<sup>80</sup> in New York City supplies electricity, natural gas and district heating to the community.

### Option 4: Site Specific Company

A final model would involve a single site for which a special purpose company to provide district energy services specifically for that single site.

The Dockside Green Energy LLP<sup>81</sup> is an example of this option. It was established to run a small district heating system for the Dockside Green development in Victoria, BC. Siedlungswerk<sup>82</sup>, a major property developer in Stuttgart, German has a wholly-owned district energy affiliate,

which establishes development specific entities if appropriate municipal services are not available.

In both of these examples, the intent is either to ultimately broaden the service area (Dockside Green) or to fill a gap until the wider community is ready to take over the services (Stuttgart). This site-specific model is not commonly used.

## **CREATION OF A DISTRICT ENERGY COMPANY THAT SHARES DISTRICT ENERGY INVESTMENTS AND BENEFITS**

Whichever ownership and governance model is finally chosen, the operational business model should be developed that clearly shares the investments and benefits equitably between the property owners, energy consumers, and the DEC. Some variation on the following concepts should be used based on successful worldwide practices:

### **PHYSICAL ASSETS**

The DEC could own and operate the following assets that comprise the district energy system:

- Network of highly insulated pipes that carry heating and cooling between supply sources and connected buildings including the necessary various pumps and controls.
- Thermal sub-stations, including heat exchangers, meters and ancillary equipment, to transfer heating and cooling from the network to buildings
- The DEC could either own energy sources or purchase the output of sources owned by others under long-term contracts. The definitive configuration will be specific to each district energy area of the County and will change over time. Initially it will include:
  - Existing chillers, boilers and furnaces reassigned to the district energy system
  - New chillers, boilers and furnaces assigned to the district energy system
  - Distributed CHP generation

As the district energy network grows, and depending on cost and technical evolution, other thermal sources may be added to the network including geothermal loops, solar thermal collectors, biofuel heat or CHP, and waste heat recovered from various sources.

In Arlington and possibly neighboring jurisdictions, this could eventually include heat from existing waste-to-energy plants, the Pentagon, and other sources.

The owner of a property connected to district energy would no longer own heating and cooling assets. Even if they are still in the building, the DE assets will be shared across the network (i.e., the horizontal infrastructure, owned and operated by the DEC). This reduces total investment and the operating costs from the perspective of the property owner. This may free up resources for property owners to invest in efficient renovation and above-code new construction.

### **REVENUES**

District energy heating, hot water and cooling services should be invoiced by the DEC using heating and cooling meters. Prices would be competitive with prevailing heating or cooling equivalents using natural gas or electricity. In a multi-tenant apartment or commercial complex, there would typically be a single tariff meter, supported by low-cost allocation meters, allowing for end-user billing.

Electricity generated by CHP should be sold to DVP under the prevailing public service rules of the Commonwealth of Virginia State Corporation Commission.

### **PRICING**

Due to the inherent efficiency and the flexibility of district energy to make use of multiple fuels and waste heat, and the long-term nature of the service agreements, the costs for the end-user should be equal or less than business-as-usual. This is consistently the case in the majority of European district energy systems.<sup>83</sup> With the low penetration of modern, hot water-based district energy in the U.S., experience is

limited. However, an example is lower district energy heating cost in St. Paul compared to equivalent higher costs in Minneapolis using individual heating<sup>84</sup>.

### DEVELOPMENT OF DISTRICT ENERGY SERVICES

In an area has been designated for district energy, the expectation is that project owners for all major renovations, new commercial buildings and apartment blocks could determine what it would take to create district energy-ready buildings as outlined earlier. This will accelerate the rate at which the DEC could interconnect buildings and gain the operating and economic advantages.

Depending on the specifics of a neighborhood, the DEC could also preemptively invest in the energy assets and heating and cooling interconnection of a single building to make it economically attractive for the developer/owner to make efficiency and interconnection adjustments. The DEC could then operate these assets and deliver heating, hot water and cooling services to the stand-alone building in anticipation of its future interconnection to the district energy system.

In areas such as Crystal City, which are subject to a comprehensive redevelopment plan, the implementation steps to a district energy network should be formally incorporated into the overall planning efforts. As the district energy network develops, the cost to add

individual buildings reduces substantially and the system tends to evolve organically.

Mandatory district energy zoning for designated areas is common practice in many cities around the world. Arlington could use the combination of district energy-ready development, scale project planning, and County sponsorship to review the option of creating a viable alternative to standard zoning. The positive involvement of Dominion Virginia Power and Washington Gas, along with major property developers and owners in the evolutionary planning of the County's district energy strategies, could be a crucial factor in any alternative zoning's early success.

---

<sup>73</sup> See Appendix B for additional detail on Energy Planning Areas

<sup>74</sup> [http://www.hvv-heidelberg.de/cms/Kopfnavigation/Unternehmen/Die\\_Stadtwerke\\_Heidelberg.html](http://www.hvv-heidelberg.de/cms/Kopfnavigation/Unternehmen/Die_Stadtwerke_Heidelberg.html)

<sup>75</sup> <http://www.smud.org/en/Pages/index.aspx>

<sup>76</sup> <http://www.austinenergy.com/>

<sup>77</sup> <http://www.toolkit.bc.ca/success-stories/district-heating-north-vancouver>

<sup>78</sup> <http://www.mvv-energie.de/cms/konzernportal/en/homepage.jsp>

<sup>79</sup> <http://www.vattenfall.de/de/index.htm>

<sup>80</sup> <http://www.coned.com/>

<sup>81</sup> <http://docksidegreenenergy.com/index.html>

<sup>82</sup> <http://www.siedlungswerk.de/>

<sup>83</sup> Extensive consultant experience – GIL and MVV decon GmbH

<sup>84</sup> See Appendix I for description of the St Paul DE System.

# CHAPTER 8: CONCLUSION

The estimated energy and GHG impacts resulting from the integration of efficient transportation, residential and non-residential buildings, along with restructured clean and renewable energy supply, supported by good community governance, awareness and other enabling strategies has been assessed annually from the 2007 Baseline to 2050. **Figure 8.1** summarizes how the various recommended energy strategies build on each other to achieve the energy transformation outlined in Chapter 3.

Over time the four levels of transformation create a new norm of outstanding energy performance, and expectations. No one element is more important than any other; it is the combination that creates world-class performance. Performance is measured as much by new investments in Arlington because of its innovative approach to energy as it is by

the affordability, efficiency and reduced environmental impacts of future energy use.

## ENERGY EFFICIENCY

The annual energy consumption and energy consumption per capita for the County in 2007, 2016, 2025 and 2050 are shown below (**Figures 8.2 and 8.3**) for the three major sectors – residential buildings, non-residential buildings and transportation.

By 2050, the County will have experienced significant population and job growth, yet is predicted to use less than 50% of the energy used today. Energy use per capita drops an impressive 61% despite accelerated growth in employment.

All new buildings are assumed to be 30% more efficient than current Virginia code by 2015 and annually become more efficient thereafter. Starting in 2015, 2%-3% of existing residential

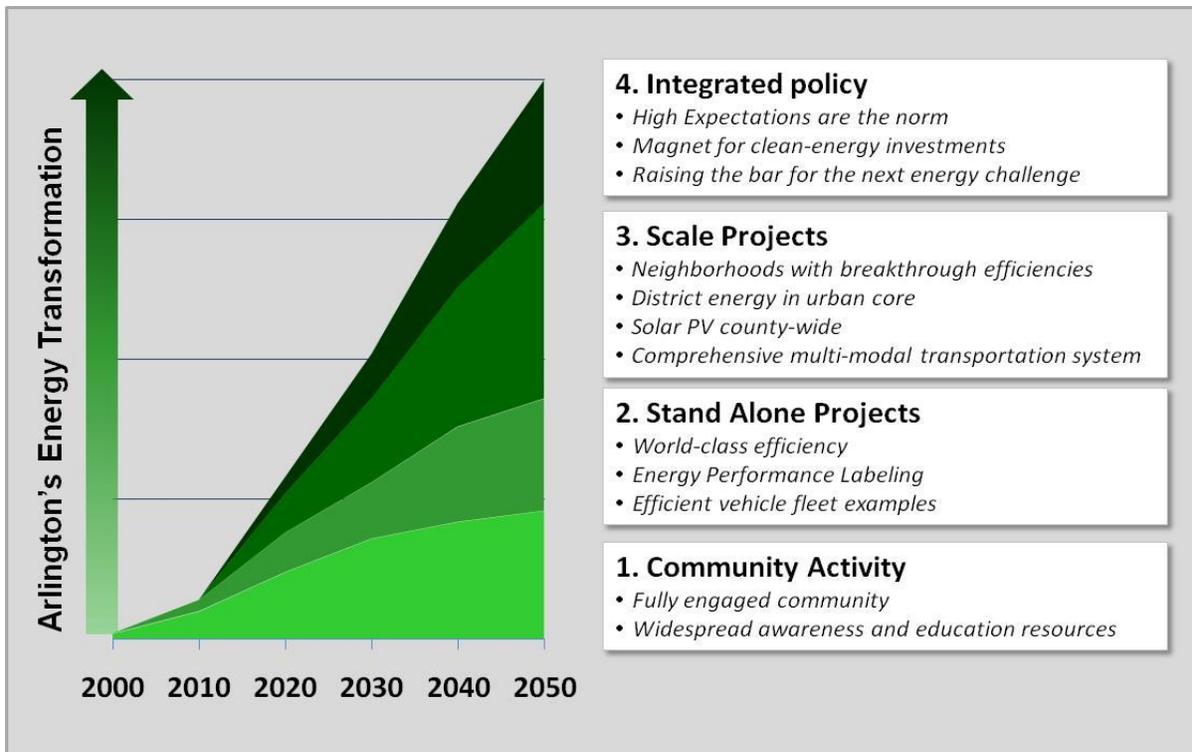


Figure 8.1: Arlington's Pathway to Energy Transformation

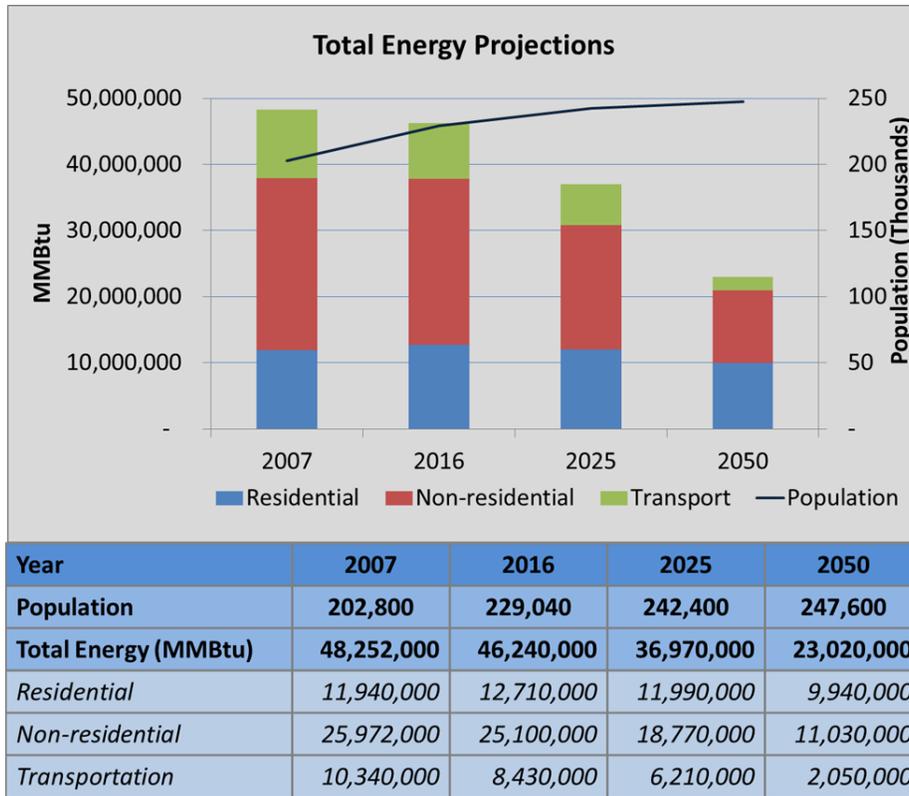


Figure 8.2: Total Energy Use by Sector

units are expected to be renovated annually and will operate at least 30% more efficiently than today’s average. Non-residential buildings are likely to be renovated at a similar rate, and starting in 2015 should operate 50% more efficiently than today.

Energy Performance Labeling of residential and non-residential buildings should be common by 2015 and standard practice by 2025, providing an easily understood way for buyers, sellers and renters to take into account the value of energy efficiency when they make buying or renting decisions. The confidence this will give in the true energy performance should enhance property values, facilitate easier financing, increase rental values and reduce vacancy rates.

Beginning in 2015, district energy networks delivering competitively priced heating and cooling should begin to spread in high-density neighborhoods operated by a well-invested

company teamed closely with the County. Most of the total of 145 MW of CHP units should be sited and in place by 2030, enhancing energy supply security, cost and environmental performance. This will also free property owners from many operating costs and inconveniences. In the same time frame, 160 MW of rooftop and wall-mounted solar PV should be deployed, reducing emissions and eliminating the summer peak demands from the regional electricity grid.

Transportation energy is estimated to reduce by a total of 80% as Arlington’s existing and anticipated transit-oriented planning is implemented. This reduction comes from the increased use of mass transit along with lower carbon-content fuels and more efficient vehicle choices, including a significant deployment of electric vehicles.

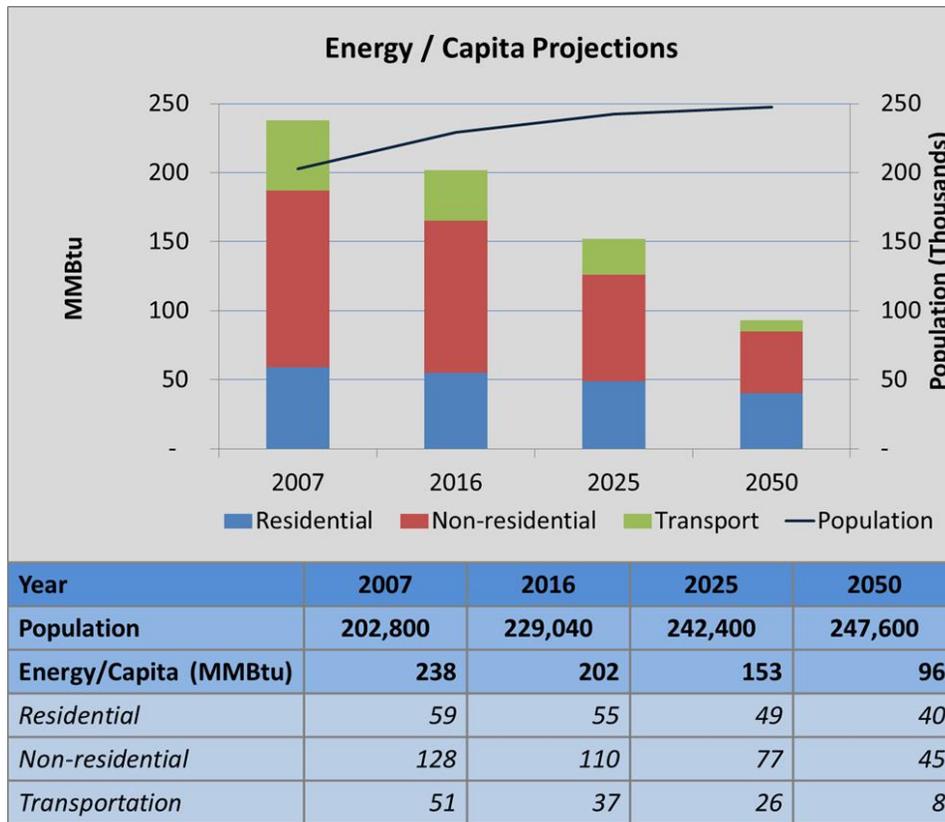


Figure 8.3: Per Capita Energy Use by Sector

## GREENHOUSE GAS REDUCTIONS

With the increases in energy efficiency, deployment of district energy, addition of clean and renewable fuel choices, and changes in transportation, the CES Task Force Technical Working Group estimates that by 2050 the total GHG emissions will drop by more than 70% from 2.7 million mt to 780,000 mt CO<sub>2</sub>e.

By 2016, total emissions will have absorbed population and employment growth and dropped slightly to a total of 2.6 million mt. By 2025, the total will drop to 1.8 million mt. In the following 15 years, total emissions will further drop to 1 million mt by 2040 (Figure 8.4).

Per capita emissions are estimated by modeling and analysis to drop from today’s 13.4 mt to 3.1 mt (Figure 8.5). This is a level comparable to today’s global best practices. After considering the assumptions used for modeling and analysis, and the reasonable uncertainties surrounding any projection 40 years into the future, the CES Task Force recommended rounding the 2050 target to 3.0 mt/capita.

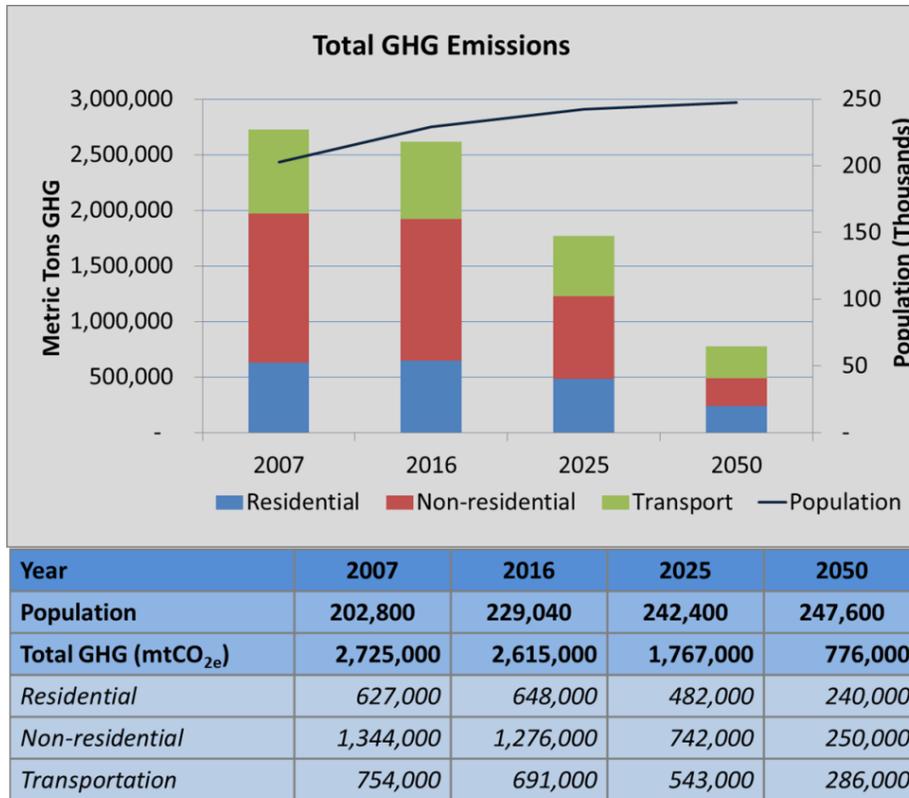


Figure 8.4: Total GHG Emissions Projections by Sector

The targeted total reductions to 2016 of 4%, or 15% on a per capita basis, are relatively modest as the various strategies are put into place and begin to take effect. Reductions should then start to accelerate such that by 2025, total emissions will be 35% less than the baseline on a total basis, or 45% on a per capita basis.

The evolution of the impacts of the four key strategies – building efficiency, district energy associated with combined heat and power, transportation efficiency and renewable energy is summarized above in **Figures 8.6 and 8.7**.

## ECONOMIC AND SOCIAL BENEFITS

Even at today’s relatively low energy prices, the energy efficiency gains would be worth over \$280 million annually. While short-term forecasts vary, there is a strong consensus that in the longer term, energy prices will increase

substantially, further enhancing the value of the efficiency. Money from avoided costs can be reinvested into the community.

The combination of lower energy operating costs combined with an energy system that has very low greenhouse gas emissions is very attractive to investors that have their own corporate energy management and environmental targets. This is increasingly common as businesses respond to energy-related competitive and regulatory pressures from around the world. The inclusion of a large amount of district heating and cooling clean and renewable energy sources within the County is intrinsically more reliable, as well as being cost-effective and efficient. Energy supply quality and reliability is increasingly a major factor for investors, further enhancing Arlington’s competitiveness.

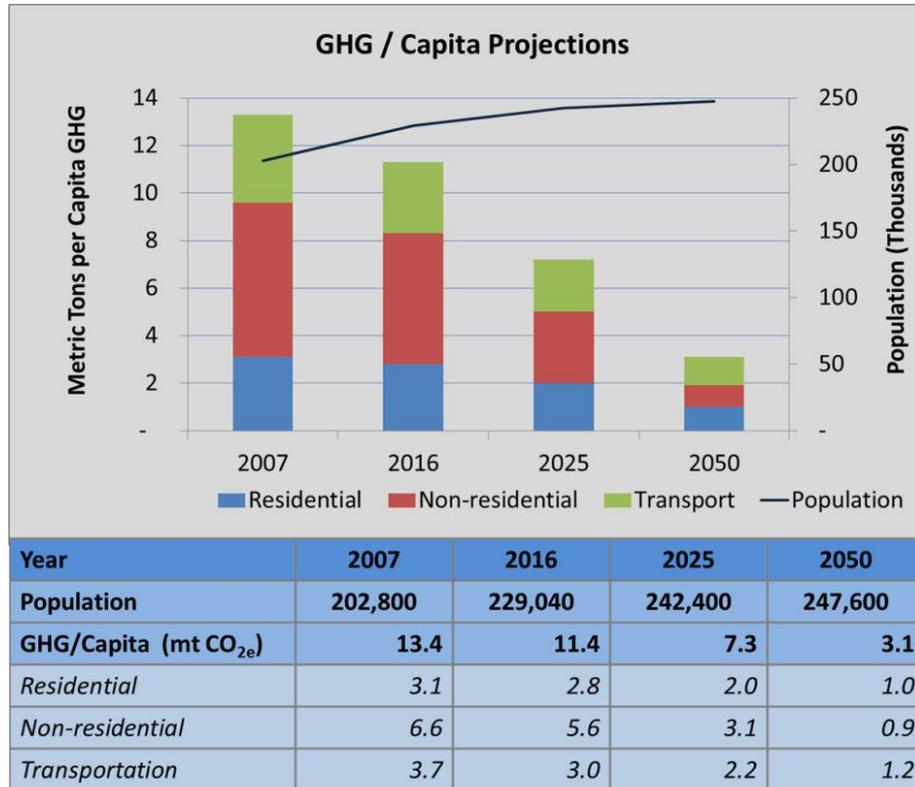


Figure 8.5: Per Capita GHG Emissions Projections by Sector

Attracting and retaining employers has obvious benefits for Arlington’s resident community. Employment will be available within the community which will have a positive impact on transportation energy use. Residents also benefit from the reduced volatility and lower energy costs than surrounding communities<sup>85</sup>. With the cost of energy contained, all housing should be more affordable, with the greatest impact felt at the lower income level.

Energy efficient commercial properties attract higher rents<sup>86</sup> and have higher occupancy rates reflected in property values, which will be offset by lower utility costs.. Businesses often report higher productivity from workers in efficient buildings.<sup>87</sup> As property values rise, banks should enjoy increased collateral value and credit worthiness. It is expected that homes with demonstrated energy efficiency will be more attractive to both sell and rent, with buyers, lenders and renters reassured by credible energy performance labels.

Environmentally, Arlington will have complied with its Cool Counties commitment by putting in place a forward-thinking energy strategy . The infrastructure proposed can use multiple technology and fuel choices to reduce emissions and control costs over the next 40 years. By demonstrating its commitment to rational, integrated energy planning and implementation, Arlington will be a magnet for clean energy companies seeking to establish and grow national and global businesses and could serve as a model for other cities, counties and towns.

With many or all of the CES Task Force recommendations and strategies eventually implemented through a consistent and methodical, long-term approach, Arlington County, its residents and businesses, the Metro DC region, and the country as a whole stand to benefit greatly.

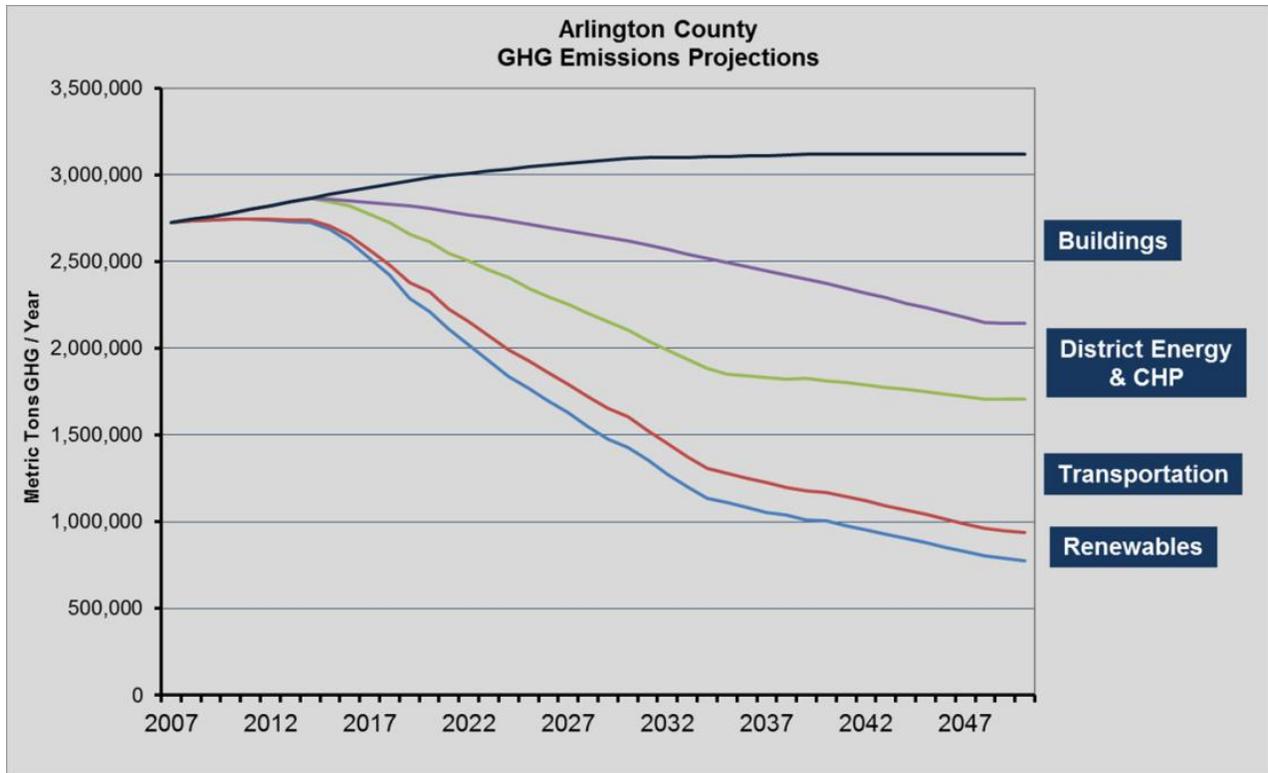


Figure 8.6: Total GHG Emissions by Strategy

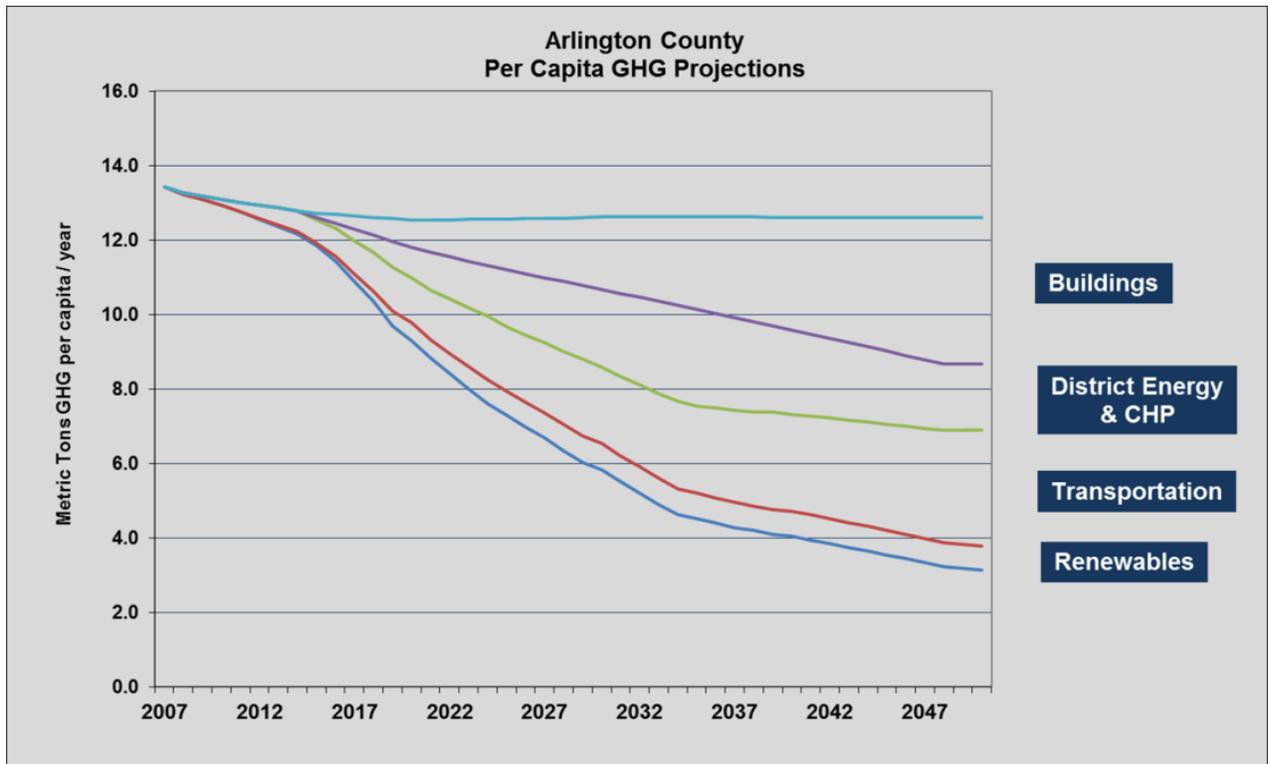


Figure 8.7: Per Capita GHG Emissions by Strategy

---

<sup>85</sup> Natural Resources Defense Council and the Enterprise Green Communities (<http://www.greencommunities.org>) have documented the costs and benefits of sustainable developments for low-income residents.

<sup>86</sup> [http://www.jetsongreen.com/files/doing\\_well\\_b\\_y\\_doing\\_good\\_green\\_office\\_buildings.pdf](http://www.jetsongreen.com/files/doing_well_b_y_doing_good_green_office_buildings.pdf)

<sup>87</sup> [http://catcher.sandiego.edu/items/business/Productivity\\_paper\\_with\\_CBRE\\_and\\_USD\\_Aug\\_2009-Miller\\_Pogue.pdf](http://catcher.sandiego.edu/items/business/Productivity_paper_with_CBRE_and_USD_Aug_2009-Miller_Pogue.pdf)

## GLOSSARY OF TERMS

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

Term	Definition
<b>Air Pollutants</b>	In addition to greenhouse gases, these include: Sulphur dioxide (SO <sub>2</sub> ), Nitrogen oxide (NO <sub>x</sub> ), Hydrogen chloride (HCl), Hydrogen fluoride (HF), carbon monoxide (CC), and non-methane volatile organic compounds (NMVOC).
<b>ASHRAE</b>	The American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
<b>Base Case</b>	Estimation of the present energy use, greenhouse gas emissions, and the prevailing conditions affecting them
<b>Baseline</b>	See “Base Case”
<b>Biomass</b>	Vegetation such as wood, agricultural or animal waste, catering waste or landfill gas, etc. with the potential to be used as a fuel. Suitably separated municipal waste may fall into this category.
<b>Btu</b>	British thermal unit (BTU or Btu) is a unit of energy defined as the amount needed to heat one pound of water one degree Fahrenheit. For the purposes of the CES Task Force Report, 1,000 Btus are labeled kBtu, while 1,000,000 Btus are labeled MM Btu.
<b>Building Code</b>	Legally required construction practices.
<b>Building Standard</b>	Voluntary construction practices, generally exceeding code Requirements.
<b>Built Infrastructure</b>	General term referring to all the residential and non-residential buildings in Arlington.
<b>CAFE</b>	Corporate Average Fuel Economy, defined as the sales weighted average fuel economy, expressed in miles per gallon (mpg), for a fleet of vehicles. This is a mandatory standard regulated by the EPA. The 2009 version includes greenhouse gas emissions per mile for the first time.
<b>Carbon Dioxide</b>	The most common form of greenhouse gas. Over 70% of man-made greenhouse gas emissions are from the use of energy.
<b>Carbon Dioxide Equivalent</b>	Where “e” is used to denote the term “equivalent”: Greenhouse effect of the other five greenhouse gases identified in the Kyoto Treaty expressed in equivalents of carbon dioxide. This unit of measure is used to allow the addition of or the comparison between gases that have different global warming potentials (GWPs). Since many greenhouse gases (GHGs) exist and their GWPs vary, the emissions are added in a common unit, CO <sub>2</sub> e. To express GHG emissions in units of CO <sub>2</sub> e, the quantity of a given GHG (expressed in units of mass) is multiplied by its GWP.

<b>Certified Emission Reduction</b>	Generic term used to describe metric ton of greenhouse gas reduction or avoidance that has independently validated certification and can be traded in a recognized regulated market. Certified Emission Reductions come in many forms.
<b>CHP</b>	See “Cogeneration.”
<b>Clean and Renewable Energy</b>	This phrase is used to indicate some combination of renewable energy and cogeneration (CHP) energy sources.
<b>CO<sub>2</sub></b>	See “Carbon dioxide”
<b>CO<sub>2</sub>e</b>	See “Carbon dioxide equivalent”
<b>Cogeneration</b>	Generating electricity in such a way that most of the heat produced is usefully used. A common definition is that an average minimum overall fuel efficiency of 70% is expected. Peak efficiency would typically exceed 90%. Also known as “CHP.”
<b>Combined Heat and Power</b>	See “Cogeneration.”
<b>Commercial Buildings</b>	Non-residential buildings; often owned or operated by for-profit entities.
<b>Community Energy Project</b>	Project that led to the CES Task Force Report’s creation and that provided high-level recommendations and strategies for energy generation, distribution, storage, and use in the greater Arlington community from now to the year 2050.
<b>Cooling Degree Days</b>	A measure of how hot a location was over a period, relative to a base temperature. In the CES Task Force Report, the base temperature is 65°F and the period is one year. If the daily average temperature exceeds the base temperature, the number of cooling degree-days for that day is the difference between the two temperatures. However, if the daily average is equal to or less than the base temperature, the number of cooling degree-days for that day is zero.
<b>Daylighting</b>	Designing buildings to maximize the use of natural daylight to reduce the need for electricity.
<b>DEC</b>	See “District Energy Company”
<b>District Cooling</b>	Cooling services delivered via district energy systems.
<b>District energy</b>	Networks that deliver heating or cooling to energy consumers carried through the medium of chilled or hot water, or (in older systems) steam. Heating and cooling is transferred to the home or buildings via a heat exchanger.
<b>District Energy Company</b>	While individual buildings that are customers in a district energy network are owned by property owners and developers, a District Energy Company (DEC) is an organization that operates and maintains the district energy network, i.e., the horizontal infrastructure of district energy piping and equipment. The DEC can also wholly or partially own the district energy network.
<b>District Heating</b>	Heat services delivered via district energy systems.

<b>Electrical Conversion Losses</b>	The difference between the energy value of the fuel used to make electricity and the energy value of the electricity itself.
<b>Energy Performance Label</b>	This would be an easily recognizable benchmark that energy auditors, retrofitters, lenders, realtors, and consumers can use to compare home energy performance and identify the most energy efficient residential and non-residential buildings. It would show how much energy a home or building actually used per utility bills, as opposed to energy modeling which attempts to predict how much energy a home or building would use, and would compare that structure to similar structures.
<b>ENERGY STAR®</b>	Joint U.S. Environmental Protection Agency and U.S. Department of Energy programs <a href="http://www.energystar.gov/">http://www.energystar.gov/</a> supporting energy efficiency as a cost-effective way to reduce greenhouse gas emissions in home, buildings, industry and equipment.
<b>EPL</b>	See “Energy Performance Label”
<b>EU</b>	European Union
<b>EV</b>	Electric Vehicle
<b>Fossil Fuels</b>	Combustible material obtained from below ground and formed during a geological event. For purposes of the CES Task Force Report, examples of such fuels include coal, oil and natural gas.
<b>GDP</b>	See “Gross Domestic Product”
<b>Geothermal systems (low temperature)</b>	Systems that use the relatively constant temperature of the ground starting about 6 to 10 feet below ground to cool buildings in summer and heat them in winter.
<b>GHG</b>	See “Greenhouse Gases”
<b>Global Warming Potential</b>	A relative measure of the warming effect that the emission of a GHG might have on the Earth’s atmosphere. It is calculated as the ratio of the time-integrated radiative forcing (i.e. the amount of heat-trapping potential) (measured in units of power (watts) per unit of area (square meters) that would result from the emission of 1 kg of a given GHG to that from the emission of 1 kg of CO <sub>2</sub> . For example, the GWP for nitrous oxide (N <sub>2</sub> O) is 310, which means that 1 kg of N <sub>2</sub> O emissions is equivalent to 310 kg of CO <sub>2</sub> emissions.
<b>g/m</b>	Grams of CO <sub>2</sub> per vehicle mile - term used to capture GHG emissions as they apply to transportation
<b>Green Energy</b>	Energy derived from conservation, renewable sources of energy and clean distributed energy. What energy forms are included varies depending on local jurisdictions and practices.
<b>Greenhouse Gases</b>	A greenhouse gas absorbs and radiates heat in the lower atmosphere that otherwise would be lost in space. The main greenhouse gases are carbon dioxide (CO <sub>2</sub> ), methane (CH <sub>4</sub> ), chlorofluorocarbons (CFCs) and nitrous oxide (N <sub>2</sub> O), sulphur hexafluoride (SF <sub>6</sub> ), hydrofluorocarbons (HFC) and perfluorinated carbons (PFC). The most abundant greenhouse gas is carbon dioxide (CO <sub>2</sub> ).

<b>GHG Monetization</b>	Processes to convert tradable energy and environmental benefits into cash or cash equivalents.
<b>Gross Domestic Product</b>	The total value of goods and services produced by a country during a given time period, most commonly a year.
<b>Gross Vehicle Weight Rating</b>	The maximum allowable weight of a fully loaded vehicle, including liquids, passengers, cargo, and the tongue weight of any towed vehicle. This value is defined by the manufacturer and is based on vehicle design.
<b>GVWR</b>	See “Gross Vehicle Weight Rating”
<b>GWP</b>	See “Global Warming Potential”
<b>Heating Degree Days</b>	A measure of how cold a location was over a period, relative to a base temperature. In the CES Task Force Report, the base temperature is 65°F and the period is one year. If the daily average temperature is below the base temperature, the number of heating degree-days for that day is the difference between the two temperatures.
<b>IECC</b>	International Energy Conservation Code - a model energy building code produced by the International Code Council (ICC). The code contains minimum energy efficiency provisions for residential and commercial buildings, offering both prescriptive- and performance-based approaches. The code also contains building envelope requirements for thermal performance and air leakage. Primarily influences US and Latin American markets.
<b>IEMP</b>	Integrated Energy Master Plan – A comprehensive plan defining the energy efficiency of construction, energy distribution and energy supply to achieve agreed economic, environmental and other goals. Typically an IEMP would cover at least 15 years into the future and would apply to large developments.
<b>Insolation</b>	The amount of solar energy received on a surface over a period of time. It is usually expressed in units of kilowatts-hours per square meter (kWh/m <sup>2</sup> ), "peak sun hours", megajoules per square meter (MJ/m <sup>2</sup> ) or Langleys (L), for the given period such as a day or hour.  1kWh/m <sup>2</sup> = 1 peak hour = 3.6 MJ/m <sup>2</sup> = 0.00116 L
<b>Institutional Buildings</b>	Nonresidential buildings generally owned by public administration, education, public or private healthcare facilities and other not-for-profit entities.
<b>kBtu</b>	See “Btu”
<b>Kilowatt-hour</b>	A unit of electrical energy universally used as the basic billing unit and equals the use of one thousand watts of electrical energy in one hour. One kWh is about 3,412 Btu.
<b>Kilowatt-hour Equivalent</b>	A unit of energy from any source equivalent to one kilowatt-hour of electricity. Used to get a standard measurement for comparison of different forms of energy.
<b>kWh</b>	See “Kilowatt-hour”
<b>kWhe</b>	See “Kilowatt-hour equivalent”

<b>Kyoto Treaty</b>	International Treaty aimed at reducing man-made greenhouse gases primarily through reduced use of fossil fuels. Signed in 1997 and ratified in 2005 by most industrialized countries accepting mandatory targets; and by many other countries accepting mandatory reporting and voluntary goals.
<b>Leadership in Energy and Environmental Design</b>	A voluntary system for rating existing and new residential and non-residential buildings and neighborhoods based on their overall environmental performance including energy and water use. Developed by US Green Buildings Council, a non-profit group.
<b>LEED</b>	See “Leadership in Energy and Environmental Design”
<b>Megawatt-hour</b>	A unit of electrical energy equals the use of one million watts of electrical energy in one hour.
<b>Megawatt-hour-Equivalent</b>	A unit of energy from any source equivalent to one megawatt-hour of electricity. Used to get a standard measurement for comparison of different forms of energy.
<b>Metric Ton</b>	Unit of weight equal to 1,000 kilograms. Often used in the CES Task Force Report as a measure of greenhouse gas emissions. 1 mt = 1.102 US ton.
<b>MM Btu</b>	See “Btu”
<b>mt</b>	See “Metric Ton”
<b>MWh</b>	See “Megawatt-hour”
<b>MWhe</b>	See “Megawatt-hour equivalent”
<b>NGOs</b>	Non-governmental organizations
<b>NREL</b>	National Renewable Energy Laboratory, part of U.S. DOE
<b>OECD</b>	Organization for Economic Cooperation and Development
<b>Per Capita</b>	For each person in the total population being considered; generally referred to as a resident.
<b>PV</b>	See “Solar Photovoltaic Systems”
<b>Renewable energy</b>	Energy generated from sources other than fossil fuels, most commonly sun, wind, water and various animal and plant derived fuels. These create the least greenhouse gases in operation.
<b>RECS</b>	The U.S. DOE The Residential Energy Consumption Survey (RECS) provides information on the use of energy in residential housing units in the United States.
<b>Scale Projects</b>	Developments with the size and timing such that new guidelines in line with the CES can be applied within relatively large, but contained boundaries. These are projects large enough to capture the combined value of efficient use, efficient distribution, and clean and renewable energy, but are bounded such that benefits can be clearly identified and risks fully understood. They can range from entire mixed-use neighborhoods to single large commercial or institutional developments. Over time, multiple Scale Projects blend together.

<b>Smart Growth</b>	Approach to developing areas of a cities to use minimum resources, to maximize social interactions with a balanced mix of demographics, usually associated with creating mixed-use, walkable neighborhoods.
<b>Smart Meters</b>	Energy meters (heat/electricity/cooling, gas) capable of gathering energy use patterns, applying different tariffs depending on time of day and use level, and capable of being integrated into wider information and control systems.
<b>Solar Photovoltaic Systems</b>	Systems that directly convert sunlight into electricity either for use locally or for delivery to the wider grid.
<b>Sustainability</b>	Meeting the needs of the present generation without compromising the ability of future generations to meet their own needs.
<b>TOD</b>	See “Transit Oriented Design”
<b>Transit Oriented Design</b>	Land development that takes into account transportation choices as a means of reducing oil and other energy use. Typically it would combine public transit with walkable, mixed-use communities, and approaches to minimize the impact of individual vehicles and commuting.
<b>UNFCC</b>	United Nations Framework Convention on Climate Change
<b>Vehicle Miles Traveled</b>	The distance traveled by vehicles on the road.
<b>VMT</b>	See “Vehicle Miles Traveled”

*ARLINGTON COUNTY*  
*COMMUNITY ENERGY AND SUSTAINABILITY TASK FORCE*  
*FINAL REPORT*  
*APPENDICES*

*Draft*  
*March 11, 2011*



Prepared by CEP Technical Working Group  
for consideration by the  
Arlington County CES Task Force

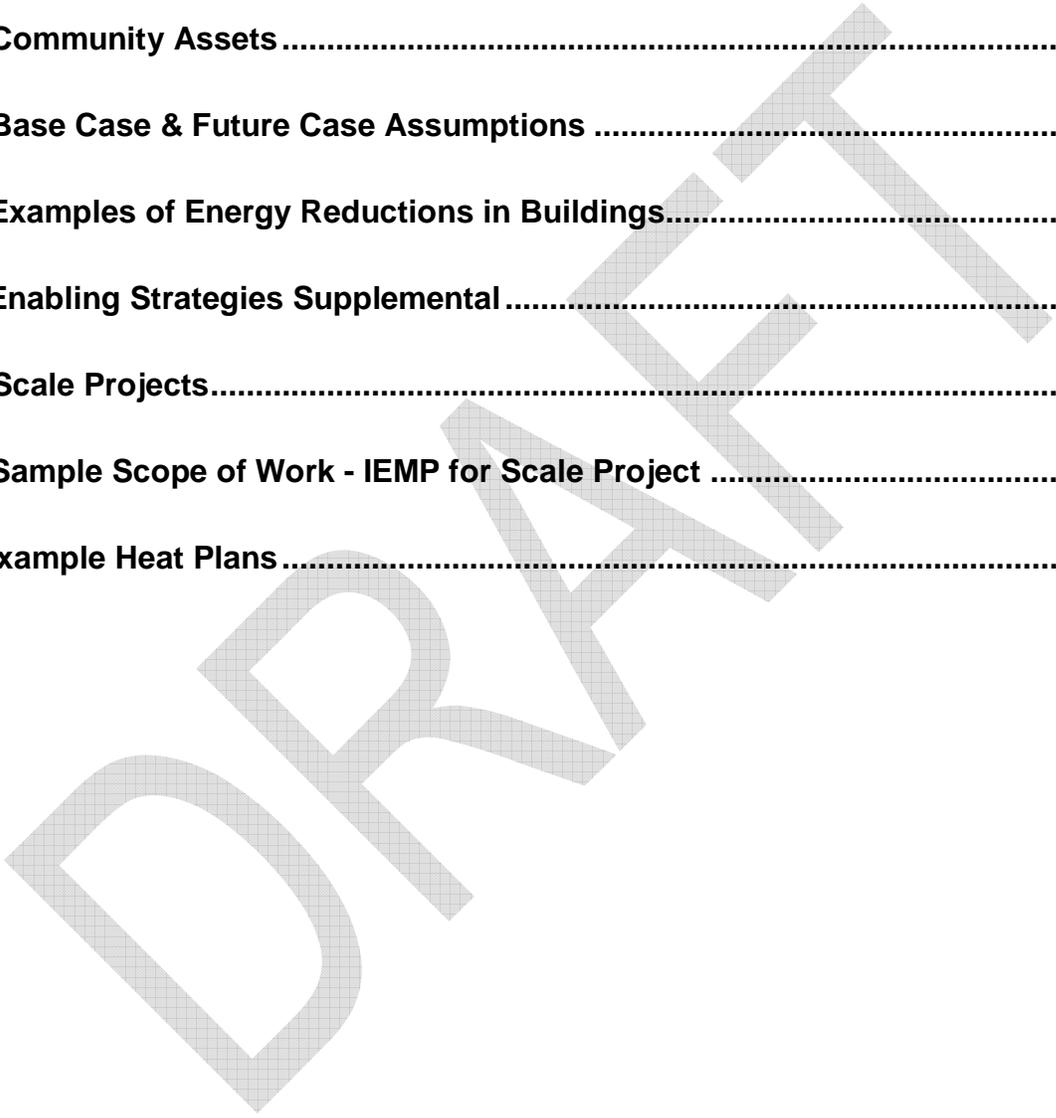
*Disclaimer*

*This draft has been prepared for consideration by the Arlington CES Task Force. This draft is subject to change before it is presented to the Arlington County Board Members in May 2011.*

*ARLINGTON COUNTY*  
*COMMUNITY ENERGY PLAN*  
*FINAL REPORT – SUPPLEMENTAL APPENDICES*

## List of Appendices

<b>A-2007 Baseline Assumptions and Methodology.....</b>	<b>2</b>
<b>B-Energy Planning Areas .....</b>	<b>6</b>
<b>C-Community Assets .....</b>	<b>11</b>
<b>D-Base Case &amp; Future Case Assumptions .....</b>	<b>24</b>
<b>E-Examples of Energy Reductions in Buildings.....</b>	<b>30</b>
<b>F-Enabling Strategies Supplemental .....</b>	<b>39</b>
<b>G-Scale Projects.....</b>	<b>49</b>
<b>H-Sample Scope of Work - IEMP for Scale Project .....</b>	<b>79</b>
<b>I-Example Heat Plans.....</b>	<b>91</b>



# Appendix A

## 2007 Baseline Assumptions and Methodology

The *Greenhouse Gas Inventory Arlington County, Virginia 2000 and 2007*<sup>1</sup> provided both energy use and greenhouse gas emissions for major categories of residential buildings, non-residential buildings, transportation and waste. These data are the primary source of information establishing the 2007 baseline used in the CES Task Force Final Report.

The methodologies and assumptions underpinning the development of the County Inventory are described in detail in the full report. To gain a better understanding of its basis, the link to the report can be used.

### ***Building Modeling for the CES Task Force Final Report***

Modeling of buildings, including residential and non-residential buildings of various types, was chosen as a means to estimate the splits of energy use by building type, energy density of smaller geographies within the County, as well as building energy use projected into the future. The actual electric and gas consumption data provided by Dominion Virginia Power and Washington Gas were not available for specific buildings or geographic areas, so categories of building types were chosen for modeling to represent the typical building inventory within the County.

Information provided by the County identified six major types of buildings: single-family detached, single-family attached, multi-family, office, retail and hotel. These are generally described as residential and non-residential buildings in the CES Task Force Report. Prototypical models were developed for each of these building types, using Energy Plus Version 5.0, with standard model operating schedules and levels of occupancy. Comparisons were made to actual buildings and energy indexes to validate the broader statistical approach. Since the heating fuel in each building type has an estimated statistical mix throughout the County, heating plants for the building models were also defined as either natural gas or electricity for building types.

---

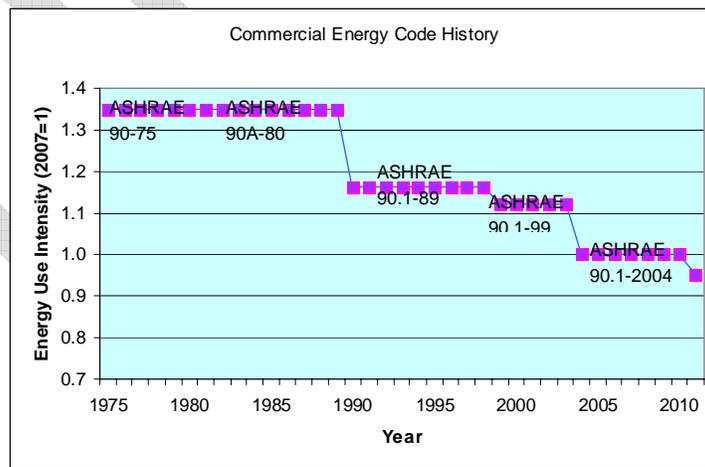
<sup>1</sup> <http://www.arlingtonva.us/aire>

Building Modeling Matrix					
Building Type	Building Size	Heating Fuel		Performance Standard	
Office	184,000	Natural Gas	Electricity	ASHRAE 90-75	ASHRAE 90.1-2001
Hotel	141,000	Natural Gas	Electricity	ASHRAE 90-75	ASHRAE 90.1-2001
Retail	24,000		Electricity	ASHRAE 90-75	ASHRAE 90.1-2001
Multi-Family	180,000	Natural Gas	Electricity	ASHRAE 90-75	ASHRAE 90.1-2001
Single Family Detached	1,600	Natural Gas	Electricity	ASHRAE 90-75	
Single Family Attached	8,000	Natural Gas	Electricity	ASHRAE 90-75	

**Figure A.1: Variables Used in Building Modeling**

Arlington County has a mix of older and newer buildings. County information gathered from numerous departments provided data on the age of buildings within the County, allowing the modeling to be further split into two categories (the age split was applied to multi-family, office, retail and hotel): prior to 1991 and after 1991.

As the graph below (Figure A.2) indicates, building codes for office, hotel, retail and multi-family buildings built prior to 1991 have a level of energy intensity that is generally higher to building codes that come after. The intent of differentiating by age was a desire to reflect the likely energy use differences between older buildings and newer buildings. The building type models prior to 1991 assumed building envelope and equipment choices based on ASHRAE 90-75 Standard, while the building type models after 1991 assumed choices based on ASHRAE 90.1-2001 Standard. Both standards were assumed to be representative of the buildings in each age group category.



**Figure A.2: Non-Residential Energy Code Comparison<sup>2</sup>**

<sup>2</sup> Owens Corning Science and Technology, LLC

## County-wide Modeling

The results of building type models were combined with estimates of building square footages to extend modeling to the County level. These square foot areas were either provided directly by the County or by estimating square feet from unit counts and an average unit size (see Figure A.3 below).

Building Type	Units	Estimated Size	Estimated Square Feet
Single Family Detached	28,021	1,814	50,830,094
Single Family Attached	10,628	1,531	16,308,212
Multi Family	60,440	845	51,071,800
Office (Includes other)			46,648,506
Retail			9,580,603
Hotel	10,318	689	7,111,355

**Figure A.3: County Building Types Data**

A split in heating fuels was assumed in the County-wide modeling. Residential fuel split generally followed the U.S. Census data on unit heating fuel, while an assumption was made for non-residential buildings. The modeling results for all residential buildings (defined for the purposes of the Report as single-family detached, single-family attached and multi-family) were then compared to the utility data for the residential consumption of natural gas and electricity, while the same comparison was done for non-residential (defined as office, retail and hotel) consumption.

For residential, the building type models were adjusted by modifying internal load, HVAC operating and building envelope assumptions until the total County-wide modeling results for natural gas and electricity were reasonably close to actual consumption. This iterative process aligned modeling to actual consumption.

Because the non-residential County-wide modeling results were substantially different than actual natural gas and electricity consumption, correction factors were applied to the model results instead of modifying standard operating or envelope assumptions. These factors increased the County-wide modeling results to match actual natural gas and electricity consumption. The reasons for the difference were likely due to multiple factors, but most likely are linked to the 60% higher site energy intensity per square foot that Arlington County non-residential buildings have compared to the CBECS Middle Atlantic data<sup>3</sup>. While the CBECS data and the County-wide non-residential utility data were derived using different methodologies, they are similar enough to make the direct comparison for benchmarking purposes. Where data on groups of local buildings were available, they compared well with these assumptions.

<sup>3</sup> [http://www.eia.doe.gov/emeu/cbeecs/cbeecs2003/detailed\\_tables\\_2003/detailed\\_tables\\_2003.html](http://www.eia.doe.gov/emeu/cbeecs/cbeecs2003/detailed_tables_2003/detailed_tables_2003.html)

Arlington Residential Consumption and Emissions						
Sector	Area Estimate MMsf	Estimated Energy Use			GHG Emissions	
		Total MMBtu/year	Per sf kBtu/year	Per Capita MMBtu/year	Total mtyear	Per Capita mtyear
Single Family Detached	63.8	3,993,000	62	17		
Single Family Attached	14.9	773,000	52	4		
Multi-Family	31.1	1,023,000	33	10		
Residential Total (site)	113.2	5,789,000	52	30		
Non-Residential (Total)						
Office/Other			101	59		
Hotel/Stores			66	37		
Arlington Emissions Conversion		5,420,000				
Residential Total (Source)	113.2	11,930,000	101	59	627,000	3.1

Arlington Non-Residential Consumption and Emissions						
Sector	Area Estimate MMsf	Energy			GHG Emissions	
		Total MMBtu/year	Per sf kBtu/year	Per Capita MMBtu/year	Total mtyear	Per Capita mtyear
Office & Other	42.8	7,980,000	189	34		
Retail	8.6	1,480,000	171	7		
Hotel	7.1	1,420,000	201	7		
Non-Residential Total (Site)	53.3	10,880,000	159	50		
Non-Residential (Total)						
Office/Other			100	36		
Hotel/Stores			67	32		
Arlington Emissions Conversion		17,570,000				
Non-Residential Total (Source)	53.3	25,930,000	409	128	1,318,000	6.5

**Figure A.4: Residential and Non-Residential Building Indicators**

Once the modeling was aligned to actual consumption, a “bottom up” check of the building type County-wide energy estimates was conducted by comparing energy consumption from a sampling of actual buildings to the modeling results for each building type. Composite energy use per square foot derived from metered energy use of a number of actual buildings in Arlington County matched very well with building types of office, hotel and multi-family modeling estimates, providing a level of confidence that the values provided by the County-wide modeling are reasonably representative.

***Extensions beyond County Baseline***

Building modeling that has been aligned to County-wide consumption could now be used to estimate how much energy is used for heating, cooling, hot water and plug loads. Smaller geographic areas can also be estimated by linking local square foot data for each of the types of buildings identified in a defined area with the prototype building models. See Appendix B for further information on Energy Planning Areas.

The same building modeling approach was used in the future projections of energy use in both the Base Case and Future Case. See Appendix D for further information on Base Case and Future Case Assumptions.

# Appendix B

## Energy Planning Areas

Arlington County is a diverse community, with different types of neighborhoods, ranging from low-density suburban residential neighborhoods to high-rise office, residential and retail transit hubs. Because of these differences, the energy use of each neighborhood varies as do the potential solutions that will be needed as part of the CES Task Force Final Report.

To get a further breakdown of where and how energy is used within the County, twenty geographic locations were defined as Energy Planning Areas for the purposes of the CES Task Force Final Report. The number of local neighborhoods could have easily been in the hundreds, if every grouping had been considered. The Task Force members, liaisons, and Technical Working Group members assembled a list of potential Energy Planning Areas.

These areas were specifically selected to represent the wide variety of neighborhoods within the County, recognizing that not every subgroup could be included. Energy Planning Areas were chosen to cover the following:

- high density areas with mixed residential and commercial buildings around transit hubs
- high density areas with single use buildings
- medium to low density areas with residential or mixed use
- low-density areas with mostly single family homes
- Special establishments (e.g., DOD and Airport)

Energy Planning Area	Land Area (sf)	Energy Planning Area	Land Area (sf)
Crystal City	17,084,306	Trades	1,828,288
National Airport	36,766,895	Shirlington	1,921,525
Pentagon City	11,076,979	Rosslyn	13,167,064
Pentagon	7,608,725	Court House	10,475,359
Arlington Cemetery	41,319,188	Clarendon	9,134,646
Joint Base	11,456,763	Virginia Square	8,276,467
Navy Annex	1,222,019	Ballston	14,429,776
Columbia Pike	24,327,661	Buckingham	6,160,051
Nauck	11,796,727	East Falls Church	4,035,817
Fairlington	18,322,060	WPCP	2,125,922

**Figure B.1: Selected Energy Planning Areas**

Using County datasets and mapping capability, geographic boundaries were established for each Energy Planning Area. Then building type and size information was assembled for each geographic area. Energy use was then modeled for each of these 20 areas by applying the same building models used for the entire County-wide modeling utilizing the square footage of each building type identified. The same correction factors for non-residential buildings were applied.

The results of the Energy Intensity for the Energy Planning Areas are summarized in Figure B.2; Greenhouse Gas Density in Figure B.3. Darker colors represent higher energy use per geographic area. Crystal City and the Pentagon are examples of the highest energy intensity,

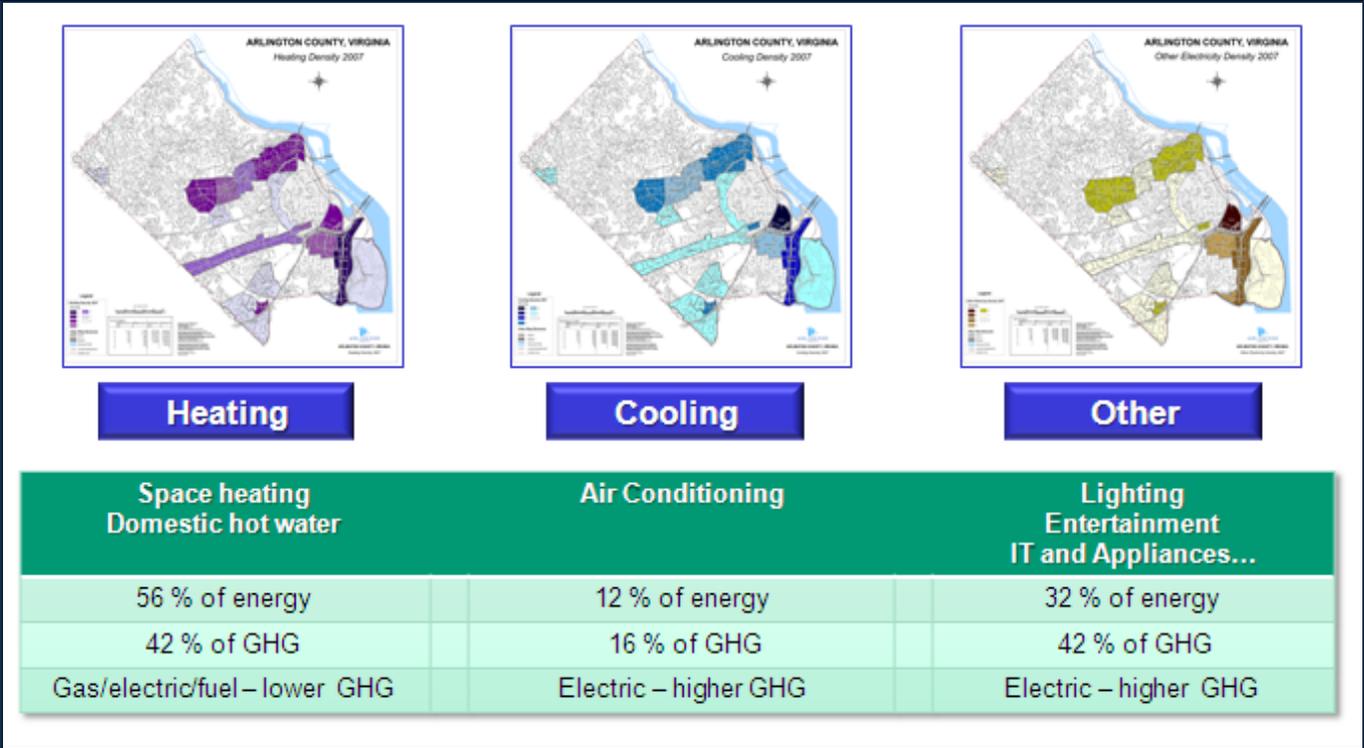
while the Rosslyn-Ballston corridor represents medium energy density. These 20 areas in total represent 67% of energy used in the County, while covering only 35% of the County's land area. This energy use represents 70% of building greenhouse gas emissions.

The remaining areas outside of the 20 Energy Planning Areas generally have low energy densities, and are mostly residential in character, with residential buildings accounting for approximately 85% of the square footage. These un-modeled areas consume only 33% of energy within the County, yet cover 65% of total area. The greenhouse gas emissions are about 30% of the buildings total.

DRAFT







**Figure B.4: End Use Energy Needs and Impacts**

The information on Energy Planning Areas indicates that certain corridors and geographies would be leading candidates for energy solutions to include district energy, because of their adjacency and energy intensity. Both district heating and district cooling can make sense in the higher density areas identified on these maps.

# Appendix C

## Community Assets

### ***General***

To help meet the CES Task Force goals, Arlington County already has many existing energy and environmental resources, including government programs, private firms and non-profit organizations, utility programs, and institutions of higher learning. As the CES Task Force Final Report progresses to implementation, these will be invaluable in meeting the County's energy and environmental goals. Limited information about these assets gathered from web sites and other material are summarized in this Appendix. While not included in this Appendix, the universities and community colleges described in the CES Report are critical community assets as well.

### **Education and Outreach**

There are numerous educational assets available to Arlington County in addition to resources highlighted in the CES Task Force Final Report. A partial listing follows below:

#### ***Public and Private Schools***

Energy concepts are already integrated into curricula, including; "Conservation" and "Sun and Earth" (Grade 1), "Energy" (Grade 3), "Electricity", "Ecosystems", and "Resources" (Grade 4), "Energy" (Grades 6 & 7), "Work, Energy & Machines" (Grade 8), and "Physics" and "Earth and Space" high school courses and Montessori programs. The Office of Career Technical and Adult Education serves the career and technical education needs of students of all ages. In addition to K-12 education, County staff could work with APS staff to help adapt certain adult education courses so that they align with the CES Report.

While APS already has numerous resources to support energy education, the following are suggestions that could enhance the current offerings:

- Students would be exposed to energy education through science, mathematics, language arts, and social studies. Arlington Public Schools could help influence Virginia course requirements to include opportunities for energy education to be taught as a multi-disciplinary approach within the Virginia K-12 educational curriculum.
- Montessori programs could use the Practical Life/Care of the Environment curriculum to teach conservation habits such that they become second nature in later life.
- The National Energy Education Development (NEED)<sup>4</sup> Project or the National Wildlife Foundation's Eco-Schools program could be used as a resource for curriculum development and efficient campus management.
- Students could use a form of Energy Performance Labels (EPLs) in conjunction with building automation and energy management systems as tools to teach energy conservation and efficiency in building operations.
- The concept of energy options could be incorporated into adult education programs, including DE, passive design, renewable technologies, and efficient building operations and management.
- Partnerships could be formed with energy-related companies to provide job shadowing and internship opportunities for students at all levels.

---

<sup>4</sup> [www.need.org](http://www.need.org)

- The Governor's Career and Technical Academy could develop and offer courses that focus on skills and abilities that focus on energy-related jobs as part of the APS Career and Technology Education program.

### ***Colleges and Universities***

Arlington has universities that are respected centers for research and technology, and many already have programs in climate research, energy and efficiency. Institutions of higher learning could play a vital role in supporting the success of the CES Report. Their roles could include the following:

- Campuses could develop Strategic Campus Energy Plans that meet the CES Task Force goals and create teaching and awareness platforms for staff, students and faculty.
- Campuses could engage in the Alliance to Save Energy's Green Campus Program or similar efforts to encourage staff, faculty and student engagement in energy and climate performance.
- Tracking systems could be used to measure energy efficiency improvement and include the public display of EPLs.
- Partnerships could be established with APS to align energy-related topics in their curricula.
- New degree programs could be developed that emphasize the cross-cutting environmental, business, technical and security aspects of energy, both serving the local CES Report needs and enhancing Arlington's position as a regional and national leader.
- Continuing education venues for trade, contractor and professional personnel, including building expertise with programs developed in cooperation with professional organizations, could be established
- Building on the global nature of the CES Report benchmarking, universities could partner with international institutions to stimulate innovation and best practice sharing, including providing educational possibilities in both directions.

### **County Government Programs**

#### ***Overarching Initiatives***

- **Arlington Initiative to Reduce Emissions (Fresh AIRE)**

<http://www.arlingtonva.us/portals/topics/Climate.aspx>

*Fresh AIRE was launched in January 2007 as Arlington County Board Chairman Paul Ferguson's signature initiative. This program knits together existing energy management, green power, and climate activities. It focuses primarily on County government emissions but with strong outreach to the residential and commercial sectors.*

*The central policy goal of the AIRE program was a commitment to reducing emissions from County government operations by 10% by 2012, from a 2000 baseline. This goal is pursued through steady investments in greater energy efficiency in County buildings, the continued purchase and use of more fuel-efficient vehicles, investments in advanced traffic signal and streetlight technology, an employee education and awareness program, and the purchase and use of alternative fuels, including biodiesel for vehicles, hybrid-electric vehicles, and purchase of renewable energy credits (RECs) representing green power from wind.*

- **County Operations**

<http://www.arlingtonva.us/Portals/Topics/AIRE/BuildingEnergy.aspx>

*Improving energy efficiency in buildings is necessarily central to meeting the goal of a 10% reduction in emissions by 2012. Improvements in many buildings have resulted in energy use reductions of 20%-50%. The County makes available case studies of these successes on the website. Continuing energy efficiency improvements in existing buildings is critical because the County has added significant new square footage to its building stock since 2000, which increases the energy demand in County facilities.*

*In addition to tracking the emissions from the County's buildings, vehicle fleet, infrastructure, and wastewater treatment operations, Fresh AIRE has also developed Building Energy Report Cards on the County's website to make County energy consumption transparent to the public.*

- **County Vehicle Fleet**

*Arlington was the first local government on the East Coast to purchase energy-efficient hybrid-electric vehicles. These vehicles are widely used by County staff for various work functions, and combine high-efficiency gasoline engines with an electric motor and rechargeable batteries to achieve high gas mileage.*

- **Business Outreach**

<http://www.arlingtonva.us/Portals/Topics/ClimateBusinesses.aspx>

*Fresh AIRE supports businesses that reduce emissions and energy demand. This includes encouraging businesses to partner with the federal ENERGY STAR program and other resources to help reduce energy use. Fresh AIRE promotes various programs and events available to businesses, including the County's Green It workshops. It also forms ongoing partnerships via its AIRE Partners program, and recognizes the environmental efforts of businesses through its AIRE Champions awards.*

*Thus far, the Fresh AIRE Business Champions distinction has been awarded 43 times to a variety of businesses and institutions for milestone accomplishments, including Energy Star-labeled buildings, LEED-certified buildings, 100% green power purchases, and outstanding commuter services to employees.*

*The recently introduced "Green Games" initiative is a good example of friendly competition between commercial office property owners that showcases successful energy efficiency and cost-saving decisions.*

- **Residential Outreach**

<http://www.arlingtonva.us/Portals/Topics/ClimateIndividual.aspx>

<http://www.arlingtonva.us/Portals/Topics/Climatecondos.aspx>

*Fresh AIRE encourages residents to reduce their energy usage and provides information and free resources to help residents adopt effective energy-saving practices. Fresh AIRE promotes various programs and events, including those in the County's Green It series, and provides a Multi-family Toolkit to help property managers and residents of multi-family buildings increase their energy efficiency and reduce their utility bills.*

## **Commuting & Transit Initiatives**

- **Commuter Services**

<http://www.commuterpage.com/>

*Arlington is nationally recognized for land use planning emphasizing public transportation, bicycling, and walking. Arlington County Commuter Services (ACCS) is a bureau of the Arlington County Department of Environmental Services. Established in 1990, ACCS serves people who live, work, or play in Arlington by providing programs and services to make it easier to get around without a car. CommuterPage.com is designed to encourage the use of mass transit, carpooling and vanpooling, bicycling, walking, teleworking, and other alternatives to driving alone.*

- **WALKArlington**

<http://www.walkarlington.com/>

*By partnering with citizens, businesses, and County departments to promote the health, environmental, commuter, financial, and community-building benefits of walking, WALKArlington strives to "get more people walking more of the time." Arlington County's urban villages comprised seven of the 20 most walkable communities in the Washington Metropolitan Area, highlighted in a December 2007 report released by the Brookings Institution.*

- **BikeArlington**

<http://www.bikearlington.com/>

*More than one hundred miles of multi-use trails, on-street bike lanes, and designated bike routes make it easy for cyclists to get where they need to go. The goal of BikeArlington is to get more Arlingtonians biking more often, whether they're commuting, shopping, or just having fun. Arlington recently launched Capital Bike Share, a bike sharing program in partnership with Washington, D.C.*

## **Green Building Programs**

- **Green Building Density Incentive Program & LEED Site Plan Conditions**

<http://www.arlingtonva.us/departments/EnvironmentalServices/epo/PDFfiles/file69951.pdf>

*The purpose of Arlington County's Green Building Density Incentive Policy for Site Plans is to encourage private developers of large office, high-rise residential, and mixed use projects to design, construct, and operate environmentally responsible buildings. The bonus density program applies to special exception site plan requests for bonus density and/or height. The program uses the US Green Building Council's LEED green building rating system as a standard for measuring the comprehensive green approach of each project.*

- **Green Home Choice Program for Residential Construction & Renovation**

<http://www.arlingtonva.us/departments/environmentalservices/epo/environmentalserviceesepogreenhomechoice.aspx>

*Arlington's Green Home Choice program is one of the few programs of its kind in the region that provides a support system and resources for builders and homeowners who want to build more efficient and healthier homes through green building techniques and the use of sustainable materials. The 2010 awards honored 14 local builders for the construction and certification of 27 green home projects during the past year.*

## **Solid Waste Programs**

- **Saving Arlington's Valuable Resources (SAVR)**

<http://www.arlingtonva.us/departments/EnvironmentalServices/swd/page65608.aspx>

*In partnership with Fresh AIRE, the SAVR Awards recognize commercial properties that have exceptional recycling programs. Local businesses, multi-family properties, institutions and property management companies that show leadership in recycling, waste reduction, and the use of recycled products are invited to submit entries for the semi-annual SAVR "Saving Arlington's Valuable Resources" Recognition Program.*

- **Adopt-a-Street**

<http://egov.arlingtonva.us/des-adopt-a-street/>

*The Adopt-A-Street program is designed to support litter control and storm water management throughout Arlington, while providing residents with an opportunity to do something positive for the community by volunteering to keep neighborhoods clean. Individuals or groups may "adopt" a specific section of road pledging to keep the street, curb, and storm drain free of trash and debris, for a commitment of 1 year with duties performed on a quarterly basis. In return, the Solid Waste Bureau provides free street cleaning supplies and sweeping debris pickup.*

- **Recycling**

<http://www.arlingtonva.us/departments/EnvironmentalServices/swd/EnvironmentalServicesSwdRecycling.asp/>

*All jurisdictions in the Commonwealth are required to recycling at least 25% of the total municipal solid waste generated annually within their borders. Additionally, jurisdictions are required to annually report on recycling activities and file a report with the Virginia Department of Environmental Quality (DEQ). In 2007, Arlington County had a recycling rate of over 40%.*

- **Waste-to-Energy**

<http://www.arlingtonva.us/Departments/EnvironmentalServices/swd/pdffiles/WTE.pdf>

*The trash collected in Arlington is delivered to the Arlington Alexandria Waste-to-Energy facility and is burned to create electricity. The facility generates up to 23 megawatts (MW) of electricity, which is sold to Dominion Virginia Power. By using this technology, methane emissions that would have been released had the trash been sent to a landfill are prevented. Methane has a high global warming potential. It is estimated that for every ton of fuel processed at this facility, approximately one ton of carbon dioxide is prevented from entering the atmosphere. Furthermore, this technology reduced the resulting weight of the trash by over 70% and the volume by over 90%.*

## **The Community Energy Project (CEP)**

[www.arlingtonva.us/energyplan](http://www.arlingtonva.us/energyplan)

*The CES Task Force Final Report itself, once completed will be a major Community Asset. The CES Task Force Final Report will establish energy goals and strategies for the entire County and will result in an energy plan for our community and offer strategies to enhance Arlington's economic competitiveness, ensure reliable and affordable energy supplies, and demonstrate the County's long-term commitment to environmental responsibility. The process for developing the CES Task Force Final Report included two important elements: community feedback and engagement with the Community Energy and Sustainability Task Force. With input from the community and the Technical*

Working Group, Task Force leaders work with the CEP's Technical Working Group to recommend short- and long-term energy goals and identify actions needed to meet these goals.

### **Chamber of Commerce**

[www.arlingtonchamber.org](http://www.arlingtonchamber.org)

The Arlington County Chamber of Commerce has successfully lured to Arlington a range of global energy firms, including SMARTGrid and AES. The Chamber also has actively participated in the development of the CES Task Force Final Report. The Chamber's role as the key voice of Arlington's business community position is a critical facilitator in the CES Task Force Final Report's implementation. Special roles of the Chamber of Commerce will be to identify, attract and retain world leading companies in the business of energy efficiency, renewable energy, and District Energy systems.

### **International Partnerships**

[www.aicgs.org/documents/pubs/polrep43.pdf](http://www.aicgs.org/documents/pubs/polrep43.pdf)

Arlington is linked to a variety of global partnerships that include cities serving as global best practices benchmarks. Via the NVRC-led METREX network, Arlington and its CES Task Force Final Report partners can conduct problem-focused and goal-oriented education exchanges on topics such as waste-to-energy, scale projects and District Energy with cities like Stuttgart, Hamburg, Copenhagen or Stockholm.

### **Non-profit/Private Programs**

### **Sustainability Organizations in Arlington**

- **Virginia Sustainable Building Network**

PO Box 6539  
Arlington, VA 22206  
<http://www.vsbn.org/>

Virginia Sustainable Building Network (VSBN) is a statewide organization that brings together representatives from diverse sectors interested in building healthy, energy-efficient, environmentally friendly buildings and sustainable communities. VSBN's mission is to promote environmentally sound — or Green Building — practices in Virginia. These building designs, methods, and materials save energy costs, reduce waste and promote recycling, reduce environmental impacts and exposure to unhealthy substances, strengthen local economies, and contribute to an enhanced quality of life.

- **Arlingtonians for a Clean Environment**

3308 S Stafford St.  
Arlington, VA 22206  
<http://www.arlingtonenvironment.org/>

Arlingtonians for a Clean Environment (ACE) was founded in 1978 by the Arlington County Department of Public Works as a member of Keep America Beautiful. During the 1980s, the ACE started to address environmental issues beyond litter and began focusing its efforts on recycling. During the 1990's, ACE is no longer affiliated with Keep America Beautiful but continues to focus on litter and works with the local business community. Today, ACE remains a volunteer organization focusing on local environmental issues including green living, litter prevention, and invasive plants

removal, with additional programs in the areas of watershed resources and schoolyard education.

- **Sierra Club – Mount Vernon Group**

<http://virginia.sierraclub.org/mvg/default.html>

*The Mount Vernon branch of the Sierra Club is the largest local Sierra Club group in Virginia, with more than 3,800 members in Alexandria and Falls Church, Arlington County, and parts of Fairfax and Prince William Counties. Since 1892, the Sierra Club has worked to protect communities, wild places, and natural resources.*

- **Potomac Overlook Park**

2845 N. Marcey Rd.  
Arlington, VA 22207

[http://www.nvrpa.org/park/potomac\\_overlook/](http://www.nvrpa.org/park/potomac_overlook/)

*On the Potomac Palisades, Potomac Overlook offers 70 acres of peaceful woodland, trails, educational gardens, a small picnic area and a Nature Center. The Nature Center features energy focused exhibits called the "Energerium", teaching visitors energy basics and ways to create sustainable energy solutions. The displays blend lessons from ecology, Earth Science, physics, chemistry and other topics in clear, understandable ways. The Nature Center also houses live animals and natural history exhibits and is the office for NVRPA's naturalist staff.*

- **The Nature Conservancy**

4245 Fairfax Drive #100  
Arlington, VA 22203-1606

[www.nature.org](http://www.nature.org)

*The Nature Conservancy is a leading conservation organization working around the world to protect ecologically important lands and waters for nature and people. With more than 1 million members spanning all 50 US states and more than 30 countries, the Nature Conservancy addresses threats to conservation involving climate change, fire, fresh water, forests, invasive species, and marine ecosystems. To meet its conservation measures, it engages with indigenous communities, businesses, governments, multilateral institutions, other non-profits, and its membership.*

- **Conservation International**

2011 Crystal Drive  
Arlington, VA 22202-3787

[www.conservation.org](http://www.conservation.org)

*Conservation International (CI) works to ensure a healthy and productive planet by working at every level – from remote villages to national leaders– to help move societies toward a more sustainable development path. Through science, policy and field work, CI applies solutions to protect our natural resources. CI helps communities, countries and societies protect tropical forests, grasslands, rivers, wetlands, lakes, and the sea by emphasizing the value that these ecosystems offer.*

- **Conservation Fund**

1655 North Fort Myer Drive  
Arlington, VA 22209-3199

[www.conservationfund.org](http://www.conservationfund.org)

*The Conservation Fund works with community, government and corporate organizations to conserve land, train leaders, and invest in conservation at home. Headquartered in Arlington, the group has field offices across the country and has*

*saved more than 6 million acres land in all 50 states. The fund focuses on the balance of environmental and economic goals, protecting "working" forests and recreation destinations that provide local revenue to helping communities grow thoughtfully.*

- **Pew Center on Global Climate Change**

2101 Wilson Blvd  
Arlington, Virginia 22201

[www.pewclimate.org](http://www.pewclimate.org)

*The Pew Center on Global Climate Change brings together business leaders, policy makers, scientists, and other experts to focus a new approach to a complex and often controversial issue. Pew's approach is based on sound science, clear communication, and a belief that people can work together to protect the climate while sustaining economic growth. The Pew Center produces widely respected analyses of key climate issues, keeps members of Congress, key Executive Branch officials as well as state and international leaders informed of the latest climate issues, engages with the business community in the search for solutions, and reaches out to educate key audiences.*

### **Private Firms in Arlington with Sustainability Focus**

- **SRA, International**

3434 Washington Boulevard  
Arlington, VA 22209

[www.sra.com](http://www.sra.com)

*With three decades of experience, SRA provides program development and implementation support, sustainability advisory services, and information technology solutions to government agencies and other organizations in support of environmental and energy missions. SRA works to advance environmental and public health programs; increase efficient and equitable use of economic and natural resources; strengthen economic and national security; and promote social equity. SRA has supported numerous EPA air quality regulatory programs, including cap-and-trade, as well as voluntary approaches, such as ENERGY STAR® and Climate Leaders.*

- **Cadmus Group**

1600 son Boulevard  
Arlington, VA 22209

[www.cadmusgroup.com](http://www.cadmusgroup.com)

*Cadmus' major service areas include Water, Energy Services, Social Marketing and Communications, Green Building, Corporate Social Responsibility and Sustainability, Strategic Environmental Management, and International Development. In the quarter century since its founding, Cadmus has grown to become a leading support contractor for EPA, in a wide variety of programs including drinking water indoor air and radiation, and energy efficiency.*

- **ClearCarbon Consulting**

2000 N. 14<sup>th</sup> St.  
Suite 730  
Arlington, VA 22201

<http://www.clearcarboninc.com/>

*ClearCarbon was founded in 2007 as the first full service carbon specialty firm in North America, bringing together top experts from government, industry, academia, information management, and professional services to create a new hub for carbon*

knowledge and action. ClearCarbon understands where business and carbon intersect and sees carbon as a lens for effective energy use, cost savings, and reduced environmental impacts. ClearCarbon has a proven record of creating accurate greenhouse gas (GHG) inventories and have helped clients adopt strategies that are relevant to their businesses – both now and in the future.

### **Private Firms in Arlington with Energy Focus**

- **National Rural Electric Cooperative Association**

4301 Wilson Blvd.  
Arlington, VA 22203  
<http://www.nreca.org/>

*The National Rural Electric Cooperative Association (NRECA) is the national service organization dedicated to representing the national interests of cooperative electric utilities and the consumers they serve. Founded in 1942, NRECA was organized specifically to overcome World War II shortages of electric construction materials, to obtain insurance coverage for newly constructed rural electric cooperatives, and to mitigate wholesale power problems. Since then, NRECA has been an advocate for consumer-owned cooperatives on energy and operational issues as well as rural community and economic development. NRECA's more than 900 member cooperatives serve 42 million people in 47 states. Most of the 864 distribution systems are consumer-owned cooperatives; some are public power districts.*

- **AES**

901 N Stuart St.  
Arlington, VA 22203  
[www.aes.com](http://www.aes.com)

*As alternatives to traditional fossil fuels become more economically competitive, more necessary and more in demand, AES is developing projects to meet growing market needs for renewable energy resources and technologies in order to provide sustainable and affordable electricity. AES Wind Generation operates more than 1,300 MW of wind capacity in the U.S., China and Europe, and AES Solar owns and operates more than 30 MW of projects in Europe. AES is also developing projects and technologies that reduce or offset greenhouse gas (GHG) emissions—primarily by capturing and destroying methane in a variety of forms before it reaches the atmosphere.*

- **ERG**

2300 Wilson Boulevard  
Arlington, VA 22201-5408  
<http://www.erg.com/>

*ERG offers multidisciplinary skills in more than 20 specialized services areas. The firm helps clients plan, research, develop, implement, promote, and assess their programs and projects. ERG serves by a broad spectrum of clients, including federal agencies, state governments, corporations, and universities. ERG's services support work in several key markets, including climate change, energy, air quality, water quality, and solid waste management. ERG also operates and maintains a fully accredited research laboratory in Research Triangle Park, North Carolina.*

- **Gridpoint**  
2801 N. Clarendon Boulevard  
Arlington, VA 22201-6828  
[www.gridpoint.com](http://www.gridpoint.com)

*An enterprise-class software platform provides a shared foundation for Gridpoint's products, creating a common point of integration, asset provisioning and real-time management. For enterprises, GridPoint provides a comprehensive energy management solution designed to optimize energy consumption. For consumers, GridPoint offers solutions for understanding, reducing, and managing energy consumption. For utilities, GridPoint delivers a suite of smart grid applications that aggregate and manage distributed sources of load, generation and storage in real-time. Gridpoint works with some of North America's leading utilities.*

- **OPOWER**  
1515 N. Courthouse Road  
Arlington, VA 22201-2909  
[www.opower.com](http://www.opower.com)

*OPOWER is an industry leader in Energy Efficiency and Smart Grid software. OPOWER has successfully converted large-scale customer engagement into a highly reliable energy efficiency program that delivers unprecedented energy savings to our utility partners. Its flagship Home Energy Reporting program triggers energy-saving actions in up to 80% of targeted households, delivering unprecedented results. OPOWER utilizes a patent-pending, customer-engagement approach that leverages cutting-edge behavioral science, customer data analytics and the latest software to engage millions of utilities customers.*

### Utility Programs

- **Pepco Energy Services**  
1300 N. 17<sup>th</sup> St.  
Suite 600  
Arlington, VA 22209  
<http://www.pepcoenergy.com/default.aspx>

*Since 1995, Pepco Energy Services (PES) has successfully evolved to become one of the leading providers of energy-saving and sustainable energy products and services for a wide range of energy users, including large commercial, institutional, industrial, and government users. PES currently provides services from North Carolina to Massachusetts and from New York to Tennessee and Illinois. PES provides both energy suppliers and large energy users such as utilities, municipalities, cooperatives and aggregators with an array of energy management services including the management of power generation assets. Its mission is to help energy and facility managers maximize energy resources by providing a complete suite of cost-effective integrated energy solutions to achieve significant overall cost savings.*

- **Washington Gas Energy Services, Inc. (WGES) – Various Projects & Programs**  
<http://www.wges.com/index.php>

*WGES is one of the largest and most experienced natural gas and electricity suppliers in the Mid-Atlantic region with approximately 289,800 customers in Maryland, Virginia, Delaware, DC and Pennsylvania. Washington Gas Energy Services, Inc. (WGES) is a subsidiary of WGL Holdings, and is an affiliate of the natural gas utility, Washington Gas. WGES has worked to engage customers and government entities in a variety of*

cost- and energy-saving initiatives. Currently, WGES is helping commercial customers and state governments reduce energy costs and increase their environmental practices by utilizing a competitive electricity supply. As of today, 10,000 residential customers have enrolled in the CleanSteps<sup>SM</sup> WindPower Program.

- **Washington Gas Energy Systems, Inc. (WGESystems) – Various Projects & Programs**

*Washington Gas Energy Systems, Inc. (WGESystems) is a utility-owned energy management and service company. WGESystems provides clean, efficient, and cost-effective energy solutions for its customers. Since 1983, WGESystems has provided over 1,200 successful design/build energy efficiency, renewable and alternative energy facility improvement projects to institutional, commercial and federal government customers throughout the Mid-Atlantic region. Successful combined heating, cooling and power programs and numerous other renewable/energy infrastructure modernization projects have been the product of sound engineering, project planning and management, and skilled local subcontractors. WGESystems works with energy and facility managers in identifying, managing and rewarding the best in local trade disciplines, including minority companies, and considers this approach a key to building successful teams.*

- **Dominion Virginia Power's (DVP) Green Power and SCC-approved Rebate Programs**

<http://www.dom.com/civism/index.jsp>

*Dominion's Green Power is a voluntary program that gives homes, businesses, local governments, and state and federal accounts a practical and economical way to support renewable energy and harness the benefits. For a small monthly fee, customers can help add renewable energy sources to the power supply pool, support renewable energy education and outreach programs, and create verifiable and certified environmental benefits. DVP provides five energy efficiency and peak-shaving programs designed to meet the needs of customers and move toward meeting the Virginia's 10 percent voluntary energy conservation goal enacted by the Virginia General Assembly and the governor. Home programs include a Lighting Program, Smart Cooling Rewards, and Home Energy Improvements. Business programs include HVAC and Lighting Rewards, both offering rebates.*

- **Dominion Virginia Power's (DVP) Energy Efficiency Programs**

<http://www.dom.com/dominion-virginia-power/customer-service/energy-conservation/ec-programs.jsp>

*Dominion Virginia Power's energy efficiency programs rolled out on May 1, 2010. Over the next three years, Dominion will spend \$15.4 million on the two commercial programs – lighting retrofits and HVAC – so members are encouraged to take advantage of these funds. These programs will expire on March 31, 2013.*

## Other Agencies, Groups and Associations

- **National Science Foundation**

4201 Wilson Boulevard  
Arlington, Virginia 22230  
<http://www.nsf.gov/>

*The National Science Foundation (NSF) is an independent federal agency created by Congress in 1950 "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense..." With an annual budget of about \$6.9 billion (FY 2010), NSF funds approximately 20 percent of all federally supported basic research conducted by America's colleges and universities in many fields such as mathematics, computer science and the social sciences,*

- **Defense Advanced Research Projects Agency (DARPA)**

3701 N Fairfax Dr.  
Arlington, VA 22201  
<http://www.darpa.mil/index.html>

*DARPA is the research and development office for the U.S. Department of Defense. DARPA's mission is to maintain technological superiority of the U.S. military and prevent technological surprise from harming our national security. DARPA was established as a DoD agency in 1958 as America's response to the Soviet Union's launching of Sputnik. In the years since, DARPA's freedom to act quickly and decisively with high quality people has paid handsome dividends for DoD in terms of revolutionary military capabilities.*

- **Northern Virginia Regional Park Authority – Potomac Overlook Nature Center**

[www.nvrpa.org/park/potomac\\_overlook](http://www.nvrpa.org/park/potomac_overlook)

*Northern Virginia Regional Park Authority – Potomac Overlook Nature Center offers several energy education opportunities. The park buildings and operations are working examples of efficient and conservative energy use. This is demonstrated in an energy efficiency renovation that resulted in 20-25% reduction in energy consumption. A solar photovoltaic system provides 10-15% of electricity needs for the Center.*

- **Senior Corps**

[www.seniorcorps.gov/](http://www.seniorcorps.gov/)

*Senior Corps connects people over 55 with organizations needing volunteers. They have a major interest in supporting enhanced energy efficiency in the home, through weatherization, energy audits, or through connecting residents to qualified resources.*

- **Arlington County Public Library**

<http://library.arlingtonva.us/departments/libraries/librariesmain.aspx>

*The County Library has been characterized as the "heart of the community". It is a resource to all demographics and cultures, and works with Potomac Overlook to provide energy education on solar power, efficiency, transportation, and more. These are efforts that can be adapted to support the CES Task Force Final Report priorities and goals.*

- **Arlington Learning in Retirement Institute**

<http://www.arlingtonlri.org/>

*ALRI's non-degree college-level courses include studies in Science and Engineering, and will be extended to include CES Task Force Final Report efforts.*

- **Arlington's Civic Associations**

*Civic Associations in Arlington are excellent assets for mobilizing residents and providing outreach related to the CES Task Force Final Report. The Neighborhood College Program and Neighborhood Conservation Program engage the local community, and provide education on County services and programs. This could be especially useful in the context of the CES Task Force Final Report's call to develop and implement Neighborhood Energy Master Plans.*

### **Trade Associations**

Trade associations are valuable resources to assist with outreach and education of the CES Task Force Final Report. A sample list includes:

- **Virginia Contractors Institute**

<http://www.virginiaexamtraining.com/>

*Virginia Contractors Institute provides both contractor and tradesmen continuing education training on topics like HVAC, electrical, plumbing, and gas fitting.*

- **Mid-Atlantic Clean Energy Application Center**

*Sponsored by DOE, the center offers regional application assistance and training to states like Virginia for the use of combined heat and power. Practical application of District Energy could be local training done in cooperation with the Center.*

- **National Capital Chapter of the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE)**

*ASHRAE offers training opportunities to design professionals on energy efficient building design and operation, application of CHP, and LowEx Systems. Tailored continuing education opportunities could be led by or partnered with the local ASHRAE chapter.*

- **Association of Energy Engineers – National Capital Chapter**

*AEE offers training opportunities for energy professionals on auditing facility energy use, lighting efficiency, distributed generation and onsite CHP and sustainable development & carbon reduction. Efficient facility operation training consistent with the CES Task Force Final Report could be managed by or coordinated with the local AEE chapter.*

# Appendix D

## Base Case & Future Case Assumption

Providing a prediction of energy use and greenhouse gas emissions over the next 40 years necessitates that a series of assumptions be established. Two cases are needed: the Base Case, where the current state is projected out until 2050, and the Future Case, where the impacts of energy strategies are assessed.

### ***Base Case for the CES Task Force Final Report***

Modeling was done for every year to the year 2050. The modeling for the Base Case started in 2007 with the County Inventory data (referred to as the Baseline in the CES Task Force Final Report). The assumption for existing buildings is that they have consistent energy usage through time. The building modeling used for Energy Planning Areas and County-wide alignment was used to estimate energy use by building type.

Over the next 40 years, a demolition rate by building type was derived from County historic data, and applied as a constant annual percentage reduction in square footage for each building type. It was assumed that new construction replaces demolished buildings, square foot for square foot.

New construction (including both demolition replacement and new) was assumed to fully meet the current energy code in place in 2010. Projections of future construction are based on the County projections for each building type, plus the same assumptions of unit size used in the baseline modeling.

For the purposes of new construction building modeling, ASHRAE 90.1-2001 based models were used for office, retail, hotel and multi-family. However, adjustments used for the Energy Planning Areas and County-wide alignment of the 2007 baseline were not applied to new construction. This has the effect of making new construction considerably better in energy performance than existing buildings. New single-family attached and detached housing utilized the building modeling used previously for Energy Planning Areas and County-wide alignment, but had a 0.85 factor applied to model the small number of newly constructed units as more efficient than existing.

The energy supply infrastructure in place today is assumed to continue. The existing natural gas and electricity networks will remain in place. The choice of heating and cooling fuel will remain the same. The choice of equipment used for heating and cooling (that is individual furnaces, boilers, chillers and air conditioners) will also remain the same. The Base Case analysis using these assumptions has no district energy or alternative clean and renewable energy supplies.

For transportation, the Base Case firstly holds the 2007 transportation energy use and emissions for each resident constant to 2050. Underlying this is a further set of conditions, including that vehicle material mix and weight and drive train technologies remain constant. Also this assumes that the current choice in transportation type (Metro, bike, car, etc.) and selection of the type of vehicle holds the same. Land-use planning and transit oriented design mix is held constant as it is in place today. This first assumption for constant energy and emissions per capita, would, by itself, drive total transportation emissions up over 20% by 2050 because of rising population. However, there is another component to transportation. The

second assumption is that jobs will increase at a faster rate than the population, increasing the non-resident transportation related energy and emissions. The net result is that the population and jobs increase, which is an approximate 40% Base Case increase in total emissions. The increase in jobs relative to the increase in population is a transportation “headwind” that will make reductions within the County more challenging.

### ***Future Case for the CES Task Force Final Report***

The Future Case also starts in 2007 with the County Inventory (Baseline), with modeling done for every year to the year 2050.

As in the Base Case, over the next 40 years a demolition rate by building type derived from County historic data was applied as a constant annual percentage reduction in square footage for each building type. It was assumed that new construction replaces demolished buildings, square foot for square foot.

As defined in CES Task Force Final Report Chapter 8 Conclusion, all new residential and non-residential buildings are assumed to fully meet the current energy code through 2014, and be 30% better than the energy code beginning in 2015. This would be roughly equivalent to the level outlined in the recent IECC recommendations<sup>5</sup>. From 2025 through 2050 new construction incrementally improves 1% per year beyond the 30% level. For the purposes of building the modeling, the ASHRAE 90.1-2001 based models were used for office, retail, hotel and multi-family buildings with no increase factors applied up to 2015 where reduction multipliers described above were applied. New single family attached and detached followed a similar approach.

Beginning in 2015, existing residential units are projected to be renovated at a rate of 2.7%<sup>6</sup>, and operate at least 30% more efficiently than today’s building average. The same assumption is made for existing non-residential buildings at a performance improvement of 50% better than the building average. Over the planning period, all existing buildings are assumed to be renovated at this rate.

Beginning in 2015, District Energy networks will begin to be utilized in high density neighborhoods. District heating and domestic hot water are provided by a hot water network. The fuel assumed used for providing District Energy is 90 percent natural gas, and 10 percent fuel oil.

Combined heat and power units (CHP) will be sited within the District Energy areas and are assumed to be in place by 2030. The CHP units are assumed to be fueled by natural gas, with a nominal combined efficiency of 85%. The assumed CHP co-generation electrical capacity is 146 MW. Peak heating needs are provided by gas and oil fired boilers. In selected areas, district cooling is assumed, with some cooling provided by the district heating network. District cooling is mostly supplied by a shared mix of absorption and compressor chillers.

By 2015, 2% of existing multi-family and non-residential buildings are assumed to be District Energy ready. From 2016 through 2034, the number of DE ready existing multi-family and non-residential buildings rises linearly to 65 percent. The number of DE ready buildings remains constant out to 2050. By 2015, 5% of new multi-family and non-residential buildings are DE ready. From 2016 to 2019, the number of DE ready new multi-family and non-residential

---

<sup>5</sup> [http://www.energycodes.gov/status/2012\\_Final.stm](http://www.energycodes.gov/status/2012_Final.stm)

<sup>6</sup> Assumption based on Owens Corning national averages for renovations

buildings rises linearly to 75 percent. The number of DE ready buildings remains constant out to 2050.

Low-density neighborhoods are assumed to remain on today's existing natural gas and electricity networks. Lower density neighborhoods are also assumed to have some of their heating and domestic hot water supplied by solar thermal, low-temperature geo-thermal and small scale biomass sources.

Throughout the County, a large scale deployment of Solar PV is assumed, ultimately reaching a nominal capacity of 160 MW by the year 2050.

Numerous assumptions work together in the transportation sector. Vehicle material evolution will reduce the weight of vehicles, which along with drive train technologies are anticipated to increase the efficiency of individual vehicles by 15% by 2030, and then assumed to remain constant after that. In addition, changing consumer trends are predicted to evolve, changing the types of vehicles purchased, causing migration to smaller and lighter vehicles, resulting in a further 15% fuel efficiency by 2050. Another factor is the anticipated move toward using fuels that have lower carbon content than that of fuels used today. Land-use planning and a transit oriented design mix will further drive choice to alternative transport that is in place today, including more cycling and walking. Some shift to electric vehicles is also assumed.

Figure D.1 summarizes in tabular form the specific assumptions described above that were used to develop the energy and greenhouse gas evolutions from 2007 to 2050.

**Figure D.1: Table of Base & Future Case Modeling Assumptions**

Assumptions	Base Case	Future Case
<b>Baseline</b>	Inventory 2007	Inventory 2007
<b>Existing Buildings - All</b>	Subtract year on year demolition estimates  Add year on year new construction estimates	Subtract year on year demolition estimates  Add year on year new construction estimates
<b>Existing Residential</b>	Existing buildings neither improve nor deteriorate	All Buildings have been renovated at a rate of 2.7% per year by 2050  2007 to 2014: Same as average of prior years 2015 to 2025: Exceeds current practice (52 kBtu/sf) by 30% (36 kBtu/sf) <sup>7</sup> 2025 to 2050: 30 % & becomes 1% more efficient per year
<b>Existing Non-Residential</b>	Existing buildings neither improve nor deteriorate	All Buildings have been renovated at a rate of 2.7% per year by 2050  2007 to 2014: Same as average of prior years 2015 to 2015: Exceeds current practice (159 kBtu/sf) by 50% (80 kBtu/sf) <sup>8</sup> 2016 to 2020: Improves linearly to be 70% by 2020 2020 to 2050: Remains 70% more efficient than 2007
<b>New Residential</b>	All new construction meets and performs to current code	2007 to 2014: Meets current code 2015 to 2025: Exceeds current code by 30% 2025 to 2050: 30% & becomes 1% more efficient every year
<b>New Non-Residential</b>	All new construction meets and performs to current code	2007 to 2014: Meets current code 2015 to 2025: Exceeds current code by 30% 2025 to 2050: 30% and becomes 1% more efficient every year

<sup>7</sup> Target of 36 kBtu/sf is a County-wide target for renovated existing buildings collectively, not an individual building goal.

<sup>8</sup> Target of 80 kBtu/sf is a County-wide target for renovated buildings collectively, not an individual building goal.

<b>Energy Supply - Networks</b>	Electricity and gas supplied via existing networks	High-density Energy Planning Areas migrate to District Energy (DE) District Heating and Domestic hot water via HW network District Cooling via DC network District Cooling via DH network (minor) Low-density Energy Planning Areas remain on gas and electricity networks
<b>Energy Supply - Fuel Mix</b>	Heating and cooling gas/oil/electricity mix unchanged	DE Energy with 90% gas, 10% Fuel oil Non DE Heating & cooling gas/oil/electricity mix unchanged 146 MW in co-generation 160 MW PV by 2025 in a mix of rooftop, wall cladding, ground mounted and small individual installations
<b>Energy Supply - Equipment</b>	Heating and cooling supplied by individual building boilers, furnaces and chillers	<i>District Energy</i> CHP gas engines/turbines: nominal fuel efficiencies of 85% District cooling mostly supplied by shared mix of absorption & compressor chillers Peak heating needs from gas and oil fired boilers <i>Non-District Energy</i> Small scale renewable solutions for stand-alone buildings supplying domestic hot water and heating Most cooling assumed conventional, some geothermal
<b>Rate of DE - Existing Buildings</b>	none	<i>Single family houses:</i> No DE Connections <i>MFH and non-residential:</i> 2015: 2% of existing buildings will be DE-Ready 2016 to 2034: DE-Ready rises linearly to 65% of total 2034 to 2050: 65 % of existing buildings are DE-Ready
<b>Rate of DE - New Construction</b>	none	<i>Single family houses:</i> No DE connections <i>MFH and non-residential:</i> 2015: 5% of new construction will be DE-Ready 2016 to 2019: DE-Ready rises linearly to 75% of total 2020 to 2050: 75% of new buildings are DE-Ready

<p><b>Transportation</b></p>	<p>2007 energy use per resident capita and emissions per capita constant. Transportation from non-residents increases in proportion to jobs increase</p>	<p>Vehicle material evolution and drive train technologies improve efficiency by 15% by 2030.  Migration to smaller vehicles improve efficiency by 15% by 2050.  Carbon content of fuel decreases.  Vehicle Miles Traveled (VMT) decreases.  Land-use planning and transit oriented design mix drive choice to alternative transport than in place today.  A shift to some electric vehicle usage.</p>
------------------------------	--	--

DRAFT

# Appendix E

## Examples of Energy Reductions in Buildings

Reducing energy use in existing buildings has the potential for short- and long-term benefits for owners, tenants, and the community at large. Examples of buildings that have made substantial reductions through operational changes, renovation, or a combination of both are described below.

Most of these examples only report energy usage at the site (i.e., metered energy usage delivered at the property line). One example below provides source energy usage, which includes site usage and accounts for the inefficiencies related to production and transmission of electricity. Examples show energy use reductions ranging from 23 to 56 percent. As a reminder, the CES Task Force Final Report calls for an average 50% reduction starting in 2015 for non-residential buildings being renovated, based on the current Arlington average of 159 kBtu/sf, which itself is 60% higher than the current Mid-Atlantic average.

### **Harris Bank Complex**

Reduction primarily through operations

Location: Chicago, IL

Building size: approximately 1.2 million square feet

Energy Intensity:

Site Usage

263 kBtu/sf before

117 kBtu/sf after

56% Reduction

The Harris Bank Complex includes several buildings of mixed ages, and is situated in the heart of Chicago's financial core at the intersection of LaSalle and Monroe streets. Hines acquired the site in 2005 on behalf of National Office Partners Limited Partnership (NOP), its investment partnership with the California Public Employees' Retirement System (CalPERS). Hines is the Owner and Property Manager.



Since acquisition, Hines has seen a 56% reduction in energy use through demand management and systems optimization. Operating schedules were put in place to meet tenant needs, while minimizing off-hour run time. Monitoring of actual equipment operation times was established. Existing equipment set-points, outputs and programming were optimized to deliver needed performance to the schedules. Reductions began to be observed within the first month of implementation. Website: <http://www.hines.com/property/detail.aspx?id=1752>



### **Madison Community Center**

Reduction primarily through equipment renovation

Location: Arlington, VA

Building size: 35,000 square feet

Energy Intensity:

Site Usage

103 kBtu/sf before

50 kBtu/sf after

52% Reduction

Madison Community Center was built in the 1950s as an elementary school and has served as a multi-purpose community and senior recreation center for the past two decades, welcoming audiences ranging from preschoolers to seniors. This building hosts 20 staff and hundreds of visitors weekly in its recreation and fitness classes.

The County upgraded lighting in this building over the past five years, beginning with replacement of old magnetic ballasted T12 light fixtures in classrooms, and most recently with a conversion from high-output compact fluorescent lighting to induction lighting in a gymnasium. The greatest energy savings is expected from a new boiler installation completed in September 2009. The County replaced two cast-iron boilers with five modular condensing boilers. A domestic water heater and storage tank were also replaced by an indirect storage tank heated off a boiler. There was minimal renovation of the building envelope.

Website:

[http://www.arlingtonva.us/departments/ParksRecreation/scripts/comm\\_center/ParksRecreationScriptsComm\\_centerMadison.aspx](http://www.arlingtonva.us/departments/ParksRecreation/scripts/comm_center/ParksRecreationScriptsComm_centerMadison.aspx)



### **Empire State Building**

Reduction primarily through renovation

Location: New York City

Building size: approximately 2 million square feet

Energy Intensity:

#### Site Usage

88 kBtu/sf before renovation

55 kBtu/sf projected after renovation

38% Reduction

The owners of the Empire State Building wanted to reduce greenhouse gas emissions, demonstrate how to retrofit large commercial buildings cost effectively, and demonstrate that such retrofits make good business sense. A series of building retrofit measures and tenant engagement tactics were evaluated and eight specific measures were selected and estimated to yield a 38% reduction in energy use. The incremental costs above the original capital budget for eight measures were estimated at \$13.2 million, with an estimated electricity and steam savings of \$4.4 million per year.

Three different stakeholders will implement the eight savings measures over a 5-year period using various implementation mechanisms.

The 6,500 existing window units will be remanufactured on site to include suspended coated film and gas fill. More than 6,000 insulated reflective barriers will be installed behind perimeter steam radiator units. Tenant daylighting controls and plug load sensors will be installed. The chiller plant retrofit will include upgrades to controls, drives and bypasses. Variable air volume units will replace constant volume units. Existing control systems will be upgraded to direct digital controls. Ventilation will be controlled by CO<sub>2</sub> sensors. Tenants will be provided with online energy and benchmarking information.

Partners: Jones, Lang, LaSalle; Clinton Foundation; Rocky Mountain Institute; Johnson Controls

Website: <http://esbsustainability.com/SocMe/?Id=0>

## **Cherrydale Library**

Reduction primarily by renovation

Location: Arlington, VA

Building size: 5,600 square feet

Energy Intensity:

### Site Usage

116 kBtu/sf before

43 kBtu/sf after

37% Reduction



The current Cherrydale Branch Library was built in 1961, and houses over 30,000 items. Recent renovation in the building yielded an overall 37% energy reduction, providing a utility cost savings of \$4,000 per year. Renovations to the building included lighting retrofits and the replacement of three heat pumps. There was minimal renovation of the building envelope.

Website: <http://cherrydalelibraryarlingtonva.blogspot.com/>

DRAFT

## Houston Government Buildings



Reduction primarily through renovation

Location: Houston, TX

Project Building size: 38,000 square feet

Energy Intensity:

Site Usage

173 kBtu/sf before renovation

111 kBtu/sf after renovation

36% Reduction

The Houston city government planned to upgrade facilities over a several years. The city government worked with the Clinton Foundation and two ESCO companies to address needed improvements. For two buildings, four measures were selected that reduced electricity by 44% and natural gas by nearly 20%. The overall energy reduction was 36%, with a simple payback of 13 years.

Improvements included replacement of packaged rooftop units and split systems; upgrading lighting from T12 bulbs to T8 lighting systems with occupancy sensors; installing building automation systems; and adding a solar thermal collector for pool heating. There was minimal renovation of the building envelope.

Partners: City of Houston; Clinton Foundation; Siemens

Website: <http://www.naesco.org/news/press/pressrelease.aspx?PressReleaseID=161>

## **Arlington Central Library**

Reduction primarily through renovation

Location: Arlington, VA

Building size: 177,000 square feet

Energy Intensity:

### Site Usage

90 kBtu/sf before renovation

60 kBtu/sf after renovation

33% Reduction



Arlington County Central Library, originally built in 1961 and expanded in 1994, is a multi-storied 177,100 square foot building (including garage) open for over 80 hours per week. Central Library is the primary resource for the County library system, and one of the largest public library collections in metropolitan Washington, D.C area. In addition to heating, cooling, ventilation (HVAC), lighting, and water heating equipment associated with any commercial building, the Library also hosts a robust public access computer center.

The County's energy management office adjusted the building's automation system and upgraded lighting in 2001; additional lighting retrofits were completed recently. All fluorescent fixtures were retrofitted from T12 lamps with magnetic ballasts to T8 lamps with electronic ballasts. High-wattage indirect pendant fixtures were replaced with T8 fluorescent pendant fixtures. All incandescent lamps were replaced with either compact fluorescent or LED lights. Auditorium lighting was replaced with dimmable LED downlights. Electricity use has been reduced by 41%, while overall energy has been reduced by 33%.

The building's HVAC controls will continue to be fine-tuned in the months ahead, and the County is investigating the replacement of several electric tank water heaters with instant-hot fixtures at various sinks.

Website: <http://centrallibraryarlingtonva.blogspot.com/>



### **Lee College Campus**

Reduction primarily through renovation

<http://www.thehighschoolgraduate.com/cgi-bin/redirect?url=http://www.lee.edu/BeARebel>

Location: Houston, TX

35 Building size: approximately 600,000 square feet

Energy Intensity:

Site Usage

146 kBtu/sf before renovation

96 kBtu/sf after renovation

33% Reduction

Lee College is a Community College located in Baytown, TX with an enrollment of over 13,000 students. The College initially planned to improve its facilities through a multi-year infrastructure upgrade program. Working with the Clinton Foundation and Johnson Controls, Lee College identified nine areas of improvement that reduced electricity by 45% and overall energy use by 33%. The project implemented water conservation measures as well as energy improvements with 16 year simple payback.

The ESCO contract addressed upgrading direct digital controls in all buildings; retrofitting over 7,000 light fixtures and installing occupancy sensors; upgrading existing chiller pumps and drives; replacing nine rooftop air handling units; installing 20,000 square feet of solar window film; installing computer power management software in 2,300 computers; upgrading boilers and steam system; installing power factor correction capacitors; and installing 37 new vending machines.

Partners: Lee College; Clinton Foundation; Johnson Controls

Website: <http://www2.presidentsclimatecommitment.org/documents/EEBRPLee.pdf>



**Glenborough, LLC**

Reduction primarily through renovation

Location: Arlington, VA

Project Building size: 317,000 square feet

Energy Intensity:

Source Usage

297 kBtu/sf before renovation

214 kBtu/sf after renovation

28% Reduction

Site Usage

89 kBtu/sf before

64 kBtu/sf after

28% Reduction

Constructed in 1987, the 1525 Wilson Boulevard Building is a 12-story Class-A commercial office building located in Arlington, Virginia. This 23-year-old building consists of 316,959 square feet of multi-tenant office space in the downtown Rosslyn neighborhood and is managed by Glenborough, LLC.

As part of the EPA ENERGY STAR's National Building Competition in 2010, Glenborough's energy team converted all of the building's pneumatic variable air volume boxes to direct digital control, upgraded the energy management system, and is in the process of upgrading all the compressors and controls for floor supply fans. The net result was an overall 28% reduction.

For the future, building managers plan to elevate tenant participation into a formal "energy reduction" tenant program. The program provides frequent tips on saving energy as part of routine tenant outreach. Additionally, the building will incorporate a next-generation technology for building optimization.

Website: <http://www.glenborough.com/properties/washingtondc/1525wilson.html>

## Owens Corning World Headquarters

Reduction primarily through operations

Location: Toledo, Ohio

Building size: 400,000 square feet

Energy Intensity:

### Site Usage

101 kBtu/sf before

78 kBtu/sf today

23% Reduction



Owens Corning opened its World Headquarters building in late 1996. As a new building it exceeded the Ohio building code efficiencies at the time. Over the past 14 years, energy usage has been reduced by 23%, primarily through operational and scheduling changes. Business operations and occupant comfort have been maintained without interruption. Very modest investment has been made in items like incandescent light replacement with CFLs, the addition of refrigerator unit curtains and small modifications to equipment.

Hines is the site Development and Facilities Manager. HVAC improvements included enhanced warm-up control strategies, temperature setbacks and set point changes, and exhaust fan operational changes. Lighting enhancements included reduced timing for unoccupied use, and reduced parking lot and Atrium lighting. Signage was installed in conference rooms to encourage shutting off lights. Plastic curtains were installed on food display coolers.

Partners: Owens Corning; Hines

Website: <http://www.hines.com/property/detail.aspx?id=252>

# Appendix F

## Enabling Strategies Supplemental Information

This section contains additional Enabling Strategies information on Energy Performance Labels and Energy Efficiency and Renewable Energy Financial Incentives.

### ***Energy Performance Labels – EPLs***

EPL are recommended to raise the awareness and transparency of the actual energy performance of residential and non-residential buildings. These have been implemented in various ways around the world. The following notes give further background.

#### EPLs in the European Union

The EU Directive on Energy Performance of Buildings (EPBD) entered into force on January 2003, and is unique in that it created a harmonized calculation methodology and minimum standards for energy performance of both new buildings and existing buildings undergoing renovation across the European Union. It also is globally recognized as the first law to require sellers and leasers of new or existing residential and non-residential buildings to provide “Energy Performance Labels”. In all Member countries, all buildings, new or existing, must regularly update their total energy consumption and greenhouse gas performance and make this available via a simply understood performance label at the time of sale or lease. In addition, buildings greater than 1,000 square meters (10,000 square feet) regularly used by the public, must display a current label in clear view. The Directive requires the inclusion of heating, cooling, heat recovery, and lighting. Inspections of heating and cooling systems older than fifteen years also were mandated in the Directive. The label must also list information about energy ratings and efficiencies that could be readily achieved along with the estimated costs.

#### EPLs in Germany

In 2002, the German government implemented the EU building energy performance label directives through laws requiring the development and display of energy performance measures via building certificates for new residential and commercial buildings, and minimum standards for building retrofits. The method is a holistic assessment of the building’s thermal shell, lighting installation, and appliances for heating, ventilation cooling, and hot water. There are two forms of energy certificates:

- The consumption certificate lists consumption of energy during the last three years and basic facts of the building and requires no site visit/audit
- The demand certificate requires an audit for heating systems and total energy demands.

#### EPLs in the United States

While there are no national-level policies requiring building labeling at present (2010), a number of agencies are developing voluntary programs that address the basic need for energy performance transparency. These are summarized here.

- **ASHRAE Building Energy Quotient**

*The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) has developed the Building Energy Quotient<sup>9</sup> as a voluntary building energy label for non-residential buildings. This has adopted an appearance similar to the EU label. The ASHRAE “As Designed” and “In Operation” Ratings are intended to provide:*

- *Information on the potential and actual energy use of buildings*
- *Feedback to building owners and operators on how their building is performing*
- *Insight into the value and potential long-term costs of a building*
- *Differentiation in the marketplace*

*The “As Designed”, also known as the “Asset Rating”, provides an assessment of the building based on the components specified in the design—including mechanical systems, building envelope, building orientation, and day-lighting features. The asset rating is based on the results of building energy modeling, and applies to both new and existing buildings.*

*The “In Operation” Rating provides information on the actual energy use of an existing or new (12 to 18 months of operation) building and is based on a combination of the structure of the building and how it is operated.*

- **US EPA Energy Star Building Labeling**

The Environmental Protection Agency (EPA) promotes ENERGY STAR labeling under its *Buildings and Plants*<sup>10</sup> program, which provides voluntary listings for many building types, including office, data centers, banks, hospitals, retail, schools, dormitories and industrial facilities. The building is rated against similar buildings and must be in the top 25% to be accepted in the program. The Statement of Energy Performance provides site and source energy intensity as well as emissions of the property, although the ENERGY STAR website listing only provides a number rating. There have been 44 office buildings, one grocery store and one hotel listed under the program in Arlington since 2000. Thirty-five buildings have either 2009 or 2010 labels representing nearly 11 million square feet of floor area that have already been participating in a voluntary labeling program.

- **US DOE – Builder’s Challenge Labeling**

The Department of Energy (DOE) is also promoting a voluntary energy label for new residential buildings under the *Builder’s Challenge*<sup>11</sup> program. Under this program, a home design is compared to the local energy code set at 100 and “Zero Energy” set at 0, with a rating number for the individual home displayed on the scale.

#### EPLs in Close Proximity to Arlington

The District of Columbia requires public disclosure of building energy use, put in place under The Clean and Affordable Energy Act of 2008, with requirements on public and private buildings phased in over time. DC will require all eligible buildings to benchmark energy use every year, and display the energy rating through an online database.

---

<sup>9</sup> <http://buildingeq.com/>

<sup>10</sup> [http://www.energystar.gov/index.cfm?c=business.bus\\_index](http://www.energystar.gov/index.cfm?c=business.bus_index)

<sup>11</sup> <http://www1.eere.energy.gov/buildings/challenge/requirements.html>

In Virginia, enabling legislation for mandatory Energy Performance Labeling requirements is conceivable but unlikely at the time of writing the CES Task Force Final Report. For this reason, the CES Task Force Final Report is recommending a voluntary program.

### ***Energy Efficiency and Renewable Energy Financial Incentives***

At the time of preparing the CES Task Force Final Report (2010), several rebate, grant, tax and financial options are available for use in Arlington County for energy efficient building improvements, clean and renewable energy and efficient transportation. The summary that follows represents a snapshot in time, and will need to be regularly updated.

#### US Federal

Consumers and businesses can receive information they need to make use of the federal income tax benefits for energy efficient products, vehicles and technologies from the sources below. The heating and cooling equipment tax incentive, building envelope tax incentive, and biomass stoves credit are all set to expire in December 2010. For up-to-date information contact the Virginia Department of Mines, Minerals, and Energy or visit the Tax Incentives Assistance Project website at [www.energytaxincentives.org](http://www.energytaxincentives.org).

- **Fuel Cell Motor Vehicle Tax Credit**

A tax credit of up to \$8,000 is available for the purchase of qualified light-duty fuel cell vehicles. After December 31, 2010, the credit is reduced to \$4,000. Tax credits are also available for medium- and heavy-duty fuel cell vehicles; credit amounts are based on vehicle weight. Vehicle manufacturers must follow the procedures as published in Notice 2008-33 (<http://www.irs.gov/pub/irs-drop/n-08-33.pdf>) in order to certify to the Internal Revenue Service that a vehicle meets certain requirements to claim the fuel cell vehicle credit. Notice 2008-33 also provides guidance to taxpayers about claiming the credit. For more information, see IRS Form 8910, which is available via the IRS Web site. This tax credit expires on December 31, 2014.

- **Qualified Plug-In Electric Drive Motor Vehicle Tax Credit**

A tax credit is available for the purchase of a new qualified plug-in electric drive motor vehicle that draws propulsion using a traction battery that has at least four kilowatt hours of capacity, uses an external source of energy to recharge the battery, has a gross vehicle weight rating of up to 14,000 pounds, and meets specified emission standards. The minimum credit amount is \$2,500, and the credit may be up to \$7,500, based on each vehicle's traction battery capacity and the gross vehicle weight rating. The credit will begin to be phased out for each manufacturer in the second quarter following the calendar quarter in which a minimum of 200,000 qualified plug-in electric drive vehicles have been sold by that manufacturer for use in the U.S. This tax credit applies to vehicles acquired after December 31, 2009. Through December 31, 2011, qualified plug-in electric vehicle conversions are also eligible for a tax credit for 10% of the conversion cost, not to exceed \$4,000. Additionally, a tax credit of up to 10% of the cost of qualified low-speed electric vehicles, electric motorcycles, and three-wheeled electric vehicles, not to exceed \$2,500, is available through December 31, 2011.

- **Advanced Energy Research Project Grants**

The Advanced Research Projects Agency - Energy (ARPA-E) was established within the U.S. Department of Energy with the mission to fund projects that will develop transformational technologies that reduce the nation's dependence on foreign energy imports; reduce U.S. energy related emissions, including greenhouse gases; improve

energy efficiency across all sectors of the economy; and ensure that the U.S. maintains its leadership in developing and deploying advanced energy technologies. The ARPA-E focuses on various concepts in multiple program areas including, but not limited to, vehicle technologies, biomass energy, and energy storage. For more information, visit the ARPA-E Web site.

- **Biodiesel Education Grants**

Competitive grants are available through the Biodiesel Fuel Education Program (Section 9006) to educate governmental and private entities that operate vehicle fleets, the public, and other interested entities about the benefits of biodiesel fuel use. Eligible applicants are nonprofit organizations or institutes of higher education that have demonstrated knowledge of biodiesel fuel production, use, or distribution, and have demonstrated the ability to conduct educational and technical support programs.

### Commonwealth of Virginia

State level incentives as of 2010 include:

- **Energy Efficient Appliance Rebate Program**

Virginia is offering rebates to single-family homeowners purchasing ENERGY STAR furnaces, heat pumps, clothes washers, gas water heaters, and refrigerators purchased and installed on or after April 28, 2010. To review requirements and reserve a rebate prior to purchase, visit the Virginia Department of Mines and Minerals (DMME) online reservation system. The DMME has partnered with Washington Gas to administer certain rebates for their customers directly. Visit <http://www.dmme.virginia.gov/arra.shtml>

- **Energy Leasing Program for State Agencies**

The Commonwealth's Energy Leasing Program is a loan program to finance energy efficiency projects in state agencies. The Commonwealth has secured \$40 million in financing for projects, which can include lighting and motor upgrades, building envelope improvements, and equipment or control enhancements. The loans are expected to be repaid by agencies from energy savings generated by the projects.

- **Green Jobs Tax Credit**

To qualify for a State income tax credit, a business must create a new job in the alternative energy/renewable energy fields, which includes the use of solar hot water/pool/space heating, landfill gas/biomass, wind, hydroelectric, geothermal direct use/heat pump, or fuel cells using renewable fuels. The Department of Commerce and Trade will issue rules regarding qualifying jobs. Visit <http://www.commerce.virginia.gov/>

- **Income Tax Deductions on Energy Efficient Products**

Virginia allows an amount equal to 20% of the sales tax paid by an individual, not to exceed \$500 in each taxable year, in purchasing for his own use the following items: ENERGY STAR clothes washers, room air conditioners, dishwashers, and standard size refrigerators; an electrochemical fuel cell, gas heat pump or electric heat pump meeting certain efficiency requirements; a central air conditioner that has a cooling seasonal energy efficiency ratio (SEER) of at least 13.5; an advanced gas or oil water heater, oil-fired boiler or oil-fired furnace meeting certain requirements; and programmable thermostats. Visit: <http://www.dmme.virginia.gov/DE/taxcredit.shtml>

- **Solar Manufacturing Incentive Grant (SMIG) Program:**

The Virginia Department of Mines, Minerals, and Energy manages the Solar Photovoltaic Manufacturing Incentive Grant Program, offering incentives to encourage the product development and manufacture of a high-technology, renewable energy source in Virginia. Any manufacturer who sells solar photovoltaic panels manufactured in Virginia is entitled to receive an annual grant of up to 75 cents per watt of the rated capacity of panels sold.

Visit: [http://www.dmme.virginia.gov/DE/Alternative\\_Fuels/solar.shtml](http://www.dmme.virginia.gov/DE/Alternative_Fuels/solar.shtml)

- **Sales Tax Holiday for Energy Star and WaterSense Qualified Products:**

During a specified period, purchases of certain Energy Star and WaterSense qualified products purchased for non-commercial use and costing \$2,500 or less will be exempt from sales tax. The exempt Energy Star items include dishwashers, clothes washers, refrigerators, air conditioners, ceiling fans, compact fluorescent light bulbs, and programmable thermostats that carry the Energy Star designation. The exempt WaterSense items include bathroom sink faucets, faucet accessories, and toilets. As an example of this kind of time limited incentive, the 2010 holiday will take place Friday, October 8 through Monday, October 11, 2010.

Visit: <http://www.tax.virginia.gov/site.cfm?alias=EnergyStarQualifiedProductsHoliday>

- **Virginia Energy Assistance Program (VEAP)**

The Virginia Department of Social Services offers the Energy Assistance Program which assists low-income households, particularly those with the lowest incomes that pay a high proportion of household income for home energy. It has four components:

- Fuel Assistance - Helps with the cost of heating
- Crisis Assistance - Helps when fuel and other assistance don't meet the need
- Cooling Assistance - Helps with cooling emergencies resulting from extreme heat
- Weatherization Assistance - Assists with energy efficiency and air infiltration

Visit: <http://www.dss.virginia.gov/>

- **High Occupancy Vehicle (HOV) Lane Exemption**

Alternative fuel vehicles (AFVs) displaying the Virginia Clean Special Fuels license plate may use Virginia HOV lanes, regardless of the number of occupants, until July 1, 2011. For HOV lanes serving the I-95/395 corridor, only registered vehicles displaying Clean Special Fuels license plates issued prior to July 1, 2006, are exempt from HOV lane requirements. Dedicated AFVs and some hybrid electric vehicles may qualify for the license plate and HOV exemption; see the [Virginia Department of Motor Vehicles Website](#) for a complete list of qualifying vehicles. The annual fee for Clean Special Fuels license plates is \$25 in addition to the prescribed fee for Commonwealth license plates.

- **Alternative Fuel Vehicle (AFV) and Fueling Infrastructure Loans**

The Virginia Board of Education may use funding from the Literary Fund to grant loans to school boards that convert school buses to operate on alternative fuels or construct alternative fueling stations.

## Arlington County

The County Administration offers some incentives specifically relevant to developing an energy efficient built environment.

- **Green Building Incentive Program**

The Arlington County Green Building Density Incentive Policy for Site Plans encourages developers of office, high-rise residential and mixed-use projects to design, construct, and operate buildings in an environmentally responsible way. Bonus density applies to special exception site plan requests for bonus density and/or height. Currently the US Green Building Council's LEED green building rating system is the standard used. The CES Task Force Final Report recommends looking into the possibility of extending this to explicitly recognize developments that meet or exceed the energy performance levels of the CES Task Force Final Report, backed by a rigorous traceable Energy Performance Labeling program included in all property deeds and lease agreements. In developments that are in areas designated for DE and where the developer accepts the DE option, consideration could possibly be given to further enhance the incentive. For background on the current (pre-CES Task Force Final Report) program visit:

<http://www.arlingtonva.us/Departments/EnvironmentalServices/epo/EnvironmentalServicesEpoIncentiveProgram.aspx>

- **PACE Clean Energy Financing**

Virginia legislation authorizes local governments to establish a Property-Assessed Clean Energy (PACE) loan ordinance to finance clean energy improvements by property owners. A property tax assessment would repay the loan amount. Arlington County would need to pass an ordinance to enable local PACE financing. At the time of this report preparation, there is a current complication in that major mortgage lenders do not recognize the primacy and continuity of the PACE financing, which has effectively stalled the program. The CES Task Force Final Report recommends looking into the idea of designing a comparable mechanism with local financing institutions, potentially backed by a municipal guarantee, which would be secured through a small risk premium on the entire portfolio.

- **Reduced Property Tax Assessment for Energy Efficient Buildings:**

Under Virginia legislation, cities and counties may assess the property tax on residential, commercial or industrial buildings at a reduced rate, if the building exceeds the Virginia Uniform Statewide Building Code by 30%. Alternatives can include qualification for the Green Globes Green Building Rating System, the Leadership in Energy and Environmental Design (LEED) System, the EarthCraft House Program or the EPA Energy Star home.

The CES Task Force Final Report recommends Arlington County conduct a review process to determine the feasibility of passing an ordinance to reduce property taxes on developments, including building renovation, that meet or exceed the energy performance levels of the CES Task Force Final Report, backed by a rigorous traceable Energy Performance Labeling program included in all property deeds and lease agreements. In developments that are in areas designated for DE and where the developer accepts the DE option, consideration should be given to further enhancing the incentive. As this is a definition of energy efficiency that is not explicitly covered in the various rating systems currently recognized, clarifying language may be needed and agreed to by state officials.

- **Solar Tax Exemption for Arlington County:**

Virginia allows any local government to exempt solar energy equipment or recycling equipment from local property taxes. Solar energy equipment is defined as equipment "designed and used primarily for the purpose of providing for the collection and use of incident solar energy for water heating, space heating or cooling or other application which would otherwise require a conventional source of energy. The CES Task Force Final Report recommends that Arlington County review the option of enabling the property tax exemption, specifically aligned with the goal to establish 160MW of Solar PV and to accelerate the deployment of Solar Thermal installations for heating and domestic hot water in neighborhoods not designated for District Energy.

#### Commercial Incentives

Various utility and other commercial based incentives exist. Some are listed below:

- **Dominion Virginia Power Energy Conservation Programs**

Dominion Virginia Power offers five energy efficiency and peak-shaving programs to their customers as a way of meeting the state's 10% voluntary energy conservation goal enacted by the Virginia General Assembly and the Governor. These programs cover discounts on residential CFL purchases, allowing Dominion to cycle on and off residential air-conditioning systems during periods of peak demand; free in-home energy evaluation for income qualifying families; rebates to businesses for HVAC replacement; and rebates to businesses for lighting replacement.

The CES Task Force Final Report recommends working with Dominion Virginia Power, an engaged member of the Task Force, on two additional areas.

1. To develop incentives to accelerate the deployment of 146 MW of gas fired CHP over and above the net-metering available today. The most likely model would be to consider either a Feed-in Tariff similar to Ontario<sup>12</sup> and/or to treat CHP electrical capacity as despatchable first-call peak-load reduction at Demand Side Management (DSM) premium prices.
2. To develop incentives to accelerate the deployment of 160 MW of solar PV over and above the net-metering available today. The most likely model would be to consider a Feed-in Tariff similar to Ontario and Sacramento.<sup>13</sup>

Both of these would require the explicit approval of the State public service regulatory authorities, and would normally only be granted if these were State-wide programs. The CES Task Force Final Report is encouraging Arlington leadership to form a team with Dominion Virginia Power, and possibly neighboring Loudoun County, to position Arlington as a pilot community for these incentives, with the goal to test them for effectiveness for wider proliferation in Virginia. For background on the current programs visit:

<http://www.dom.com/dominion-virginia-power/customer-service/energy-conservation/ec-programs.jsp>

- **Washington Gas Residential Rebates**

Washington Gas offers certain customer rebates that are paid via an American Express prepaid card. Customers with existing housing can apply for a natural gas heating system checkup or programmable thermostat, a boiler replacement or a water heater

---

<sup>12</sup> <http://fit.powerauthority.on.ca/Page.asp?PageID=1115&SiteNodeID=1052>

<sup>13</sup> <http://www.smud.org/en/community-environment/solar-renewables/pages/feed-in-tariff.aspx>

replacement. New housing that is Energy Star certified may apply for a new home rebate or a water heater rebate. All items must be installed by a licensed contractor to be eligible. Documentation is required. For background on the current programs visit: [www.washingtongasrebates.com](http://www.washingtongasrebates.com)

- **Financing Energy Efficiency through Business.gov**

Businesses can connect with lenders that provide loans to small businesses interested in making energy efficient upgrades. There are wide-ranging financing options available, from small improvements to complete system upgrades. Rebates, financing and special offers may be available on office equipment, electronics, appliances, and lighting products.

The CES Task Force Final Report recommends that the County investigate the opportunity to create an Energy Financing Information Center. Such a one-stop resource could selectively work with these vendors and financing sources to enhance their energy offerings for neighborhood scale projects, or in exchange for promotional benefits, be being part of Arlington's trail blazing CES Task Force Final Report.

Visit: <http://www.business.gov/expand/green-business/energy-efficiency/get-started/financing.html>.

- **Electric Vehicle Supply Equipment (EVSE) Incentive - Coulomb Technologies**

Coulomb Technologies' ChargePoint America program offers EVSE at no cost to individuals or entities in the Washington, DC metropolitan area. To be eligible for a public or commercial charging system, an entity must be located within the Washington, DC metropolitan area and in defined potentially "high use" areas, and provide public access to the charging system. Companies and municipalities may apply on the ChargePoint America Web site. To be eligible for free home charging stations, individuals living within the specified area must purchase a qualified electric vehicle (EV) or plug-in hybrid electric vehicle (PHEV). Qualified vehicles include the Chevrolet Volt, Ford Transit Connect EV, and Ford Focus EV. Individuals purchasing an eligible EV or PHEV should apply for the ChargePoint America program at the dealership or with the vehicle manufacturer at the time of vehicle purchase. In most cases, installation will be paid for by the EVSE owner; some cities, states, and utilities, however, will provide funding towards installation costs. All participants in the ChargePoint America program must agree to anonymous data collection after installation. Additional restrictions may apply.

- **Electric Vehicle Supply Equipment (EVSE) Incentive – ECotality**

Through the EV Project, ECotality offers EVSE at no cost to individuals in the Washington, DC metropolitan area. To be eligible for free home charging stations, individuals living within the specified areas must purchase a qualified electric vehicle (EV) or plug-in hybrid electric vehicle (PHEV). Qualified vehicles include the Nissan LEAF and Chevrolet Volt. Individuals purchasing an eligible EV or PHEV should apply at the dealership at the time of vehicle purchase. The EV Project incentive program will also cover most, if not all, of the costs of EVSE installation. All participants in the EV Project incentive program must agree to anonymous data collection after installation. Additional restrictions may apply.

- **Natural Gas Technical Assistance and Fuel Rate Reduction:**

Virginia Natural Gas provides technical support and training to customers who are interested in establishing a natural gas vehicle (NGV) fleet. Virginia Natural Gas offers two special fuel rates specifically for NGVs.

- **Natural Gas Infrastructure Technical Assistance:**

Atmos Energy offers preliminary feasibility studies for compressed natural gas fueling stations and may assist with vendor selection on a case-by-case basis.

### ***Example of Community Financial Information Approaches***

The CES Task Force Final Report recommends that Arlington County provide information on all currently available incentives and financing options on a continuing basis. The information the County provides will be a clearinghouse for wider Federal, State, Commercial and Foundation incentives, along with some County level programs.

#### European Example – KEA GmbH, Germany

KEA - Klimaschutz- und Energieagentur Baden-Württemberg GmbH (Climate protection and energy agency Baden-Württemberg) - was founded in 1994. The shareholders are:

- The State of Baden-Württemberg (50.4%)
- Energy supply enterprises of the country (25.1%)
- Chamber of Trade, Associations, Enterprises (16.0%)
- Landesbank Baden-Württemberg (State Bank Baden-Württemberg) (8.0%)
- Landesnaturschutzverband Baden-Württemberg (0.5%)

Task of the KEA is the cooperation in the climate protection politics of the State of Baden-Württemberg. Moreover the following basic duties were defined in the partner contract of the KEA:

- Contribution to the reinforced use of:
  - Renewable energy
  - Energy conservation
  - Rational energy use
- With the target groups of:
  - Public
  - Small and medium enterprises
  - Artisans and planners
- To help in the development of:
  - Climate protection conceptions
  - Urban land-use planning
  - Complex projects
  - Energy management
  - Know how - transfer
  - Documentations, trainings, public relations
  - Consulting to foundation programs

The KEA receives no institutional financing, but instead finances itself exclusively by its own services. The revenue from these services including foreign projects, in the period from 1995 to 2006 has increased from 0.5 M€ to 1.9 M€.

According to the assigned duties, the KEA deals specifically with the following central topics of interest:

- Use of energy from wood for generation of electricity, heat and combined heat and power within the scope of the implementation of projects from energy conceptions for complexes of buildings and new building areas
- Energy conservation in existing and new buildings
- Community energy management with a system developed by the KEA
- Company of contracting projects
- Conception and implementation of funding programs for the Federal Ministry of Environment
- Climate protection programs in schools in Baden-Württemberg
- Sustainable development of communities with local engaged groups
- Conception for mobility
- Information about energy aspects in the modernization of building stock

KEA provides several services around funding programs:

- Information about programs on the website
- Information about programs via telephone hotline
- Administration of programs
- Evaluation of programs

As one example, the very successful funding program "Klimaschutz Plus" (Climate protection plus) is administrated and evaluated by KEA. Klimaschutz Plus is a program of the Ministry of Environment, Nature Protection and Traffic of the State Baden Württemberg. The program addresses especially non-residential and community energy project as a complement to federal programs which have a main focus on residential buildings. Another important program of the State Baden Württemberg is "Heizen und Wärmenetze mit regenerativen Energien" (heating networks with renewable energies). This program is in addition to a federal general district energy funding program and is also developed and administrated by KEA.

They offer a portal with links to several funding databases on their website.

- Home page: <http://www.kea-bw.de/index.php?id=home>
- Funding programs (main): <http://www.kea-bw.de/arbeitsfelder/foerderprogramme/>
- Funding programs databases: <http://www.kea-bw.de/arbeitsfelder/foerderprogramme/foerderdatenbanken/>

# Appendix G

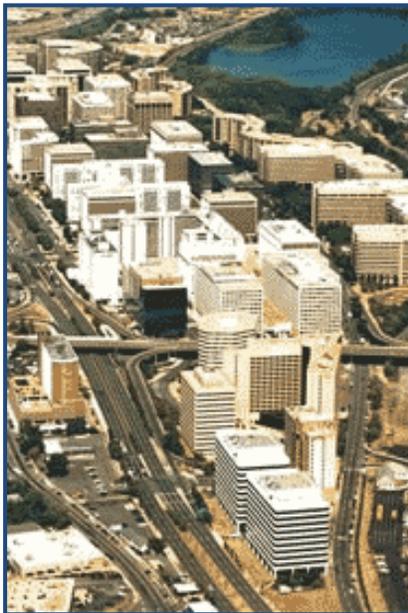
## Scale Projects

The Task Force and the Technical Working Group identified 20 potential Scale Projects to consider in Arlington County. The four high priority potential scale projects are described in detail below and are recommended for immediate action. The remaining 16 potential Scale Projects are described below in alphabetical order. All population, employment, and housing unit data are provided by the Arlington County Planning, Research, and Analysis Team (PRAT) in a report entitled "Planning Research Brief #6, Round 8.0 Forecast" dated December 2010<sup>14</sup>.

### ***Potential Scale Project: Crystal City***

#### **Overview**

Crystal City is home to Arlington County's largest office and hotel sector, and as such is one of the County's primary economic engines, today comprising over 25 million square feet of mixed-use development. It is a major regional employment center, with over 24,800 employees. It is also a neighborhood that is home to 7,400 households with 10,700 residents and is one of the region's primary activity centers.



The 2005 Base Realignment and Closure Commission (BRAC) will cause major changes to Crystal City. The BRAC recommendations will relocate about 13,000 jobs from Crystal City, freeing up 3.2 million square feet of office space.

In response to this and other changes, the County initiated long-range planning to create a new vision for Crystal City out to 2050. The draft plan envisions Crystal City will have approximately 60% more development than today; employ 59,000 people; and provide homes to 27,000 residents.

Crystal City is one of the most accessible neighborhoods in Arlington County, with two Metrorail lines, Virginia Railway Express service, Jefferson Davis Highway, and Interstate 395. There are easy connections to the Mount Vernon and Four Mile Run trails. Washington Reagan National Airport is located adjacent to Crystal City to the east.

Before 1960, much of Crystal City consisted of low-intensity industrial uses such as brickyards, warehouses, and other construction related activities. However, by the mid-60's, the growing demand for office space near to Washington DC led to Crystal City's early development as an urban center due to its proximity to the National Airport, the Pentagon, and downtown Washington DC.

Novel for its time, Crystal City was initially designed as a mixed-use urban neighborhood with office, apartment, and hotel buildings, along with a retail spine east of Jefferson Davis Highway. As development continued, new apartment and hotel buildings were built west of Jefferson Davis Highway.

---

<sup>14</sup> The Arlington County Planning, Research, and Analysis Team (PRAT) in a report entitled "Planning Research Brief #6, Round 8.0 Forecast," December 2010 can be found at [http://www.arlingtonva.us/departments/CPHD/planning/data\\_maps/pdf/file79200.pdf](http://www.arlingtonva.us/departments/CPHD/planning/data_maps/pdf/file79200.pdf)

The federal government's decision in the late 1960s to locate the US Patent Office and the Institute of Defense Analysis in Crystal City, along with the 1977 opening of the Crystal City Metro Station, and later the Virginia Railway Express (VRE), cemented Crystal City as a pre-eminent regional center.

### **Properties**

Most of the existing buildings in Crystal City date from the 1960s to the 1980's. By 2006, Crystal City had 10.8 million square feet of offices; nearly a million square feet of retail; 3.5 million square feet of hotels; and about 9 million square feet of residential space for a total of about 25 million square feet of buildings.<sup>15</sup>

This urban landscape is made up of mid-rise to high-rise buildings: offices rise up to 15 stories; residential high-rise rental apartments or condominiums rise up to 20 stories; and hotels rise up to 18 stories. Many have street-level retail and some below street-level retail near the Metrorail station accessed via an interior pedestrian concourse.

### **Future Development**

Crystal City's Sector Plan<sup>16</sup> envisions the neighborhood to be approximately 60% larger by 2050. By this time, residential space will have grown to 17 million square feet; offices to 16 million square feet; hotels to just over 5 million square feet; and retail to 1.5 million square feet. By 2050, today's 25 million square feet of buildings will have grown to nearly 40 million square feet.

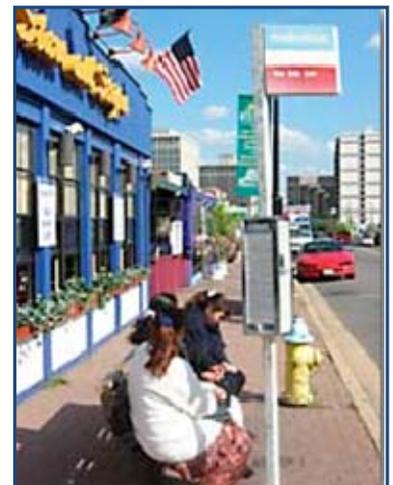


Three major projects are currently under consideration that will be important for launching Crystal City towards 2050. Kingdon Gould is pursuing a site plan amendment for Airport Plaza IV to develop the final part of a high-rise mixed-use complex approved in 1981. Vornado/Charles E Smith already has approval for Crystal City Retail Phase 2. When completed, this will continue the retail frontage along Crystal Drive north towards 18<sup>th</sup> Street. Arlington County is in the early stage of developing a master plan for an ART Bus Operations center along Eads Street near 32<sup>nd</sup> Street S, at the southern edge of Crystal City.

In parallel with new developments, much of the existing property will undergo major renovation and some repurposing in the coming decades, along with redefinition of some of the external spaces. The relatively dense urban framework, combined with somewhat older buildings and aggressive new development plans, creates major opportunities to redefine the energy footprint of Crystal City.

### **Transportation**

Crystal City is well positioned with regard to transit services. It currently has a wide range of public services linking it to both Washington DC, to Arlington County, and regionally to Northern Virginia. These services include the Metro Rail Blue and Yellow Lines, Metro Bus, Arlington



<sup>15</sup> Development Capacity in Arlington's Metro Corridors, December 2007.

<sup>16</sup> The Crystal City Sector Plan can be found at [http://www.arlingtonvirginiausa.com/docs/100621CRYBK-BDK\\_Complete\\_Book\\_for%20CB%20Distribution.pdf](http://www.arlingtonvirginiausa.com/docs/100621CRYBK-BDK_Complete_Book_for%20CB%20Distribution.pdf)

Transit Service, Virginia Railway Express Station (VRE), and commuter services from both Loudoun Transit and The Potomac and Rappahannock Transportation Commission (PRTC). There is also a vast network of private shuttle operators serving Crystal City.

The Crystal City Sector Plan recommends a Transitway that will extend the reach of Metro and VRE, and will improve local mobility. The Crystal City/Potomac Yard Transitway is a joint project between Arlington County and the City of Alexandria, and will use buses in the near-term and will transition to a streetcar technology. The Transitway will provide a high capacity and high quality surface transit system in the five-mile corridor between Pentagon City and the Braddock Metrorail Station. The proposed system will connect with the anticipated Columbia Pike streetcar in the Pentagon City area via South 12th Street. Existing transit options within Crystal City will be maintained and enhanced. Future transit options could include additional or revised commuter-oriented services, off-peak services, and cross-county connections. The connections between transit services within Crystal City and throughout the County, as well as connections to other modes of transportation, will be convenient, easily understandable, and efficient.

Plans to improve transit services are aimed at supporting increases in both residential and commercial development to make transit a preferred option over private vehicles for both residents and visitors any time in the day. They will also have a major impact on the energy use and resulting greenhouse gas emissions from Crystal City, which today are about 20% of the total for the County.

### **Stakeholders**

The Crystal City Planning Task Force represents a number of key stakeholders in Crystal City's present and future successes. It includes resident groups and retail and office tenants. The major property owners and developers are represented, the largest of which is Charles E Smith/Vornado along with Archstone Smith, and Lowe. Also represented from the County are the Commissions for Planning, Economic Development, Transportation, Art, and Parks and Recreation. The neighboring civic associations also play a key role.

A major additional stakeholder is the Crystal City Business Improvement District, clearly driven by ensuring future competitiveness, which is also a key aspect of energy use. Given the dual role as both a destination and a transit hub, other organizations have a strong interest in the future of Crystal City. These include the Virginia Department of Transportation, Metropolitan Washington Airports Authority, Washington Metropolitan Area Transit Authority, Virginia Department of Rail and Public Transportation, and Virginia Railway Express.

### **Potential Building Energy Solutions**

Crystal City's energy use and resulting greenhouse gas emissions are the highest of any of the twenty Energy Planning Areas evaluated as a part of Arlington County's Community Energy Project. In 2007, they were responsible for 19% of the County's energy use, and over 20% of the County's greenhouse gas emissions, underlining its importance to the County's in meeting its breakthrough energy targets.

Successfully managing potential benefits, costs, and risks associated with energy over the coming decades will be important to the future competitiveness of Crystal City, affecting its ability to attract residents and high-value tenants. For that reason, the CES Task Force designated Crystal City as a high-priority early-stage CES Task Force Scale Project to develop a neighborhood energy approach, integrating building and transport efficiency with clean and renewable energy supply.

Existing high building densities, combined with the planned 60% growth resulting in greater density, technically make Crystal City a high probability candidate for a successful district energy solution. This would serve both existing and new buildings with heating and cooling services through a highly efficient network, supplied by a mix of clean and renewable heating

and cooling sources. The implementation of district energy will be a multi-year process. Crystal City's key stakeholders, along with the County and suitable energy services partners, will establish a neighborhood concept that will ensure that district energy investments and services are delivered in a cost-effective, reliable, and environmentally responsible way for decades to come. This could include the formation of a district energy utility, which could ultimately also deliver service beyond Crystal City.

In the first stages, some preconditions need to be in place to ensure a successful realization of district energy. First, major renovation and new developments should meet the highest possible level of energy efficient design consistent with market realities. The CES Task Force Report lays out general guidelines for the County as a whole and Crystal City should follow these. The high-density of Crystal City, along with the market competitiveness goals, indicates that even higher energy efficiencies can probably be achieved in many cases. In general, the higher the energy efficiency of the buildings, the more viable any district energy solution is likely to be.

In the future, all of the key stakeholders and property managers in Crystal City will be strongly encouraged to voluntarily monitor the energy and greenhouse gas performance of their buildings and to display Energy Performance Labels such that users and the general public are aware of the actual efficiencies of each building. If widely adopted, energy performance labeling will be seen as the norm. The very transparency of energy performance could become a signature marketing feature of Crystal City.

A technical aspect of all future major developments and renovations is that they should be "*district energy ready*", irrespective of the ownership of the property. Currently a mix of different HVAC systems, rooftop units and boilers, furnaces and chillers using different fuel mixes (gas/electricity, all-electric) are in place. During renovation these could be reconfigured to be intrinsically more efficient and prepared to be connected to a future district energy network.

Even in this first phase, some interconnection of heating and cooling systems between neighboring buildings should take place. In fact, Vornado has already started sharing cooling between some buildings. This early interconnection is an opportunity to use existing heating and cooling capacity more efficiently by sharing capacity. Crystal City's mixed-use nature increases the potential benefits in both existing and new buildings. As an example, an office building may need more energy during the day while an apartment complex may have higher demand during the evening and weekend. Sharing assets offers energy efficiency, reduced emissions, and is less expensive. Sharing capacity also allows less efficient heaters and chillers to be taken out of service.

The next step should be to implement combined heat, cooling and power generation with gas fired turbines and absorption cooling. This is a starting point for a wider pressurized hot water and chilled water network to serve further buildings. The generation of heat and chilled water may begin in the basement of buildings in the earlier stages, supplemented by increasingly centralized generation plants in a customized facility. This central facility could be an energy asset to the neighborhood and could serve as an educational center for employees, residents, and local school and college students. Within decades, most of Crystal City could be interconnected with competitive heating and cooling supplies serving highly efficient renovated and new buildings. The energy used would be at least half of today's norms with even greater percentage reductions in greenhouse gas emissions.

A district energy approach makes it easier to use renewable energy resources cost effectively and at scale. The most likely choices would be to include natural gas delivered within the normal natural gas network in parallel with solar thermal collection. Other thermal renewables such as heat from burning municipal waste or biomass in waste-to-energy facilities are not likely to be effective solutions in Crystal City, (or in Arlington in general).

Besides the use of thermal renewable energy as part of the district energy system, all renovations and new developments should make every effort to cost-effectively incorporate solar panels in building facades and on roofs. With the current state of technology, high building density, and poor wind conditions, wind generation is unlikely to be effective except in smaller experimental projects.

Crystal City's district energy network would be designed to allow further connection to other Community Energy Scale Projects' energy systems, and is also the basis for cost effective expansion into areas with lower densities. Specifically, Pentagon City, Potomac Yards, and the new County Aquatic Center could all be incorporated into the energy planning as logical district energy and efficiency expansions, even in the very early stages of energy planning.

As the CES Task Force Final Report and the energy plans for Crystal City are developed, neighboring civic associations such as Aurora Highlands and Arlington Ridge should be expected to join the discussion. The City of Alexandria could also be a future partner in extending the reach of any neighborhood solution to serve the planned 7.5 million square feet of mixed-use development centered on a new Metrorail station, just south of Four Mile Run.

### **Decision Grade Integrated Energy Master Plan (IEMP) for Crystal City**

This narrative is based on experience in neighborhoods similar to Crystal City from around the world. Key stakeholders are discussing the development of a decision grade IEMP<sup>17</sup> for Crystal City to validate the benefits. Charles E Smith/Vornado, the owner of about 60% of the commercial office property covered by the Draft Crystal City Sector Plan, and a member of the CES Task Force, has already expressed interest in evaluating the potential benefits of an integrated energy master planning approach for the Crystal City area covered by the Draft Sector Plan.

---

<sup>17</sup> See Appendix H for the draft Crystal City IEMP – Scope of Work

## **Potential Scale Project: Rosslyn**

### **Background**



Rosslyn is the leading employment center in Arlington County. It is host to 38,200 employees and boasts more than 8 million square feet of office space, over 7,200 households, 2,103 hotel rooms<sup>18</sup>, several urban parks and diverse restaurants. Current

projections indicate that, by 2040, employment in Rosslyn will grow by 16,700 jobs; local resident population will likely increase from 10,900 to 14,700; and households will increase from 7,200 to 10,200.

The character of the Rosslyn area has changed dramatically since the late 1950s and early 1960s. At that time, the predominant land uses in Rosslyn were a mix of pawn shops, lumber yards, oil storage tanks, vacant lots, and other commercial and industrial uses, with about 2,500 homes.

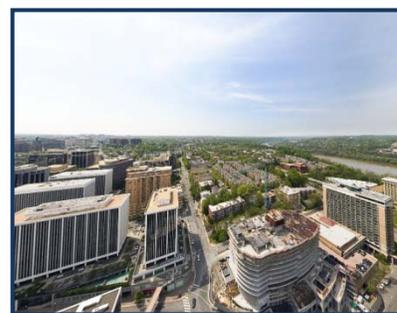
Redevelopment of Rosslyn began in the early 1960s. Following the approval of the Metrorail plan in the early 1960s and the designation of the Rosslyn Metrorail Station as a transfer point between the Orange and Blue Lines, the planning process intensified. The Rosslyn Sector Plan and Transit Station Area Plan were adopted by the County Board in 1977. Plans were extensively updated in 1992 to create a more functional and livable urban place.



### **Properties**



Most buildings were constructed from the 1960s to the 1980s, with a large percentage now anticipating significant renovation or redevelopment. Recently approved new developments include Rosslyn Central Place and 1812 N. Moore Street. Rosslyn Central Place has separate residential and office buildings totaling over 1 million square feet. Each will include ground floor



retail space. The office building includes a public observation area at the top. A plaza area is planned between the buildings. 1812 N. Moore St. will have 30-stories of Class A office space totaling 581,000 square feet, and will include extensive retail space at street level.

Recently completed projects include the 27-story, 246-unit Turnberry Tower condominium and the Waterview, a mixed-use development with 631,000 square feet of offices, street level retail, a 154-room hotel, and 133 apartments. Other major buildings include the 24-story 1801 North Lynn Street built in 2002, and the offices at 1000/1100 Wilson Boulevard completed in 1981.

### **Future Development**

In 1996, the "Rosslyn Coordinated Redevelopment District" was established by the County Board. Its 25-year goal is to maximize Rosslyn's economic and physical potential by becoming

<sup>18</sup> Planning, Research, and Analysis Team, Arlington County, VA January 2010

a competitive first-class urban center exemplifying superior architecture and excellent urban design, including high quality mixed-use development at the core of Rosslyn. This will include a mix of housing and hotel choices with office space designed to attract the regional and national headquarters of major US and international corporations and institutions.

The land use plan allows densities between 3.8 and 4.8 floor area ratio (FAR) for residential, hotel, office, restaurant, and retail mixed-use developments. These densities depend on the specific mix of any given project. The County Board may grant additional density up to a 10.0 floor area ratio, and height up to 300 feet (or slightly greater in the two blocks nearest the Metro Station), where there are significant community benefits such as:

- Mixed-use development with a significant housing component
- New or upgraded retail, restaurant, and entertainment facilities
- Enhanced pedestrian, vehicle, and mass transit circulation
- Attractive public spaces and amenities, possibly including urban forest contribution
- Creation of a "Central Place" and the "Esplanade" as envisioned in the plan for the Rosslyn station area

In 2002, the County Board adopted a resolution for Rosslyn calling for architecturally distinctive buildings with particular attention to the tops of the buildings and their impact on the Rosslyn skyline. It also concluded that the tallest buildings should be clustered around the Metro Station, with heights tapering down towards the edges of the Redevelopment District. A subsequent resolution in 2007 provides additional guidance on urban design surrounding future development within Central Place. It also allows the possibility to grant additional height within Central Place. These could be up to a maximum height of 490 feet above sea level as long as the following principles were respected:

- Inclusion of distinctive architectural features such as sculpted rooftop designs or significant tapering in form and mass.
- Incorporation of significant community amenities such as public viewing access from building tops, public open space areas, or support of other important County goals for the Rosslyn area.
- Preservation of views from any existing public observation deck in Central Place.
- Incorporation of global best practices in energy conservation and sustainable design.

## **Transportation**

Rosslyn is well served by a multi-modal transportation system. This includes Rosslyn Metrorail Station served by the Orange and Blue Lines, and a number of buses including Metrobus, ART, Loudoun County Transit, PRTC OmniRide, the Georgetown University shuttle, and the DC Circulator Service.



Additional elements include an active bicycle/pedestrian system and a network of on-street parking and curb space dedicated to taxicab stands, car sharing, “slugging,” and metered public parking.

The intense redevelopment that will occur in Rosslyn over the next 20 years will require significant upgrades to the existing transportation system. These will include a major expansion of public transportation options, such as the recently-launched Rosslyn Station Access Improvements project. As travel demand increases, a dramatic mode shift away from single occupancy vehicles to public transportation options will become necessary for Rosslyn to continue to function efficiently. The improvements to the Rosslyn transportation system will be addressed within the upcoming Rosslyn Multimodal Transportation Plan.



Over a quarter of all the energy and greenhouse gas emissions in Arlington County come from all forms of transportation, which can be reduced through sensitive transport planning in dense urban areas like Rosslyn.

## **Stakeholders**

Effective neighborhood energy plans have a higher probability of success with strong local engagement. Key stakeholders in the Rosslyn corridor are the North Rosslyn Civic Association, Radnor/Ft. Myer Heights Civic Association, Arlington Public Schools, and the Rosslyn Renaissance and Rosslyn Business Improvement District. Major property developers and owners include Monday Properties, JBG, and Vornado.

## **Potential Energy Solutions for Buildings**

Rosslyn’s energy use and resulting greenhouse gas emissions in 2007 was approximately 8% Arlington County’s total emissions, making it an important node in the overall CES Task Force Report. For that reason, the CES Task Force designated Rosslyn as a high priority early stage Scale Project to develop a neighborhood energy approach, integrating building and transport efficiency with clean and renewable energy supplies.

The existing high building densities, combined with new development and increased density, make Rosslyn a suitable candidate for a district energy solution. This would serve both existing and new buildings with heating and cooling services through a highly efficient network, supplied by a mix of clean and renewable heating and cooling sources.

The implementation of district energy would be a multi-year process. Rosslyn’s key stakeholders along with the County and suitable energy services partners could establish a neighborhood concept that would ensure that district energy investments and services are delivered in a cost effective, reliable, and environmentally responsible manner for decades to come. This would likely include the formation of a district energy utility, which ultimately could also deliver service beyond Rosslyn.

Initially, some preconditions should exist to ensure a successful realization of a district energy system. First, all major building renovations and new developments should meet the highest possible level of efficient design consistent within market realities. The CES Task Force Report lays out the general guidelines for the County as a whole, and Rosslyn should follow these. The high-density “signature” buildings envisioned for Rosslyn, means these general efficiency guidelines could be achieved, or even be exceeded.

In the future, all of the key stakeholders and property managers in Rosslyn will be strongly encouraged to voluntarily monitor the energy and greenhouse gas performance of their buildings and to display Energy Performance Labels such that users and the general public are aware of the actual efficiencies of each building. If widely adopted, energy performance labeling will be seen as the norm. The very transparency of energy performance could become a signature marketing feature of Rosslyn.

A technical aspect of all future major developments and renovations is that they should be “*district energy ready*”, irrespective of the ownership of the property. Currently a mix of different HVAC systems, rooftop units and boilers, furnaces and chillers using different fuel mixes (gas/electricity, all-electric) are in place. During renovation these could be reconfigured to be intrinsically more efficient and prepared to be connected to a future district energy network.

Even in this early stage, some interconnection of heating and cooling systems between neighboring buildings should take place. This is an immediate opportunity to use existing heating and cooling capacity more efficiently by sharing capacity. Rosslyn’s growing mixed-use development increases the potential benefits. As an example, an office building may need more energy during the day while an apartment complex may have higher energy demands during the evening and on weekends. Sharing assets is offers energy efficiency, reduced emissions, and is less expensive. Sharing capacity also allows less efficient heaters and chillers to be taken out of service.

The next step should be to implement combined heat, cool and power generation with gas fired turbines and absorption cooling. This is a starting point for a wider pressurized hot water and chilled water network to serve further buildings. The generation of heat and chilled water may begin in the basement of buildings in the earlier stages, supplemented by increasingly centralized generation plants in a customized facility. This central facility would be an energy asset to the neighborhood and could serve as an educational center for employees, residents, and local school and college students.

Within decades, much of Rosslyn could be interconnected with high quality competitive heating and cooling supplies serving highly efficient buildings. The energy used would be at least half of today’s norms with even greater reductions in greenhouse gas emissions. This approach would make it easier to use renewable energy resources cost effectively and at scale. The most likely choices would be to include natural gas delivered within the normal natural gas network in conjunction with solar thermal collection. Other thermal renewables such as heat from burning municipal solid waste or biomass in waste-to-energy facilities are not likely to be effective solutions in Rosslyn.

Besides the use of thermal renewable energy as part of a district energy system, all renovations and new developments should make every effort to cost-effectively incorporate solar panels in building facades and on roofs. With the current state of technology, high building density, and poor wind conditions, wind generation is unlikely to be attractive beyond smaller more experimental projects.

Rosslyn’s district energy network would be open to further connection to other district energy systems, and is the basis for cost effective expansion into areas with lower densities.

**Decision Grade Integrated Energy Master Plan (IEMP) for Rosslyn**

This narrative is based on experience in neighborhoods similar to Rosslyn. Key stakeholders should consider the development a decision-grade IEMP for Rosslyn to validate the benefits.

DRAFT

## **Potential Scale Project: Columbia Pike**

### **Background**



The Columbia Pike corridor is an eclectic mix of the old and new, with wide ethnic and demographic diversity. The “Pike” is home to over 40,400 residents and 11,300 employees. Recent studies indicate that future commercial, retail and housing developments will generate more than 3,900 households by 2040.



### **Properties**

Until recently, Columbia Pike was characterized by outdated suburban, auto-oriented small-scale commercial development, as well as an aging rental-based housing stock. Many of Columbia Pike’s commercial buildings were constructed in the 1980s while some residential complexes were built in the 1960s. Few office buildings are located along Columbia Pike.



Redevelopment plans for the Pike began in the 1980s, and intensified progressively until the adoption of the Columbia Pike Form Based Code (FBC) in 2003. This revitalization has already brought millions of dollars in capital improvements and has enabled growth through the provision of incentives for new retail, residential and commercial development while maintaining much of the distinctive character along Columbia Pike. Through the Form Based Code, the County created land use incentives, transportation resources, and public infrastructure tools to encourage revitalization along Columbia Pike. The FBC is generating new projects and piquing interests of other property owners. Since the Columbia Pike Initiative Plan’s adoption in 2002, nine new development projects have either been completed or approved, with the majority of projects applying the FBC zoning.

### **Future Development**



The Pike is expected to attract at least 7,000 new employees, 7,300 new residents, and 3,900 new housing units between 2010 and 2040. Housing and employment growth in the existing revitalization district under the FBC were developed to create an influx of market-rate housing as well as niche office and retail property. This would create a mixed-use structure with jobs closer to homes. The County will target preservation of affordable units along the Pike, to maintain a diverse

population.

The County is studying the residential areas in between the existing revitalization district nodes to ensure that they are well integrated with future land use plans and consistent with the County and community goals. One critical aspect of the study is to develop tools to preserve the high concentration of affordable housing along the Pike. Energy affordability is one such tool.

## **Transportation**



To support the growth in the existing Revitalization District nodes and to supplement the existing transit services, the County is considering a streetcar line along Columbia Pike. It would be integrated with the regional transit system to improve citizen mobility and lessen automobile dependence. In 2010, preliminary engineering and environmental assessments are in progress, with a potential new line being considered for the near future. In

addition to plans for enhanced transit services, the County leveraged funding at two redevelopment projects to create a pool of public parking spaces to be used by the residents, workers, shoppers, and visitors. Parking would be convenient for the streetcar, further minimizing the use of the car for short journeys within the neighborhood.

The Pike has also demonstrated its commitment to improving pedestrian safety and enhancing the walking experience by leading streetscape improvements in the Town Center node and the Neighborhood Center.



## **Stakeholders**

As a distinct community within Arlington County, Columbia Pike has a large number of stakeholders. All of these stakeholders will be engaged in developing a neighborhood approach to implementing the Community Energy and Sustainability Task Force Report recommendations and strategies. The key stakeholders include, but are not limited to, the following:

Columbia Pike Revitalization Organization (CPRO) is a major stakeholder in the growth and sustainability of Columbia Pike. CPRO members include businesses, civic associations, property owners, and individuals working with the Arlington County Government to revitalize Columbia Pike and its adjacent neighborhoods.

Civic Associations within the Columbia Pike Revitalization District/Columbia Pike Planning Area include: Alcovia Heights, Arlington Heights, Arlington View, Barcroft, Claremont, Columbia Forest, Columbia Heights, Columbia Heights West, Douglas Park, Forest Glen, Foxcroft Heights, and Penrose.

Arlington County Public Schools - In the Columbia Pike corridor there are seven (7) Arlington Public Schools: Hoffman-Boston, Patrick Henry, Arlington Career Center, Randolph, Thomas Jefferson, Barcroft, and Campbell.

Other Stakeholders include rental housing tenants and condo owners, housing developers (profit and non-profit) and small business owners.

## **Potential Energy Solutions**

The following energy narrative is based on experience in neighborhoods similar to Columbia Pike from around the world. Key stakeholders should develop a Neighborhood Energy Master Plan to both engage the community and to ensure the widest penetration of efficient, cost-effective district energy systems, efficient buildings and low-density neighborhoods.

Columbia Pike's energy use and resulting greenhouse gas emissions in 2007 were about 4% of the total of Arlington County, making it an important node in the overall CES Task Force Report. The CES Task Force designated Columbia Pike as one of four high-priority early-stage Scale Projects. As such, it would be one of the first to develop a neighborhood energy master plan integrating building and transport efficiency with clean and renewable energy supplies.

Compared with Crystal City and Rosslyn, two of the other early stage Scale Projects, Columbia Pike has a more diverse mix of building density, use and ownership. Columbia Pike is an area with the potential for future development and new construction, requiring a balance between highly efficient new construction and effective renovation. The diversity of its infrastructure and smaller neighborhoods will require a differentiated approach to supplying energy solutions.

In existing areas with high current or planned building densities, Columbia Pike is a suitable candidate for district energy solutions. A new district energy utility could serve both existing and new buildings with heating and cooling through a highly efficient network, supplied by a mix of clean and renewable energy sources.

Implementing district energy systems would be a multi-year process. Columbia Pike's key stakeholders, including the County and the district utility, would establish a neighborhood energy concept to ensure that district energy investments and services would be delivered in a cost effective, reliable and environmentally responsible manner for decades to come.

In those areas of Columbia Pike targeted for district energy, some preconditions need to be set in place to ensure the successful long-term realization of a district energy system.

First, all major renovation and new developments should meet the highest possible level of energy efficient design consistent with market realities. The CES Task Force Report lays out general guidelines of the County as a whole, and Columbia Pike should follow these.

As part of a neighborhood-oriented energy plan, all the key stakeholders and property managers in Columbia Pike would be strongly encouraged to voluntarily monitor the energy and greenhouse performance of their buildings and to display Energy Performance Labels such that the users and the general public can be aware of actual efficiencies in buildings. If widely adopted, energy performance labeling could be seen as the norm. Energy efficiency could become part of conversations involving real estate sales or rental agreement.

A technical aspect of all future major developments and renovations is that buildings be "district energy ready", irrespective of the ownership of the property. Currently a mix of various HVAC systems, rooftop units, boilers, furnaces and chillers using different fuel mixes (gas/electricity, all-electric) are in place. During renovation these could be reconfigured to be more efficient and prepared to connect to a future district energy network. This will be especially relevant in a mixed-density neighborhood like Columbia Pike, where the pace and configuration of possible integration be less predictable than in other areas.

Even in this early stage, some interconnection of heating and cooling systems between neighboring buildings could take place. This is an immediate opportunity to use existing heating and cooling capacity more efficiently because typically, most individual systems are over-sized. Columbia Pike's growing mixed-use development increases the potential benefits of interconnection and adoption of district energy systems, as some buildings have higher energy

demand during the day while others have higher evening and weekend demands. Promoting interconnectivity and sharing assets is more energy efficient, environmentally responsible, and less expensive.. Sharing extra capacity through district energy systems also allows less efficient heaters and chillers to be taken out of service.

The next step towards creating District Energy along Columbia Pike should be the implementation of combined heating, cooling and power generation with gas-fired turbines and absorption cooling. This is a starting point for a wider pressurized hot water and chilled water network to serve further buildings. The generation of heat and chilled water may begin in the basements of buildings in the earlier stages, supplemented by increasingly centralized generation in a customized facility. This facility could be an energy asset to the neighborhood. It will also serve as an educational center for residents, employees, and local school and college students.

Within decades, much of Columbia Pike could be interconnected with high quality competitive heating and cooling supplies serving highly efficient buildings. The energy used could be at least half of today's norms with even greater reductions of greenhouse gas emissions. This approach would make it easier to use renewable energy cost effectively and in large-scale contexts. The most practical and cost-effective options include natural gas delivered within the normal natural gas network in conjunction with solar thermal collection.

Besides the use of thermal renewable energy in the District Energy system, all renovations and new developments should consider installation of solar panels in building facades and on roofs. With the current state of technology and poor wind conditions, wind generation is unlikely to be attractive beyond small experimental projects.

Implementation of district energy systems along Columbia Pike's lower density neighborhoods would offer unique challenges. However, it is likely that future development will offer opportunities for specific energy efficiency improvements. Energy efficient renovation and new construction (perhaps including Passive House standards) are critical to maintaining affordable housing along Columbia Pike since energy is a large and growing portion of lower income households' budgets.

Finally, there is potential for low-density new construction to approach net zero energy levels. This is achievable by combinations of highly efficient building envelopes, HVAC-systems and efficient lighting, and renewable energy applications, such as solar thermal energy for domestic hot water, ground source heat pump systems for heating and cooling with heat pumps, and photovoltaic panels for electricity. The use of wood pellets, which can be stored and handled like fuel oil, could be an alternative option for home heating.

**Potential Scale Project: East Falls Church**

**Background**

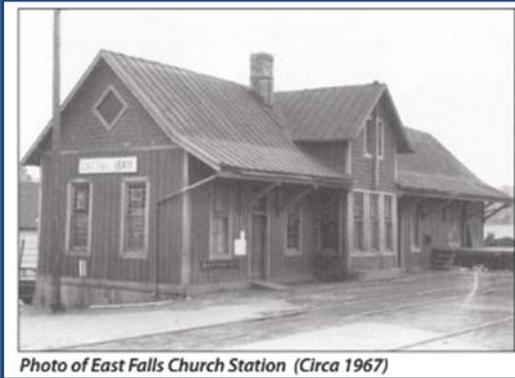


Photo of East Falls Church Station (Circa 1967)

The history of East Falls Church dates back to the 1700s when the first settlers arrived in the area. Initially an area of farms and woodlands, East Falls Church changed in the 1800s as the first trolley lines arrived. The last of three stations was constructed in 1895. Homes dating from 1876 still exist today. East Falls Church rejoined Arlington County in 1936 after being part of Falls Church for over 60 years.

East Falls Church became a commuter suburb between the 1930 and the 1950s serving Washington, D.C. In the 1950s, the Washington

Metropolitan area’s population experienced a significant increase just as an expanding network of roads and highways replaced streetcars and trolleys. Much of East Falls Church central business district was demolished in 1982 to make way for Interstate I-66, which bisects the community and serves as the primary east-west corridor through Arlington County. In 1986, the East Falls Church Metrorail Station opened, linking the community to the region by rail.

East Falls Church has continued to grow, remaining a largely residential community with detached single family houses and townhouses. There is limited commercial and light industrial development centered on the intersection of Lee Highway, Washington Boulevard and I-66. Recently higher density townhouse and apartment developments have been built adjacent to Lee Highway and Washington Boulevard. The Washington & Old Dominion and Custis Bike Trails, along with several parks, provide bicycle and pedestrian pathways and recreational opportunities for the community.

Future plans for the area include residential, commercial, retail, and hotel mixed-use developments focused around the Metrorail station. With approximately 4,100 riders per day the East Falls Church station it ranks 57th in the regional Metrorail network.

According to the County’s estimates<sup>19</sup>, expansion of Metrorail services and potential new residential and commercial development in the East Falls Church area could result in increases in households, population, and jobs by 2040, contingent on adoption of the East Falls Church Area Plan in 2010.

**Properties**

Most housing is single-family detached, with newer townhouse developments and multi-family complexes close to the Metrorail station. Detached homes were mostly built in the early to mid 1900s. In recent decades, some homes have been renovated, while others have demolished and replaced with new construction



Two residential projects were recently completed near the Metrorail station. The

West Lee, completed in 2006, is a 128-unit luxury mid-rise condominium. The Crescent is a 214-unit market-rate rental complex.



<sup>19</sup> Estimates are from Arlington County Department of Community Planning Housing and Development, Planning Research and Analysis Team (PRAT) dated 2005

## **Future Development**

East Falls Church's development plan is based on three primary areas: transit mixed-use, neighborhood transition, and gateway mixed-use.



The transit mixed-use area is proposed to be a hub of activity with street-level shops around a central plaza with residential, office, or hotel uses on the upper floors of mid-rise buildings. The development would help meet local neighborhood shopping needs and improve pedestrian, bicycle and bus connections to the Metrorail station. On the Park & Ride site, 450,000 to 600,000 square feet of development is proposed. Townhouse-style development is also planned on sites adjacent to existing single-family

development.

The three sites within the Neighborhood Transition areas would develop along Lee Highway and Washington Boulevard, mostly with townhouse and mid-rise buildings. This development would reflect the area's residential character with improved pedestrian access, local shopping and some professional offices.

The proposed Gateway Mixed-Use Area includes mid-rise development that would be in scale with its surroundings. The character of the development will define this important "gateway" to the County. It would include street-level retail, on-street parking, and a plaza. There are three sites specifically targeted in this area: the Oil Company Site, the French restaurant/motel site, and the commercial property at Fairfax Drive and Little Falls Road.



## **Transportation**

The Metrorail station is a major focus for development in East Falls Church. The station currently has 422 parking spaces and is served by several bus lines. When the Silver Line opens to Dulles, the station will be the western-most station served by the Orange and Silver Lines, and will serve as a transfer point for rail and buses. Improvements to the station are proposed that would improve pedestrian, bicycle, and bus access to the station.



## **Stakeholders**

Key community stakeholders include citizens from civic associations located near the station, residents in the City of Falls Church, Virginia Department of Transportation (VDOT), and Washington Metropolitan Area Transit Authority (WMATA).

Civic Associations in the area are invested in the development of East Falls Church and include Madison Manor and Williamsburg Civic Associations. Some have representatives on the East Falls Church Planning Task Force.

## **Potential Energy Solutions**

The following energy narrative is based on experience in similar neighborhoods to East Falls Church from around the world. Key stakeholders should develop an East Falls Church Energy

Master Plan to both engage the community and to ensure the widest penetration of energy efficient buildings as well as cost-effective district energy systems for higher density areas and supply solutions suitable for low-density neighborhoods.

East Falls Church's energy use and greenhouse gas emissions in 2007 were less than 1% of the total of Arlington County. This is predicted to grow, due to the planned rapid development around the Metro station. The CES Task Force designated East Falls Church as a high-priority early-stage Scale Project to develop a neighborhood energy approach that integrates building and transportation efficiency with clean and renewable energy supply.

Compared with two other Scale Projects, Crystal City and Rosslyn, East Falls Church is planned to have a greater mix of buildings densities, and greater complexity of ownership. Much of the development would be new construction. With this mixed density profile, a more differentiated approach to neighborhood energy solutions is required.

Areas of mid-rise development would be suitable for district energy solutions, serving new buildings with heating, domestic hot water and cooling services through a highly efficient network, supplied by a mix of clean and renewable heating and cooling sources. This may also expand into the lower density Neighborhood Transition areas.

The implementation of District Energy would be a multi-year process that would need to be fully integrated into the overall planning. This would ensure that district energy investments and services are delivered in a cost-effective, reliable, and environmentally responsible manner for decades to come. With the full support of the County and suitable energy services partners, District Energy plans could include the new district energy utility discussed in the CES Task Force Report.

In areas designated for DE, some preconditions are needed to ensure the ultimate successful realization of the system. First, all major renovation and new construction in the East Falls Church should meet the efficiency expectations outlined in the CES Task Force Report for the County as a whole. Second, the heating and cooling systems will be "district energy ready", irrespective of the ownership of the property. This will allow properties to be interconnected as the district energy network expands.

Finally, East Fall Church could have new neighborhoods designated for district energy and one or two centralized energy plants could be the most effective solution. If this is determined to be the case, suitable sites should be designated early in the process. The facility where the heat, power and chilled water are created will be a major asset to a neighborhood, and could also serve as an educational center residents, employees and local students.

All renovations and new construction should consider incorporation of solar panels in building facades and on roofs to support. With the current state of technology and poor wind conditions, wind generation is unlikely to be attractive beyond small experimental projects.

East Falls Church already has, and will continue to have attractive neighborhoods, with lower densities that will never be suitable for District Energy. These low-density neighborhoods could serve as role models for renovation and construction with exceptional energy efficiency. Energy efficient renovation is especially important from a social standpoint for any affordable housing since energy is a large and growing portion of lower income households' budgets. In addition, they could be opportunities for on-site implementation of renewable energy technologies such as solar thermal energy for domestic hot water, ground source heat pumps for heating and cooling, and solar panels for electricity. The use of wood pellets, which can be stored and handled like fuel oil, is a potential renewable option for heating.

Some lower density new construction could approach net zero levels. This would be achievable by using energy efficient building envelopes, HVAC-systems and lighting, and other equipment and sophisticated operating approaches. The CES Task Force Report recommends that a

near-zero “passive house” village be established in the County; East Falls Church could be a strong candidate for its location.

As part of a neighborhood-oriented energy plan, all the key stakeholders and property managers in East Falls Church will be encouraged to voluntarily monitor the energy and greenhouse performance of their buildings and to display Energy Performance Labels such that the users and the general public can be aware of how efficient these buildings are. If widely adopted, energy performance labeling will be so widespread that it will rapidly be seen as the norm.

DRAFT

## Aquatics, Health and Fitness Center (Long Bridge Park)



Long Bridge Park is a proposed park located at 475 S. Old Jefferson Davis Highway. To provide access to these new facilities via walking or biking, plans are underway to redesign about 2,750 feet of Old Jefferson Davis Highway and 6th Street South. Long Bridge Park, formerly known as the North Tract Project will be a new state of the art aquatics, health and fitness facility and park on the north end of Crystal City in Arlington. Its concept was approved in February 2004 by the Arlington County Board. Currently, plans and work are underway for a swimming and exercise venue set within a dynamic recreational complex that will feature four full-size athletic fields overlooking premier views of Washington D.C.

All buildings in Long Bridge will be designed to adhere to the U.S. Green Building Council's LEED silver design standards.

The first phase of development commenced in spring 2010, and is expected to finish in summer 2011. Because the center is expected to require vast amounts of energy for heating and ventilation, careful planning will be required moving into the next phase of development to ensure that the facility operates as efficiency as possible, reducing energy demands and costs.



The initial phase of the aquatic, health and fitness center will draw upon a number of the component fitness and aquatics pieces. The program will include a 50-meter x 25-yard pool designed for recreational, fitness and competition aquatics. A family leisure and therapy pool will complement the main pool. The center's warm water lap lanes, therapy pool and zero-depth "beach" entry and free-form water play area will appeal to a wide range of users. A separate deep water pool with be able to accommodate 10 meter diving and recreational programming.



In addition to aquatics, the building will include an indoor fitness area for cardiovascular equipment and weight training, Multiple Activity Center (gymnasium), group exercise rooms, community use space, childcare drop off area, locker rooms and administrative facilities.

The Pentagon Power Plant has an outfall line that runs by the site at which the Arlington County center is to be built. At the time of this report's preparation the County and The

Pentagon are attempting to craft an agreement wherein The Pentagon would provide access to its outfall line and the County would use a portion of the outfall for the purposes of providing thermal energy, as heat, to the County's aquatic, health and fitness center.

### **Arlington Mill**

The Arlington Mill Community Center project is located at 4975 Columbia Pike, bordered by Columbia Pike to the south, South Dinwiddie Street to the west, and Arlington Mill Drive to the east.



Multi-family and duplex residential units are located north and west of the property. A strip of commercial development with surface parking is located further to the west. Four Mile Run and Glen Carlyn Park border the site to the east. Low-rise residential buildings and strip commercial development are located across Columbia Pike to the south of the proposed project. (This strip development is planned for open space per the Columbia Pike

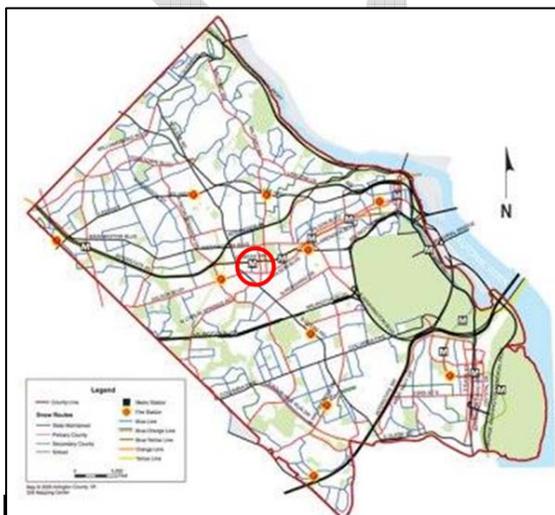
Revitalization Plan.) The site is served by multiple Metro and ART bus routes. Bicycle



and pedestrian have easy access to the site via the Four Mile Run Trail, the W&OD Trail, and on-street bike lanes.

Two buildings are included in this plan. The building fronting on Columbia Pike would have a mix of public and private uses, including the proposed community center and a gymnasium (30,000 sq. ft.) and retail (3,000 sq. ft.). The building at the northern portion of the site is proposed as a rental apartment building with 122 residential apartment units, 121 of which are designated as affordable housing units. The affordable units serve households at or below the area's 60% median income. A public plaza and two levels of underground parking are also included.

### **Ballston**



Ballston is located on the western flank of the "Rosslyn-Ballston (R-B) Metro Corridor, approximately bounded by Washington Boulevard to the north, George Mason Drive and Henderson Rd. to the west and south, and N. Quincy St. to the east.

Ballston is Arlington's hub of science and technology and contains the nation's greatest concentration of scientific research agencies, e.g., the National Science Foundation, DARPA. The many mixed-use projects in the area lend itself to a walk-able, urban environment that provides a good amount of activity day or night. High-rises,

national and regional corporate and association headquarters, upscale hotels, shopping, pocket parks and restaurants concentrated in the core of Ballston all contribute to create a vibrant, pedestrian-friendly mix of business and pleasure. Going outside the ¼ mile radius around the Metro station the land uses change to town homes and single family residential areas.



According to marketing profiles, residents are young, affluent and highly-educated professionals. Average household income was estimated at \$105,000 in 2006.

The Ballston - Virginia Square Partnership, is a public-private organization of citizens, real estate professionals, businesses, civic and condominium associations, educational institutions and non-profits that works toward keeping Ballston thriving. In addition, the Ballston - Virginia Square, Ashton Heights, and Bluemont civic associations all have a keen interest in what happens in Ballston. The buildings range from a single-family residential housing stock of older, early 20<sup>th</sup> century homes, many of which have been remodeled, to brand-new high-rises for residents, office workers, and retailers.

The population of Ballston-Virginia Square is approximately 12,300 and is expected to grow by 18% by 2040. Founders Square is a major redevelopment project current underway in Ballston, and the American Service Center dealership has plans for expansion. The N. Quincy St. Plan helps to guide land use centered along N. Quincy St., while the 30-year old Ballston Sector Plan provides good background regarding long-range planning that has led to today's Ballston.

There are numerous property owners in the 330-acre neighborhood. The community is very active and engaged in local land use decisions.

**Civic Associations/SFH Neighborhoods**

As one example, Cherrydale is located north of Interstate 66, approximately bounded by Lorcom Lane to the north and N. Utah Street to the west.



It is a primarily single-family residential area. However, Lee Highway runs across the civic association, which provides a corridor of mixed uses.



The bounds include HB Woodlawn School, the Cherrydale Library, four neighborhood parks, and the Custis Trail. The majority of the housing stock is older, early 20<sup>th</sup> century homes, many of which have been remodeled.

Arlington Fire Station 3 is currently being rebuilt in the neighborhood. The Bromptons is a new condominium building in the process of being built. There is a 2005 Neighborhood Conservation

Plan which outlines many future visions for the community.

There are numerous property owners in the 295 acre neighborhood, and the community is very active and engaged in local land use decisions.

### ***Courthouse***

Located between Rosslyn and Clarendon on Metro's Orange line, Courthouse is an example of a community where business, government, residential and retail uses combine. Soon, Courthouse will undergo new changes as it welcomes an upscale Marriott Residence Inn, along with a redesigned Courthouse Plaza, which will house a mix of shops and restaurants. With its open-air markets, restaurants, movie theater and neighborhood shops, Courthouse is a prime example of mixed-use development. It is approximately bounded by Key Boulevard to the north, Highland St. to the west, Fort Myer and Fairfax Drive to the south, and the Rhodes St. to the east.



Along with the County's primary government operations located in a campus-style setting along Courthouse Rd., Courthouse employers also include Verizon, Strayer University, the National Science Teachers Association, and the Navy League. The Clarendon Alliance, a public-private partnership that was chartered by the Arlington County Board in 1986, works with the Lyon Village, Lyon Park, and Clarendon-Courthouse civic associations to help guide redevelopment in the area.

Courthouse has over 3.8 million square feet of existing office

space, with close to 600,000 square feet of office space approved but not yet built. Over 7,500 housing units exist in the Courthouse area, housing approximately 11,700 residents. Town homes and single family residences are located within a short walk of the Courthouse Metro, providing for an active and lively community along the Clarendon-Wilson Boulevard core.



There are numerous property owners in the 395-acre neighborhood. The community is extremely active and engaged in local land use decisions.

### ***DoD Joint Base Myer-Henderson Hall***

Joint Base Myer-Henderson Hall (JBMHH), formerly known separately as Fort Myer and Henderson Hall, is located east of Highway 50, and is adjacent to Arlington National Cemetery. JBMHH is comprised of over fifty buildings, many more than 50 years old. More than forty buildings are interconnected with an aging district heating (steam) system that was assessed by the US Army Corps of Engineers for possible energy upgrade alternatives at the end of 2006. At that time, the recommendations were to upgrade and extend the district heating system both within the Fort and to include the neighboring US Marine Corps Henderson Hall.

JBMHH is a small town with over 2 million square feet of property in multiple buildings, including an older housing stock, with substantial energy productivity potential. It could serve as

both a local and national example of a community scale project. Its location to the east of the relatively densely developed areas of Arlington County could make it a candidate to be a node in the wider community energy solutions in the future.



The US Army Corps of Engineers is currently the chair of the IEA Appendix 46, a group of eight countries developing a holistic tool kit for developing energy efficient government installations. A large part of the work of this group is to exchange best practices from Europe and elsewhere to develop and integrated energy master planning approach to large government facilities. CES Task Force Final Report Team member, MVV was both associated with the energy assessment at Fort Meyer in 2006, and is the energy supplier to the US Army facilities in Mannheim, a benchmark for US ACE.

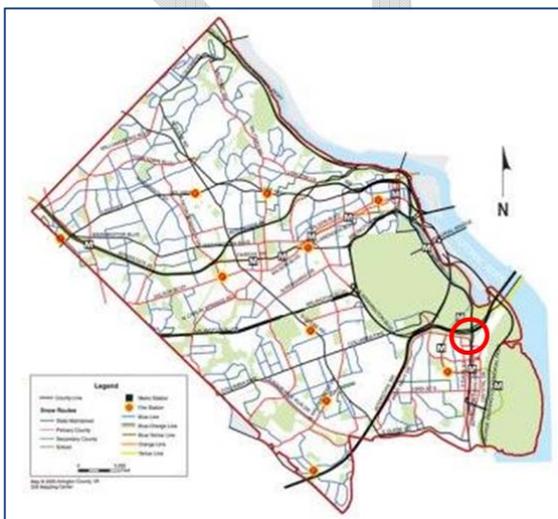
### **George Mason University Arlington Campus**



The George Mason Arlington Campus is a 5.2-acre site to eventually serve about 10,000 students. The site is bounded by Fairfax Drive to the South, Washington Blvd to the North and Kirkwood to the East.

The school offers a multitude of graduate degrees. The five buildings on the site will include Founders Hall (a 250,000-square-foot building to be complete in 2010), Hazel Hall, Truland, Foundation Building and the Original Building. The Arlington campus is served on the Washington Metro by the Virginia Square-GMU station on the Orange line. The station is located approximately two blocks west of the campus.

### **North Ten Block**



The North Ten Block is bounded by Army Navy Drive to the north, South Fern Street to the west, South Eads Street to the east, and an unconstructed portion of 12<sup>th</sup> Street to the south.

The 12.21 acre block is largely undeveloped, with only the Marriot Residence Inn occupying the northwest corner portion. The North Ten Block is the subject of a preliminary application to amend the Pentagon City Phased Development Site Plan (PDSP). The proposal would add five buildings, potentially including two secure federal

government facilities, two office buildings, and a hotel with conference center. Existing Pentagon City PDSP projects include Pentagon Town Center, The Fashion Mall, and the Metropolitan Park phases.



The three lot portions comprising the site are under common ownership. The opportunity to have the undeveloped portion of 12<sup>th</sup> Street constructed provides an important transportation link for the Crystal City Street Car. Situated adjacent to the Crystal City Sector Plan, the block provides critical links to the County. Close proximity to the Pentagon will certainly influence the site's ultimate development pattern.

### **DoD Pentagon**

Located across the Potomac River from Washington, D.C., the 280 acre site is bounded by Jefferson Davis Highway, Route 27, and Interstate 395. The site includes parking, 200 acres of lawn, and a Metro stop. The Pentagon building spans 28.7 acres (116,000 m<sup>2</sup>), and includes an additional 5.1 acres (21,000 m<sup>2</sup>) as a central courtyard.

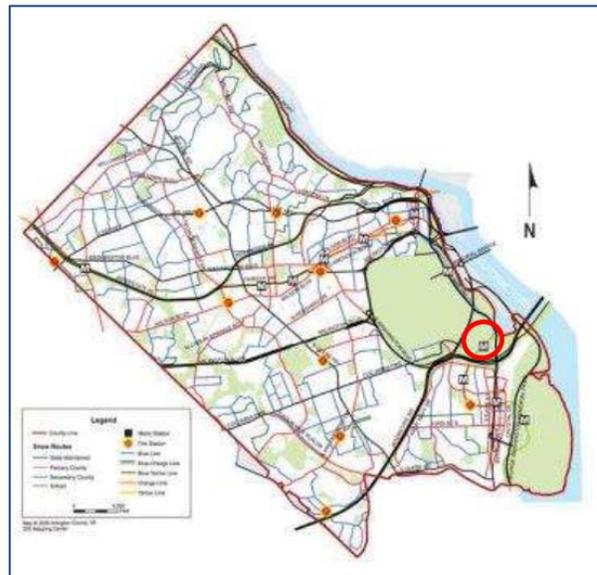


Completed in 1943, the five-floor building consists of five concentric pentagons connected to each other by corridors (adding up to 17.5 miles) and covering an area of 34 acres. The gross square footage is 6.5 million, with about 3.7 million square feet of office space. The Pentagon includes a five-acre (20,000 m<sup>2</sup>) central plaza, leaving 280 acres (1.1 km<sup>2</sup>) for the Pentagon.

The Pentagon services about 25,000 employees for the U.S. Dept. of Defense. Employees arrive daily from Washington, D.C. and its suburbs over approximately 30 miles of access highways, including express bus lanes and one of the newest subway systems in the country. They ride past 200 acres of lawn to park approximately 8,770 cars in 16 parking lots, climb 131 stairways, or ride 19 escalators to reach offices that occupy 3,705,793 square feet. Transportation needs include moving employees to the Marc Center building, which is not served by the Metro or regional transport services.

The site also has an incinerator operating 24/7.

Renovations are currently underway at the Pentagon. When renovations are completed, the new space will include a return to open office bays, with a new Universal Space Plan of standardized office furniture and partitions developed by Studios Architecture.



Because the Pentagon is host to several thousand employees, plans for the site should include staff and administrative input regarding how to implement renovations without compromising productivity and safety.

### **Pentagon City**

Located at 1100 S. Hayes St., Pentagon City is bound by Army-Navy Drive to the north, S. Eads Street to the east, 18<sup>th</sup> Street South to the south and S. Joyce Street to the west. The site is located immediately south of the Pentagon and due west of Crystal City.

Pentagon City, at approximately 133 acres, is a high density, mixed use community around the Pentagon City Metro station. It is comprised of office, commercial and retail uses with single-family housing around the edges. Located within Pentagon City is the Fashion Center at Pentagon City (shopping mall), Pentagon Row (mixed use retail and residential development), Harris Teeter grocery store, Pentagon Centre shopping center which consists of Costco, Marshalls, Best Buy, and other big box retail stores, South Hampton Condominiums, Metropolitan Park residential development, two hotels, and an 11-acre park.



Built in 1988, the Fashion Centre is approximately 1,019,300 square feet and features four stories of retail space that includes 172 stores, a food court, and a 6-screen movie theater. The lower level of the mall is directly connected with the Washington Metro blue line. A nine tower office building and Ritz Carlton hotel are connected to the mall. There are 4,300 structured parking spaces built for the mall.



Development in the area is governed by the Pentagon City Phased Development Site Plan (1976) and the Pentagon Centre Phased Development Site Plan approved in 2008. Under the Pentagon City PDSP, the multi-phase Metropolitan Park Residential Development is being built with new roads and parks. The area is also planned for hotels on the remaining undeveloped parcels. Under the Pentagon Centre PDSP, new retail, residential, office and hotel buildings are planned in phases around the existing Metro Station and Costco and other big box retail

until such time as their leases expire.

There are numerous property owners in the surrounding neighborhood including Vornado and KIMCO realty. The Aurora Highlands Civic Association is very active and engaged in local land use decisions.

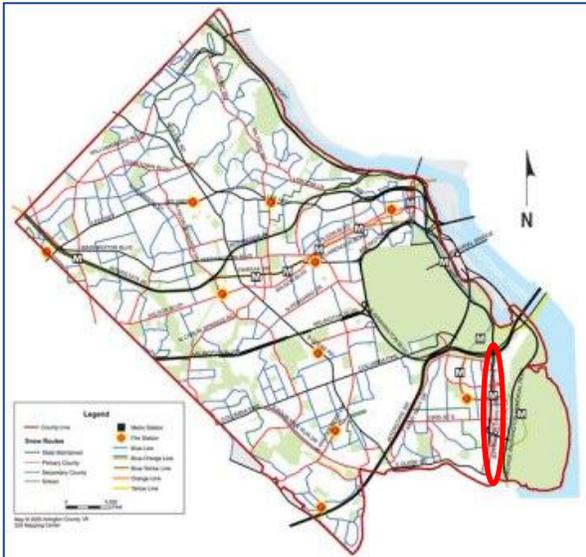
### **Potomac Yard**

Potomac Yard refers to the neighborhood that straddles southeastern Arlington County and northern Alexandria, Virginia, bounded by U.S. Route 1, the George Washington Memorial Parkway, and the Four Mile Run.



The Potomac Yard Phased-Development Site Plan (PDSP) was adopted by the Arlington County Board in 2000. The site is divided into six land bay areas to be developed in phases. Full build-out of the PDSP was anticipated take approximately 15 to 20 years. The developers envisioned 2.94 million sq. feet of office/commercial space, 1 million sq. feet of residential space and 469,835 sq. feet of hotel space for the tract 50-acre tract. The Commercial/office space component of the Potomac Yard Development consisted of two towers referred to as One and Two Potomac Yard,

which represented one of the first "green," new speculative office building projects in the Washington, DC area. Two twelve-story buildings total 654,000 SF and consist of office and retail spaces. One and Two Potomac Yard earned LEED Gold for New Commercial Construction (NC) certification. Construction of the buildings began in 2004 and was completed in May 2006.



The Crystal City/Potomac Yard Corridor Transit Improvements Project will provide high-capacity and high-quality bus transit services to the Potomac Yard area. Build-out of Potomac Yard over the next 5-10 years will result in a substantial increase in new retail, office, hotel, and residential space. The new transit system will add transportation capacity along the corridor and provide better connections to Metrorail and other activity centers in the area. The transit improvements are being phased in to accommodate new growth being planned in each jurisdiction; the rate of implementation varies with each jurisdiction's development plans. Discussion is underway to develop additional strategies to link transit improvements, such as the Columbia Pike

Streetcar initiative, together into one comprehensive approach.

The Transit Improvements Project is jointly sponsored by Arlington County and the City of Alexandria in cooperation with the Washington Metropolitan Area Transit Authority (WMATA) and the Virginia Department of Rail and Public Transportation (DRPT).

### Reagan National Airport

Ronald Reagan Washington National Airport (DCA) is bounded on the East by the Potomac River and Route 400 on the West. The site is approximately 730 acres, with 44 gates in Terminals A, B and C. Terminal A is on the National Register of Historic Places. The airfield contains three runways. The Metropolitan Washington Airports Authority operates both Washington National and Dulles International Airports. The site includes parking, a Metro stop, and a Fixed Base Operator (Signature Flight Support) which serves the general aviation community with



31,000 square feet for terminal, administrative, and office space located in Hangar 7 at the south end of the Airport.



Terminal A has approximately 132,000 square feet of floor space, while Terminal B/C has 1 million square feet of floor space spread over three levels. Passengers have direct connections to the Metrorail and public parking garages via enclosed pedestrian bridges and tunnel. There are nearly 100 shops and restaurants in the Airport Terminals with a mix of national, local and regional retail and food concessions. The buildings are served by district heating and cooling.

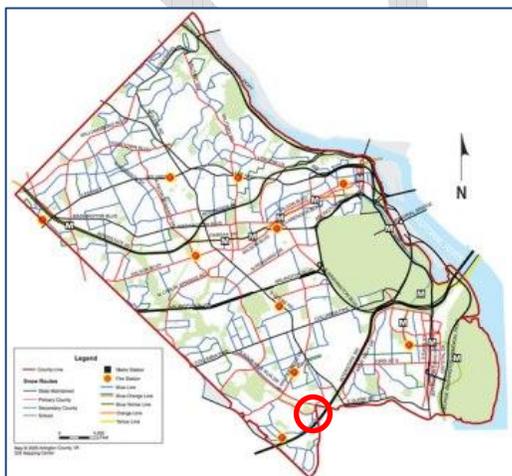
Metropolitan Washington Airports Authority is one of the DCA's major stakeholders, and a representative of MWWA currently sits on the Community Energy and Sustainability Task Force.

### Shirlington

The Village at Shirlington was approved by the County Board as a Phased Development Site Plan (PDSP), which established the uses, densities, heights, parking locations, transportation facilities, utilities, and community facilities for the area in conceptual form. The PDSP, comprising 27.23 acres, is bounded by I-395 to the southeast, Arlington Mill Drive and Four Mile Run to the north, and the Arlington County Trades Center to the west.



The Village at Shirlington is now a vibrant destination with a walk-able main street lined with restaurants and local retailers, an art house cinema, a two-level grocery store, a state-of-the-art library, as well as one regional and two smaller theater companies. Shirlington embodies mixed-use development with its 2,800 multifamily rental and condominium units, 335,395 square feet of office space in four buildings, 217,445 square feet of retail space, cultural facilities, a 142- room hotel, Arlington's first enclosed bus transfer station, and several garages and surface parking lots, most sharing parking among various uses.



Shirlington includes 15 affordable housing units, and \$900,000 was contributed to the County's Affordable Housing Reserve Fund to provide additional affordable units. All the planned development in the Village at Shirlington in Phases I and II of the PDSP to date has been built out.

The overarching goal for Shirlington is to become a model urban, residential, shopping and entertainment destination.





varying age and condition, totaling 78,000 square feet, used by the Department of Human Services.

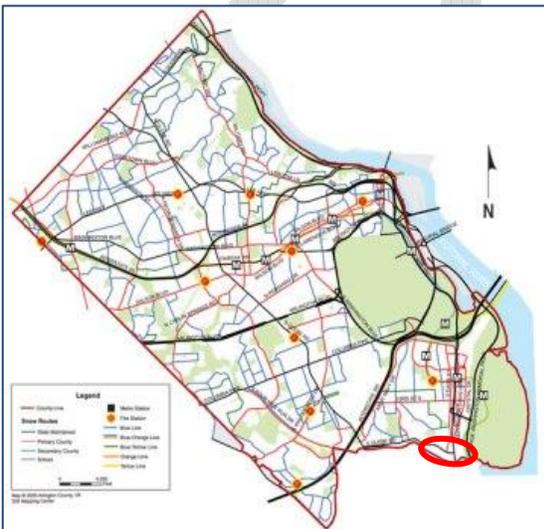
The hospital was renovated in 2005 and features a 530,000 square foot primary facility, consisting of several buildings of various ages linked together. Two additional medical office buildings, operated by others, are on the roughly 12-acre campus. The hospital has primary and secondary electrical service feeds, as well as emergency back-up generators in case of electric supply interruption.

**Wastewater Treatment Plant**

The Arlington Water Pollution Control Plant (WPCP) is located in South Arlington on 35 acres of land in a residential/commercial neighborhood. It is bordered by S. Glebe Rd. to the north, Four Mile Run stream to the south, S. Arlington Ridge Rd. to the west, and Jefferson Davis Hwy to the east.



The original plant buildings were constructed in 1937 and were upgraded several times from the 1950s through the 1990s. The 30 million gallon per day (mgd) plant treats flows from nearly all of Arlington, as well as



sections of Alexandria, Fairfax County, and Falls Church City. The remainder of the Arlington flow is processed at the Blue Plains Plant in Washington DC. The WPCP uses fine bubble diffusers in an aerobic process to remove nitrogen and other biological nutrients. The typical peak power consumption at the plant is about 4.5 MW, and it consumes about 28 million kWh and 125,000 therms per year. On the basis of energy use per gallon of water treated, the plant remains inefficient compared to its peers.

The plant is now under renovation to increase capacity to 40 mgd and to meet increasingly strict state and federal regulations. This \$568 million upgrade will be completed in 2011. A new emergency electric generation plant is under construction to provide up to 7.5 MW of power to the plant in case of power outages. The fixed boundaries and geography of this urban facility hinder energy-efficient process optimization; put plainly, we pump uphill during the treatment process.



The neighborhoods of Aurora Highlands and Arlington Ridge are stakeholders to the north. Four Mile Run to the south receives plant output. Urban Crystal City and the Potomac Yard commercial development are immediately to the east, across Jefferson Davis Highway.

DRAFT

# Appendix H

## Sample of Scope of Work Integrated Energy Master Plan for Scale Project

The CES Task Force recommends that each Scale Project and neighborhood develop a local detailed energy plan. These will be distinct for each neighborhood, depending on the local characteristics and community structure. Crystal City is one of the four scale projects that have been identified as a high probability in the CES Task Force Final Report.

The Scope of Work for developing the Integrated Energy Master Plan for this project is included as an example typical of a high density neighborhood designated as a district energy candidate. Note that the outline structure and numbering in this Appendix from here forward is separate from the other sections in the document.

DRAFT

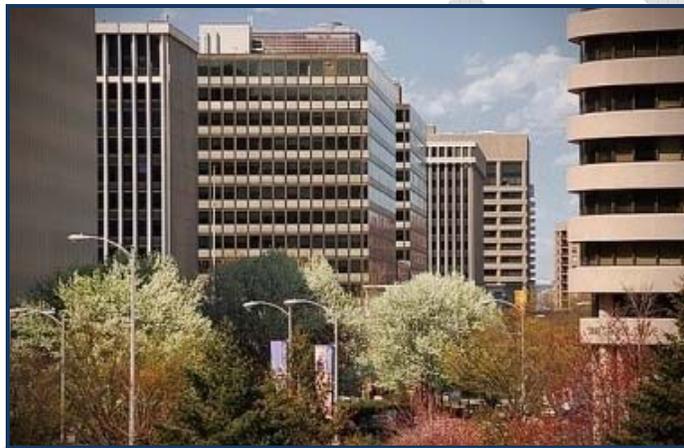
***CRYSTAL CITY***  
***DECISION GRADE INTEGRATED ENERGY MASTER PLAN***

Scope of Work for Request for Proposal

**DRAFT**

*Version dated August 21<sup>st</sup>, 2010*

*Prepared for*  
Arlington County – Vornado – WGL Holdings, Inc.



Prepared by Garforth International llc  
*(Preparation of this draft funded under Arlington County Community Energy Project Contract No. 439-09)*

# REQUEST FOR PROPOSAL

## Decision-Grade Integrated Energy Master Plan (DG-IEMP) for Crystal City

### 1. BACKGROUND TO RFP

This is a Request for Proposal (RFP) for Consulting Services for a Decision-Grade Integrated Energy Master Plan for Crystal City (IEMP) issued by a Consortium (Consortium) consisting of Arlington County (County), Vornado/Charles E. Smith (Vornado), and WGL Holdings, Inc (WGLH).

The Crystal City Site (Site or Crystal City) will enter a period of major renovation and restructuring over the coming years. The Crystal City Sector Plan (Sector Plan) process has already started between Vornado and the County. The Sector Plan is targeted to be completed by September 2010. For the purposes of this Request for Proposal, Crystal City will be defined identically to the Sector Plan. Figure 1 shows the boundaries.

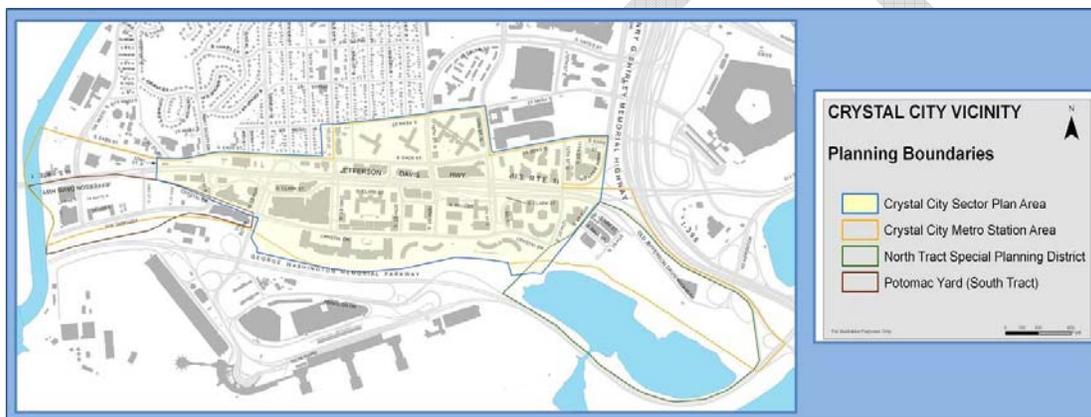


Figure 1: Boundaries of Crystal City for IEMP Purposes

In January 2010, the County initiated the development of a comprehensive Community Energy and Sustainability Task Force Report (CES Task Force Final Report) aimed at substantially reducing the energy use and energy related greenhouse gas (GHG) emissions of the County as a whole, while improving the overall competitiveness of the County and the quality and reliability of its energy services.

The CES Task Force Final Report uses 2007 as its baseline year and has a planning horizon to 2050. The CES Task Force Final Report is scheduled to be considered by the County Board in spring 2011. The headline target of the CES Task Force is to reduce energy-related GHG emissions per resident from the 2007 baseline of 13.4 metric tons to 3.0 metric tons by 2050. This includes energy use in residential and non-residential buildings and for transportation for all public and private uses.

In May 2010, the CES Task Force Final Report Task Force, a community body set up to oversee the CES Task Force Final Report development process, selected Crystal City as one of four high-priority potential Energy Scale Projects (ESP). Each ESP will be expected to develop an IEMP over the coming months. The final recommendations of the IEMP, provided they are accepted by the Consortium, shall be integrated into the overall planning process for Crystal City.

Further background on the CEP process is available on the County web site (<http://www.arlingtonva.us/departments/DES-CEP/CommunityEnergyPlan/CommunityEnergyPlanMain.aspx>)

## **2. CRYSTAL CITY GENERAL BACKGROUND**

Crystal City is currently one of the largest energy consuming areas of Arlington County, using 19% of all energy and creating 20% of all GHGs of the entire County total.

The Sector Plan anticipates deep renovation and repurposing of existing structures, along with substantial increases in total finished commercial and retail space, hotel rooms, and housing units. The summary of the current sector planning is included in Appendix 1.

The Arlington County CES Task Force Final Report will include Narratives for each of the four priority Energy Scale Projects. The draft Crystal City Scale Project Narrative is included in Appendix 2, and includes additional background.

## **3. IEMP ASSESSMENT FRAMEWORK**

The IEMP will evaluate the feasibility of adopting an integrated approach to efficient energy delivery and usage, increased energy efficiency, and optimized energy supply for Crystal City. The feasibility of the integrated approach will be assessed on energy-related investment returns; competitiveness of Crystal City as a whole; and the environmental impact in terms of avoided GHG. The overriding goal of the IEMP should be to radically reduce the environmental impact of total energy use and to provide high commercial and customer attractiveness.

The specific elements that are to be evaluated are detailed in the Scope of Work found in Section 6 of this RFP.

## **4. OVERALL TEAM FRAMEWORK**

The IEMP Team (Team) will include members and skills from both the Consortium and from the responder to this RFP (*Bidder*). Irrespective of the final mix of the Team between Bidder and Consortium membership, the accountability for the completion of the IEMP meeting the Scope of Work (Section 6) lies with the Bidder.

The Team needed to successfully complete the IEMP will have a wide range of experience and skills summarized in Figure 2.

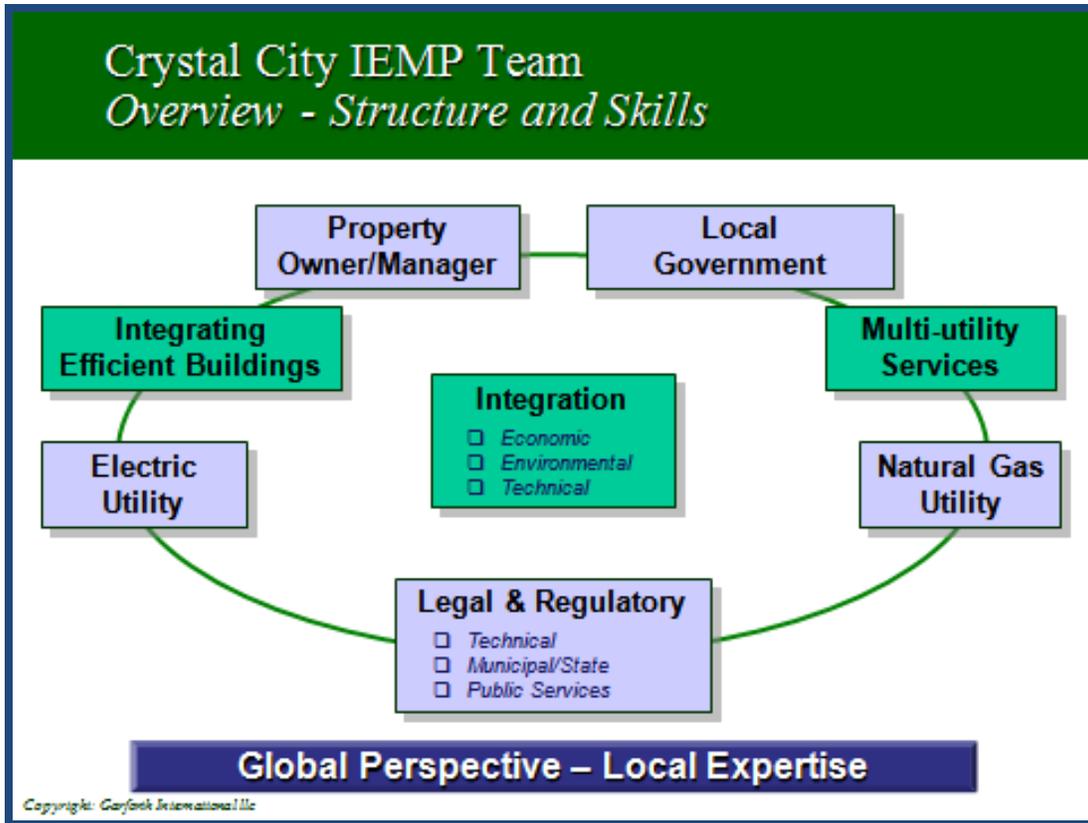


Figure 2: IEMP Team Structure and Skills

The Consortium is looking for a Bidder that can provide expertise highlighted in green in Figure 2. The successful Bidder will be able to demonstrate experience and expertise in these three areas, including:

**Integrating Efficient Buildings**

- US residential and non-residential building practices, HVAC and BMS systems
- US residential and non-residential building codes
- EU building codes, practices, performance, and performance validation (for benchmarking purposes)
- Building and community energy demand modeling for new construction and deep renovation
- Matching modeled energy data to metered data for baseline purposes
- Developing and modeling energy demand scenarios at both building and community level
- Integrating clean and renewable energy sources including district heating, district cooling, and on-site combined heat and power into both existing and new buildings
- Impacts of efficiency scenarios on construction and building operating costs

**Multi-utility Services**

- Designing, constructing, and operating community multi-utility energy networks delivering district energy (heating and cooling) in addition to natural gas and electricity
- Developing and evaluating centralized and decentralized heating and cooling generation strategies including combined heat and power generation from small-, medium-, and large-scale plants
- Integration of reliable and economically feasible renewable energy sources in both building and community systems

- Integration of smart multi-utility energy metering and management systems
- Impacts of energy supply and distribution scenarios on investments and supply system operating costs and revenues
- Impacts of energy supply and distribution scenarios on community direct and indirect greenhouse gas emissions

### **Integration**

- Technical aspects of integrating efficient buildings with multi-utility supply options
- Investment, operating costs, and revenue aspects of integrating efficient buildings with multi-utility supply options
- Greenhouse gas aspects of integrating efficient buildings with multi-utility supply options
- Developing risk scenarios for differing energy prices, climate legislation, and regulatory outlooks
- Modeling business performance from the property owners/operators' standpoint
- Modeling business performance from energy services investors' and operators' standpoints
- Familiarity with different energy services, and energy investment business and operating models from the USA and elsewhere
- Familiarity with current and planned energy and climate legislation in the USA and elsewhere
- Familiarity with GHG emissions and efficiency monetization in both voluntary and regulated markets

In general, integrated community level approaches to efficiency and supply of urban energy services are common in Scandinavia, Germany, and other areas of central and northern Europe. A Team familiar with the technical, economic, and business approaches of various energy efficiency and supply scenarios from around the world is essential to ensure that best practices are recommended. At the same time, there must be a high level of US construction and building science knowledge.

The Bidder will be asked to include resumes of key personnel, similar project experience background including references, and samples of relevant project reports.

It is expected that some of the required expertise and local knowledge will be provided by the Consortium members. This could include:

- Details of the Crystal City build-out schedule
- Ownership of property
- Real estate market values
- Lease and purchase contracts' structures
- Virginia public service regulatory frameworks
- County regulatory frameworks including awarding rights-of-way to district energy
- Some business and institutional goals and constraints; short-, medium-, and long-term
- Baseline and historic electricity and gas consumption data from existing buildings and utility deliveries
- Local renewable portfolio standards and anticipated RPS programs
- Natural gas supply and infrastructure

The Bidder should also indicate if they have focused expertise in any of these areas.

## **5. INTEGRATED ENERGY MASTER PLANNING**

The IEMP shall propose options to radically reduce the environmental impact of energy use while enhancing comfort, convenience, and cost for the owners and building operators. Total energy usage should be substantially less than a comparable development elsewhere in Virginia. The indicative target is that the energy use will be 60% less than current practice by 2040, with GHG levels being at least 70% less.

The IEMP shall recommend integrated approaches to providing Crystal City with energy services respecting the following goals:

1. To meet the commercial real-estate expectations of Vornado and other property owners in Crystal City in terms of market attractiveness and construction costs
2. To be sufficiently flexible to grow with the anticipated build out of Crystal City while retaining price competitiveness
3. To be sufficiently flexible to add neighboring areas to Crystal City if this should prove to be desirable in future – possible energy service extensions could include the Pentagon City, Potomac Yard, and the planned Arlington County Aquatic Center
4. To minimize direct and indirect greenhouse gases caused by energy use of Crystal City
5. To maximize the energy service reliability and affordability to all end users in Crystal City
6. To be sufficiently flexible to incorporate new operating strategies and technologies as they emerge
7. To be able to be integrated into a future wider County energy services concept through appropriate technology and operating business model choices
8. To be a role model of effective sustainable community design to enhance the competitiveness of Crystal City and to encourage proliferation of similar approaches

## **6. SCOPE OF WORK**

The development of the IEMP shall be based on a number of clearly structured scenarios. The IEMP scenarios shall be reasonable combinations of the followings attributes:

- Buildings Energy Demand Estimates
- Buildings Energy Supply Estimates
- Site Additional Energy Demand Estimates
- Site Control and Interconnection
- Climate Change Legislation
- Energy Pricing Estimates
- Energy and Climate Performance Validation
- Investments
- Legislative and Regulatory (excluding financial incentives)
- Financial Incentives
- Ownership and Operating Structure
- Market Pricing

The timeline that should be considered for the assessment is the build-out timetable for Crystal City as defined in the summary of the current sector planning shown in Appendix 1 of this RFP. Financial and economic calculation will take into account a period up to 30 years. The final choice of scenarios will be a Team decision as part of the IEMP process.

The IEMP will address the following topics:

Topic	Description
1	<p>Buildings Energy Demand Estimates</p> <p><i>Generally will be building specific with some grouping by type</i></p> <ul style="list-style-type: none"> <li>■ <i>Base case:</i> <ul style="list-style-type: none"> <li>■ <i>Vornado's minimum commitment (Local Code is default)</i></li> </ul> </li> <li>■ <i>Scenario cases:</i> <ul style="list-style-type: none"> <li>■ <i>Renovation: XX % below current practice – may be time related</i></li> <li>■ <i>New Construction: YY % above Base-case – may be time related</i></li> </ul> </li> </ul>
2	<p>Buildings Energy Supply Estimates</p> <ul style="list-style-type: none"> <li>■ <i>Base case:</i> <ul style="list-style-type: none"> <li>■ <i>Conventional boiler/furnace and electric AC and grid electricity including, where applicable, electricity for heating for the same percentage of buildings that are currently not using shared infrastructure through the Tenant Service Center</i></li> <li>■ <i>Percentage of buildings with shared infrastructure through the Tenant Service Center will remain constant, with technologies and efficiencies at today's level</i></li> </ul> </li> <li>■ <i>Scenario cases - agreed mix of:</i> <ul style="list-style-type: none"> <li>■ <i>In-building cogeneration and/or renewables</i></li> <li>■ <i>On-site cogeneration and/or renewables</i></li> <li>■ <i>District energy (heating and/or cooling)</i></li> <li>■ <i>Conventional boiler/furnace and electric AC and grid electricity</i></li> </ul> </li> </ul>
3	<p>Additional Crystal City Energy Demand Estimates</p> <ul style="list-style-type: none"> <li>■ <i>Base case:</i> <ul style="list-style-type: none"> <li>■ <i>Current construction densities with conventional supply (buildings)</i></li> </ul> </li> <li>■ <i>Scenario case:</i> <ul style="list-style-type: none"> <li>■ <i>Higher construction densities</i></li> </ul> </li> </ul>
4	<p>Crystal City Smart Metering and Energy Management</p> <ul style="list-style-type: none"> <li>■ <i>Base case:</i> <ul style="list-style-type: none"> <li>■ <i>Individual BMS systems for each building</i></li> <li>■ <i>No interoperability guidelines for BMS, supply metering and controls</i></li> </ul> </li> <li>■ <i>Scenario cases to capture coincidence benefits – agreed mix of:</i> <ul style="list-style-type: none"> <li>■ <i>Interoperable BMS architecture between buildings</i></li> <li>■ <i>BMS interconnection standards to allow future integration</i></li> <li>■ <i>Site energy supply control and metering integrated with BMS architecture</i></li> <li>■ <i>Common metering information standards for all energy types</i></li> <li>■ <i>District energy-ready installation of heating, cooling and distributed generation units to allow future integration</i></li> </ul> </li> </ul>
5	<p>Climate Change Legislation</p> <ul style="list-style-type: none"> <li>■ <i>Base case:</i> <ul style="list-style-type: none"> <li>■ <i>No financial value from reducing GHG emissions (in USA)</i></li> </ul> </li> <li>■ <i>Scenario case:</i> <ul style="list-style-type: none"> <li>■ <i>National legislation in force similar to HR2454</i></li> </ul> </li> </ul>
6	<p>Energy Pricing Estimates</p> <ul style="list-style-type: none"> <li>■ <i>Base case:</i> <ul style="list-style-type: none"> <li>■ <i>Evolution of prices using widely recognized market assumptions</i></li> </ul> </li> <li>■ <i>Scenario case:</i> <ul style="list-style-type: none"> <li>■ <i>Evolution of energy prices assuming carbon pricing risk from HR2454 or similar</i></li> </ul> </li> </ul>

7	<p><b>Energy and Climate Performance Validation</b></p> <ul style="list-style-type: none"> <li>■ <i>Base case:</i> <ul style="list-style-type: none"> <li>■ <i>No systematic approach with year-on-year energy efficiency loss</i></li> </ul> </li> <li>■ <i>Scenario case:</i> <ul style="list-style-type: none"> <li>■ <i>Energy performance labeling (or similar) at initial point of sale</i></li> <li>■ <i>Energy performance labeling (or similar) at point of resale or lease</i></li> </ul> </li> </ul>
8	<p><b>Investments</b></p> <ul style="list-style-type: none"> <li>■ <i>Base case:</i> <ul style="list-style-type: none"> <li>■ <i>Used as reference level</i></li> </ul> </li> <li>■ <i>Scenario cases (each incremental to Base case):</i> <ul style="list-style-type: none"> <li>■ <i>Efficient building shell</i></li> <li>■ <i>Controls and metering</i></li> <li>■ <i>District heating and cooling</i></li> <li>■ <i>Alternative energy generation and supply (e.g. cogeneration and renewable energy)</i></li> </ul> </li> </ul>
9	<p><b>Legislative and Regulatory (excluding financial incentives)</b></p> <ul style="list-style-type: none"> <li>■ <i>Base case:</i> <ul style="list-style-type: none"> <li>■ <i>Current or confirmed future status that has passed formal hurdles/votes</i></li> </ul> </li> <li>■ <i>Scenario cases:</i> <ul style="list-style-type: none"> <li>■ <i>Possible future picture(s) agreed by Team</i></li> </ul> </li> </ul>
10	<p><b>Financial and other Market Incentives</b></p> <ul style="list-style-type: none"> <li>■ <i>Base case:</i> <ul style="list-style-type: none"> <li>■ <i>Current or a confirmed future status that has passed formal hurdles/votes</i></li> </ul> </li> <li>■ <i>Scenario cases (See Note 2):</i> <ul style="list-style-type: none"> <li>■ <i>Current incentives are not available</i></li> <li>■ <i>Clean and renewable energy including cogeneration is at least using net-metered conditions</i></li> <li>■ <i>Above plus marketing approaches and incentives agreed by the team including marketing, meeting customers' own environmental targets and needs, and restructuring leases and tax incentives.</i></li> </ul> </li> </ul>
11	<p><b>Ownership and Operating Structure</b></p> <ul style="list-style-type: none"> <li>■ <i>Base case:</i> <ul style="list-style-type: none"> <li>■ <i>Currently planned property ownership and leasing conditions</i></li> </ul> </li> <li>■ <i>Scenario cases - agreed mix of:</i> <ul style="list-style-type: none"> <li>■ <i>District Energy Utility ownership of selected energy supply and distribution assets, including recommendations on structure and governance</i></li> <li>■ <i>Currently planned vertical property ownership and leasing conditions</i></li> <li>■ <i>Evolutionary transfer of ownership of energy supply and distribution assets to District Energy Utility</i></li> <li>■ <i>Restructured leases to align financial interest in efficiency</i></li> </ul> </li> </ul>
12	<p><b>Market Pricing of Property</b></p> <ul style="list-style-type: none"> <li>■ <i>Base case:</i> <ul style="list-style-type: none"> <li>■ <i>Currently estimated sale and rental values and occupancy</i></li> </ul> </li> <li>■ <i>Scenario cases:</i> <ul style="list-style-type: none"> <li>■ <i>Enhanced sales value as function of energy operating costs/other factors using assumptions agreed by the Team (see Note 1)</i></li> <li>■ <i>Enhanced rental value as function of energy operating costs/other factors using assumptions agreed by the Team</i></li> <li>■ <i>Increased occupancy as function of energy operating costs/other</i></li> </ul> </li> </ul>

<i>factors using assumptions agreed by the Team</i>	
13	<p>Analyses</p> <ul style="list-style-type: none"> <li>■ <i>All analyses have to be done relative to Base case.</i></li> <li>■ <i>All agreed scenarios should have been done for at least two energy and carbon cost profiles.</i></li> <li>■ <i>The model should be structured to allow doing a series of “what-if” assessments.</i></li> <li>■ <i>All costs and benefits shall be calculated on a yearly basis as well as the estimation for all key variables.</i></li> <li>■ <i>Scenarios analyses must to be done from the perspective of the property developers/owners as well as of the District Energy Utility.</i></li> </ul> <p>The minimum analysis sets will be:</p> <ul style="list-style-type: none"> <li>■ <b><i>Internal rate of return (IRR)</i></b></li> <li>■ <b><i>Net present value (NPV)</i></b></li> <li>■ <b><i>Energy use reductions</i></b></li> <li>■ <b><i>Avoided greenhouse gas emissions</i></b></li> <li>■ <b><i>Recommendations including timeline with milestones</i></b></li> </ul>

Notes for Bidder Consideration:

1. There is a growing body of market factors research and data that is indicating enhanced market value of “Green Buildings” to occupants, owners and tenants. These indicate a significant enhancement of rental value or sales value relative to the saving of energy costs. In addition, significant productivity factors are also becoming accepted as data is becoming more available. Lastly, the possibility for future carbon pricing may affect the property and rental values. However, as time goes on, and “Green Building” becomes a market norm as it is in Scandinavia and Germany, this market premium begins to disappear. The Team will agree value enhancement / destruction scenarios as part of the Scenario modeling exercise. The bidder is encouraged to present their suggested approach, background experience and knowledge in evaluating the market value of Green Developments.
2. The successful bidder will demonstrate knowledge and ideally experience of successful marketing approaches and incentives that can be applied to the sale and leasing of Green Developments. The Team as a whole will agree the extent these will be factored into the Scenarios as a value enhancement or value risk. Specifically a working knowledge of the property leasing and purchase requirements of GSA and the US Department of Defense is required.

**7. REQUIRED DELIVERABLES**

Proposal will be for the following deliverables:

1. Decision Grade Integrated Energy Master Plan – Full Report – The Full Report should also include an Executive Summary suitable for use as a stand-alone document for extended distribution as needed.
2. Decision Grade Integrated Energy Master Plan– Presentation – Bidder will present findings and recommendations in an oral presentation format. The presentation slides as used will also be submitted as part of this deliverable.

3. Meeting participation in 3 (three) or more milestone meetings to present and discuss findings and recommendations. These will include:
  - Project Kick-off Meeting
  - Mid-point Project Review and Developmental Recommendation Alignment
  - Final Recommendation Presentation (also see Deliverable 2)
  - Others as determined

## **8. REQUIRED TIMING**

Deliverable 1 shall be delivered 180-days after signing of final contract. The Project Kick-off Meeting should be scheduled as soon as possible following contract signing, subject to mutual scheduling of the Team.

The Final Recommendation Presentation shall be completed no later than 30 days following the delivery of Deliverable 1, subject to mutual scheduling of the Team and stakeholders.

Deliverable 3 will be held at the discretion of the Consortium throughout the project as needed, subject to mutual scheduling of the Team.

## **9. RESPONSE CONTENTS**

In addition to the proposal for the deliverables outlined in Section 7, the successful Bidder is expected to provide at least the following information:

- Detailed resumes of the proposed consulting team highlighting the elements specifically relevant to this Proposal
- Organization Chart of the overall IEMP Team showing the Bidders' Team members by name and role, and showing the Consortium Members by role only.
- General business background of the Team Members' home companies or organizations, if the Bidder's Team is from multiple entities. As long as the Team has the appropriate experience, a structure representing multiple organizations will be viewed as completely acceptable as long as there is a credible project management approach.
- A summary of the detailed sub-tasks and the resources assigned to each in hours for each team members
- Summary of the billing rates for each Team Member
- Summary of Team expertise and experience that highlights their fit to the three areas outlined in Section 4 of this RFP:
  - Integrating efficient buildings
  - Multi-Utility Services
  - Integration

This summary should also address each of sub-bullets in these three main areas, also detailed in Section 4.

If the team also has additional expertise that is relevant to the overall success of the IEMP, this should be highlighted.

- Reference projects that clearly demonstrate large area integrated energy planning, implementation and operating experience of the team members. These may include projects that have completed the detailed energy master planning stage, but have not yet been implemented. They may include projects where team members may have been members of a different team.

- The Consortium is committed to Crystal City being an example of competitive world-class practice. The successful bidder will be asked to clearly demonstrate their awareness and experience with Global Best Practices in all critical area. Specifically, detailed knowledge of EU integrated urban multi-utility energy systems would be expected.

DRAFT

# Appendix I

## Example Heat Plans

In Arlington, 45% of all energy consumed by the county is wasted heat from the generation of electricity. This is also the major cause of greenhouse gas emissions. At the US national level, the picture is comparable.

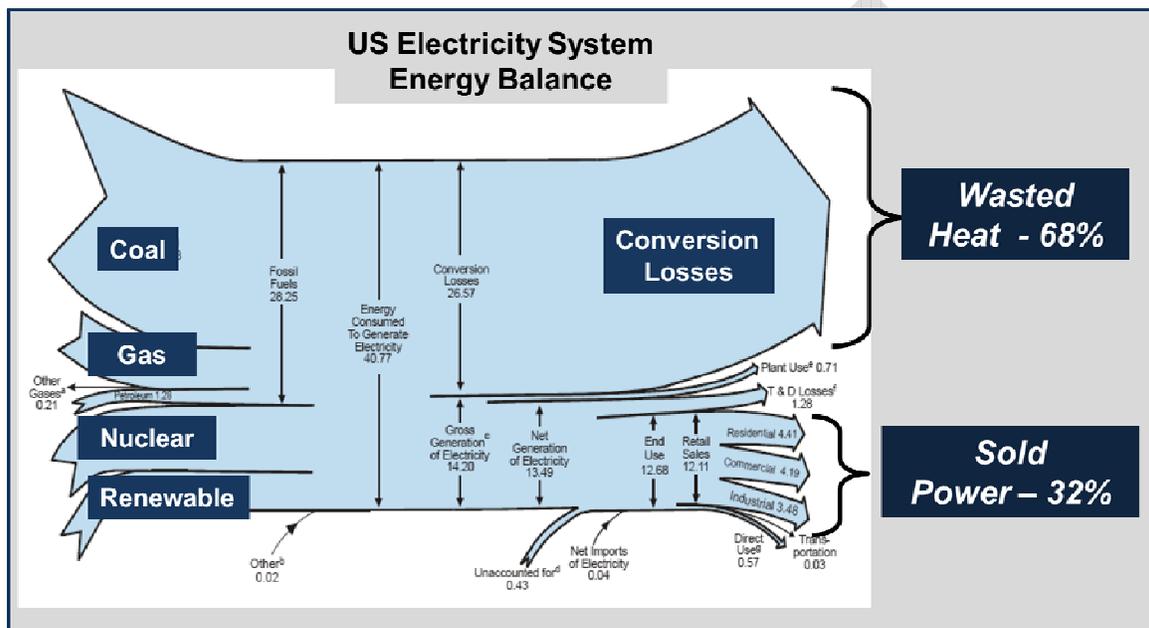


Figure I.1: Energy Balance of the US Electricity Supply System

Nationally, about 40% of all fuels are used for the generation of electricity, shown on the left hand side of the Sankey Diagram in Figure I-1. The majority are converted to electricity in thermal power stations (nuclear, coal and gas). The process wastes most (60 to 70 percent) of the fuel in heat and loses another 3 to 5% in transmission losses. The net deliveries of electricity are only 32% of the potential energy value of the original fuels.

Capturing and using this kind of heat is a key reason why the CES Report is recommending both distributed Combined Heat and Power generation and District Energy Networks to deliver the “waste” heat in the form of saleable heating or cooling. In any community, there are also other forms of heat that can be usefully generated, captured and distributed given the right infrastructure. The list of possible sources is long, and includes gas oil fired boilers; industrial heat waste, municipal waste-to-energy plants; biomass or biogas boilers or CHP, solar thermal collectors, geothermal collectors etc.

A District Energy system allow all these and other heat sources to be combined in a single unified system, greatly reducing waste, greenhouse gas emissions and costs.

The following presentations summarize two communities that are systematically addressing the use of waste and clean heat. The first is the heating and cooling system of St Paul Minnesota, one of the few cities in the USA that is investing and expanding district energy. The second is recent revision of the National Heat Plan for Denmark. Denmark has been systematically

decentralizing their energy system since the 1970's, including a long-term view of district energy as a national utility.

**District Energy – St Paul Minnesota**

# Welcome!

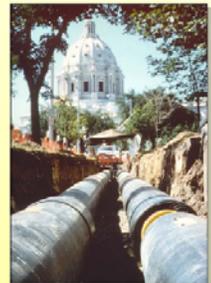


**DISTRICT ENERGY  
ST. PAUL™**

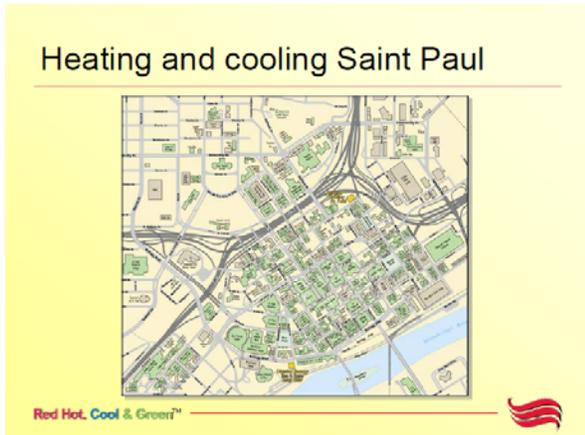
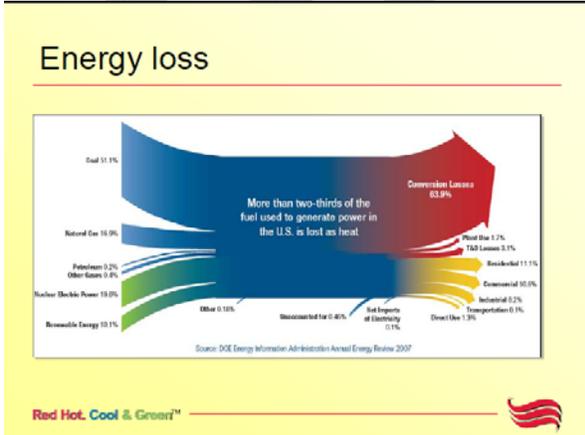
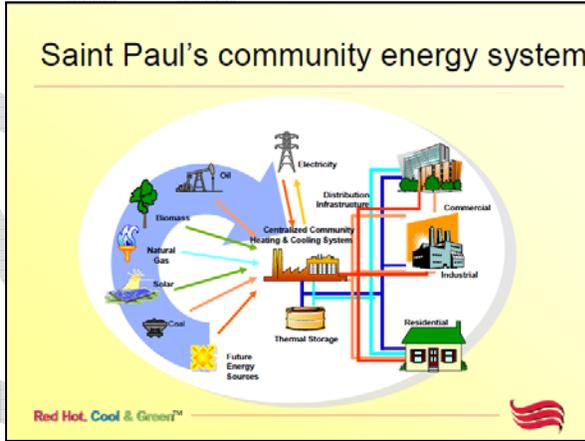
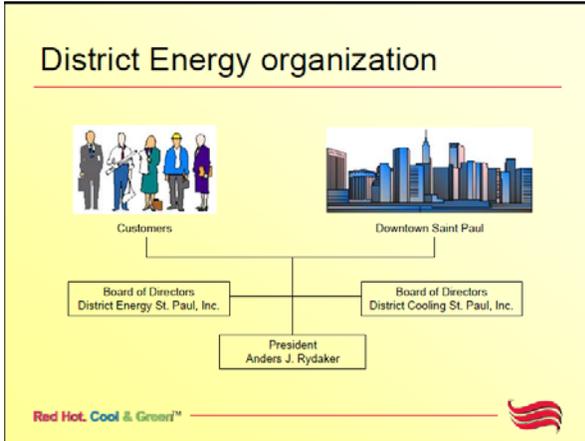
*Greening Saint Paul by using clean, urban wood residue and CHP to heat and cool downtown buildings...*

## Our mission

*"Be the preferred provider of community energy services that benefit our customers, the community and the environment."*



Red Hot, Cool & Green™



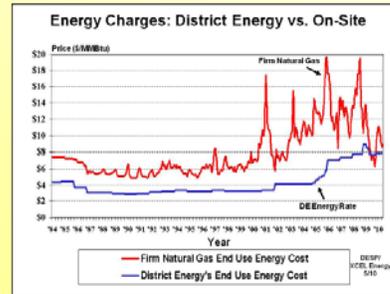
## District Energy today

- Serves more than 80 percent of the downtown area - over 31 million sq. ft.
- Reduced sulfur dioxide and particulate emissions by more than 50 percent
- Twenty-seven years of outstanding reliability and rate stability
- CHP integration shifted fuel use for system away from fossil fuels to primarily renewable fuels

Red Hot, Cool & Green™



## Rate stability



Red Hot, Cool & Green™



## District Cooling St. Paul



Red Hot, Cool & Green™



## District Cooling results today

- Chilled-water demand started at 2,900 tons and has increased to 29,000 tons over 16 years
- Serving more than 60% of the downtown area – approximately 19 million sq. ft.
- Chilled water system includes 6.5 million gallons of storage capacity
- Thermal storage reduced peak-electric demand by as much as 9,000 kilowatts

Red Hot, Cool & Green™



## Bringing “green energy” to Saint Paul



Red Hot, Cool & Green™



## Goal: Enhance Efficiency & Renewable Fuels

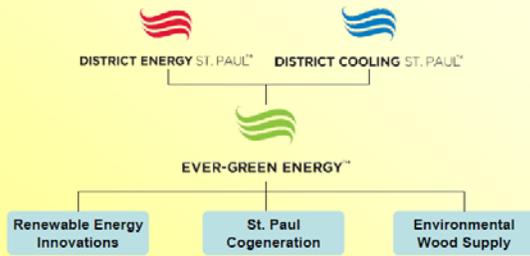
- Community energy systems/District energy
- Based on:
  - Locally-derived renewable fuels
  - Combined heat and power



Red Hot, Cool & Green™



## Company structure



Red Hot, Cool & Green™



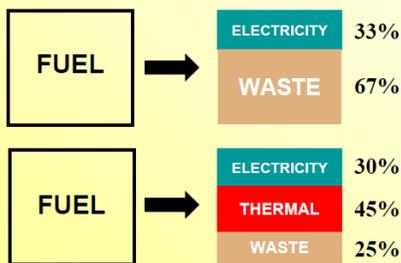
## St. Paul Cogeneration

- 25 MW<sub>e</sub> of electricity to the grid
- 65 MW<sub>th</sub> to the District Energy system
- Fueled by renewable, clean, urban wood residue
- Double the efficiency of conventional electricity-only steam power plants
- Greenhouse gas CO<sub>2</sub> reduced by 280,000 tons per year

Red Hot, Cool & Green™



## Energy efficiency of CHP

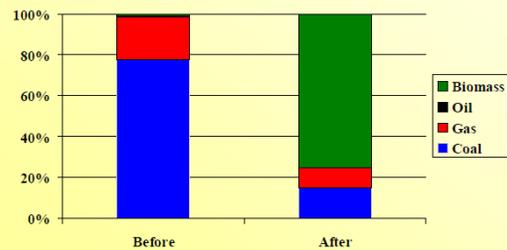


Red Hot, Cool & Green™



## Fuel diversification (2008)

Before and after wood-fired CHP project...



Red Hot, Cool & Green™



## Why wood waste?

- Large quantities in metro area
- Disposal problem
- Economically viable
- Community based



Red Hot, Cool & Green™



## Keys to a successful energy project

- Size of the facility
  - Match with energy demand and fuel availability
- Locate near a thermal load
  - Use CHP to maximize the efficiency and generate additional revenue
- Design for high plant reliability/availability/maintainability
- Community support

Red Hot, Cool & Green™



## Benefits of CHP & biomass

### ✓ Customers



- Competitive energy prices
- Marketing – served by renewable energy

Red Hot, Cool & Green™



## Benefits of CHP & biomass

### ✓ Community



- Community based
- Competitive energy prices
- Marketing opportunities
- Keeps energy dollars local
- Fuels economic growth
- Improves power grid

Red Hot, Cool & Green™



## Benefits of CHP & biomass

### ✓ Environment

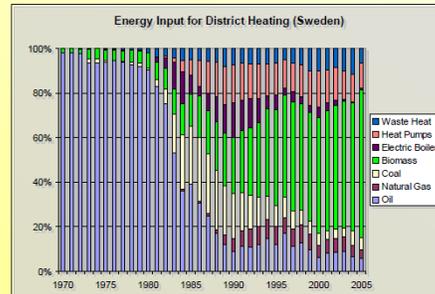


- Decreased emissions
  - Air contaminants
  - Green house gases
- Decreased waste

Red Hot, Cool & Green™



## What is possible?



Red Hot, Cool & Green™



# Thank You!



**DISTRICT ENERGY**  
ST. PAUL™

Michael Burns, Sr. Vice President – Energy Services  
[michael.burns@ever-greenenergy.com](mailto:michael.burns@ever-greenenergy.com); (651) 297-8955





### **Heat Plan Denmark** **a small study with a significant impact**

- Bottom-up R&D study financed by the district heating consumers
- Prepared by an independent team of experts from
  - Rambøll Denmark and
  - Aalborg University
- The first study in Denmark, really to integrate the energy and building sectors – to combine the supply and the demand side
- An eye-opener for the Danish politicians
- Could be a model for other countries

RAMBØLL

Heat Plan Denmark by Anders Dyrelund

Energy Tours CTR FEB 2009

2

## We focus on the overall energy policy objective in the European Union

- The main objective is to reduce the fossil fuel consumption and the CO<sub>2</sub> emission in a cost effective way



- Important EU directives to implement this objective
  - Strategic environmental assessment
  - Combined Heat and Power (CHP)
  - Energy performance of buildings
  - Renewable energy

RAMBOLL

Heat Plan Denmark by Anders Dynkønd

Energy Tours CTR FRB 2009

3

## Most important objectives in the energy policy in Denmark since 1976

- Objectives since 1976
  - Develop the most economic heat supply projects for the society of Denmark
  - Reduce the dependency on oil
  - Promote Combined Heat and Power (CHP)
  - Promote renewable energy



- New additional objectives
  - National obligation to reduce CO<sub>2</sub> emissions outside the CO<sub>2</sub> emission trading scheme
  - Reduce CO<sub>2</sub> emissions for the whole society
  - **To be independent of fossil fuels in the long run ! (2050?)**

RAMBOLL

Heat Plan Denmark by Anders Dynkønd

Energy Tours CTR FRB 2009

4

## Important Danish legislation to implement the policy

- Electricity supply act from 1976
  - all new power capacity since 1976 has been CHP
- Heat supply act from 1979
  - municipal heat supply planning, a new natural gas infrastructure and a substantial increase of district heating
  - optimal zoning of district heating and natural gas networks based on overall economic evaluation for the society of Denmark
  - district heating shifts from fossil fuel boilers to CHP and renewable energy
- This legislation ensures unique least cost integration of power, heat, gas and waste sectors in Denmark
- However, the building sector is not yet fully co-ordinated with the other sectors

RAMBOLL

Heat Plan Denmark by Anders Dynkønd

Energy Tours CTR FRB 2009

5

## Heat plan Denmark focus on the heating sector

- The plan shows how the Danish heating sector has reduced CO<sub>2</sub> emissions from 25 to 10 kg/m<sup>2</sup> since 1980
- The plan shows that this progressive development can continue
  - to achieve a further **50%** reduction before 2020 and
  - to achieve an **almost CO<sub>2</sub> neutral** society before 2030
- The plan is based on an integrated approach, combining
  - optimal end-user heat demand reductions - additional 25% or more?
  - a lower return temperature from building installations - <35°C
  - more district heating (DH) - from 46% up to 63-70% of the market
  - energy efficient use of renewable energy in district heating
  - individual heat pumps, solar heating and wood pellets

RAMBOLL

Heat Plan Denmark by Anders Dynkønd

Energy Tours CTR FRB 2009

6

## How to produce the heat? CHP and surplus wind energy via heat pumps combined with large heat accumulators

District heating which combines

- Large and small CHP
- Electric boilers
- Heat pumps and
- Heat accumulators

Is a precondition for integration of large share of wind energy in Europe

In Denmark the share of wind is growing from 20% towards 70%



RAMBOLL

Heat Plan Denmark by Anders Dyrelund

Energy Tours CTR FRIS 2009

7

## How to produce the heat? Waste to energy CHP

Case: Amagerforbrænding

- the first 100% utilization of waste
- tunnel to Zealand



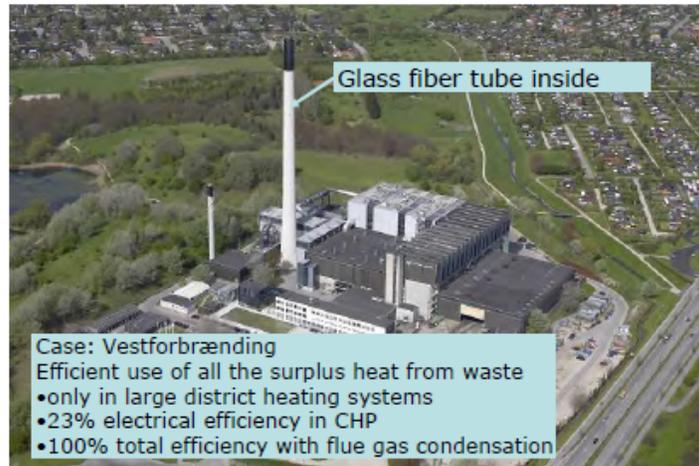
RAMBOLL

Heat Plan Denmark by Anders Dyrelund

Energy Tours CTR FRIS 2009

8

## How to produce the heat? Waste to energy with flue gas condensation



RAMBOLL

Heat Plan Denmark by Anders Dynkønd

Energy Tours CTR FRB 2009

9

## How to produce the heat? Biogas CHP



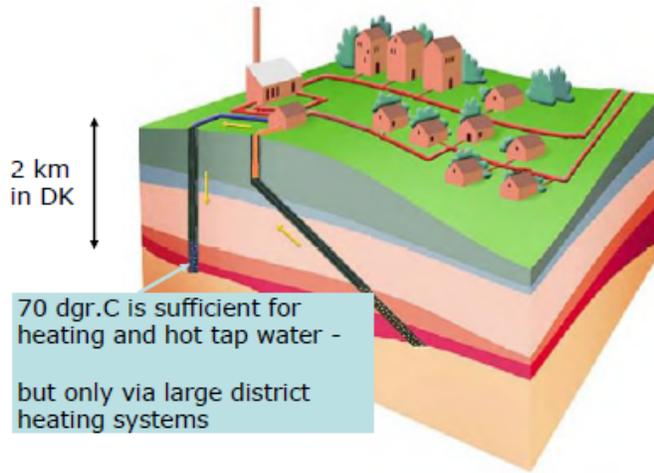
RAMBOLL

Heat Plan Denmark by Anders Dynkønd

Energy Tours CTR FRB 2009

10

## How to produce the heat? Geothermal energy boosted by biomass



70 dgr.C is sufficient for heating and hot tap water -  
but only via large district heating systems

RAMBOLL

Heat Plan Denmark by Anders Dyrholm

Energy Tours CTR FRB 2009

11

## How to produce the heat? Large scale solar thermal plants



6 times more cost effective than individual solar heating

RAMBOLL

Heat Plan Denmark by Anders Dyrholm

Energy Tours CTR FRB 2009

12

## How to produce the heat? Straw



RAMBOLL

Heat Plan Denmark by Anders Dynkønd

Energy Tours CTR FRB 2009

13

## How to produce the heat? Surplus wood chip with flue gas condensation



1000 times more  
environmental friendly  
than wood stoves –  
and twice as efficient



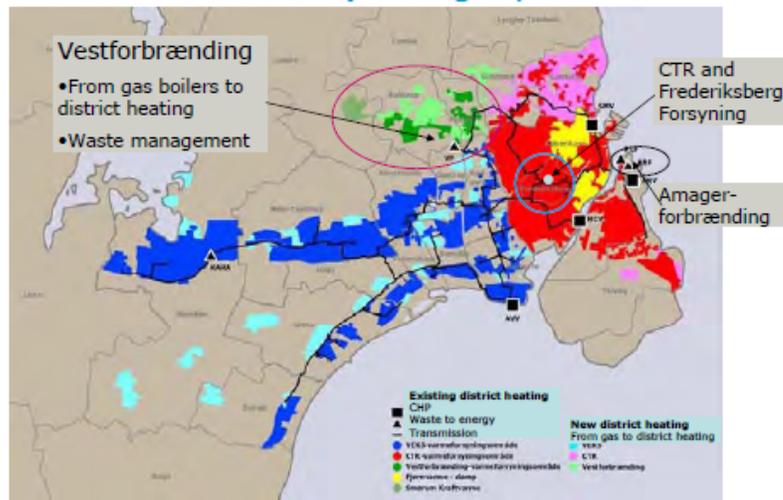
RAMBOLL

Heat Plan Denmark by Anders Dynkønd

Energy Tours CTR FRB 2009

14

## Integrated district heating systems Case: Greater Copenhagen, 2009



RAMBOLL

Heat Plan Denmark by Anders Dynelund

Energy Tours CTR FRB 2009

15

## New sustainable buildings interact with the energy infrastructure

### Case: New Ramboll office in Kolding:

- Close to public transport
- District heating with
- Waste to energy CHP with flue gas condensation
- "District Cooling" from near by water
- Low temperature floor heating down to 25 dgr. C
- High temperature free cooling through the same floor tupe system



RAMBOLL

Heat Plan Denmark by Anders Dynelund

Energy Tours CTR FRB 2009

16

## Heat Plan Denmark statistics from 1980–forecast to 2050

- Statistics from 1980–2006
  - Danish Energy Authority
  - More specific information from 430 district heating companies
- Forecast 2006–2050 based on bottom-up analysis for all 420 DH companies grouped in 10 clusters, which reflects the average
  - DH from 46% to 63% in 2020
  - DH up to 70% before 2050
  - 25% heat demand reduction
  - return temperature down to 35 °C in 2030
- State of the art of to-days technologies

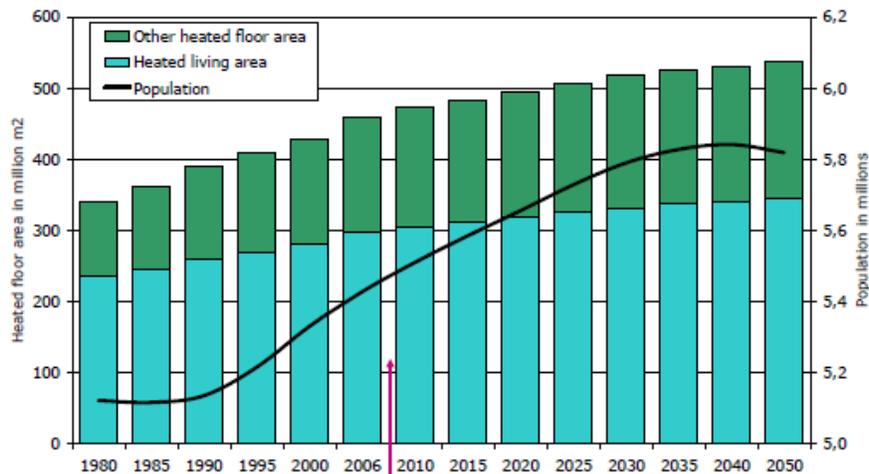


Heat Plan Denmark by Anders Dynlund

Energy Tours CTR FRB 2009

17

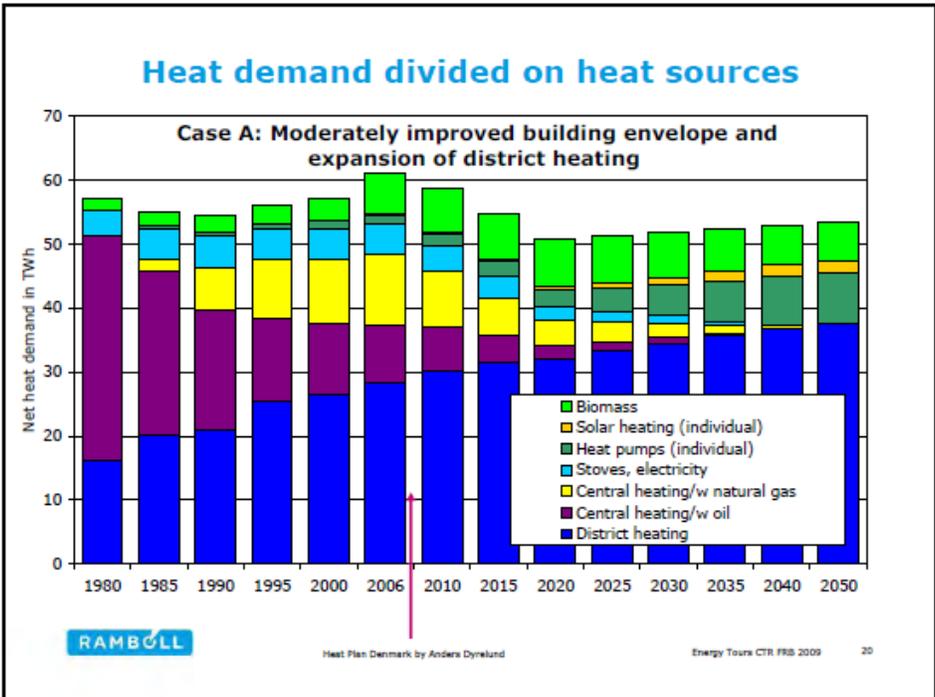
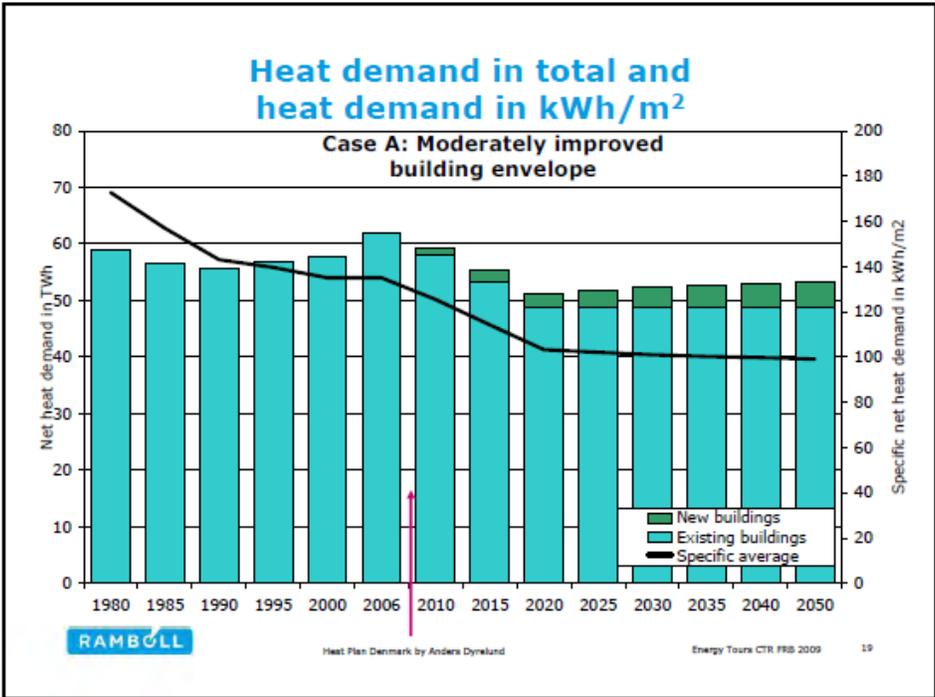
## Heated floor area and population grows



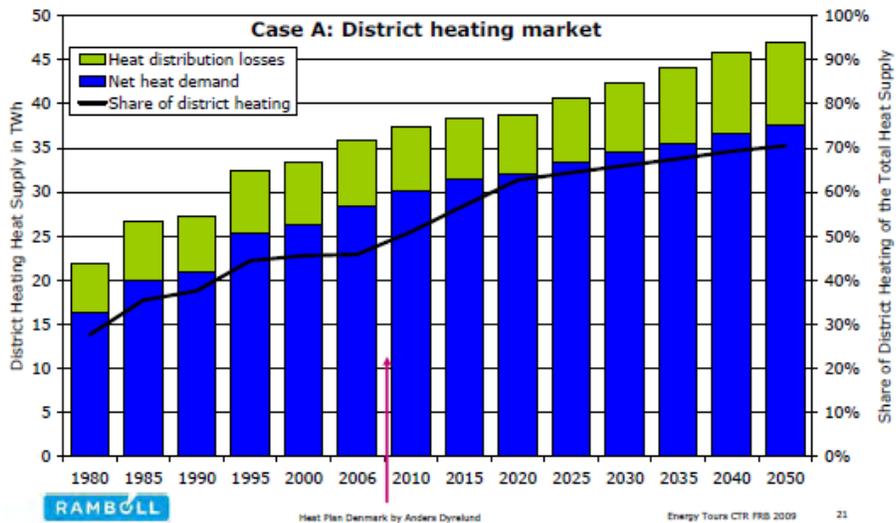
Heat Plan Denmark by Anders Dynlund

Energy Tours CTR FRB 2009

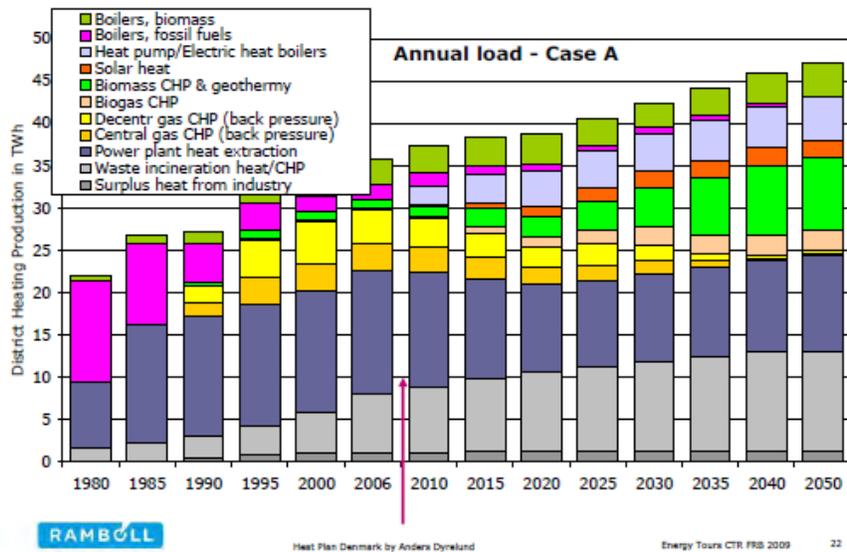
18



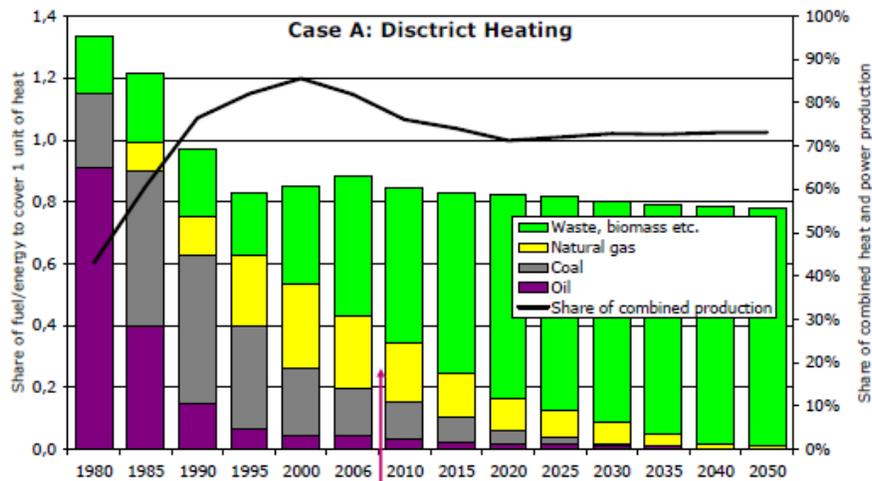
## District heating demand and market share



## District heating heat sources



## Fuel consumption per unit of district heating delivered to end-user and share of CHP

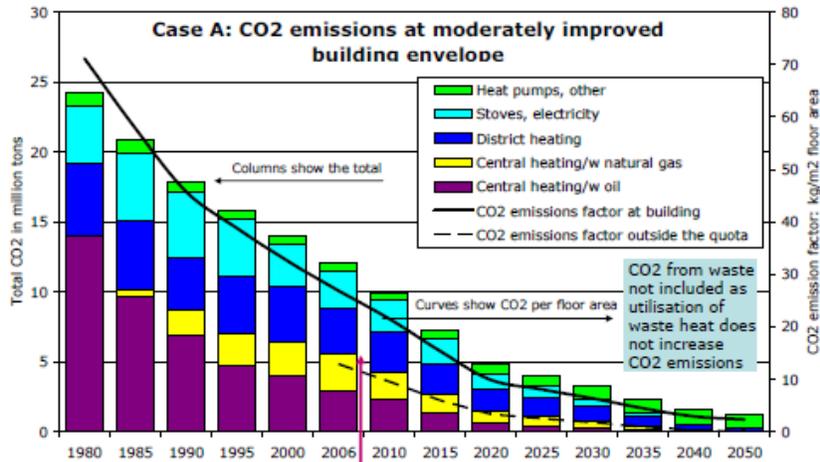


RAMBOLL

Heat Plan Denmark by Anders Dynkild

Energy Tours CTR FRB 2009 23

## CO<sub>2</sub> emission in million tonnes for all heating and in kg/m<sup>2</sup> floor area



RAMBOLL

Heat Plan Denmark by Anders Dynkild

Energy Tours CTR FRB 2009 24

## Heat plan Denmark - Statements

- It is important to focus on **integrated solutions**, including building envelope, building installations, district heating and power system
- **District heating** is a natural part of the urban infrastructure in modern cities
- District heating is a **precondition** for efficient, flexible and cost-effective use of renewable energy and CHP for urban heating, not least waste-to-energy and wind
- **District cooling** is a natural part of the urban infrastructure in districts with sufficient cooling load
- A stable energy policy since 1976, municipal planning and a tradition for **co-operation in the society** have been important preconditions for CO<sub>2</sub> emission reductions in Denmark

RAMBOLL

Heat Plan Denmark by Anders Dynkjørd

Energy Tours CTR FRB 2009 25