City of Annapolis Department of Neighborhood and Environmental Programs (DNEP)

Hon. Ellen O. Moyer, Mayor
Michael D. Mallinoff, Director

The Energy Consumption and Greenhouse Gas Emissions of the Facilities and Operations of the City of Annapolis in Fiscal Year 2006

Produced for:
The City of Annapolis

Produced by:
Frank Biba, Chief of Environmental Programs
Eric Schmitt, Intern, Department of Neighborhood and Environmental Programs

INTRODUCTION

The City of Annapolis Energy Efficiency Task Force was established in October 2005 "to study the application and recommend the implementation of energy efficient standards for the city to reduce costs, reduce energy consumption, and to reduce our reliance upon foreign petroleum." The committee met for six months and produced twelve recommendations, which were then adopted by the City Council as a guide for the city's energy policy (APPENDIX A). Chief among these recommendations was that the city commit to a 10% reduction in energy use of all publicly owned or leased facilities within 5 years and a 15% reduction by 2020. In order to forecast and measure progress towards future reductions, the city was required to establish an inventory of energy use and emissions for a baseline year. From March to May 2006, Frank Biba and Eric Schmitt of the Department of Neighborhood and Environmental Programs conducted this energy inventory. Their findings are summarized in this report.

For convenience's sake, the inventory used the city's Fiscal Year 2006 (FY 2006), July 1, 2005 through June 30, 2006, as its baseline year. The total energy consumption and greenhouse gas emissions of all municipal government facilities and operations in FY 2006 were measured and recorded. Energy cost was also inventoried in order to better measure the costs and benefits of future proposed changes in energy use.

This report divides the inventory into five sectors: **Buildings,** all publicly owned and leased facilities other than the water plant; **Vehicle Fleet**, all land and sea vehicles owned by the city; **Streetlights**, which also includes traffic signals and park lighting; **Water/Sewage**, the city's water plant, water storage tanks, and pumping stations; and **Waste**, the solid waste produced at city facilities. After an initial overview, each of these sectors will be discussed in detail.

The software used during the inventory was the Clean Air and Climate Protection Software, developed by the State and Territorial Air Pollution Program Administrators and the Association of Local Air Pollution Control Officials (STAPPA/ALAPCO), the International Council for Local Environmental Initiatives (ICLEI), and Torrie Smith Associates. This measures quantities of greenhouse gas (CO_2, NO_2, and CH_4 (methane) measured in CO_2 equivalents) produced based on the size and sources of energy consumption. Additionally, the program measures the production of other air pollutants and this data has been included as an appendix to this report (APPENDIX B).

TOTALS FOR ALL CITY FACILITIES AND OPERATIONS

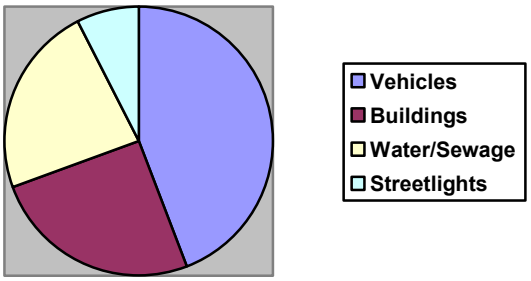
Total Energy Consumption

The total energy use of all the municipal facilities and operations of the City of Annapolis in FY 2006 was the equivalent of 101,358 million BTU (MMBtu) or 29,697,900 kWh.

A 5% reduction in total energy consumption would require a reduction of 5067.9 MMBtu or 1,484,890 kWh; a 20% reduction would require a reduction of 20,271.6 MMBtu or 5,939,580 kWh.

The city's vehicle fleet was its biggest consumer of energy, followed by its buildings, water/ sewage facilities, and streetlights. The following chart details energy consumption by sector. All units have been converted to MMBtu to facilitate comparison.

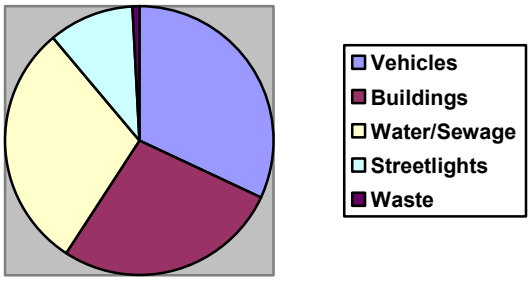
	Energy (in MMBtu)	*%*
Vehicle Fleet	44,645	44.0
Buildings	25,857	25.5
Water/Sewage	23,150	22.8
Streetlights	7,706	7.6
Total	101,358	



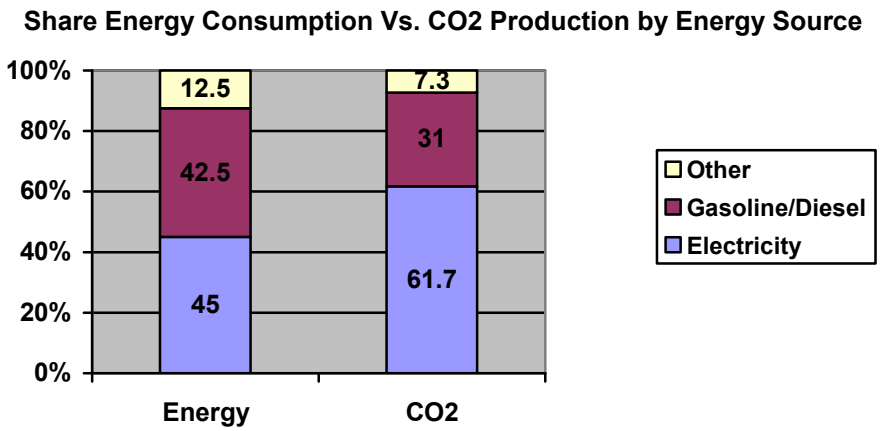
Total Greenhouse Gas Emissions

Municipal facilities and operations produced the equivalent of 11,979 tons of carbon dioxide in FY 2006.

	Equiv CO_2 (Tons)	*%*
Vehicle Fleet	3,813	31.8
Buildings	3,280	27.5
Water/Sewage	3,552	29.6
Streetlights	1,247	10.3
Waste	87	0.7
Total	11,979	



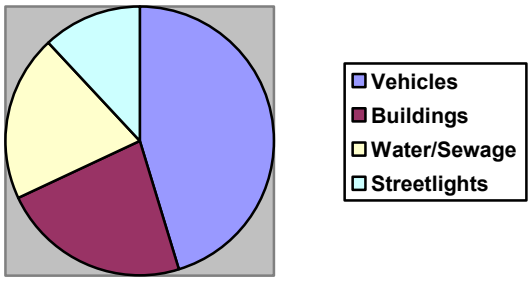
While the vehicle fleet consumes by far the most energy of any sector, it produces a much smaller share of total greenhouse gas emissions. This is due to the greenhouse gas intensive nature of the electricity provided to the city. The following graphs make this point even more clearly (For a more detailed look at greenhouse gas emissions by energy source see APPENDIX C):



Total Energy Cost

The total cost of energy for all municipal facilities and operations in FY 2006 was $1,773,981.

	Cost ($)	*%*
Vehicle Fleet	802,134	45.2
Buildings	406,137	22.9
Water/Sewage	352,696	19.9
Streetlights	213,014	12.0
Total	1,773,981	



BREAKDOWN BY SECTOR

The following sections itemize energy use within the five sectors described above (Vehicle Fleet, Buildings, Water/Sewage, Streetlights, and Waste). Also included are the sources and quantities of energy, total greenhouse gas emissions (in the equivalent tonnage of CO2), and energy cost.

Vehicle Fleet

The department of finance lists 273 city owned vehicles. The logs for the Department of Public Work's gas pumps on Spa Rd. show 307 distinct users in FY2006, of which 255 are identifiable as specific cars. Additionally, the Harbormaster has three boats which fuel up at a private marina. The following charts show the total energy consumption and greenhouse gas emissions by department/bureau.

Department	*Total Energy (MMBtu)*	*Gasoline (Gal.)*	*Diesel (Gal.)*	*Other (Equiv. Gal.)*
Transportation	18,244	4,951.7	133,016.3	11,085[1]
Police	9,139	73,981.9	689.4	-
Fire	4,555	17,486.2	21,532.9	-
Residential Refuse	2,659	933.1	20,833.4	-
Roadways	1,784	5,028.5	9,011.3	1,250[2]
Recreation & Parks	1,402	9,929.3	1,263.1	-
Street Sanitation	1,081	1,980.9	6,821.6	-
Yard Waste	949	2,209.2	2,907.6	1,250[3]
DNEP	909	7,238.5	-	-
Sewer Collection	839	289.3	6,577.5	-
Water Distribution	804	1,439.5	5,104.6	-
Engineering & Construction	425	3,386.5	-	-
Storm Water Management	376	-	3,082.1	-
Harbormaster	345	2,635.1	115.3	-
Signs & Markers	250	1,238.7	773.9	-
Garage	240	1,101.8	1,777.4	-
Parking Enforcement	240	1,926	-	-
Water Plant	154	785.3	456.6	-
Snow & Ice	114	76.3	857	-
Central Services	104	834.3	-	-
Administration	32	253.5	-	-
Total	44,645	137,705.6	214,820	13,585

[1] Container Natural Gas
[2] B-20 (20%) Biodiesel
[3] B-20 (20%) Biodiesel

Department	*CO_2 (Tons)*	*Cost ($)*
Transportation	1,549	295,503.62
Police	779	170,388.48
Fire	393	90,822.16
Residential Refuse	230	52,354.92
Roadways	151	36,185.66
Recreation & Parks	120	24,873.10
Street Sanitation	94	21,507.97
Yard Waste	79	15,625.12
DNEP	78	16,459.56
Sewer Collection	73	16,546.14
Water Distribution	70	15,279.53
Engineering & Construction	36	7,571.44
Storm Water Management	33	7,264.11
Harbormaster	29	8,376.70
Signs & Markers	22	4,608.65
Garage	21	6,830.64
Parking Enforcement	21	4,304.73
Water Plant	13	2,785.95
Snow & Ice	10	2,298.46
Central Services	9	1,932.38
Administration	3	614.84
Total	3,813	802,134.16

There are two ways to reduce carbon emissions in the vehicle fleet: reduce energy consumption and alternative fuel sources.

Unless overall vehicle miles are reduced, the only way to reduce energy consumption is through better fuel efficiency. And with a few exceptions, fuel efficiency for all departments is very poor.[4] For certain departments which use heavy and light trucks, such as roadways or fire, this is inevitable. However, many departments using light trucks/SUVs and full size cars also experience poor gas mileage. The police department's Ford Crown Victorias, for instance, get between eight and eleven miles per gallon.

On the positive side, the city has begun converting hybrid vehicles, with a total of ten purchased already. These ten vehicles are estimated to reduce the municipal fleet's fuel consumption by 4495 gallons (565 MMBtu) and CO_2 emissions by 50 tons per year. They thus save the city roughly $13,500 per year in fuel costs.

In FY 2006, alternative fuels were used by three city vehicles. The Department of Transportation's Trolley #67 has used natural gas since 1997. The Department of Public

[4] It should be noted that the mileage data from the Spa Rd. gas pumps is in a majority of cases either erroneous or incomplete. More accurate data would be necessary for a thorough study of vehicle fuel efficiency.

Works obtained 500 gallons of pure biodiesel and mixed this with diesel to make 2500 gallons of B-20 (20%) biodiesel. This was used in two heavy trucks (Roadways 4257 and Yard Waste 4924) and reduced the CO_2 emissions in these two vehicles by 10%, from an estimated 55 to 49 tons. Biodiesel is generally more expensive than regular diesel but was made affordable in this case by a one time grant.

Sources

Most of the data on fuel consumption is from the logs of the fuel pumps on Spa Rd. Data on total cost and fuel purchased at outside pumps are from the records of finance. Data on the harbormaster's boats is from the vessels' daily logs. Data on biodiesel is from Phil Scrivener at Public Works.

Buildings

This section includes the structures which the city owned or leased in FY 2006, with the exception of 159 Duke of Gloucester St.[5] Since that time the city has begun using two floors of offices at 145 Gorman St., and stopped using those at 93 Main St. These structures are divided into buildings (including temporary structures), parking, and service garages.

Buildings	*Total Energy (MMBtu)*	*Electricity (kWh)*	*Natural Gas (Therms)*	*CO_2 (Tons)*	*Cost ($)*
Fire Department, Forest Dr.	2,864	254,100	19,963	264	27,296
Transportation Administration	2,210	277,000	12,643	231	29,205
Fire Department, W. Annapolis	1,981	286,500	10,035	220	39,897
Temporary[6]	1,949	357,274	8	315	56,811
Stanton Center	1,763	242,200	-	192	9,317
City Hall	1,617	473,800	-	262	9,739
Fire Department, Eastport	1,168	144,026	6,769	121	14,930
Police Department, Taylor Ave.	1,115	326,600	-	180	32,236
Harbormaster, Dock St.[7]	724	212,140	-	117	18,805
Recreation and Parks, St. Mary's St.	489	140,100	107	78	4,493
Boat Pier, Dock St.	435	127,380	-	70	11344
Public Works, 937 Spa Rd.	402	-	4,022	25	1,206
Recreation and Parks, Hilltop Lane	387	113,273	-	63	5,340
Chesapeake Children's Museum	222	65,058	-	36	5,967
Truxtun Park Pool and Bathhouse	199	58,371	-	32	5,527
Police Department, 929 West St.	102	29,772	-	16	3,110
93 Main St., 3rd Floor[8]	64	18,644	-	10	1,810
Annapolis Walk Community Center	64	18,843	-	10	2,380
93 Main St., 2nd Floor[9]	61	17,790	-	10	1,832
Church Clock, Church Circle	19	5,503	-	3	663
Maritime Museum	13	65,058	-	2	501
Truxtun Park Shed	9	2,572	-	1	392
Back Creek Park Shed	1	256	-	0	176
Totals	17,858	3,236,260	53,547	2,258	282,977

[5] This section should include 159 Duke of Gloucester St. However, for unknown reasons, BGE does not record energy use in this building and does not bill for it. Apparently it has not done so for many years.
[6] Includes boat show and temporary construction related structures at 1 Dock St., 199 Taylor Ave., and 25 Market St. 199 Taylor was by far the biggest energy user, consuming 1,843 MMBtu.
[7] Includes public rest rooms
[8] Former lease, no longer in use
[9] Former lease, no longer in use

The following chart illustrates the levels of energy efficiency among the buildings by recording their energy consumption and greenhouse gas emissions per 1000 square feet of floor space.

Buildings	*MMBtu per 1000 Sq. Ft.*	*Tons CO_2 per 1000 Sq. Ft*
Public Works, 937 Spa Rd.	324.4	20
Harbormaster, Dock St.[10]	214.8	34.8
Transportation Administration	173.6	18.2
Fire Department, Forest Dr.	160.9	14.8
Fire Department, W. Annapolis	125.2	13.9
Fire Department, Eastport	119.7	12.4
Chesapeake Children's Museum	95.7	15.5
City Hall	74.2	12
Stanton Center	63.6	6.9
Truxtun Park Pool and Bathhouse	59.6	9.7
Police Department, Taylor Ave.	44.5	7.2
Recreation and Parks, St. Mary's St.	33.9	5.4
Recreation and Parks, Hilltop Lane	30.7	5.0
Annapolis Walk Community Center	28.6	4.6
Truxtun Park Shed	16.3	2.6
Police Department, 929 West St.	11.4	1.8
Maritime Museum	1.7	0.3
Back Creek Park Shed	1.5	0.2

The following two charts list the energy consumption and greenhouse gas emissions of two other categories of city structures: parking garages/lots and service garages.

Parking	*Total Energy (MMBtu)*	*Electricity (kWh)*	*CO_2 (Tons)*	*Cost ($)*
25 Northwest St.	1,612	472,428	261	8,902
170 Conduit St.	1,257	368,200	203	35,329
1 Colonial Ave	1,145	335,360	185	31,557
Parking Lots[11]	89	26,420	14	2,945
Totals	4,103	1,202,408	663	78,733

[10] Includes public rest rooms
[11] 138 South St., 228 Farragut Rd., 35 Larkin St.

Service Garage	*Energy (MMBtu)*	*Electricity (kWh)*	*Natural Gas (Therms)*	*CO_2 (Tons)*	*Cost ($)*
935 Spa Rd.	2,390	134,094	19,323	193	16,506
932 Spa Rd.	550	67,849	3,183	57	7,525
308 Chinquapin Round Rd.	490	4,898	-	30	6,991
937 Spa Rd.	389	113,907	-	63	10,564
934 Spa Rd. (Salt Storage)	12	3,629	-	2	472
932 Spa Rd. (Bus Lift)	4	1,075	-	1	238
Totals	3,835	325,452	22,506	346	42,296

Sources
All energy and cost data is taken from BGE bills.

Water/Sewage
The city's water system is composed of the water works and wells on Defense Highway and five water storage tanks located throughout the city. The sewage system is comprised of 22 pumping stations.

	Energy (MMBtu)	*Electricity (kWh)*	*Natural Gas (Therms)*	*Light Fuel Oil (Gal)*	*CO_2 (Tons)*	*Cost ($)*
Water Works	11,650	3,296,160	-	2,861[12]	1,853	135,209
Water Well	5,733	1,679,700	-	-	928	122,472
Pumping Stations	5,549	1,149,730	16,252	-	735	88,398
Water Storage	213	62,409[13]	-	-	34	6,207
Other[14]	5	1,387	-	-	1	410
Total	23,150	6,189,386	16,252	2,861	3551	352,696

In FY2006 the output of the water plant was 1,603.3 million gallons of water. Energy was used by the water works at a rate of 7.27 MMBtu (or 2,055.86 kWh) per million gallons produced and by the water wells at 3.58 MMBtu (or 1,047.65 kWh) per million gallons produced.

Five pumping stations far exceed the others in energy use. These are 270 Hanover St. (1,631 MMBtu), 713 Second St. (1079 MMBtu), 3061 Harness Creek Rd. (613 MMBtu), 927 King James Landing Rd. (597 MMBtu), and 300 Smith Rd. (430 MMBtu). See Appendix D for an energy use of every individual pumping station.

The water works and wells are the biggest individual users of energy of any items inventoried. While this is inevitable given the nature of their work, it also presents an excellent opportunity as even small increases in efficiency can create substantial energy savings.

To a lesser degree this applies to the five major pumping stations listed above. However, reliable records on the throughput for these stations are not currently kept. Such records are necessary to identify inefficiencies and potential energy savings.

Sources
Constellation/New Energy provides the energy for the water works and wells, while BGE charges a distribution charge. All other energy use data comes from BGE bills.

[12] Fuel oil is used to heat the fireman's house and the old raw water pumping station.
[13] Data is slightly inflated because Bembe tank (7290 Edgewood) shares an electric meter with a park building.
[14] Includes the sprinkler system for the Naval Academy Stadium and the sewage siphon head at the end of Shipwright Street

Streetlights
In FY2006 the City of Annapolis either owned or paid BGE for the use of 2531 Streetlights, 19 traffic signals, and off-street lighting (what BGE refers to as "Private Area Lighting) at 11 locations, mostly parks.

	Energy (MMBtu)	*Electricity (kWh)*	*CO_2 (Tons)*	*Cost ($)*
Streetlights	6,977	2,044,391	1,129	189,106[15]
Private Area Lighting	491	144,055	79	12,337
Traffic Signals	238	69,734	38	9,058
Total	7,706	2,258,180	1,246	21,395

As the intensity of streetlights is generally related to other factors (i.e. physical location and crime), the easiest way to decrease their energy use is by converting to more energy efficient types of lighting, such as sodium vapor. The Department of Public Works has for a number of years used sodium vapor bulbs for most new or replacement lighting. However since most of the city's street lighting is several decades old, the majority of streetlights are of the less efficient mercury vapor type.

The city began converting its traffic signals from incandescent bulbs to much more efficient LED technology (Light Emitting Diode) in 2002. When completed, this conversion will have reduced energy consumption by traffic signals by over 90%. Currently 100% of red lights, 50% of green lights, and 25% on the yellow lights have been converted to LED, and the "Walk/Don't Walk" indicators will soon be as well.

The private area lighting stock varies drastically and would need to be examined on a case by case basis to determine potential savings.

Sources
All energy data is from BGE bills. The director of Public Works maintains a list of all streetlights, their wattage and type based on BGE records. Information on the conversion of traffic signals comes from Public Work's traffic engineer Larry Moore.

[15] BGE does not meter individual streetlights. Instead a fee is assigned based on the type and wattage of the light. A maintenance fee is also charged, but not included here.

Waste

City owned and leased buildings currently produce an estimated 281,688 pounds of solid waste a year. The methane gas released from this waste is the equivalent of 87 tons of CO_2, a negligible amount relative to other sectors studied. The vast majority of this methane was due to paper waste, which formed the largest part of the solid waste.

Building	*Estimated Waste Produced (lbs.)*	*CO_2 (Tons)*
Fire, Forest Dr.	61,048	16
Fire, W. Annapolis & Eastport	55,120	16
Stanton Center	53,535	23
City Hall & 145 Gorman	37,350	11
Police	31,980	10
Transportation	22,204	6
Recreation & Parks, Hilltop Lane	13,728	4
City Hall (Side)[16]	6,723	2
Total	281,688	88

Source

Waste production is estimated based on a sample of one week's waste collected by Eric Schmitt and Department of Public Works employees led by Robert Brown and Joe Holland.

[16] Waste from city hall is collected in both the dumpster it shares with 145 Gorman and trash cans which sit along the side of the building.

Appendix A

CITY COUNCIL OF THE CITY OF ANNAPOLIS

RESOLUTION NO. R-38-06

Introduced by Mayor Moyer

LEGISLATIVE HISTORY			
First Reader:	Public Hearing:	Fiscal Impact Note:	120 Day Rule:
9/11/06			n/a
Referred to:	Meeting Date:	Action Taken:	

A RESOLUTION concerning

Recommendations of the City of Annapolis Energy Efficiency Task Force

FOR the purpose of the City Council to adopt the recommendations of the Energy Efficiency Task force to guide the energy policy of the City of Annapolis.

WHEREAS, the Annapolis City Council adopted R-31-05 on October 10, 2005, which established the City of Annapolis Energy Efficiency Task Force to study the application and recommend the implementation of energy efficient standards for the city to reduce costs, reduce energy consumption, and to reduce our reliance upon foreign petroleum; and

WHEREAS, the Energy Efficiency Task Force met for six consecutive months, gathered information and discussed energy efficiency standards and their implementation by the City government; and

WHEREAS, the Energy Efficiency Task Force developed recommendations for the City to reduce costs, energy consumption and reliance upon petroleum.

NOW THEREFORE BE IT RESOLVED BY THE ANNAPOLIS CITY COUNCIL that the following recommendations of the City of Annapolis Energy Efficiency Task Force are hereby adopted which guide the energy policy of the City of Annapolis.

Energy Efficiency Task Force Recommendations

1. Comprehensive Municipal Energy Audit
    a. Undertake a comprehensive energy audit of all public owned or leased facilities

b. Conduct a baseline emissions inventory and forecast. Based on energy consumption and waste generation, the city calculates greenhouse gas emissions for a base year (e.g., 2000) and for a forecast year. The inventory and forecast provide a benchmark against which the city can measure progress.

c. Commit to 10% reduction in energy use of all public owned or leased facilities within 5 years of establishing an emissions baseline and 15% by 2020.

2.Energy Performance Contracting

a. Enter into an agreement with an energy service company which identifies and evaluates energy-saving opportunities and recommends a package of improvements which are paid for through the resulting savings.

3.Distributed Energy Resources

a. Install on-site energy generation wherever practical (solar, wind, geothermal) for every public facility. Energy generated on-site will be adequate to supply total energy requirement (e.g., stop lights, area or street lights, bus shelters) or will be fed back into the electrical grid to lower overall energy costs.

b. Public benefits: lower cost/kw; deferral of capital costs for construction of power plants and substations; reduced net pollution emissions; stand-alone installations not connected to the power grid are unaffected by power outages.

4. Provide Leadership in Energy and Environmental Design (LEED) green building design checklist and green building fact sheet for all private building permit applications to raise awareness of green building standards in the private sector.

a "Green building" is a movement within building design and construction which incorporates the following concepts: using natural resources efficiently; considering the impact of buildings on the local, regional and global environment; reducing building footprint size; allowing ecosystems to function naturally; conserving and reusing water; treating storm water on-site; maximizing the use of local materials; optimizing energy performance by installing energy efficient equipment and systems; optimizing climatic conditions through site orientation and design; integrating natural day-lighting and ventilation; minimizing construction waste by reducing, reusing and recycling materials during all phases of construction and deconstruction, incorporating low VOC materials and design concepts that lend to a healthy work environment.

5. Adopt LEED building standards for all new public facilities and renovations of existing public buildings with a minimum standard of Silver Certification.

a. LEED standards define Silver, Gol and Platinum Certifications
b. Energy efficient buildings provide significant energy cost savings
c. Green buildings reduce waste management costs, air and water pollution.
d. Green buildings produce operating cost savings.
e. Green buildings provide improved and healthier working environments.

f. Widespread application of green building practices can produce economic development potential by fostering new markets for green products and technologies

g. LEED saves time and resources by providing a comprehensive set of tools for local application and use.

h. LEED avoids the need to establish local certification bodies.

i. LEED allows benchmarking with other LEED jurisdictions.

6. Apply existing green purchasing standards vigorously for all City departments.

a. Purchase only Energy Star equipment and appliances for City use.

b Evaluate opportunities to increase pump efficiency in water and wastewater systems.

7. Investigate incentives for the private sector to include green building standards in new construction. For example:

a. Property tax credits

b. Reduced permit fees

c. Increased zoning density

d. Apply a fee/sq ft for non-green building projects that can be diverted to low income housing, outreach education promoting green building, etc.

8. Education program

a. Provide for training of government staff in LEED methodology which can be provided by the US Green Building Council, Green Building Institute, American Institute of Architects, or other similar group.

b. Develop a green building outreach program for the professional building community.

9. Transportation

a. Commit to purchasing hybrid, alternative energy source or other energy efficient vehicles to account for a minimum of 25% of the city's fleet

b. Convert City vehicles to biodiesel wherever possible and establish a fueling facility.

c. Developments that are required to submit traffic impact studies will include impacts on the city's current transportation infrastructure and will provide mitigation such as financial transit subsidies, promotion of car pooling and telecommuting, sale of transit passes.

d. Annapolis Transit will identify the needs of residents within new development and adjust routes accordingly.

e. Promote transportation options such as bicycle trails, commute trip reduction programs, incentives for car pooling and public transit.

f. Explore water based transit options, such as water taxis and ferries.

10. Purchase green energy through regional purchasing agreements

a. Purchase 20% of the City's total energy needs from renewable sources by the year 2020. Renewable energy sources are: solar, wind, geothermal, biomass, small hydro power, and fuel cell.

11. Increase recycling rates in City operations and in the residential and commercial communities.

a. Products made from recycled materials as opposed to virgin materials generally require less energy for manufacture.

b. Reduced waste equates to a reduction in trips to the landfill which reduces vehicle emissions.

12. Maintain healthy urban forests and promote tree planting to increase shading and to absorb CO2.

a. Trees absorb carbon dioxide and discharge oxygen as part of their natural growing process.

b. Shaded areas have lower temperatures, reducing the urban heat island effect and the production of ground level ozone.

c. Increase the urban forest canopy to 50% of the City's land area by 2036.

ADOPTED this 9th day of October, 2006.

ATTEST:

THE ANNAPOLIS CITY COUNCIL

_____

Regina C. Watkins-Eldridge, CMC
City Clerk

BY:_____

ELLEN O. MOYER, MAYOR

Appendix B

Government Criteria Air Pollutant Emissions

	NO_X (lbs.)	SO_X (lbs.)	CO (lbs.)	VOC[17] (lbs.)	PM10[18] (lbs.)
Vehicle Fleet	37,609	1,994	109,510	12,219	1,413
Buildings	9,468	30,074	3,160	393	2,355
Water/Sewage	10,362	38,023	3,568	407	2,919
Streetlights	3,642	13,747	1,268	142	1,057
Total	61,082	83,837	117,507	13,162	7,745

[17] Volatile Organic Compounds
[18] Particulates

Appendix C

Greenhouse Gas Emissions by Source

	CO_2 (tons)	*CO_2 (%)*	*Energy (MMBtu)*	*Cost ($)*
Electricity	7,387	61.7	45,656	923,216
Diesel	2,262	18.0	26,053	-
Gasoline	1,453	12.1	17,042	800,922[19]
Natural Gas	658	5.5	10,656	43,147
CNG	89	0.7	1,392	-
Paper Products (Waste)	58	0.5	-	-
Light Fuel Oil	33	0.3	400	5,484
Food Waste	32	0.3	-	-
Biodiesel (B-20)	21	0.2	301	1,213
Total	11,991	100	101,502	1,773,981

[19] Combined cost of Diesel and Unleaded Gasoline

Appendix D

Sewage Pumping Stations

	Energy (MMBtu)	*Electricty (kWh)*	*Natural Gas (Therms)*	*CO_2 (Tons)*	*Cost ($)*
713 Second St.	1,079	316,200	-	175	7,049
3061 Harness Creek Rd.	613	179,745	-	99	16,078
927 King James Landing Rd.	597	175,000	-	97	15,795
300 Smith Ave.	430	126,050	-	70	11,483
275 Pump House Rd.	161	47,085	-	26	4,287
441 Admiral Dr.	158	46,407	-	26	4,305
31 Bristol Dr.	142	41,481	-	23	3,808
2035 Forest Dr.	123	35,992	-	20	3,304
270 Hanover St.	101	1,845	16,252	101	4,070
1 Alden Ln.	83	24,316	-	13	2,292
413 Schley Rd.	77	22,603	-	12	2,141
1225 Boucher Ave.	75	21,862	-	12	2,089
160 Porter Dr.	73	21,514	-	12	2,033
986 Awald Rd.	72	21,195	-	12	2,054
1111 Lake Heron Dr.	72	21,147	-	12	2,010
307 Monterey Ave.	40	11,678	-	6	1,175
701 Bywater Farms Rd.	37	10,768	-	6	1,282
5 Spa Creek Landing	35	10,264	-	6	1,076
1808 Whiton Ct.	35	10,227	-	6	1,223
48 Harness Creek Ct.	11	3,361	-	2	463
11 President Point Dr.	2	599	-	0	196
4 President Point Dr.	2	478	-	0	185
Total	4,018	1,149,817	16,252	736	88,398