An Energy Plan

for

Middletown Township, New Jersey

August 2010

RUTGERS
Edward J. Bloustein School
of Planning and Public Policy

33 Livingston Avenue | New Brunswick | New Jersey 08901

PARTNERS

New Jersey Sustainable State Institute
Center for Energy, Economic, & Environmental Policy
Center for Planning Practice
Rutgers Center for Green Building
Voorhees Transportation Center

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1. Executive Summary

This is the energy plan for Middletown Township. It was prepared for Middletown by a technical assistance team from the Edward J. Bloustein School of Planning and Public Policy, Rutgers University, New Brunswick. The team included faculty and staff members from:

- New Jersey Sustainable State Institute (lead)
- Center for Energy, Economic, & Environmental Policy
- Center for Planning Practice
- Rutgers Center for Green Building
- Voorhees Transportation Center

In addition, the Bloustein team included an external planning consultant, Sam Casella, FAICP/PP, who specializes in energy planning and implementation.

The purposes of this plan are as follows:

- Satisfy U.S. Department of Energy requirements for receipt of Energy Efficiency and Conservation Block Grant (EECBG) monies;
- Reduce fossil fuel emissions;
- Reduce total energy use within Middletown;
- Improve energy efficiency in the transportation, building, and other appropriate sectors; and
- Create and retain jobs

The Energy Efficiency and Conservation Block Grants (EECBG) Program, funded for the first time by the American Recovery and Reinvestment Act (Recovery Act) of 2009, represents a Presidential priority to deploy the cheapest, cleanest, and most reliable energy technologies we have - energy efficiency and conservation - across the country. The Program, authorized in Title V, Subtitle E of the Energy Independence and Security Act (EISA) and signed into law on December 19, 2007, is modeled after the Community Development Block Grant program administered by the Department of Housing and Urban Development (HUD). Through formula and competitive grants, the program

empowers local governments to make strategic investments to meet the nation's long-term goals for energy independence and leadership on climate change.

About Middletown

Middletown Township is located in Monmouth County. The township has a total area of 59.3 sq mi, of which, 41.1 sq mi (69.0 percent) is land and 18.2 sq mi (31.0 percent) of it is water according to the U.S. Census Bureau.

According to the U.S. Census Bureau, as of 2000, there were 66,327, people, 23,236 households, and 18,109 families residing in the township. The population density was 1,613.0 people per square mile. The estimated 2006-2008 population was 67,904.

The North Jersey Regional Transportation Authority (NJRTPA), the Metropolitan Planning Organization for the region, has projected Middletown's population to grow to 71,580 by 2035.

Estimated housing units in 2008 were 24,205, of which 23,243 were occupied. Average household size in 2000 was 2.84, and estimated household size in 2008 was 2.91.

According to the New Jersey Council on Affordable Housing (COAH), Middletown was estimated to have 24,181 housing units in 2004, and this number has been projected to increase to 25,330 in 2018, a change of 1.0 percent.

The number of jobs within Middletown Township in 2004 was estimated at 15,996 by COAH, which forecasts the number to grow to 19,927 in 2018. [1] NJTPA projects employment within the township at 28,130 by 2035.

Estimated 2008 per capita income was $41,126, with 3.4 percent of its residents under the poverty level during the previous 12 months.

Middletown's Carbon Footprint

A carbon footprint is a measurement of the amount of greenhouse gas emissions and energy usage produced by a local government's residents, schools, businesses, and industries in a given year. It shows a community's impact on global warming and climate change. The footprint can be reported publicly to build awareness and support for actions that can bring down carbon emissions. It also can be used to track the progress of a local government as it implements actions to combat global warming and climate change and reduce energy consumption.

[1] COAH, *supra* note 5, Figure A-2.

The municipal operations carbon footprint measures the greenhouse gas emissions (GHG) that occur as a result of municipal operations (e.g., municipal buildings, fleet, water and sewer, solid waste, etc.). The footprint illustrates baseline greenhouse gas emissions for Middletown and identifies the relative contributions of municipal activities and sectors. Calculations to determine the carbon footprint were made using emissions factors included in Sustainable Jersey's "Community Carbon Footprint Calculator." Reduction targets and actions for achieving them can be determined based on the data provided in the footprint which serves as a baseline against which future emissions can be compared to determine the success of emission reduction efforts.

The municipal operations carbon footprint displays emissions from activities within the boundaries of local government operations (those activities over which the local government has control). Activities included do not necessarily take place within the geopolitical boundaries of Middletown (such as waste disposal), but are nonetheless a result of the local government's operations. To develop a carbon footprint of Middletown's local government operations, a greenhouse gas inventory of municipal operations was conducted using 2008 as a baseline year.

Data collected reflects the best available information and data on emissions from solid waste from municipal operations was not available for this inventory. Also absent in the inventory is commuting data for municipal employees. Therms of natural gas, kilowatt hours of electricity, and gallons of gasoline and diesel were all converted into short tons of carbon dioxide equivalents (CO2e) to determine the total emissions resulting from municipal operations.

The carbon footprint analysis for Middletown's municipal operations indicates that emissions from buildings and facilities are the greatest contributor to the footprint; the majority of emissions are from electricity usage followed by natural gas. An emissions summary for the community as a whole shows that the greatest sources of emissions are from electricity usage in the commercial sector followed by the residential sector.

Projections for Municipal Energy Use, Greenhouse Gas Emissions, and Costs

This section contains graphs showing projections for savings in CO_2, electricity, natural gas, and vehicle miles traveled (VMT) if Middletown implements seven categories of implementation measures to reduce energy use and greenhouse gas emissions that are described in more detail in the following section. The measures are grouped under the following categories, and the projections show the contribution of each of those categories to energy savings and VMT reduction from a base year of 2009 to the year 2030.

The measures are grouped under the following categories:

- Education and Outreach
- Renewable Energy
- Sustainable Landscaping and Land Use
- Water Efficiency
- Waste Reduction
- Vehicle Miles Traveled (VMT) Reduction
- Energy Efficiency and Green Building

Alternate Measures to Implement the Energy Plan

The energy plan contains a series of 47 detailed measures to implement the plan in order to reduce energy use and greenhouse gas emissions. The measures are grouped under the following categories.

- Education and Outreach
- Renewable Energy
- Sustainable Landscaping and Land Use
- Water Efficiency
- Waste Reduction
- Vehicle Miles Traveled (VMT) Reduction
- Energy Efficiency and Green Building

The body of the plan includes summaries of each of the measures. Detailed descriptions of the measures are in Appendix A (see below)

Recommended Policy Alternatives and Targets

1. No or Low Mow for Municipal Properties
2. Convert Public Lighting to LED
3. Reduce Heat Island Effect in New Commercial Buildings
4. Sustainable Landscaping for Residential Properties
5. Reduce Heat Island Effect in New Residential Buildings
6. Energy Efficiency in New Residential Buildings
7. Energy Efficiency in Existing Commercial Buildings

8. Sustainable Landscaping for Commercial Properties
9. Energy Efficiency in New Commercial Buildings
10. Energy Efficiency in Existing Residential Buildings

Energy Planning by Other Governmental Units

The energy plan discusses energy planning by other governmental units in New Jersey. In particular, it summarizes the New Jersey Energy Master Plan. New Jersey is statutorily required to adopt an Energy Master Plan addressing the production, distribution, consumption, and conservation of energy for a period of ten years and to provide updates every three years. The New Jersey Energy Master Plan, last updated in October 2009, is organized into a series of five goals that are proposed to be accomplished by the year 2020, with a series of action items associated with each goal. The five goals of the New Jersey Energy Master Plan are:

1. Maximize the State's energy conservation and energy efficiency to achieve reductions in energy consumption of at least 20% by 2020.
2. Reduce peak demand for electricity by 5,700 MW by the year 2020.
3. Strive to surpass the current RPS goals with a goal of achieving 30% of the State's electricity needs from renewable sources by 2020.
4. Develop a 21st century energy infrastructure that supports the goals and action items of the Energy Master Plan, ensures the reliability of the system, and makes available additional tools to consumers to manage their energy consumption.
5. Invest in innovative clean energy technologies and businesses to stimulate the industry's growth in New Jersey.

The action items that are included under the main goals more detailed initiatives such as developing and implementing statewide building codes for energy efficiency, participating in demand response programs, increasing the state's solar electricity goals, developing renewable energy sources such as offshore wind turbines and biomass generating facilities, and developing individual utility energy master plans with the electric and gas utilities in the state. The plan does not contain specific actions to be taken by municipalities.

Appendices

The energy plan contains three appendices. Appendix A contains detailed descriptions of alternative energy efficiency and conservation strategy measures. Each narrative includes a description of the measure, data on fiscal, social and environmental, and economic impacts, an explanation of how the measure may be implemented, and a short list of other resources. These measures are presented in a generic manner, and can be scaled up to apply to a given city or area.

Appendix B contains a series of tables with data to define the community's carbon footprint in terms of energy usage and greenhouse gas emissions for a baseline year, either 2008 or 2009. Where the actual data were not available, the project team developed estimates.

Appendix C summarizes the assumptions and methodology used for the energy plan's cost-benefit analysis and spreadsheet model for energy projections.

2. Introduction and Purpose of Plan

This is the energy plan for Middletown Township It was prepared for Middletown Township by a technical assistance team from the Edward J. Bloustein School of Planning and Public Policy, Rutgers University, New Brunswick. The team included faculty and staff members from:

- New Jersey Sustainable State Institute (lead)
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In addition, the Bloustein team included an external planning consultant, Sam Casella, FAICP/PP, who specializes in energy planning and implementation.

The purposes of this plan are as follows:

- Satisfy U.S. Department of Energy requirements for receipt of Energy Efficiency and Conservation Block Grant (EECBG) monies;
- Reduce fossil fuel emissions;
- Reduce total energy use within Middletown Township;
- Improve energy efficiency in the transportation, building, and other appropriate sectors; and
- Create and retain jobs

2.1 About the EECBG Program

The Energy Efficiency and Conservation Block Grants (EECBG) Program, funded for the first time by the American Recovery and Reinvestment Act (Recovery Act) of 2009, represents a Presidential priority to deploy the cheapest, cleanest, and most reliable energy technologies we have - energy efficiency and conservation - across the country. The Program, authorized in Title V, Subtitle E of the Energy Independence and Security Act (EISA) and signed into law on December 19, 2007, is modeled after the Community Development Block Grant program administered by the Department of Housing and Urban Development (HUD). Through formula and competitive grants, the program empowers local governments to make strategic investments to meet the nation's long-term goals for energy independence and leadership on climate change.

2.2 Eligible Program Activities

Grants can be used for energy efficiency and conservation programs and projects community wide, as well as renewable energy installations on government buildings. Activities eligible for use of funds include:

- Development of an energy efficiency and conservation strategy;
- Building energy audits and retrofits, including weatherization;
- Financial incentive programs for energy efficiency such as energy savings performance contracting, on-bill financing, and revolving loan funds;
- Transportation programs to conserve energy;
- Building code development, implementation, and inspections;
- Installation of distributed energy technologies including combined heat and power and district heating and cooling systems;
- Material conservation programs including source reduction, recycling, and recycled content procurement programs;
- Reduction and capture of greenhouse gas emissions generated by landfills or similar waste-related sources;
- Installation of energy efficient traffic signals and street lighting;
- Installation of renewable energy technologies on government buildings;
- Any other appropriate activity that meets the purposes of the program and is approved by DOE.

2.3 How This Plan Was Developed

This plan was developed over a period spanning from September 2009 to August 2010 by a team from four centers and institutes in the Edward J. Bloustein School of Planning and Public Policy at Rutgers. The planning initiative involved the following municipalities who were able to benefit from spreading the cost of researching energy saving measures and developing various modeling tools over the entire project, avoiding a duplication of effort: Middletown Twp.; Howell Twp.; Parsippany-Troy Hills Twp.; the City of Fort Lee; the City of Perth Amboy; the City of East Orange; the City of West Orange; the City of Plainfield; Edison Township; Montclair Township; and Willingboro Township. In September 2009, the project team provided all municipalities with a questionnaire intended to prepare the carbon footprint for both municipal operations and the community as a whole. In a number of cases, a municipality found it difficult to complete the questionnaire because of inability to obtain data. As consequence, the project team developed estimates using 2008 population, 2008 total housing units, 2000 density, and land area. This involved calculating per capita or household multipliers from actual aggregate data from other municipalities, and factoring them up to provide the missing figures. These estimates, for all practical purposes, will not adequately characterize a municipality's carbon footprint, especially the part of the footprint related to municipal operations. In addition, the project team prepared profiles of each municipality using census data and data from municipal master plans and reexamination reports. Finally, the team researched the 47 measures to save energy and reduce greenhouse gas emissions and developed a spreadsheet model to forecast energy usage.

3. Profile of Middletown Township

3.1 Type of Government

Middletown, New Jersey, is a township that operates under a special charter approved by the New Jersey legislature June 23, 1971. It is governed by a five-member township committee, which designates one of its members to serve as mayor for a one-year term. The term for each committee member is three years. The committee supervises the operation of municipal government by establishing policies and programs and appropriating funds.

3.2 Location

Middletown is located in Monmouth County. The township has a total area of 59.3 sq mi, of which, 41.1 sq mi (69.0 percent) is land and 18.2 sq mi (31.0 percent) of it is water according to the U.S. Census Bureau.[2]

3.3 Population and Housing

According to the U.S. Census Bureau, as of 2000, there were 66,327, people, 23,236 households, and 18,109 families residing in the township. The population density was 1,613.0 people per square mile. The estimated 2006-2008 population was 67,904.[3]

The North Jersey Regional Transportation Authority (NJRTPA), the Metropolitan Planning Organization for the region, has projected Middletown's population to grow to 71,580 by 2035.[4]

Estimated housing units in 2008 were 24,205, of which 23,243 were occupied. Average household size in 2000 was 2.84, and estimated household size in 2008 was 2.91. [5]

[2] U.S. Census Bureau, New Jersey by Place and County Subdivision, GCT-PH1, Population, Housing Units, Area, and Density 2000, http://factfinder.census.gov/servlet/GCTTable?_bm=y&-context=gct&-ds_name=DEC_2000_SF1_U&-mt_name=DEC_2000_SF1_U_GCTPH1_ST7&-CONTEXT=gct&-tree_id=4001&-geo_id=04000US34&-format=ST-7|ST-7S&-_lang=en.

[3] U.S. Census Bureau, American Fact Finder,factfinder.census.gov. Data are from the 2000 Census and the 2006-2008 American Community Survey.

[4] North Jersey Transportation Authority (NJTPA), NJTPA *Approved Demographic and Employment Forecasts*, 8/24/2009, http://www.njtpa.org/DataMap/Demog/Forecast/documents/2035DemographicForecastsbyMunicipality--FinalApprovedforWebsite20090824.pdf.

[5] U.S. Census Bureau, *supra* note 2.

According to the New Jersey Council on Affordable Housing (COAH), Middletown was estimated to have 24,181 housing units in 2004, and this number has been projected to increase to 25,330 in 2018, a change of 1.0 percent.[6]

3.4 Employment and Income

The number of jobs within Middletown Township in 2004 was estimated at 15,996 by COAH, which forecasts the number to grow to 19,927 in 2018. [7] The North Jersey Transportation Planning Authority (NJTPA), projects employment within the township at 28,130 by 2035.[8]

Estimated 2008 per capital income was $41,126, with 3.4 percent of its residents under the poverty level during the previous 12 months.

3.5 Type of Land Use

According to the Middletown Master Plan (2004), the township had the following types and amounts of land use:

Land Use in Middletown Township, 2004

Land Use	Acreage	Percent
Vacant/Undeveloped	1,419	**6%**
Residential	9,516	39%
Multi-Family Residential	563	3%
Commercial	1,561	6%
Industrial	5	0%
Farmland	1,927	8%
Military Land	705	3%
Public Parks/Open Space	3,671	15%
Public Schools	587	2%
Other Land Uses	2,076	8%
Street, Highways & Railroads	2,418	10%
Total	24,448	100%

[6] New Jersey Council on Affordable Housing (COAH), *Third Round Consultants Reports, Allocating Growth to Municipalities*, http://www.state.nj.us/dca/affiliates/coah/regulations/thirdroundregs/597f.pdf., Figure A-1.

[7] COAH, *supra* note 5, Figure A-2.
[8] NJTPA, *supra* note 3.

Source: Middletown Township Planning Board, *Township of Middletown Master Plan* (October 27, 2004), Table L3.

3.5 Building Stock

Of the estimated 23,243 occupied housing units in 2006-2008, 19,846 (85.4 percent) were owner-occupied and 3,397 14.6 (percent) were renter-occupied. Of the total estimated 2006-2008 housing unit stock of 24,205 dwelling units, 13,003 or 53.7 percent were built before 1970.[9]

3.6 Transportation

Exits 109 and 114 of the Garden State Parkway are located in Middletown Township. The Parkway provides access to the New Jersey Turnpike, and, through the Turnpike, New York City and New York State.

New Jersey Transit's North Jersey Coast Line, which runs to Penn Station in New York City to Bay Head, New Jersey, has a rail station in Middletown. In addition, NJ Transit has bus service as well with numerous stops in the township.

According to the 2006-2008 American Community Survey, Middletown's commuting-to-work characteristics were as follows:

Commuting to Work Characteristics, 2006-2008, Middletown, NJ

	Estimate	Percent
Workers 16 years and older commuting to work	**32,105**	100.00%
Car, truck, or van -- drove alone	24,731	77.03%
Car, truck, or van -- carpooled	2,143	6.68%
Public transportation (excluding taxicab)	3,544	11.04%
Walked	424	1.32%
Other means	153	0.48%
Worked at home	1,110	3.46%

[9] U.S. Census Bureau, *supra* note 2.

Mean travel time to work (minutes)	35.8	

Source: U.S. Census Bureau, 2006-2008 American Community Survey, Selected Economic Characteristics, Middletown, NJ.

4. Existing Carbon Footprint for Middletown Township

A carbon footprint is a measurement of the amount of greenhouse gas emissions and energy usage produced by a local government's residents, schools, businesses, and industries in a given year. It shows a community's impact on global warming and climate change. The footprint can be reported publicly to build awareness and support for actions that can bring down carbon emissions. It also can be used to track the progress of a local government as it implements actions to combat global warming and climate change and reduce energy consumption.

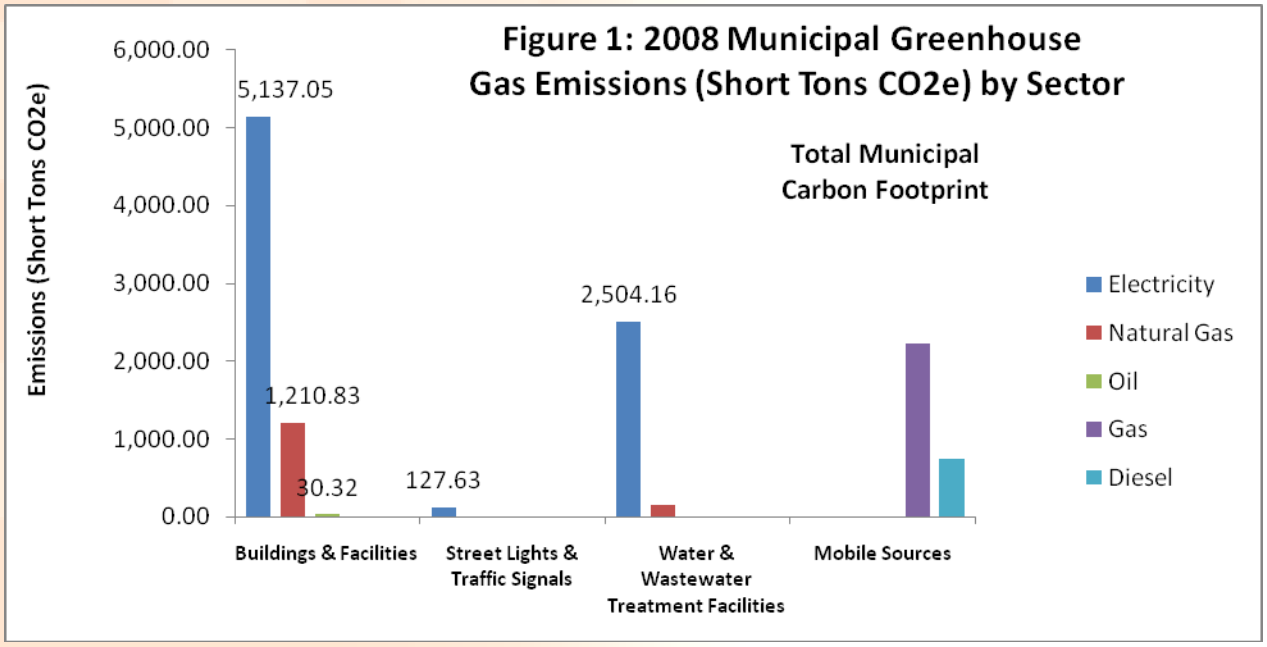
The municipal operations carbon footprint measures the greenhouse gas emissions (GHG) that occur as a result of municipal operations (e.g., municipal buildings, fleet, water and sewer, solid waste, etc.). The footprint illustrates baseline greenhouse gas emissions for Middletown and identifies the relative contributions of municipal activities and sectors. Calculations to determine the carbon footprint were made using emissions factors included in Sustainable Jersey's "Community Carbon Footprint Calculator."[i] Reduction targets and actions for achieving them can be determined based on the data provided in the footprint which serves as a baseline against which future emissions can be compared to determine the success of emission reduction efforts.

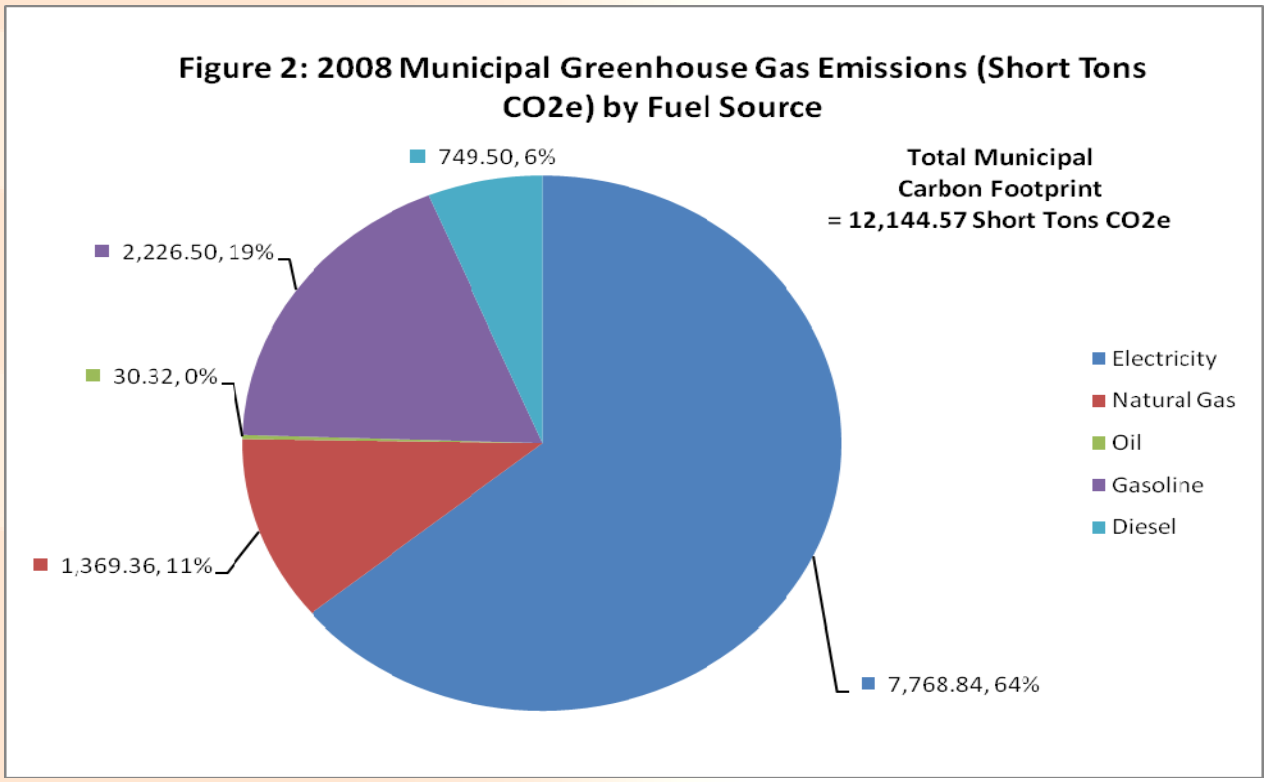
The municipal operations carbon footprint displays emissions from activities within the boundaries of local government operations (those activities over which the local government has control). Activities included do not necessarily take place within the geopolitical boundaries of Middletown (such as waste disposal), but are nonetheless a result of the local government's operations. To develop a carbon footprint of Middletown's local government operations, a greenhouse gas inventory of municipal operations was conducted using 2008 as a baseline year.

Data collected reflects the best available information, and data to calculate emissions from solid waste from municipal operations was not available for this inventory. Also absent in the inventory is commuting data for municipal employees. The emissions from water and wastewater treatment facilities reflect purchased electricity consumed within the facility, not emissions resulting from wastewater treatment processes. Therms of natural gas, kilowatt hours of electricity, and gallons of gasoline and diesel were all converted into short tons of carbon dioxide equivalents (CO2e) to determine the total emissions resulting from municipal operations.

Figures 1 to 4 summarize, in graphic form, energy usage and greenhouse gas emissions, based on the inventory in Appendix B of this plan. Figures 1 and 2, displayed in the following pages, summarize key information from Middletown's municipal operations carbon footprint. Figure 1 shows that emissions from buildings and facilities are the

greatest contributor to the footprint, while Figure 2 illustrates that the majority of emissions are from electricity usage followed by gasoline.



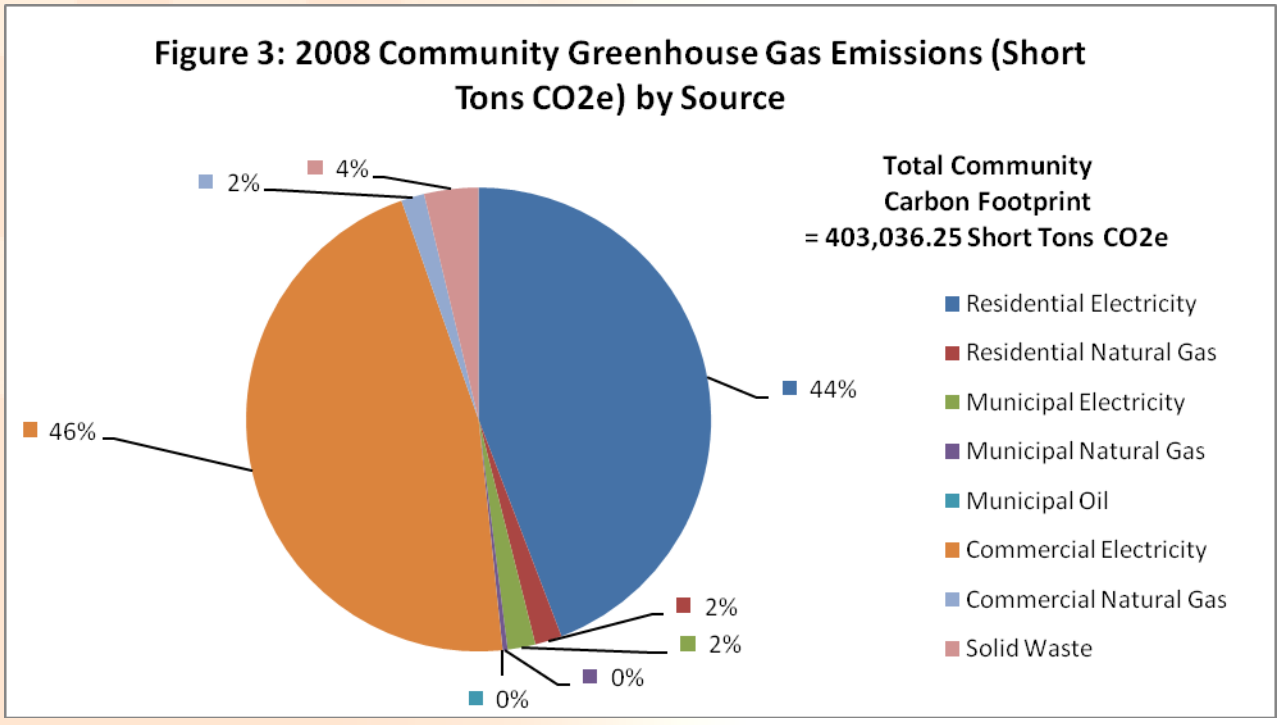


The community-wide carbon footprint measures the greenhouse gas (GHG) emissions from Middletown as a whole (e.g., municipal operations, residential and commercial emissions,

vehicle emissions, etc.). The footprint illustrates baseline greenhouse gas emissions for the city and identifies the relative contributions of different sectors and activities. Calculations to determine the carbon footprint were made using emissions factors included in Sustainable Jersey's "Community Carbon Footprint Calculator."[ii] Reduction targets and actions for achieving them can be determined based on the data provided in the footprint which serves as a baseline against which future emissions can be compared to determine the success of emission reduction efforts.

Again using 2008 as a baseline year, a community-wide greenhouse gas inventory was compiled to determine the carbon footprint of the city as a whole. An inventory of emissions released within Middletown's geopolitical boundaries was assembled, excluding emissions resulting from land use or land change, fugitive emissions, or industrial processes. The carbon footprint reflects the best available information. All units were converted into short tons of carbon dioxide equivalents (CO2e) to determine the total emissions resulting from Middletown's community-wide activities.

Figures 3 and 4, displayed in the following pages, summarize key information from Middletown's community-wide carbon footprint. Figure 3 illustrates a summary of emissions from the community as a whole and shows that the greatest sources of emissions are from electricity usage in the commercial sector followed by the residential sector. Figure 4, which shows the per capita emissions by sector, is useful for tracking emission levels over time as Middletown's population may change.



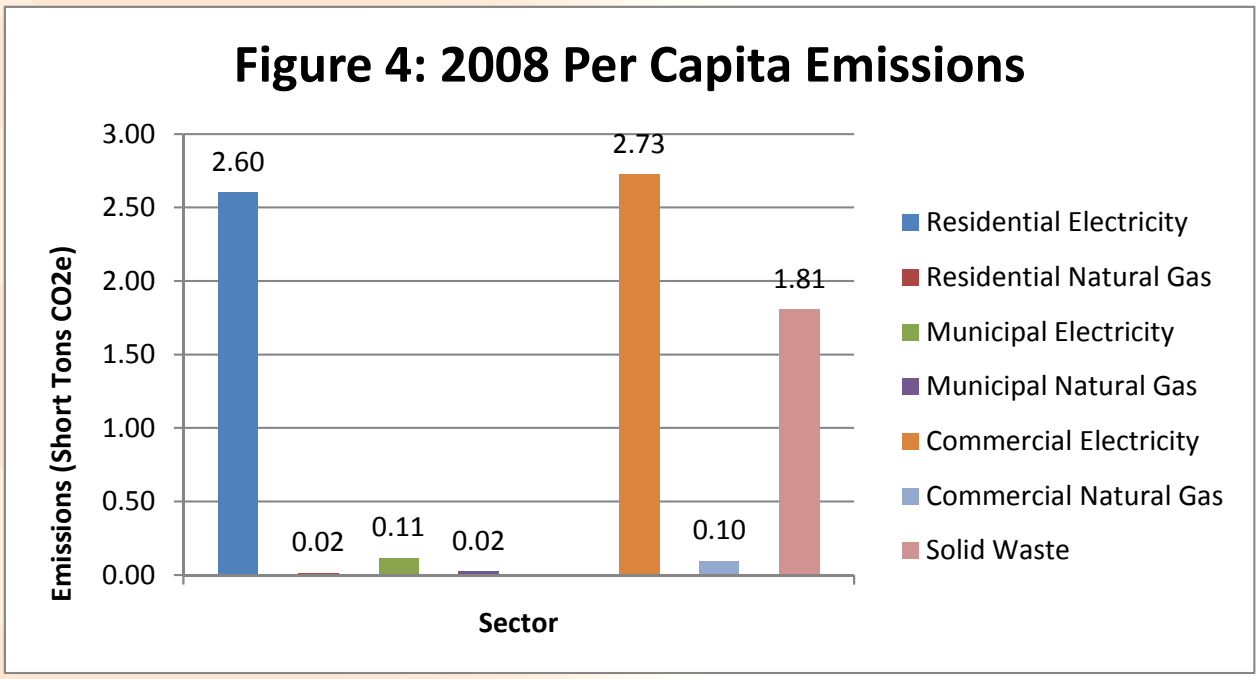


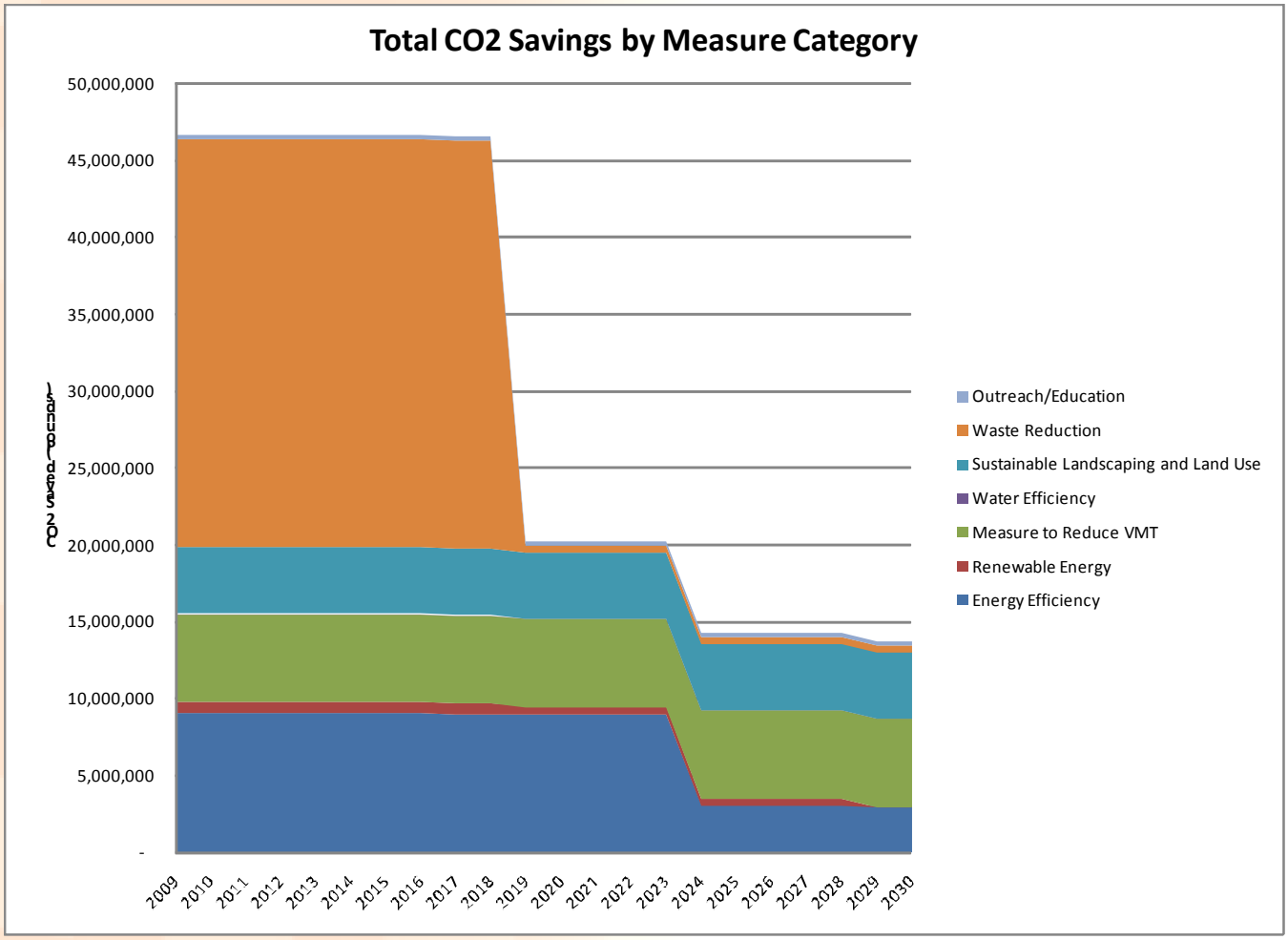
Figure 4: 2008 Per Capita Emissions
3.00
2.50
2.00
1.50
1.00
0.50
0.00
Emissions (Short Tons CO2e)
2.60
0.02
0.11
0.02
2.73
0.10
1.81
Sector
Residential Electricity
Residential Natural Gas
Municipal Electricity
Municipal Natural Gas
Commercial Electricity
Commercial Natural Gas
Solid Waste

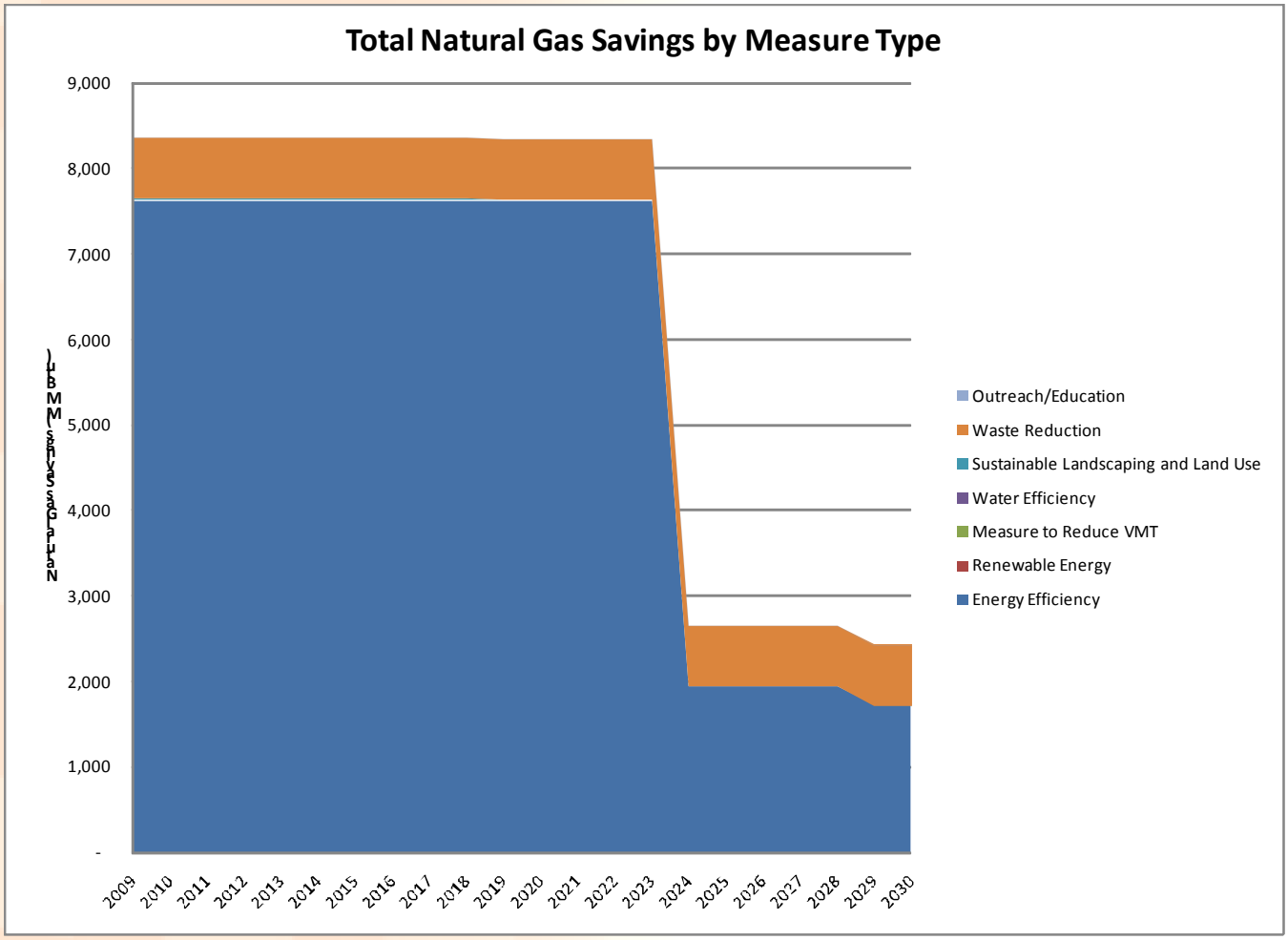
5. Projections for Community Energy Savings and VMT Reduction

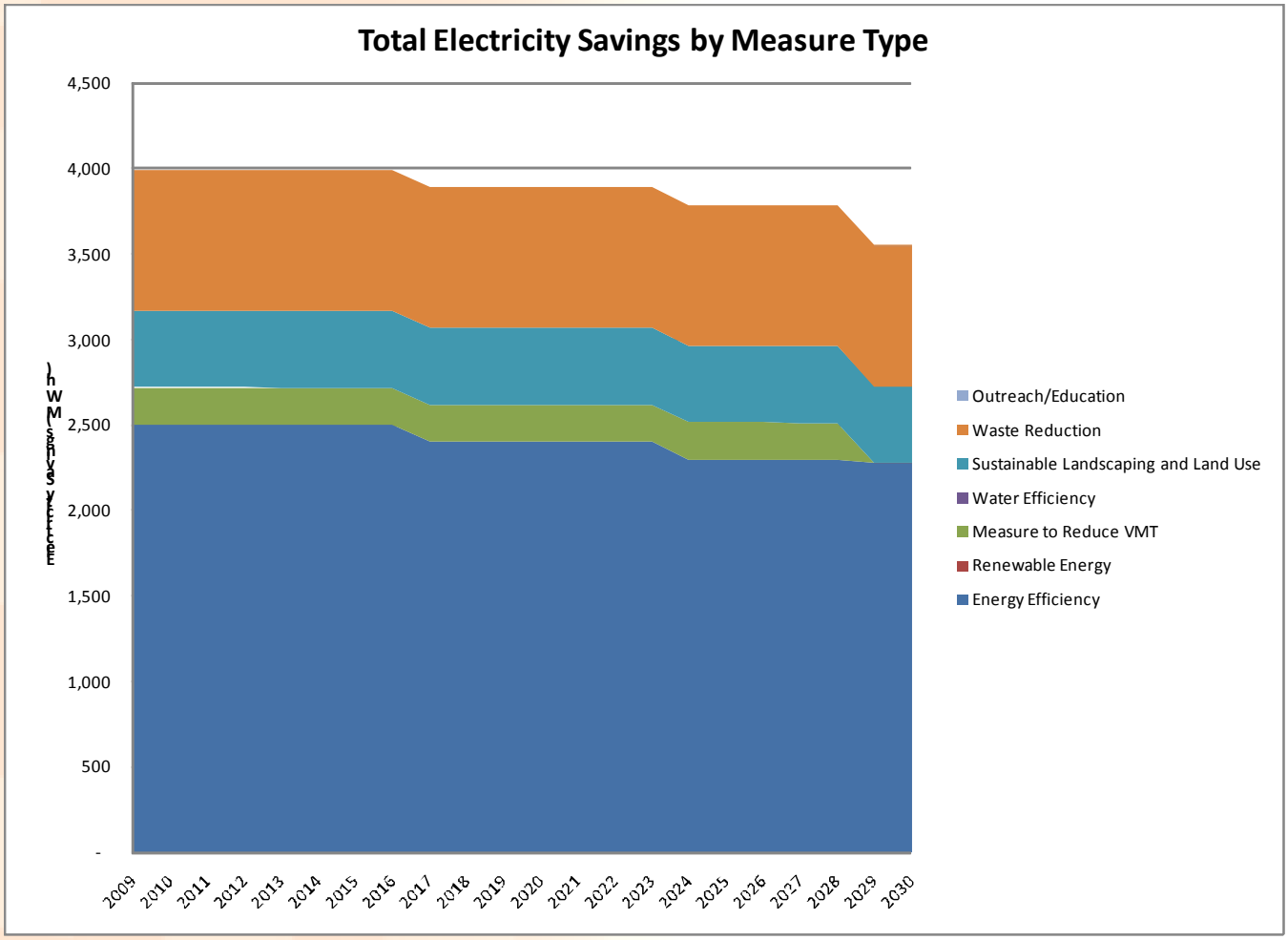
The following graphs show projections for savings in CO_2, electricity, natural gas, and vehicle miles traveled (VMT) if Middletown implements seven categories of implementation measures to reduce energy use and greenhouse gas emissions that are described in more detail in the following section. The measures are grouped under the following categories, and the projections show the contribution of each of those categories to energy savings and VMT reduction from a base year of 2009 to the year 2030.

The measures are grouped under the following categories:

- Education and Outreach
- Renewable Energy
- Sustainable Landscaping and Land Use
- Water Efficiency
- Waste Reduction
- Vehicle Miles Traveled (VMT) Reduction
- Energy Efficiency and Green Building


Total CO2 Savings by Measure Category
50,000,000
45,000,000
40,000,000
35,000,000
30,000,000
25,000,000
20,000,000
15,000,000
10,000,000
5,000,000
-
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
Outreach/Education
Waste Reduction
Sustainable Landscaping and Land Use
Water Efficiency
Measure to Reduce VMT
Renewable Energy
Energy Efficiency


Total Natural Gas Savings by Measure Type
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
-
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
Outreach/Education
Waste Reduction
Sustainable Landscaping and Land Use
Water Efficiency
Measure to Reduce VMT
Renewable Energy
Energy Efficiency


Total Electricity Savings by Measure Type
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
-
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
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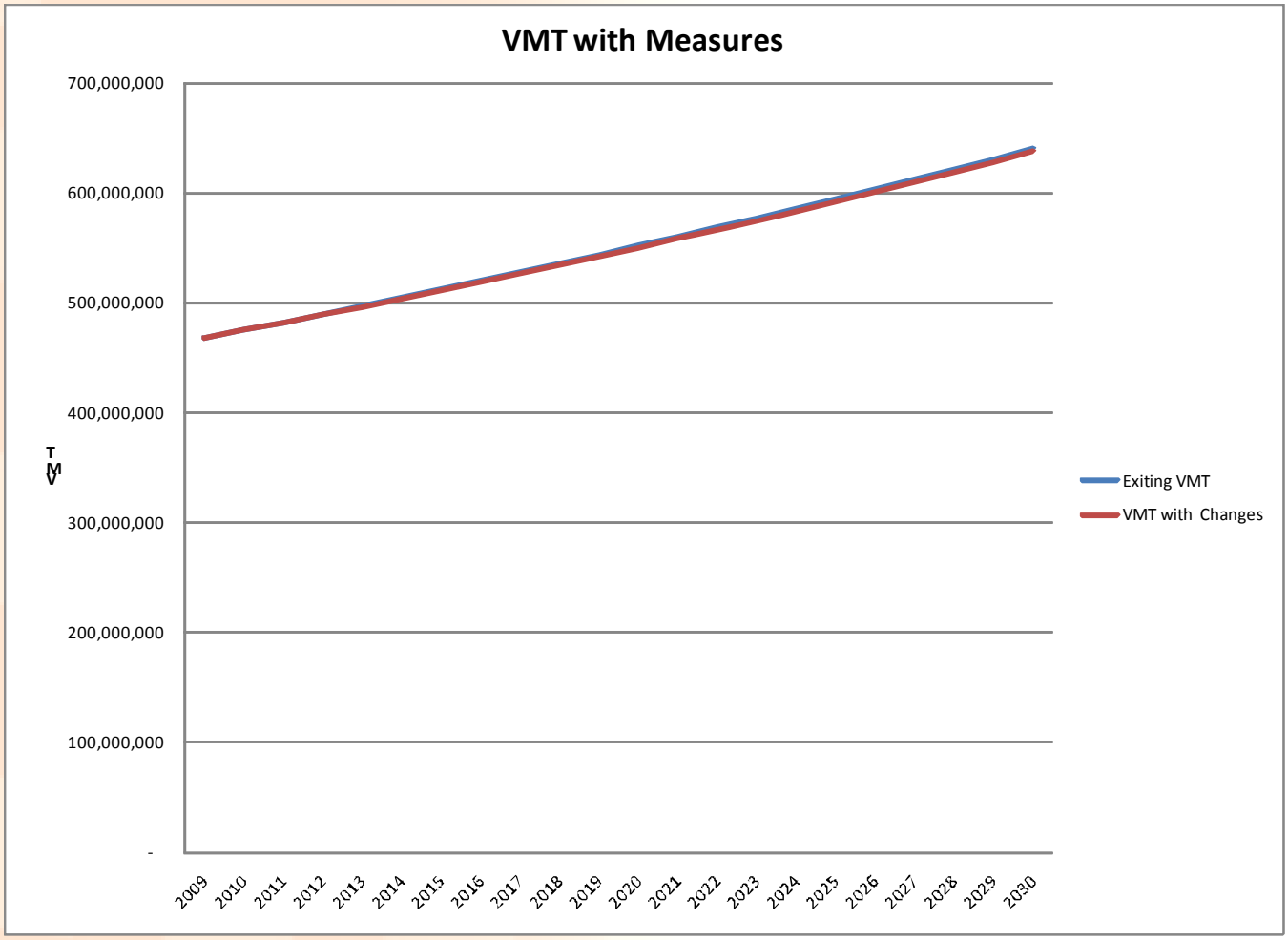
2030
Outreach/Education
Waste Reduction
Sustainable Landscaping and Land Use
Water Efficiency
Measure to Reduce VMT
Renewable Energy
Energy Efficiency


VMT with Measures
700,000,000
600,000,000
500,000,000
400,000,000
300,000,000
200,000,000
100,000,000
-
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
Exiting VMT
VMT with Changes

6. Summary of Alternative Energy and Conservation Plan Measures; Recommended Policy Alternatives

Summary of Energy Plan Implementation Measures

This summarizes measures to implement the energy plan for Middletown Township. The measures are grouped under the following categories.

- Education and Outreach
- Renewable Energy
- Sustainable Landscaping and Land Use
- Water Efficiency
- Waste Reduction
- Vehicle Miles Traveled (VMT) Reduction
- Energy Efficiency and Green Building

6.1 Education and Outreach

1. Implement an education and enforcement campaign to reduce vehicle idling.

Vehicle idling, which occurs when a vehicle engine is on while the vehicle is not in motion, reduces air quality and is associated with negative health impacts. To avoid the unnecessary environmental and health impacts associated with idling, local governments can implement an education and enforcement campaign to reduce vehicle idling. Campaign activities could include performing educational outreach, installing no-idling signs in frequent idling locations (e.g., schools, public facilities, and drive-thrus), and increasing patrols and ticketing.

2. Establish policies for personal behavioral modifications.

In typical office buildings like a municipal complex, energy expenditures account for approximately 19 percent of total costs. Considering the sources of energy usage in such facilities, lighting, heating/cooling, and office equipment account for 80% of the consumption. Given that the staff has control over energy usage in these categories, significant greenhouse gas reductions and energy savings can be realized through personal behavioral changes. Local governments can educate their employees to conserve energy and natural resources in their everyday operations and establish polices to institutionalize

environmentally-responsible and cost-saving behaviors. The local government can enact a policy that requires lights, computers, copiers, and printers to be turned off when not in use, double-sided printing and copying, and thermostat adjustments to reduce energy usage. Once adopted, educational materials and ongoing impact updates can be used to ensure all government employees not only understand the benefits of such behavioral changes but also acknowledge that they are personally responsible for implementing the policy. Energy savings can then be tracked to showcase the collective impacts the staff makes on the government's energy consumption.

6.2 Renewable Energy

1. Increase photovoltaic solar capacity.

Municipalities may choose to be leaders in the installation of photovoltaic (PV) solar capacity by installing solar panels at municipal sites. Increasing the township's solar energy capacity may increase the amount of green energy going into the electric grid, decrease a facility's carbon footprint, reduce electric bills for a facility, or any combination of such benefits.

Rather than owning the PV systems outright, a township can serve as a host site for PV systems and leave the financing, ownership, operation, and maintenance to a third party provider or the local utility. Under this scheme, the township enters into a long term service contract – also known as a power purchase agreement (PPA) – with the provider to purchase the solar electricity produced on its property. A PPA is usually written for 15 – 25 years and sets the price of the clean energy produced onsite at, or below, the facility's current electric utility rate.

2. Transition to green vehicle fleets.

Municipal vehicle fleets emit greenhouse gases and other pollutants that degrade the environment and public health. Fleet inefficiencies create unnecessary pollution and financial burdens from high fuel expenditures. Municipalities can transition to a green fleet to minimize operating costs and vehicle emissions. Fleet greening is achieved through downsizing, training drivers to operate vehicles for maximum efficiency, and the purchasing of high fuel efficiency and alternative fuel vehicles. Improving a fleet's fuel efficiency will result in long-term cost savings, cleaner air, and reduced greenhouse gas emissions.

3. Enact a small wind energy ordinance to enable greater wind energy generation.

Municipalities may enact a wind ordinance to promote the installation and operation of small wind energy systems in their jurisdiction. This action is a part of the New Jersey Board of Public Utilities' Community Partners Initiative (CPI). The CPI is a NJ Board of Public Utilities program that supports communities to take the lead in engaging residents, businesses, and municipalities in NJ's various Clean Energy Programs. Technical assistance and financial incentives are offered through the Community Partners Initiative to community leaders to help residents and businesses take advantage of clean energy and energy efficiency programs offered by the State. A $500 incentive is offered to municipalities that pass a wind energy ordinance.

6.3 Sustainable Landscaping and Land Use

1. Preserve the tree canopy.

Trees act as a sink for CO_2 by fixing carbon dioxide during photosynthesis and storing excess carbon as biomass. Street and shade trees play an important role in the sequestration of greenhouse gases, as each individual tree sequesters approximately 4.6 to 11.4 kg of carbon per year or 37 to 92 lbs. per year of CO_2, although actual sequestration rates will depend on the types and ages of trees. As urbanization and development occur in a community, the number of trees are reduced and with that reduction the potential to slow the accumulation of atmospheric carbon.

The township can preserve the existing tree canopy in the community or increase it by setting canopy goals and creating Tree Management Plans through the New Jersey Department of Environmental Protection. To implement such plans, the township can undertake a tree planting program and tree maintenance program for shade trees on public properties. Additionally, the government can pass a tree replacement ordinance that requires planting a new tree when a tree is removed or paying a fee in lieu to the township.

2. Enact sustainable landscaping ordinances for residential and commercial applications

A township can enact an ordinance that sets guidelines for the percentage of turf grass on commercial and residential properties. Requiring residential and commercial properties to reduce mowable areas or turf grass to 40% or less of a site's improved landscape area will not only help to reduce ghg emissions relating to mowing but also reduce total yard waste while additionally improving the water quality delivered to the local watershed. Nearly one-fifth of all municipal solid waste collected is organic matter generated from yard waste such as grass clippings and leaves. Lawn and garden equipment manufactured pre-1997

accounts for as much as 5% of total man-made hydrocarbons that contribute to ozone formation.

3. Enact "a no or low mow" policy for municipal properties.

In order to reduce negative environmental impacts associated with use of lawn and garden equipment, the township can enact a policy that sets guidelines for the extent of mowable turf used within its municipal properties. This policy can set similar guidelines as maximum site coverage limits, in an effort to reduce GHG emissions relating to mowing and total landscaping waste while additionally improving the water quality delivered to the local watershed.

For mowable areas that the township still chooses to mow, use well-tuned power tools where necessary and hand tools in all other areas. When possible, select electric tools over gas tools to further reduce ghg emissions. For gas powered tools, use 4-cycle engines over 2-cycle as they are more fuel efficient.

4. Encourage sustainable landscaping practices for residential applications.

Proper placement of trees and landscaping beautifies outdoor space and reduces heating and cooling costs To obtain benefits from such placement, the township can enact an ordinance applicable to new single-family homes that requires the use of sustainable landscape practices to reduce energy use.

Taller deciduous trees on the southeast, south and southwest side of a building provide shading from the high summer sun and allow low winter sun to filter into the building. Hardy evergreen trees and shrubs, placed at the northeast and northwest corners of the landscape can reduce heating costs by blocking or redirecting cold winter winds over or around the building. On west walls, use of trellises, arbors, and planting beds for annuals provides shading on west-facing windows where summertime heat gain is the biggest problem.

5. Encourage sustainable landscaping practices for commercial applications.

Proper placement of trees and landscaping beautifies outdoor space and reduces heating and cooling costs To obtain benefits from such placement, the township can enact an ordinance applicable to new construction and major renovation projects to require commercial buildings to use sustainable landscape practices to reduce energy use.

Taller deciduous trees on the southeast, south and southwest side of a building provide shading from the high summer sun and allow low winter sun to filter into the building.

Hardy evergreen trees and shrubs, placed at the northeast and northwest corners of the landscape can reduce heating costs by blocking or redirecting cold winter winds over or around the building. On west walls, use of trellises, arbors, and planting beds for annuals provides shading on west-facing windows where summertime heat gain is the biggest problem.

6. Encourage sustainable landscaping practices to reduce heat island effect in new residential buildings.

As a result of heat island effect, ambient temperatures in urban areas can be as much as 2 to 9 degrees Fahrenheit higher than surrounding suburban and undeveloped areas. To offset this, the township can enact an ordinance applicable to new construction and major renovation projects to require the use of light colored paving materials, less hardscape, or covered parking to help reduce urban heat island effect. Residential projects can help mitigate urban heat island effects by using light-colored, high albedo materials or vegetation for at least 50% of sidewalks, patios, and driveways within 50 ft of the home.

7. Encourage sustainable landscaping practices to reduce heat island effect in new and existing commercial buildings.

As a result of heat island effect, ambient temperatures in urban areas can be as much as 2 to 9 degrees Fahrenheit higher than surrounding suburban and undeveloped areas. To offset this, the township can enact ordinance applicable to new construction and major renovation projects to require the use of light colored paving materials, less hardscape, or covered parking to help reduce urban heat island effect.

Building projects can mitigate heat island effects by specifying that least 50% of site hardscape are provided through a combination of the following:

- Shade vegetation
- Paving materials with SRI of 29
- Shade structures
- Parking under building

6.4 Water Efficiency

1. Adopt a water conservation ordinance.

In order to address growing concerns about droughts, water shortages, and rising costs, the township can adopt a water conservation ordinance as a practical and effective way to decrease unnecessary water consumption. The primary goal of a water conservation

ordinance is to reduce residential and commercial seasonal outdoor water use. Numerous studies have shown that ordinances are more effective at reducing outdoor water consumption than other strategies, such as price increases and awareness campaigns. Municipalities can use the model ordinance developed by the New Jersey Department of Environmental Protection (NJDEP), which establishes a two-day per week watering limit, to reform water consumption in your community.

2. Encourage water efficiency in new single family homes.

Managing water is a growing concern in the United States. Communities across the country are starting to face challenges regarding water supply and water infrastructure. Building occupants use 12% of the total U.S. water use. Approximately 7% of U.S. water use is in the residential sector, averaging 100 gallons of water per person per day. To encourage water efficiency, the township may enact an ordinance to reduce permitting fees for new single-family homes that achieve WaterSense labeled new home certification.

3. Encourage water efficiency in new and existing municipal buildings

Managing water use is a growing concern. Building occupants use 12% of the total water consumed in the United States. Communities across the country are starting to face challenges regarding water supply and water infrastructure. To encourage water efficiency in new and existing municipal buildings, the township can adopt a green building policy that requires all new construction and major renovation projects and existing building plumbing upgrades to use WaterSense- labeled products or equivalent.

4. Encourage water efficiency in new and existing commercial buildings

Managing water use is a growing concern. Building occupants use 12% of the total water consumed in the United States. Communities across the country are starting to face challenges regarding water supply and water infrastructure. To address this problem the township may enact an ordinance to reduce permitting fees for new construction and major renovation projects and plumbing upgrades to existing buildings that use WaterSense labeled products or equivalent.

6.5 Waste Reduction

1. Reduce solid waste generation through green purchasing.

Green or Environmentally Preferable Purchasing refers to "products or services that have a lesser or reduced effect on human health and the environment when compared with competing products or services that serve the same purpose." This comparison applies to

raw materials, manufacturing, packaging, distribution, use, reuse, operation, maintenance, and disposal. Alternatives exist for almost every product used in government operations that are less hazardous, generate less pollution and save energy, water, and other resources in addition to providing reductions in solid waste generation.

The township can establish an Environmentally Preferable Purchasing Policy that minimizes the health and environmental impacts of products used in government operations and that includes a preference for products offered with minimal packaging. Product packaging is relevant to energy conservation because packaging accounts for nearly a third of all municipal solid waste generated in the United States. Because energy is consumed in the waste creation and disposal processes, reducing waste overall mitigates energy use and therefore greenhouse gas emissions.

2. Minimize GHG emissions from waste through management.

Over the past two decades, recycling rates in the United States have increased significantly. According to the Environmental Protection Agency (EPA), 33% of all municipal solid waste (MSW) was recycled in 2007. In comparison, recycling rates in 1990 were only 16%. Even though recycling rates are improving, waste production as a whole continues to rise. In 2007, the United States generated 254 million tons of MSW, a 24% increase compared to 1990 levels.

Overall, waste generation is a major contributor to global warming. The EPA reports that 4% of U.S. greenhouse gas emissions are associated with waste management. In addition, landfills are the largest source of methane (CH4), which is over 20 times more effective at trapping heat than carbon dioxide (CO2). Ultimately, the most effective way to lower greenhouse gas emissions associated with waste generation is through a combination of recycling and source reduction.

Municipalities can reduce non-recycled municipal waste by 5% annually, an ambitious but realistic target that can be achieved by implementing the following waste management strategies: (1) conducting a waste audit of municipal buildings and schools; (2) adopting a pay-a-you-throw program; (3) implement a compost waste recycling program; (4) implement waste reduction education program.

3. Encourage recycling of residential construction and demolition waste.

Numerous benefits can be achieved by diverting a portion a construction and demolition (C&D) debris from residential construction to a recycling center. Fewer virgin resources will be consumed through reducing, reusing, and recycling C&D materials. In preserving

these resources, green house gas emissions associated with extracting these resources will also be avoided. To do this, the township may enact and ordinance that requires residential new construction and major renovation projects to recycle at least 75% of construction and demolition debris.

Reductions in C&D waste also will amount to fewer traditional disposal facilities. Disposal facilities emit methane gas into the atmosphere which contributes to climate change. Therefore, reducing disposal facilities will additionally reduce methane gas emitted into the atmosphere.

4. Encourage recycling of commercial construction and demolition waste.

Numerous benefits can be achieved by diverting 75% of construction and demolition (C&D) debris from nonresidential construction to a recycling center. Fewer virgin resources will be consumed through reducing, reusing, and recycling C&D materials. In preserving these resources, green house gas emissions associated with extracting these resources will also be avoided. Enact policy that requires new nonresidential construction and major renovation projects to recycle at least 75% of construction and demolition debris. Reductions in C&D waste also will amount to fewer traditional disposal facilities. Disposal facilities emit methane gas into the atmosphere which contributes to climate change. Therefore, reducing disposal facilities will additionally reduce methane gas emitted into the atmosphere.

6.6 Vehicle Miles Traveled (VMT) Reduction

1. Create complete streets.

Local governments can encourage residents and employees to replace motor vehicle trips with walking or bicycling by making it safer and easier to walk and bike. By reducing motor vehicle trips, less greenhouse gas emissions will be generated. To do this, adoption and implementation of "Complete Streets" policy are desirable. Complete Streets is a basic concept that all streets, except perhaps limited access highways, should be designed and built for all users – motor vehicle drivers, walkers, bicyclists, and transit users. Complete Streets accommodate the young and old, the physically able and the physically challenged, moms and dads pushing strollers, children on bikes, as well as cars, buses and trucks.

The municipal or county government can establish a Complete Streets policy that requires that the needs of pedestrians and bicyclists are considered when roads and bridges are constructed or reconstructed. This may involve building sidewalks to fill in the "missing

links," providing bus shelters for transit users, and providing bike lanes or separated multi-use paths where demand is anticipated – on routes connecting downtown retail, employment districts, schools, transit stations, and parks. The government can also require bicycle parking at these destinations and improve pedestrian safety at intersections by providing crosswalk striping and pedestrian signals where warranted.

2. Achieve critical mass to support walkable communities and public transit.

Successful public transit and walkable communities require sufficient populations within a given area. Municipalities can establish a long-term goal to increase the gross density of the community (dwelling units per gross acre or per square mile) by a certain amount, up to at least a minimum level at which mass transit is supported and VMT would be reduced.

Residential densities affect public transportation usage by influencing changes in modes of travel, which in turn, affect vehicle miles traveled and associated energy usage and carbon emissions. In order to achieve this critical mass of people and destinations, the township can promote infill development through tax abatement, redevelopment, transfer of development rights, rezoning, and other methods. Additionally, the township can change parking incentive structures to support non-auto density (e.g., set parking maximums, remove minimums).

3. Provide alternative transportation incentives.

Local governments can provide incentives and education to reduce single-occupant vehicle commuting by their employees. Incentives can take the form of direct subsidies of transit passes, for example, or other benefits, such as preferential parking for carpools or covered secure bicycle parking for cyclists. Benefits can also take the form of commuter tax benefits for transit, parking, vanpool or bicycle expenses. Establishment of policies for telecommuting and offering of alternative work schedules reduce the number of days that employees commute. These programs reduce the miles traveled by employees for commuting, thereby decreasing greenhouse gas (GHG) emissions. This measure can be implemented on its own or in combination with other transportation and land use measures.

4. Institute Safe Routes to School

Safe Routes to School (SRTS) is a federal, state and local effort to enable and encourage children to walk and bicycle to school - and to make walking and bicycling to school safe and appealing. Local governments can partner with school districts to make it safer and

easier for students to walk and bike to school. SRTS activities fall under four categories: (1) education of children, parents, and the community, (2) encouragement through events and contests, (3) Enforcement of speeding and other traffic laws, and (4) engineering of street improvements to make it safer to walk along and across the road. Engineering of street improvements is excluded from this measure, however, because it is included under the related Complete Streets measure. SRTS reduces greenhouse gas (GHG) emissions by reducing the number of children being driven to school, thereby eliminating or shortening motor vehicle trips. A successful SRTS program in a compact area will reduce the need for school buses, as well. This measure can be implemented on its own or in combination with other transportation and land use measures.

5. Establish green business recognition programs and buy local campaigns.

Buy Local Campaigns and Green Business Recognition programs collectively work to reduce greenhouse gas emissions and support local economies. The Buy Local campaign encourages community members to patronize local businesses, which ultimately reduces VMT by requiring fewer and shorter distance driving trips. Previous long distance shopping trips by car can be replaced by walking, biking, and mass transportation use. Furthermore, buying locally re-circulates revenue back into the community to strengthen the municipal tax base.

In addition to conducting a buy local campaign, local governments can establish a Green Business Recognition Program to encourage local businesses to increase energy efficiency, conserve resources, and reduce waste and pollution. Businesses recognized for implementing sustainable practices attract more customers, while the Buy Local Campaign encourages community members to support local businesses. Overall, the implementation of both of these measures will strengthen local economies, reduce environmental impacts, and specifically reduce greenhouse gas emissions.

6.7 Energy Efficiency and Green Building

Generally, municipal governments can offer a number of incentives to encourage the private development of green buildings. The following is a list of the most common generic incentives offered by jurisdictions across the country:[10]

- Tax Incentives
- Bonus Density

[10] American Institute of Architects (AIA). 2008. State and Local Green Building Incentives. http://www.aia.org/aiaucmp/groups/aia/documents/pdf/aias076936.pdf

- Expedited Permitting
- Grants (including fee subsidization)
- Loans
- Technical Assistance/Design Assistance
- Permit/Zone Fee Reduction
- Rebates and Discounts on Environmental Products (e.g., Energy Star)

The following describes these approaches in more detail.

1. Increase community-wide use of conservation equipment.

To increase community-wide use of conservation equipment, municipalities can provide free or low-cost conservation equipment to residents and local businesses. By purchasing equipment in bulk and taking advantage of cooperative purchasing programs, local governments can acquire conservation equipment at discounted prices and provide this equipment to residents and businesses at reduced prices to encourage increased conservation. Conservation equipment that could be distributed in this way includes composters, low-flow showerheads, and faucet aerators.

Local governments have opportunities to maximize purchasing power that are not readily available to individuals. By purchasing in bulk, municipalities are able to negotiate lower prices than individual purchasers. Furthermore, municipalities have access to group purchasing arrangements that offer additional cost savings through competitive pricing. Using available group purchasing arrangements, local governments can obtain cost savings which can be passed on to community members to encourage the use of conservation equipment in homes and businesses.

2. Convert traffic signals/public lighting to LED.

Growing environmental concerns in conjunction with rising electricity costs have fostered a demand for more cost-effective and energy efficient lighting technology. According to the U.S. Department of Energy, 22% of the nation's electricity is devoted to lighting, and one of the most effective ways to reduce energy expenses and electricity consumption associated with lighting is by utilizing light emitting diode (LED) technology. Municipalities can convert existing traffic signals and street lights to LED to lower municipal utility expenses and overall energy consumption and greenhouse gas emissions.

In addition to the fact that LEDs do not contain toxic materials, such as mercury and lead, LED technologies offer numerous benefits when compared to conventional traffic signals and street lights. LED signals consume up to 90% less energy than regular traffic signals and last up to seven times longer. Because they do not burn out as frequently as regular

traffic lights, utilizing LEDs also reduces maintenance costs and potential driving hazards. Similarly, LEDs last ten times longer than regular street lights and use 50% less energy. As with traffic signals, LED street lights also shine brighter, thus improving nighttime visibility and public safety. Unlike standard bulbs, LEDs emit light that is easier to direct and control, which in turn reduces unnecessary light pollution. Replacing current traffic signals and street lights with LED lighting will serve to lower energy costs and consumption while improving public safety.

3. Promote New Jersey Climate Choice homes.

Education and outreach campaigns can be launched to promote the New Jersey Climate Choice Homes Program as part of the New Jersey Board of Public Utilities' Community Partners Initiative (CPI). The Community Partners Initiative is a New Jersey Board of Public Utilities (BPU) program designed to train local municipalities in performing community outreach activities and enrolling residents in various energy saving techniques. Community Partners will provide technical support, resources, and expertise to help local officials implement a successful outreach campaign. The overall goal of the campaign is to foster education and awareness on how to reduce energy costs and greenhouse gas emissions amongst local communities.

Climate Choice is a newly formed Environmental Protection Agency program that focuses on cutting-edge ways to significantly reduce carbon emissions and energy consumption. According to the EPA, residential households account for 17% of annual greenhouse gas emissions in the United States. A Climate Choice home meets all the requirements of an ENERGY STAR-rated home, while also utilizing solar energy technology, thus resulting in "near zero" household energy consumption. When compared to a standard International Energy Conservation Code (IECC) rated home from 2006 or later, a Climate Choice home is 50% more energy efficient and saves homeowners an average of $1,000 a year in household energy costs.

The New Jersey Climate Choice Homes program is a Board of Public Utilities (BPU)-sponsored initiative designed for municipalities to promote the construction of "near zero" emission homes to licensed builders and residential construction companies. Towns can receive a $1,000 incentive bonus upon issuing one Climate Choice home permit within the community.

4. Promote New Jersey ENERGY STAR homes.

Education and outreach campaigns can be launched to promote the New Jersey ENERGY STAR Homes Program as part of the New Jersey Board of Public Utilities' Community

Partners Initiative (CPI). The Community Partners Initiative is a New Jersey Board of Public Utilities (BPU) program designed to train local municipalities in performing community outreach activities and enrolling residents in various energy saving techniques. Community Partners will work alongside local municipal officials for the purpose of organizing an outreach campaign. The overall goal of the campaign is to foster education and awareness on how to reduce energy costs and greenhouse gas emissions among municipalities.

ENERGY STAR rated homes are EPA certified to be at least 15% more energy efficient than standard homes, thus reducing greenhouse gas emissions and annual energy expenses. Overall, homeowners can expect to save between $200-400 in annual energy costs. In addition, ENERGY STAR homes are built with higher quality equipment, which in turn lowers projected maintenance costs and increases the home's overall comfort and resale value.

5. Participate and encourage participation in the New Jersey Board of Public Utilities' Pay for Performance Program.

Launched in March 2009, Pay for Performance is a new program offered by the New Jersey Board of Public Utilities that takes a whole-building approach to energy reduction in commercial and industrial facilities. Local government, commercial, industrial, and institutional buildings with an annual peak demand over 200kW are eligible for this program. Municipalities can participate in, and encourage businesses in their jurisdiction to participate in, the Pay for Performance program to improve energy efficiency of facilities throughout the community.

The Pay for Performance program is aimed at projects that will be performing a facility-wide energy efficiency overhaul, but is not appropriate for facilities that only need to upgrade one or two pieces of equipment. Additionally, no one system or equipment upgrade can account for the entire 15% energy savings.

6. Participate in the New Jersey Board of Public Utilities' Community Partners Initiative.

Local governments can launch education and outreach campaigns to increase participation in the energy efficiency and conservation programs that comprise the New Jersey Board of Public Utilities' Community Partners Initiative (CPI). The CPI is a NJ Board of Public Utilities (BPU) program that supports communities to take the lead in engaging residents, businesses, and municipalities in New Jersey's various Clean Energy Programs.

7. Install variable frequency drives (VFD) in HVAC systems.

Buildings' HVAC systems often operate at less than full load for more than 95% of their operating hours while also being designed to handle unexpected overloads. These traditional, constant-operating systems use energy unnecessarily. When applied to a heating, ventilating and air-conditioning (HVAC) system, more specifically the air handling units (AHU), it will conserve energy effectively and offer significant energy savings through greatly reduced electric bills. The use of variable frequency drives (VFD) is a key technology in reducing energy usage and costs. They offer an attractive energy conservation measure where there is a need to vary the flow of a fluid in distribution systems.

8. Institute retrocommissioning.

Retrocommissioning or recommissioning (RCx) is a systematic, documented process that identifies low-cost operational and maintenance improvements in existing buildings. It most often focuses on the dynamic energy-using systems such as mechanical equipment, and lighting and related controls with the goal of reducing energy waste, obtaining energy cost savings for the owner, and identifying and fixing existing problems. The process usually includes an audit of the entire building including a study of past utility bills, interviews with facility personnel. The diagnostic monitoring and functional tests of building systems are executed and analyzed. Building systems are retested and remonitored to fine-tune improvements. This process helps find and repair operational problems. A final report, recommissioning plan and schedule are then given to the owner.

9. Install programmable thermostats.

ENERGY STAR programmable thermostats reduce energy use and lower utility bills by allowing the user to set heat or air conditioning settings for an unoccupied room or workspace. These technologies can be programmed to deliver the proper amount of heat or air conditioning specifically at the time the user requires the room, thus reducing the amount of energy normally required to regulate room temperatures in an empty workspace.

The use of programmable thermostats can result in significant savings. If used properly, a programmable thermostat can save homes and businesses up to 25% in heating costs and, in the summer, these devices can reduce cooling costs by 15 to 20%.

10. Install plug loads - power management software and vending misers.

Plug load refers to the energy consumed by any electronic device plugged into an AC outlet. In offices, this often consists of computers, monitors, copiers, vending machines,

and refrigerators including smaller appliances such as projectors and even coffeemakers. All consume electricity even when they are in standby mode or is switched off. This means that anytime an appliance or device is plugged in, it is drawing power. Office plug loads account for about 30% of office electricity bills, one of the most significant expenses for offices other than payroll. Reducing a building's plug load is an opportunity to cut building energy consumption for significant cost and energy savings.

11. Install dual-technology occupancy sensors.

Lighting accounts for about 21% of a building's electricity use and about 17% of total annual US electricity consumption. Because many building spaces are unoccupied more than half the time, switching unneeded lights off makes it possible to reduce direct lighting energy consumption up to 45%. Reducing lighting electricity usage reduces energy cost and lessens the negative environmental impacts associated with electricity generation.

Occupancy sensors use primarily two technologies to monitor and control electric lighting: infrared and ultrasonic. Infrared sensors respond to changes in temperature while ultrasonic sensors respond to changes in motion. Most sensors are designed to function independently or in parallel with other sensors for larger areas. Installing occupancy sensors with both of these technologies is an effective and relatively inexpensive way to lower energy consumption, keeping costs down.

12. Install lighting upgrades.

Lighting accounts for more than 30% of the total electrical energy consumed in commercial buildings. New energy efficient lighting equipment such as compact fluorescent lamps (CFLs) and T-5 and T-8 linear fluorescent lamps with electronic ballasts can be used to help cut lighting operational costs 30% to 60% while enhancing lighting quality and the lifetime of lighting fixtures. Installing energy efficient lighting can also significantly decrease HVAC costs because more efficient lights emit less heat.

13. Install LED exit lights.

Many buildings today currently use incandescent and fluorescent lights for their exit signs which use up 350kWh and 140kWh respectively, of electricity annually[1]. In addition to their energy costs, they also require more frequent maintenance than do LED exit lights. Replacing light bulbs frequently can become an expensive task. LED exit lights on the other hand only use 44kWh of electricity annually and can last anywhere from 10 to 25 years. Incandescent and fluorescent lamps last no more than 3 months and 10 months

respectively. These energy and maintenance differences add up to significant cost savings over the equipment's lifetime.

14. Institute time of day operations: day cleaning.

Day cleaning is an alternative to traditional nighttime janitorial services that have been common among office properties for the past century. With cutting costs on electricity seeming to dominate types of cost-effective measures, day cleaning is an often overlooked measure that can cut back on the amount of time a building is in operation, by reducing the amount of time lights are on in a building.

A typical small office building operates 55 hours per week (excluding weekends). Consider that ten of those hours (2 hours per day) are used to perform janitorial services before and after normal business hours. Typically when buildings are cleaned, all the lights are turned on during the entire cleaning process and all lighting are turned off when the cleaning staff leaves. However, there are reports of lights remaining on, not only overnight, but also throughout the weekends. Switching to day cleaning allows the janitorial staff to work during normal hours of operation, the building to be locked up at night and lights turned off, thereby reducing electricity costs.

15. Encourage energy efficiency in new single-family homes.

Middletown township may enact an ordinance that reduces permitting fees for new single-family homes and gut-rehabilitation projects that achieve LEED for Homes (Silver) certification or ICC-700-2008 National Green Building Standard (Silver) certification with a certified HERS rating of 65. Reducing permitting fees for new residential construction projects that achieve LEED for Homes (Silver) certification or ICC-700-2008 National Green Building Standard (Silver) certification with a certified HERS rating of 65 encourages a higher level of performance in new housing stock. A building with a HERS rating of 65 translates to a 35% increase in energy efficiency over a home built to current code. Each 1% *increase* in energy efficiency corresponds to a 1-point *decrease* in the HERS Index when compared with baseline 2006 International Energy Conservation Code (IECC).

16. Encourage energy efficiency in new municipal buildings.

MiddletownTownship may adopt a green building policy for new construction and major renovation projects that requires facilities to achieve LEEDV3 Design & Construction Silver certification, with the requirement of minimum 20% better performance than ASHRAE 90.1-2007 under Energy and Atmosphere Conservation Credit EA 1. Through

achieving this higher level of performance, the township is demonstrating commitment to reducing the amount of greenhouse gas emissions produced by its new and existing municipal buildings. A**ll new construction and major renovation projects will meet the standards set by an internationally recognized green building system. This certification will assure that a third party has verified** that this new building was designed and built using a broad range of green building strategies. ASHRAE 90.1-2007 will soon be the benchmark used for commercial building energy codes in New Jersey, providing minimum requirements for energy efficient design, superseding ASHRAE 90.1-2004. Achieving a minimum 20% better performance than ASHRAE 90.1-2007, assures any municipal construction will exceed this recently updated benchmark used for commercial building energy codes in the United States.

17. Encourage energy efficiency of new commercial buildings.

A municipal may enact an ordinance that reduces permitting fees for new commercial buildings and major renovations that achieve LEEDV3 Design & Construction Silver certification, with the requirement of a minimum of 20% better performance than ASHRAE 90.1-2007 under Energy & Atmosphere Conservation Credit EA1. ASHRAE 90.1-2007 will soon be the current benchmark used for commercial building energy codes in New Jersey, superseding ASHRAE 90.1-2004. Buildings designed under ASHRAE 90.1-2007 will perform 7% better in terms of energy efficiency than those designed under ASHRAE 90.1-2004.

18. Improve energy efficiency in existing single-family homes.

Middletown Township may enact an ordinance that reduces permitting fees for renovations/remodels to existing single-family homes that meet ICC-700-2008 National Green Building Standard (Bronze) and meet energy requirement of ICC-700-2008 National Green Building Standard (Silver). For buildings constructed prior to 1980, existing single-family homes must meet ICC-700-2008 National Green Building Standard (Silver) for the GREEN REMODEL path.

In order for a home to achieve ICC-700-2008 National Green Building Standard (Silver) certification, a home must be designed to use 35% less energy than a home that meets the 2006 International Energy Conservation Code (IECC).

19. Encourage energy efficiency in existing commercial buildings.

Middletown Township may enact an ordinance that reduces permitting fees for existing buildings that achieve LEED-Green Building Operation & Maintenance (GBOM) Silver

(v3) certification with minimum Energy Star Portfolio Manager Score of 69 (required pre-requisite for GBOM certification).

This measure provides an incentive for remodeling/retrofitting existing commercial buildings to meet the standards set by an internationally recognized green building system. This certification will assure that a third party has verified that this building was upgraded using energy-efficient and green building strategies.

20. Adopt energy audit policy for existing municipal buildings.

Middletown Township may adopt a policy that requires an energy audit to be performed for all municipally-owned and operated facilities every five to seven years. An energy audit establishes where and how energy is being used in buildings and facilities, and identifies opportunities for energy and cost savings. The audit process itself does not reduce energy use, but reveals opportunities and provides guidance on cost-effective practices and technologies that can improve energy efficiency.

21. Use ENERGY STAR appliances and office equipment.

Computers and electronics account of 7.7% of energy use in a typical office building. Replacing conventional appliances and office equipment at the end of their useful life with ENERGY STAR labeled products can save money through reduced energy costs. ENERGY STAR products are 10-25% more efficient than required by the federal standard.

22. Install boiler controls for HVAC system.

Installing a *dynamic boiler control* in a water/steam-distribution system is a relatively low-cost alternative to increasing the energy efficiency of an existing HVAC system. Energy is saved by adjusting the burner run pattern to match the system's heat load. The controller determines the heat load by using a strap-on temperature sensor that monitors the boiler's hot water supply temperature and the rate this temperature is changing. Depending on the measured load, the burner is adjusted so that the boiler uses less fuel to generate the required amount of hot water. This action is similar to the industry-accepted method of outdoor air temperature reset control, but does not require an outdoor air temperature sensor.

Recommended Policy Alternatives

According to the analyses performed for this plan, implementing the following measures will achieve the greatest reduction in greenhouse gases at the lowest cost (tons CO2 reduced/dollar spent).

1. No or Low Mow for Municipal Properties
2. Convert Public Lighting to LED
3. Reduce Heat Island Effect in New Commercial Buildings
4. Sustainable Landscaping for Residential Properties
5. Reduce Heat Island Effect in New Residential Buildings
6. Energy Efficiency in New Residential Buildings
7. Energy Efficiency in Existing Commercial Buildings
8. Sustainable Landscaping for Commercial Properties
9. Energy Efficiency in New Commercial Buildings
10. Energy Efficiency in Existing Residential Buildings

7. Coordination with Other Governmental Units.

State of New Jersey Master Plan

The State of New Jersey is undertaking an extensive and comprehensive energy planning effort. New Jersey is statutorily required to adopt an Energy Master Plan addressing the production, distribution, consumption, and conservation of energy for a period of ten years and to provide updates every three years. The most recent edition of the EMP was published in October 2009. In addition, on February 13, 2007, Governor Jon Corzine signed Executive Order 54, setting greenhouse gas reduction objectives for the years 2020 and 2050. The New Jersey Legislature passed and the Governor signed on July 6, 2007 the Global Warming Response Act, which calls for reducing greenhouse gas emissions to 1990 levels by the year 2020 and further reducing them to 80% below 2006 levels by 2050. The New Jersey Department of Environmental Protection (DEP) is preparing a comprehensive inventory of greenhouse gases in response to Executive Order 54 and the Global Warming Response Act.

The New Jersey Energy Master Plan is organized into a series of five goals that are proposed to be accomplished by the year 2020, with a series of action items associated with each goal. The five goals of the New Jersey Energy Master Plan are:

6. Maximize the State's energy conservation and energy efficiency to achieve reductions in energy consumption of at least 20% by 2020.
7. Reduce peak demand for electricity by 5,700 MW by the year 2020.
8. Strive to surpass the current RPS goals with a goal of achieving 30% of the State's electricity needs from renewable sources by 2020.
9. Develop a 21st century energy infrastructure that supports the goals and action items of the Energy Master Plan, ensures the reliability of the system, and makes available additional tools to consumers to manage their energy consumption.
10. Invest in innovative clean energy technologies and businesses to stimulate the industry's growth in New Jersey.

The action items that are included under the main goals more detailed initiatives such as developing and implementing statewide building codes for energy efficiency, participating in demand response programs, increasing the state's solar electricity goals, developing renewable energy sources such as offshore wind turbines and biomass generating facilities, and developing individual utility energy master plans with the electric and gas utilities in the state. The plan does not contain specific actions to be taken by municipalities. However, the plan commits that the state will work with its counties, local municipalities and school boards to

implement policies and programs to lead in the achieving the plan's goals, especially through education and outreach. Specifically, the plan proposes, through the Board of Public Utilities, to produce a series of "best practice" manuals that will propose energy efficiency improvements in different sectors, including municipal government.

If the goals of the New Jersey Energy Master Plan are met, the state will be well on its way to achieving the goals set forth in the Global Warming Response Act of reducing greenhouse gas emissions to 80% below 2006 levels by 2050.

7.2 Other New Jersey State and Local Initiatives

As of November 2009, the following activities were underway in New Jersey in the areas of energy efficiency and greenhouse gas reduction:

- The New Jersey Department of Environmental Protection (DEP) developed a statewide greenhouse gas (GHG) inventory under the authority of the Global Warming Response Act.
- The Rutgers Center for Energy, Economic, and Environmental Policy (CEEEP) has a nascent Energy Data Center funded by the NJBPU. It also developed a model to support the development of New Jersey's Energy Master Plan which required a statewide inventory.
- The Rutgers Center for Green Building (RCGB) is currently conducting numerous assessment studies to enable better evaluation of the impact of green building measures.
- Sustainable Jersey, based at Rutgers, has worked with various stakeholders to develop local GHG inventory methodology and make utility data available. Sustainable Jersey will also be a repository for many GHG inventories, assessments, and program information generated by 215 participating municipalities.
- Delaware Valley Regional Planning Commission (DVRPC), the metropolitan planning organization for transportation planning based in Philadelphia, completed a GHG inventory for its region, which includes Central New Jersey (Burlington, Camden, Gloucester and Mercer Counties) , including an allocation for all of the municipalities and counties in their region. It was partially funded by USEPA and addressed emerging methodological issues, and was published in March 2009.
- The New Jersey Regional Transportation Planning Authority (NJTPA), the MPO for 13 counties in northern New Jersey, is now developing Plan 203, the federally required long range transportation plan for the northern New Jersey region, and has established a "Climate Change Working Group," which will provide input into the development of Plan 2035. In November 2008, the NJTPA held a Plan 2035 Climate Change Roundtable which featured discussions on two key aspects of dealing with climate change -- adapting infrastructure to deal with its effects, particularly rising sea levels and new weather patterns, and developing transportation policies that will

reduce or mitigate greenhouse gas emissions. The NJTPA has a number of on-going efforts to address climate change in the transportation planning process:

- A regional GHG inventory in cooperation with NJTPA's member agencies.
- Adaptation research and planning for inventory of climate vulnerable facilities is (climate impacts include temperature, sea level, storm surge intensity and precipitation changes).
- A framework for incorporating climate impacts into evaluation criteria for programs and projects (infrastructure impacts: structures, pavement and serviceability; and mitigation demand management impacts: trip reduction, mode shift and financing)
- The NJTPA Transportation Clean Air Measures (TCAM) study specifically includes greenhouse gas emissions as an important criterion for advancing environmentally beneficial transportation actions toward implementation. Reduction of diesel locomotive idling is one initiative that is being advanced.
- Consideration of CO2 quantification in air quality conformity analysis.

- Support for city/county subregions in assessing Clean Air/Climate Protection software procurement and training needs.

Appendix A

Detailed Descriptions of Alternative Energy Efficiency and Conservation Plan Measures

Appendix A contains detailed descriptions of alternative energy efficiency and conservation strategy measures. Each narrative includes a description of the measure, data on fiscal, social and environmental, and economic impacts, an explanation of how the measure may be implemented, and a short list of other resources. These measures are presented in a generic manner and can be scaled up to apply to a given township or area. They are contained on a CD-ROM.

Appendix B

Baseline Data for Energy Use and Greenhouse Gas Emissions

The following tables were developed by the Bloustein team based on actual data submitted by Middletown. They are intended to define the community's carbon footprint in terms of energy usage and greenhouse gas emissions for a baseline year. Where the actual data were not available, the Bloustein team developed estimates.

Municipality:	Middletown	*complete applicable cells highlighted in yellow, grey cells contain formulas*								
STEP 1: Establish a Baseline Year										
Baseline Year Selected:	2008									
STEP 2: Scope 1 Emissions from Stationary Fuel Consumption in Baseline Year										
Sector Usage - Natural Gas	**Total Therms**	**converted to Million BTU**	**CO2 Emissions (lbs)**	**(Metric Tons CO2e)**	**Emissions (Metric Tons)**	**CH4 (Metric Tons CO2e)**	**N20 Emissions (Metric Tons)**	**N20 (Metric Tons CO2e)**	**Emissions (Metric Tons CO2e)**	**Total Emissions (Short Tons CO2e)**
Local Government	233305	23330.5	2731534.94	1239.004	0.1166525	2.9163125	0.00233305	0.6952489	**1242.61587**	***1369.362689***
Residential	1275758	127575.8	14936574.7	6775.121	0.637879	15.946975	0.01275758	3.80175884	**6794.869964**	***7487.946701***
Commercial	1101434.16	110143.416	12895591.1	5849.346	0.55071708	13.767927	0.011014342	3.2822738	**5866.396206**	***6464.76862***
Industrial		0	0	0	0	0	0	0	**0**	***0***
Other		0	0	0	0	0	0	0	**0**	***0***
Natural Gas Total	*2610497.16*	*261049.716*	*30563700.7*	*13863.47*	*1.30524858*	*32.6312145*	*0.026104972*	*7.77928154*	***13903.88204***	***15322.07801***
Sector Usage - Heating Oil *enter in Therms (1 gallon = 1.387 Therms)*	**Total Therms**	**converted to Million BTU**	**CO2 Emissions (lbs)**	**(Metric Tons CO2e)**	**Emissions (Metric Tons)**	**CH4 (Metric Tons CO2e)**	**N20 Emissions (Metric Tons)**	**N20 (Metric Tons CO2e)**	**Emissions (Metric Tons CO2e)**	***Total Emissions (Short Tons CO2e)***
Local Government	2694	373.6578	60303.1377	27.35306	0.00373658	0.09341445	0.000224195	0.06681001	**27.51328752**	***30.31964284***
Residential		0	0	0	0	0	0	0	**0**	***0***
Commercial		0	0	0	0	0	0	0	**0**	***0***
Industrial		0	0	0	0	0	0	0	**0**	***0***
Other		0	0	0	0	0	0	0	**0**	***0***
Heating Oil Total	*2694*	*269.4*	*43477.3884*	*19.72103*	*0.002694*	*0.06735*	*0.00016164*	*0.04816872*	***19.83654471***	***21.85987227***
Sector Usage - Other Fuel 1 *specify fuel (coal, diesel, etc)*	**Total (specify unit)**	**convert to Million BTU**	**CO2 Emissions (lbs)**	**(Metric Tons CO2e)**	**Emissions (Metric Tons)**	**CH4 (Metric Tons CO2e)**	**N20 Emissions (Metric Tons)**	**N20 (Metric Tons CO2e)**	**Emissions (Metric Tons CO2e)**	***Total Emissions (Short Tons CO2e)***
Local Government				0		0		0	**0**	***0***
Residential				0		0		0	**0**	***0***
Commercial				0		0		0	**0**	***0***
Industrial				0		0		0	**0**	***0***
Other				0		0		0	**0**	***0***
Other Fuel 1 Total	*0*			*0*		*0*		*0*	***0***	***0***
Sector Usage -Other Fuel 2 *specify fuel (coal, diesel, etc)*	**Total (specify unit)**	**convert to Million BTU**	**CO2 Emissions (lbs)**	**(Metric Tons CO2e)**	**Emissions (Metric Tons)**	**CH4 (Metric Tons CO2e)**	**N20 Emissions (Metric Tons)**	**N20 (Metric Tons CO2e)**	**Emissions (Metric Tons CO2e)**	***Total Emissions (Short Tons CO2e)***
Local Government				0		0		0	**0**	***0***
Residential				0		0		0	**0**	***0***
Commercial				0		0		0	**0**	***0***
Industrial				0		0		0	**0**	***0***
Other				0		0		0	**0**	***0***
Other Fuel 2 Total	*0*			*0*		*0*		*0*	***0***	***0***

STEP 3: Scope 2 Emissions from Purchased or Acquired Electricity in Baseline Year

Sector Usage - Electricity	Total Kwh	Total MWh	CO2e Emissions (lbs) *	CO2e (Metric Tons)					Emissions (Metric Tons CO2e)	Total Emissions (Short Tons CO2e)
Local Government	11846084	11846.084	15542062.2	7049.766					7049.76596	7768.842088
Residential	269519260	269519.26	353609269	160394.6					160394.5831	176754.8306
Commercial	282178999	282178.999	370218847	167928.6	290012077				167928.5663	185057.28
Industrial		0	0	0					0	0
Other		0	0	0					0	0
Electricity Total	*563544343*	*563544.343*	*739370178*	*335372.9*					*335372.9153*	*369580.9527*

** includes CO2, CH4 and N20 emissions preconverted to carbon dioxide equivalents (CO2e)*

STEP 4: (Optional) Scope 1 Emissions from Mobile Fuel Combustion in Baseline Year

Municipal Operation - Vehicle Emissions CO2 emissions by fuel usage *from municipal carbon footprint*	Total Fuel Units	CO2 Emissions (lbs/fuel unit)	CO2 Emissions (lbs)	(Metric Tons CO2e)						Total Emissions (Short Tons CO2e)
Motor Gasoline (per gallon)	227961	19.54	4454357.94	2020.464						2226.551598
Diesel Fuel (per gallon)	67028	22.37	1499416.36	680.1243						749.4969953
Compressed Natural Gas (per 1000 cubic feet)		120.36	0	0						0
Other *1 (specify fuel and units)*			0	0	other fuels see http://www.eia.doe.gov/oiaf/1605/excel/Fuel Emission Fac					0
Other *2 (specify fuel and units)*			0	0						0
Other *3 (specify fuel and units)*			0	0						0

Residential, Commercial & Industrial - Vehicle Emissions CO2 emissions by fuel usage	Total Fuel Units	CO2 Emissions (lbs/fuel unit)	CO2 Emissions (lbs)	(Metric Tons CO2e)						Total Emissions (Short Tons CO2e)
Motor Gasoline		19.54	0	0						0
Diesel Fuel		22.37	0	0						0
Compressed Natural Gas		120.36	0	0						0
Other *1 (specify fuel and units)*			0	0	other fuels see http://www.eia.doe.gov/oiaf/1605/excel/Fuel Emission Fac					0
Other *2 (specify fuel and units)*			0	0						0
Other *3 (specify fuel and units)*			0	0						0

Municipal Operation - Vehicle Emissions CH4 and N20 emissions by mileage		Total Mileage			Emissions (Metric	CH4 (Metric Tons CO2e)	Emissions (Metric Tons)	N20 (Metric Tons CO2e)	Emissions (Metric Tons	Total Emissions (Short Tons CO2e)
from Municipal Carbon Footprint						0		0		0

Residential, Commercial & Industrial - Vehicle Emissions CH4 and N20 emissions by mileage		Total Mileage			Emissions (Metric Tons)	CH4 (Metric Tons CO2e)	N20 Emissions (Metric Tons)	N20 (Metric Tons CO2e)	Emissions (Metric Tons CO2e)	Total Emissions (Short Tons CO2e)
requires mileage estimates by vehicle type, see Worksheet 3 of Municipal Carbon Footprint for calculation method						0		0		0
Vehicle Fuel Total			*5953774.3*	*2700.589*	*0*	*0*	*0*	*0*	*2700.58856*	

STEP 5: (Optional) Emissions from Waste Related Activities in Baseline Year

Waste Management by Sector	GHG Emissions from Baseline Waste Management calculated at http://www.epa.gov/climatechange/wycd/waste/calculators/Warm_Form.htmlnagement (MTC02E)	Emissions (Metric Tons	Total Emissions (Short Tons CO2e)
Local Government	*(from municipal carbon footprint)*		
Residential			
Commercial			
Industrial			
Other		*13734.4*	*15135.3088*
Waste Management Total		*13734.4*	*15135.3088*

TOTALS

		Emissions (Metric Tons	Total Emissions (Short Tons CO2e)
COMMUNITY CARBON FOOTPRINT		365731.6	403036.248

Appendix C

Assumptions and Methodology of Cost-Benefit Analysis and Energy Projections

In order to compare the various costs and benefits associated with each EECS measure, a cost-benefit tool was created. The purpose of the tool is to compare all measures on common ground using the same parameters. Many measures have different lifetimes and savings profiles, so all costs and benefits are brought into net present value so they can be accurately compared.[11]

The tool consists of a series of input and output data. For both input and output data, savings are calculated both for the municipal government and for the community as a whole. Municipal government savings are savings that are directly tied to municipal government actions and facilities. Community savings are savings that are accrued by the residents or businesses of the township through a program that was promoted or partially funded by the municipal government.

The tool outputs include commodity and economic lifetime savings (in dollars) for electricity, natural gas, water, solid waste, and gasoline. Also included are lifetime municipal costs and emission savings for CO_2, SO_2, and NO_x.

Tool inputs include commodity prices, emission savings, and economic assumptions. The commodity prices include prices for retail electricity, retail natural gas, motor gasoline, diesel fuel, solid waste, and water. Emission savings are for avoided electric, natural gas, and gasoline emissions. Economic assumptions are made for the discount rate, economic life of each measure, initial municipal costs, and the municipal rebate or subsidy.

The tool outputs are presented in tables and graphs to clearly illustrate the various costs and benefits associated with each measure both from the community and municipal perspectives.

This appendix documents the data and assumptions used in the energy plan's cost-benefit analysis.

[11] Net present value is the total present value (PV) of a time series of cash flows. It is a standard method for using the time value of money to appraise long-term projects using a specific discount rate. A discount rate of 7% was used for this analysis.

Tool Outputs

General Notes:

Savings for all categories (commodities, emissions, etc.) are calculated both for the municipal government and the community as a whole. Municipal government savings are savings that are directly tied to municipal government actions and facilities. Community savings are savings that are accrued by the residents or businesses of the township through a program that was promoted or partially funded by the municipal government.

Lifetime Savings (Electricity, Natural Gas, Water, Waste, Gasoline):

Commodity Savings: The annual commodity savings per sector are summed to determine lifetime commodity savings.

Economic Savings ($): Annual commodity savings are multiplied by annual commodity prices to determine the annual economic savings. The annual economic savings are converted to net present value using a specified discount rate to calculate the lifetime savings per commodity.

Lifetime Municipal Costs: Lifetime municipal costs are the sum of capital municipal costs and the net present value of annual municipal costs. Capital municipal costs are determined by calculating the initial municipal cost and subtracting any rebates or subsidies the township will receive to determine net capital municipal costs. Lifetime annual municipal costs are calculated by converting the annual municipal costs to net present value using a specified discount rate to calculate the lifetime municipal costs.

Emission Savings (CO_2, SO_2, NO_x): Lifetime emission savings are determined by multiplying the annual commodity savings by a specified emission rate for each pollutant and summing the annual savings for the lifetime of each measure and commodity.

Tool Inputs

Forecasted Commodity Prices: Electricity and natural gas prices were primarily taken from the 2009 and 2010 Annual Energy Outlook produced by the US Energy Information Administration.[12] Details are provided below:

Retail Electricity Prices: Historic New Jersey retail electricity prices were escalated using an annual growth rate taken from the EIA Annual Energy Outlook 2009 for the Mid-Atlantic Region. An adder was applied to prices starting in 2015 to account for a national CO_2 program, which was not included in the base forecast provided by EIA.[13]

Retail Natural Gas Prices: Historic New Jersey retail natural gas prices were escalated using an annual growth rate taken from the EIA Annual Energy Outlook 2009 for the Mid-Atlantic Region.

Motor Gasoline Prices: Motor gasoline prices are taken from EIA Annual Energy Outlook 2010 Table 12.

Diesel Fuel Prices: Motor gasoline prices are taken from EIA Annual Energy Outlook 2010 Table 12.

Emissions Savings: Each component is described below:

Avoided Electric and Natural Gas Emissions: Average emission rates are taken from the PJM Regional Average Disclosure Label for 2006 for electricity emissions. Emission rates for natural gas are taken from the US EPA's *Compilation of Air Pollutant Emission Factors, Volume I.*

Avoided Gasoline Emissions: Average fuel economy for a light-duty vehicle was taken from the US EPA's *Light-Duty Automotive Technology and Fuel Economy Trends*[14] and average CO_2 emissions from a gallon of gasoline was taken from EIA's *Voluntary Reporting of Greenhouse Gasses Program.*[15]

Discount Rate: Discount rates are used to convert future economic values into present day dollars. A nominal discount rate of 7% is used in the cost-benefit analysis.

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[12] Available at http://www.eia.doe.gov/oiaf/aeo/
[13] National CO_2 program based on the Waxman-Markey Bill. Modeling performed by the US EPA is available at http://www.epa.gov/climatechange/economics/economicanalyses.html
[14] Available at http://www.epa.gov/otaq/cert/mpg/fetrends/420s07001.htm
[15] Available at http://www.eia.doe.gov/oiaf/1605/coefficients.html

Economic Life: These analyses assume that the equipment being replaced is at the end of its economic life. A measure replaced at the end of its economic life has energy savings equal to the difference between the energy efficient measure and the standard measure.

Initial Municipal Costs: These are the capital costs accrued to the township to start a particular program or purchase specific measures. The costs vary by measure and are detailed in each measure write-up.

Municipal Rebate/Subsidy: These are the rebates and subsidies received by the township to start a particular program or purchase specific measures. The rebates and subsidies vary by measure and are detailed in each measure write-up.

Measure Lives: The measure life is used to determine the number of years that a measure will accrue energy savings. The measure lives vary and are detailed in each measure write-up. It should be noted that even though some measures have 25 or 30 year lifetimes, savings and costs are only calculated to the year 2030 because reliable projections are only available to that year.

Electricity, Natural Gas, Gasoline, VMT, Waste, and Water Savings: All commodity savings are calculated by taking the difference in usage between a baseline efficient unit and an efficient unit.

[i] Sustainable Jersey. "Community Carbon Footprint Calculator." Community Carbon Footprint. Section "What to Do." http://sustainablejersey.com/actiondesc.php. Accessed 4/1/10.
[ii] Sustainable Jersey. "Community Carbon Footprint Calculator." Community Carbon Footprint. Section "What to Do." http://sustainablejersey.com/actiondesc.php. Accessed 4/1/10.