Appendix A

ENERGY EFFICIENCY and GREEN BUILDING MEASURES

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ENERGY EFFICIENCY and GREEN BUILDING MEASURES

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1. Increase Community-Wide Use of Conservation Equipment.

Introduction/Summary

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.

Increase Community-Wide Use of EE Equipment

	Municipal Government	Community-Wide
Initial Municipal Costs ($)	$ 1,046	
Rebate/Subsidy ($)	$ -	
Net Capital Cost ($)	$ 1,046	
Lifetime Municipal Costs ($)	$ 1,046	
Lifetime of Measure (Years)	30	
CO2 Reductions (Tons)		243
NOx Reductions (Lbs)		-
SO2 Reductions (Lbs)		-
Electricity Savings (MWh)		-
Electricity Savings ($)		$ -
Natural Gas Savings (MMBtu)		-
Natural Gas Savings ($)		$ -

Costs/Impacts

The costs to local governments of purchasing conservation equipment in bulk and distributing this equipment to community members include the actual price paid for the equipment purchased, the cost of the additional staff time devoted to increased procurement activity, and the outreach costs associated with informing community members of the program and distributing equipment. The impacts of such a program would be measured in terms of the resulting reduction in energy use, water use, waste production, greenhouse gas (GHG) emissions, and criteria air pollutants. Each of these costs and impacts is discussed in more detail below.

Purchasing Equipment

The amount of money spent on conservation equipment will vary greatly depending on the type of equipment a municipality chooses to purchase. For example, some low-flow fixtures can be purchased for $10 to $20 a piece while purchasing composters can prove to be much more costly.[1] Additionally, some of the costs associated with the purchase price can be recouped if the municipality chooses to sell the equipment to community members rather than provide it for free. Municipalities will need to individually evaluate the types of products they wish to purchase and the best way to provide these products to community members.

Increased Procurement Activity

Purchasing conservation equipment in bulk for distribution to community members will require the devotion of additional staff time to procurement activities. For efficiency purposes, additional procurement activities should be taken on by the municipality's current purchasing agent and should be coordinated with the outreach specialist promoting the equipment. It is estimated that the annual cost of increased procurement activity resulting from a municipal bulk purchasing program would be approximately $598.56.[2]

Performing Outreach

To properly promote the program, the municipality will need to conduct an outreach campaign to inform residents and business owners of the bulk purchasing program. The upfront costs of an outreach campaign will include the cost of promotional materials, which is estimated to be $160.[3] The cost of promotional materials will also be included in the annual costs of continued program operation; however, the annual cost of promotional materials will be a reduced cost of $45 per year.

Additionally, staff time will need to be devoted to performing outreach and distributing equipment to community members. To ensure that these activities are adequately covered, the municipality should hire a part-time outreach coordinator to oversee program implementation or should designate 10% of an existing position to performing these duties. A part-time outreach coordinator is estimated to cost $4,300 per year.[4] Please note that the outreach coordinator is expected to be responsible for promoting all of the municipality's energy efficiency and sustainability projects, not just the bulk purchasing program. Therefore, the labor costs of the outreach coordinator will be shared between all of these programs. Additionally, the calculations provided here include the cost of a part-time staff person, but the cost would be considerably less if volunteers were used.

Summary of Costs/Impacts

Estimates of the costs and impacts of a sample bulk purchasing program are provided below. These estimates are based on a municipal program in which 100 composters are purchased and sold to residents at the reduced purchase price received by the municipality. Because the municipality in this example is selling the composters at the price paid for them, the cost of the composters themselves will be recouped by the municipality in the form of sales revenue.

Local Fiscal Impacts

Lifetime of measure	Indefinite
Initial Cost[5]	$5,721.56
Subsidy	N/A
Sales Revenue	$4,963.00
Initial Cost after Sales Revenue	$758.56
Annual Cost[6]	$9,906.56
Annual Cost after Sales Revenue	$4,943.56
Years to Payback	N/A
Net Present Value	N/A

The following table provides an estimate of the greenhouse gas emissions impacts that could be achieved from implementation of the bulk purchasing program described above, in which 100 composters are purchased and distributed to community residents at cost.

Greenhouse Gas Emissions Impacts[7,8, 9]

Emissions Savings (Annual)	Per Composter	100 Composters
Metric Tons of Carbon Equivalent (MTCE)	0.1001	10.0100

As a preliminary estimate, municipalities may assume that 0.13% of municipal households will purchase composters provided at reduced prices.[10]

How to Do It

1. Hire a part-time outreach coordinator or designate 10% of an existing position to performing community outreach on issues related to energy efficiency and sustainability. (The outreach coordinator would be charged with organizing all energy efficiency and sustainability outreach programs, not just the outreach associated with this particular program.)

2. Staff should work with municipal officials to make a formal commitment to pursue bulk purchasing of conservation equipment and distribution of conservation equipment to residents and local businesses. During the program development stage, municipal officials and staff should decide whether they will distribute equipment for free or sell equipment to community members.

3. The outreach coordinator should work with the municipal purchasing agent to determine what types of conservation equipment (e.g., composters or low-flow showerheads) to purchase and identify mechanisms and venues to be used to make purchases. The following purchasing options are available to local governments seeking to purchase conservation equipment in bulk.

- The New Jersey Cooperative Purchasing Program – Allows local governments to achieve cost savings by purchasing equipment and services under existing State contracts. Not only does the size of the program allow for volume-driven cost reductions, but it also saves municipalities money by eliminating redundant solicitation and/or negotiation costs.[11] Additionally, Executive Order 11 (April 22, 2006), which requires that all State entities with purchasing or procurement authority select Energy Star products when available, ensures that the State's Cooperative Purchasing Program will provide contracts for energy efficient equipment.[12]

- The U.S. Communities Government Purchasing Alliance (U.S. Communities) – A national cooperative purchasing alliance that offers a variety of green products through its Going Green Program.[13]

- ENERGY STAR Quantity Quotes Website – Connects bulk purchasers with suppliers of ENERGY STAR qualified products and facilitates the negotiation of discounted prices.[14]

- Using these programs, 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.[15] However, municipalities should keep in mind that, with the exception of the New Jersey Cooperative Purchasing Program, these purchasing methods cannot serve as an alternative to public bidding. Therefore, use of these purchasing methods should be limited to purchases under the bid threshold.[16]

4. The municipal purchasing agent should enroll in relevant cooperative purchasing programs (e.g., the New Jersey Cooperative Purchasing Program and the U.S. Communities Government Purchasing Alliance) and bulk purchasing programs (e.g., ENERGY STAR Quantity Quotes).

5. Energy efficiency equipment should be purchased through the mechanisms described above. In municipalities that decide to sell equipment, staff should work with municipal officials to price items for sale.

6. Organize and launch an outreach campaign and develop a system for distributing equipment to residents and local businesses.

Resources

<u>Bulk Purchasing</u>

ENERGY STAR Quantity Quotes.http://www.quantityquotes.net/default.aspx

<u>Cooperative Purchasing</u>

New Jersey Cooperative Purchasing Program, New Jersey Department of the Treasury

General Information and Registration:
http://www.state.nj.us/treasury/purchase/coop_agency.shtml

U.S. Communities Government Purchasing Alliance

General Information: http://www.uscommunities.org/

Registration:
https://www.psacommunities.org/gpa/us/reg/Default.aspx?sid=200910200

New Jersey Procurement Laws New Jersey Department of Community Affairs, Division of Local Government Services
http://www.nj.gov/dca/lgs/lpcl/index.shtml

2. Convert Traffic Signals/Public Lighting to LED

Introduction

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[17], 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[18] 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.[19] 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.

Convert Public Lighting to LED

	Municipal Government	Community-Wide
Initial Municipal Costs ($)	$ 17,475	
Rebate/Subsidy ($)	$ -	
Net Capital Cost ($)	$ 17,475	
Lifetime Municipal Costs ($)	$ (153,576)	
Lifetime of Measure (Years)	8	
CO2 Reductions (Tons)	489	489
NOx Reductions (Lbs)	1,595	1,595
SO2 Reductions (Lbs)	5,634	5,634
Electricity Savings (MWh)	802	802
Electricity Savings ($)	103,862	$ 103,862
Natural Gas Savings (MMBtu)	-	-
Natural Gas Savings ($)	-	$ -

Costs/Impacts

The initial costs associated with replacing existing traffic signals and street lights with LEDs are high primarily because LED technology is relatively new. As shown in the following charts, LEDs do have an initial conversion cost. However, converting to LED is a smart financial investment due to the gradual payback received through energy and maintenance savings. Also, LEDs last longer than conventional lighting, which further reduces costs associated with replacing traditional signals and bulbs. The following table demonstrates the initial cost and total lifetime savings of replacing one standard 150 watt incandescent traffic signal with a 25 watt LED signal[20].

Cost and Savings of Replacing One Standard Incandescent Signal with LED Signal[21]

Measure	Costs
Initial Conversion Cost	$72
Total Energy Savings	$344
Total Maintenance Savings	$900
Total Lifetime Savings (7 Years)	$1,190

As shown in the table, the initial conversion cost is high, but the total lifetime savings achieved are substantial. The same comparisons can be made with street lights as well. The table below displays the initial cost and overall savings of replacing a standard 100 watt street globe with a 45 watt LED light[22].

Costs and Savings of Replacing One Standard Street Globe with LED Light[23]

Measure	**Costs**
Initial Conversion Cost	$365
Total Energy Savings	$169
Total Maintenance Savings	$1,073
Total Lifetime Savings (10 years)	$1,017

Overall, the measure has high startup costs, but the eventual savings achieved are substantial. .

Converting to LED will also lower energy and greenhouse gas emissions. The following table displays the overall annual and lifetime savings achieved by converting one traffic signal and street light to LED:

Savings Achieved By Replacing One Standard Incandescent Signal with LED Signal[24]		
Measure	Annual Savings	Lifetime Savings
Energy (kWh)	492	3,440
CO2 (lbs)	747.84	5,228.8
NO2 (lbs)	1.38	9.63
SO2 (lbs)	3.19	22.36
Savings Achieved By Replacing One Standard Street Globe with LED Light25		
Measure	Annual Savings	Lifetime Savings
Energy (kWh)	228	2,280
CO2 (lbs)	346.56	3,465.6
NO2 (lbs)	.64	6.4
SO2 (lbs)	1.48	14.8

How to do it:

1. **Appoint or assign an existing staff member to take on a leadership role for the LED conversion project.** Qualified project leaders should have a background in dealing with municipal lighting responsibilities, whether it is related to planning, designing, engineering, or handling utility expenses.[26] The project leader is responsible for communicating directly with municipal officials, lighting manufacturers, and local utility providers, while also designing the planning and budgetary steps for the measure. If qualified individuals are unavailable, consider hiring an outside consultant who is knowledgeable of LED technology and municipal lighting.[27]

2. Compile a detailed inventory of all existing municipal street lights and traffic signals and assess community lighting needs. Collect inventory information that will help prioritize street lights and traffic signals to convert if a full conversion cannot be completed in the short term. For example, busy traffic intersections and sidewalks would benefit the most from the increased brightness of LED streetlights. Meet with community members, local business leaders and law enforcement officials to gain insight on which areas would benefit the most from brighter lighting. An assessment of community needs may find that some areas may require additional street light installations. While this measure focuses only on LED conversions, it might be desirable to also consider the installation of new infrastructure as part of an overall lighting plan.

3. Conduct a field study to determine what types of LED lights to install. Because LEDs are usually brighter than standard lights, it is important to test how the LEDs function in various locations. Work alongside LED lighting contractors and local utility administrators during this stage for guidance and recommendations. The recommended strategy is to retrofit existing street and traffic lights into LED lighting. Retrofitting consists of replacing the light itself and not moving or replacing the overall lighting equipment. This is the most cost-effective approach to carrying out the measure.[28]

In contrast, new construction consists of completely replacing the existing lighting equipment or installing LED street lights in new locations.[29] New construction may be effective during instances where municipalities want to revamp the aesthetic of their outdoor equipment or expand lighting to new areas; however, this approach will be more expensive and ambitious than retrofitting existing lights.

4. Use the inventory and field study to determine how much the LED conversion process will cost. Factors such as the age and quality of current lights should be considered. Damaged or old traffic signals may need additional maintenance to install an LED light, or could require new hardware and bracket installation. Installation costs could increase depending on the existing quality of the traffic signal and street light hardware.

When projecting conversion costs, distinguish between street and traffic lighting equipment owned by the municipality and equipment leased from the utilities provider. If the municipality owns the street lighting equipment, it has more flexibility and choices in respect to planning. [30] In the other case, communities that lease equipment tend to pay a flat monthly utility fee and have to consult with their provider to establish the parameters for converting to LED. In some instances, utilities may cover the costs of upgrades or maintenance if they own the equipment; however municipalities that lease their lighting may have limited options throughout the conversion process. Utility providers usually do not offer a wide selection of lighting options or upgrades.[31]

For instances where the current leasing options are insufficient, the appointed project leader will need to consider whether the municipality should alter the lease agreement and purchase the LED lighting directly from a manufacturer.

However, altering the existing leasing plan can be a difficult process, and should only be considered if the current options prevent the municipality from converting to LED. Negotiating with the utility provider may be a more feasible strategy. Sometimes utility companies will offer lighting and equipment alternatives and services at an additional fee, which could be more practical than changing the current leasing plan.

5. **Determine a conversion schedule and financing plan.** Municipalities can use their block grant funds to help finance the conversion. Also see the "Financing Energy Efficiency and Conservation Improvements" section for an overview of other funding mechanisms. One way to reduce initial costs is by gradually converting the traffic and street lights to LED over time. Instead of replacing a large amount of traffic signals and street lights at once, it might be best to convert a small percentage to LED initially, and eventually replace more once the original conversion begins to repay itself. This will help reduce the initial costs to implement the measure.

Collaborate with planning and utility administrators throughout this stage to come up with a realistic financial plan. When designing the budget, make sure to consider the short- and long-term term costs of converting to LED. For example, purchasing lower quality equipment may reduce initial expenses, but it could result in higher costs in the long run.[32] When calculating the overall costs of conversion, also consider the costs of delay in the form of higher energy bills that will continue until the replacement is made.

Before making a purchasing or leasing decision, carefully consider product warranty and maintenance options. Because LED technology is relatively new and rapidly changing, the expected lifetime measures are oftentimes based on projections and are not 100% reliable. In addition, warranty and maintenance offers are known to vary substantially among LED providers.[33] Therefore, it is important to understand how each manufacture determines LED lifetimes and what their product warranties include.

6. **After the LED conversion plans are finalized, inform community members and local media outlets about the program.** In previous cases, municipalities that converted to LED received positive press coverage. Not only is this good for publicity purposes, but it also encourages other communities to adopt similar sustainable measures.

7. **Once the LEDs are installed and operating, make sure to continually record the electricity and financial savings that are being achieved.** Compare the actual savings with those projected by the manufacturer or utility provider to help identify any potential inconsistencies.

Resources:

Referring to previous case studies may also offer insight on selecting the best lighting options and strategies. The following link provides case studies that can be useful throughout this process: http://www.ledcity.org/participants.htm

Lighting Resource Center:http://www.lrc.rpi.edu/

LED City Case Studies:http://www.ledcity.org/participants.htm

Consortium for Energy Efficiency LED Fact Sheet:http://www.cee1.org/gov/led/led-main.php3

New Jersey Traffic Signal and Safety Engineering:http://www.state.nj.us/transportation/eng/elec/TSS/metric/

Guide to Converting Municipal Lightinghttp://www.rpi.edu/dept/lrc/nystreet/how-to-officials.pdf

3. Promote New Jersey Climate Choice Homes

Introduction/Summary

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 among local communities.[34]

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.[35] 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.[36] 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.[37]

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.

Build/Permit NJ Energy Star Home/Climate Choice Home

	Municipal Government	Community-Wide
Initial Municipal Costs ($)	$ (552)	
Rebate/Subsidy ($)	$ 1,000	
Net Capital Cost ($)	$ (1,552)	
Lifetime Municipal Costs ($)	$ (552)	
Lifetime of Measure (Years)	30	
CO2 Reductions (Tons)		160
NOx Reductions (Lbs)		395
SO2 Reductions (Lbs)		985
Electricity Savings (MWh)		191
Electricity Savings ($)		$ 14,584
Natural Gas Savings (MMBtu)		1,728
Natural Gas Savings ($)		$ 10,916

Costs/Impacts

The upfront implementation costs to the town are the costs of promotional materials, which are estimated to be $160. The only additional annual cost is that of the labor of the outreach coordinator. A part-time (10% time) outreach coordinator is estimated to cost $4,300/year.[38] Please note that the outreach coordinator is assumed to be responsible for promoting all programs within the Community Partners Initiative to residents and businesses.

Upon issuing one Climate Choice homes building permit, towns will receive a $1,000 community incentive bonus from the NJ BPU.

Local Fiscal Impacts

Lifetime of measure	
Initial Cost	$160
subsidy	$1,000
Cost after subsidy	
Annual Savings/Cost	
Years to Payback	
Net Present Value	

The table below demonstrates the emission savings achieved by building a Climate Choice certified home instead of a 2006 IECC minimum code standard home:

Annual Impact Savings Achieved by Building a Climate Choice Home Over Standard Home[39]	
Measure	**Savings**
Electric (MWh)	6.372
Gas (Therms)	576
CO_2 (Tons)	8.213
NO_2 (lbs)	23.141
SO_2 (lbs)	41.418

How to Do It

1. Hire a part time outreach coordinator or designate 10% of an existing position to these duties. Individuals with a background in community outreach and/or green initiatives are preferred to accomplish these goals. The overall goal of the community outreach coordinator is to work alongside municipal officials to curb greenhouse gas emissions and foster environmental awareness among the community. Alternately, towns may recruit new or existing volunteers to lead the effort. A Sustainable Jersey Green Team or Environmental Commission are likely sources of assistance. The assigned coordinator will be responsible for promoting the New Jersey Climate Choice Homes program to local builders and residential construction companies.

2. Staff involved with community outreach or greening activities should work with municipal officials to achieve a formal commitment to enroll the community in the Community Partners Initiative.

3. Submit the enrollment form available at **http://www.njcleanenergy.com/files/file/Community%20Partners%20Initiative/Enrollment%20Forms/CPI%20Enrollment%20Form%202009.pdf**. To enroll in the New Jersey Climate Choice Homes program, check off "New Jersey ENERGY STAR Climate Choice Homes program" located in "Step 1" of the enrollment form.

4. Once the enrollment form is complete, the assigned outreach coordinator should correspond with Community Partners Initiative staff members to design an outreach campaign. The outreach campaign strategies can include, but are not limited to, door to door campaigning, mailings, events, fliers, and energy fairs. To promote the New Jersey Climate

Choice Homes program, design a marketing campaign targeted at licensed builders and home construction companies.

5. The solar technology and equipment utilized in Climate Choice homes should correspond with local building codes as the Climate Choice Homes Program has not experienced any problems in respect to local building code requirements.[40] After successfully issuing one Climate Choice home building permit within the community, contact the Community Partners Initiatives program to receive a $1,000 incentive bonus.

6. For additional information or assistance, contact the Community Partners Initiative at **http://www.njcleanenergy.com/residential/programs/community-partners-initiative-0** or call 1-866-NJSMART (1-866-657-6278).

Resources

Additional Climate Choice Homes Facts:http://www.epa.gov/cpd/climatechoice/Adv%20New%20Home%20Constr%20Adopt%20Plan3.pdf

Climate Choice Home in the News: http://www.state.nj.us/governor/news/news/2009/approved/20090827.html

EPA Climate Choice Initiative:http://www.epa.gov/cppd/climatechoice/

4. Promote New Jersey ENERGY STAR Homes

Introduction/Summary

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 local communities.[41]

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.[42]. 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.

Community Partners will provide technical support, resources, and expertise to help local officials implement a successful outreach campaign. One program municipalities can promote is The New Jersey ENERGY STAR Homes program, a BPU-sponsored initiative designed to encourage the construction of energy efficient households by providing various financial incentives to builders and communities. According to the Environmental Protection Agency (EPA), the energy used in homes accounts for 20 percent of total U.S. carbon dioxide emissions.[43] A practical way to curb residential greenhouse gas emissions is by promoting the construction of homes that are ENERGY STAR rated.

CPI - NJ Energy Star Homes

	Municipal Government	Community-Wide
Initial Municipal Costs ($)	$ 148	
Rebate/Subsidy ($)	$ 300	
Net Capital Cost ($)	$ (152)	
Lifetime Municipal Costs ($)	$ 7,705	
Lifetime of Measure (Years)	20	
CO2 Reductions (Tons)		396
NOx Reductions (Lbs)		863
SO2 Reductions (Lbs)		1,630
Electricity Savings (MWh)		232
Electricity Savings ($)		$ 24,960
Natural Gas Savings (MMBtu)		4,360
Natural Gas Savings ($)		$ 38,952

Costs/Impacts

The upfront implementation costs to the town are the costs of promotional materials, which are estimated to be $160. Since participation in the CPI is ongoing, the cost of promotional materials will also be included in the annual costs, but at a reduced amount of $45 per year. The only additional annual cost is that of the labor of the outreach coordinator. A part-time (10% time) outreach coordinator is estimated to cost $4,300/year.[44] Please note that the outreach coordinator is assumed to be responsible for promoting all programs within the CPI to residents and businesses. Upon referring ten residents within their jurisdiction to the New Jersey ENERGY STAR Homes program, towns will receive a $300 community incentive bonus from the NJ BPU. Community incentives are distributed once building permits are issued.

Local Fiscal Impacts

Lifetime of measure	
Initial Cost	$160
subsidy	$300
Cost after subsidy	
Annual Savings/Cost	$45
Years to Payback	
Net Present Value	

Below is a data chart detailing the environmental impact and financial savings for the New Jersey ENERGY STAR Homes program:

Residential New Construction Impacts (ENERGY STAR Homes) [45]

Impact Categories	Annual Savings Per Household	Total Annual Savings (10 Households)	Lifetime Savings Per household [46]	Total Lifetime Savings
MWh	1.16	11.60	23.13	231.3
Dtherm	21.80	218	436	4360
CO_2 (tons)	2.16	21.6	43	430
NO_2 (lbs)	5.25	52.5	105.07	1,050.72
SO_2 (lbs)	7.54	75.4	150.8	1,508

Average Annual Electricity/Natural Gas Bill Reductions[47]	
Annual Electricity Bill Reductions (Per Household)	$119
Annual Natural Gas Bill Reduction (Per Household)	$451
Total Annual Savings (Per Household)	$570

How to Do It

1. Hire a part-time community outreach coordinator or appoint an existing employee to designate 10% of their time to performing Community Partners Initiative related tasks. Individuals with a background in community outreach and/or green initiatives are preferred to accomplish these goals. The overall goal of the community outreach coordinator is to work alongside municipal officials to curb greenhouse gas emissions and foster environmental awareness among the community.

2. Once an outreach coordinator is assigned, join the Community Partners Initiative. To join, submit the enrollment form from the following website: http://www.njcleanenergy.com/residential/programs/community-partners-initiative/join-today

3. To enroll in the New Jersey ENERGY STAR Homes program, check off "New Jersey ENERGY STAR Homes" located in "Step 1" of the enrollment form.

4. Once the enrollment form is complete, the assigned outreach coordinator should correspond with Community Partners Initiative staff members to design an outreach campaign. The outreach campaign strategies can include, but are not limited to, door to door campaigning, mailings, events, fliers, and energy fairs.

5. Refer at least 10 household units to the New Jersey ENERGY STAR Homes program to receive a $300 community incentive bonus. Community incentives are distributed once building permits are issued. Financial incentives are only awarded when homes are built within Smart Growth areas, which are legally defined as Planning Areas I & II and Designated Centers. To identify Smart Growth areas, visit the following website: http://www.state.nj.us/dca/divisions/osg/smart/

For additional information related to the Community Partners Initiative, visit the following website:

http://www.njcleanenergy.com/residential/programs/community-partners-initiative-0, or call 1-866-NJSMART (1-866-657-6278) for immediate assistance.

Resources

NJ BPU Community Partners Initiative: http://www.njcleanenergy.com

Contact: 1-866-NJSMART

Case Studies:

http://www.njcleanenergy.com/residential/programs/community-partners-initiative/active-community-partners

New Jersey ENERGY STAR Homes:
http://www.njcleanenergy.com/residential/programs/nj-energy-star-homes/nj-energy-star-homes

Builder financial incentives and requirements:
http://www.njcleanenergy.com/files/file/Residential%20Programs/NJ%20ENERGY%20STAR%20Homes/ProgramChangeLettersep09.pdf

HVAC Builder Incentives: http://www.njcleanenergy.com/files/file/042-NJESH_ProgIncentives.pdf

ENERGY STAR Homes Virtual Tour:http://www.njcleanenergy.com/files/file/flash/njcep.swf

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

Introduction

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.[48] 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.

The first phase of the program pairs facility managers with Program Partners (technical experts) to create an Energy Reduction Plan for their facility that will result in, at a minimum, 15% energy savings. This comprehensive plan includes aspects of energy audits, financial planning for funding energy efficiency efforts, and construction scheduling assistance for the actual installation of energy efficiency measures.[49] The next two phases of the program involve the implementation of the measures outlined in the Energy Reduction Plan and the verification of actual energy savings one year after the installation of energy efficiency upgrades. Incentives are disbursed to participants upon the completion of each phase. A minimum rebate of $5,000 is offered to those entering the program to aid in the cost of completing an Energy Reduction Plan. The Pay for Performance Program also offers additional financial incentives, up to $1,000,000, to commercial, institutional, and industrial energy electricity customers for the purchase and installation of combined heat and power (CHP) systems.[50]

Pay for Performance

	Municipal Government	Community-Wide
Initial Municipal Costs ($)	$ 102,738	
Rebate/Subsidy ($)	$ 107,290	
Net Capital Cost ($)	$ (4,552)	
Lifetime Municipal Costs ($)	$ 102,738	
Lifetime of Measure (Years)	15	
CO2 Reductions (Tons)	4,991	4,991
NOx Reductions (Lbs)	8,053	8,053
SO2 Reductions (Lbs)	1,386	1,386
Electricity Savings (MWh)	197	197
Electricity Savings ($)	$ 26,748	$ 26,748
Natural Gas Savings (MMBtu)	83,268	83,268
Natural Gas Savings ($)	$ 858,306	$ 858,306

Costs/Impacts

As mentioned above, incentives are offered to encourage completion of each phase of the program. The chart below outlines the incentives, which are then used to calculate the fiscal impact of the program on the municipality.

Incentive 1: Energy Reduction Plan[51]	
Incentive Amount	$0.10 per square foot
Minimum Incentive	$5,000
Maximum Incentive	$50,000 or 50% of facility annual energy cost

Incentive 2: Installation of Recommended Measures[52]		
	Electric Incentives	Gas Incentives
Base Incentive based on 15% savings:	$0.11 per projected kWh saved	$1.10 per projected Therm saved
For each % over 15% add:	$0.005 per projected kWh saved	$0.05 per projected Therm saved
Maximum Incentive:	$0.13 per projected kWh saved	$1.45 per projected Therm saved

Incentive 3: Post-Construction Benchmarking Report[53]		
	Electric Incentives	Gas Incentives
Base Incentive based on 15% savings:	$0.07 per projected kWh saved	$0.70 per projected Therm saved
For each % over 15% add:	$0.005 per projected kWh saved	$0.05 per projected Therm saved
Maximum Incentive:	$0.09 per projected kWh saved	$1.05 per projected Therm saved

Local governments participating in the Pay for Performance program will face two significant costs – the cost of hiring a Partner to create the Energy Reduction Plan and the cost of installing recommended upgrades outlined in the Plan. The incentives of the program are designed to offset the costs of the Energy Reduction Plan creation, so the net cost to a municipality for this phase is zero, however the upfront cost of producing the plan is a minimum of $5,000 as indicated by the incentive levels integrated into this phase of the program.

For Phases II and III of the program, rebates are given for installing the recommended energy efficiency upgrades and confirming actual energy reductions. These rebates may account for up to 50% of the total project cost.[54] Therefore, it is assumed that the minimum upfront costs of the installations and reporting post-installation, will be twice the cost of the rebate. Costs are calculated according to the rebate structure above and the expected energy reductions shown in the "Energy and Emissions Impacts" table below.

While this analysis addresses municipal participation in the program, towns can continuously conduct outreach to the commercial sector to promote enrollment in the Pay for Performance program.

Local Fiscal Impacts: For Governmental Buildings

Lifetime of measure	15[55] (CHP System – 12 years[56])
Initial Cost[57]	$209,580
Rebate	$107,290
Cost after Rebate	$102,290
Annual Savings/Cost	just the electricity and natural gas savings based on

	the numbers in the chart below.
Years to Payback	
Net Present Value	

Energy and Emissions Impacts[58]

Energy impacts (annually)	**Per participant**	**Per Community**
Electricity savings[59]	13158 kWh	
Natural Gas savings[60]	55,512 therms	
Emissions savings (annually)	**Per participant**	**Per Community**
CO_2		
NOx		
SO_2		

Energy and Emissions Impacts – Combined Heat and Power

Energy impacts (annually) [61]	**Per kW of annual electric generation**	**Per CHP system[62]**
Electricity and natural gas savings	22,412,839 BTU	7,149,695,641 BTU
Emissions savings (annually) [63]	Per kW of annual electric generation	Per CHP system
CO_2		
NOx		
SO_2		
Energy impacts (lifetime)	Per kW of annual electric generation	Per CHP system
Electricity and natural gas savings	268,954,068 BTU	85,796,347,692 BTU
Emissions savings (lifetime)	Per kW of annual electric generation	Per CHP system
CO_2		
NOx		
SO_2		

How to do it:

***For Local Government Buildings*[64]**

1. Enroll in the NJ BPU's Local Government Energy Audit to determine if the Pay for Performance program is appropriate for your building stock.
2. Consider the following eligibility requirements:
   a. Participants must receive direct service from one of the following electric and natural gas providers in order to participate in the program: Atlantic City Electric, Jersey Central Power and Light, Public Service Electric and Gas, or Rockland Electric and/or Elizabethtown Gas, New Jersey Natural Gas, Public Service Electric and Gas, or South Jersey Gas.[65] Due to retail choice options in New Jersey, individual businesses may be served by alternative electric and natural gas suppliers.
   b. To be eligible for CHP incentives, the applicant must be either a participant in the Pay for Performance Program or be able to prove that the facility to be upgraded is already energy efficient, making a 15% reduction in energy consumption unlikely. An applicant can demonstrate energy efficiency through ENERGY STAR certification. When ENERGY STAR certification is not available for a given type of facility, an applicant can also demonstrate energy efficiency by achieving a designated score on the LEED for Existing Buildings Rating System (LEED-EB).[66]
   c. The Pay for Performance program is now offered to new construction projects. These projects must be located in a New Jersey SmartGrowth area, which can be identified using http://sgl.state.nj.us/hmfa/viewer.htm?LocatorType=1.
   d. Instructions and eligibility criteria for new construction projects can be found on http://www.njcleanenergy.com/commercial-industrial/programs/pay-performance/new-construction.
3. Develop a budget to fund the upfront costs of the project. Consider the following customer and equipment eligibility requirements:
   a. Customers who, from January 1- December 31, 2009, have not contributed to the societal benefits charge of the applicable New Jersey utility may not be eligible for incentives offered through this program.
   b. Equipment procured by the local government through another program offered by the New Jersey Utilities, as applicable, is not eligible for incentives through this Program.[67]
   c. Measures installed prior to the application approval date cannot be included in the Energy Reduction Plan scope of work and are not eligible for the incentives.
4. Select a Technical Partner from the approved list provided by the BPU at http://www.njcleanenergy.com/files/file/Pay%20for%20Performance/P4P%20Trade%20Ally%20Partners%20-%209-30-09.pdf.

5. With assistance from the Technical Partner, submit an application package. The application forms can be found at http://www.njcleanenergy.com/commercial-industrial/programs/pay-performance/pay-performance-applications-and-forms.
6. Wait for application approval before continuing on to the next step.
7. Once approved, develop benchmarks and goals with your Technical Partner to achieve at least the minimum 15% energy reduction.
8. Work with your Partner to submit your draft Energy Reduction Plan, a complete Benchmarking Report, a Partner-Participant Contract, and a request for Incentive #1. The request form for Incentive #1 can be found at http://www.njcleanenergy.com/files/file/Pay%20for%20Performance/P4P%20Incentive%20Form%20One%20-%20Final%20e.pdf.
9. Implement the project. The Partner will assist in the bidding process and will monitor construction to ensure that the appropriate steps are being taken to achieve the expected performance goals.
10. Confirm that the Partner has submitted a request for Incentive #2 along with the Substantial Completion Construction Report when the project is complete. The form for Incentive #2 can be found at http://www.njcleanenergy.com/files/file/Pay%20for%20Performance/P4P%20Incentive%20Form%20Two%20-%20Final%20e.pdf.
11. Within 12 months after the project has been completed, confirm that the Partner has submitted a request for Incentive #3 along with the Post-Construction Benchmarking Report. If the building performance goal is met, you will receive Incentive #3. The form for Incentive #3 can be found at http://www.njcleanenergy.com/files/file/Pay%20for%20Performance/P4P%20Incentive%20Form%20Three%20-%20Final%20e.pdf.
12. Be aware that additional information on the Pay for Performance program can be found at http://www.njcleanenergy.com/commercial-industrial/programs/pay-performance. You can also call 1-866-NJSMART (1-866-657-6278) for information or assistance.

For Non-governmental Buildings:

1. Hire a part time outreach coordinator or designate 10% of an existing position to these duties.
2. Staff involved with community ***outreach or greening activities s***hould work with municipal officials to promote the Pay for Performance program to businesses and institutions in the community.
3. Your outreach coordinator should develop an outreach campaign, including distribution of literature, fairs, etc.
4. Consider eligibility requirements. (See eligibility requirements listed above for governmental buildings.)

5. Be aware that additional information on the Pay for Performance program can be found at http://www.njcleanenergy.com/commercial-industrial/programs/pay-performance. You can also call 1-866-NJSMART (1-866-657-6278) for information or assistance.

Resources

Incentives

While no incentives are offered to towns promoting this program, incentives are offered to facility managers/owners upon completion of each phase of the program. Information on incentives can be found at:

1. http://www.njcleanenergy.com/files/file/Pay%20for%20Performance/P4P%20incentive%20structure%20-%20final.pdf
2. http://www.njcleanenergy.com/files/file/Pay%20for%20Performance/P4P%20incentive%20structure%20addition.pdf.

Additional incentives are awarded for projects that incorporate combined heat and power (CHP) into the facility's operations. More information on the CHP component of the Pay for Performance program can be found at http://www.njcleanenergy.com/commercial-industrial/programs/combined-heat-power/combined-heat-power.

Eligibility Requirements

Additional eligibility requirements for individual participants can be found at http://www.njcleanenergy.com/files/file/Pay%20for%20Performance/Pay%204%20Performance%20Application%2002-05_09%20e.pdf.

Additional eligibility requirements for CHP projects can be accessed at http://www.njcleanenergy.com/files/file/Pay%20for%20Performance/P4P%20CHP%20Application%20Package%20-%20Final%20e.pdf.

Forms

Forms for Program Participants

Program application, incentive request, and installation agreement forms can be accessed at:

http://www.njcleanenergy.com/commercial-industrial/programs/pay-performance/pay-performance-applications-and-forms.

CHP application package can be accessed at

http://www.njcleanenergy.com/files/file/Pay%20for%20Performance/P4P%20CHP%20Application%20Package%20-%20Final%20e.pdf.

Tools

ENERGY STAR Portfolio Manager

The U.S. EPA created this tool to allow facility managers to track and analyze energy and water usage in their facilities and establish efficiency goals. Use of the tool is required for Pay for Performance program participants for benchmarking purposes. Information about, and access to, the tool is on

http://www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager.

Tips for Selecting a Program Partner

This is a flyer developed by the NJ BPU to help towns select a Program Partner.

http://www.njcleanenergy.com/files/file/Pay%20for%20Performance/What%20To%20Expect%20from%20your%20Partner%20-%20final.pdf.

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

Introduction

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. Technical assistance and financial incentives are offered through the Community Partners Initiative to local governments that help residents and businesses take advantage of the following New Jersey's clean energy and energy efficiency programs:[68]

The Warm & Cool Advantage program aims to increase the energy efficiency of residential heating and cooling systems. Residents are eligible for cash rebates to install energy efficient central air conditioners, heat pumps, natural gas home heating systems, and/or water heaters. If at least 100 residents participate in the program, the municipality will receive a $200 incentive.

The CleanPower Choice program allows New Jersey electricity consumers to purchase renewable energy to offset up to 100% of their monthly electricity usage. The more residents and businesses that enroll in the program, the more clean energy will be added to the resource mix. The target for this project is to enroll 3% of households in the program.

The Energy Efficient Products Program seeks to increase the usage of energy efficient appliances by offering rebates on certain ENERGY STAR products including air conditioners, clothes washers, and dehumidifiers. Discounted energy efficient lighting products are also sold through the program's online store. The municipality will receive a $300 incentive from the BPU if at least 50 residents submit applications for rebates on ENERGY STAR purchases.

The Large Appliance Early Retirement program is designed to encourage the recycling of old refrigerators and freezers by offering financial incentives. Homeowners can avoid disposal costs and receive a $30 cash incentive bonus for each recycled appliance. Upon referring 20 units to the recycling program, the municipality will receive a $300 incentive.

The Home Performance with ENERGY STAR program is designed to significantly reduce household energy consumption by offering household energy assessments at reduced cost. A certified contractor inspects household heating and cooling equipment, insulation and ventilation quality, air sealing productivity of windows and doors, appliance efficiency, and lighting standards to provide information leading to up to 30% savings on annual energy costs. Upon referring 100 residents to the program, the municipality will receive an $800 incentive.

Participate in Community Partners Initiative (CPI)

	Municipal Government	Community-Wide
Initial Municipal Costs ($)	$ 788	
Rebate/Subsidy ($)	$ 1,900	
Net Capital Cost ($)	$ (1,112)	
Lifetime Municipal Costs ($)	$ 46,403	
Lifetime of Measure (Years)	25.83333333	
CO2 Reductions (Tons)		21,012
NOx Reductions (Lbs)		65,715
SO2 Reductions (Lbs)		222,764
Electricity Savings (MWh)		51,393
Electricity Savings ($)		$ 454,017
Natural Gas Savings (MMBtu)		37,335
Natural Gas Savings ($)		$ 248,540

Costs/Impacts

Labor will be the primary cost of CPI outreach efforts and could be accomplished through professional or volunteer efforts. If a professional is used, a part-time (10% full time) outreach coordinator is estimated to cost $4,300 per year.[69] Please note that the outreach coordinator is assumed to be responsible for promoting all programs within the CPI to residents and businesses. While the calculations presented here include the cost of a part-time staff person, the cost would be approximately neutral if volunteers are used.

The upfront material cost to the town is the cost of promotional supplies, which is estimated to be $160. [70] Since participation in the CPI is ongoing, the cost of promotional materials will also be included in the annual costs but at a reduced amount of $45 per year.

The impacts shown here are those expected if outreach is conducted for all five of the CPI programs outlined in this measure. Impacts have also been calculated for each program and are shown in the individual program descriptions following the "how to" section below.

Input	Warm& Cool	Clean Power	EE Products	Large App	Home Perform	All CPI Outreach
Lifetime of Measure (Years)						
Incentives ($)	$200	$0	$300	$300	$800	$1,600
Year 1 Outreach Coordinator Costs ($)						$4,300
Year 1 Outreach Materials Costs ($)						$160
Year 1 Total Costs						$2,860
Energy Savings	100 participants	3% of households	50 units	20 units	100 households	
Annual Electric Savings (MWh)	52	#hh * .03 * 1.7	5	21	110	188 + (#hh * .03 * 1.7) MWh
Annual Natural Gas Savings (therm)	7,970		243		40,150	48,363 Therms
Water Usage Reduced (gallons)			2,649,510			2,649,510 Gallons

How To Do It

1. **Hire a part time outreach coordinator or designate 10% of an existing position to these duties.** Individuals with a background in community outreach and/or green initiatives are preferred to accomplish these goals. The overall goal of the community outreach coordinator is to work alongside municipal officials to curb greenhouse gas emissions and foster environmental awareness within the community. Alternately,

towns may recruit new or existing volunteers to lead the effort. A Sustainable Jersey Green Team or Environmental Commission are likely sources of assistance.

2. **Staff involved with community outreach or greening activities should work with municipal officials** to achieve a formal commitment to enroll the community in the Community Partners Initiative.

3. **Review the individual Clean Energy Programs that follow to determine in which CPI programs you will enroll.** Submit the enrollment form available at:

http://www.njcleanenergy.com/files/file/Community%20Partners%20Initiative/Enrollment%20Forms/CPI%20Enrollment%20Form%202009.pdf

Warm & Cool Advantage Program

The Warm & Cool Advantage program aims to increase residential heating and cooling systems' energy efficiency. Home heating and cooling systems are energy intensive operations so it is important that the equipment, such as central air conditioners, be as energy efficient as possible.[71] Cash rebates are offered through both programs to encourage residents to install energy efficient central air conditioners, heat pumps, natural gas home heating systems, and/or water heaters. The program also provides aid selecting certified contractors to install the new heating and/or cooling systems.[72] Proper installation and selection of the appropriate size of the heating and cooling system is necessary for achieving full energy efficiency benefits.

CPI - Warm & Cool Advantage

	Municipal Government	Community-Wide
Initial Municipal Costs ($)	$ 248	
Rebate/Subsidy ($)	$ 200	
Net Capital Cost ($)	$ 48	
Lifetime Municipal Costs ($)	$ 8,138	
Lifetime of Measure (Years)	30	
CO2 Reductions (Tons)		1,720
NOx Reductions (Lbs)		3,880
SO2 Reductions (Lbs)		8,005
Electricity Savings (MWh)		1,554
Electricity Savings ($)		$ 118,560
Natural Gas Savings (MMBtu)		23,910
Natural Gas Savings ($)		$ 151,047

When promoting the program to residents, note the following eligibility issues:

- Direct homeowners of newly constructed homes to **http://sgl.state.nj.us/hmfa/viewer.htm** to determine if their home is located in a designated Smart Growth area. Installations in newly constructed homes are only eligible for equipment rebates if those homes are located in Smart Growth areas.
- Residents must receive direct service from one of the following electric and natural gas providers in order to participate in the program: Atlantic City Electric, Jersey Central Power and Light, Public Service Electric and Gas, or Rockland Electric and/or Elizabethtown Gas, New Jersey Natural Gas, Public Service Electric and Gas, or South Jersey Gas.[73,74] Due to retail choice options in New Jersey, individual residences may be served by alternative electric and natural gas suppliers.

Upon referring 100 residents within their jurisdiction to the Warm & Cool Advantage Program, towns will receive a $200 rebate from the NJ BPU.

Local Fiscal Impacts

Lifetime of measure	**Indefinite**
Initial Cost	$160
Rebate	$200
Cost after Rebate	$-40
Annual Savings/Cost	$4,345
Years to Payback	
Net Present Value	

Energy and Emissions Impacts[75]

Energy impacts (annually)	**Per participant**	**100 participants**
Electricity savings	.518 MWh	51.8 MWh
Natural Gas savings	7.97 Dtherm	797 Dtherm
Emissions Savings (lifetime)	Per participant	100 participants
CO2	13.28 metric tons	1,328 metric tons

NOx	.016 metric tons	1.6 metric tons
SO2	.023 metric tons	2.3 metric tons

Clean Power Choice Program

CleanPower Choice, launched in Fall 2006, aims to increase the amount of renewable energy used by electricity consumers in the mid-Atlantic region, thereby decreasing the region's dependency on fossil-fuels.[76] The more residents and businesses that enroll in the program, the more clean energy will be added to the resource mix. Renewable energy provides numerous environmental and economic benefits including improved air quality, conservation of natural resources, job creation, and stabilized energy prices. Clean energy currently comes at a higher price, however, as more people demand clean energy, it will become cheaper.

CPI - Clean Power Choice

	Municipal Government	Community-Wide
Initial Municipal Costs ($)	$ 448	
Rebate/Subsidy ($)	$ -	
Net Capital Cost ($)	$ 448	
Lifetime Municipal Costs ($)	$ 8,338	
Lifetime of Measure (Years)	30	
CO2 Reductions (Tons)		16,634
NOx Reductions (Lbs)		54,281
SO2 Reductions (Lbs)		191,690
Electricity Savings (MWh)		37,215
Electricity Savings ($)		$ -
Natural Gas Savings (MMBtu)		-
Natural Gas Savings ($)		$ -

Through the CleanPower Choice program, electricity consumers in New Jersey can voice a preference for the type of energy that is provided by their utility. They do this by electing to have a certain percentage of their monthly electricity usage (up to 100%) provided by renewable energy. The NJ BPU will verify that the local utility purchases this amount of renewable energy to be supplied to the electric grid on behalf of the customer.[77] CleanPower Marketers, approved by the NJ BPU, help facilitate this entire transaction.[78] The chart below outlines a clean energy package offered by each of the three approved CleanPower Marketers - Green Mountain Energy Co., Community Energy Inc., and Sterling Planet, Inc.[79] Those enrolling in the CleanPower

Choice can choose the package that most closely matches their preferences. The costs listed below are in addition to the participant's monthly electric bill.

Company	Resource	Price per Kilowatt Hour	Percent of Monthly Electricity Usage	Average Additional Monthly Cost (avg. home = 700 kWh/mo.)
Sterling Planet, Inc.	67% Wind 33% Small Hydro	3.5 ¢	25%	$6.13
Green Mountain Energy	50% Wind 50% Small Hydro	2.0 ¢	100%	$14.00
Community Energy, Inc.	100% NJ Wind	5.5 ¢	15%	$5.78

When promoting the program to residents, note the following eligibility issues:

- Participants must receive direct service from one of the following electric and natural gas providers in order to participate in the program: Atlantic City Electric, Jersey Central Power and Light, Public Service Electric and Gas, or Rockland Electric Company. Due to retail choice options in New Jersey, individuals may be served by alternative electric suppliers.
- Participants remain customers of their electric utility and receive only one electric bill that will include the renewable energy purchase on it. No new equipment installation or rewiring is necessary to participate in the program.
- Businesses may also be eligible to participate in the Clean Power Choice program.

As of 2010, a financial incentive is no longer available to municipalities. Prior to 2010, enrollment of 3% of residences would have qualified for a $400 incentive. While this funding is no longer offered, this analysis has still considered the environmental benefits of enrolling 3% of residences.

While the CleanPower Choice program does not provide any energy savings, it does off-set consumption of electricity supplied by the traditional fuel mix for New Jersey, which is primarily nuclear and coal-fired generation.[80] A calculation of the energy and emissions impacts for 3% of the population was performed to illustrate the savings obtained if a town meets the previous CPI goal for referrals.

Local Fiscal Impacts

Lifetime of measure	Indefinite
Initial Cost	$160
Rebate	$0
Cost after Rebate	$160
Annual Savings/Cost	$4,345
Years to Payback	
Net Present Value	

Energy and Emissions Impacts

Energy impacts (annually)	Per participant	3% of the municipality's residences[81]
Traditional Off-set	1.7 MWh[82]	
Natural Gas savings[83]	N/A	N/A
Emissions Savings (annually)[84]	Per participant	3% of the Town's Residences
CO_2		
NO_x		
SO_2		

Energy Efficient Products Program

The Energy Efficient Products Program (formerly the Residential ENERGY STAR Products Program) seeks to increase the usage of energy efficient appliances by offering rebates on certain ENERGY STAR products.[85] Because appliances account for approximately 17% of a household's energy consumption,[86] replacing inefficient household appliances with ENERGY

STAR appliances, which typically use 10-50% less energy and water than standard models, can result in significant energy savings.[87] By providing rebates on ENERGY STAR room air conditioners, clothes washers, and dehumidifiers, this program helps to reduce initial cost barriers to purchasing energy efficient household appliances. In addition to providing rebates for certain appliance purchases, the Energy Efficient Products Program also sells discounted energy efficient lighting products through the Clean Energy Program's online store.[88]

CPI - Energy Star Appliances

	Municipal Government	Community-Wide
Initial Municipal Costs ($)	$ 148	
Rebate/Subsidy ($)	$ 300	
Net Capital Cost ($)	$ (152)	
Lifetime Municipal Costs ($)	$ 6,645	
Lifetime of Measure (Years)	15	
CO2 Reductions (Tons)		71
NOx Reductions (Lbs)		176
SO2 Reductions (Lbs)		502
Electricity Savings (MWh)		8,327
Electricity Savings ($)		$ 365
Natural Gas Savings (MMBtu)		365
Natural Gas Savings ($)		$ 3,580
Water Savings (Gallons)		$ 2,649,510
Water Savings ($)		$ 9,261

Once referrals have resulted in the submission of 50 online ENERGY STAR rebate applications, the municipality will receive $300 from New Jersey's Board of Public Utilities.[89]

Local Fiscal Impacts

Lifetime of Measure[90]	**Room Air Conditioner – 10 years Clothes Washer – 15 years Dehumidifier – 10 years**
Initial Cost	160
Subsidy/Incentive	$300
Cost after subsidy	-$140
Annual Cost	$4,345
Years to Payback	

Net Present Value	

Energy, Water, and Emissions Impacts

Impacts/Savings (Annual)	Per Unit by Appliance			50 Units (Average Mix of Appliance Rebates) 91
	Room Air Conditioner	Clothes Washer	Dehumidifier	
Energy Savings92				
Electricity Savings (kWh)	56	125	71	4,768
Natural Gas Savings (therms)	0	9	0	243
Water Savings (gallons)93	0	6,542	0	176,634
Emissions Savings (metric tons)94				
CO2	0.039	0.133	0.049	4.558
NOx	0.000	0.000	0.000	0.000
SO2	0.000	0.000	0.000	0.000
Impacts/Savings (Lifetime)	**Per Unit by Appliance**			**50 Units (Average Mix of Appliance Rebates)**
	Room Air Conditioner	**Clothes Washer**	**Dehumidifier**	
Energy Savings95				
Electricity Savings (kWh)	564	1,869	710	64,457
Natural Gas Savings (therms)	0	132	0	3,564
Water Savings (gallons)96	0	98,130	0	2,649,510
Emissions Savings (metric tons)97				
CO2	0.390	1.993	0.491	63.488
NOx	0.001	0.003	0.000	0.097
SO2	0.001	0.005	0.002	0.165

Large Appliance Early Retirement Program

The Large Appliance Early Retirement program is a BPU-sponsored initiative designed to encourage the recycling of old refrigerators and freezers by offering financial incentives to homeowners and communities. Out of all household appliances, refrigerators and freezers consume the most energy. The majority of New Jersey residents own a spare, outdated refrigerator that consumes up to four times more energy than newer models.[98] By recycling spare refrigerators and freezers, homeowners can significantly reduce greenhouse gas emissions and household energy costs.

CPI - Large Appliance Early Retirement

	Municipal Government	Community-Wide
Initial Municipal Costs ($)	$ 148	
Rebate/Subsidy ($)	$ 300	
Net Capital Cost ($)	$ (152)	
Lifetime Municipal Costs ($)	$ 8,038	
Lifetime of Measure (Years)	30	
CO2 Reductions (Tons)		342
NOx Reductions (Lbs)		1,116
SO2 Reductions (Lbs)		3,940
Electricity Savings (MWh)		765
Electricity Savings ($)		$ 58,365
Natural Gas Savings (MMBtu)		-
Natural Gas Savings ($)		$ -

Because old refrigerators and freezers are not bio-degradable, it is against the law in New Jersey to dump these appliances in landfills.[99] Unfortunately though, recycling old appliances is an intensive process, and most companies charge a pickup and service fee, which can discourage individuals from discarding their outdated and spare appliances. Through the Large Appliance Early Retirement program, homeowners can avoid these costs and receive a $30 cash incentive bonus for each recycled appliance, with a limit of two appliances per customer. Homeowners can utilize this program to recycle and remove in-use spare appliances or to replace their outdated appliance with an updated model.

Upon referring 20 units within their jurisdiction to the Large Appliance Early Retirement program, towns will receive a $300 community incentive bonus from the NJ BPU.

Local Fiscal Impacts

Lifetime of measure	
Initial Cost	$160
Subsidy	$300
C Cost after subsidy	$-140
Annual Savings/Cost	$4,300
Years to Payback	
Net Present Value	

The following data chart details the energy savings and associated air quality and greenhouse gas improvements that result from recycling an old in-use refrigerator. By recycling an old in-use spare refrigerator, homeowners can achieve the following emission reductions:

Savings for Removing In-Use Refrigerator (1990-older)[100]		
Impact Categories	**Annual (12 month) Emission Savings Per Unit**	**Annual Emission Savings for 20 Units**
Electric (MWh)	1.5	30
CO_2 (tons)	1.14	22.8
NO_2 (lbs)	4.2	84
SO_2 (lbs)	9.75	195

In addition to recycling outdated refrigerators, homeowners can also replace previously owned refrigerators with current models (2001-present). Modern refrigerators are much more energy efficient than older models, so updating the appliance can significantly reduce household energy costs and greenhouse gas emissions. The following table demonstrates the emission savings achieved by recycling an old in-use refrigerator (1990-older) and replacing it with a modern refrigerator.

Savings from Replacing Old Refrigerator with Modern Unit[101]		
Impact Categories	**Annual Emission Savings Per Unit**	**Annual Emission Savings for 20 Units**
Electric (MWh)	1.05	21
CO_2 (tons)	.80	16
NO_2 (lbs)	2.94	58.8
SO_2 (lbs)	6.83	136.6

Home Performance with ENERGY STAR Program

Municipalities can promote The Home Performance with ENERGY STAR program, a BPU-sponsored initiative designed to significantly reduce household energy consumption by offering thorough and accurate household assessments. Each household assessment is valued at $300, but homeowners who participate in the ENERGY STAR program will only pay $125. The average assessment takes roughly 2-3 hours, and the information gathered could save homeowners up to 30% in annual energy costs.[102] All assessments are conducted by a certified contractor who thoroughly inspects each of the following: household heating and cooling equipment, insulation and ventilation quality, air sealing productivity of windows and doors, appliance efficiency, and lighting standards.[103] After each assessment, homeowners are provided with energy efficiency recommendations and a comprehensive guide to financial incentives and installation requirements.[104] Homeowners can then determine whether to implement the various recommended changes, however all assessments are worthwhile investments for identifying possible health and safety risks, regardless of whether the homeowner decides to undergo the proposed energy renovations.

CPI - Home Performance with Energy Star

	Municipal Government	Community Wide
Initial Municipal Costs ($)	$ (352)	
Rebate/Subsidy ($)	$ 800	
Net Capital Cost ($)	$ (1,152)	
Lifetime Municipal Costs ($)	$ 7,538	
Lifetime of Measure (Years)	30	
CO2 Reductions (Tons)		1,848
NOx Reductions (Lbs)		5,400
SO2 Reductions (Lbs)		16,998
Electricity Savings (MWh)		3,300
Electricity Savings ($)		$ 251,769
Natural Gas Savings (MMBtu)		8,700
Natural Gas Savings ($)		$ 54,961

Upon referring 100 residents within their jurisdiction to the Home Performance with ENERGY STAR program, a local government will receive an $800 community incentive bonus from the NJ BPU.[105]

Local Fiscal Impacts

Lifetime of measure	
Initial Cost	$160
subsidy	$800
Cost after subsidy	-$640
Annual Savings/Cost	$4,300
Years to Payback	
Net Present Value	

Below is a data chart detailing the environmental impacts for the Home Performance with ENERGY STAR program.[106]

Home Performance with ENERGY STAR Impacts				
Impact Categories	**Annual Average Savings Per Household**	**Annual Total (100 households)**	**Lifetime Savings Per Household**	**Lifetime Emission Reduction Savings (for 100 households)**
CO_2	2.9	290	66.9	6,690

(Tons)				
Electric (MWh)	1.1	110	22.1	2,210
DTh	40.15	4,015	964.95	96,495
SO_2 (lbs)	7.15	715	143.65	14,365
NO_2 (lbs)	2.74	275	55.25	5,525

1. Once the enrollment form is complete, the assigned outreach coordinator should correspond with Community Partners Initiative staff members to design an outreach campaign. The outreach campaign strategies can include, but are not limited to, door to door campaigning, mailings, events, fliers,and energy fairrs.

2. For programs that offer financial incentives, refer a sufficient number of participants to collect payment from the Board of Public Utilities. See individual programs below for the referral targets.

3. For additional information or assistance, contact the Community Partners Initiative at **http://www.njcleanenergy.com/residential/programs/community-partners-initiative-0** or call 1-866-NJSMART (1-866-657-6278).

Resources

NJ BPU Community Partners Initiative: http://www.njcleanenergy.com/residential/programs/community-partners-initiative-0

Contact: 1-866-NJSMART

Case Studies:http://www.njcleanenergy.com/residential/programs/community-partners-initiative/active-community-partners

Resources for Warm & Cool Advantage Program

Incentives

Charts outlining incentives for residents enrolling in the Warm & Cool Advantage program can be found on the website of the Board of Public Utilities.Please visit http://www.njcleanenergy.com/residential/programs/cooladvantage/cooladvantage-program to view the rebates available to individuals.

Eligibility Requirements & Application Forms

Additional eligibility requirements for residents may be found on the application forms for each program:

CoolAdvantage Program Application Form. http://www.njcleanenergy.com/files/file/Residential%20Programs/Cool%20Advantage/101-CoolAdvForm-2009-2-25.pdf.

WarmAdvantage Program Application Form. http://www.njcleanenergy.com/files/file/Residential%20Programs/WARMAdvantage/WarmAdvForm2009final.pdf.

Resources for Clean Power Choice Program

Eligibility Requirements & Application Form

Additional customer eligibility criteria are listed on the program application form. Application forms for businesses and residents desiring to enroll in the CleanPower Choice Program can be found: http://www.njcleanenergy.com/files/file/CleanPowerChoice/OCE0409_CPC_WebForm-3-18.pdf

CleanPower Marketer Contacts:

Company	Phone	Website
Sterling Planet, Inc.	1-877-457-2306	www.sterlingplanet.com
Green Mountain Energy	1-800-810-7300	http://greenmountainenergy.com/
Community Energy, Inc.	1-866-WIND-123	www.communityenergyinc.com

Electric Utility Account/Customer Number Identification Assistance

Residents and businesses enrolling in the CleanPower Choice Program will need to identify their personal account number to complete the enrollment application form.

http://www.njcleanenergy.com/renewable-energy/programs/cleanpower-choice-program/find-your-customer-number/find-your-customer-num

EPA Power Profiler

This tool shows residents and businesses the energy resource mix that is being used to meet their area's electricity needs.

http://www.epa.gov/RDEE/energy-and-you/how-clean.html

Resources for Energy Efficient Products Program

Energy Efficient Products Program

http://www.njcleanenergy.com/residential/programs/energy-star-product-rebates/new-jersey-energy-star-product-rebates

Current rebate offerings and online rebate applications http://www.njcleanenergy.com/residential/programs/energy-star-product-rebates/rebates-programs/rebates-and-programs

Resources for Large Appliance Early Retirement Program

Refrigerator/Freezer Recycling Program (Large Appliance Early Retirement Program):

http://www.njcleanenergy.com/residential/programs/refrigerator-freezer-recycling-program

Eligibility Requirements:

http://www.njcleanenergy.com/files/file/CS%20Marketing/Residential%20/RFRP%20FAQs%202.pdf

Recycling Facts:

http://www.njcleanenergy.com/files/file/Residential%20Programs/RefrigeratorFreezerRecycling/Sheet3_facts_NJ.pdf

Resources for Home Performance with ENERGY STAR Program

For detailed information on obtaining a loan, contact Energy Finance Solutions at 888-264-4367 or visit their website: http://www.energyfinancesolutions.com/main/homeownersnjone/title/New%20Jersey

Additional ENERGY STAR appliance information:

http://www.energystar.gov/

List of NJ certified contractors who perform household assessments:

http://www.njcleanenergy.com/misc/residential/certified-contractors

7. Install Variable Frequency Drives (VFD) in HVAC systems

Introduction

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.[107] 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.[108]

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.[109]

This flow can refer to various systems such as water, air or energy. Variable-frequency motors on fans save energy by allowing the volume of air moved to match the system demand. Reducing the power supplied to mechanical equipment when the demand for power is reduced is achieved by using lower frequency and voltage during motor startup and then in accelerating, limiting the current.[110]

ABB Drives. Helsinki. Finland

HVAC makes up the largest percentage of energy consumption (space heating, ventilation, cooling):

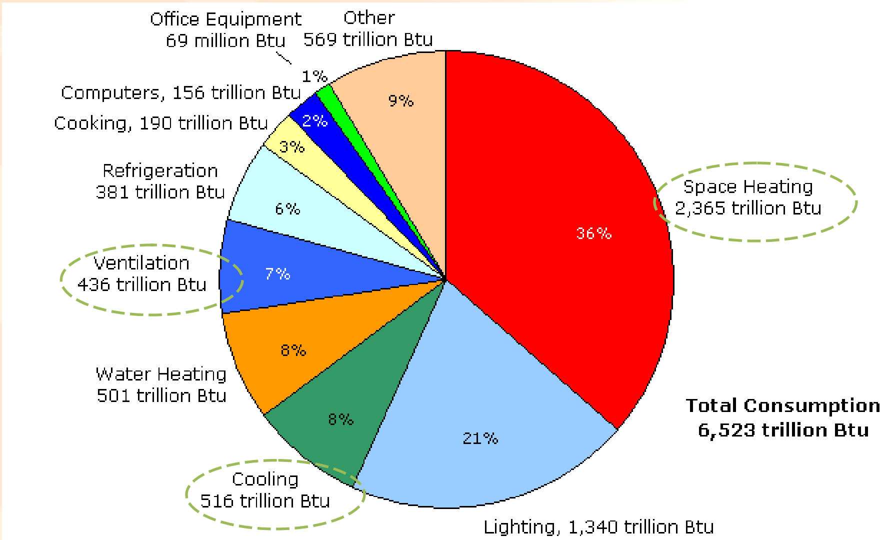

Figure 1- HVAC percentage of total building energy consumption[111]

ECM - Variable Frequency Drives for HVAC

	Municipal Government	Community-Wide
Initial Municipal Costs ($)	$ (3,910)	
Rebate/Subsidy ($)	$ 7,000	
Net Capital Cost ($)	$ (10,910)	
Lifetime Municipal Costs ($)	$ (3,910)	
Lifetime of Measure (Years)	15	
CO2 Reductions (Tons)	358	358
NOx Reductions (Lbs)	1,168	1,168
SO2 Reductions (Lbs)	4,126	4,126
Electricity Savings (MWh)	587	587
Electricity Savings ($)	$ 60,312	$ 60,312
Natural Gas Savings (MMBtu)	0	-
Natural Gas Savings ($)	$ -	$ -

Costs/Impacts

All estimates based on the following per unit costs:

$0.14/kWh, $10.66/MMBtu, $1.07/therm

Scenario: A 20,000 SF municipal building, installs one VFD (enclosed, 460 volt, 10 HP motor size, NEMA 1 (National Electrical Manufacturers Association)[112]) to its VAV HVAC system which runs 24hr/day, at $0.14/kWh. The estimated savings is as follows:

- Convert motor hp → kWh: 10hp * 0.746 = 7.46kWh

· VFD ratio[113]*kWh → 0.28 * 7.46kWh = 2.09kWh
· Ride the Fan Curve ratio[114]* kWh → 0.88 * 7.46kWh = 6.56kWh
· Difference between daily energy use, before VFD and after:
6.56kWh - 2.09kWh = 4.47kWh

Annual Electricity Savings = 4.47kWh * 8,760hrs = **39,157kWh**

Annual Cost Savings = annual electricity savings * rate of electricity

= 39,157kWh * $0.14/kWh = **$5,482**

Local Fiscal Impacts

	Variable Frequency Drives
Lifetime of Measure (Years)	15 years[115]
Annual Electric Savings (kWh)	**39,157 kWh/yr** (4.47kWh/unit/day) *On average, over 50%*[116][117]
Annual Peak Load Reductions (kWh)	72%[118]
Incentives ($)	$65 - $155 per hp (VAV) $60 per hp (Chilled-water pump) $5,250 to $12,500 per drive (Compressors)[119] *Also, see incentives section below*
Annual Cost Savings ($)	**$5,482**[120]
Capital Costs to Municipality ($)	$2,025 (bare material) + $560 (bare labor) + $505 (profit) = $3,090 [121]
Payback	4.14 months (after incentives) [122] *for another payback example see* [123]

Social and Environmental Impacts

	Annual		**Lifetime**	
	Government	Communit	Government	Communit

		y-wide		y-wide
GHG reduction	47,732 lbs/CO2/ 20,000 sq. ft. building			
kWh/Therms/gallons reduced	39,157kWh/20,000 sq. ft. building			
Criteria Air Pollutants				
Other				

How to Do it

1. Locate and assess HVAC system; gather equipment manuals and specifications.
2. Read through incentive procedures and options.
3. Contact an HVAC technician / Service Specialist for installation.

For a more detailed installation procedure, see Resources section.

Case Studies

- *Moulton Niguel Water District***,** *California* http://www.energy.ca.gov/process/pubs/moulton.pdf
- *Replacement of Damper Controls with VFDs in an HVAC System (case b)* http://oee.nrcan.gc.ca/industrial/equipment/vfd-ref/page-06.cfm

Incentives

- Financial incentives for qualifying equipment are available. These incentives were developed to help offset some of the added cost to purchase qualifying energy-efficient equipment, which provides significant long-term energy savings.[124]
  VFDs are eligible for incentives (dependent on application):

- Variable air volume ($65 - $155 per hp)
- Chilled-water pumps ($60 per hp)
- Compressors ($5,250 to $12,500 per drive) [125]

See Resource 1.

- Small to mid-sized facilities (whose peak electric demand did not exceed 200 kW in any of the preceding 12 months) serviced by a NJ public, regulated utility (electric or natural gas) company are eligible to participate in *Direct Install*. Payback is approximately two (2) years with NJ Clean Energy Program paying ~80% of costs.

See Resource 2.

Resources

Application from *NJ Clean Energy* to receive up to 100% in cost subsidy Guidelines & Application Forms**:**

http://www.njcleanenergy.com/files/file/Municipal%20Audit/MAP%20Guidelines%20and%20Applications%206-22-09%20final%20eform.pdf

Direct Install
http://www.njcleanenergy.com/files/file/Direct%20Install/Direct%20Install%20Flyer%20-%20Final%2012-8-09.pdf

California State Department of Energy's VFD: Planning your System
http://www.energy.ca.gov/process/agriculture/ag_pubs/Variable_Frequency_Drive.pdf

The Benefits of VFDs in HVAC Systems
http://www.facilitiesnet.com/hvac/article/The-Benefits-of-VFDs-In-HVAC-Systems--11278

Danfoss: VFD 101 for HVAC
http://www.danfoss.com/North_America/BusinessAreas/DrivesSolutions/Training+and+Education/VFD-101+for+HVAC+Market.htm

8. Institute Retrocommissioning.

Introduction

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.[1] 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.

Summary of Retrocommissioning Approach[126]

Commissioning Approach	Primary Objectives	Relative Costs	Benefits	Best Applications
Recommissioning or Retrocommissioning (RCx)	Adjust equipment to provide services within equipment specifications while also meeting current mission/tenant operating requirements.	$0.05 to $0.40 per square foot. Additional data are needed to help pin-point costs based on specific building features and the scope of the RCx effort.	Verifies and restores equipment operation in accordance with original design intent and/or to meet current operating requirements.	Since RCx is a point-in-time event, best applications are for buildings/ systems that have not been adequately maintained (recommissioned) for some period of time, especially those systems that have not been adapted to accommodate changing space/ tenant needs.

ECM - Retro Commissioning

	Municipal Government	Community-Wide
Initial Municipal Costs ($)	$ 6,000	
Rebate/Subsidy ($)	$ -	
Net Capital Cost ($)	$ 6,000	
Lifetime Municipal Costs ($)	$ 6,000	
Lifetime of Measure (Years)	30	
CO2 Reductions (Tons)	528	528
NOx Reductions (Lbs)	1,690	1,690
SO2 Reductions (Lbs)	5,860	5,860
Electricity Savings (MWh)	1,138	1,138
Electricity Savings ($)	$ 77,084	$ 77,084
Natural Gas Savings (MMBtu)	457	457
Natural Gas Savings ($)	$ 2,356	$ 2,356

Costs/Impacts

Scenario: Assume a 20,000 sq. ft. building undergoes a retrocommissioning project. The project team sets out to estimate cost in dollars, kilowatt hours (kWh) of electricity, and in kilo British thermal units (kBtu) of gas. The project team uses a median cost estimate of $0.30/sf[127] to determine potential costs for the retrocommissioning project. The median whole-building energy savings for a retrocommissioning project is estimated at 16%[128]. Assume an office building built to ASHRAE 90.1-2007 uses 11.85 kWh/sf/yr[129] and 4.76 kBtu/sf/yr[130] (natural gas).

Cost Estimate for Retrocommissioning:

20,000 sq. ft. building x $0.30/sf = **$6000** estimated cost for a retrocommissioning project

Electricity Savings:

20,000 sq. ft. x 11.85 kWh/sf/yr = 237,000 kWh of electricity used in a 20,000 sq. ft. building per year

237,000 kWh/yr x 16% (better performance than ASHRAE 90.1-2007 standard) = **37,920 kWh/yr saved**

Gas Savings:

20,000 sq. ft. x 4.76 kBtu/sf/yr = 95,200 kBtu of gas used in a 20,000 sq. ft. building per year

95,200 kBtu/yr x 16% (better performance than ASHRAE 90.1-2007 standard) = **15,232 kBtu/yr saved or 152.36 therms/yr saved**[131]

Annual Energy Savings:

37,920 kWh

15,232 kBtu or 152.36 therms

Annual Cost Savings:

37,920 kWh*.41= $5,309

152.36 therms*$1.07= $163

Total= $5472

Local Fiscal Impacts

	Retrocommissioning (per sq. ft. calculations)
Lifetime of Measure (Years)	Commissioning can be applied throughout the entire life of a building (ASHRAE Guideline 1 – 1996)
Annual Electric Savings (MWh)	37,920 kWh/20,000 sq. ft. building (1.9 kWh/sq.ft)[132]
Annual Natural Gas Savings (MMBtu)	152.36 therms/20,000 sq.ft. building (.008 therms/sq.ft)[133]
Annual Peak Load Reductions (kW)	
Gallons	

Reduced	
VMT Reduced	
Custom Conversion (If gallons water --> electricity, etc.)	
Tax Credits ($)	
Incentives ($)	NJ SmartStart Buildings[134]
Capital Administrative Costs ($)	
Yearly Administrative Costs ($)	
Capital Costs to Municipality ($)	$6000/20,000 sq.ft building ($0.30/sq. ft.)[3]
Yearly Costs to Municipality ($)	
Capital Incremental Costs ($)	Varies depending on the upgrades chosen.[135]
Yearly Incremental Costs ($)	Varies depending on the upgrades chosen.[10,136]
Payback	1.1 years[137]

Social and Environmental Impacts

	Annual		**Lifetime**	
	Government	Community-wide	Government	Community-wide
GHG reduction	48,008 lbs CO2/20,000 sq. ft. building (46,225 lbs/CO2			

	(kWh) + 1783 lbs/CO2 (therms)			
kWh/Therms/gallons reduced				
Criteria Air Pollutants				
Other				

How to Do it

Retrocommissioning (existing equipment)[1,138]

1. Planning phase

(a) Develop commissioning objectives

(b) Hire commissioning provider

(c) Review available documentation and obtain historical utility data

(d) Develop retrocommissioning plan

2. Investigation phase

(a) Perform site assessment

(b) Obtain or develop missing documentation

(c) Develop and execute diagnostic monitoring and test plans

(d) Develop and execute functional test plans

(e) Analyze results

(f) Develop Master List of deficiencies and improvements

(g) Recommend most cost-effective improvements for implementation

3. Implementation phase

(a) Implement repairs and improvements

(b) Retest and remonitor for results

(c) Fine-tune improvements if needed

(d) Revise estimated energy savings calculations

4. Project hand-off and integration phase

(a) Prepare and submit final report

(b) Perform deferred tests (if needed)

(c) Develop recommissioning plan/schedule

Resources

Case Studies:

http://www.oregon.gov/ENERGY/CONS/BUS/comm/docs/Silverton.PDF

http://www.peci.org/library/PECI_BdgSelect1_1002.pdf

http://www.energymanagement.uiuc.edu/pdfs/RCx%20Progress%20Report%20FY09.pdf

Retrocommissioning Guide:

http://www.peci.org/Library/EPAguide.pdf

http://resources.cacx.org/library/holdings/020.pdf

http://www.facilitiesnet.com/energyefficiency/article/Retrocommissioning--4126

Incentives:

New Jersey SmartStart Buildings (2008) - Program Guide (pg's 3-17) http://www.njcleanenergy.com/files/file/NJSSB%20Program%20Guide/NJSSB%20Program%20Guide%20Rev%201-28-09.pdf

9. Install Programmable Thermostats.

Introduction

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.[139]

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%.[140]

Consider that the average price of a programmable thermostat ranges from $30 to $150; with savings up to $160/year, a programmable thermostat maintaining the recommended default settings can pay for itself in reduced energy costs in under a year.[141]

ECM - Programmable Thermostats

	Municipal Government	Community Wide
Initial Municipal Costs ($)	$ 92	
Rebate/Subsidy ($)	$ -	
Net Capital Cost ($)	$ 92	
Lifetime Municipal Costs ($)	$ 92	
Lifetime of Measure (Years)	15	
CO2 Reductions (Tons)	14	14
NOx Reductions (Lbs)	29	29
SO2 Reductions (Lbs)	48	48
Electricity Savings (MWh)	7	7
Electricity Savings ($)	$ 709	$ 709
Natural Gas Savings (MMBtu)	171	171
Natural Gas Savings ($)	$ 1,365	$ 1,365

Costs/Impacts

Scenario: Assume a 20,000 sq. ft. building implemented a programmable thermostat to control their heating and cooling operations of their HVAC system. The estimated annual savings are described below.

This energy savings calculator was developed by the U.S. EPA and U.S. DOE and is provided for estimating purposes only. Actual energy savings may vary based on use and other factors.

Enter your own values in the gray boxes or use our default values.

Number of Units	1
Initial Cost per ENERGY STAR Unit (retail price)	$92
Initial Cost per Conventional Unit (retail price)	$73
Unit Fuel Cost (Cooling) ($/kWh)	$0.113
Unit Fuel Cost (Heating) ($/Therm)	$1.33

24 Hour Typical Usage Patterns*

	Weekday	Weekend
Nighttime Set-Back/Set-Up Hours	8	8
Daytime Set-Back/Set-Up Hours	10	10
Hours without Set-Back/Set-Up	6	6

City

NJ-Newark

Heating Season*

Typical Indoor Temperature w/o Set-Back	70
Nighttime Set-Back Temperature (Average)	62
Daytime Set-Back Temperature (Average)	62
Heating System Type	Gas Furnace

Cooling Season*

Typical Indoor Temperature w/o Set-Up	78
Nighttime Set-Up Temperature (Average)	82
Daytime Set-Up Temperature (Average)	85
Cooling System Type	Central AC

**All temperatures are in degrees Fahrenheit. Setpoint is defined as the temperature setting for any given time period. Set-back temperature is defined as the lower setpoint temperature for the energy-savings periods during the heating season, generally ni*

Annual and Life Cycle Costs and Savings for 1 Programmable Thermostat(s)

	1 ENERGY STAR Unit(s)	1 Conventional Unit(s)	Savings with ENERGY STAR
Annual Energy Costs			
Heating Energy Cost	$689	$841	$151
Heating Energy Consumption (MBTU)	*52*	*63*	*11*
Cooling Energy Cost	$150	$202	$52
Cooling Energy Consumption (MBTU)	*4.5*	*6.1*	*2*
Total	**$840**	**$1,043**	**$203**
Life Cycle Costs			
Energy Costs	$9,338	$11,593	$2,255
Heating Energy Costs	*$7,665*	*$9,347*	*$1,683*
Heating Energy Consumption (MBTU)	778	948	171
Cooling Energy Costs	$1,673	$2,246	$573
Cooling Energy Consumption (MBTU)	68	91	23
Purchase Price for 1 Unit(s)	*$92*	*$73*	*-$19*
Total	**$9,430**	**$11,666**	**$2,236**
		Simple payback of initial cost (years)	**0.1**

Source: Energy Star. Programmable Thermostat Calculator http://www.energystar.gov/index.cfm?c=thermostats.pr_thermostats

Local Fiscal Impacts

	Programmable Thermostats
Lifetime of Measure (Years)	15 years[142]
Annual Electric Savings (MWh)	Cooling: 460 kWh[143]
Annual	Heating: 114 therms[144]

Natural Gas Savings (MMBtu)	
Annual Peak Load Reductions (kW)	
Gallons Reduced	
VMT Reduced	
Custom Conversion (If gallons water --> electricity, etc.)	
Tax Credits ($)	
Incentives ($)	No incentives are currently available in New Jersey.
Capital Administrative Costs ($)	
Yearly Administrative Costs ($)	
Capital Costs to Municipality ($)	$92[145]
Yearly Costs to Municipality ($)	
Capital Incremental Costs ($)	$19[146]
Yearly Incremental Costs ($)	
Payback	0.1 years[147]

Social and Environmental Impacts

	Annual		**Lifetime**	
	Government	Community-wide	Government	Community-wide
GHG reduction				
kWh/Therms/gallons reduced[148]	460 kWh/yr 114 therms/yr			
Criteria Air Pollutants	Heating: Cooling:			
Other				

How to Do it

1. Conduct an energy audit on the heating and cooling in your building.
2. Develop a strategy that will maximize savings through the type of usage you want out of a specific programmable thermostat.
3. Determine which programmable thermostat is best suited for your building.
4. Estimate potential savings based on the usage of the chosen programmable thermostat and the conditions for which it will be set.
5. Implement the measure in your building
6. Conduct a human resource initiative that will explain to the building's tenants what the goals and the effects are of the programmable thermostat.

Types of Automatic and Programmable Thermostats[149]

There are five basic types of automatic and programmable thermostats. Electromechanical (EM) thermostats, digital thermostats, and hybrid systems range in price from $30 to $150 while occupancy thermostats and light-sensing thermostats cost about $200.

Purchasing Tips[150]

It is recommended that users conduct research on the various types of programmable thermostats before purchasing one as they are new to the market and perform in a variety of different ways.

Resources

ToolBase Services. Programmable thermostats. http://www.toolbase.org/TechInventory/TechDetails.aspx?ContentDetailID=801

Energy Star Programmable Thermostat Savings Calculator: http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/CalculatorProgrammableThermostat.xls

10. Install Plug Loads - Power Management Software and Vending Misers

Introduction

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[151], 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.

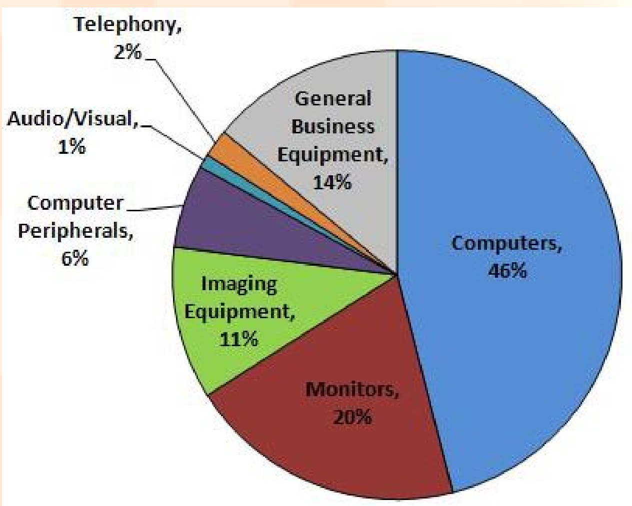

Figure 2- Breakdown of Commercial Plug Load Energy

http://www.efficientproducts.org/product.php?productID=11#surveyfootnote1

This Energy Conservation Measure (ECM), focuses on reducing plug loads from operating computers and vending machines, as combined, they account for about 50% of the total plug load in most office buildings and have high operating (energy) costs. One way to reduce computer related energy usage is through *power management software*. Power management software allows a network of computers to be controlled and monitored, maximizing efficiency and reducing energy loads. This is done through limiting how long PCs are allowed to stay on while inactive, scheduling shutdown and power up times and synchronizing computer update installations. This enables companies to implement power-saving strategies for little cost and with little effort and maintenance from the IT Department.[152]

Vending machines are common in municipal buildings. Other than a network of computers, cold vending machines have one of the highest operating costs—especially because they are never (or rarely) turned off, running 24/7. Applying an automated controller and motion sensor can help reduced energy costs in one of two ways:

1. A passive infrared sensor (PID) powers down the machine when the surrounding area is vacant, and
2. Temperature monitor turns on compressor only when temperatures rise above desired levels.

ECM - Plug Loads & Power Management Software

	Municipal Government	Community-Wide
Initial Municipal Costs ($)	$ 530	
Rebate/Subsidy ($)	$ -	
Net Capital Cost ($)	$ 530	
Lifetime Municipal Costs ($)	$ 530	
Lifetime of Measure (Years)	30	
CO_2 Reductions (Tons)	132	132
NO_x Reductions (Lbs)	431	431
SO_2 Reductions (Lbs)	1,523	1,523
Electricity Savings (MWh)	296	296
Electricity Savings ($)	$ 20,041	$ 20,041
Natural Gas Savings (MMBtu)	0	-
Natural Gas Savings ($)	$ -	$ -

Costs/Impacts

PC Power Management Software Scenario: Assume a 20,000 sq. ft. building has 10 standard computers with LCD monitors that run year round (approx. 168hrs/wk, or 8,760 hrs/yr) at 106 watts per desktop/monitor combination[153]. Assume that power management software is then installed that has a combined effect of reducing hours of energy usage to 2,340 hrs/yr at the same wattage (45hrs/wk).

10 desktops/monitors * 106 watts per desktop/monitor = 1,060 watts

1,060 watts * 1 hours = 1,060 watt hours ÷ 1000 = 1.06 kWh total used

Before Power Management Software:

1.06 kWh (for 10 desktops/monitors) * 8,760 hrs/yr = 9,286 kWh/yr

After installing Power Management Software:

1.06 kWh (for 10 desktops/monitors) * 2,340 hrs/yr = 2,480 kWh/yr

Annual Energy Savings: 9,286 kWh/yr – 2,480 kWh/yr = **6,806 kWh/yr**

Annual Cost Savings 6,806 kWh * $0.14/kWh = **$952.84**

Vending Miser Scenario: Assume a 20,000 sq. ft. building has two cold beverage vending machines. Annual energy consumption for one cold vending machine is about 3,318 kWh[154]. Assume that without a vending miser, these vending machines operate constantly throughout the year. Installing Vender Miser cuts energy consumption by 46% on average[155].

Before Vending Miser:

Annual energy consumption = 2 vending machines * 3,318kWh = 6,636 kWh/yr

After installing Vending Miser:

If energy consumption is reduced by 46%, then

0.54* 6,636 kWh = **3,583 kWh/yr**

Annual Energy Savings: 6,636 kWh/yr – 3,583 kWh/yr = **3,053 kWh/yr**

Annual Cost Savings: 3,053 kWh * $0.14/kWh = **$427.42**

Local Fiscal Impacts

	Power Management Software	**Vending Misers**
Lifetime of Measure	As long as the software remains installed and used	5 years (warranty)[156]
Annual Electric Savings (kWh)	**680.6 kWh**[157] (per standard desktop/LCD monitor combination) *Note*: savings will vary depending on type of computer/monitor combinations	**1,527 kWh**[158] (per cold beverage vending machine)
Tax Credits & Incentives ($)		*See* NJ Buildings Smart Start Program *at* NJ Clean Energy *for Technical Assistance and offsetting costs*[159]
Yearly	*Possibly Part-time (hourly*	N/A

Administrative Costs ($)	*IT Staff*	
Capital Costs to Municipality ($)	Free through Energy Star[160] and the EPA or through commercial software packages at minimal or no cost.	- $165 for device[161] + labor costs (varies) - average installed price: $265[162]
Average Payback	Immediate (using Open Source software), savings of **$952.84**	**1.2 years**[163]

Social and Environmental Impacts

	Annual		Lifetime	
	Government		Government	Community
GHG reduction	a) Vending Miser: 2300 lbs/year[164] b) Computer Power Management: 6,978 CO2/20,000 sq. ft. building (697.76 CO2/unit)			
kWh/Therms/gallons reduced				
Criteria Air Pollutants				
Other				

Economic Impacts

	Per Unit	Annual	Lifetime
Temporary Jobs	An electrician to install the vending misers.		
Permanent Jobs	IT Staff (if necessary, to install/manage power management software)		
Economic Impact			

Other			

How to Do it

Power Management Software

1. Conduct a building-wide computer and monitor energy audit.
2. Notify IT Staff about power management strategies such as power management software, aggressive power-management settings, using smart plug power strips, etc.
3. Determine which power management software is best suited for the building and coordinate with the IT Staff to implement the ECM.
4. Inform and educate staff about what *power management* is and how ECM aims to achieve lower energy costs and decreasing a building's overall carbon footprint. This will help change user behavior with respect to computer/monitor use.

Costs associated with implementation are few. *Costs* may include[165]:

a) **IT staff time** Care must be taken to ensure that sleeping computers do not interfere with the distribution of administrative software updates**.** Older software applications and peripheral devices should be tested for "sleep" compatibility. Even for the largest companies, these precautions rarely take more than a few days of work — and EPA can save you time**.**
b) **Software solutions** There are lots of ways to activate sleep settings across entire networks of computers, and many are open source**.** Commercial software packages provide additional flexibility and features, and the energy savings they deliver outweigh their cost.

Power Management Software suggestions on ENERGY STAR:

http://www.energystar.gov/index.cfm?c=power_mgt.pr_power_mgt_ez_gpo
http://verdiem.com/edison.aspx

Steps to help with implementing Power Management:
http://www.energystar.gov/ia/products/power_mgt/StateCaseStudiesDRvfinalv4.pdf

<u>Vending Misers</u>

1. Conduct a building-wide energy audit of all the vending machines (i.e. How many cold vending machines? How often are they used? Can they be efficiently powered off overnight?)
2. Identify vending machines that would benefit from a vending miser.
3. Determine which vending miser is best suited for your vending machines and arrange for the vending miser to be installed (an electrician will need to be hired) on the identified vending machines.

Resources

Action Plan Template for building plug loads (*for schools; modify as applicable*)
http://apps1.eere.energy.gov/buildings/publications/pdfs/energysmartschools/ess_plug-loads-template.pdf

General Information on Plug Load savings
http://www.efficientproducts.org/reports/plugload/Plug-Load-Summary-4-pager_FINAL_Rev_20Jul2009.pdf

Power Management Software Resources

Techniques

http://www.energystar.gov/index.cfm?c=power_mgt.pr_power_management
http://www.energystar.gov/ia/products/power_mgt/StateCaseStudiesDRvfinalv4.pdf

Information

http://www.energystar.gov/index.cfm?c=power_mgt.pr_power_mgt_implementation_res#tech_assistance
http://www.1e.com/softwareproducts/1EWakeUp/index.aspx

Software Calculators
http://www.energystar.gov/ia/products/power_mgt/LowCarbonITSavingsCalc_v26_with_5_0v2.xls
http://www.computerpowersaver.com/calculator.asp#results
http://www.p2pays.org/energy/Monitor.pdf

Vending Misers Resources
Information
http://www.conservationsolutions.com/pdfs/vm_datasheet.pdf

Fact Sheet
http://p2pays.org/energy/Vending.pdf

Calculator
http://www.usatech.com/energy_management/energy_calculator.php

Case Studies
Power Management
http://www.cityofpaloalto.org/civica/filebank/blobdload.asp?BlobID=15887
Vending Miser
Hopewell Township Recreation- New Jersey
http://www.njcleanenergy.com/files/file/LGEA%20PDFs/Hopewell%20Township%20-%20Muni%20Athletic%20Complex%20and%20Snack%20Bar%20Energy%20Audit%20Final%20Report.pdf
http://sustainability.tufts.edu/downloads/VendingMiserHandout.pdf
http://greenstarinc.org/downloads/UAAVendingMiser.pdf
http://www.efficientproducts.org/reports/plugload/Plug-Load-Summary-4-pager_FINAL_Rev_20Jul2009.pdf

11. Install Dual-Technology Occupancy Sensors

Introduction

Lighting accounts for about 21% of a building's electricity use[166] 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%. Electric lighting is only necessary when people are present in the building and daylight is inadequate or absent. Reducing lighting electricity usage reduces energy cost and lessens the negative environmental impacts associated with electricity generation.[167]

Both the presence of people and daylight can be detected through the use of sensors. 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.

A common occupancy sensor system consists of the actual motion sensors, an electronic control unit, and a controllable switch/relay. Once installed, it will serve three basic functions[168]:

1. automatically turn lights on when a room becomes occupied,
2. keep the lights on without interruption while the controlled space is occupied, and
3. turn the lights off within a preset time period after the space has been vacated.

ECM - Dual Technology Occupancy Sensors

	Municipal Government	Community Wide
Initial Municipal Costs ($)	$ 3,335	
Rebate/Subsidy ($)	$ 460	
Net Capital Cost ($)	$ 2,875	
Lifetime Municipal Costs ($)	$ 3,335	
Lifetime of Measure (Years)	15	
CO2 Reductions (Tons)	183	183
NOx Reductions (Lbs)	596	596
SO2 Reductions (Lbs)	2,104	2,104
Electricity Savings (MWh)	300	300
Electricity Savings ($)	$ 30,756	$ 30,756
Natural Gas Savings (MMBtu)	0	-
Natural Gas Savings ($)	$ -	$ -

Costs/Impacts

All estimates based on the following per unit costs:

$0.14/kWh, $10.66/MMBtu, $1.07/therm

<u>Scenario:</u> A 20,000 SF municipal building operates for 10 hours a day, 5 days a week, 52 weeks per year. Consider the following room types in which a total of 400 2-lamp T-8 32 watt lighting fixtures are used: 1 open office, 12 private offices, 2 bathrooms, 1 cafeteria, 1 auditorium/multi-purpose and 2 conference rooms[169]. If 23[170] occupancy sensors are installed, approximately 30%[171] (approximately 15 hours per week) of electric lighting usage can be reduced.

Note: We assume lighting upgrades have been fulfilled; therefore this scenario uses T-8 lighting fixtures.

Annual Electric Savings = 19,968 kWh/yr[172]

Annual Cost Savings = $2,795.52[173]

Local Fiscal Impacts

	Dual-Technology Occupancy Sensors
Lifetime of Measure (Years)	a) 12 to 15 years[174] for occupancy sensors b) 6 to 10 years for control switches[6]

Annual Electric Savings (kWh)	49.9 kWh/T-8 lighting fixture through use of occupancy sensors[175]
Annual Peak Load Reductions (kW)	
Tax Credits and Incentives ($)	a) $20 per control (Wall Mounted) b) $35 per ballast (Remote Mounted) [176]
Capital Costs to Municipality ($)	$145/unit (with $20/unit incentive)[177]
Average Payback	1.2 years (1 year and 3 months)[178]

A basic rule of thumb is that for every 10kWh saved, 7.3lbs of GHG emissions are reduced.[179]

Social and Environmental Impacts

	Annual		**Lifetime**	
	Government	Community-wide	Governmen t	Community-wide
GHG reduction	23,341 lbs CO_2/20,000 sq. ft. building (61 lbs of CO_2/unit)			
kWh/Therms/gallon s reduced	49.4 kWh/T-8 fixture through the use of occupancy sensors			

How to Do it

1. Conduct a lighting audit (Which rooms/spaces are occupied the most? the least? Which rooms do people tend to leave lights on? Which rooms are occupied during specific times of day?)
2. Survey potential areas for occupancy sensors to be located.

3. The best areas are spaces that are not frequently used, have irregular use patterns or areas where lights are inadvertently left on.
   Commissioning and calibration of lighting controls are essential. See "Section B: Selecting the Appropriate Lighting Controls" from the "Electric Lighting Controls" article on WBDG, written by David Nelson, AIA in 2009.
4. Conduct a cost analysis of the retrofit action.
   Areas that already have incandescent lighting will yield more significant reductions and a faster payback.
5. Implement retrofit activities.

More technical information about occupancy sensors can be found at: http://www.wbdg.org/ccb/GREEN/STDS/gc12.pdf

"Selecting the Appropriate Lighting Controls" (chart, section B) is helpful in determining which type of lighting controls are best suited for specific types of spaces: http://www.wbdg.org/resources/electriclighting.php

Additional information on choosing an appropriate system:

http://www.anaheim.net/utilities/ea/PA_10.html#manufacturers

Incentives

New Jersey Office of Clean Energy Incentives: http://www.njcleanenergy.com/misc/commercial-industrial/lighting-control

Follow the directions under "Lighting Controls Requirements" to learn how to become eligible for occupancy sensor incentives.
Fill out the "2009 Lighting Controls Application" http://www.njcleanenergy.com/files/file/NJSSB%202009%20Applications/013%20Lighting%20Controls%20-%20002-02-09.pdf
Fill out the "2009 Lighting Controls Incentive Worksheet" http://www.njcleanenergy.com/files/file/NJSSB%202009%20Applications/014%20Lighting%20Controls%20Worksheet%20-%20001-01-09.pdf

Resources

Manufacturers/Suppliers of Occupancy Sensors

Manufacturer/Supplier	
The Watt Stopper http://www.wattstopper.com/	Manufactures a complete line of energy efficient and intelligent lighting, HVAC, and office power control products.

Sensor Switch, Inc. http://www.sensorswitch.com/	Manufactures passive infrared occupancy sensors, daylight control devices, and most recently, passive dual technology sensors.
Novitas, Inc. http://greengate.coopercontrol.com/common/brands.cfm?pg=Detail&brandName=Greengate&category=Occupancy%20Sensors%3A%20Ceiling%20Sensors%3A%20Dual%20Tech&id=15171	In 1977, Novitas invented and produced the first sensor for lighting control. Its Greengate product line specializes in lighting energy management using occupancy sensors, lighting control panels and daylighting controls.
Lutron Electronics Company http://www.lutron.com/products/commercial/	Produced the world's first solid-state electronic device used to dim lights in a home. Offers occupancy sensors and other lighting control systems for commercial buildings.

Case Studies

Broughton Hall Classrooms at North Carolina State University
http://www.energync.net/programs/docs/usi/om/hvac/finalreportdocs/NCSU%20Broughton%20Hall%20Occupancy%20Sensors.doc

J.N. Desmarias Library at Laurentian University (pg.2)
http://www.rowan.edu/colleges/engineering/clinics/cleanenergy/Rowan%20University%20Clean%20Energy%20Program/Energy%20Efficiency%20Audits/Energy%20Technology%20Case%20Studies/files/Lighting%20Occupancy%20Controls.pdf

Way Station Club House, Frederick MD (30,000 SF facility incorporating occupancy sensors)
http://www.aboutlightingcontrols.org/projects/waystation.shtml

12. Install Lighting Upgrades

Introduction

Lighting accounts for more than 30% of the total electrical energy consumed in commercial buildings.[180] 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.

The following ECM strategy illustrates typical cost and energy savings for replacing existing fixtures containing T-12 lamps and magnetic ballasts with fixtures containing T-8 lamps and electronic ballasts.

ECM - Lighting Upgrades

	Municipal Government	Community-Wide
Initial Municipal Costs ($)	$ 406	
Rebate/Subsidy ($)	$ 9,150	
Net Capital Cost ($)	$ (8,744)	
Lifetime Municipal Costs ($)	$ 406	
Lifetime of Measure (Years)	15	
CO2 Reductions (Tons)	242	242
NOx Reductions (Lbs)	789	789
SO2 Reductions (Lbs)	2,787	2,787
Electricity Savings (MWh)	397	397
Electricity Savings ($)	$ 40,744	$ 40,744
Natural Gas Savings (MMBtu)	0	-
Natural Gas Savings ($)	$ -	$ -

Costs/Impacts

Scenario: The data is based on lighting upgrades to a 20,000 square foot municipal building. The lighting upgrade includes the switch of 400 T-12 fixtures (2-lamp 40 watt) with magnetic ballasts to 400 T-8 fixtures (2-lamp 32 watt) with electronic ballasts.

Total annual electric savings: 28,908 kWh/yr[181]

Total annual cost savings: $4,047.12[182]

The chart below shows per unit energy and cost savings for the following scenarios:

1) Replacing a 2-lamp T-12 40 watt fixture with magnetic ballasts with a 2-lamp T-8 32 watt fixture
2) Replacing a 2-lamp T-12 40 watt fixture with magnetic ballasts with a 2-lamp T-5 28 watts fixture with electronic ballasts
3) Replacing a 100 watt Incandescent with a 26 watt cfl lamp.

Local Fiscal Impacts

	T-8 dimming electronic ballast lamp	**T-5 lamps**	**26 watt Integral CFL lamp**
Lifetime of Measure (Years)	15 years (30,000 burn hours)[183]	15 years (30,000 burn hours)[184]	5 years (8,000 hours)
Annual Electric Savings (kWh)	72.27 kWh/unit/yr[185]	101.47 kWh/unit/yr[186]	270.1 kWh/unit/yr[187]
Incentives ($)	($25 per 1-2 lamp fixture; $30 per 3-4 lamp fixture)	($25 per 1-2 lamp fixture; $30 per 3-4 lamp fixture)	
Annual Cost Savings ($)	$2.77 saved per unit[188]	$3.89 saved per unit[189]	$10.36 saved per unit[190]
Yearly Administrative Costs ($)			
Capital Costs to Municipality ($)			
Yearly Costs to Municipality ($)			
Capital Incremental Costs ($)	$23.89 ($48.89[191] - $25 incentive)	$63.66 ($88.66[192] -$25 incentive)	$20.00[193]

Yearly Incremental Costs ($)			
Payback	2.4 years[194]	4.5 years[195]	0.5 years[196]

How to Do It

1. Conduct a lighting audit.
2. Identify retrofit actions.
3. Implement retrofit activities.

New fluorescent lamps and ballasts are available as direct replacements for existing lamps and ballasts.

a) *Replace a 2-lamp T-12 40 watt fixture with magnetic ballasts with a 2-lamp T-8 32 watt fixture*
b) *Replace a 2-lamp T-12 40 watt fixture with magnetic ballasts with a 2-lamp T-5 28 watts fixture with electronic ballasts*
c) *Replace a 100 watt Incandescent with a 26 watt cfl lamp.*

4. Establish a routine lighting maintenance program.

Resources

Links to programs, incentives, and examples/models (optional)

Energy Efficient Lighting, Whole Building Design Guide

http://www.wbdg.org/resources/efficientlighting.php?r=minimize_consumption

EPA, Tools and Resources of Lighting Retrofit Projects
http://www.epa.gov/eebuildings/lighting/detail/index.html

New Jersey Smart Start Buildings – Equipment Incentives

http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/tools-and-resources/equipment-incentives/equi

13. Install LED Exit Lights

Introduction

Exit signs are an important feature to every building. They mark the nearest safe exit out of a building during an emergency, and are always in operation Since facilities are required to have exit signs/lights lit at all times, they are constantly using electricity. This energy conservation measure (ECM) is important to implement not only because it is an important safety feature, but also because light emitting diode (LED) exit lights are brighter, more reliable, and have significant energy and environmental savings over their conventional counterparts.

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.

ECM - LED Exit Signs

	Municipal Government	Community Wide
Initial Municipal Costs ($)	$ 160	
Rebate/Subsidy ($)	$ 150	
Net Capital Cost ($)	$ 10	
Lifetime Municipal Costs ($)	$ 160	
Lifetime of Measure (Years)	18	
CO2 Reductions (Tons)	34	34
NOx Reductions (Lbs)	110	110
SO2 Reductions (Lbs)	388	388
Electricity Savings (MWh)	55	55
Electricity Savings ($)	$ 5,420	$ 5,420
Natural Gas Savings (MMBtu)	0	-
Natural Gas Savings ($)	$ -	$ -

Costs/Impacts

Scenario: A 20,000 sq. ft. building has 10 incandescent-lighted exit signs. If 10 incandescent exit signs were replaced with 10 LED exit signs, the estimated savings is as follows:

- Incandescent (2 bulb) Sign = 40 Watts[197]
- LED (2 bulb) Sign = 5 Watts
- Electricity Rate = $0.14 kWh[198]

Incandescent vs. LED Operational Costs

Incandescent											
1a) # of Signs	x	2a) Watts per Sign	x	3a) Hours per Year	/	Conversion to kWh	x	4a) Rate per kWh	=	5a) Annual Operation Cost
10	x	40 Watts (2 bulb)	x	8760	/	1000	x	$0.14	=	$490.56
LED										
1b) # of Signs	x	2b) Watts per Sign	x	3b) Hours per Year	/	Conversion to kWh	x	4b) Rate per kWh	=	5b) Annual Operation Cost
10	x	5 Watts (2 bulb)	x	8760	/	1000	x	$0.14	=	$61.32
Estimated Savings From Conversion										
Cost of 5a	-	Cost of 5b	=	Annual Savings						
$490.56	-	$61.32	=	$429.24						

Annual Energy Savings **= 3,066 kWh**[199]

Annual Cost Savings **= $429.24**[200]

Local Fiscal Impacts

	LED Exit Lights
Lifetime of Measure (Years)	10 to 25 years (87,600 to 219,000 burn hours)[1]
Annual Electric Savings (MWh)	1 Incandescent Exit Sign (2 bulb) to 1 LED Exit Sign (2 bulb): 306.6 kWh or **0.307 MWh**[201] 1 Fluorescent Exit Sign (2 bulb) to 1 LED Exit Sign (2 bulb): 78.8 kWh or **0.079 MWh**[202]
Annual Peak	3,066 kWh

Load Reductions (kWh)	
Incentives ($)	$10/$20 per fixture[203]
Capital Costs to Municipality ($)	$1,220[204] ($73 material + $49 labor= $122 per fixture)[205]
Capital Incremental Costs ($)	$ 31(Incandescent to LED)[206] $ 8 (Fluorescent to LED)[207]
Average Payback	0.72 years and 0.73 years[208]

A basic rule of thumb is that for every 10kWh saved, 7.3lbs of GHG emissions are reduced.[209]

Social and Environmental Impacts

	Annual		Lifetime	
	Government	Community-wide	Government	Community-wide
GHG reduction	a) 374 lbs/CO2/unit (Incandescent to LED) b) 96 lbs/CO2/unit(Fluorescent to LED)			
kWh/Therms/gallons reduced	a) 306.6 kWh/unit (Incandescent to LED) b) 78.8 kWh/unit (Fluorescent to LED)			
Criteria Air Pollutants 1.54 lbs CO_2/kWh[210]	a) Incandescent to LED -3,738 lbs CO_2/20,000 sq. ft. building (374 lbs CO_2/unit) - b) 961 lbs		a) Incandescent to LED – 9,350 lbs CO_2 per unit saved over a	

	CO_2/20,000 sq. ft. building (96 lbs CO_2/unit) 472 lbs CO_2 per unit saved - (Fluorescent to LED)		25 year lifetime b) Fluorescent to LED- 2,400 lbs CO_2 per unit saved over a 25 year lifetime	
Other				

How to Do it

1. Conduct an audit of the current exit signs' electricity usage.
2. Identify retrofit actions.
3. Implement retrofit activities.

Retrofit kits may be available to upgrade from conventional exit sign lights to LED exit sign lights. This may be a better option than replacing the exit sign altogether. However, in order to receive price incentives on LED Exit Signs, new fixtures must be purchased.

Resources

The New Jersey Office of Clean Energy (NJ OCE) offers equipment incentives for LED Exit Signs. Incentives are either $10 or $20 for LED Exit Signs. Refer to the websites below for information on how to receive the price incentive
http://njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/tools-and-resources/equipment-incentives/equi

2009 Prescriptive Lighting Application
http://www.njcleanenergy.com/files/file/NJSSB%202009%20Applications/010%20Prescriptive%20Lighting%20Application%20-%20004-09-09.pdf

2009 Prescriptive Lighting Incentive Worksheet
http://www.njcleanenergy.com/files/file/NJSSB%202009%20Applications/011%20Prescriptive%20Lighting%20Worksheet%20-%20003-09-09.pdf

The Energy Star Calculator for Exit Signs is a good place to estimate potential cost and electricity savings

www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/Calc_Exit_Signs.xls

Energy Star. LED Tech sheet http://www.energystar.gov/ia/business/small_business/led_exitsigns_techsheet.pdf

14. Institute Time of Day Operations: Day Cleaning

Introduction

Day cleaning is an alternative to traditional nighttime janitorial services that have been common among office properties for the past century[211]. 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).[212] 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.[213] 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.

ECM - Day Cleaning

	Municipal Government	Community Wide
Initial Municipal Costs ($)	$ -	
Rebate/Subsidy ($)	$ -	
Net Capital Cost ($)	$ -	
Lifetime Municipal Costs ($)	$ -	
Lifetime of Measure (Years)	30	
CO2 Reductions (Tons)	172	172
NOx Reductions (Lbs)	560	560
SO2 Reductions (Lbs)	1,978	1,978
Electricity Savings (MWh)	384	384
Electricity Savings ($)	$ 26,020	$ 26,020
Natural Gas Savings (MMBtu)	0	-
Natural Gas Savings ($)	$ -	$ -

Costs/Impacts

All estimates based on the following per unit costs:

$0.14/kWh, $10.66/MMBtu, $1.07/therm

<u>Scenario:</u> A 20,000 sq. ft. building with T-8 lighting fixtures[214] operates 55 hours per 5-day work week when Day Cleaning is not in effect; when Day

Cleaning is in effect, the building saves 2 hours per operating day (5 service days * 2 hours saved per day = 10 hours saved per week, reducing hours of operation to 45 per 5-day work week). Savings from switching to Day Cleaning are based on the reduction in a building's operating hours from 55 to 45 hours per week and the associated reductions in lighting (kWh).

Note: This scenario assumes that ECM 2: Lighting Upgrades (Switching from T-12 to T-8) has already been implemented.

Annual Cost Savings:

Local Fiscal Impacts

	85 Hour Work Week (Day Cleaning not in effect) [215]	**65 Hour Work Week (Day Cleaning in effect)** [216]
Lifetime of Measure (Years)	As long as Day cleaning is not in effect	As long as Day Cleaning stays in effect
Annual Electric Savings (kWh)		32 kWh/T-8 lamp fixture; 12,800 kWh/building/yr[217]
Annual Peak Load Reductions (kWh)		
Annual Cost Savings ($)		$1792/building/yr[218]
Capital Administrative Costs ($)		
Capital Incremental Costs ($)		
Yearly Incremental Costs ($)		
Payback		Immediate savings of $1,792 annually

Social and Environmental Impacts

	Annual	**Lifetime**

	Government	Community-wide	Government	Community-wide
GHG reduction	15,603 lbs/CO2			
kWh/Therms/ gallons reduced	12,800 kWh/building/yr[219]			
Criteria Air Pollutants				
Other				

Economic Impacts

	Per Unit	Annual	Lifetime
Temporary Jobs			
Permanent Jobs			
Economic Impact			
Other	Janitorial employees will need to be notified of changing work schedules.		

How to Do it

There are many different operational measures that one can take in order to implement day cleaning strategies: [220]

1. After getting management approval and occupant support, the next step is to develop a scope of work for the Day Cleaning program.

2. Communicating the benefits of day cleaning to the janitorial staff and tenants/office workers (e.g., energy and cost savings) will help build support for the change.

3. It is important to keep upper management involved in this step to support the process and to achieve successful implementation.

- Use a computer work loading program to help determine the scope of work, including labor hour requirements and job descriptions for employees.

- Develop a communications plan to inform and educate all occupants of the building on the Day Cleaning program, beginning about eight weeks prior to full implementation, increasing the frequency of communication with occupants as the transition date approaches.
- Select the appropriate chemical systems, cleaning equipment, and train the staff on best practices for Day Cleaning.
- Plan everything thoroughly and stick to the plan.

One final tip: When transitioning from cleaning at night to Day Cleaning, it often works best to stop night cleaning on a Friday night and begin Day Cleaning on the following Monday. This allows you to use the weekend for orientation and proper closet preparation.

Resources

Day Cleaning: Reaping The Benefits
http://www.cleanlink.com/hs/article/Day-Cleaning-Reaping-The-Benefits--8585

Day Cleaning Energy Saving Calculator
http://www.cleanforhealth.com/daycleaning.htm

15. Encourage energy efficiency in new single-family homes

Introduction

A municipality 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. [221] Reducing permitting fees for new residential construction projects that achieve LEED[222] for Homes (Silver) certification or ICC-700-2008 National Green Building Standard[223] (Silver) certification with a certified HERS rating of 65 encourages a higher level of performance in new housing stock. A building with a HERS[224] 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).[225]

Note: Energy Star certification is required by LEED and the New Jersey Energy Star Home program standard would satisfy the energy efficiency component of this guidance for new residential buildings.

EE in New Residential Buildings

	Municipal Government	Community-Wide
Initial Municipal Costs ($)	$ (23,667)	
Rebate/Subsidy ($)	$ 25,245	
Net Capital Cost ($)	$ (48,912)	
Lifetime Municipal Costs ($)	$ (23,667)	
Lifetime of Measure (Years)	25	
CO2 Reductions (Tons)		1,208
NOx Reductions (Lbs)		3,675
SO2 Reductions (Lbs)		12,103
Electricity Savings (MWh)		1,958
Electricity Savings ($)		$ 179,259
Natural Gas Savings (MMBtu)		3,058
Natural Gas Savings ($)		$ 23,182

Costs/Impacts

Many building strategies such as using standard dimensioned materials, planning for open office layouts, and design choices should be made early in the design process to minimize cost premiums associated with green building.

The average premium for LEED silver certification is approximately 2%.[226] With typical construction costs currently averaging around $150 per square foot, cost premiums to achieve LEED silver certification are approximately $3 per square foot.

For new residential construction permits submitted by a homeowner, the benefits of reduced permit fees will offset a portion of the cost associated with incorporating sustainable design. Developers should be motivated to invest in this relatively small cost premium to build more energy efficient homes as mounting evidence suggest that green and energy efficient features may lead to higher resale value in the real estate market.

With current market conditions, prospective home buyers are staying in one home for a longer period of time. By remaining in one home for a longer period of time, homeowners will be more likely benefit from a payback on their investment in a more energy efficient home.

Scenario (building scale):

The average square footage of a single family home constructed in 2008 has risen to approximately 2,750 square foot.[227] At $150 per square foot, a typical 2,750 sq. ft. home will cost approximately $412,500 in construction costs for typical construction. A 2% increase in construction cost to implement green building components would add a premium of $8,250 to total construction costs.

The savings incentive for a 2,750 sq. ft. home will vary by municipality depending on each municipality's permit fee multiplier. In estimating permit fee savings, a .0075 permit fee multiplier will be assumed.[228] This would equate to a $3,155.63 permit fee. If the municipality were to reduce the permit fee in half for green buildings, developers would realize a savings of $1,577.81

The remainder of savings will be realized through increased energy efficiency. Energy expenses average $ 0.14/kWh for electricity and $1.07/therm for natural gas.[229] With an assumed electric savings of 1.78 kWh/sf per year[230] and an assumed gas savings of 2.78 kBtu/sf [231] per year, this 2,750 sq. ft. home would save 4,895 kWh and 7,645 kBtu per year or 76.4 therms[232]. This equates to a $685.30 savings in electricity expenses and a $81.75 savings in natural gas expenses.

Assuming a permit fee reduction of $1,577.81 and annual energy cost savings of $767.05, the simple payback for an additional $8,250 in construction costs is 8.70 years.

Scenario (municipality–wide):

Based on participations rates of similar green building incentive programs nationwide, assume a 5% annual increase in the percentage new residential projects that will take advantage of reduced permit fees for green buildings. By the time this ordinance is in place for four years, a 20% level of participation is anticipated.

East Orange

The city of East Orange adds on average, 41 units per year. [233] On this forth year, it is anticipated that 8 of the 41 units will take advantage of reduced permit fees. This will equate to a $12,374 reduction in permit revenue for this municipality.[234]

With a per home savings of 4,895 kWh and 7,645 kBtu per year, these 8 new homes will save 39,160 kWh and 61,160 kBtu per year.

Edison

Edison Twp. adds on average, 184 units per year. [235] On this forth year, it is anticipated that 37 of the 184 units will take advantage of reduced permit fees. This will equate to a $57,230 reduction in permit revenue for this municipality. [236]

With a per home savings of 4,895 kWh and 7,645 kBtu per year, these 37 new homes will save 181,115 kWh and 282,865 kBtu per year.

Fort Lee

The city of Fort Lee adds on average, 91 units per year. [237] On this forth year, it is anticipated that 18 of the 91 units will take advantage of reduced permit fees. This will equate to a $27,842 reduction in permit revenue for this municipality. [238]

With a per home savings of 4,895 kWh and 7,645 kBtu per year, these 18 new homes will save 88,110 kWh and 137,610 kBtu per year.

Howell Twp.

Howell Twp. adds on average, 141 units per year. [239] On this forth year, it is anticipated that 28 of the 141 units will take advantage of reduced permit fees. This will equate to a $43,309 reduction in permit revenue for this municipality.[240]

With a per home savings of 4,895 kWh and 7,645 kBtu per year, these 28 new homes will save 137,060 kWh and 214,060 kBtu per year.

Middletown

Middletown Twp. adds on average, 82 units per year.[241] On this forth year, it is anticipated that 16 of the 82 units will take advantage of reduced permit fees. This will equate to a $24,748 reduction in permit revenue for this municipality.[242]

With a per home savings of 4,895 kWh and 7,645 kBtu per year, these 16 new homes will save 78,320 kWh and 122,320 kBtu per year.

Montclair

Montclair Twp. adds on average, 25 units per year.[243] On this forth year, it is anticipated that 5 of the 25 units will take advantage of reduced permit fees. This will equate to a $7,734 reduction in permit revenue for this municipality.[244]

With a per home savings of 4,895 kWh and 7,645 kBtu per year, these 5 new homes will save 24,475 kWh and 38,225 kBtu per year.

Parsippany – Troy Hills

Parsippany-Troy Hills Twp. adds on average, 65 units per year.[245] On this forth year, it is anticipated that 13 of the 65 units will take advantage of reduced permit fees. This will equate to a $20,108 reduction in permit revenue for this municipality.[246]

With a per home savings of 4,895 kWh and 7,645 kBtu per year, these 13 new homes will save 63,635 kWh and 99,385 kBtu per year.

Perth Amboy

The city of Perth Amboy adds on average, 48 units per year.[247] On this forth year, it is anticipated that 10 of the 48 units will take advantage of reduced permit fees. This will equate to a $15,477 reduction in permit revenue for this municipality.[248]

With a per home savings of 4,895 kWh and 7,645 kBtu per year, these 10 new homes will save 48,950 kWh and 76,450 kBtu per year.

Plainfield

The city of Plainfield adds on average, 27 units per year. [249] On this forth year, it is anticipated that 6 of the 27 units will take advantage of reduced permit fees. This will equate to a $9,281 reduction in permit revenue for this municipality. [250]

With a per home savings of 4,895 kWh and 7,645 kBtu per year, these 6 new homes will save 29,370 kWh and 45,870 kBtu per year.

West Orange

The city of West Orange adds on average, 67 units per year. [251] On this forth year, it is anticipated that 13 of the 67 units will take advantage of reduced permit fees. This will equate to a $20,108 reduction in permit revenue for this municipality. [252]

With a per home savings of 4,895 kWh and 7,645 kBtu per year, these 13 new homes will save 63,635 kWh and 99,385 kBtu per year.

Willingboro Twp.

Willingboro Twp. adds on average, 47 units per year. [253] On this forth year, it is anticipated that 9 of the 47 units will take advantage of reduced permit fees. This will equate to a $13,921 reduction in permit revenue for this municipality. [254]

With a per home savings of 4,895 kWh and 7,645 kBtu per year, these 9 new homes will save 44,055 kWh and 68,805 kBtu per year.

Local Fiscal Impacts

	Value
Lifetime of Measure (Years)	Major Building Components: 20[255] Policy: 5[256]
Annual Electric Savings (MWh)	1.78 kWh/sf/yr [257]
Annual Natural Gas Savings	2.78 kBtu/sf/yr [258]
Annual Peak Load Reductions (kW)	
Gallons Reduced	
VMT Reduced	
Custom Conversion (If gallons water --> electricity, etc..)	
Tax Credits ($)	

Incentives ($)	
Capital Administrative Costs ($)	
Yearly Administrative Costs ($)	
Capital Costs to Municipality ($)	
Yearly Costs to Municipality ($)	
Capital Incremental Costs ($)	2% increase in construction costs[259]
Yearly Incremental Costs ($)	

How to Do it

In order to meet this measure the municipality must 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. [260]

In adopting this green building policy, the municipality must consider the following;[261]

1. Involve representatives from existing volunteer boards, such as the Planning and Zoning Boards, environmental commission, and redevelopment and housing agencies, as well as municipal staff, especially the Zoning Official, Construction Code Official, and planner should be involved with this action.

2. Set a Timeframe: Timeframes to implement the components will vary; however they can be pursued at the same time. Adopting a green building policy will take between one and three months.

3. Take into account the Project Costs and Resource Needs: Developing a green building policy will require municipal staff time; however costs should be minimal and likely will be related to legal professional fees.

4. Execute: Municipalities should adopt a resolution that sets forth their intention to encourage or require green design for commercial and residential buildings. Note that a New Jersey municipality presently cannot require compliance with a green building standard that exceeds the State's Uniform Construction Code, nor require green building certification such as Leadership in Energy and Environmental Design (LEED) or Energy Star.

a. What is allowable is for a municipality to encourage adherence to a green building standard or guideline or to encourage green building generally. It is also permissible to require specific green design strategies or measures that do not fall under the State's jurisdiction regarding building codes or state or federal jurisdiction over appliance standards. These typically impact site design rather than the building itself.
b. This policy should encourage municipalities to think through how green building can best be promoted given the environmental, political, social priorities, and existing conditions of that municipality and develop strategies that work for them.
c. The simplest thing for a municipality to do to satisfy this component is to adopt a green building resolution. This resolution should assert the municipality's intent to increase green building in the public sector through a combination of voluntary actions, required actions, and educational actions.
d. In order to compensate for revenue lost through reduced permit fees, the municipality should develop two construction fee formulas; one for conventional building, and a second formula for green building. In determining both formulas, the municipality must project an anticipated level of participation in the reduced permit fee incentive. Revenue lost from reduce permit fees can be recovered by raising permit fees for conventional building.

Resources:

ANSI/NAHB/ICC. 2008. National Green Building Standard™ ICC-700 http://www.nahbgreen.org/Guidelines/ansistandard.aspx

Database of State Incentives for Renewables and Efficiency (DSIRE) - A comprehensive source funding resources on state, local, utility, and federal incentives can be found at www.dsireusa.org/

New Jersey Clean Energy Program www.njcleanenergy.com/

U.S. EPA Green Homeswww.epa.gov/greenhomes/

U.S. Green Building Council. 2009. Green Home Guide Websitewww.greenhomeguide.com/

U.S. Green Building Council – LEED
www.usgbc.org/DisplayPage.aspx?CMSPageID=147

Sustainable Jersey www.sustainablejersey.com

16. Encourage energy efficiency in new municipal buildings

A municipality 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

Introduction

Presently, energy use from commercial and industrial buildings cost over $200 billion per year. Nearly half of U.S. greenhouse gas emissions are produced by commercial and industrial buildings, directly contributing to global warming.

Through achieving this higher level of performance, the municipality is demonstrating commitment to reducing the amount of greenhouse gas emissions produced by its new and existing municipal buildings. All 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.

Energy Efficiency in New Municipal Buildings

	Municipal Government	Community-Wide
Initial Municipal Costs ($)	$ 60,000	
Rebate/Subsidy ($)	$ -	
Net Capital Cost ($)	$ 60,000	
Lifetime Municipal Costs ($)	$ 60,000	
Lifetime of Measure (Years)	30	
CO2 Reductions (Tons)	660	660
NOx Reductions (Lbs)	2,113	2,113
SO2 Reductions (Lbs)	7,325	7,325
Electricity Savings (MWh)	1,422	1,422
Electricity Savings ($)	$ 96,355	$ 96,355
Natural Gas Savings (MMBtu)	570	570
Natural Gas Savings ($)	$ 2,938	$ 2,938

Costs/Impacts

Many building strategies such as using standard dimensioned materials, planning for open office layouts, and design choices should be made early in the design process to minimize cost premiums associated with green building.

The average premium for LEED silver certification is approximately 2%.[262] With typical construction costs currently averaging around $150 per square foot, cost premiums to achieve LEED silver certification are approximately $3 per square foot.

Scenario (building scale):

At $150 per square foot, construction of a new 20,000 sq. ft. municipal building will cost approximately $3,000,000 for typical construction. A 2% increase in construction cost to implement green building components would add premium of $60,000 to total construction costs.

The municipality will begin to reclaim costs associated with implementing green building measures through increased energy efficiency. With an assumed electric savings of 2.37 kWh/sf per year[263] and an assumed gas savings of .95 kBtu/sf per year[264], this building would save 47,400 kWh and 19,000 kBtu, or 189.87 therms per year[265].

Assuming a typical energy cost of $.14/kWh and $1.07/therm[266], this building would save $6636 in electric savings and $203.16 in gas savings per year. Assuming an annual savings of $6,839 the simple payback for an additional $60,000 in construction costs is 8.8 years.

Local Fiscal Impacts

	Value
Lifetime of Measure (Years)	Major Building Components: 30[267] Policy: 5[268]
Annual Electric Savings (MWh)	2.37 kWh/sf/yr [269]
Annual Natural Gas Savings	.95 kBtu/sf/yr [270]
Annual Peak Load Reductions (kW)	
Gallons Reduced	
VMT Reduced	
Custom Conversion (If gallons water --> electricity, etc.)	
Tax Credits ($)	
Incentives ($)	
Capital Administrative Costs ($)	
Yearly Administrative Costs ($)	
Capital Costs to Municipality ($)	
Yearly Costs to Municipality ($)	
Capital Incremental Costs ($)	2% increase in construction costs[271]
Yearly Incremental Costs ($)	

How to Do it

In order to meet this measure the municipality must:

Enact 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

In adopting this green building policy, the municipality must consider the following; [272]

1. Involved representatives from existing volunteer boards, such as the planning and zoning boards, environmental commission, and redevelopment and housing agencies, as well as municipal staff, especially the zoning official, construction code official, and planner should be involved with this action.

2. **Set a Timeframe:** Adopting a green building policy will take between one and three months.

3. Take into account the Project Costs and Resource Needs: Developing a green building policy will require municipal staff time; however costs should be minimal and likely will be related to legal professional fees.

4. Execute: In obtaining LEED certification with the U.S. Green Building Council the municipality must do the following; [273]

a. Register intent to obtain LEED certification with the U.S. Green Building Council on the USGBC website, www.usgbc.org. The application fee is to be paid during registration.

b. During the certification process, the building can pass through two separate reviews. In order to obtain Silver certification, a project must earn a minimum of 50 points. The first review is at the design phase. In this review reviewers will provide feedback as to which credits are anticipated. This review is optional. The second review is at the construction phases. This review is mandatory. After passing through Construction Phase Review, the USGBC will formally rule on the full application, all anticipated credits will be designated as Achieved or Denied.

c. At the end of either review phase, the municipality may appeal any credits that have been denied. There is a per credit fee for all credits appealed.

Resources:

Database of State Incentives for Renewables and Efficiency (DSIRE) - A comprehensive source funding resources on state, local, utility, and federal incentives can be found at www.dsireusa.org/

U.S. EPA Energy Star Portfolio Target Finder

http://www.energystar.gov/index.cfm?c=new_bldg_design.bus_target_finder

U.S. Green Building Council. 2009. LEED Reference Guide for Green Building Design and Construction – For the Design, Construction of Major Renovations of Commercial and Institutional Buildings including Core & Shell and K-12 School Project. 2009 Edition. http://www.usgbc.org/DisplayPage.aspx?CMSPageID=1970

Sustainable Jersey

www.sustainablejersey.com

17. Encourage energy efficiency of new commercial buildings

A municipal may enacted an ordinance that reduces permitting fees for new commercial buildings and major renovations that achieve LEEDV3 Design & Construction Silver certification[274], with the requirement of a minimum of 20% better performance than ASHRAE 90.1-2007[275] under Energy & Atmosphere Conservation Credit EA1.[276]

Introduction

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.

By encouraging new commercial building to achieve a minimum of 20% better performance than ASHRAE 90.1-2007, the municipality is contributing to the state's environmental goals and recent commitments to cut greenhouse gas emissions, to invest in renewable energy, and to creating green jobs.[277] Implementation of this measure demonstrates the municipality's support for raising awareness to green building practices. With this incentive in place, a concentration of green buildings will be encouraged within the municipality.

EE in New Commercial Buildings

	Municipal Government	Community-Wide
Initial Municipal Costs ($)	$ (30,753)	
Rebate/Subsidy ($)	$ 42,228	
Net Capital Cost ($)	$ (72,981)	
Lifetime Municipal Costs ($)	$ (30,753)	
Lifetime of Measure (Years)	30	
CO2 Reductions (Tons)		2,429
NOx Reductions (Lbs)		7,774
SO2 Reductions (Lbs)		26,955
Electricity Savings (MWh)		5,233
Electricity Savings ($)		$ 354,587
Natural Gas Savings (MMBtu)		2,098
Natural Gas Savings ($)		$ 10,811

Costs/Impacts

Many building strategies such as using standard dimensioned materials, planning for open office layouts, and design choices made early in the design process help to minimize any cost premiums associated with green building.

The average premium for achieving LEED silver certification is approximately 2%.[278] With typical construction costs currently averaging around $150 per square foot, cost premiums to achieve LEED silver certification are approximately $3 per square foot.

The savings incurred from reduced permitting fees and annual operational savings will help cover any additional upfront costs.

Scenario (building scale):

At $150 per square foot, a typical 20,000 sq. ft. office building will cost approximately $3,000,000 in construction costs for typical construction. A 2% increase in construction cost to implement green building components would add a premium of $60,000 to total construction costs.

The savings incentive for a 20,000 sq. ft. office building will vary by municipality depending on each municipality's permit fee multiplier. In estimating permit fee savings, a .0075 permit fee multiplier will be assumed.[279] This would equate to a $22,950 permit fee. If the municipality were to reduce the permit fee in half for green buildings, developers would realize a savings of $11,475.

The remainder of savings will be realized through increased energy efficiency. With an assumed electric savings of 2.37 kWh/sf per year[280] and an assumed gas savings of .95 kBtu/sf per year[281], this building would save 47,400 kWh and 19,000 kBtu or 189.87 therms per year[282].

Assuming a typical energy cost of $.14/kWh and $1.07/therm[283], this building would save $6636 in electric savings and $203.16 in gas savings per year. Assuming an annual savings of $6,839 the simple payback for an additional $60,000 in construction costs is 7 years.

Scenario (municipality–wide):

Based on participation rates of similar green building incentive programs nationwide, assume 80% of new commercial projects will take advantage of reduced permit fees for green buildings.

East Orange

The city of East Orange adds on average 62,931[284] square feet of new office space, or 3.15 (20,000 sq. ft. office buildings) per year. In the introductory year an 80% level of participation is anticipated. Therefore, 50,345 square feet or 2.52 (20,000 sq. ft office buildings) are expected take advantage of the reduced permitting fees for green building.

With an assumed electric savings of 2.37 kWh/sf per year[285] and an assumed gas savings of .95 kBtu/sf per year[286], this anticipated 50,345 square feet of new office space will save 119,318 kWh and 47,828 kBtu per year.

Edison

Edison Twp. adds on average 232,512[287] square feet of new office space, or 11.63 (20,000 sq. ft. office buildings) per year. In the introductory year an 80% level of participation is anticipated. Therefore, 186,010 square feet or 9.30 (20,000 sq. ft office buildings) are expected take advantage of the reduced permitting fees for green building.

With an assumed electric savings of 2.37 kWh/sf per year[288] and an assumed gas savings of .95 kBtu/sf per year[289], this anticipated 186,010 square feet of new office space will save 440,844 kWh and 176,710 kBtu per year.

Fort Lee

The city of Fort Lee adds on average 124,310[290] square feet of new office space, or 6.22 (20,000 sq. ft. office buildings) per year. In the introductory year an 80% level of participation is anticipated. Therefore, 99,448 square feet or 4.97 (20,000 sq. ft office buildings) are expected take advantage of the reduced permitting fees for green building.

With an assumed electric savings of 2.37 kWh/sf per year[291] and an assumed gas savings of .95 kBtu/sf per year[292], this anticipated 99,448 square feet of new office space will save 235,692 kWh and 94,476 kBtu per year.

Howell Twp. .

Howell Twp. . adds on average 177,660[293] square feet of new office space, or 8.88 (20,000 sq. ft. office buildings) per year. In the introductory year an 80% level of participation is anticipated. Therefore, 142,128 square feet or 7.11 (20,000 sq. ft office buildings) are expected take advantage of the reduced permitting fees for green building.

With an assumed electric savings of 2.37 kWh/sf per year[294] and an assumed gas savings of .95 kBtu/sf per year[295], this anticipated 142,128 square feet of new office space will save 336,843 kWh and 135,022 kBtu per year.

Middletown

Middletown Twp. adds on average 91,897[296] square feet of new office space, or 4.59 (20,000 sq. ft. office buildings) per year. In the introductory year an 80%

level of participation is anticipated. Therefore, 73,518 square feet or 3.68 (20,000 sq. ft office buildings) are expected take advantage of the reduced permitting fees for green building.

With an assumed electric savings of 2.37 kWh/sf per year[297] and an assumed gas savings of .95 kBtu/sf per year[298], this anticipated 73,518 square feet of new office space will save 174,238 kWh and 69,842 kBtu per year.

Montclair

Montclair Twp. adds on average 35,936[299] square feet of new office space, or 1.80 (20,000 sq. ft. office buildings) per year. In the introductory year an 80% level of participation is anticipated. Therefore, 28,749 square feet or 1.44 (20,000 sq. ft office buildings) are expected take advantage of the reduced permitting fees for green building.

With an assumed electric savings of 2.37 kWh/sf per year[300] and an assumed gas savings of .95 kBtu/sf per year[301], this anticipated 28,749 square feet of new office space will save 68,135 kWh and 27,312 kBtu per year.

Parsippany – Troy Hills

Parsippany-Troy Hills Twp. adds on average 616,256[302] square feet of new office space, or 30.81 (20,000 sq. ft. office buildings) per year. In the introductory year an 80% level of participation is anticipated. Therefore, 493,005 square feet or 24.65 (20,000 sq. ft office buildings) are expected take advantage of the reduced permitting fees for green building.

With an assumed electric savings of 2.37 kWh/sf per year[303] and an assumed gas savings of .95 kBtu/sf per year[304], this anticipated 493,005 square feet of new office space will save 1,168,422 kWh and 468,355 kBtu per year.

Perth Amboy

The city of Perth Amboy adds on average 23,719[305] square feet of new office space, or 1.19 (20,000 sq. ft. office buildings) per year. In the introductory year an 80% level of participation is anticipated. Therefore, 18,975 square feet or .98 (20,000 sq. ft office buildings) are expected take advantage of the reduced permitting fees for green building.

With an assumed electric savings of 2.37 kWh/sf per year[306] and an assumed gas savings of .95 kBtu/sf per year[307], this anticipated 18,975 square feet of new office space will save 44,971 kWh and 18,026 kBtu per year.

Plainfield

The city of Plainfield adds on average 32,069[308] square feet of new office space, or 1.60 (20,000 sq. ft. office buildings) per year. In the introductory year an 80% level of participation is anticipated. Therefore, 25,655 square feet or 1.28 (20,000 sq. ft office buildings) are expected take advantage of the reduced permitting fees for green building.

With an assumed electric savings of 2.37 kWh/sf per year[309] and an assumed gas savings of .95 kBtu/sf per year[310], this anticipated 25,655 square feet of new office space will save 60,802 kWh and 24,372 kBtu per year.

West Orange

The city of West Orange adds on average 60,961[311] square feet of new office space, or 3.05 (20,000 sq. ft. office buildings) per year. In the introductory year an 80% level of participation is anticipated. Therefore, 48,769 square feet or 2.44 (20,000 sq. ft office buildings) are expected take advantage of the reduced permitting fees for green building.

With an assumed electric savings of 2.37 kWh/sf per year[312] and an assumed gas savings of .95 kBtu/sf per year[313], this anticipated 48,769 square feet of new office space will save 115,583 kWh and 46,331 kBtu per year.

Willingboro Twp.

The city of Willingboro Twp. adds on average 38,621[314] square feet of new office space, or 1.93 (20,000 sq. ft. office buildings) per year. In the introductory year an 80% level of participation is anticipated. Therefore, 30,897 square feet or 1.54 (20,000 sq. ft office buildings) are expected take advantage of the reduced permitting fees for green building.

With an assumed electric savings of 2.37 kWh/sf per year[315] and an assumed gas savings of .95 kBtu/sf per year[316], this anticipated 30,897 square feet of new office space will save 73,226 kWh and 29,352 kBtu per year.

Local Fiscal Impacts

	Value
Lifetime of Measure (Years)	Major Building Components: 30[317] Policy: 5[318]
Annual Electric Savings (MWh)	2.37 kWh/sf/yr [319]
Annual Natural Gas Savings	.95 kBtu/sf/yr [320]
Annual Peak Load Reductions (kW)	

Gallons Reduced	
VMT Reduced	
Custom Conversion (If gallons water --> electricity, etc..)	
Tax Credits ($)	
Incentives ($)	
Capital Administrative Costs ($)	
Yearly Administrative Costs ($)	
Capital Costs to Municipality ($)	
Yearly Costs to Municipality ($)	
Capital Incremental Costs ($)	2% increase in construction costs[321]
Yearly Incremental Costs ($)	

How to Do it

In order to meet this measure the municipality must:

1. Pass 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 EA 1.
In adopting this green building ordinance, the municipality must consider the following; [322]

2. Involved representatives from existing volunteer boards, such as the planning and zoning boards, environmental commission, and redevelopment and housing agencies, as well as municipal staff, especially the zoning official, construction code official, and planner should be involved with this action.

3. Set a Timeframe. Adopting a green building ordinance will take between one and three months.

4. Take into account the Project Costs and Resource Needs:

Developing a green building ordinance will require municipal staff time; however costs should be minimal and likely will be related to legal professional fees.

5. **Execute:**

a. Municipalities should adopt a resolution that sets forth their intention to encourage or require green design for commercial and residential buildings. Note that a New Jersey municipality presently cannot require compliance with a green building standard that exceeds the State's Uniform Construction Code, nor require green building certification such as Leadership in Energy and Environmental Design (LEED) or Energy Star.
b. What is allowable is for a municipality to encourage adherence to a green building standard or guideline or to encourage green building generally. It is also permissible to require specific green design strategies or measures that do not fall under the State's jurisdiction regarding building codes or state or federal jurisdiction over appliance standards. These typically impact site design rather than the building itself.
c. This policy should encourage municipalities to think through how green building can best be promoted given the environmental, political, social priorities, and existing conditions of that municipality and develop strategies that work for them.
d. The simplest thing for a municipality to do to satisfy this component is to adopt a green building resolution. This resolution should assert the municipality's intent to increase green building in the public sector through a combination of voluntary actions, required actions, and educational actions.
e. In order to compensate for revenue lost through reduced permit fees, the municipality should develop two construction fee formulas; one for conventional building, and a second formula for green building. In determining both formulas, the municipality must project an anticipated level of participation in the reduced permit fee incentive. Revenue lost from reduce permit fees can be recovered by raising permit fees for conventional building.

Resources

Database of State Incentives for Renewables and Efficiency (DSIRE) - A comprehensive source funding resources on state, local, utility, and federal incentives can be found at www.dsireusa.org/

New Buildings Institute. Core Performance Guide www.advancedbuildings.net/corePerf.htm

U.S. Green Building Council www.usgbc.org

Sustainable Jersey www.sustainablejersey.com

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

A municipality 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.

Introduction

In order for a home to achieve ICC-700-2008 National Green Building Standard[323] (Silver) certification, a home must be designed to use 35% less energy than a home that meets the 2006 International Energy Conservation Code (IECC).[324]

Encouraging existing housing stock to reach these standards will encourage responsible modifications to the municipality's existing housing stock. With this incentive in place, homeowners may be encouraged to either remain in their current home or purchase an existing home. This decision will decrease the amount of resources consumed for new residential construction.

Note: The certification standards of the New Jersey Home Performance with Energy Star Program could be used to satisfy the energy efficiency component of this guidance for existing residential buildings.

EE in Existing Residential Buildings

	Municipal Government	Community-Wide
Initial Municipal Costs ($)	$ (24,865)	
Rebate/Subsidy ($)	$ 25,642	
Net Capital Cost ($)	$ (50,506)	
Lifetime Municipal Costs ($)	$ (24,865)	
Lifetime of Measure (Years)	25	
CO2 Reductions (Tons)		2,038
NOx Reductions (Lbs)		6,201
SO2 Reductions (Lbs)		20,423
Electricity Savings (MWh)		3,304
Electricity Savings ($)		$ 302,500
Natural Gas Savings (MMBtu)		5,160
Natural Gas Savings ($)		$ 39,120

Costs/Impacts

Many building strategies such as using standard dimensioned materials, planning for open office layouts, and design choices should be made early in the design process to minimize cost premiums associated with green building.

The average premium for LEED silver certification is approximately 2%.[325] With typical construction costs currently averaging around $150 per square foot, cost premiums to achieve LEED silver certification are approximately $3 per square foot.

The homeowner will recover a portion of the additional expense in achieving a higher level of sustainability from the reduced/waived permit fees and energy cost savings. With current market conditions, prospective home buyers are staying in one home for period of time. They will therefore be more likely recover the remainder of their investment in energy efficiency as they remain in this home for a longer period of time.

Scenario (building scale):

The average square footage of a single -family home constructed before 1980 is approximately 1,800 square foot. The average square footage of a single-family home constructed in 2008 has risen to approximately 2,750 square foot.[326]

Assuming renovations to this home built before 1980 add an additional 450 square feet, this renovated home will total 2,250 square feet. New construction costs average $150 per square foot. If an additional $75 per square foot were budgeted to renovate the existing portions of the home, renovation costs would total $202,500[327]. A 2% increase in construction cost to implement green building components would add a premium of $4705 to total construction costs.

The savings incentive for a 2,250 sq. ft. home will vary by municipality depending on each municipalities permit fee multiplier. In estimating permit fee savings, a .0075 permit fee multiplier will be assumed.[328] This would equate to a $1554.04 permit fee. If the municipality were to reduce the permit fee in half for green buildings, developers would realize a savings of $777.02

The remainder of savings will be realized through increased energy efficiency. Energy expenses average $ 0.14/kWh for electricity and $1.07/therm for natural gas.[329] With an assumed electric savings of 1.78 kWh/sf per year[330] and an assumed gas savings of 2.78 kBtu/sf [331] per year, this 2,250 sq. ft. home would save 4,005 kWh and 6,255 kBtu per year or 62.5

therms[332]. This equates to a $560.07 savings in electricity expenses and a $66.88 savings in natural gas expenses.

Assuming a permit fee reduction of $777.02 and annual energy cost savings of $626.95, the simple payback for an additional $4705 in construction costs is 6.26 years.

Scenario (municipality–wide):

Based on participations rates of similar green building incentive programs nationwide, assume a 5% annual increase in the percentage remodeling projects that will take advantage of reduced permit fees for green buildings.

East Orange

By the time this ordinance is in place for four years, a 20% level of participation is anticipated. The city of East Orange renovates on average, 82 units per year. [333] On this forth year, it is anticipated that 16 of the 82 units will take advantage of reduced permit fees. This will equate to a $12,453.83 reduction in permit revenue for this municipality.

With a per home savings of 4,005 kWh and 6,255 kBtu per year, these 16 remodeled homes will save 64,080 kWh and 100,080 kBtu per year.

Edison

By the time this ordinance is in place for four years, a 20% level of participation is anticipated. Edison Twp. renovates on average, 368 units per year. [334] On this forth year, it is anticipated that 74 of the 368 units will take advantage of reduced permit fees. This will equate to a $56,194.12 reduction in permit revenue for this municipality.

With a per home savings of 4,005 kWh and 6,255 kBtu per year, these 74 remodeled homes will save 296,370 kWh and 462,870 kBtu per year.

Fort Lee

By the time this ordinance is in place for four years, a 20% level of participation is anticipated. The city of Fort Lee renovates on average, 182 units per year. [335] On this forth year, it is anticipated that 36 of the 182 units will take advantage of reduced permit fees. This will equate to a $27,641.43 reduction in permit revenue for this municipality.

With a per home savings of 4,005 kWh and 6,255 kBtu per year, these eleven remodeled homes will save 144,180 kWh and 225,180 kBtu per year.

Howell

By the time this ordinance is in place for four years, a 20% level of participation is anticipated. Howell Twp. renovates on average, 282 units per year. [336] On this forth year, it is anticipated that 56 of the 282 units will take advantage of reduced permit fees. This will equate to a $45,525.28 reduction in permit revenue for this municipality.

With a per home savings of 4,005 kWh and 6,255 kBtu per year, these eleven remodeled homes will save 224,280 kWh and 350,280 kBtu per year.

Middletown

By the time this ordinance is in place for four years, a 20% level of participation is anticipated. Middletown Twp. renovates on average, 164 units per year. [337] On this forth year, it is anticipated that 33 of the 164 units will take advantage of reduced permit fees. This will equate to a $25,059.54 reduction in permit revenue for this municipality.

With a per home savings of 4,005 kWh and 6,255 kBtu per year, these eleven remodeled homes will save 132,165 kWh and 206,415 kBtu per year.

Montclair

By the time this ordinance is in place for four years, a 20% level of participation is anticipated. Montclair Twp. renovates on average, 50[338] units per year. On this forth year, it is anticipated that 10 of the 50 units will take advantage of reduced permit fees. This will equate to a $7593.80 reduction in permit revenue for this municipality.

With a per home savings of 4,005 kWh and 6,255 kBtu per year, these eleven remodeled homes will save 40,050 kWh and 62,550 kBtu per year.

Parsippany – Troy Hills

By the time this ordinance is in place for four years, a 20% level of participation is anticipated. Parsippany-Troy Hills Twp. renovates on average, 130 units per year. [339] On this forth year, it is anticipated that 26 of the 130 units will take advantage of reduced permit fees. This will equate to a $19,743.88 reduction in permit revenue for this municipality.

With a per home savings of 4,005 kWh and 6,255 kBtu per year, these eleven remodeled homes will save 104,130 kWh and 162,630 kBtu per year.

Perth Amboy

By the time this ordinance is in place for four years, a 20% level of participation is anticipated. The city of Perth Amboy renovates on average, 96[340] new units per year. On this forth year, it is anticipated that 19 of the 96 units will take advantage of reduced permit fees. This will equate to a $14,428.22 reduction in permit revenue for this municipality.

With a per home savings of 4,005 kWh and 6,255 kBtu per year, these 19 remodeled homes will save 76,095 kWh and 118,845 kBtu per year.

Plainfield

By the time this ordinance is in place for four years, a 20% level of participation is anticipated. The city of Plainfield renovates on average, 54 units per year.[341] On this forth year, it is anticipated that 11 of the 54 units will take advantage of reduced permit fees. This will equate to a $8353.18 reduction in permit revenue for this municipality.

With a per home savings of 4,005 kWh and 6,255 kBtu per year, these 11 remodeled homes will save 44,055 kWh and 68,805 kBtu per year.

West Orange

By the time this ordinance is in place for four years, a 20% level of participation is anticipated. The city of West Orange renovates on average, 134 units per year. [342] On this forth year, it is anticipated that 27 of the 134 units will take advantage of reduced permit fees. This will equate to a $20,503.26 reduction in permit revenue for this municipality.

With a per home savings of 4,005 kWh and 6,255 kBtu per year, these 27 remodeled homes will save 108,135 kWh and 168,885 kBtu per year.

Willingboro Twp.

By the time this ordinance is in place for four years, a 20% level of participation is anticipated. Willingboro Twp. renovates on average, 94 units per year. [343] On this forth year, it is anticipated that 19 of the 94 units will take advantage of reduced permit fees. This will equate to a $14,428.22 reduction in permit revenue for this municipality.

With a per home savings of 4,005 kWh and 6,255 kBtu per year, these eleven remodeled homes will save 76,095 kWh and 118,845 kBtu per year.

Local Fiscal Impacts

	Value
Lifetime of Measure (Years)	Major Building Components: 20[344] Policy: 5[345]
Annual Electric Savings (MWh)	1.78 kWh/sf/yr [346]
Annual Natural Gas Savings	2.78 kBtu/sf/yr [347]
Annual Peak Load Reductions (kW)	
Gallons Reduced	
VMT Reduced	
Custom Conversion (If gallons water --> electricity, etc..)	
Tax Credits ($)	
Incentives ($)	
Capital Administrative Costs ($)	
Yearly Administrative Costs ($)	
Capital Costs to Municipality ($)	
Yearly Costs to Municipality ($)	
Capital Incremental Costs ($)	2% increase in construction costs[348]
Yearly Incremental Costs ($)	

How to do It

In order to meet this measure the municipality must:

1. Pass an ordinance that reduces permitting fees for renovations to existing residential buildings built prior to 1980 that meet the energy requirement of ANSI 700 Silver.

In adopting this green building policy, the municipality must consider the following;[349]

2. Involved representatives from existing volunteer boards, such as the Planning and Zoning Boards, environmental commission, and redevelopment and housing agencies, as well as municipal staff, especially the Zoning Official, Construction Code Official, and planner should be involved with this action.

3. Set a Timeframe: Timeframes to implement the components will vary; however they can be pursued at the same time. Adopting a green building policy will take between one and three months.

4. Take into account the Project Costs and Resource Needs:

Developing a green building policy will require municipal staff time; however costs should be minimal and likely will be related to legal professional fees.

5. Execute:

a. Municipalities should adopt a resolution that sets forth their intention to encourage or require green design for commercial and residential buildings. Note that a New Jersey municipality presently cannot require compliance with a green building standard that exceeds the State's Uniform Construction Code, nor require green building certification such as Leadership in Energy and Environmental Design (LEED) or Energy Star.

   What is allowable is for a municipality to encourage adherence to a green building standard or guideline or to encourage green building generally. It is also permissible to require specific green design strategies or measures that do not fall under the State's jurisdiction regarding building codes or state or federal jurisdiction over appliance standards. These typically impact site design rather than the building itself.

b. This policy should encourage municipalities to think through how green building can best be promoted given the environmental, political, social priorities, and existing conditions of that municipality and develop strategies that work for them.

   The simplest thing for a municipality to do to satisfy this component is to adopt a green building resolution. This resolution should assert the municipality's intent to increase green building in the public sector through a combination of voluntary actions, required actions, and educational actions.

c. In order to compensate for revenue lost through reduced permit fees, the municipality should develop two construction fee formulas; one for conventional building, and a second formula for green building. In determining both formulas, the municipality must project an anticipated level of participation in the reduced permit fee incentive. Revenue lost from reduce permit fees can be recovered by raising permit fees for conventional building.

Resources:

ANSI/NAHB/ICC. 2008. National Green Building Standard™ ICC-700 http://www.nahbgreen.org/Guidelines/ansistandard.aspx

Database of State Incentives for Renewables and Efficiency (DSIRE) - A comprehensive source funding resources on state, local, utility, and federal incentives can be found at www.dsireusa.org/

New Jersey Clean Energy Program http://www.njcleanenergy.com/

Rutgers Center for Green Building. 2009. New Jersey Green Home Remodeling Guidelines Version 1.0.

www.greenbuildingrutgers.us/projects.asp?Level2ItemID=52

U.S. Green Building Council. 2009. Green Home Guide Website www.greenhomeguide.com/

Sustainable Jersey www.sustainablejersey.com

19. Encourage energy efficiency of existing commercial buildings

A municipal may enact a 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). [350]

Introduction

This measure provides an incentive for remodeling/retrofitting existing commercial buildings to meet the standards set by an internationally recognized green building system[351]. This certification will assure that a third party has verified that this building was upgraded using energy-efficient and green building strategies.

An Energy Star Portfolio Manager[352] score of 69 indicates that a building performs better than 69% of all similar buildings nationwide in terms of energy consumption. A better performing building is less expensive to operate, and causes fewer greenhouse gas emissions than a conventional building.[353]

Presently, energy use from commercial and industrial buildings cost over $200 billion per year. Nearly half of U.S. greenhouse gas emissions are produced by commercial and industrial buildings, directly contributing to global warming. Through achieving this higher level of performance, the municipality is demonstrating commitment to reducing the amount of greenhouse gas emissions produced by its existing commercial buildings.

EE in Existing Commercial Buildings

	Municipal Government	Community-Wide
Initial Municipal Costs ($)	$ (72,866)	
Rebate/Subsidy ($)	$ 84,341	
Net Capital Cost ($)	$ (157,208)	
Lifetime Municipal Costs ($)	$ (72,866)	
Lifetime of Measure (Years)	30	
CO2 Reductions (Tons)		4,851
NOx Reductions (Lbs)		15,528
SO2 Reductions (Lbs)		53,836
Electricity Savings (MWh)		10,452
Electricity Savings ($)		$ 708,211
Natural Gas Savings (MMBtu)		4,190
Natural Gas Savings ($)		$ 21,592

Costs/Impacts

Many building strategies such as using standard dimensioned materials, planning for open office layouts, and design choices made early in the design process help to minimize cost premiums associated with green building.

The average premium for LEED for Existing Building (EB) silver certification is approximately $1.22 per square foot.[354] With typical construction costs currently averaging around $150[355] per square foot, the cost to achieve LEED-Green Building Operation & Maintenance (GBOM) Silver (v3) certification with minimum Energy Star Portfolio Manager Score of 69 is approximately $151.22 per square foot.

The owner can be motivated to use savings incurred from permitting fees, reallocating the savings to any additional expense in achieving a higher level of green building.

Scenario (building scale):

At $150 per square foot, renovations to a typical 20,000 sq. ft. office building will cost approximately $3,000,000 in construction costs for typical construction. A $1.22 increase per square foot in construction cost to implement green building components would slightly increase this number to $152.22 per square foot for total construction costs, raising total construction cost to 3,044,400.

The savings incentive for a 20,000 sq. ft. office building will vary by municipality depending on each municipalities permit fee multiplier. In estimating permit fee savings, a .0075 permit fee multiplier will be assumed.[356] This would equate to a $22,833 permit fee. If the municipality were to reduce the permit fee in half for green buildings, developers would realize a savings of $11,417.

The remainder of savings will be realized through increased energy efficiency. With an assumed electric savings of 2.37 kWh/sf per year[357] and an assumed gas savings of .95 kBtu/sf per year[358], this building would save 47,400 kWh and 19,000 kBtu, or 189.87 therms per year[359].

Assuming a typical energy cost of $.14/kWh and $1.07/therm[360], this building would save $6636 in electric savings and $203 in gas savings per year. Assuming a permit fee reduction of $11,417 and an annual energy savings of savings of $6,839; the simple payback for an additional $44,400 in construction costs is 4.8 years.

Scenario (municipality–wide):

Based on participations rates of similar green building incentive programs nationwide, assume 80% of existing commercial projects will take advantage of reduced permit fees for green buildings.

East Orange

The city of East Orange renovates on average 125,862[361] square feet of existing commercial space, or the equivalent of 6.29 (20,000 sq. ft. office buildings) per year. In the introductory year it is anticipated that 100,690 square feet or 5.03 (20,000 sq. ft office buildings) will take advantage of the reduced permitting fees for reducing heat island effect.

With an assumed electric savings of 2.37 kWh/sf per year[362] and an assumed gas savings of .95 kBtu/sf per year[363], this anticipated 100,690 square feet of new office space will save 238,635 kWh and 95,656 kBtu per year.

Edison

Edison Twp. renovates on average 465,024[364] square feet of existing commercial space, or the equivalent of 23.25 (20,000 sq. ft. office buildings) per year. In the introductory year it is anticipated that 372,019 square feet or 18.60 (20,000 sq. ft office buildings) will take advantage of the reduced permitting fees for reducing heat island effect.

With an assumed electric savings of 2.37 kWh/sf per year[365] and an assumed gas savings of .95 kBtu/sf per year[366], this anticipated 372,019 square feet of new office space will save 881,685 kWh and 353,418 kBtu per year.

Fort Lee

The city of Fort Lee renovates on average 248,620[367] square feet of existing commercial space, or the equivalent of 12.43 (20,000 sq. ft. office buildings) per year. In the introductory year it is anticipated that 198,896 square feet or 9.94 (20,000 sq. ft office buildings) will take advantage of the reduced permitting fees for reducing heat island effect.

With an assumed electric savings of 2.37 kWh/sf per year[368] and an assumed gas savings of .95 kBtu/sf per year[369], this anticipated 198,896 square feet of new office space will save 471,320 kWh and 188,951 kBtu per year.

Howell Twp.

Howell Twp. renovates on average 355,320[370] square feet of existing commercial space, or the equivalent of 17.76 (20,000 sq. ft. office buildings) per year. In the introductory year it is anticipated that 284,256 square feet or 14.21 (20,000 sq. ft office buildings) will take advantage of the reduced permitting fees for reducing heat island effect.

With an assumed electric savings of 2.37 kWh/sf per year[371] and an assumed gas savings of .95 kBtu/sf per year[372], this anticipated 284,256 square feet of new office space will save 673,687 kWh and 270,043 kBtu per year.

Middletown

Middletown Twp. renovates on average 183,794[373] square feet of existing commercial space, or the equivalent of 9.19 (20,000 sq. ft. office buildings) per year. In the introductory year it is anticipated that 147,035 square feet or 7.35 (20,000 sq. ft office buildings) will take advantage of the reduced permitting fees for reducing heat island effect.

With an assumed electric savings of 2.37 kWh/sf per year[374] and an assumed gas savings of .95 kBtu/sf per year[375], this anticipated 147,035 square feet of new office space will save 348,743 kWh and 139,683 kBtu per year.

Montclair

Montclair Twp. renovates on average 71,872[376] square feet of existing commercial space, or the equivalent of 3.59 (20,000 sq. ft. office buildings) per year. In the introductory year it is anticipated that 57,498 square feet or 2.87 (20,000 sq. ft office buildings) will take advantage of the reduced permitting fees for reducing heat island effect.

With an assumed electric savings of 2.37 kWh/sf per year[377] and an assumed gas savings of .95 kBtu/sf per year[378], this anticipated 57,498 square feet of new office space will save 136,270 kWh and 54,623 kBtu per year.

Parsippany

Parsippany-Troy Hills Twp. renovates on average 1,232,512[379] square feet of existing commercial space, or the equivalent of 61.63 (20,000 sq. ft. office buildings) per year. In the introductory year it is anticipated that 986,010 square feet or 49.30 (20,000 sq. ft office buildings) will take advantage of the reduced permitting fees for reducing heat island effect.

With an assumed electric savings of 2.37 kWh/sf per year[380] and an assumed gas savings of .95 kBtu/sf per year[381], this anticipated 986,010 square feet of new office space will save 2,336,844 kWh and 936,710 kBtu per year.

Perth Amboy

The city of Perth Amboy renovates on average 47,438[382] square feet of existing commercial space, or the equivalent of 2.37 (20,000 sq. ft. office buildings) per year. In the introductory year it is anticipated that 37,950 square feet or 1.89 (20,000 sq. ft office buildings) will take advantage of the reduced permitting fees for reducing heat island effect.

With an assumed electric savings of 2.37 kWh/sf per year[383] and an assumed gas savings of .95 kBtu/sf per year[384], this anticipated 37,950 square feet of new office space will save 89,942 kWh and 36,053 kBtu per year.

Plainfield

The city of Plainfield renovates on average 64,138[385] square feet of existing commercial space, or the equivalent of 3.20 (20,000 sq. ft. office buildings) per year. In the introductory year it is anticipated that 51,310 square feet or 2.57 (20,000 sq. ft office buildings) will take advantage of the reduced permitting fees for reducing heat island effect.

With an assumed electric savings of 2.37 kWh/sf per year[386] and an assumed gas savings of .95 kBtu/sf per year[387], this anticipated 51,310 square feet of new office space will save 121,605 kWh and 48,745 kBtu per year.

West Orange

The city of West Orange renovates on average 121,922[388] square feet of existing commercial space, or the equivalent of 6.10 (20,000 sq. ft. office buildings) per year. In the introductory year it is anticipated that 97,538 square feet or 4.87 (20,000 sq. ft office buildings) will take advantage of the reduced permitting fees for reducing heat island effect.

With an assumed electric savings of 2.37 kWh/sf per year[389] and an assumed gas savings of .95 kBtu/sf per year[390], this anticipated 97,538 square feet of new office space will save 231,165 kWh and 92,661 kBtu per year.

Willingboro Twp.

Willingboro Twp. renovates on average 77,242[391] square feet of existing commercial space, or the equivalent of 3.87 (20,000 sq. ft. office buildings) per year. In the introductory year it is anticipated that 61,794 square feet or 3.10 (20,000 sq. ft office buildings) will take advantage of the reduced permitting fees for reducing heat island effect.

With an assumed electric savings of 2.37 kWh/sf per year[392] and an assumed gas savings of .95 kBtu/sf per year[393], this anticipated 61,794 square feet of new office space will save 146,452 kWh and 58,704 kBtu per year.

Local Fiscal Impacts

	Value
Lifetime of Measure (Years)	Major Building Components: 30[394] Policy: 5[395]
Annual Electric Savings (MWh)	2.37 kWh/sf/yr [396]
Annual Natural Gas Savings	.95 kBtu/sf/yr [397]
Annual Peak Load Reductions (kW)	
Gallons Reduced	
VMT Reduced	
Custom Conversion (If gallons water --> electricity, etc.)	
Tax Credits ($)	
Incentives ($)	
Capital Administrative Costs ($)	
Yearly Administrative Costs ($)	
Capital Costs to Municipality ($)	
Yearly Costs to Municipality ($)	
Capital Incremental Costs ($)	2% increase in construction costs[398]
Yearly Incremental Costs ($)	

How to Do it

In order to meet this measure the municipality must enacts 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)

In adopting this green building ordinance, the municipality must consider the following; [399]

1. Involve representatives from existing volunteer boards, such as the planning and zoning boards, environmental commission, and redevelopment and housing agencies, as well as municipal staff, especially the zoning official, construction code official, and planner should be involved with this action.

2. Set a Timeframe: Adopting a green building policy will take between one and three months.

3. Take into account the Project Costs and Resource Needs:

Developing a green building policy will require municipal staff time; however costs should be minimal and likely will be related to legal professional fees.

4. Execute:

a. Municipalities should adopt a resolution that sets forth their intention to encourage or require green design for commercial and residential buildings. Note that a New Jersey municipality presently cannot require compliance with a green building standard that exceeds the State's Uniform Construction Code, nor require green building certification such as Leadership in Energy and Environmental Design (LEED) or Energy Star.

   What is allowable is for a municipality to encourage adherence to a green building standard or guideline or to encourage green building generally. It is also permissible to require specific green design strategies or measures that do not fall under the State's jurisdiction regarding building codes or state or federal jurisdiction over appliance standards. These typically impact site design rather than the building itself.

b. This policy should encourage municipalities to think through how green building can best be promoted given the environmental, political, social priorities, and existing conditions of that municipality and develop strategies that work for them.

   The simplest thing for a municipality to do to satisfy this component is to adopt a green building resolution. This resolution should assert the municipality's intent to increase green building in the public sector through a combination of voluntary actions, required actions, and educational actions.

c. In order to compensate for revenue lost through reduced permit fees, the municipality should develop two construction fee formulas; one for conventional building, and a second formula for green building. In determining both formulas, the municipality must project an anticipated level of participation in the reduced permit fee incentive. Revenue lost from reduce permit fees can be recovered by raising permit fees for conventional building.

Resources:

Database of State Incentives for Renewables and Efficiency (DSIRE) - A comprehensive source funding resources on state, local, utility, and federal incentives can be found at www.dsireusa.org/

U.S. EPA Energy Star Portfolio Manager Tool

http://www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager

U.S. EPA Energy Star. 2008. Building Upgrade Manual. http://www.energystar.gov/index.cfm?c=business.bus_upgrade_manual

Leonardo Academy. 2008. The Economics of LEED for Existing Buildings

http://redesign.leonardoacademy.org/download/2009-5-29RevisedReportEconomicsLEEDEB.pdf

U.S. Green Building Council www.usgbc.org

Sustainable Jersey www.sustainablejersey.com

20. Adopt energy audit policy for existing municipal buildings

Introduction

A municipality 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.

Recommendations in an energy audit can range from improved energy data management, to appropriate energy-saving technologies, to structural improvements and system retrofits, to behavior change strategies for energy conservation. See Energy Conservation Measures (ECMs) for 10 commonly recommended and implemented ECMs that have paybacks of 7 years or less.

Improve Existing Municipal Buildings (All ECMs Combined)

	Municipal Government	Community-Wide
Initial Municipal Costs ($)	$ 12,853	
Rebate/Subsidy ($)	$ 16,810	
Net Capital Cost ($)	$ (3,957)	
Lifetime Municipal Costs ($)	$ 12,853	
Lifetime of Measure (Years)	18.7	
CO2 Reductions (Tons)	1,758	1,758
NOx Reductions (Lbs)	5,539	5,539
SO2 Reductions (Lbs)	18,910	18,910
Electricity Savings (MWh)	3,177	3,177
Electricity Savings ($)	$ 262,759	$ 262,759
Natural Gas Savings (MMBtu)	2,128	2,128
Natural Gas Savings ($)	$ 15,690	$ 15,690

Costs/Impacts

A typical energy audit price tag ranges from18 to 50 cents per square foot for facilities with less than 50,000 square feet of conditioned area, to about 12 cents per square foot for larger facilities (e.g., greater than 250,000 square feet), to 10 cents per square foot for very large facilities (e.g., greater than one million square feet).[400] Some Energy Service Companies may charge per square foot and on a sliding scale. Others may build the audit fee into an energy improvement package that includes the cost of the audit, recommendations, and labor and materials for implementing the recommendations.

For example, the Township of Montclair conducted a comprehensive energy audit for all of their municipal buildings in 2005. The audit resulted in the following energy and cost saving measures:

- Upgrade of the heating/cooling/ventilating system in the Municipal Building, dramatically increasing the energy-efficiency of the space while improving comfort inside the offices;
- Installation of occupancy sensors for all possible light switches in that building, reducing waste of electricity and money;
- Retrofitting high-efficiency lighting for the Community Services and Municipal Buildings.

Montclair estimates that if all of the audit recommendations are implemented, they could save taxpayers as much as $100,000 per year.

Scenario: (Building Scale)

A typical energy audit conducted on a 20,000 square foot municipal building will cost $3,600 to $10,000.

Local Fiscal Impacts

	Value
Lifetime of Measure (Years)	Five to seven years[401]
Annual Electric Savings (MWh)	Depends on Energy Conservation Measures (ECMs) implemented. See 10 common ECMs.
Annual Natural Gas Savings (MMBtu)	Depends on Energy Conservation Measures (ECMs) implemented. See 10 Common ECMs.
Annual Peak Load Reductions (kW)	
Gallons Reduced	
VMT Reduced	
Custom Conversion (If gallons water --> electricity, etc..)	
Tax Credits ($)	
Incentives ($)	The BPU Office of Clean Energy Municipal Energy Audit Program will pay 75% or more of the total cost

	of the audit if certain conditions are met[402]
Capital Administrative Costs ($)	
Yearly Administrative Costs ($)	
Capital Costs to Municipality ($)	18 to 50 cents per square foot for facilities with less than 50,000 square feet of conditioned area.
Yearly Costs to Municipality ($)	
Capital Incremental Costs ($)	
Yearly Incremental Costs ($)	

How to Do it

1. Create an energy audit team made up of the municipal business administrator as well as facilities, environmental, and maintenance staff.

2. Apply for funding from the NJ Board of Public Utilities (BPU) Municipal/Local Government Energy Audit Program. www.njcleanenergy.com/lgea

3. If approved for funding, follow the BPU's requirements for hiring an Energy Service Company (ESCO) and conducting a municipal energy audit on eligible facilities owned and operated by the municipality.

4. Work with the ESCO to collect facility information and 12 consecutive months of utility data (for electricity, natural gas, heating fuel, and water/sewer accounts).

5. Review the energy performance report. Meet with the ESCO to discuss energy efficiency implementation recommendations. If one or more facilities receive an ENERGY STAR rating of 75 or higher, see the Sustainable Jersey action for ENERGY STAR Buildings for recognition and points.

6. Apply for funding from the NJ Clean Energy Program to partially cover the costs of implementing recommendations.

7. Submit documentation to secure remaining funding from the BPU municipal energy audit program to cover the costs of the audit.

Conducting a municipal energy audit is also a priority action for achieving certification under Sustainable Jersey™. For step-by-step guidance on how to conduct a municipal energy audit, visit the Sustainable Jersey™ website and download the *Energy Audits for Municipal Facilities Tool* (www.sustainablejersey.com/action.php?pagename=act3tb&actid=1)

Resources

Links to programs, incentives, and examples/models (optional)

Funding Resources:

BPU Municipal/Local Government Audit program
www.njcleanenergy.com/lgea, or call **1-866-NJSMART (1-866-657-6278)**
The Local Government Energy Audit program pays 75% of the audit fee with the remaining 25% depending on the energy efficiency measures installed and the energy efficiency rebates received after the audit is completed. Maximum of $100,000 per local government agency per year.

Database of State Incentives for Renewables and Efficiency
http://www.dsireusa.org/

New Jersey Smart Start Buildings
http://www.njcleanenergy.com/commercial-industrial/programs/programs

Education/Training Resources:

Sustainable Jersey – Energy Audits for Municipal Facilities Tool

http://www.sustainablejersey.com/action.php?pagename=act3tb&actid=1

The Board of Public Utilities' Teaching Energy Awareness with Children's Help (TEACH) program will assist schools in collecting basic building characteristics and evaluating the data while providing a hands-on learning experience for students.
http://www.njcleanenergy.com/commercial-industrial/programs/teach

U.S. EPA, ENERGY STAR Portfolio Manager- an online energy tracking and benchmarking tool: https://energystar.gov/istar/pmpam/

Energy Star for Local Government

http://www.energystar.gov/index.cfm?c=government.bus_government_local

NJ Department of Environmental Protection Office of Planning and Sustainable Communities (2007) "How to Conduct an Energy Audit: A Short Guide for Local Governments and Communities." http://www.nj.gov/dep/opsc/docs/conduct_an_energy_audit.pdf

Sample Request for Proposals (RFPs) to hire professional energy auditing services:

Montclair's Energy Audit RFP
http://www.njssi.org/uploaded_documents/MontclairEnergyAuditRFP.doc
Princeton's Energy Audit RFP
http://www.njssi.org/uploaded_documents/PrincetonRFPenergyaudit.doc

General Resources on Action Topic:

Department of Energy- Energy Efficiency and Renewable Energy (EERE)
http://www.eere.energy.gov/

Energy Information Administration
http://www.eia.doe.gov/

21. Use Energy Star Appliances and Office Equipment

Introduction

If every home office product purchased in the U.S. this year were ENERGY STAR qualified, Americans would save $200 million in annual energy costs while preventing almost 3 billion pounds of greenhouse gases – equivalent to the emissions of 250,000 cars.[403] This fact alone is an important reminder that everyone can do their part to be more environmentally conscious by using appliances and office equipment that are more energy efficient.

Computers and electronics account of 7.7% of energy use in a typical office building.[404] 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.[405]

ECM - Energy Star Appliances & Office Equipment

	Municipal Government	Community Wide
Initial Municipal Costs ($)	$ 1,240	
Rebate/Subsidy ($)	$ 50	
Net Capital Cost ($)	$ 1,190	
Lifetime Municipal Costs ($)	$ 1,240	
Lifetime of Measure (Years)	4	
CO2 Reductions (Tons)	8	8
NOx Reductions (Lbs)	27	27
SO2 Reductions (Lbs)	97	97
Electricity Savings (MWh)	14	14
Electricity Savings ($)	$ 1,672	$ 1,672
Natural Gas Savings (MMBtu)	0	-
Natural Gas Savings ($)	$ -	$ -

Costs/Impacts

All estimates based on the following per unit costs:

$0.14/kWh, $10.66/MMBtu, $1.07/therm

The following data has been collected from various ENERGY STAR cost savings calculators. The products listed in the table show expected energy savings by switching from a conventional product to an ENERGY STAR product. The examples include common appliances and office equipment found in existing municipal buildings but is not exhaustive. When it is time to replace appliances or office equipment or if new products are to be purchased consider purchasing ENERGY STAR labeled products whenever possible. *Note: Annual Electric Savings (MWh) are calculated per unit.*

Scenario: 20,000 sq. ft. building

Annual electric savings =

1 computer server: 800 kWh/yr

10 desktops (CPU): 1,375 kWh/yr

10 monitors (LCD): 184 kWh/yr

2 refrigerators: 266 kWh/yr

2 water coolers (hot/cold): 723 kWh/yr

Total: 3,347 kWh/yr

Annual cost savings =

1 computer server: 800 kWh/yr *

0.14 kWh = $112

10 desktops (CPU): 1,375 kWh/yr * 0.14kWh = $192.50

10 monitors (LCD): 184 kWh/yr * 0.14kWh = $25.76

2 refrigerators: 266 kWh/yr *

0.14 kWh= $37.24

2 water coolers (hot/cold): 723 kWh/yr * 0.14 kWh = $101.22

Total: $468.58

Local Fiscal Impacts	**Computer servers**	**Desktops (CPU)**	**Monitor (LCD)**	**Refrigerator**	**Water Coolers**
Lifetime of Measure (Years)	3 years (estimate) [406]	4 years (warranty) [407]	4 years[408]	12 years[409]	1 year (renewable contract period)[410]
Annual Electric Savings (kWh)	**800 kWh**[411]	a) 134.6 kWh (Idle) b) 0.4 kWh (Sleep) c) 2.5 kWh (Off) d) Total = **137.5 kWh/unit** [412]	a) 10.4 kWh (Active) b) 5.5 kWh (Sleep) c) 2.5 kWh (Off) d) Total = **18.4kWh/unit** [413]	a) **133kWh/unit** [414] (if the conventional model is upgraded to the same ES qualified model)	a) **361.5 kWh/unit** (Hot/Cold Water) b) **47.5 kWh/unit** (Cold Water)
Incentives ($)				$50 Cash Back[415]	
Capital Costs to Municipality ($)	Computer Server (1): $630-$1330 ($30 Cost Premium [416])	$784/unit	$189/unit	$600+/unit *Find an ENERGY STAR refrigerator*	$1180/unit
Yearly Costs to Municipality ($)	None	None	None	None	Hot/Cold: $216 rental cost/yr[417] Cold: $168 rental cost/yr
Capital Incremental Costs ($)	$30 Cost Premium [418]	$42	(ES Qualified $189 vs. $111 Conventional) = $78	(ES Qualified Unit $1180 - Conventional Unit $1150) = $30	$0[419]
Average Payback[420]	0.27 years[421]	2.18 years[422]	*30.28 years*[423]	1.61 years[424]	N/A[425]

How to Do it

1. Create a list of all appliances in the building, noting how many units there are of each appliance.

2. Evaluate whether older appliances may be replaced by an ENERGY STAR product; evaluate whether most common appliances may be replaced by an ENERGY STAR product.

3. Follow instructions provided with each appliance or contact a professional for installation assistance.

For helpful tips and information regarding the ENERGY STAR labeled products in the table above, refer to the ENERGY STAR website for 'Office Equipment': http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductCategory&pcw_code=OEF

For 'Appliances':

http://www.energystar.gov/index.cfm?c=appliances.pr_appliances

These websites also have information for other ENERGY STAR labeled products that could also be used in a municipal building. The websites provided also have information regarding stores that sell ENERGY STAR products and if there are special offers/rebates for purchasing certain appliances and/or equipment in your area. The Calculators (.xls files) under the footnotes will also provide assistance for determining your specific energy and cost savings for your specific building.

Resources

Special Offers and Rebates[426]

The links below include websites external to the* "energystar.gov" *domain.

Sponsor	Special Offer/Rebate	Products	Dates
New Jersey Office of Clean Energy 877-270-3520	Rebate, Mail-in, Recycling	Freezers, Refrigerators & Freezers	Ongoing
Get $30 cash back for recycling your refrigerator or freezer. You must own the refrigerator or freezer, it must be in working condition, and it must be between 10			

and 30 cubic feet in size. You must be a New Jersey resident and a customer of Atlantic City Electric, Jersey Central Power & Light, PSE&G, or Rockland Electric Company. For more information, visit the web site.			
U-Line Corporation	Dollar Incentive: Other	Freezers, Refrigerators & Freezers	01/01/2010 - 05/31/2010
Receive a complimentary commercial-style handle with the purchase of any Echelon series stainless steel model. This is a savings of $50. Visit www.u-line.com for more details.			
Dacor (Distinctive Appliance Corp.)	Dollar Incentive: Other	Freezers, Refrigerators & Freezers	01/01/2010 - 03/31/2010
The Dacor Get It While It's Hot free product event offers consumers who purchase a qualifying Dacor package the opportunity to receive a free eligible reward appliance. This is a possible savings of up to $4,670. Examples of select ENERGY STAR® qualified products include the EPICURE 36" Freestanding Cabinet Depth Refrigerator. For more details, please see http://www.dacor.com/hot.aspx or call 1-800-793-0093 to find the Dacor dealer nearest you.			

Sponsor	**Special Offer/Rebate**	**Products**	**Dates**
Public Service Electric & Gas Company (PSE&G)	Rebate - Instant, Dollar Incentive: Other	Light Fixtures, CFL Bulbs	Ongoing
ASKO Appliances Inc.	Rebate - Mail-in	Dishwashers	01/01/2010 - 06/30/2010
Get a $100 rebate for purchasing an eligible ENERGY STAR qualified dishwasher. Rebate offer is limited to one rebate per certificate on models D5122XXL and D5223XXL, purchased from an authorized retailer. May not be available in all markets. Contact your local distributor with questions.			

You may be eligible for federal tax credits if you make energy-efficient improvements to your home. *Read more about federal tax credits for energy-efficient improvements*:

http://www.energystar.gov/index.cfm?c=products.pr_tax_credits

22. Install Boiler Controls for HVAC system

Introduction

Climate control accounts for about 41 percent of an office building's total electrical energy consumption - almost double that of any other building system. Because daily high temperatures coincide with peak energy use, climate control equipment operates at its highest capacity during the most expensive utility rate time.[427] Thus, the efficiency of the HVAC system is essential to energy and cost savings.

Replacing entire HVAC systems can be expensive. There are ways to improve the performance of an existing system if it is not yet time to replace it. Installing a *dynamic boiler control* in a water/steam-distribution system is a relatively low-cost alternative to increasing the energy efficiency of an entire, existing 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.[428]

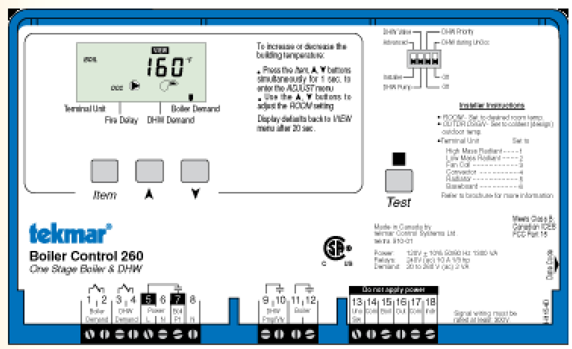

Figure 3- Sample Control readout

http://www.tekmarcontrols.com/prod/260.shtml

ECM - Boiler Controls for HVAC System

	Municipal Government	Community-Wide
Initial Municipal Costs ($)	$ 5,000	
Rebate/Subsidy ($)	$ -	
Net Capital Cost ($)	$ 5,000	
Lifetime Municipal Costs ($)	$ 5,000	
Lifetime of Measure (Years)	15	
CO2 Reductions (Tons)	88	88
NOx Reductions (Lbs)	138	138
SO2 Reductions (Lbs)	0	-
Electricity Savings (MWh)	0	-
Electricity Savings ($)	$ -	$ -
Natural Gas Savings (MMBtu)	1,500	1,500
Natural Gas Savings ($)	$ 11,969	$ 11,969

Costs/Impacts

All estimates based on the following per unit costs:

$0.14/kWh, $10.66/MMBtu, $1.07/therm

Scenario: Consider an existing boiler working at 60% efficiency that uses natural gas in a 20,000 sq. ft. building. Installing a boiler controller will yield the following annual costs, savings and impacts:

Minimum reduction in fuel consumption by installing dynamic boiler controllers:

10%[429]

Average cost of natural gas in NJ:

$1.07/therm

Estimated consumption of natural gas in medium (20,000sq.ft.) commercial building:

10,000 therms[430]

Annual energy savings = 10% * 10,000 therms = **1,000 therms**

Annual cost savings = $1.07 * 1,000 therms = **$1,070**

Local Fiscal Impacts

	Boiler Controls
Lifetime of Measure (Years)	

Annual Electric Savings (MWh)	
Annual Natural Gas Savings (MMBtu)	1000 therms
Tax Credits ($)	
Incentives ($)	
Capital Costs to Municipality ($)	$2,500 + $2,500 = $5,000[431] (material + labor)
Average Payback	4.67 years[432]

A basic rule of thumb is that for every 10kWh saved, 7.3lbs of GHG emissions are reduced.[433]

Social and Environmental Impacts

	Annual		**Lifetime**	
	Government	Community-wide	Government	Community-wide
GHG reduction	21,396.3 lbs[434]			
kWh/Therms/gallons reduced	1,000 therms[435]			
Criteria Air Pollutants				
Other				

How to Do it

For additional information on Boiler Controller systems:
1. Boiler Reset Control
2. Boiler Sequence Control

Case Studies

- *Swinerton, Inc., California*

http://www.fypower.org/bpg/case_study.html?b=offices&c=Swinerton%2c_Inc.

Incentives

- Database for State Incentives for Renewables & Efficiency http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=NJ18F&re=1&ee=1
- NJ State Incentives and Resources Program http://www1.eere.energy.gov/industry/about/state_activities/incentive_search.asp?ac=su

Resources

Washington State University "Energy Efficiency Fact Sheet" on boiler combustion monitoring and oxygen trim systems
http://www.energy.wsu.edu/documents/engineering/boiler_comb.pdf

RENEWABLE ENERGY MEASURES

1. Increase Photovoltaic Solar Capacity

2. Transition to Green Vehicle Fleets

3. Enact a Small Wind Energy Ordinance to Enable Greater Wind Energy Generation

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 municipality'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. With solar energy, the reduced reliance on utility-provided electricity comes without incurring any reliability risk as the municipal buildings remain grid-tied and served by the local utility.

Rather than owning the PV systems outright, a municipality 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 (hereafter referred to as the provider).[436] This will likely be the most financially feasible options for increasing PV capacity on government buildings and lands. Under this scheme, the municipality 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.[437] A PPA is usually written for 15 – 25 years[438] and sets the price of the clean energy produced onsite at, or below, the facility's current electric utility rate.[439,440] This price will then escalate annually at some fixed, pre-determined rate, typically around 3 percent.[441] To be clear, this price only applies to the portion of electricity consumed by the host site that is produced by the PV installation. The remaining load is met with electricity supplied by the utility at the host's normal electric rate. While it is unclear whether the PPA will ultimately reduce the municipality's electric bills, this arrangement hedges against volatile energy markets by supplying the municipality with a portion of its electricity at a known price for the duration of the PPA.[442]

In addition to greater predictability of electricity costs, there are a number of other benefits to using a PPA as a means of deploying solar electricity across municipal sites. All, or most, of the upfront costs that the municipality would have faced as an owner of a PV system are eliminated. Installation and O&M costs, as well as the performance risk, are all shifted to the provider. If the PPA is written such that the host pays only for the electricity produced, the provider has a large incentive to ensure that the PV system is operating at maximum capacity. Additionally, since the provider is a taxable entity, it can take advantage of certain state and federal incentives that are only available to tax-paying entities interested in owning solar systems. These incentives lower the overall cost of the project to the provider, which may in turn be reflected in a lower PPA price for electricity generated on-site.[443]

Increase photovoltaic solar capacity

	Municipal Government	Community-Wide
Initial Municipal Costs ($)	$ -	
Rebate/Subsidy ($)	$ -	
Net Capital Cost ($)	$ -	
Lifetime Municipal Costs ($)	$ -	
Lifetime of Measure (Years)	15	
CO2 Reductions (Tons)	-	-
NOx Reductions (Lbs)	-	-
SO2 Reductions (Lbs)	-	-
Electricity Savings (MWh)	-	-
Electricity Savings ($)	$ -	$ -
Natural Gas Savings (MMBtu)	-	-
Natural Gas Savings ($)	$ -	$ -

Costs/Impacts

The cost, energy, and emissions impacts detailed below illustrate the costs and savings associated with the PPA solar electricity model. Again, there may be high labor costs associated with the negotiation of a PPA, but those costs are not quantified in this analysis. The tax benefits received by the provider are also not included in this analysis as they do not directly affect the municipal host. The analysis performed here also assumes that the municipality does not accept an early buyout option, but rather remains a host for the entirely of the PPA.

Local Fiscal Impacts of a PPA

Lifetime of measure	15 years[444]
Initial Cost	$0
Rebate	$0
Cost after Rebate	$0
Annual Savings/Cost Price of Electricity (Utility Provided) Expected Elec. Utility Rate Price Escalator PV Electricity PV Price Escalator	 from model 2.7%[445] 5% below Price of Elec.[446] 3%[447]
Years to Payback	
Net Present Value	

Energy and Emissions Impacts[448]

Energy impacts	Per 100 kW	

(annually)	system	
Electricity off-sets	118.26 MWh[449,450]	
Natural Gas off-sets	N/A	
Emissions Savings (lifetime)	Per participant	
CO_2		
NOx		
SO_2		

How to do it:[451]

1. **A number of decisions must be made regarding ownership and financing options.** Towns may choose to own the systems that are installed or serve as a host for the solar panels, but leave the ownership and operation of the system to a third party. Assuming towns elect to host solar installations, the following steps apply.
2. **Understand that the provider must have access to all facilities that will be hosting a PV system for the duration of the PPA.** A municipality will want to consider the security implications of such access.
3. **The municipality will need to allocate sufficient resources** to employ knowledgeable lawyers and other personnel to negotiate a sound contract.[452] The transaction and legal costs of negotiating and implementing a PPA can sometimes be very high.
4. **For a PPA project to be cost-effective, the project should be at least 100kW** (either on a single structure or smaller projects on numerous facilities that cumulatively add up to 100kW).[453,454] An installation of this size will require approximately 10,000 square feet of space on a roof, parking structure, or space for mounting it in a field.[455]
5. It is also important for the municipality to realize that as a host, not an owner, it may not be able to claim the SRECs produced by the PV system and therefore it cannot claim to be powered by green energy. If the municipality retains ownership of the SRECs under the PPA, the negotiated PPA electricity price will likely be higher to reflect the lost SREC revenue stream that the provider would have otherwise captured.[456]
6. **Additionally, when negotiating the PPA the municipality should be wary of PV price escalators** that increase drastically after the first 6 years (once the provider has realized all the tax benefits) that sometimes exist to encourage an early buyout.
7. **Site assessment is an important first step in deploying solar energy.** While possibly most cost-effective, site assessment does not need to be carried out independently by the municipality. The selected provider should lead or

at least aid in this effort, but the municipality will need to be a supportive partner. Facility managers at the host sites should be enlisted as partners to ensure that the provider has appropriate access to the site and serve as an on-site contact. Overall, the municipality may want to consider the following questions:

a. How does solar fit into your long-term strategy?
b. Will the facility in question remain government-owned for 15 years or more?
c. What is the condition of the installation site? Does the roof need to be replaced?
d. What is your electric load profile and what impact will solar have on it?

8. **Standardize solicitations for solar installations.** In order to obtain a PPA provider that best matches the municipality's needs, the town should release a request for proposals (RFP) or a request for qualifications (RFQ). Third party providers and utilities should be eligible to respond. Standardizing the solicitation process, forms, and evaluation criteria will help streamline this process. These documents typically specify the requirements for the installation, such as system size or energy output, technology type, installation location, and cost range. They can also include information needed to submit a proposal, such as the facility's energy load data, electrical or water heating schematics, building plans, and permitting requirements. After a predetermined solicitation period, a committee typically evaluates bids and chooses a developer that meets the specified requirements. Specific steps suggested by the U.S. Department of Energy's Solar America Cities project include[457]:

   a. Identify the city or county departments that you'll be working with and understand their RFP/RFQ processes.

   b. Determine whether changes can be made to the existing RFP process to create a solar-specific RFP/RFQ.

   c. Develop the criteria and process for evaluating bids.

   d. Consider which elements should be specified by the RFP issuer and which should be left to responders to specify.

      i. Require companies submitting proposals use a nationally recognized modeling tool to estimate the energy output of the system. This allows for an equitable comparison of bids.

      ii. Require a shading analysis report for each proposed location so you understand the potential system output at each proposed location.

iii. Require a minimum annual energy production for the system based on solar resource availability. If the system doesn't meet that minimum requirement, penalize the installer for every kilowatt-hour not produced.

iv. Require companies submitting proposals to demonstrate financing ability.

v. Require the installer take full responsibility for obtaining permits from the appropriate government agencies. This should include meeting all local building codes as well as the National Electrical Code®

vi. Require the installer to take full responsibility for obtaining the interconnection agreement with the utility, including all drawings, schematics, and other required technical documentation.

vii. If the system is installed on the roof of a building, require the installer to be responsible for the integrity of the roof after the installation is completed. This may require working with the contractor that originally installed the roof to determine if the solar energy system installation will affect the roof warranty. Depending on the installation site, you may also wish to require a ballasted system, which requires little or no rooftop penetration.

e. Be conscious of the quantity and sophistication of likely respondents and, if your intent is to support the local market through municipal installations, design the solicitation to be compatible with local industry.

f. Post the solicitation publicly.

g. Use qualified, independent technical reviewers to help evaluate the proposals.

9. **Select a provider.** The Rahus Institute suggests looking for the following qualities in a provider[458]:
   a. A track record of accomplishment with this kind of transaction.
   b. Personal references that show experience working with solar electricity systems similar to yours.
   c. Financial partners with the substance and sophistication to follow through with the deal.
   d. Installation expertise and knowledge. Be sure the solar services provider works with experienced installers who have built a system under SPPA terms. The installer may continue to work closely for

many years with the solar services provider to ensure the system produces as expected.

e. Contract flexibility to support your needs. (But recognize that changes you make to the standard contract raise transaction expenses, potentially increasing your price for solar electricity.)
f. Monitoring and production reports and feedback. You pay for the power they say the system is producing, so you want to know exactly what you purchased. A defensible savings analysis. Is the company using the proper tariffs in its calculations? Is it providing realistic assumptions about your system's electricity output. Inflating output is the number one "fudge factor" used to exaggerate the benefits of solar electricity.
g. The ability to provide the best equipment for your installation location.

10. **Negotiate the PPA contract.** Devote sufficient monetary and staff resources, as well as time, to navigate the legal landscape. Since the contract negotiation phase takes time, setting deadlines and targets may be helpful in moving the process along. Consult with municipal energy managers and city or county lawyers who have been through the process so that you can more successfully navigate state laws, understand beneficial language to insert into the contract, and determine the strengths and weaknesses of various providers. Consult Chapter 6 of the Rahus Institute's "The Customer's Guide to Solar Power Purchase Agreements" for a list of successfully negotiated real-world PPA projects. The document contains names and contact information for key personnel involved in each project. Additionally, refer to Appendix 2 in the Rahus Institute's guide for information on solar PPA contracting.[459]
11. **Commission the project.** The local utility will check the installation's interconnection, inspectors will check that the electrical wiring is compliant with code, and the installer will ensure that the system is producing power at the expected levels.[460]
12. **Commit facility managers to work with the provider** to guarantee that they have access to the installation for maintenance and repairs, thus ensuring optimal operation.

Resources

DOE Solar America Cities

For more information on ways in which a municipality can promote solar energy, the U.S. Department of Energy's Solar America Cities program is a terrific resource to see what has been done around the county and current projects underway. http://www.solaramericacities.energy.gov/

DSIRESOLAR

The Database of State Incentives for Renewables & Efficiency has a solar specific website. The site details federal and state level incentives available to public and private entities. http://dsireusa.org/solar/

Sample Solar Request for Proposals

The Local Government Commission has compiled a number of sample RFPs that municipalities have used to procure PV installations. These documents have been used by municipalities to purchase equipment to own and operate, not to select a provider for a PPA. http://www.lgc.org/spire/rfps.html

2. Transition to Green Vehicle Fleets

Introduction/Summary

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.

Prior to the development of a fleet greening strategy, a comprehensive fleet inventory should be conducted. The fleet inventory should be evaluated to determine if vehicles are appropriate (size, engine) for the tasks they perform. Decision-makers can then downsize to smaller vehicles or replace less efficient models with non-motorized forms of transportation (e.g. bicycles). In addition to selecting a biodiesel blend instead of 100% petroleum diesel, municipalities can purchase hybrid and alternative fuel vehicles for additional fleet efficiency gains.

Green Fleets - Driver Training

	Municipal Government	Community-Wide
Initial Municipal Costs ($)	$ 1,935	
Rebate/Subsidy ($)	$ -	
Net Capital Cost ($)	$ 1,935	
Lifetime Municipal Costs ($)	$ 406,797	
Lifetime of Measure (Years)	20	
CO2 Reductions (Tons)	10	10
Gasoline Savings (Gallons)	1,000	1,000
Gasoline Savings ($)	$ 1,708	$ 1,708
Diesel Savings (Gallons)	67,028	67,028
Diesel Savings ($)	$ 119,135	$ 119,135

Costs/Impacts

Some components of a green fleets program are low-cost, such as switching to biodiesel for diesel-powered vehicles or implementing a driver training program. Vehicle purchases and conversions require larger upfront investments, which can be offset by New Jersey's Alternative Fuel Vehicle Rebate Program. Staff time will be required to coordinate green fleet strategies across municipal departments.

Driver Training

The benefits shown here are calculated based on EPA estimates that a driver training program generates fuel savings of at least 5%.[461] The costs assume that driver training for fuel efficiency is incorporated to an existing employee training schedule in the form of a hands-on training (led by a municipal employee) complemented with an online green driver training module.[462]

Input	Value	Notes (If savings are scaled to a certain level, please note here)
Lifetime of Measure (Years)		
Annual Electric Savings (MWh)		
Annual Natural Gas Savings (MMBtu)		
Annual Peak Load Reductions (kW)		
Gallons Reduced	5% x gallons of fuel	Multiply town's annual gallons of gasoline purchased by 0.05
VMT Reduced		
Custom Conversion (If gallons water --> electricity, etc)		
Tax Credits ($)		
Incentives ($)		
Capital Administrative Costs ($)		
Yearly Administrative Costs ($)		
Capital Costs to Municipality ($)	$1,935	Cost of instructor training, incurred every three years.
Yearly Costs to Municipality ($)	-5% x fuel costs +$20 x number of drivers	Multiple town's annual cost of gasoline purchases by -0.05 Online green driver course at $20 per employee, multiply by # of employee drivers for first year and every third year thereafter. Multiply by 0.19 * # of employee drivers for intervening years.
Capital Incremental Costs ($)		
Yearly Incremental Costs ($)		

Switch to Biodiesel

Through the NJ Office of Clean Energy, local governments can receive rebates on biodiesel purchases so that biodiesel can be purchased at a net cost equal to petrodiesel. Participants are reimbursed for the incremental costs of using biodiesel through the Biodiesel Fuel Rebate Program.[463] The most recent Alterative Fuels Price Report[464] shows B20 in the Northeast Region selling for $3.16 per gallon compared with $2.62 for regular petroleum diesel.[465]

Compared to 100% conventional diesel, using a B20 biodiesel blend affects emissions as follows: [466],[467]

* Carbon monoxide (CO) reduced by 11%

* Nitrogen oxides (NOx) increased by 2%

* Carbon dioxide (CO2) reduced by 15%

* Unburned hydrocarbons reduced by 21%

* Ozone forming potential reduced by 10%

* Sulfates reduced by 20%

* Carcinogenic polyaromatic hydrocarbons (PAHs) reduced by 13%

Input	Value	Notes (If Savings are scaled to a certain level, please note here)
Lifetime of Measure (Years)		
Annual Electric Savings (MWh)		
Annual Natural Gas Savings (MMBtu)		
Annual Peak Load Reductions (kW)		
GHG Emissions Reduced		15% reduction in C02 emissions Multiply annual fleet consumption of diesel fuel x 0.0101 metric tons CO2 per gallon[468] x 0.15 (for percent reduction)

		Other emissions factors[469]
VMT Reduced		
Custom Conversion (If gallons water --> electricity, etc)		
Tax Credits ($)		
Incentives ($)	$0.54 per gallon	Multiply by annual fleet consumption of diesel fuel, incentives are yearly as well
Capital Administrative Costs ($)		
Yearly Administrative Costs ($)		
Capital Costs to Municipality ($)		
Yearly Costs to Municipality ($)		
Capital Incremental Costs ($)		
Yearly Incremental Costs ($)	$0.54 per gallon	Multiply by annual fleet consumption of diesel fuel ($3.16-$2.62)

Purchase Hybrid Vehicles

This example compares the purchase of a state contract Toyota Prius at $20,294 with the purchase of a conventional compact sedan also offered under the state contract (Chevy Cobalt at $13,127).[470] According to fueleconomy.gov, the Prius is estimated to achieve 50 mpg versus 27 mpg for the Cobalt, generating significant annual fuel and emissions savings.[471] Costs and benefits are compared over 10 years of ownership.

Input	Value	Notes (If Savings are scaled to a certain level, please note here)
Lifetime of Measure (Years)	10	
Annual Electric Savings		

(MWh)		
Annual Natural Gas Savings (MMBtu)		
Annual Peak Load Reductions (kW)		
Gallons Reduced	243.6	Gallons of gasoline reduced by each hybrid purchase (compared to conventional vehicle), use to generate emissions savings based on standard factors
VMT Reduced		
Custom Conversion (If gallons water --> electricity, etc)		
Tax Credits ($)		
Incentives ($)	$4,000	New Jersey's Alternative Fuel Vehicle Rebate Program
Capital Administrative Costs ($)		
Yearly Administrative Costs ($)		
Capital Costs to Municipality ($)		
Yearly Costs to Municipality ($)	-243.6 x $/gallon of gasoline	Fuel savings based on 15,000 miles/year
Capital Incremental Costs ($)	$7,167	Difference between Prius at $20,294 and Cobalt at $13,127
Yearly Incremental Costs ($)		

__Purchase Natural Gas Vehicles__

The incremental cost of purchasing the Honda Civic GX (the only production light-duty natural gas vehicle currently on the market) in New Jersey is estimated as $6,935 with an annual fuel cost savings of $254, compared with a comparable gasoline vehicle.[472] Projected carbon emissions savings[473] are for typical annual vehicle mileage and usage. A $4,000 subsidy is available from New Jersey's Alternative Fuel Vehicle Rebate Program. Costs and benefits are compared over 10 years of ownership.

Compared to gasoline powered vehicles, typical NGVs reduce exhaust emissions of the following:

* Carbon monoxide (CO) by 70 percent,

* Non-methane organic gas (NMOG) by 87 percent,

* Nitrogen oxides (NOx) by 87 percent,

* Carbon dioxide (CO2) by almost 20 percent.

Input	Value	Notes (If Savings are scaled to a certain level, please note here)
Lifetime of Measure (Years)	10 years	
Annual Electric Savings (MWh)		
Annual Natural Gas Savings (MMBtu)		
Annual Peak Load Reductions (kW)		
CO2 emissions reductions	0.9 metric tons CO2	Per vehicle, based on average mileage and driving habits
VMT Reduced		
Custom Conversion (If gallons water --> electricity, etc)		
Tax Credits ($)		
Incentives ($)	$4,000	Per vehicle
Capital Administrative Costs ($)		
Yearly Administrative Costs ($)		
Capital Costs to Municipality ($)		
Yearly Costs to Municipality ($)	-$254	Fuel savings per vehicle
Capital Incremental Costs ($)	$6,935	Per vehicle
Yearly Incremental Costs ($)		

How to Do It

Designate a fleet manager to coordinate greening efforts and to convene a Green Fleet task force that includes personnel from each department responsible for vehicle purchasing, maintenance, and deployment. While staff can complete the fleet inventory and efficiency audit, local governments with larger fleets may benefit from hiring a consulting firm to conduct an evaluation of the existing fleet and recommend greening strategies.

1. First, complete an inventory of all existing motorized vehicles owned or operated by all municipal departments. Performing a fleet inventory allows a municipality to evaluate its current vehicles and equipment to better understand where efficiency might be improved. Depending on the availability of staff and existing records, it could take approximately four to six months to generate a fleet inventory and fuel efficiency audit for the existing fleet. Determine annual vehicle miles traveled and fuel efficiencies and calculate the associated greenhouse gas emissions. For additional guidance in performing an inventory, including a spreadsheet to assist with calculations, see the Sustainable Jersey Fleet Inventory action at
http://www.sustainablejersey.com/actiondesc.php?arr_num=109&id_num=12!

2. Conduct an efficiency audit by evaluating the inventory data. Consider opportunities for downsizing and vehicle replacements. Consider the appropriateness of each fleet vehicle for the specific duty requirements and identify opportunities for more fuel-efficient vehicles to carry out a similar function. Determine whether fleet vehicles are within acceptable miles per gallon ranges. Lookup vehicles in the EPA Green Vehicle Guide at http://www.epa.gov/smartway/vehicles/smartway-certified.htm to view ratings based on emissions and fuel economy. Evaluate passenger vehicle fuel efficiency in the context of the proposed 2012 Corporate Average Fuel Economy (CAFÉ) standard of 35 miles per gallon.[474]

Additionally, identify candidate vehicles for retrofitting or replacement, and evaluate driver training and maintenance practices.

3. Set specific targets to transition to a greener fleet. Targets must be measurable and include a timeframe.

Sample targets:

- Fuel all diesel vehicles with a B20 biodiesel blend by 2011.
- Reduce annual fuel expenditures by 20% in 4 years.
- Achieve an average fuel efficiency of 35 mpg for all passenger vehicles by 2012 (in line with proposed CAFÉ standards[475]).

- Beginning in 2011, all new light-duty vehicle purchases achieve EPA's SmartWay Certification and at least 50% of new vehicle purchases are SmartWay Elite.

See http://www.epa.gov/smartway/vehicles/smartway-certified.htm for details on the SmartWay certification. Currently only hybrid vehicles achieve the Smartway Elite certification. A wider range of vehicles are SmartWay certified, indicating that they reflect the greener choice within the vehicle class.

4. Identify strategies for fuel efficiency, vehicle purchases, vehicle conversions, driver training, and maintenance programs.

A. Fleet Management: If multiple departments are managing vehicles, consider centralizing fleet operations for efficiency savings. Establish procedures to maintain accurate, organized, and current vehicle records to provide a "baseline" of fleet data and to measure success from actions that are taken to reduce fuel use, costs, and emissions. Consider the purchase of specialized fleet management software to track vehicle licensing, maintenance, fuel usage, etc. Communities with larger fleets may be interested in telematics technology which uses GPS enabled devices to monitor vehicle movements. Driver behavior can be tracked to reduce idling and unnecessary vehicle use.

B. Downsize: Eliminate unnecessary vehicles and unnecessary trips. Share vehicles among staff members or departments and conduct municipal business by walking, biking, or public transit whenever possible. Eliminate take-home vehicles and any other private use of municipal vehicles. Sell off less fuel-efficient vehicles if more fuel-efficient models can accomplish the same task.

C. Driver Training: Save 5% or more on fuel purchases by training drivers to operate vehicles for maximum efficiency and reduce idling time. A driver's behavior significantly impacts vehicle fuel efficiency. To maximize fuel economy, minimize greenhouse gas emissions, and reduce vehicle maintenance, municipalities should offer driver training courses. Training can be conducted by qualified municipal staff or outside professionals. A number of training providers are now offering online courses for green driver training. Municipalities should conduct training for all employees who use vehicles in the fleet to improve driving habits and maximize fuel efficiency. Each new hire that will be operating a municipal vehicle should be taught the current driver efficiency protocols for their particular department. All employees should be updated every three years as a refresher course that can be included with other required training refresher courses, such as OSHA. Online driver training modules are offered by a number of providers.[476]

Examples of best practices to incorporate in a driver training program:

i) Turn off the vehicle if stopped for more than 10 seconds (unless in traffic) instead of idling.
ii) Avoid rapid starts and stops; use cruise control and drive smoothly.
iii) Leave enough space between vehicles to avoid excessive braking.
iv) Avoid using the A/C at speeds under 45 mph when rolling down the windows is more efficient. At faster speeds, the A/C is more efficient.
v) Don't carry unnecessary weight in the vehicle.
vi) Pack cargo inside the vehicle instead of on top of it to reduce drag.
vii) In snowy conditions, drive in other cars' snow tracks to decrease resistance.
viii) Driving in lower gears burns up more fuel. When using a manual transmission, move through the lower gears gently but quickly.

D. Maintenance: Revise maintenance practices to ensure that vehicles are operating at optimal efficiency and undergo regularly scheduled preventative maintenance. Leaking fluids, dirty filters and underinflated tires reduce vehicle performance. Require regular maintenance on all municipal vehicles to increase fuel efficiency, reduce environmental impacts, and increase the life of the vehicle. (e.g., avoid oil leaks, ensure proper tire inflation). Ensure proper use, storage, disposal, and recycling of old parts and hazardous materials. Use environmentally responsible materials (e.g., alternative hydraulic fluids, recycled anti-freeze, eco-friendly cleaners, etc.) to maintain fleet.

E. Switch to Biodiesel: Purchase B20 biodiesel blend (available through the state contract) to power all diesel vehicles in the fleet. Making the transition to biodiesel is simple as diesel vehicles manufactured after 1992 can use biodiesel without any modifications. In addition to being non-toxic and biodegradable, biodiesel produces fewer and less toxic air pollutants and greenhouse gases compared to conventional petroleum diesel. . While biodiesel can be utilized in its pure form (B100), it is more commonly employed as a blend of 20% biodiesel and 80% petroleum-diesel (B20) to avoid concerns of material compatibility and cold weather performance.[477]

The fleet manager should assess the municipal vehicle inventory and determine which vehicles can begin using biodiesel. The fleet manager should work with the town officials to determine whether an alternative fueling station will be installed or whether storage tanks will be used to hold biodiesel purchased from a supplier. The purchasing agent can negotiate with biodiesel suppliers, and the maintenance manager can coordinate fuel tank cleaning prior to arrival of the first biodiesel delivery and ensure that biodiesel dispensers have adequate filtering.

i) Identify vehicles: While all diesel engines can utilize biodiesel, it may affect the manufacturer warranties in some cases. Federal law protects against voided warranties in cases where the fuel was not the cause of the failure[478], and most engine companies have formally announced that the use of blends up to B20 will not void the parts and workmanship warranties. Despite these assurances, some warranties specify that the fuel must meet a ASTM D-6751 standard. The National Biodiesel Accreditation Commission (NBAC) issues a "Certified Biodiesel Marketer" seal of approval to fuel producers and marketers that have been audited to provide quality assurance to consumers. The seal reflects that the biodiesel meets the ASTM standards.[479] In addition to the seal, municipalities can check with potential suppliers to ensure that they offer warranties on their fuels.

ii) Determine how the fuel will be stored: Storage tanks for conventional diesel are well-suited to biodiesel storage. Those constructed of aluminum, steel, fluorinated polyethylene, fluorinated polypropylene, Teflon, and fiberglass are suitable for holding biodiesel. Some insurance companies or local regulations for fuel storage tanks may require an Underwriters Laboratories (UL) listing. While UL testing programs for storage and dispenser equipment is underway, the lack of UL certification may be a barrier to biodiesel use in some locations.[480] The maintenance manager should prepare storage prior to the delivery of fuel.

iii) Identify a fuel provider: Determine which blend of biodiesel to employ in the municipality's fleet. Most purchasers use B20 or lower blends that can be delivered by a petroleum distributor. The distributor is responsible for ensuring the biodiesel is blended properly. If low temperature use is a concern, specify in your purchase contract that the fuel must meet low-temperature operability requirements. Additionally, the suppliers' liability coverage may provide protection in the case that biodiesel usage causes engine damage that is not covered by the OEM's warranty.[481] The purchasing agent should identify potential suppliers using the listing of NJ biodiesel providers found here and negotiate a purchase contract. http://www.biodiesel.org/buyingbiodiesel/distributors/biomaps/biomaps.shtm#

iv) Apply for the Biodiesel Fuel Rebate Program to receive rebates that offset any difference in the cost of purchasing biodiesel versus conventional diesel. Read more at http://www.njcleanenergy.com/commercial-industrial/programs/alternative-fuels/biodiesel-fuel-rebate-program/biodiesel-fuel-rebate

F. Purchase alternative fuel and hybrid vehicles Use the fleet inventory to determine a vehicle replacement schedule. Amend bid specifications to require fuel efficiency. Replace less fuel-efficient vehicles with more fuel-efficient models and select hybrids or alternative fuel vehicles where feasible.

This measure demonstrates the impacts of purchasing a hybrid and natural gas vehicle. In addition municipalities might consider the purchase of flexible fuel, propane or electric vehicles. Conventional vehicles may also be modified to run on alternative fuels such as natural gas, propane, and electricity. These alternative fuel vehicles produce fewer emissions and therefore improve air and water quality in addition to public health. They are also more efficient than conventional vehicles and therefore reduce operating costs. Purchases of hybrids and alternative fuel vehicles as well as conversions of vehicles to alternative fuels are eligible for rebates under New Jersey's Alternative Fuel Vehicle Rebate Program.

i) Purchase Hybrid Vehicles: A hybrid electric vehicle derives driving power from both an internal combustion engine and a battery-powered electric motor which result in cleaner emissions, lower fuel costs, and higher fuel efficiency. Hybrids can achieve up to twice the fuel economy of a conventional car and produce 30 to 50 percent fewer greenhouse gas emissions.

Hybrids do not need to be plugged in to recharge the battery, as the battery recovers and stores energy normally lost as heat during braking through a process called regenerative braking. The battery is also recharged by the engine when it produces more power than is needed to drive the wheels. Because the electric motor provides extra power, gasoline engines in hybrids can be built smaller without compromising the vehicle's energy. Engine downsizing further increases the environmental performance of hybrids and their fuel economy.

Hybrid cars are roughly $3,000-$10,000 more expensive than their conventional counterparts but the higher purchase prices are offset by fuel savings and state rebates.

A comparison for the Toyota Prius was calculated above. Sample MSRPs for other hybrid models:

2009 Honda Civic Hybrid $23,550 vs. $20,005 for non-hybrid 2009 Civic

2009 Toyota Camry Hybrid $26,150 vs. $21,650 for non-hybrid 2009 Camry[482]

Sample SUV price under the NJ state cooperative purchasing contract:

2010 Ford Escape Hybrid 2WD $27,057 vs. $18,150 for 2009/2010 non-hybrid Escape 2WD[483]

ii) Purchase Natural Gas Vehicles

A natural gas vehicle runs on compressed natural gas (CNG) or liquefied natural gas (LNG). Natural gas is the cleanest burning of all fossil fuels, found in abundance in the U.S., and significantly less expensive than gasoline. Tests have shown that natural gas vehicles (NGVs) produce up to 20 percent less greenhouse gas (GHG) emissions than comparable gasoline vehicles and up to 15 percent less than comparable diesel vehicles. Because natural gas is such a clean burning fuel, carbon deposits in an engine are practically nonexistent which reduces cylinder and ring wear. This extends the life of the engine and minimizes the frequency of oil changes and tune ups. In addition, studies have shown that CNG is safer than gasoline as it dissipates harmlessly into the air and has a very low range of flammability.

The Honda Civic GX is the only production light-duty natural gas vehicle currently on the market. Another option is to purchase a used natural gas vehicle. Government agencies use a large number of light-duty NGVs that are often sold after reaching a certain age or mileage. See Federal agencies' used vehicles website at: http://www.autoauctions.gsa.gov/index.cfm (accessed 10/26/09).

In order to operate a CNG vehicle, a municipality must have access to a facility where the CNG vehicles can refuel. See CNG locations list: http://www.afdc.energy.gov/afdc/progs/ind_state.php/NJ/CNG

Alternatively, the municipality could install their own refueling system. For example, The FuelMaker 'Q' refueling appliance costs just under $10,000 plus installation while the Phill is priced at about $4,500 plus installation.

5. **Prioritize fleet greening strategies and adopt new policies to improve efficiency standards and green the municipal fleet.** Implement strategies and reevaluate fleet efficiency on an annual basis to track progress towards goals.

Resources

Funding Resources

New Jersey's Office of Clean Energy offers rebates for the purchase of alternative fuel or hybrid-electric vehicles. The vehicle incentives are as follows:

Light Duty (under 8,500 lbs): Up to $4,000
Medium Duty (8,500 - 14,000 lbs): Up to $7,000
Heavy Duty (over 14,000 lbs): Up to $12,000

New Jersey's Alternative Fuel Vehicle Rebate Program. http://www.njcleanenergy.com/commercial-industrial/programs/alternative-fuels/alternative-fuel-vehicle-rebate-program/alternative (accessed 10/26/09)

NJ Clean Energy Program Biodiesel Fuel Rebates.
http://www.njcleanenergy.com/commercial-industrial/programs/alternative-fuels/biodiesel-fuel-rebate-program/biodiesel-fuel-rebate (accessed 10/22/09)

The U.S. Department of Energy Office of Efficiency and Renewable Energy has a complete database of State & Federal Incentives and Laws related to alternative fuels and vehicles, air quality, fuel efficiency, and other transportation related topics:

New Jersey summary:
http://www.afdc.energy.gov/afdc/progs/state_summary.php/NJ (accessed 10/26/09)
Federals summary:
http://www.afdc.energy.gov/afdc/progs/fed_summary.php/afdc/US/0 (accessed 10/26/09)

General Resources

US Department of Energy Office of Efficiency & Renewable Energy Alternative Fuels & Advanced Vehicles Data Center

Hybrid vehicles: http://www.afdc.energy.gov/afdc/vehicles/hybrid_electric.html (accessed 10/26/09)

Natural Gas vehicles: http://www.afdc.energy.gov/afdc/vehicles/natural_gas.html (accessed 10/26/09)

The British Columbia Green Fleets information management page provides a Fuel Management Systems and Maintenance Management Systems Checklist to help your fleet establish a data baseline.
http://greenfleetsbc.com/index.php?option=com_content&task=view&id=67&Itemid=83 (accessed 11/16/09)

Clean Fleets Toolkit

Sustainable Earth Initiative and the San Francisco Department of the Environment-
http://www.sfenvironment.org/downloads/library/clean_fleets_toolkit__greening_commercial_fleet.pdf (accessed 11/16/09)

Greening Fleets: A road map to lower costs and cleaner corporate fleets

http://innovation.edf.org/page.cfm?tagID=27202&redirect=greenfleet (accessed 11/16/09)

New Jersey Clean Cities Coalition-http://www.njcleancities.org/ (accessed 11/16/09)

The U.S. Department of Energy Office of Efficiency and Renewable Energy and the U.S. Environmental Protection Agency provide information on alternative fuel and hybrid vehicles, tax incentives, energy impact scores and a fuel cost calculator. www.fueleconomy.gov (accessed 10/26/09)

Case Studies

Edison, NJ

"Hybrid Fleet Takes the Road in Edison"- http://edisonnj.org/index.asp?Type=B_DIR&SEC={82EC73D0-2E00-4880-A87A-EBCCF965B6AC}&DE={2202B1BE-82F9-4A85-8C86-F55D66B7C25B}

"Blue Goes Green: Police use Hybrid Vehicles". http://www.edisonnj.org/index.asp?Type=B_DIR&SEC={82EC73D0-2E00-4880-A87A-EBCCF965B6AC}&DE={4F1ABD10-999B-40B0-A641-20F65671F434}

Woodbridge, NJ

"Woodbridge Mayor John E. McCormac Announces Purchase of 12 Hybrid Vehicles to Supplement Township Fleet". http://www.twp.woodbridge.nj.us/Portals/7/breakingnews/WDBG_NEWS/environmentalhybridcarpr22807.html

Westwood, NJ

" Hybrid Police Patrol Vehicles Praised". http://icma.org/pm/9006/public/feature1.cfm?author=Robert%20S.%20Hoffmann&title=Hybrid%20Police%20Patrol%20Vehicles%20Praised

Bergen County, NJ

Police department conversion of a Ford Crown Victoria into a propane-gasoline bi-fuel hybrid. http://americancityandcounty.com/pubwks/fleets_alt_fuels/alternative-fuel-police-vehicle-demands-200901/

New York, NY

Introduction of hybrid cars to fleet of police response vehicles. http://www.nyc.gov/html/nypd/html/pr/pr_2009_014.shtml

Parks Department: Greening the Fleet. http://www.nycgovparks.org/sub_about/go_greener/greening_fleet.html

Chicago, IL

How the City of Chicago is Reducing Its Fleet Carbon Footprint. http://www.greenfleetconference.com/uploads/GFC/files/Matt_Stewart_GFC_2009_WEB_Presentation.pdf

Seattle, WA

"A Clean and Green Fleet: An *Updated* Action Plan for the City of Seattle" August 2007. http://www.cityofseattle.net/fleets/docs/ClnGrnFltPlan_Sea_07Update.pdf

Ann Arbor, MI

Green Fleets Policy

http://www.a2gov.org/government/publicservices/systems_planning/energy/Documents/systemsplanning_greenfleetspolicy_2005-07-01.pdf

Green Fleets Website (includes annual reports). http://www.a2gov.org/GOVERNMENT/PUBLICSERVICES/SYSTEMS_PLANNING/ENERGY/Pages/GreenFleets.aspx

Inglewood, CA

How the City of Inglewood Won NAFA's Green Fleet Award. http://www.greenfleetconference.com/uploads/GFC/files/Rick_Longobart_GFC_2009_WEB_Presentation.pdf

Oakville, Ontario

"Sustainable Green Fleet Guide". http://www.oakville.ca/Media_Files/2009SustainableGreenFleetGuide.pdf

Driver Training Resources

The Drive Smarter Challenge. http://drivesmarterchallenge.org/money-saving-tips/Default.aspx (accessed 10/26/09)

EcoDriving USA.http://www.ecodrivingusa.com/#/be-an-ecodriver/ (accessed 10/26/09)

Manual. http://www.ecodrivingusa.com/files/EcoDriving_Manual.pdf (accessed 11/23/09)

Gas Mileage Tips from fueleconomy.gov. http://www.fueleconomy.gov/feg/drive.shtml (accessed 10/26/09)

A Glance at Clean Freight Strategies.

Drivers Training (EPA factsheet).
http://www.epa.gov/smartway/documents/drivertraining.pdf (accessed 10/26/09)

Training providers:

Environmental Defense Fund: fuel-smart driver training programs

http://blogs.edf.org/innovation/2009/06/11/greener-drivers-driver-training-programs-can-boost-fuel-efficiency-for-corporate-fleets/ (accessed 10/26/09)

Green Driver. http://www.greendriver.com/home/ (accessed 12/22/09)
Driving Green. http://www.adtsweb.com/adts.drivegreen.html (accessed 12/22/09)
PHH GreenFleet. http://www.phharval.com/home/news-and-media/press-releases/185-phh-arval-launches-phh-greenfleet-driver-training (accessed 12/22/09)
FuelClinic Fleet Ecosystem.
http://www.fuelclinic.com/index.cfm/page/fuelclinic_for_fleets (accessed 12/22/09)

Biodiesel Resources

National Biodiesel Board (NBB) www.biodiesel.org

List of OEMs and their position statements regarding warranties
www.biodiesel.org/resources/fuelfactsheets/standards_and_warranties.shtm

The DOE Clean Cities Program summarizes state and local laws and incentives related to alternative fuels www.eere.energy.gov/cleancities/vbg/progs/laws.cgi

Biodiesel Fuel Rebate Program (NJ OCE).
http://www.njcleanenergy.com/commercial-industrial/programs/alternative-fuels/biodiesel-fuel-rebate-program/biodiesel-fuel-rebate

Contact John Zarzycki 973-648-4967 for more information.

Case Study: Arlington, VA http://www.hrccc.org/images/Arlington_B20_Study_1-05_-s.pdf

Hybrid Vehicle Resources

See the Alternative Fuels and Advanced Vehicles Data center for more details on hybrid electric vehicle availability.
http://www.afdc.energy.gov/afdc/vehicles/hybrid_electric_availability.html

HybridCars.com provides a gas calculator that compares the fuel economy of any new vehicle to a gas-electric car in terms of annual gas consumption, emissions of greenhouse gases, and other tailpipe pollutants.
http://www.hybridcars.com/calculator/

Natural Gas Vehicle Resources

See the Alternative Fuels and Advanced Vehicles Data center for more details on natural gas vehicle availability.
http://www.afdc.energy.gov/afdc/vehicles/natural_gas_availability.html

3. Enact a Small Wind Energy Ordinance to Enable Greater Wind Energy Generation

Introduction

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).[484] 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.[485] A $500 incentive is offered to municipalities that pass a wind energy ordinance.

The New Jersey Board of Public Utilities initiated the New Jersey Small Wind Working Group in 2006, recognizing that there are many opportunities to develop small, terrestrial wind projects around the state. The group identified restrictive local land use codes and ordinances as a major barrier to the deployment of small wind systems at the local level.[486] To overcome this obstacle, the group developed a NJ Small Wind Energy System Ordinance, which is designed to be used as a zoning ordinance.[487] This model ordinance is meant to facilitate the permitting of small wind energy installations while protecting public health and safety without sacrificing the efficiency of the system or increasing its cost.[488] Nine municipalities across the state have passed small wind energy system ordinances based on the Working Group's model ordinance.[489]

Pass Small Wind Ordinance

	Municipal Government	Community-Wide
Initial Municipal Costs ($)	$ (500)	
Rebate/Subsidy ($)	$ 500	
Net Capital Cost ($)	$ (1,000)	
Lifetime Municipal Costs ($)	$ (500)	
Lifetime of Measure (Years)	20	
CO2 Reductions (Tons)		2,670
NOx Reductions (Lbs)		8,712
SO2 Reductions (Lbs)		30,765
Electricity Savings (MWh)		4,380
Electricity Savings ($)		$ -
Natural Gas Savings (MMBtu)		-
Natural Gas Savings ($)		$ -

Costs/Impacts

The costs of creating, implementing, and enforcing the ordinance should be minimal (or even zero if existing personnel and/or volunteers are used). The drafting, review, and approval of the ordinance may involve limited professional consultant and attorney review and staff time to learn about small wind energy systems. Notification of community members regarding the new policy could include preparation and distribution of informational materials. Enforcement costs may be incurred to ensure that the wind energy system site and installation meet all relevant codes and standards, however these should present only a very modest increase in staff time if enforcement occurs during normal staff work routines.

Local Fiscal Impacts

Lifetime of measure	Indefinite
Initial Cost	$0
Rebate	$500
Cost after Rebate	-$500
Annual Savings/Cost	$0
Years to Payback	
Net Present Value	

While the Small Wind Ordinance does not provide any energy savings directly, it does encourage the development of clean energy systems that may off-set consumption of electricity supplied by the traditional fuel mix for New Jersey, which is primarily nuclear and coal-fired generation.[490,491,492493,494] Emissions savings are calculated using the emissions rates for the fuel mix of New Jersey. The total number of wind energy systems, and resulting electricity generation, will depend upon a municipality's size and ordinance restrictions.[495]

Energy and Emissions Impacts

Energy impacts (annually)	Per participant	
Electricity off-sets	219,000 kWh	
Natural Gas off-sets[496]	N/A	
Emissions Savings (annually)	Per participant	
CO_2		
NO_x		
SO_2		

How To:

1. **Draft and approve an ordinance** specific to the implementing municipality that is substantially based on the model ordinance developed by the NJ BPU. Access the language of the ordinance at http://www.njcleanenergy.com/files/file/SmallWindModelOrdinance111907.pdf.
2. **The ordinance can be simply used as a conditional use permit** for a small wind turbine by inserting the following sections of the model ordinance into the municipality's zoning ordinance[497]:
   a. 00.05 Standards
   b. 00.06 Permit Requirements
   c. 00.07 Abandonment
3. **Notify community members about new policies governing wind energy systems.** This can be done via existing outreach mechanisms such as community newsletters and a municipal web page.
   a. Communicate that users of the ordinance for wind energy systems must receive all necessary permits from the NJ Department of Environmental Protection (DEP). Compliance with the ordinance does not constitute compliance with DEP rules for those permits nor does it constitute compliance with the Uniform Construction Code (N.J.A.C. 5:23).[498]
4. **Enforce site standards for installation sites upon issuing a permit.** Once the wind energy system is installed, ensure that all installation codes and standards have been met.

Resources:

Examples of Small Wind Ordinances Passed

The New Jersey Board of Public Utilities has compiled a number of small wind ordinances passed by municipalities around the state that were based on the Small Wind Model Ordinance developed by the NJ Small Wind Working Group. The ordinances can be accessed through the BPU's website. http://www.njcleanenergy.com/renewable-energy/technologies/wind/small-wind-systems/small-wind-systems

American Wind Energy Association (AWEA)

AWEA developed their own small wind model ordinance that can be accessed through their website. http://www.awea.org/smallwind/documents/modelzo.html
AWEA created a guide for state and local governments title, "In the Public Interest: How and Why to Permit for Small Wind Systems." The document contains suggestions for supportive zoning regulations.
http://www.awea.org/smallwind/pdf/InThePublicInterest.pdf

Small Wind Toolbox

This website can assist policy-makers in the do's and don'ts of zoning to support small wind energy systems.
http://www.awea.org/smallwind/toolbox/IMPROVE/zoning.asp

MEASURES TO REDUCE VMT

1. Create Complete Streets

2. Achieve Critical Mass to Support Walkable Communities and Public Transit

3. Provide Alternative Transportation Incentives

4. Institute Safe Routes to School

5. Establish Green Business Recognition Programs and Buy Local Campaigns

1. Create Complete Streets

Introduction/Summary

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.

A Complete Streets policy is not a design prescription, nor is it a mandate for immediate installation of sidewalks and bike lanes on every road. Rather, pedestrian and bicycle facilities will be built incrementally as roads are constructed and reconstructed, using existing federal, state, and local funding sources. In other cases, facilities will be built to address critical needs separate from road construction. Each road will be individually designed to meet local travel and safety needs. However, streets designed to serve *all* users should become the norm, and design plans that do not achieve this must be justified and approved through a structured process.

This measure can be implemented on its own or in combination with other transportation and land use measures.

Establish complete streets policy or Complete Streets

	Municipal Government	Community-Wide
Initial Municipal Costs ($)	$ 6,500	
Rebate/Subsidy ($)	$ -	
Net Capital Cost ($)	$ 6,500	
Lifetime Municipal Costs ($)	$ 6,500	
Lifetime of Measure (Years)	30	
CO2 Reductions (Tons)		62,362
VMT Reduced (Miles)		32,247,140
Gasoline Savings (Gallons)		1,596,393
Gasoline Savings ($)		$ 2,214,274

Costs/Impacts

Costs

The cost to implement a Complete Streets policy is low to moderate. This measure requires staff time to accomplish the following:[499]

- Developing a Complete Streets policy that addresses how the policy will be adopted in the municipality's routine roadway planning, design, and implementation. See the Resources section for example policies.
- Restructuring how municipal procedures are implemented in order to accommodate all users on every project.
- Educating and integrating the policy into the work of municipal planners, engineers, and planning and zoning board members.
- Creating data collection procedures to begin to track how well the streets are serving all users.

At higher cost, revising the circulation element of a master plan, hiring consultants, or hosting a workshop of experts is also an option to make sure the policy and procedures work for your town.

Establishment of a Complete Streets policy is anticipated to be a one-time cost.

Example costs:

Staff time for policy development $ 5,000.00

Assumes 66 hours of staff time at a cost of $75 per hour.

Training seminar for municipal staff and Board members $ 1,500.00

Assumes a cost of $100 per person for 15 people.

Optional – Consultant-led revision of Circulation Element of Master Plan
$25,000.00

Installation of facilities for pedestrians, bicyclists, and transit users are expected to be constructed as part of routine street construction and reconstruction. Implementation of the policy will increase construction costs over the status quo, however it is much less expensive to include these features as part of a larger construction project than to conduct a retrofit at a later date. In addition, providing multi-modal transportation options in the short-run has the potential to reduce long-term demand for roadway expansion.

For the purposes of estimating the additional construction costs of a complete streets policy, it can be assumed that it will add 10%-15% to project cost, therefore add 10%-15% to the jurisdiction's annual road construction budget.

Note – Look up average municipal street budget in calculating increased cost. This will be available from the local government's capital budget.

Impacts

Greenhouse gas reduction impacts of a complete streets policy are difficult to predict because of the complex relationship between land uses, densities, and transportation networks. The report Moving Cooler[500] examined previous studies of the relationship between transportation infrastructure, density, and vehicle miles travelled (VMT), and found a change in VMT from -1.5% to -12.7% in suburban areas and from -0.05% to -3.8% in urban areas resulting from improvements to the walking and bicycling environment, depending on the intensity of improvements. These reductions were applied to the population affected by the improvements, assumed to be within a half mile of an improved roadway.

For the purposes of our analysis an impact on VMT of -5.0% is assumed in suburban and exurban areas that are undergoing development and an impact of -1.5% is assumed in fully developed areas (cities, villages and older suburbs). Furthermore, it is assumed that the complete streets improvements will reach 25% of the population by full implementation, and that this part of the population is responsible for 25% of the home-based VMT in the municipality. Therefore, the VMT reduction from a Complete Streets policy can be estimated as follows. It is important to keep in mind that the estimate relies on significant assumptions; an impact analysis study of the selected policy would be needed to more accurately predict its effects.

Note – Find average annual % municipal roadway constructed/reconstructed to determine years to compete implementation.

Community type [developed = -0.015; developing = 0.05] x home-based annual daily average VMT x 0.25 x 365 = Annualized VMT reduction

To translate this into changes in pounds of CO_2 emissions from transportation, VMT is multiplied by the national average fuel economy for a light-duty vehicle (20.2 mpg) [501] to estimate the number of gallons of gasoline consumed, then the resulting number is multiplied the average CO_2 emissions from one gallon of gasoline (19.562 lbs)[502]

VMT x 20.2 x 19.562 = Lbs CO_2 annual reduction

Local Fiscal Impacts

Lifetime of measure	**permanent**
Initial Cost	$6,500-$31,500
subsidy	
Cost after subsidy	$6,500-$31,500
Annual Savings/Cost	
Years to Payback	
Net Present Value	

How to Do It

A Complete Streets policy can be established at the municipal or county level of government.

Timeframe

A policy can be researched, drafted and adopted within six months. Changes to street infrastructure will occur as part of routine street construction and reconstruction, therefore will be a gradual and ongoing process.

Who should be involved

Municipal administrator, engineer, planning professionals, related staff, and elected leaders should be involved in creating the Complete Streets policy.

Recommended action plan

The following is a recommended action plan for a municipal-led initiative to develop and implement a Complete Streets policy.[499]

1. Municipal administrator, engineer, planning professionals, related staff, and elected leaders meet to discuss current roadway policies and decision-making

structures and how to best adapt them to the Complete Streets approach whereby all user needs are addressed.

2. Staff, possibly with assistance from consultants, write a policy that addresses how the Complete Streets policy will be formally adopted into the municipality's comprehensive planning and decision-making processes, including the master plan. The policy should establish internal protocols so that different departments are working together toward the same outcomes. Sources of example policies are provided in Resources below.

3. Planners, engineers and planning and zoning board members are educated and informed about the new procedures and protocols and are instructed to adopt the Complete Streets approach. In particular, the municipal governing body will direct its engineering and planning professionals to follow the Complete Streets policies for all road construction projects that are considered outside the planning board process, by including Complete Streets policy specifications in its bidding documents and through duly adopted Resolutions.

4. Create data collection procedures to track how well the streets are serving all potential users.

Resources

Model Complete Streets policy from U.S. Department of Transportation (U.S. DOT) Design Guidance, Accommodating Bicycle and Pedestrian Travel:
http://www.fhwa.dot.gov/environment/bikeped/design.htm

Developing language for Complete Streets policy:

http://www.fhwa.dot.gov/environment/bikeped/design.htm#d4

Examples of municipal policies and resolutions from the National Complete Streets Coalition:

http://www.completestreets.org/complete-streets-fundamentals/complete-streets-atlas/

Examples of municipal resolutions:

http://www.completestreets.org/completestreets/Tab1-%20Early%20Success%20Stories/Complete_Streets_Policies.pdf

Workshops offered by the National Complete Streets Coalition:

http://www.completestreets.org/changing-policy/workshops/

2. Achieve Critical Mass to Support Walkable Communities and Public Transit

Introduction

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 vehicle miles traveled (VMT) would be reduced.[503]

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 municipality can promote infill development through tax abatement, redevelopment, transfer of development rights, rezoning, and other methods. Additionally, a municipality can change parking incentive structures to support non-auto density (e.g., set parking maximums, remove minimums).

Costs/Impacts

The ballpark cost of planning for increased density, including master plan revisions and a fiscal impact analysis, would be approximately $50,000. Grant funding to offset these costs may be available through the New Jersey Department of Environmental Protection, Department of Transportation, or Office of Smart Growth.

The emission reductions and energy savings that result from reduced VMT vary greatly depending on the density achieved and the complementary strategies employed to support alternative forms of transportation. While the impacts are too variable to estimate here, research suggests that doubling residential density across a metropolitan area might lower household VMT by about 5 to 12 percent, and perhaps by as much as 25 percent, if coupled with higher employment concentrations, significant public transit improvements, mixed uses, and other supportive demand management measures.[504]

How to Do It

The Planning Board could lead efforts to develop a long-term redevelopment plan that increases the city's density and reduces vehicle miles traveled (VMT). Planning consultants would likely be hired to analyze scenarios and recommend revisions to the master plan and zoning ordinance. These studies and revisions would take about a year or two to complete, depending on the availability of data.

1. Analyze scenarios for increasing density:

A fiscal impact analysis and an air quality and energy analysis would be needed to evaluate various scenarios for increasing density. The fiscal impact analysis would be necessary because the precise impact on municipal costs and revenues would be affected by the mix of proposed dwelling units. Similarly the air quality and energy analysis would evaluate the impacts of various scenarios of increased density on these factors.

2. Revise the city's master plan and zoning ordinance:

The effects of compact, mixed-use development on VMT are likely to be enhanced when this approach is combined with other measures that make alternatives to driving relatively more convenient and affordable. Examples of such measures include a street network that provides good connectivity between locations and accommodates non-vehicular travel, well-located transit stops, and good neighborhood design. Likewise, demand management measures, such as reducing the supply and increasing the cost of parking, can complement efforts to reduce VMT.[505]

Studies suggest that it is necessary to have moderate net residential densities (exclusive of streets and other public improvements) of at least 7 to 15 dwellings per acre in order to support "'moderately convenient transit service' (by rapid transit, buses, and taxis)."[506] Assuming that for mature communities, public streets and other public improvements represent 20 percent of each acre (with the result being that 80 percent is developable), 7 to 15 dwelling units per net acre would be 5.6 to 12 units per gross acre (or 7 units * 0.8 =5.6; 15 units * 0.8 = 12).

The municipality would need to prepare and adopt a new land use element for the city's master plan and enact a new zoning ordinance to reflect plan revisions. Revisions to the circulation element may also be necessary. Increased density must be matched with well-located transit stops, frequency of transit services, good neighborhood design, and enhanced pedestrian and biking options.

3. Implementation:

Implementation would occur over time, gradually increasing the density of the community as developers assembled parcels for reuse and redevelopment. The strategy may take as long as 30 to 40 years to implement successfully, assuming continued and steady commitment by elected and appointed officials. It would also depend on the market for such units and the strength of the local economy to support this expansion.

Resources

(1) New Jersey Office of Smart Growth Smart Growth Grants

Over the past several years, the Office of Smart Growth has offered $3 million annually for Smart Growth grants. However, for the fiscal year 2009-2010, the program has been suspended. Office of Smart Growth website: http://www.nj.gov/dca/divisions/osg/

(2) New Jersey Department of Transportation (NJDOT) Transit Village Initiative

The Transit Village Initiative creates incentives for municipalities to redevelop or revitalize the areas around transit stations using design standards of transit-oriented development (TOD) create attractive, vibrant, pedestrian-friendly neighborhoods where people can live, shop, work and play without relying on automobiles. Designation provides a municipality with the following benefits:

State of New Jersey commitment to the municipality's vision for redevelopment.

Coordination among the state agencies that make up the Transit Village Task Force.

Priority funding from some state agencies.

Technical assistance from some state agencies.

Eligibility for grants from the New Jersey Department of Transportation (NJDOT).

Program website: http://www.state.nj.us/transportation/community/village/

(3) DEP Local Government Greenhouse Gas Reduction Grant Program

This New Jersey Department of Environmental Protection (DEP) grant program is intended to support New Jersey's local government efforts to plan, develop, and implement measures that reduce greenhouse gas emissions through programs that result in energy efficiency, renewable energy, distributed energy and sustainable land use planning. This program will cover certain land use planning and transportation planning activities, including amending a municipal master plan to establish, prioritize, and enact municipal greenhouse gas reduction policies and actions, the development and implementation of supportive design guidelines and zoning standards, and the development and implementation of integrated land use and circulation plans aimed at reducing VMT. Program website: http://nj.gov/dep/opsc/ghggrant.html

3. Provide Alternative Transportation Incentives

Introduction/Summary

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.[507] 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.

Establish public employee incentive program for alt. transport use

	Municipal Government	Community-Wide
Initial Municipal Costs ($)	$ 5,000	
Rebate/Subsidy ($)	$ -	
Net Capital Cost ($)	$ 5,000	
Lifetime Municipal Costs ($)	$ 174,485	
Lifetime of Measure (Years)	30	
CO2 Reductions (Tons)		99
VMT Reduced (Miles)		204,160
Gasoline Savings (Gallons)		10,107
Gasoline Savings ($)		$ 16,534

Costs/Impacts

Costs

An employee commute trip reduction program is relatively inexpensive, requiring staff time to plan and administer the program. The government may partner with the transportation management association for their county to help plan and administer their program. Depending on the scope of the program and the number of employees participating, it may also include non-administrative costs such as one-time installation of a shower/locker room, installation of a bicycle parking area, or technology and training investments to permit secure, efficient telecommuting. If direct monthly incentives are provided, the cost of those must be included.

Example costs:

Staff time for policy development $5,000.00

Assumes 66 hours of staff time at a cost of $75 per hour.

Total One-time Cost **$5,000.00**

Annual administrative cost $12,000.00

Assumes 20 hours staff time per month at a cost of $50 per hour.

Annual parking cash-out of $1/day/parking stall[508] $2,320.00

Assumes 50 employees with 232 working days per year take advantage of the cash-out 20% of the time. (50 * 232 * 0.20 = $2,320)

Total Annual Cost **$14,320.00**

Impacts

The 2009 report *Moving Cooler* estimated that a comprehensive program of employer support for alternative commute methods would result in a reduction of VMT per employee of 5.2% - 6.2%.[509] For the purpose of estimating the GHG reduction impact of an alternative transportation incentives program, a 5% annual reduction in VMT for commute-related VMT associated with the employer is assumed. Furthermore, it is assumed that all employees are offered the program.

Determining the impact for a given employer requires the following information:

- Number of employees offered the program
- Average round trip commute distance, available from the US Census or an employee travel survey
- Number of working days in a year

Example impact:

A municipality has 50 employees. The average one-way commute distance for the municipality is 8 miles, determined an employee survey, so the average daily round trip commute distance is 16 miles. Each employee works an average of 232 days per year, accounting for holidays, vacation, and personal time. Therefore, the current annual vehicle miles traveled (VMT) for commuting is:

50 x 16 x 232 = 185,600 VMT

Following program implementation, the annual commuting VMT declines by 5% or 9280 miles to 176320 miles.

VMT can be converted to GHG by dividing by the average fuel economy for a light duty vehicle (20.2 mpg[510]) then multiplying by the average CO_2 emissions from a gallon of gasoline (19.562 lbs/gallon[511]). The result is an annual CO_2 reduction of 3,667,014 lbs.

Local Fiscal Impacts

Lifetime of measure	
Initial Cost	$5,000
subsidy	
Cost after subsidy	$5,000
Annual Savings/Cost	$14,320
Years to Payback	
Net Present Value	

How to Do It

In order to select the right incentives for an alternative transportation incentives program, a committee is established to develop the program, a survey is conducted of employee commute behavior, and opportunities and barriers to commute alternatives are identified at each worksite. The government may partner with the transportation management association (TMA) for their county[512] to plan their program, provide educational presentations and promotional materials for employees, and provide rideshare matching services.

Timeframe

Creation of an alternative transportation incentives program can be accomplished within six months and is anticipated to be an ongoing program.

Who should be involved

The municipal or county administrator and staff should take the lead in developing the program, working closely with department heads. Union and non-union employees should have a meaningful opportunity to comment on the program as it is being developed, and may serve on a planning committee.

Recommended action plan

1. Establish a program planning committee.

The committee should include representatives of the major departments as well as representation by employee groups and the governing body.

2. Conduct a survey of employee commute practices.

Determine how employees are getting to work now at all government worksites by administering a brief survey. The survey should include questions about employees travel time, distance, and home location. It can also contain questions that gauge interest/willingness to use alternatives that could be promoted under the program, such as carpooling or transit.

3. Conduct a scan of commuting conditions at all worksites.
The scan should answer questions such as:

- What transit is available?
- How suitable are nearby roads for walking and cycling?
- Do employees need to travel regularly in their own vehicles for work?
- Do employees have regular work tasks that could be completed by part-time telecommuting?

4. Select the alternative transportation incentives for your program:
Critically evaluate the suitability of alternative transportation incentives found in guides such as Commuter Choice[513] and the Online TDM Encyclopedia[514], based on the findings of the employee commute survey and scan. The government should partner with the TMA for their county to help plan their program. TMAs can also provide assistance with rideshare (carpool and vanpool) matching, education, and promotion.

Common program elements include:

- <u>Commuter Financial Incentives</u> (Parking Cash Out and Transit Allowances) – enables employees to receive a direct subsidy from their employer to pay for commuting expenses such as parking or transit fares, or use pre-tax income for these expenses
- <u>Rideshare Matching</u> – helps employees find carpool and vanpool partners[515]
- Alternative Scheduling (Flextime and Compressed Work Weeks) – enables employees to work fewer days per month, thereby reducing their commuting
- <u>Telecommuting</u> – enables employees to work from home
- <u>Guaranteed Ride Home</u> – supports ridesharing, transit and bicycling by providing an alternative means to get home during personal emergencies, such as for a sick child
- <u>Walking and Cycling Encouragement</u> – provide a supportive environment and assistance with planning walking and cycling routes
- <u>Bicycle Parking and Changing Facilities</u> – encourages cycling by providing secure and weather-protected parking and a place to change during warmer weather

Resources

Commuter Choice – Federal resource for information about alternative transportation incentive programs.

http://www.commuterchoice.com/

Online TDM Encyclopedia – A web-based guide for implementing alternative transportation incentives from the Victoria Transportation Policy Institute.

http://www.vtpi.org/tdm/index.php

NJ Transportation Management Associations – Regional organizations that help employers plan and administer alternative transportation incentive programs.

http://www.state.nj.us/transportation/commuter/smartmoves/tmaprograms.shtm

4. Institute Safe Routes to School

Introduction/Summary

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.

Implement a Safe Routes to School program

	Municipal Government	Community-Wide
Initial Municipal Costs ($)	$ 5,750	
Rebate/Subsidy ($)	$ -	
Net Capital Cost ($)	$ 5,750	
Lifetime Municipal Costs ($)	$ 5,750	
Lifetime of Measure (Years)	30	
CO2 Reductions (Tons)		22
VMT Reduced (Miles)		44,550
Gasoline Savings (Gallons)		2,205
Gasoline Savings ($)		$ 3,608

Costs/Impacts

Costs

The cost to implement most non-infrastructure SRTS programs is generally low. This measure requires staff time to accomplish the following:

- Assemble a SRTS Team (town-wide or individual by school)
- Develop a School Travel Plan(s)

- Plan and implement a Walk and/or Bike to School Event(s)
- Evaluate the SRTS Program

Significant photocopy or printing costs may be needed for announcing walk/bike to school events and for surveys/assessment tools for evaluation.

Giveaways and incentives like reflective stickers, zipper pulls, t-shirts, bike gear, etc. to reward students that walk or bike are not necessary but are recommended. Providing free bicycle helmets to low-income residents is recommended.

SRTS grants are available from the New Jersey Department of Transportation (NJDOT) Division of Local Aid. In addition, other state agency grant programs may be used for SRTS activities. A listing of funding opportunities can be found on the NJDOT SRTS website.[516]

Example costs:

Staff time for policy development	$5000.00
Assumes 66 hours of staff time at a cost of $75 per hour.	
Printing and reproduction	$ 750.00
Total	$5750.00

Impacts

The GHG reduction impact of a SRTS program is based on assumptions about participation in the program. For the purposes of the impact assessment the following assumptions are made: 10% of students in grades 3-8 participate in a walking or bicycling program, and these students walk or bicycle 100 days per school year.[517] Forty-five percent of these students formerly traveled to school in a family vehicle.[518] School bus routes are assumed to remain the same, so no impact is received from students who switch from busing to walking or cycling.

So, for a school with 600 students in grades 3-8, 60 participate in the program, and 27 of these formerly rode in a family vehicle, resulting in 2700 school trips saved. Assuming an average round trip distance of 0.75 mi. results in an annual VMT reduction of 2,025 miles.

VMT can be converted to GHG by dividing by the average fuel economy for a light duty vehicle (20.2 mpg[519]) then multiplying by the average CO_2 emissions from a gallon of gasoline (19.562 lbs/gallon[520]). The result is an annual CO_2 reduction of 1,961 lbs.

Key data points needed to make a case-specific impact assessment include:

- Student population, 3rd through 8th grade. This is the typical grade range for SRTS programs.
- Percentage of students traveling to school in a family vehicle, which can be determined through a travel survey.
- Average round trip walking distance to school, which can be estimated through professional judgment or determined through a travel survey.

Local Fiscal Impacts

Lifetime of measure	
Initial Cost	$5,750
subsidy	
Cost after subsidy	$5,750
Annual Savings/Cost	
Years to Payback	
Net Present Value	

Social and Environmental Impacts

	Annual		Lifetime	
	Government	Community-wide	Government	Community-wide
GHG reduction		1,961 lbs.		
kWh/Therms/gallons reduced				
Criteria Air Pollutants				
Other				

How to Do It

Guides to planning and implementing a SRTS program can be found in the "Getting Started" section of the NJDOT SRTS website and on the Sustainable Jersey website.

Timeframe

The following tasks can be accomplished simultaneously:

Develop a SRTS Team (town-wide or individual by school): 1-3 months

Develop Travel Plan(s) and prioritize locations for physical improvements: 1-12 months

Plan and implement Walk and/or Bike to School Event(s): 1-5 months

Evaluate Your SRTS Program: 1-6 months

Who should be involved

All levels of municipal and school governments should be informed of the Safe Routes to School program and be provided with information to distribute so they may serve as a resource for residents.

The leadership for a SRTS initiative can be initiated from many different groups. Municipal government can include engineers, planners and enforcement. School administrators can include principals, superintendents and teachers. Elected officials can include Mayors, council members and Board of Education members. Don't forget to reach out to parents (parent-teacher organizations), crossing guards, neighborhood associations, environmental and community groups, etc.

At a minimum, representatives from the school and municipal administration and/or governments and police/municipal traffic safety officer(s) should be involved.

Recommended action plan

1. Build a Safe Routes to School Team.

See "Build a Safe Routes to School Team" fact sheet at:

http://www.state.nj.us/transportation/community/srts/pdf/building.pdf

2. Develop a Basic Travel Plan for Each School.

A Safe Routes to School Travel Plan "maps out" how to improve pedestrian and bike travel to and from school for the purpose of increasing the number of students and parents who bike or walk to school and/or improving safety.

3. Plan and Implement a Walk and/or Bike to School Event.

Walk and bike to school events are planned activities designed to enhance and support SRTS programs by providing a specific occasion to involve students in walking or biking to school.

4. Evaluate and Monitor Your SRTS Program.

Evaluating your Safe Routes to School efforts is a key component in order to assess the impact of your projects and programs.

Resources

New Jersey Department of Transportation – Safe Routes to School Program

http://www.state.nj.us/transportation/community/srts

New Jersey Department of Transportation - How to Get Started: SRTS Implementation Costs

http://www.state.nj.us/transportation/community/srts/pdf/srts_costs.pdf

New Jersey Safe Routes to School Resource Center at the Alan M. Voorhees Transportation Center, Rutgers University

http://policy.rutgers.edu/vtc/srts

New Jersey Bicycle and Pedestrian Resource Center

http://www.njbikeped.org/

National Center for Safe Routes to School

http://www.saferoutesinfo.org/

Safe Routes to School National Partnership

http://saferoutespartnership.org/

International Walk to School in the USA

http://www.walktoschool.org/

National Center for Bicycling and Walking

http://www.bikewalk.org/saferoutestoschool.php

5. Establish Green Business Recognition Programs and Buy Local Campaigns

Introduction

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 vehicle miles traveled (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.[521]

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.[522] 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.

Promote green businesses and buy local campaigns

	Municipal Government	Community-Wide
Initial Municipal Costs ($)	$ -	
Rebate/Subsidy ($)	$ -	
Net Capital Cost ($)	$ -	
Lifetime Municipal Costs ($)	$ -	
Lifetime of Measure (Years)	30	
CO_2 Reductions (Tons)		1
VMT Reduced (Miles)		1,780
Gasoline Savings (Gallons)		88
Gasoline Savings ($)		$ 144

Costs/Impacts

Dozens of towns across the country have initiated robust Buy Local Campaigns. Surveys of businesses in these communities consistently report an average 2% increase in sales when compared to respondents from towns that did not conduct a Buy Local effort. Assuming that a Green Business Recognition Program will further enhance local economic activity, local governments that implement these programs are likely to experience notable decreases in vehicle miles traveled.

2%[523] X shopping trip miles (NJTPA data) = assumed mileage reduction

How to do it:

Buy Local[524]:

1. Form a committee consisting of various representatives from local government, the business community, and civic organizations dedicated to revitalization efforts. This step can also be accomplished if municipalities already have an existing committee focusing on green initiatives.

2. Set up eligibility rules and requirements. Distinguish between what should and should not qualify as locally-owned.

3. Set a launch date to promote the Buy Local campaign. To ensure a successful launch event, work alongside local businesses and media outlets to design a press conference for the kick off.

4. Develop an awareness and marketing campaign that consists of a program name, promotional materials, and a memorable slogan and campaign logo. To save money, seek out donations for promotional material supplies and services.

5. Create materials and information packets that local businesses can utilize.

6. Utilize personal and professional business connections to recruit local businesses and associations to join the Buy Local campaign.

7. Following the launch, continually promote the benefits of buying local and maintain efforts to improve name recognition and participation. Survey businesses to determine impacts of the campaign.

Green Business Recognition Program:

1. Form a Green Business Recognition Program committee. In order to ensure a successful program, committee members should consist of individuals from the business community, local environmental organizations, and the local Chamber of Commerce. After committee members are selected, initiate a program timeline and launch date.

2. Determine the various standards that recognized Green Businesses will have to meet. Participation requirements can range anywhere from comprehensive business inspections to straightforward pledges to reduce waste and pollution. When designing the rules for participation, the Green Business committee should take into consideration the effectiveness in achieving a desirable environmental outcome and the likelihood that businesses will carry out various requirements. Business membership renewal requirements should also be taken into consideration. For a

more detailed explanation of potential business requirement strategies, visit the following link:

http://sustainablejersey.com/listview.php?pagename=act8tb&actid=4&subactid=0&actionlist=5

3. Identify incentives to reward recognized businesses. Consider publicity and tax incentives to reward performance.

4. As with the Buy Local campaign, design a comprehensive marketing strategy consisting of a program name and slogan and various promotional materials. The two initiatives can be promoted together.

5. Committee members should designate someone to administer the Green Business Recognition Program. Administrative responsibilities may include determining business eligibility and recognition requirements or simply promoting the program on a continual basis. Administrative duties may be allocated to a current municipal official or can be designated to a member of the committee.

6. Determine a budget for the program, while considering such factors as promotional materials, labor, and potential financial incentives for business participants. Some aspects of the budget can be supported by donations and contributions from committee members and co-sponsors.

7. To ensure a successful launch event, work alongside local businesses and media outlets to design a press conference. Once the business participants are identified, publish and distribute a directory that highlights the recognized Green Businesses.

8. Update the program based on emerging best practices. As with the Buy Local campaign, continually promote the Green Business Recognition Program and develop strategies to further improve name recognition and participation. Conduct surveys of businesses to identify program impacts.

Resources

Sustainable Jersey Green Business Recognition Programhttp://sustainablejersey.com/action.php?pagename=act8tb&actid=4

Middlesex County Go Green, Save Greenhttp://co.middlesex.nj.us/gogreen/index.html

Sustainable Jersey Buy Local Campaignhttp://sustainablejersey.com/action.php?pagename=act8tb&actid=3

Portland Buy Localhttp://portlandbuylocal.org/

Baltimore Buy Localhttp://www.buylocalbaltimore.com/

WATER EFFICIENCY MEASURES

1. Adopt a water conservation ordinance

2 Encourage water efficiency in new single-family homes

3 Encourage water efficiency in new and existing municipal buildings

4 Encourage water efficiency in new and existing commercial buildings

5 Encourage water efficiency in existing single-family homes

1. Adopt a water conservation ordinance

Introduction:

Increasing population and development strain New Jersey's natural resources, particularly water. Many watersheds in New Jersey are in deficit as impervious surfaces reduce groundwater recharge while anthropogenic uses withdraw more water than nature can replenish. Just as unsustainable use jeopardizes future supplies, ecological functions also become impaired as a result. Supplying communities with water and collecting wastewater requires elaborate infrastructure and maintenance. Costs associated with maintaining the infrastructure as well as wastewater treatment increase as water use increases.

In order to address growing concerns about droughts, water shortages, and rising costs, a municipality 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.[525] 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[526], to reform water consumption in your community.

The implementation of this ordinance will not only decrease unnecessary water and energy consumption, but it will also prevent individuals from damaging their property through the use of over-watering. Contrary to popular belief, water conservation ordinances actually promote healthier lawn care techniques, because excessive watering is harmful to lawns and undermines the turf's overall drought tolerance.[527] By adopting a straightforward water conservation ordinance that follows the guidelines of the NJDEP, communities can eliminate excessive seasonal outdoor water use without sacrificing the health and aesthetic quality of residential and commercial lawns.

Adopt a Water Conservation Ordinance

	Municipal Government	Community-Wide
Initial Municipal Costs ($)	$ -	
Rebate/Subsidy ($)	$ -	
Net Capital Cost ($)	$ -	
Lifetime Municipal Costs ($)	$ -	
Lifetime of Measure (Years)	10	
CO2 Reductions (Tons)		0
NOx Reductions (Lbs)		1
SO2 Reductions (Lbs)		3
Electricity Savings (MWh)		0
Electricity Savings ($)		$ 45
Natural Gas Savings (MMBtu)		-
Natural Gas Savings ($)		$ -
Water Savings (Gallons)		150,000
Water Savings ($)		$ 606

Costs/Impacts:

Overall costs to carry out this measure are minimal, and extensive training for monitoring and enforcement responsibilities will not be required. Costs related to staff time and legal review will vary depending on the local government's unique situation. Expenses associated with informing the community of the new regulations can be offset by combining ordinance information with regularly scheduled community mailings and publications.

Adopting a water conservation ordinance is less expensive and more effective when compared to other policy approaches. Educational and awareness programs are expensive and complicated to organize. Increasing prices to lower consumption can be politically controversial and problematic for consumers. The following table demonstrates the effectiveness of each of the three policy approaches at lowering seasonal water consumption:

Comparisons Between Water Conservation Ordinances, Price Increases, and Educational Programs at Reducing Water Demand.[528]

Measure	Water Conservation Ordinance	Water Price Increase	Educational/ Awareness Program
Estimated Overall Decrease in Water Demand	29%	1.6%	8%

As a whole, water conservation ordinances are superior in terms of cost and impact savings. The following chart details the impact savings achieved by implementing a two day per week water conservation ordinance:

2 Day/Per Week Water Conservation Ordinance Impact Savings	
Impact Category	To Annual Savings
Total Water Reduction[529]	30%
Water (million gallons)[530]	Total water savings= Annual Municipal water use *.30. If data is unavailable, Use 300 gallons per day/per household. (300*# of households*365*.30)
Total Energy (MWh)[531]	Total= 2700 kWh/mg * total water savings
CO_2 (Tons)	

How to do it:

1. Convene appropriate staff to develop a water conservation ordinance that includes the following NJDEP provisions:

- The conservation provisions apply at all times and not just in drought or water emergency situations.
- Each household is restricted to watering no more than 2 days per week. For each of these days, the time allocated for watering a single area is restricted to 30 minutes.
- Outline an appropriate and effective penalty system to deter individuals from violating the rules of the ordinance.

Recommended:

Watering is most effective when conducted in the early morning hours. Less water evaporates compared to later in the day when higher temperatures facilitate evaporation. Watering early also prevents fungal growth that thrives in dark, wet conditions to maintain a healthier lawn.

Consider cost-effective strategies, such as scheduling watering times concurrent with garbage pickups to reduce monitoring costs.[532]

Require all automatic irrigation systems to be equipped with an operational rain sensor. New Jersey state law mandates that all irrigation systems installed after September 8, 2000 include rain sensors. Extending this requirement to all irrigation systems will further reduce unnecessary outdoor water consumption. The retrofit is inexpensive and can also be accomplished as a condition of home sale.
To refer to the NJDEP sample ordinance, please visit the following link:
http://www.njssi.org/uploaded_documents/waterordinance.pdf

2. Once the water conservation ordinance is drafted, notice the public and host readings according to customary legal processes.

3. Have the legislative body adopt the ordinance, and be sure the designated entity responsible for enforcing the ordinance is prepared to do so.

4. Continue to educate the public about the water conservation ordinance provisions as well as the benefits. Evaluate water demand reductions and report savings to the community to encourage water conservation activities.

Resources:

NJ Department of Environmental Protection Sample Ordinance:
http://www.njssi.org/uploaded_documents/waterordinance.pdf

Highlands, New Jersey Water Conservation Ordinance:
http://www.njssi.org/uploaded_documents/highlandsmodelwater.pdf

Sustainable Jersey Water Ordinance Information:
http://sustainablejersey.com/editor/doc/act9tb3sa1.pdf

American Water Resources Association (AWRA):http://www.awra.org/

2. Encourage water efficiency in new single-family homes

Introduction

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, a municipality may enact an ordinance to reduce permitting fees for new single-family homes that achieve WaterSense-labeled new home certification.[533]

An easy way to reduce the quantity of water used per person per day is to select WaterSense-labeled fixtures such as faucets, showerheads, and toilets. These fixtures offer a greater degree of efficiency, therefore reducing water used without altering usage patterns.

Currently, federal standards require that lavatory faucets and faucet aerators manufactured after 1994 use no more than 2.2 gallons per minute. WaterSense-labeled faucets offer a greater degree of efficiency over 1994 federal standards. For example, lavatory faucets for private bathrooms have a maximum flow rate of 1.5 gallons per minute, .7 gallon per minute savings over federal standards.

Increase water efficiency in new residential buildings

	Municipal Government	Community-Wide
Initial Municipal Costs ($)	$ -	
Rebate/Subsidy ($)	$ -	
Net Capital Cost ($)	$ -	
Lifetime Municipal Costs ($)	$ -	
Lifetime of Measure (Years)	10	
CO2 Reductions (Tons)		5
NOx Reductions (Lbs)		7
SO2 Reductions (Lbs)		-
Electricity Savings (MWh)		-
Electricity Savings ($)		$ -
Natural Gas Savings (MMBtu)		79
Natural Gas Savings ($)		$ 856
Water Savings (Gallons)		131,910
Water Savings ($)		$ 533

Costs/Impacts

Indoor water use for a typical single family home is 69.3 gallons per capita per day[534]. WaterSense-labeled new homes reduce the total amount of water used by 20% or 13.9 gallons, to 55.4 gallons per capita per day[535].

Scenario: (per capita and average household #)

Assuming the national average household size in of 2.6 occupants[536], achieving WaterSense-labeled new home certification will save a total of 36.1 gallons per household per day, or 13,191gallons per household per year[537]. This is a savings of approximately $52.76 annually in water costs per household per year.[538] In addition, energy savings through reduced hot water heating needs will be about 480 cu ft of natural gas. This will save approximately $6.00 annually in energy bills. [539]

Scenario: (municipal-wide)

Based on participations rates of similar green building incentive programs nationwide, assume a 5% annual increase in the percentage new home projects that will take advantage of reduced permit fees for achieving WaterSense-labeled new home certification. By the time this ordinance is in place for four years, a 20% level of participation is anticipated.

East Orange

The city of East Orange adds on average, 41[540] new units per year. On this forth year, it is anticipated that 20% or 8 of the 41 units will take advantage of reduced permit fees by achieving WaterSense-labeled new home certification.

If an average household using WaterSense-labeled fixtures saves approximately 13,191 gallons of water per year, these 8 new homes will reduce annual water consumption in East Orange by 105,528 gallons per year. In addition, 3,840 cu ft of natural gas will be saved through reduced hot water heating needs.[541]

Edison

The city of Edison adds on average, 184[542] new units per year. On this forth year, it is anticipated that 20% or 37 of the 184 units will take advantage of reduced permit fees achieving WaterSense-labeled new home certification.

If an average household using WaterSense-labeled fixtures saves approximately 13,191 gallons of water per year, these <u>37</u> new homes will reduce annual water consumption in Edison by 488,067 gallons per year. In addition, 17,760 cu ft of natural gas will be saved through reduced hot water heating needs.[543]

Fort Lee

The city of Fort Lee adds on average, 91[544] new units per year. On this forth year, it is anticipated that 20% or 18 of the 91 units will take advantage of reduced permit fees achieving WaterSense-labeled new home certification

If an average household using WaterSense-labeled fixtures saves approximately 13,191 gallons of water per year, these 18 new homes will reduce annual water consumption in Fort Lee by 237,438 gallons per year. In addition, 8,640 cu ft of natural gas will be saved through reduced hot water heating needs.[545]

Howell Twp.

Howell Twp. adds on average, 141[546] new units per year. On this forth year, it is anticipated that 20% or 28 of the 141 units will take advantage of reduced permit fees by achieving WaterSense-labeled new home certification

If an average household using WaterSense-labeled fixtures saves approximately 13,191 gallons of water per year, these 28 new homes will reduce annual water consumption in Howell Twp. by 369,348 gallons per year. In addition, 13,440 cu ft of natural gas will be saved through reduced hot water heating needs.[547]

Middletown

Middletown adds on average, 82[548] new units per year. On this forth year, it is anticipated that 20% or 16 of the 82 units will take advantage of reduced permit fees by achieving WaterSense-labeled new home certification

If an average household using WaterSense-labeled fixtures saves approximately 13,191 gallons of water per year, these 16 new homes will reduce annual water consumption in Middletown by 211,056 gallons per year. In addition, 7,680 cu ft of natural gas will be saved through reduced hot water heating needs.[549]

Montclair

Montclair adds on average, 25[550] new units per year. On this forth year, it is anticipated that 20% or 5 of the 25 units will take advantage of reduced permit fees achieving WaterSense-labeled new home certification

If an average household using WaterSense-labeled fixtures saves approximately 13,191 gallons of water per year, these 5 new homes will reduce annual water consumption in Montclair by 65,955 gallons per year. In addition, 2,400 cu ft of natural gas will be saved through reduced hot water heating needs.[551]

Parsippany – Troy Hills

Parsippany—Troy Hills adds on average, 65[552] new units per year. On this forth year, it is anticipated that 20% or 13 of the 65 units will take advantage of reduced permit fees by achieving WaterSense-labeled new home certification

If an average household using WaterSense-labeled fixtures saves approximately 13,191 gallons of water per year, these 13 new homes will reduce annual water consumption in Parsippany by 171,483 gallons per year. In addition, 6,240 cu ft of natural gas will be saved through reduced hot water heating needs.[553]

Perth Amboy

The city of Perth Amboy adds on average, 48[554] new units per year. On this forth year, it is anticipated that 20% or 10 of the 48 units will take advantage of reduced permit fees by achieving WaterSense-labeled new home certification

If an average household using WaterSense-labeled fixtures saves approximately 13,191 gallons of water per year, these 10 new homes will reduce annual water consumption in Perth Amboy by 131,910 gallons per year. In addition, 4,800 cu ft of natural gas will be saved through reduced hot water heating needs.[555]

Plainfield

The city of Plainfield adds on average, 27[556] new units per year. On this forth year, it is anticipated that 20% or 5 of the 27 units will take advantage of reduced permit fees by achieving WaterSense-labeled new home certification

If an average household using WaterSense-labeled fixtures saves approximately 13,191 gallons of water per year, these 5 new homes will reduce annual water consumption in Plainfield by 65,955 gallons per year. In addition, 2,400 cu ft of natural gas will be saved through reduced hot water heating needs.[557]

West Orange

The city of West Orange adds on average, 67[558] new units per year. On this forth year, it is anticipated that 20% or 13 of the 67 units will take advantage of reduced permit fees by achieving WaterSense-labeled new home certification

If an average household using WaterSense-labeled fixtures saves approximately 13,191 gallons of water per year, these 13 new homes will reduce annual water consumption in West Orange by 171,483 gallons per year. In addition, 6,240 cu ft of natural gas will be saved through reduced hot water heating needs.[559]

Willingboro Twp.

Willingboro Twp. adds on average, 47[560] new units per year. On this forth year, it is anticipated that 20% or 9 of the 47 units will take advantage of reduced permit fees by achieving WaterSense-labeled new home certification

If an average household using WaterSense-labeled fixtures saves approximately 13,191 gallons of water per year, these 9 new homes will reduce annual water consumption in Willingboro Twp. by 118,719 gallons per year. In addition, 4,320 cu ft of natural gas will be saved through reduced hot water heating needs.[561]

Local Fiscal Impacts

	WaterSense-labeled fixtures (faucets, showerheads, toilets)
Lifetime of Measure (Years)	10
Annual Electric Savings (MWh)	
Annual Natural Gas Savings	
Annual Peak Load Reductions (kW)	
Gallons Reduced	13.9 gallons per capita per day562
VMT Reduced	
Custom Conversion (If gallons water --> electrcity, etc)	
Tax Credits ($)	
Incentives ($)	
Capital Administrative Costs ($)	
Yearly Administrative Costs ($)	
Capital Costs to	

Municipality ($)	
Yearly Costs to Municipality ($)	
Capital Incremental Costs ($)	
Yearly Incremental Costs ($)	

How to Do it

In order to meet this measure the municipality must pass an ordinance to reduce permitting fees for major renovation projects that use WaterSense-labeled products or equivalent.

In adopting this green building ordinance, the municipality must consider the following: [563]

1. Involve representatives from existing volunteer boards, such as the Planning and Zoning Boards, environmental commission, and redevelopment and housing agencies, as well as municipal staff, especially the Zoning Official, Construction Code Official, and planner should be involved with this action.

2. Set a timeframe. Timeframes to implement the components will vary; however they can be pursued at the same time. Adopting a green building ordinance will take between one and three months.

3. Take in account the project costs and resource needs. Developing a green building ordinance will require municipal staff time; however costs should be minimal and likely will be related to legal professional fees.

4. Execute. In order to compensate for revenue lost through reduced permit fees, the municipality should develop two construction fee formulas; one for conventional building, and a second formula for green building. In determining both formulas, the municipality must project an anticipated level of participation in the reduced permit fee incentive. Revenue lost from reduce permit fees can be recovered by raising permit fees for conventional building.

Resources:

Sustainable Jersey. www.sustainablejersey.com

EPA WaterSense. http://www.epa.gov/watersense/

U.S. Environmental Protection Agency WaterSense Program. Water Savings and Energy Calculator. http://www.epa.gov/WaterSense/calculator/index.htm.

U.S. Department of Energy Federal Energy Management Program. Energy Cost Calculator for Faucets and Showerheads. http://www1.eere.energy.gov/femp/technologies/eep_faucets_showerheads_calctml

Energy Efficient Rehab Advisor. http://www.rehabadvisor.pathnet.org/

H20USE: Water Saver Home http://www.h2ouse.net/index.cfm

3. Encourage water efficiency in new and existing municipal buildings

Introduction

Managing water 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 a existing municipal buildings, a municipality 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.[564]

An easy way to reduce the quantity of water used in commercial buildings is to select WaterSense-labeled faucets and toilets. These fixtures offer a greater degree of efficiency, therefore reducing water used without altering usage patterns.

Currently, federal standards require that lavatory faucets and faucet aerators manufactured after 1994 use no more than 2.2 gallons per minute. WaterSense-labeled faucets offer a greater degree of efficiency over 1994 federal standards. Lavatory faucets for private bathrooms have a maximum flow rate of 1.5 gpm, a .7 gallon per minute savings over federal standards.

Increase water efficiency in new & existing muni buildings

	Municipal Government	Community-Wide
Initial Municipal Costs ($)	$ -	
Rebate/Subsidy ($)	$ -	
Net Capital Cost ($)	$ -	
Lifetime Municipal Costs ($)	$ -	
Lifetime of Measure (Years)	10	
CO2 Reductions (Tons)	1	1
NOx Reductions (Lbs)	1	1
SO2 Reductions (Lbs)	-	-
Electricity Savings (MWh)	-	-
Electricity Savings ($)	$ -	$ -
Natural Gas Savings (MMBtu)	15	15
Natural Gas Savings ($)	$ 134	$ 134
Water Savings (Gallons)	255,600	255,600
Water Savings ($)	$ 1,033	$ 1,033

Costs/Impacts

Selecting a WaterSense-labeled faucet at a flow rate of 1.5 gpm will consume 12.15 gallons per capita per day. Typical faucets produced after 1994 with a flow rate of

2.2 gpm will consume 17.82 gallons per capita per day. Switching to a WaterSense-labeled faucet will save 5.67 gallons per capita per day.[565]

Selecting a WaterSense-labeled toilet that consumes 1.3 gallons of water per flush will consume 6.57 gallons of water per capita per day. Typical toilets which use at least 3.5 gallons of water per flush will consume 17.67 gallons per capita per day. Switching to a WaterSense-labeled toilet will save 11.10 gallons per capita per day. [566]

Scenario: (per 20,000 SF building)

Assume that conventional 20,000 SF commercial office building consumes between 116,400 – 140, 600 gallons of water annually.[567] By switching to WaterSense-labeled products that building can save an estimated 20% or 23,000 – 28,120 gallons of water per year. This is a savings of approximately $102 annually in water costs per year.[568] In addition, this building will save 1,520 kBtu per year through reduced hot water heating.

Local Fiscal Impacts

	WaterSense-labeled fixtures (faucets, showerheads, toilets)
Lifetime of Measure (Years)	10
Annual Electric Savings (MWh)	.076 kBtu/sf/yr 569
Annual Natural Gas Savings	
Annual Peak Load Reductions (kW)	
Gallons Reduced	
VMT Reduced	
Custom Conversion (If gallons water --> electrcity, etc)	
Tax Credits ($)	
Incentives ($)	
Capital Administrative Costs ($)	
Yearly Administrative Costs ($)	

Capital Costs to Municipality ($)	
Yearly Costs to Municipality ($)	
Capital Incremental Costs ($)	
Yearly Incremental Costs ($)	

How to Do it

In order to meet this measure the municipality must enact 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.[570]

In adopting this green building ordinance, the municipality must consider the following: [571]

1. Involved representatives from existing volunteer boards, such as the planning and zoning boards, environmental commission, and redevelopment and housing agencies, as well as municipal staff, especially the zoning official, construction code official, and planner should be involved with this action.
2. Set a timeframe. Timeframes to implement the components will vary; however they can be pursued at the same time. Adopting a green building policy will take between one and three months.
3. Take into account the project costs and resource needs. Developing a green building policy will require municipal staff time; however costs should be minimal and likely will be related to legal professional fees.
4. Execute. Specify WaterSense-labeled or equivalent low flow fixtures. EPA WaterSense high-efficiency toilets (1.28 gpf), dual-flush toilets (1.6/1.1 gpf), or low-flow (1.1 gpf) toilets.

Resources:

Sustainable Jersey.www.sustainablejersey.com

EPA WaterSense.http://www.epa.gov/watersense/

U.S. Environmental Protection Agency WaterSense Program. Water Savings and Energy Calculator. http://www.epa.gov/WaterSense/calculator/index.htm.

U.S. Department of Energy Federal Energy Management Program. Energy Cost Calculator for Faucets and Showerheads.
http://www1.eere.energy.gov/femp/technologies/eep_faucets_showerheads_calctml

Whole Building Design Guide – Protect and Conserve Water
http://www.wbdg.org/design/conserve_water.php

4. Encourage water efficiency in new and existing commercial buildings

Introduction

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 a municipality 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.[572]

An easy way to reduce the quantity of water used in commercial buildings is to select WaterSense-labeled faucets and toilets. These fixtures offer a greater degree of efficiency, therefore reducing water used without altering usage patterns.

Currently, federal standards require that lavatory faucets and faucet aerators manufactured after 1994 use no more than 2.2 gallons per minute. WaterSense-labeled faucets offer a greater degree of efficiency over 1994 federal standards. Lavatory faucets for private bathrooms have a maximum flow rate of 1.5 gpm, a .7 gallon per minute savings over federal standards.

Increase water efficiency in new & existing com buildings

	Municipal Government	Community-Wide
Initial Municipal Costs ($)	$ -	
Rebate/Subsidy ($)	$ -	
Net Capital Cost ($)	$ -	
Lifetime Municipal Costs ($)	$ -	
Lifetime of Measure (Years)	10	
CO2 Reductions (Tons)		2
NOx Reductions (Lbs)		3
SO2 Reductions (Lbs)		-
Electricity Savings (MWh)		-
Electricity Savings ($)		$ -
Natural Gas Savings (MMBtu)		34
Natural Gas Savings ($)		$ 295
Water Savings (Gallons)		102,240
Water Savings ($)		$ 413

Costs/Impacts

Selecting a WaterSense-labeled faucet at a flow rate of 1.5 gpm will consume 12.15 gallons per capita per day. Typical faucets produced after 1994 with a flow rate of 2.2 gpm will consume 17.82 gallons per capita per day. Switching to a WaterSense-labeled faucet will save 5.67 gallons per capita per day.[573]

Selecting a WaterSense-labeled toilet that consumes 1.3 gallons of water per flush will consume 6.57 gallons of water per capita per day. Typical toilets which use at least 3.5 gallons of water per flush will consume 17.67 gallons per capita per day. Switching to a WaterSense-labeled toilet will save 11.10 gallons per capita per day.[574]

Scenario: (per 20,000 SF building)

Assume that conventional 20,000 SF commercial office building consumes between 116,400 – 140, 600 gallons of water annually.[575] By switching to WaterSense-labeled products that building can save an estimated 20% or 23,000 – 28,120 gallons of water per year. This is a savings of approximately $102 annually in water costs per year.[576] In addition, this building will save 1,520 kBtu per year through reduced hot water heating.

Scenario: (municipal-wide) (total sq footage commercial building sector)

East Orange

The city of East Orange adds on average 62,931[577] square feet of new commercial space and renovates on average 125,862[578] square feet of existing commercial space. This totals 188,793 square foot of construction per year (approximately nine, 20,000 sq. ft. office buildings).

In the introductory year it is anticipated that 20% of new and existing commercial buildings will select WaterSense-labeled fixtures. Therefore 37,758 square feet of the total 188,793 square feet will take advantage of the reduced permitting fees for selecting WaterSense-labeled fixtures (approximately two, 20,000 sq. ft office building).

Assuming a baseline case of 5.82 - 7.03 gallons of water per SF per year, this 37,758 square feet of new and existing commercial space will consume between 219,751 – 265,439 gallons of water if typical plumbing fixtures are used. By switching to WaterSense-labeled products that building can save an estimated 20% or 43,950 – 53,089 gallons of water per year.

Note: 8% of total site energy is consumed by water heating in commercial buildings.[579] If ASHRAE 90.1-2007 requires a base of 4.76 kBtu/sf/yr [580], .38 kBtu/sf/yr will be devoted to water heating. A 20% reduction in water use will therefore save .076 kBtu/sf/yr. This anticipated 37,758 square feet of new office space will save 2,869 kBtu per year.

Edison

Edison adds on average 232,512[581] square feet of new commercial space and renovates on average 465,024[582] square feet of existing commercial space. This totals 697,536 square foot of construction per year (approximately thirty-five, 20,000 sq. ft. office buildings).

In the introductory year it is anticipated that 20% of new and existing commercial buildings will select WaterSense-labeled fixtures. Therefore 139,507 square feet of the total 697,536 square feet will take advantage of the reduced permitting fees for selecting WaterSense-labeled fixtures (approximately seven, 20,000 sq. ft office buildings).

Assuming a baseline case of 5.82 - 7.03 gallons of water per SF per year, this 139,507 square feet of new and existing commercial space will consume between 811,931 – 980,734 gallons of water if typical plumbing fixtures are used. By switching to WaterSense-labeled products that building can save an estimated 20% or 162,386 – 196,146 gallons of water per year.

Note: 8% of total site energy is consumed by water heating in commercial buildings.[583] If ASHRAE 90.1-2007 requires a base of 4.76 kBtu/sf/yr [584], .38 kBtu/sf/yr will be devoted to water heating. A 20% reduction in water use will therefore save .076 kBtu/sf/yr. This anticipated 139,507 square feet of new office space will save 10,602 kBtu per year.

Fort Lee

The city of Fort Lee adds on average 124,310[585] square feet of new commercial space and renovates on average 248,620[586] square feet of existing commercial space. This totals 372,930 square foot of construction per year (approximately eighteen, 20,000 sq. ft. office buildings).

In the introductory year it is anticipated that 20% of new and existing commercial buildings will select WaterSense-labeled fixtures. Therefore 74,586 square feet of the total 372,930 square feet will take advantage of the reduced permitting fees for selecting WaterSense-labeled fixtures (approximately four, 20,000 sq. ft office building).

Assuming a baseline case of 5.82 - 7.03 gallons of water per SF per year, this 74,586 square feet of new and existing commercial space will consume between 434,091 – 524,340 gallons of water if typical plumbing fixtures are used. By switching to WaterSense-labeled products that building can save an estimated 20% or 86,818 – 104,868 gallons of water per year.

Note: 8% of total site energy is consumed by water heating in commercial buildings.[587] If ASHRAE 90.1-2007 requires a base of 4.76 kBtu/sf/yr [588], .38 kBtu/sf/yr will be devoted to water heating. A 20% reduction in water use will therefore save .076 kBtu/sf/yr. This anticipated 74,586 square feet of new office space will save 5,669 kBtu per year.

Howell Twp.

Howell Twp. adds on average 177,660[589] square feet of new commercial space and renovates on average 355,320[590] square feet of existing commercial space. This totals 532,980 square foot of construction per year (approximately twenty seven 20,000 sq. ft. office buildings).

In the introductory year it is anticipated that 20% of new and existing commercial buildings will select WaterSense-labeled fixtures. Therefore 106,596 square feet of the total 532,980 square feet will take advantage of the reduced permitting fees for selecting WaterSense-labeled fixtures (approximately five 20,000 sq. ft office building).

Assuming a baseline case of 5.82 - 7.03 gallons of water per SF per year, this 106,596 square feet of new and existing commercial space will consume between 620,389 – 749,370 gallons of water if typical plumbing fixtures are used. By switching to WaterSense-labeled products that building can save an estimated 20% or 124,078 – 149,874 gallons of water per year.

Note: 8% of total site energy is consumed by water heating in commercial buildings.[591] If ASHRAE 90.1-2007 requires a base of 4.76 kBtu/sf/yr [592], .38 kBtu/sf/yr will be devoted to water heating. A 20% reduction in water use will therefore save .076 kBtu/sf/yr. This anticipated 106,596 square feet of new office space will save 8,101 kBtu per year.

Middletown

Middletown adds on average 91,897[593] square feet of new commercial space and renovates on average 183,794[594] square feet of existing commercial space. This totals 275,691 square foot of construction per year (approximately fourteen 20,000 sq. ft. office buildings).

In the introductory year it is anticipated that 20% of new and existing commercial buildings will select WaterSense-labeled fixtures. Therefore 55,138 square feet of the total 275,691 square feet will take advantage of the reduced permitting fees for selecting WaterSense-labeled fixtures (approximately three 20,000 sq. ft office building).

Assuming a baseline case of 5.82 - 7.03 gallons of water per SF per year, this 55,138 square feet of new and existing commercial space will consume between 320,904 – 387,622 gallons of water if typical plumbing fixtures are used. By switching to WaterSense-labeled products that building can save an estimated 20% or 64,181 – 77,524 gallons of water per year.

Note: 8% of total site energy is consumed by water heating in commercial buildings.[595] If ASHRAE 90.1-2007 requires a base of 4.76 kBtu/sf/yr [596], .38

kBtu/sf/yr will be devoted to water heating. A 20% reduction in water use will therefore save .076 kBtu/sf/yr. This anticipated 55,138 square feet of new office space will save 4,190 kBtu per year.

Montclair

Montclair adds on average 35,936[597] square feet of new commercial space and renovates on average 71,872[598] square feet of existing commercial space. This totals 107,808 square foot of construction per year (approximately five, 20,000 sq. ft. office buildings).

In the introductory year it is anticipated that 20% of new and existing commercial buildings will select WaterSense-labeled fixtures. Therefore 21,562 square feet of the total 107,808 square feet will take advantage of the reduced permitting fees for selecting WaterSense-labeled fixtures (approximately one, 20,000 sq. ft office building).

Assuming a baseline case of 5.82 - 7.03 gallons of water per SF per year, this 21,562 square feet of new and existing commercial space will consume between 125,491 – 151,581 gallons of water if typical plumbing fixtures are used. By switching to WaterSense-labeled products that building can save an estimated 20% or 25,098 – 30,316 gallons of water per year.

Note: 8% of total site energy is consumed by water heating in commercial buildings.[599] If ASHRAE 90.1-2007 requires a base of 4.76 kBtu/sf/yr [600], .38 kBtu/sf/yr will be devoted to water heating. A 20% reduction in water use will therefore save .076 kBtu/sf/yr. This anticipated 21,562 square feet of new office space will save 1,639 kBtu per year.

Parsippany – Troy Hills

Parsippany—Troy Hills adds on average 616,256[601] square feet of new commercial space and renovates on average 1,232,512[602] square feet of existing commercial space. This totals 1,848,768 square foot of construction per year (approximately ninety two 20,000 sq. ft. office buildings).

In the introductory year it is anticipated that 20% of new and existing commercial buildings will select WaterSense-labeled fixtures. Therefore 369,754 square feet of the total 1,848,768 square feet will take advantage of the reduced permitting fees for selecting WaterSense-labeled fixtures (approximately eighteen 20,000 sq. ft office building).

Assuming a baseline case of 5.82 - 7.03 gallons of water per SF per year, this 369,754 square feet of new and existing commercial space will consume between 2,151,966 – 2,599,368 gallons of water if typical plumbing fixtures are used. By switching to WaterSense-labeled products that building can save an estimated 20% or 430,393 – 519,874 gallons of water per year.

Note: 8% of total site energy is consumed by water heating in commercial buildings.[603] If ASHRAE 90.1-2007 requires a base of 4.76 kBtu/sf/yr [604], .38 kBtu/sf/yr will be devoted to water heating. A 20% reduction in water use will therefore save .076 kBtu/sf/yr. This anticipated 369,754 square feet of new office space will save 28,101 kBtu per year.

Perth Amboy

The city of Perth Amboy adds on average 23,719[605] square feet of new commercial space and renovates on average 47,438[606] square feet of existing commercial space. This totals 71,157 square foot of construction per year (approximately five, 20,000 sq. ft. office buildings).

In the introductory year it is anticipated that 20% of new and existing commercial buildings will select WaterSense-labeled fixtures. Therefore 14,231 square feet of the total 71,157 square feet will take advantage of the reduced permitting fees for selecting WaterSense-labeled fixtures (approximately one, 20,000 sq. ft office building).

Assuming a baseline case of 5.82 - 7.03 gallons of water per SF per year, this 14,231 square feet of new and existing commercial space will consume between 82,827 – 100,047 gallons of water if typical plumbing fixtures are used. By switching to WaterSense-labeled products that building can save an estimated 20% or 16,565 – 20,009 gallons of water per year.

Note: 8% of total site energy is consumed by water heating in commercial buildings.[607] If ASHRAE 90.1-2007 requires a base of 4.76 kBtu/sf/yr [608], .38 kBtu/sf/yr will be devoted to water heating. A 20% reduction in water use will therefore save .076 kBtu/sf/yr. This anticipated 14,231 square feet of new office space will save 1,082 kBtu per year.

Plainfield

The city of Plainfield adds on average 32,069[609] square feet of new commercial space and renovates on average 64,138[610] square feet of existing commercial space. This totals 96,207 square foot of construction per year (approximately five, 20,000 sq. ft. office buildings).

In the introductory year it is anticipated that 20% of new and existing commercial buildings will select WaterSense-labeled fixtures. Therefore 19,204 square feet of the total 96,207 square feet will take advantage of the reduced permitting fees for selecting WaterSense-labeled fixtures (approximately one, 20,000 sq. ft office building).

Assuming a baseline case of 5.82 - 7.03 gallons of water per SF per year, this 19,204 square feet of new and existing commercial space will consume between 111,985 – 136,267 gallons of water if typical plumbing fixtures are used. By switching to WaterSense-labeled products that building can save an estimated 20% or 22,397 – 27,253 gallons of water per year.

Note: 8% of total site energy is consumed by water heating in commercial buildings.[611] If ASHRAE 90.1-2007 requires a base of 4.76 kBtu/sf/yr [612], .38 kBtu/sf/yr will be devoted to water heating. A 20% reduction in water use will therefore save .076 kBtu/sf/yr. This anticipated 19,204 square feet of new office space will save 1,462 kBtu per year.

West Orange

The city of West Orange adds on average 60,961[613] square feet of new commercial space and renovates on average 121,922[614] square feet of existing commercial space. This totals 182,883 square foot of construction per year (approximately five, 20,000 sq. ft. office buildings).

In the introductory year it is anticipated that 20% of new and existing commercial buildings will select WaterSense-labeled fixtures. Therefore 36,577 square feet of the total 182,883 square feet will take advantage of the reduced permitting fees for selecting WaterSense-labeled fixtures (approximately one, 20,000 sq. ft office building).

Assuming a baseline case of 5.82 - 7.03 gallons of water per SF per year, this 36,577 square feet of new and existing commercial space will consume between 212,878 – 257,136 gallons of water if typical plumbing fixtures are used. By switching to WaterSense-labeled products that building can save an estimated 20% or 42,576 – 51,427 gallons of water per year.

Note: 8% of total site energy is consumed by water heating in commercial buildings.[615] If ASHRAE 90.1-2007 requires a base of 4.76 kBtu/sf/yr [616], .38 kBtu/sf/yr will be devoted to water heating. A 20% reduction in water use will therefore save .076 kBtu/sf/yr. This anticipated 36,577 square feet of new office space will save 2,780 kBtu per year.

Willingboro Twp.

Willingboro Twp. adds on average 38,621[617] square feet of new commercial space and renovates on average 77,242[618] square feet of existing commercial space. This totals 115,863 square foot of construction per year (approximately five, 20,000 sq. ft. office buildings).

In the introductory year it is anticipated that 20% of new and existing commercial buildings will select WaterSense-labeled fixtures. Therefore 23,173 square feet of the total 115,863 square feet will take advantage of the reduced permitting fees for selecting WaterSense-labeled fixtures (approximately one, 20,000 sq. ft office building).

Assuming a baseline case of 5.82 - 7.03 gallons of water per SF per year, this 23,173 square feet of new and existing commercial space will consume between 134,867 – 162,906 gallons of water if typical plumbing fixtures are used. By switching to WaterSense-labeled products that building can save an estimated 20% or 26,973 – 32,581 gallons of water per year.

Note: 8% of total site energy is consumed by water heating in commercial buildings.[619] If ASHRAE 90.1-2007 requires a base of 4.76 kBtu/sf/yr [620], .38 kBtu/sf/yr will be devoted to water heating. A 20% reduction in water use will therefore save .076 kBtu/sf/yr. This anticipated 23,173 square feet of new office space will save 1,761 kBtu per year.

Local Fiscal Impacts

	WaterSense-labeled fixtures (faucets, showerheads, toilets)
Lifetime of Measure (Years)	10
Annual Electric Savings (MWh)	.076 kBtu/sf/yr [621]
Annual Natural Gas Savings	
Annual Peak Load Reductions (kW)	
Gallons Reduced	See above per municipality
VMT Reduced	
Custom Conversion (If gallons water --> electrcity, etc)	
Tax Credits ($)	
Incentives ($)	
Capital Administrative Costs ($)	
Yearly Administrative Costs ($)	
Capital Costs to Municipality ($)	
Yearly Costs to	

Municipality ($)	
Capital Incremental Costs ($)	
Yearly Incremental Costs ($)	

How to Do it

In order to meet this measure the municipality must 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.[622]

In adopting this green building ordinance, the municipality must consider the following: [623]

1. Involved representatives from existing volunteer boards, such as the Planning and Zoning Boards, environmental commission, and redevelopment and housing agencies, as well as municipal staff, especially the Zoning Official, Construction Code Official, and planner should be involved with this action.

2. Set a Timeframe. Timeframes to implement the components will vary; however they can be pursued at the same time. Adopting a green building ordiance will take between one and three months.

3. Take into account the Project Costs and Resource Needs. Developing a green building ordinance will require municipal staff time; however costs should be minimal and likely will be related to legal professional fees.

4. Execute. In order to compensate for revenue lost through reduced permit fees, the municipality should develop two construction fee formulas; one for conventional building, and a second formula for green building. In determining both formulas, the municipality must project an anticipated level of participation in the reduced permit fee incentive. Revenue lost from reduce permit fees can be recovered by raising permit fees for conventional building.

Resources:

Sustainable Jersey www.sustainablejersey.com

EPA WaterSense http://www.epa.gov/watersense/

U.S. Environmental Protection Agency WaterSense Program. Water Savings and Energy Calculator. http://www.epa.gov/WaterSense/calculator/index.htm.

U.S. Department of Energy Federal Energy Management Program. Energy Cost

Calculator for Faucets and Showerheads. http://www1.eere.energy.gov/femp/technologies/eep_faucets_showerheads_calctml

Energy Efficient Rehab Advisor. http://www.rehabadvisor.pathnet.org/

H20USE: Water Saver Home http://www.h2ouse.net/index.cfm

5. Encourage water efficiency in existing single-family homes

Introduction

Managing water use 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 offset this problem, a municipality may enact an ordinance to reduce permitting fees for single-family renovation/remodeling projects that use WaterSense-labeled products or equivalent.[624]

An easy way to reduce the quantity of water used per person per day is to select WaterSense-labeled fixtures such as faucets, showerheads, and toilets. These fixtures offer a greater degree of efficiency, therefore reducing water used without altering usage patterns.

Currently, federal standards require that lavatory faucets and faucet aerators manufactured after 1994 use no more than 2.2 gallons per minute.

WaterSense-labeled faucets offer a greater degree of efficiency over 1994 federal standards. Lavatory faucets for private bathrooms have a maximum flow rate of 1.5 gpm, a .7 gallon per minute savings over federal standards.

Increase water efficiency in existing residential buildings

	Municipal Government	Community-Wide
Initial Municipal Costs ($)	$ -	
Rebate/Subsidy ($)	$ -	
Net Capital Cost ($)	$ -	
Lifetime Municipal Costs ($)	$ -	
Lifetime of Measure (Years)	10	
CO2 Reductions (Tons)		8
NOx Reductions (Lbs)		12
SO2 Reductions (Lbs)		-
Electricity Savings (MWh)		-
Electricity Savings ($)		$ -
Natural Gas Savings (MMBtu)		136
Natural Gas Savings ($)		$ 1,472
Water Savings (Gallons)		110,000
Water Savings ($)		$ 445

Costs/Impacts

Selecting a WaterSense-labeled faucet at a flow rate of 1.5 gpm will consume 12.15 gallons per capita per day. Typical faucets produced after 1994 with a flow rate of 2.2 gpm will consume 17.82 gallons per capita per day. Switching to a WaterSense-labeled faucet will save 5.67 gallons per capita per day.[625]

Selecting a WaterSense-labeled toilet that consumes 1.3 gallons of water per flush will consume 6.57 gallons of water per capita per day. Typical toilets which use at least 3.5 gallons of water per flush will consume 17.67 gallons per capita per day. Switching to a WaterSense-labeled toilet will save 11.10 gallons per capita per day. [626]

Scenario: (per capita and average household #)

Assuming the national average household size in of 2.6 occupants[627], switching a typical residential bath to WaterSense-labeled faucets and toilets would save a total of approximately 11,000 gallons of water per year[628], or 11.6 gallons per capita per day[629]. This is a savings of approximately $44.00 annually in water costs per household per year.[630] In addition, energy savings through reduced hot water heating needs will be about 400 cu ft of natural gas. This will save approximately $5.00 annually in energy bills. [631]

Scenario: (municipal-wide)

Based on participations rates of similar green building incentive programs nationwide, assume a 5% annual increase in the percentage remodeling projects that will take advantage of reduced permit fees for specifying WaterSense-labeled products.

East Orange

By the time this ordinance is in place for four years, a 20% level of participation is anticipated. The city of East Orange adds on average, 41[632] new units per year. Assume that twice as many permits are issued for remodeling projects, totaling 82 projects per year. On this forth year, it is anticipated that 20% or 16 of the 82 units will take advantage of reduced permit fees by specifying WaterSense-labeled products.

If an average household using WaterSense-labeled fixtures saves approximately 11,000 gallons of water per year, these 16 renovations will reduce annual water consumption in East Orange by 176,000 gallons per year. In addition, 6400 cu ft of natural gas will be saved through reduced hot water heating needs.[633]

Edison

By the time this ordinance is in place for four years, a 20% level of participation is anticipated. Edison adds on average, 184[634] new units per year. Assume that twice as many permits are issued for remodeling projects, totaling 368 projects per year. On this forth year, it is anticipated that 20% or 74 of the 368 units will take advantage of reduced permit fees by specifying WaterSense-labeled products.

If an average household using WaterSense-labeled fixtures saves approximately 11,000 gallons of water per year, these 74 renovations will reduce annual water consumption in Edison by 814,000 gallons per year. In addition, 29,600 cu ft of natural gas will be saved through reduced hot water heating needs.[635]

Fort Lee

By the time this ordinance is in place for four years, a 20% level of participation is anticipated. The city of Fort Lee adds on average, 91[636] new units per year. Assume that twice as many permits are issued for remodeling projects, totaling 182 projects per year. On this forth year, it is anticipated that 20% or 36 of the 182 units will take advantage of reduced permit fees by specifying WaterSense-labeled products.

If an average household using WaterSense-labeled fixtures saves approximately 11,000 gallons of water per year, these 36 renovations will reduce annual water consumption in Fort Lee by 396,000 gallons per year. In addition, 14,400 cu ft of natural gas will be saved through reduced hot water heating needs.[637]

Howell Twp.

By the time this ordinance is in place for four years, a 20% level of participation is anticipated. Howell Twp. adds on average, 141[638] new units per year. Assume that twice as many permits are issued for remodeling projects, totaling 282 projects per year. On this forth year, it is anticipated that 20% or 56 of the 141 units will take advantage of reduced permit fees by specifying WaterSense-labeled products.

If an average household using WaterSense-labeled fixtures saves approximately 11,000 gallons of water per year, these 56 renovations will reduce annual water consumption in Howell Twp. by 616,000 gallons per year. In addition, 22,400 cu ft of natural gas will be saved through reduced hot water heating needs.[639]

Middletown

By the time this ordinance is in place for four years, a 20% level of participation is anticipated. Middletown adds on average, 82[640] new units per year. Assume that twice as many permits are issued for remodeling projects, totaling 162 projects per year. On this forth year, it is anticipated that 20% or 32 of the 162 units will take advantage of reduced permit fees by specifying WaterSense-labeled products.

If an average household using WaterSense-labeled fixtures saves approximately 11,000 gallons of water per year, these 32 renovations will reduce annual water consumption in Middletown by 352,000 gallons per year. In addition, 12,800 cu ft of natural gas will be saved through reduced hot water heating needs.[641]

Montclair

By the time this ordinance is in place for four years, a 20% level of participation is anticipated. Montclair adds on average, 25[642] new units per year. Assume that twice as many permits are issued for remodeling projects, totaling 50 projects per year. On this forth year, it is anticipated that 20% or 10 of the 50 units will take advantage of reduced permit fees by specifying WaterSense-labeled products.

If an average household using WaterSense-labeled fixtures saves approximately 11,000 gallons of water per year, these 10 renovations will reduce annual water consumption in Montclair by 110,000 gallons per year. In addition, 4,000 cu ft of natural gas will be saved through reduced hot water heating needs.[643]

Parsippany – Troy Hills

By the time this ordinance is in place for four years, a 20% level of participation is anticipated. Parsippany-Troy Hills adds on average, 65[644] new units per year. Assume that twice as many permits are issued for remodeling projects, totaling 130 projects per year. On this forth year, it is anticipated that 20% or 26 of the 130 units will take advantage of reduced permit fees by specifying WaterSense-labeled products.

If an average household using WaterSense-labeled fixtures saves approximately 11,000 gallons of water per year, these 26 renovations will reduce annual water consumption by 286,000 gallons per year. In addition, 10,400 cu ft of natural gas will be saved through reduced hot water heating needs.[645]

Perth Amboy

By the time this ordinance is in place for four years, a 20% level of participation is anticipated. The city of Perth Amboy adds on average, 48[646] new units per year. Assume that twice as many permits are issued for remodeling projects, totaling 96 projects per year. On this forth year, it is anticipated that 20% or 19 of the 96 units will take advantage of reduced permit fees by specifying WaterSense-labeled products.

If an average household using WaterSense-labeled fixtures saves approximately 11,000 gallons of water per year, these 19 renovations will reduce annual water consumption in Perth Amboy by 209,000 gallons per year. In addition, 7,600 cu ft of natural gas will be saved through reduced hot water heating needs.[647]

Plainfield

By the time this ordinance is in place for four years, a 20% level of participation is anticipated. The city of Plainfield adds on average, 27[648] new units per year. Assume that twice as many permits are issued for remodeling projects, totaling 54 projects per year. On this forth year, it is anticipated that 20% or 11 of the 54 units will take advantage of reduced permit fees by specifying WaterSense-labeled products.

If an average household using WaterSense-labeled fixtures saves approximately 11,000 gallons of water per year, these 11 renovations will reduce annual water consumption in Plainfield by 121,000 gallons per year. In addition, 4,400 cu ft of natural gas will be saved through reduced hot water heating needs.[649]

West Orange

By the time this ordinance is in place for four years, a 20% level of participation is anticipated. The city of West Orange adds on average, 67[650] new units per year. Assume that twice as many permits are issued for remodeling projects, totaling 134 projects per year. On this forth year, it is anticipated that 20% or 27 of the 134 units will take advantage of reduced permit fees by specifying WaterSense-labeled products.

If an average household using WaterSense-labeled fixtures saves approximately 11,000 gallons of water per year, these 27 renovations will reduce annual water consumption in West Orange by 297,000 gallons per year. In addition, 10,800 cu ft of natural gas will be saved through reduced hot water heating needs.[651]

Willingboro Twp.

By the time this ordinance is in place for four years, a 20% level of participation is anticipated. Willingboro adds on average, 47[652] new units per year. Assume that twice as many permits are issued for remodeling projects, totaling 94 projects per year. On this forth year, it is anticipated that 20% or 19 of the 94 units will take advantage of reduced permit fees by specifying WaterSense-labeled products.

If an average household using WaterSense-labeled fixtures saves approximately 11,000 gallons of water per year, these 19 renovations will reduce annual water consumption in Willingboro Twp. by 209,000 gallons per year. In addition, 7,600 cu ft of natural gas will be saved through reduced hot water heating needs.[653]

Local Fiscal Impacts

	WaterSense-labeled fixtures (faucets, showerheads, toilets)
Lifetime of Measure (Years)	10

Annual Electric Savings (MWh)	
Annual Natural Gas Savings	400 cu ft of natural gas per 2.6 person household
Annual Peak Load Reductions (kW)	
Gallons Reduced	11.6 gallons per capita per day[654]
VMT Reduced	
Custom Conversion (If gallons water --> electrcity, etc)	
Tax Credits ($)	
Incentives ($)	
Capital Administrative Costs ($)	
Yearly Administrative Costs ($)	
Capital Costs to Municipality ($)	
Yearly Costs to Municipality ($)	
Capital Incremental Costs ($)	
Yearly Incremental Costs ($)	

How to Do it

In order to meet this measure the municipality must pass an ordinance to reduce permitting fees for single-family renovation/remodeling projects that use WaterSense-labeled products or equivalent.[655]

In adopting this green building ordinance, the municipality must consider the following:

1. Involved representatives from existing volunteer boards, such as the Planning and Zoning Boards, environmental commission, and redevelopment and housing agencies, as well as municipal staff, especially the Zoning Official, Construction Code Official, and planner should be involved with this action.

2. Set a Timeframe. Timeframes to implement the components will vary; however they can be pursued at the same time. Adopting a green building ordinance will take between one and three months.

3. Take into account the Project Costs and Resource Needs:

Developing a green building ordinance will require municipal staff time; however costs should be minimal and likely will be related to legal professional fees.

4. Execute. In order to compensate for revenue lost through reduced permit fees, the municipality should develop two construction fee formulas; one for conventional building, and a second formula for green building. In determining both formulas, the municipality must project an anticipated level of participation in the reduced permit fee incentive. Revenue lost from reduce permit fees can be recovered by raising permit fees for conventional building.

Resources:

Sustainable Jersey www.sustainablejersey.com

EPA WaterSense http://www.epa.gov/watersense/

U.S. Environmental Protection Agency WaterSense Program. Water Savings and Energy Calculator. http://www.epa.gov/WaterSense/calculator/index.htm.

U.S. Department of Energy Federal Energy Management Program. Energy Cost Calculator for Faucets and Showerheads.
http://www1.eere.energy.gov/femp/technologies/eep_faucets_showerheads_calctml

Energy Efficient Rehab Advisor. http://www.rehabadvisor.pathnet.org/

H20USE: Water Saver Home http://www.h2ouse.net/index.cfm

SUSTAINABLE LANDSCAPE AND LAND USE MEASURES

1. Preserve the tree canopy.

2. Enact sustainable landscaping ordinances for residential and commercial applications

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

4. Encourage sustainable landscaping practices for residential applications.

5. Encourage sustainable landscaping practices for commercial applications.

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

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

1. Preserve the tree canopy.

Introduction/Summary

Trees act as a sink for CO_2 by fixing carbon dioxide during photosynthesis and storing excess carbon as biomass.[656] 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.[657] 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 municipality 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 municipality 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 municipality.

Preserve tree canopy

	Municipal Government	Community-Wide
Initial Municipal Costs ($)	$ -	
Rebate/Subsidy ($)	$ 25,000	
Net Capital Cost ($)	$ (25,000)	
Lifetime Municipal Costs ($)	$ 2,959	
Lifetime of Measure (Years)	30	
CO2 Reductions (Tons)		12
NOx Reductions (Lbs)		-
SO2 Reductions (Lbs)		-
Electricity Savings (MWh)		-
Electricity Savings ($)		$ -
Natural Gas Savings (MMBtu)		-
Natural Gas Savings ($)		$ -

Costs/Impacts

Local Fiscal Impacts

Lifetime of measure	40 years
Initial Cost	$3,000 to

	$25,000
Subsidy	$3,000 to $25,000
Cost after subsidy	See below
Annual Savings/Cost	See below
Years to Payback	
Net Present Value	

Social and Environmental Impacts

	Annual	Lifetime
GHG reduction	37 to 92 lbs/yr./tree	See below
kWh/Therms/gallons reduced		
Criteria Air Pollutants		

How to Do It

The following section describes: (1) preparation of a community forestry plan and establishment of a tree canopy goal; (2) a tree planting program; (3) a tree maintenance program; and (4) adoption and administration of a tree conservation ordinance.[658]

Community Forestry Plan and Tree Canopy Goal. Communities throughout New Jersey have long recognized the importance of managing and protecting their street tree and woodlands resources.

1. **New Jersey municipalities may initiate or expand tree management programs through the development of a Community Forestry Plan** that meets the New Jersey Department of Environmental Protection (DEP)'s Community Forestry Program standards under the New Jersey Shade Tree and Community Forestry Assistance Act. Communities must also need to achieve "approved status" through the program by completing annual training requirements and submitting an Annual Report of Accomplishments to DEP. . . .

2. **Involve** municipal shade tree commissions and committees, environmental commissions or municipal sustainability committee members, the public works department, and the parks and recreation commission should lead and be involved with this action.

3. **Set a timeframe.** Developing a Community Forestry Plan and fulfilling first year CORE Training and reporting requirements usually takes 12-18 months. Establishing a community tree canopy goal should take 1 month.

4. **Preparing a Community Forestry Plan.** The cost for a qualified consultant to prepare a Community Forestry Plan ranges from $3,000 to $4,000. A $3,000 grant is available annually each December from the NJ Department of Environmental Protection, Bureau of Forestry's Community Forestry Program, to support the costs of preparing the Community Forestry Plan.

   This grant will cover the majority of the costs of the development of the Plan by a qualified consultant and requires a municipal match that can be met by in-kind volunteer time or cash. Approximately 10 days of municipal volunteers' time from the Shade Tree Commission or Board, or Environmental Commission, as well as some municipal staff time, will be required to support the development of the plan.

5. **Acquiring or maintaining Municipal Accreditation under the Community Forestry Program**. During the first year of program participation, communities are required to send 2 municipal representatives to CORE Training classes. This training typically costs less than $300 in the first year of the program. To maintain municipal certification in years 2-5 of the Community Forestry Program, community volunteers and/or staff need to accumulate 8 Continuing Education course credits which cost approximately $200-300/year.
6. **Characterizing Percentage (%) of Tree Cover in Municipality.** Municipal Volunteers will need to access tool data to gather data, review, and develop a municipal tree canopy goal. This task takes about 2 days to complete.

The municipality must develop a five- year Community Forestry Management Plan that meets the guidelines of the NJ Community Forestry program. Each December, the NJ Department of Environmental Protection (DEP) announcesa a grant program to fund the development of Community Forestry Management Plans. Complete program guidelines and information can be found at: http://www.state.nj.us/dep/parksandforests/forest/community/pdf_files/new_jersey_community_forestry_program.pdf.

Working through the municipal shade tree commission/committee or the environmental commission/committee, the municipality should adopt a community tree canopy goal for expanding and protecting municipal tree canopy cover. This goal should identify the municipality's current canopy coverage and identify a specific municipal tree canopy goal. American Forests recommends areas east of the Mississippi River maintain an average tree cover of 40%. It recommends a tree cover goal of 50% for suburban residential zones, 25% for urban residential zones, and 15% for central business districts. [659]These are general guidelines and canopy goals should also take into account the climate, geography, land cover, and land use patterns of each municipality.[660]

Tree Planting Program. A tree planting program is an important component of maintaining and expanding the municipal tree canopy. It can focus on expanding street tree coverage, creating new canopy cover around municipal buildings and schools, enhancing parks and recreation sites, establishing forest cover on municipal open space, and reducing heat island impacts in urban settings.

1. **Involve** municipal shade tree commissions and committees, environmental commissions or municipal sustainability committee members, the public works department, and parks and recreation commission members should be involved with and lead this action.
2. **Set a timeframe.** Organizing, designing, and executing tree planting programs can be accomplished in 3-12 months depending on access to funding, planting season considerations, land access issues, and site conditions. If communities are seeking grant funding from NJDEP's Community Forestry programs, the time from grant development to planting the first tree in the ground can take up to 18 months.
3. **Municipal staff or volunteer time is needed to design the planting program, secure funding, and supervise the tree planting.** On average, it costs $250 to $300 to plant a 2 ½ inch caliper tree by a private company. This average cost excludes any costs associated with unusual tree planting conditions, such as removal of sidewalk concrete to create a tree planting area.

Tree Maintenance Program. A tree maintenance program is an important component of maintaining and expanding the municipal tree canopy. It can focus on preserving the street tree coverage, reducing tree hazard conditions, promoting healthy tree form and structure, and reducing tree liability in the community. Proper and timely maintenance supports the long-term health of the municipal tree stock and can minimize and manage impacts from disease and insect pests on the tree population.

1. **Involve** municipal shade tree commissions and committees, environmental commissions or municipal sustainability committee members, the municipality's department of public works (DPW), and if appropriate, private qualified arborists or certified tree experts.
2. **Set a timeframe.** Tree maintenance programs should be scheduled on an annual basis in the community. It is advisable to organize tree maintenance so that all trees under management receive maintenance on a 3 to 5 year cycle. Communities seeking grant funding from NJDEP's Community Forestry

program to initiate tree maintenance programs may not be able to initiate programs for up to 6 months.

3. **Department of public works staff, municipal shade tree commission volunteers, or outside consultants may all be needed to undertake an annual tree maintenance program.** During the first few years of implementation, program work should focus on high hazard trees identified in the community that have been identified through a tree inventory program or on an annual inspection completed by municipal shade tree commission volunteers, public works staff, or through a municipal tree referral process.

The pruning cycle can be once every five years if the street tree population does not include too many young trees; it can be three years for young trees and seven years for mature trees. Pruning budgets and equipment depend on characteristics of the street tree population and municipal budget resources.

Contract maintenance is another method of maintaining street trees. Communities can hire contractors to implement municipal tree maintenance programs or on an as needed basis to address hazard tree pruning needs.

Tree Protection Ordinance. A tree protection ordinance establishes a regulatory process that requires a permit to cut down a tree and ensures that the tree will be replaced, either on site, or nearby. Alternately, the person cutting down the tree can pay into a fund that will be used for planting trees in the community.

Resources

The cost of operating the program, which involves reviewing plans submitted in connection with tree removal and replanting, is covered by permit fees. An administrative study should be completed before adopting the ordinance to determine at what level to set fees.

Randolph Township in Morris County has adopted a tree protection ordinance.
http://www.anjec.org/html/Sustainability-TreeProtection.htm

See also, Christopher Duerksen. *Tree Conservation Ordinances*. Planning Advisory Service Report No. 446. Chicago: American Planning Association, 1993. http://www.planning.org/apastore/Search/Default.aspx?p=2375

Funding Resources

The New Jersey Community Forestry Program's Green Community Grant helps defray the cost of developing a Community Forestry Management Plan that meets the requirements of the New Jersey Shade Tree and Community Forestry Assistance Act. The Act, which was passed on December 5, 1996, allows New Jersey communities to obtain liability protection under the New Jersey Tort Claims Act for their shade tree programs. However, in order to qualify for this protection, shade tree commissioners or other community representatives must develop a Community Forestry Plan for their community, as well as attend the state's training skills and accreditation program. This $3,000 grant allows a county or municipality to hire an outside firm to assist in the development of a Community Forestry Management Plan. Communities apply for the funding by completing a simple one-page grant application. A minimum matching amount of $1,500 is necessary, from either cash or in-kind services. The New Jersey

Community Forestry Council, in cooperation with the State Forester, has developed the management plan guidelines and training program. Copies of the guidelines and one-page grant application are available on the Community Forestry web site. http://www.state.nj.us/dep/parksandforests/forest/community/grants.html.

Community Stewardship Incentive Program (CSIP) grants through the DEP enable municipalities to implement their Community Forestry Management Plans. Only municipalities with Approved Status under the New Jersey Shade Tree and Community Forestry Assistance Act for the previous calendar year are eligible to apply for a CSIP grant. The cost-share ratio is 75 percent grant to 25 percent match of cash or in-kind services. During 2008, the NJDEP's Division of Parks and Forestry, NJ Forest Service, Community Forestry Program offered grants for $25,000. Copies of the grant application and supporting documents can be found at: www.state.nj.us/dep/parksandforests/forest/community/pdf_files/application_pamphlet_csip.doc

Cool Cities Grants are available through NJDEP's Community Forestry

Program to communities identified as Municipal Urban Aid Program communities that also have tree canopy coverage less than 27%. Contact NJDEP's Community Forestry Program at 609-292-2532 to explore opportunities if your tree canopy cover is less than 27% and is included in the Municipal Urban Aid Program. http://www.state.nj.us/dca/lgs/muniaid/08_aid/ua_fy09_pub_notice.htm

Calculating CO2 Sequestration from Land Cover

Professor Clinton Andrews at Rutgers has set forth a methodology for calculating sequestration of CO_2 from land cover, and showing the impact of lost of forested acreage.[661] This methodology can be applied when there is a reasonable estimate of the various land cover categories in a community. The steps are shown below.

1. For a jurisdiction, perform a land cover classification analysis using a GIS tool.

2. Calculate total acreage for each land cover category.

3. Get annual carbon sequestration rates per acre by land cover category.

4. Calculate carbon sequestration by land cover category.

For example, assume the following:

> For a 53.5 acre a Deciduous Forest > 50% Crown Closure, a CO2 sequestration rate of 3,909 lbs per yr. per acre would yield a total of 209,132 lbs. This can be converted to metric tons by multiplying by 0.000453, which would yield 94.86 metric tons.

Andrew's estimate for all of the land cover categories in Highland Park, New Jersey, totaled 3,969,000 lbs or 1,806 metric tons per year of CO_2 sequestered per year...

5. For the jurisdiction (Highland Park, NJ in Andrew's example), calculate carbon emissions due to land use changes by comparing land cover maps from two time periods.

6. Annualize the loss of forested acreage.

7. Get an estimate of CO_2 released per acre.

8. Multiply acres lost times CO_2 released per acre to get total CO2 emissions from landuse changes.

Acres lost (1995-2002)	Average annual loss (acres/year)	CO2 released (metric tons/acre)	Total CO2 released (metric tons)
2.31	0.33	141	46

2. Enact sustainable landscaping ordinances for residential and commercial applications

Introduction

In order to reduce the negative environmental impacts associated with use of lawn and garden equipment, a municipality can enact an ordinance that set guidelines for the percentage of turf grass on commercial and residential properties. Such an ordinance would requires new single-family homes and commercial buildings to reduce mowable areas or turf grass to 40% or less of a site's improved landscape area.

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.[662]

Lawn and garden equipment manufactured pre-1997 accounts for as much as 5% of total man-made hydrocarbons that contribute to ozone formation.[663]

Costs/Impacts

The case study of Middlebury College in Middlebury Vermont provides a useful example from which to base potential cost savings.

Middlebury College has reduced mowable area from 75 acres to 55 acres. This reduction of roughly 25% in mowable area will save the municipality approximately 1,000 hours of labor and about 670 gallons of fuel annually.[664]

From the benefits reported at Middlebury College, it can be assumed that for every one acre reduction in mow able area, 50 hours of labor and 33.5 gallons of fuel will be saved annually.[665]

Operating a typical ride on gasoline-powered lawn mower for one hour will emit approximately 11 times as much pollution in one hour as driving a recently manufactured car[666]. Therefore every one acre of mowable area reduced will equate to the same reduction in emissions as 550 hours of driving time.

An additional positive impact can be found in reduction of VOC emissions. Reducing mow able area from the municipality would directly equate to less mowers necessary within a municipalities maintenance fleet. For every lawn mower taken out of use, a municipality would reduce VOC emissions by 19.6 pounds per year.[667]

Scenario (municipality –wide):

Assume a 25% reduction in mowable area for all commercially and residentially managed land.

East Orange

East Orange has a total of [x] acres of commercially managed land, and [x] acres or residentially managed land, totaling [x] acres.

If East Orange were to reduce the mowable area of its commercially and residentially managed land by 25%, [x] hours of labor, and [x] gallons of fuel could be saved annually.

Edison

Edison has a total of [x] acres of commercially managed land, and [x] acres or residentially managed land, totaling [x] acres.

If Edison were to reduce the mowable area of its commercially and residentially managed land by 25%, [x] hours of labor, and [x] gallons of fuel could be saved annually.

Fort Lee

Fort Lee has a total of [x] acres of commercially managed land, and [x] acres or residentially managed land, totaling [x] acres.

If Fort Lee were to reduce the mowable area of its commercially and residentially managed land by 25%, [x] hours of labor, and [x] gallons of fuel could be saved annually.

If Fort Lee were to reduce the mowable area of its commercially and residentially managed land by 25%, [x] hours of labor, and [x] gallons of fuel could be saved annually.

Howell Twp

Howell Twp. has a total of [x] acres of commercially managed land, and [x] acres or residentially managed land, totaling [x] acres.

If Howell Twp. were to reduce the mowable area of its commercially and residentially managed land by 25%, [x] hours of labor, and [x] gallons of fuel could be saved annually.

Middletown

Middletown has a total of [x] acres of commercially managed land, and [x] acres or residentially managed land, totaling [x] acres.

If Middletown were to reduce the mowable area of its commercially and residentially managed land by 25%, [x] hours of labor, and [x] gallons of fuel could be saved annually.

Montclair

Middletown has a total of [x] acres of commercially managed land, and [x] acres or residentially managed land, totaling [x] acres.

If Middletown were to reduce the mowable area of its commercially and residentially managed land by 25%, [x] hours of labor, and [x] gallons of fuel could be saved annually.

Parsippany – Troy Hills

Parsippany has a total of [x] acres of commercially managed land, and [x] acres or residentially managed land, totaling [x] acres.

If Parsippany were to reduce the mowable area of its commercially and residentially managed land by 25%, [x] hours of labor, and [x] gallons of fuel could be saved annually.

Perth Amboy

Perth Amboy has a total of [x] acres of commercially managed land, and [x] acres or residentially managed land, totaling [x] acres.

If Perth Amboy were to reduce the mowable area of its commercially and residentially managed land by 25%, [x] hours of labor, and [x] gallons of fuel could be saved annually.

Plainfield

Plainfield has a total of [x] acres of commercially managed land, and [x] acres or residentially managed land, totaling [x] acres.

If Plainfield were to reduce the mowable area of its commercially and residentially managed land by 25%, [x] hours of labor, and [x] gallons of fuel could be saved annually.

West Orange

West Orange has a total of [x] acres of commercially managed land, and [x] acres or residentially managed land, totaling [x] acres.

If West Orange were to reduce the mowable area of its commercially and residentially managed land by 25%, [x] hours of labor, and [x] gallons of fuel could be saved annually.

Willingboro Twp.

Willingboro Twp. has a total of [x] acres of commercially managed land, and [x] acres or residentially managed land, totaling [x] acres.

If Willingboro Twp. were to reduce the mowable area of its commercially and residentially managed land by 25%, [x] hours of labor, and [x] gallons of fuel could be saved annually.

ow to Do it

1. **The municipality must adopt a no-mow ordinance.** The ordinance must designate which areas of municipality can be designated as no mow areas.

In adopting this ordinance, the municipality must consider the following; [668669]

2. Involve. The ordinance would follow the standard municipal review and approval process. Enforcement of restrictions would fall to local code and law enforcement officials.

3. Set a time frame. Time required to approve ordinance is a function of local processes. Enforcement requirements would likely be limited to summer months and could occur during normal code and law officials' community rounds or based on complaints.

4. Take into account project costs and resource needs. Costs to implement this strategy are minimal:

- The drafting, review, and approval of the ordinance may involve some limited professional consultant and attorney review.
- Notification of community members regarding new policy could include preparation and distribution of information materials.
- Enforcing the ordinance should present only a very modest increase in staff time if enforcement occurs during normal staff work routines and travel around municipality.

5. Execute. Implementing this action requires several basic steps:

1) Draft and approve an ordinance.

2) Notify community members about new policies governing lawn care. This can be done via existing outreach mechanisms such as community newsletters and a municipal web page.

3) Train local planners, building inspectors, and other local officials on sustainable landscaping practices as these are the main points of contact between the jurisdiction and private building interests. Offer information on websites and host free workshops run by sustainable landscaping design experts for local residents and businesses.

Resources

University of Delaware Cooperative Extension.
http://ag.udel.edu/udbg/sl/vegetation/Turf_Grass_Madness.pdf

Rutgers New Jersey Agricultural Experiment Station. http://njaes.rutgers.edu/

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

Introduction

In order to reduce negative environmental impacts associated with use of lawn and garden equipment, a municipality 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 not only 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 municipality 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.

Lawn and garden equipment manufactured pre-1997 accounts for as much as 5% of total man-made hydrocarbons that contribute to ozone formation.[670] In addition to reducing ghg emissions by implementing this measure, an additional benefit of keeping landscaping waste on site is reducing total municipal solid wastes. Nearly one-fifth of all municipal solid waste collected is organic matter generated from yard waste such as grass clippings and leaves.[671]

Low or No Mow for Municipal Properties

	Municipal Government	Community-Wide
Initial Municipal Costs ($)	$ -	
Rebate/Subsidy ($)	$ -	
Net Capital Cost ($)	$ -	
Lifetime Municipal Costs ($)	$ (14,467,749)	
Lifetime of Measure (Years)	25	
CO2 Reductions (Tons)	99	99
NOx Reductions (Lbs)	-	-
SO2 Reductions (Lbs)	-	-
Gasoline Savings (Gallons)	11,516	11,516
Gasoline Savings ($)	16,578	$ 16,578

Costs/Impacts

The case study of Middlebury College in Middlebury Vermont provides a useful example from which to base potential cost and energy savings.

Middlebury College reduced mowable area from 75 acres to 55 acres. This reduction of roughly 25% in mowable area saved the municipality approximately 1,000 hours of labor and about 670 gallons of fuel annually.[672]

From the benefits reported at Middlebury College, it can be assumed that for every one acre reduction in mowable area, 50 hours of labor and 33.5 gallons of fuel will be saved annually.[673]

Operating a typical ride-on gasoline-powered lawn mower for one hour will emit approximately 11 times as much pollution in one hour as driving a recently manufactured car[674]. Therefore every one acre of mowable area reduced will equate to the same reduction in emissions as 550 hours of driving time.

An additional positive impact can be found in reduction of VOC emissions. Reducing mow able area from the municipality would directly equate to less mowers necessary within a municipalities maintenance fleet. For every lawn mower taken out of use, a municipality would reduce VOC emissions by 19.6 pounds per year.[675]

Scenario (municipality–wide):

Assume a 25% reduction in mowable area for all municipally managed land.

East Orange

East Orange has a total of [x] acres of municipally managed land.

If East Orange were to reduce its mowable area by 25%, [x] hours of labor, and [x] gallons of fuel could be saved annually.

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Edison has a total of [x] acres of municipally managed land.

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Fort Lee

Fort Lee has a total of [x] acres of municipally managed land.

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Howell Twp.

Howell Twp. has a total of [x] acres of municipally managed land.

If Howell Twp. were to reduce its mowable area by 25%, [x] hours of labor, and [x] gallons of fuel could be saved annually.

Middletown

Middletown has a total of [x] acres of municipally managed land.

If Middletown were to reduce its mowable area by 25%, [x] hours of labor, and [x] gallons of fuel could be saved annually.

Montclair

Montclair has a total of [x] acres of municipally managed land.

If Montclair were to reduce its mowable area by 25%, [x] hours of labor, and [x] gallons of fuel could be saved annually.

Parsippany – Troy Hills

Parsippany has a total of [x] acres of municipally managed land.

If Parsippany were to reduce its mowable area by 25%, [x] hours of labor, and [x] gallons of fuel could be saved annually.

Perth Amboy

Perth Amboy has a total of [x] acres of municipally managed land.

If Perth Amboy were to reduce its mowable area by 25%, [x] hours of labor, and [x] gallons of fuel could be saved annually.

Plainfield

The City of Plainfield has a total of [x] acres of municipally managed land.

If The City of Plainfield were to reduce its mowable area by 25%, [x] hours of labor, and [x] gallons of fuel could be saved annually.

West Orange

West Orange has a total of [x] acres of municipally managed land.

If West Orange were to reduce its mowable area by 25%, [x] hours of labor, and [x] gallons of fuel could be saved annually.

Willingboro Twp.

Willingboro Twp. has a total of [x] acres of municipally managed land.

If Willingboro Twp. were to reduce its mowable area by 25%, [x] hours of labor, and [x] gallons of fuel could be saved annually.

How to Do it

1. **The municipality must adopt a no or low mow policy.** The policy must assign which areas of municipality can be designated as no mow areas.

In adopting this green building policy, the municipality must consider the following; 676677

2. **Involve.** Representatives from existing volunteer boards, such as the Planning and Zoning Boards, environmental commission, and redevelopment and housing agencies, as well as municipal staff, especially the Zoning Official, Construction Code Official, and planner should be involved with this action.

3. **Set a timeframe.** Timeframes to implement the components will vary; however they can be pursued at the same time. Adopting a Green Building Policy will take between one and three months.

4. **Take into account project costs and resource needs.** Developing a Green Building Policy will require municipal staff time; however costs should be minimal and likely will be related to legal professional fees

5. **Execute.**
    a. Consider reducing the size of turf grass and use it strictly for structural and functional purposes, such as a designated recreational area.
    b. Use groundcovers. Low-growing, low-maintenance groundcovers offer a great alternative to turf grass, especially in hard-to-grow or hard-to-mow areas.
    c. Employ a wide variety of low-maintenance trees, shrubs, and perennials to create garden spaces with year-round interest.

Resources:

University of Delaware Cooperative Extension. http://ag.udel.edu/udbg/sl/vegetation/Turf_Grass_Madness.pdf

Rutgers New Jersey Agricultural Experiment Station. http://njaes.rutgers.edu/

4. Encourage sustainable landscaping practices for residential applications.

Introduction

Proper placement of trees and landscaping beautifies outdoor space and reduces heating and cooling costs To obtain benefits from such placement, a municipality 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.

The Center for Urban Forest Research with support from the US Department of Agriculture Forest Service publishes web-based software designed to evaluate the economic trade-offs between different landscape practices on residential parcels.[678]

Sustainable Landscaping for Residential Properties

	Municipal Government	Community-Wide
Initial Municipal Costs ($)	$ (129,948)	
Rebate/Subsidy ($)	$ 137,683	
Net Capital Cost ($)	$ (267,631)	
Lifetime Municipal Costs ($)	$ (129,948)	
Lifetime of Measure (Years)	25	
CO2 Reductions (Tons)		5,021
NOx Reductions (Lbs)		15,276
SO2 Reductions (Lbs)		50,308
Electricity Savings (MWh)		8,139
Electricity Savings ($)		$ 661,806
Natural Gas Savings (MMBtu)		12,727
Natural Gas Savings ($)		$ 78,712

Costs/Impacts

Proper placement of both deciduous and coniferous trees creating either wind protection or shading can save up to 25% of the energy a typical household uses for energy. Daytime air temperatures in tree-shaded neighborhoods can be 3 to 6 degrees cooler than in treeless areas.[679]

Scenario (building scale):

The average square footage of a single family home constructed in 2008 has risen to approximately 2,750 square foot.[680] At $150 per square foot, a typical 2,750 sq. ft. home will cost approximately $412,500 in construction costs for typical construction. Proper placement of both deciduous and coniferous trees does not add any additional cost premium to typical landscaping and savings will be realized through increased energy efficiency.

Energy expenses average $ 0.14/kWh for electricity and $1.07/therm for natural gas.[681] With an assumed electric savings of 1.33 kwh/sf/yr[682] and an assumed gas savings of 2.08 kBtu/sf/yr[683], this 2,750 sq. ft. home would save 3,658 kWh and 5,720 kBtu, or 57.2 therms[684], per year. This equates to a $512.12 savings in electricity expenses and a $61.20 savings in natural gas expenses.

Scenario (municipality –wide):

East Orange

East Orange adds on average, 41 units per year. [685] With a per home savings of 3,658 kWh and 5,720 kBtu per year, these new homes will save 149978 kWh and 234520 kBtu per year.

Edison

Edison adds on average, 184 units per year. [686] With a per home savings of 3,658 kWh and 5,720 kBtu per year, these new homes will save 673072 kWh and 1052480 kBtu per year.

Fort Lee

Fort Lee adds on average, 91 units per year. [687] With a per home savings of 3,658 kWh and 5,720 kBtu per year, these new homes will save 332878 kWh and 520520 kBtu per year.

Howell Twp

Howell Twp. adds on average, 141 units per year. [688] With a per home savings of 3,658 kWh and 5,720 kBtu per year, these new homes will save 515778 kWh and 806520 kBtu per year.

Middletown

Middletown adds on average, 82 units per year. [689] With a per home savings of 3,658 kWh and 5,720 kBtu per year, these new homes will save 299956 kWh and 469040 kBtu per year.

Montclair

Montclair adds on average, 25 units per year. [690] With a per home savings of 3,658 kWh and 5,720 kBtu per year, these new homes will save 91450 kWh and 143000 kBtu per year.

Parsippany – Troy Hills

Parsippany adds on average, 65 units per year. [691] With a per home savings of 3,658 kWh and 5,720 kBtu per year, these new homes will save 237770 kWh and 371800 kBtu per year.

Perth Amboy

Perth Amboy adds on average, 48 units per year. [692] With a per home savings of 3,658 kWh and 5,720 kBtu per year, these new homes will save 175584 kWh and 274560 kBtu per year.

Plainfield

Plainfield adds on average, 27 units per year. [693] With a per home savings of 3,658 kWh and 5,720 kBtu per year, these new homes will save 98766 kWh and 154440 kBtu per year.

West Orange

West Orange adds on average, 67 units per year. [694] With a per home savings of 3,658 kWh and 5,720 kBtu per year, these new homes will save 245086 kWh and 383240 kBtu per year.

Willingboro Twp

Willingboro Twp. adds on average, 47 units per year. [695] With a per home savings of 3,658 kWh and 5,720 kBtu per year, these new homes will save 171926 kWh and 268840 kBtu per year.

Local Fiscal Impacts

	Value
Lifetime of Measure (Years)	
Annual Electric Savings (MWh)	1.33 kwh/sf/yr
Annual Natural Gas Savings	2.08 kBtu/sf/yr
Annual Peak Load Reductions (kW)	
Gallons Reduced	

VMT Reduced	
Custom Conversion (If gallons water --> electrcity, etc)	
Tax Credits ($)	
Incentives ($)	
Capital Administrative Costs ($)	
Yearly Administrative Costs ($)	
Capital Costs to Municipality ($)	
Yearly Costs to Municipality ($)	
Capital Incremental Costs ($)	
Yearly Incremental Costs ($)	

Social and Environmental Impacts

	Annual		Lifetime	
	Government	Community-wide	Government	Community-wide
GHG reduction				
kWh/Therms/gallons reduced				
Criteria Air Pollutants				
Other				

Economic Impacts

	Per Unit	Annual	Lifetime
Temporary Jobs			
Permanent Jobs			

Economic Impact			
Other			

How to Do it

In adopting this sustainable landscaping ordinance, the municipality must consider the following;[696]

1. Involve. Representatives from existing volunteer boards, such as the Planning and Zoning Boards, environmental commission, and redevelopment and housing agencies, as well as municipal staff, especially the Zoning Official, Construction Code Official, and planner should be involved with this action.

2. Set a timeframe. Timeframes to implement the components will vary; however they can be pursued at the same time. Adopting a sustainable landscaping ordinance will take between one and three months.

3. Take into account project costs and resource needs. Developing a sustainable landscaping ordinance will require municipal staff time; however costs should be minimal and likely will be related to legal and related professional fees.

4. Execute. It will be necessary to train local planners, building inspectors, and other local officials on sustainable landscaping practices as these are the main points of contact between the jurisdiction and private building interests. A municipality can off information on websites and host free workshops run by sustainable landscaping design experts for local residents and businesses.

Resources

Sustainable Sites Initiative http://www.sustainablesites.org/

Rutgers New Jersey Agriculture Extension Service http://njaes.rutgers.edu/

5. Encourage sustainable landscaping practices for commercial applications

Introduction

Proper placement of trees and landscaping beautifies outdoor space and reduces heating and cooling costs   To obtain benefits from such placement, a municipality 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.

The Center for Urban Forest Research with support from the US Department of Agriculture Forest Service publishes free web-based software designed to evaluate the economic and environmental trade-offs between different landscaping practices.[697]

Sustainable Landscaping for Commercial Properties

	Municipal Government	Community-Wide
Initial Municipal Costs ($)	$ (101,250)	
Rebate/Subsidy ($)	$ 157,500	
Net Capital Cost ($)	$ (258,750)	
Lifetime Municipal Costs ($)	$ (101,250)	
Lifetime of Measure (Years)	30	
CO2 Reductions (Tons)		6,901
NOx Reductions (Lbs)		22,089
SO2 Reductions (Lbs)		76,584
Electricity Savings (MWh)		14,868
Electricity Savings ($)		$ 1,007,461
Natural Gas Savings (MMBtu)		5,964
Natural Gas Savings ($)		$ 30,738

Costs/Impacts

Proper placement of both deciduous and coniferous trees creating either wind protection or shading can save up to 25% of the energy a typical building uses for energy. Daytime air temperatures in tree-shaded neighborhoods can be 3 to 6 degrees cooler than in treeless areas.[698]

Scenario (building scale):

At $150 per square foot, a typical 20,000 sq. ft. office building will cost approximately $3,000,000 in construction costs for typical construction. Additional savings will be realized through increased energy efficiency. Energy expenses average $ 0.14/kWh for electricity and $1.07/therm for natural gas.[699] With an assumed electric savings of 1.77 kWh/sf per year[700] and an assumed gas savings of .71 kBtu/sf per year[701], this building would save 35,400 kWh and 14,200 kBtu or 141.9 therms[702] per year. This equates to a $4956 savings in electricity expenses and a $151.83 savings in natural gas expenses.

Scenario (municipality –wide):

East Orange

East Orange adds on average 62,931[703] square feet of new office space, or 3.15 (20,000 sq. ft. office buildings) per year. With an assumed electric savings of 1.77 kWh/sf per year and an assumed gas savings of .71 kBtu/sf per year, the anticipated square feet of new office space will save 111388 kWh and 44681 kBtu per year.

Edison

Edison adds on average 232,512[704] square feet of new office space, or 11.63 (20,000 sq. ft. office buildings) per year. With an assumed electric savings of 1.77 kWh/sf per year and an assumed gas savings of .71 kBtu/sf per year, the anticipated square feet of new office space will save 411546 kWh and 165084 kBtu per year.

Fort Lee

Fort Lee adds on average 124,310[705] square feet of new office space, or 6.22 (20,000 sq. ft. office buildings) per year. With an assumed electric savings of 1.77 kWh/sf per year and an assumed gas savings of .71 kBtu/sf per year, the anticipated square feet of new office space will save 220029 kWh and 88260 kBtu per year.

Howell Twp

Howell Twp. adds on average 177,660[706] square feet of new office space, or 8.88 (20,000 sq. ft. office buildings) per year. With an assumed electric savings of 1.77 kWh/sf per year and an assumed gas savings of .71 kBtu/sf per year, the anticipated square feet of new office space will save 314458 kWh and 126139 kBtu per year.

Middletown

Middletown adds on average 91,897[707] square feet of new office space, or 4.59 (20,000 sq. ft. office buildings) per year. With an assumed electric savings of 1.77 kWh/sf per year and an assumed gas savings of .71 kBtu/sf per year, the anticipated square feet of new office space will save 163658 kWh and 65247 kBtu per year.

Montclair

Montclair adds on average 35,936[708] square feet of new office space, or 1.80 (20,000 sq. ft. office buildings) per year. With an assumed electric savings of 1.77 kWh/sf per year and an assumed gas savings of .71 kBtu/sf per year, the anticipated square feet of new office space will save 63607 kWh and 25515 kBtu per year.

Parsippany – Troy Hills

Parsippany adds on average 616,256[709] square feet of new office space, or 30.81 (20,000 sq. ft. office buildings) per year. With an assumed electric savings of 1.77 kWh/sf per year and an assumed gas savings of .71 kBtu/sf per year, the anticipated square feet of new office space will save 1090773 kWh and 437542 kBtu per year.

Perth Amboy

Perth Amboy adds on average 23,719[710] square feet of new office space, or 1.19 (20,000 sq. ft. office buildings) per year. With an assumed electric savings of 1.77 kWh/sf per year and an assumed gas savings of .71 kBtu/sf per year, the anticipated square feet of new office space will save 41983 kWh and 16840 kBtu per year.

Plainfield

Plainfield adds on average 32,069[711] square feet of new office space, or 1.60 (20,000 sq. ft. office buildings) per year. With an assumed electric savings of 1.77 kWh/sf per year and an assumed gas savings of .71 kBtu/sf per year, the anticipated square feet of new office space will save 56762 kWh and 22769 kBtu per year.

West Orange

West Orange adds on average 60,961[712] square feet of new office space, or 3.05 (20,000 sq. ft. office buildings) per year. With an assumed electric savings of 1.77 kWh/sf per year and an assumed gas savings of .71 kBtu/sf per year, the anticipated square feet of new office space will save 107901 kWh and 43282 kBtu per year.

Willingboro Twp

Willingboro Township adds on average 38,621[713] square feet of new office space, or 1.93 (20,000 sq. ft. office buildings) per year. With an assumed electric savings of 1.77 kWh/sf per year and an assumed gas savings of .71 kBtu/sf per year, the anticipated square feet of new office space will save 68359 kWh and 27421 kBtu per year.

Local Fiscal Impacts

	Value
Lifetime of Measure (Years)	
Annual Electric Savings (MWh)	1.77 kwh/sf/yr
Annual Natural Gas Savings	.71 kBtu/sf/yr
Annual Peak Load Reductions (kW)	
Gallons Reduced	
VMT Reduced	
Custom Conversion (If gallons water --> electrcity, etc)	
Tax Credits ($)	
Incentives ($)	
Capital Administrative Costs ($)	
Yearly Administrative Costs ($)	
Capital Costs to Municipality ($)	
Yearly Costs to Municipality ($)	
Capital Incremental Costs ($)	
Yearly Incremental Costs ($)	

How to Do it

In adopting this sustainable landscaping policy, the municipality must consider the following;[714]

1. Involve. Representatives from existing volunteer boards, such as the Planning and Zoning Boards, environmental commission, and redevelopment and housing agencies, as well as municipal staff, especially the Zoning Official, Construction Code Official, and planner should be involved with this action.

2. Set a timeframe. Timeframes to implement the components will vary; however they can be pursued at the same time. Adopting a Green Building ordinance will take between one and three months.

3. Take into account project costs and resource needs:

Developing a sustainable landscaping ordinance will require municipal staff time; however costs should be minimal and likely will be related to legal and related professional fees.

4. Execute. It will be necessary to train local planners, building inspectors, and other local officials on sustainable landscaping practices as these are the main points of contact between the jurisdiction and private building interests. A municipality can off information on websites and host free workshops run by sustainable landscaping design experts for local residents and businesses.

Resources

Sustainable Sites Initiative. http://www.sustainablesites.org/

Rutgers New Jersey Agriculture Extension Service. http://njaes.rutgers.edu/

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

Introduction

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.[715] To offset this, a municipality 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 installing light-colored, high albedo materials or vegetation for at least 50% of sidewalks, patios, and driveways within 50 ft of the home.[716]

Acceptable materials include:

-White Concrete

- Gray Concrete

- Open Pavers

- Any material with a solar reflectance index (SRI) of at least 29.

Another viable strategy to mitigate urban heat island effects is to specify that existing and new deciduous trees shade 50% of sidewalks, patio or drive within five years.

Reducing heat generated from paving materials can be reduced by selecting paving materials with a low solar reflectance or by planting trees, known as know as urban forestry, to reduce heat delivered to pavement. In addition, preference should be given to covered parking which reduces exposed parking area, thus reducing heat transfer from paving materials.

Reduce Heat Island Effect in New Residential Buildings

	Municipal Government	Community-Wide
Initial Municipal Costs ($)	$ (124,583)	
Rebate/Subsidy ($)	$ 140,353	
Net Capital Cost ($)	$ (264,936)	
Lifetime Municipal Costs ($)	$ (124,583)	
Lifetime of Measure (Years)	25	
CO2 Reductions (Tons)		5,251
NOx Reductions (Lbs)		17,136
SO2 Reductions (Lbs)		60,513
Electricity Savings (MWh)		9,790
Electricity Savings ($)		$ 796,049
Natural Gas Savings (MMBtu)		-
Natural Gas Savings ($)		$ -

Costs/Impacts

For every 1°F increase in air temperature, electricity demand for cooling grows by 1.5-2%.[717] A 1.75% increase in cooling demand over ASHREA's base of 8.90 kwh/sf/yr equates to an additional .16 kwh/sf/yr for every 1°F increase in air temperature. Densely populated urban areas are often 2 to 9 degrees Fahrenheit higher than surrounding suburban and undeveloped areas, this translates to an increase in cooling demand ranging between 3.5-15.75%.

Scenario (building scale):

The average square footage of a single family home constructed in 2008 has risen to approximately 2,750 square foot.[718]

With an assumed additional electric demand of .16 kwh/sf/yr, this single family home will save 440 kWh/sf per year for every 1°F reduction in temperature achieved through urban heat island reduction strategies.

Scenario (municipality –wide):

East Orange

East Orange adds on average 41[719] units per year. With an assumed additional electric demand savings of 440 kWh/sf per year, these new single family homes will save 18040 kWh for every 1°F reduction in temperature achieved through urban heat island reduction strategies.

Edison

Edison adds on average 184[720] units per year. With an assumed additional electric demand savings of 440 kWh/sf per year, these new single family homes will save 80960 kWh for every 1°F reduction in temperature achieved through urban heat island reduction strategies.

Fort Lee

Fort Lee adds on average 91[721] units per year. With an assumed additional electric demand savings of 440 kWh/sf per year, these new single family homes will save 40040 kWh for every 1°F reduction in temperature achieved through urban heat island reduction strategies.

Howell Twp

Howell Township adds on average 141[722] units per year. With an assumed additional electric demand savings of 440 kWh/sf per year, these new single family homes will save 62040 kWh for every 1°F reduction in temperature achieved through urban heat island reduction strategies.

Middletown

Middletown adds on average 89[723] units per year. With an assumed additional electric demand savings of 440 kWh/sf per year, these new single family homes will save 39160 kWh for every 1°F reduction in temperature achieved through urban heat island reduction strategies.

Montclair

Montclair adds on average 25[724] units per year. With an assumed additional electric demand savings of 440 kWh/sf per year, these new single family homes will save 11000 kWh for every 1°F reduction in temperature achieved through urban heat island reduction strategies.

Parsippany

Parsippany adds on average 65[725] units per year. With an assumed additional electric demand savings of 440 kWh/sf per year, these new single family homes will save 28600 kWh for every 1°F reduction in temperature achieved through urban heat island reduction strategies. .

Perth Amboy

Perth Amboy adds on average 48[726] units per year. With an assumed additional electric demand savings of 440 kWh/sf per year, these new single family homes will save 21120 kWh for every 1°F reduction in temperature achieved through urban heat island reduction strategies.

Plainfield

Plainfield adds on average 27[727] units per year. With an assumed additional electric demand savings of 440 kWh/sf per year, these new single family homes will save 11880 kWh for every 1°F reduction in temperature achieved through urban heat island reduction strategies.

West Orange

West Orange adds on average 67[728] units per year. With an assumed additional electric demand savings of 440 kWh/sf per year, these new single family homes will save 29480 kWh for every 1°F reduction in temperature achieved through urban heat island reduction strategies.

Willingboro Twp

Willingboro Twp. adds on average 47[729] units per year. With an assumed additional electric demand savings of 440 kWh/sf per year, these new single family homes will save 20680 kWh for every 1°F reduction in temperature achieved through urban heat island reduction strategies.

How to Do it

In adopting this green building ordinance, the municipality must consider the following; [730]

1. Involve. Representatives from existing volunteer boards, such as the Planning and Zoning Boards, environmental commission, and redevelopment and housing agencies, as well as municipal staff, especially the Zoning Official, Construction Code Official, and planner should be involved with this action.

2. Set a timeframe. Timeframes to implement the components will vary; however they can be pursued at the same time. Adopting a Green Building ordinance will take between one and three months.

3. Take into account project costs and resource needs. Developing a Green Building ordinance will require municipal staff time; however costs should be minimal and likely will be related to legal professional fees.

Resources

A comprehensive source funding resources on state, local, utility, and federal incentives can be found at http://www.dsireusa.org/

U.S. EPA. Urban Heat Island Effect.http://www.epa.gov/hiri/index.htm

Department of Energy. Cool Roof Calculator.
http://www.ornl.gov/sci/roofs+walls/facts/CoolCalcEnergy.htm

U.S. EPA Energy Star Roofing Comparison Calculator. http://www.roofcalc.com/

Lawrence Berkeley Laboratory. Heat Island Group. Cool Pavements
http://eetd.lbl.gov/HeatIsland/Pavements/

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

Introduction

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.[731] To offset this, a municipality 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[732]:

a) Shade vegetation
b) Paving materials with SRI of 29
c) Shade structures
d) Parking under building

One major cause is the heat absorption generated from pavement materials. Reducing heat generated from paving materials can be reduced by selecting paving materials with a solar reflectance index (SRI) or 29 or by planting trees, known as know as urban forestry, to reduce heat delivered to pavement. In addition, preference should be given to covered parking which reduces exposed parking area, thus reducing heat transfer from paving materials.

If reflectance of pavement throughout a city were increased from 10 to 35 percent, the air temperature could potentially be reduced by 1°F.[733] Typical paving materials reach peak temperatures of 120–150°F[734]. In addition to this heat being transferred into the air, it also heats stormwater as it runs off the pavement into local watershed.[735]

Reduce Heat Island Effect in New Commercial Buildings

	Municipal Government	Community-Wide
Initial Municipal Costs ($)	$ (114,750)	
Rebate/Subsidy ($)	$ 160,650	
Net Capital Cost ($)	$ (275,400)	
Lifetime Municipal Costs ($)	$ (114,750)	
Lifetime of Measure (Years)	30	
CO2 Reductions (Tons)		788
NOx Reductions (Lbs)		2,573
SO2 Reductions (Lbs)		9,086
Electricity Savings (MWh)		1,764
Electricity Savings ($)		$ 119,529
Natural Gas Savings (MMBtu)		-
Natural Gas Savings ($)		$ -

Costs/Impacts

For every 1°F increase in air temperature, electricity demand for cooling grows by 1.5-2%.[736] A 1.75% increase in cooling demand over ASHRAE's base of 11.85 kwh/sf/yr equates to an additional .21 kwh/sf/yr. For every 1°F reduction in temperature achieved through reducing heat island mitigation strategies, a building's cooling demands are decreased by .21 kwh/sf/yr. Densely populated urban areas are often 2 to 9 degrees Fahrenheit higher than surrounding suburban and undeveloped areas, this translates to an increase in cooling demand ranging between 3.5-15.75%.

Scenario (municipality–wide):

East Orange

East Orange adds on average 62,931[737] square feet of new commercial space and renovates on average 125,862[738] square feet of existing commercial space. This totals 188,793 square foot of construction per year (approximately nine, 20,000 sq. ft. office buildings). With an assumed electric additional cooling cost of .21 kwh/sf/yr, the anticipated square feet of new office space will save an additional 39647 kWh per year for every 1°F reduction in temperature achieved through reducing heat island effect.

Edison

Edison adds on average 232,512[739] square feet of new commercial space and renovates on average 465,024[740] square feet of existing commercial space. This totals 697,536 square foot of construction per year (approximately thirty-five, 20,000 sq. ft. office buildings). With an assumed electric additional cooling cost of .21 kwh/sf/yr, the anticipated e square feet of new office space will save an additional 146483 kWh per year for every 1°F reduction in temperature achieved through reducing heat island effect

Fort Lee

Fort Lee adds on average 124,310[741] square feet of new commercial space and renovates on average 248,620[742] square feet of existing commercial space. This totals 372,930 square foot of construction per year (approximately eighteen, 20,000 sq. ft. office buildings). With an assumed electric additional cooling cost of .21 kwh/sf/yr, the anticipated square feet of new office space will save an additional 78315 kWh per year for every 1°F reduction in temperature achieved through reducing heat island effect

Howell Twp

Howell Twp. adds on average 177,660[743] square feet of new commercial space and renovates on average 355,320[744] square feet of existing commercial space. This totals 532,980 square foot of construction per year (approximately twenty seven 20,000 sq. ft. office buildings). With an assumed electric additional cooling cost of .21 kwh/sf/yr, the anticipated square feet of new office space will save an additional 111926 kWh per year for every 1°F reduction in temperature achieved through reducing heat island effect

Middletown

Middletown adds on average 91,897[745] square feet of new commercial space and renovates on average 183,794[746] square feet of existing commercial space. This totals 275,691 square foot of construction per year (approximately fourteen 20,000 sq. ft. office buildings). With an assumed electric additional cooling cost of .21 kwh/sf/yr, the anticipated square feet of new office space will save an additional 57895 kWh per year for every 1°F reduction in temperature achieved through reducing heat island effect.

Montclair

Montclair adds on average 35,936[747] square feet of new commercial space and renovates on average 71,872[748] square feet of existing commercial space. This totals 107,808 square foot of construction per year (approximately five, 20,000 sq. ft. office buildings). With an assumed electric additional cooling cost of .21 kwh/sf/yr, the anticipated square feet of new office space will save an additional 22640 kWh per year for every 1°F reduction in temperature achieved through reducing heat island effect.

Parsippany

Parsippany adds on average 616,256[749] square feet of new commercial space and renovates on average 1,232,512[750] square feet of existing commercial space. This totals 1,848,768 square foot of construction per year (approximately ninety two 20,000 sq. ft. office buildings). With an assumed electric additional cooling cost of .21 kwh/sf/yr, the anticipated square feet of new office space will save an additional 388241 kWh per year for every 1°F reduction in temperature achieved through reducing heat island effect.

Perth Amboy

Perth Amboy adds on average 23,719[751] square feet of new commercial space and renovates on average 47,438[752] square feet of existing commercial space. This totals 71,157 square foot of construction per year (approximately five, 20,000 sq. ft. office buildings). With an assumed electric additional cooling cost of .21 kwh/sf/yr, the anticipated square feet of new office space will save an additional 14943 kWh per year for every 1°F reduction in temperature achieved through reducing heat island effect.

Plainfield

Plainfield adds on average 32,069[753] square feet of new commercial space and renovates on average 64,138[754] square feet of existing commercial space. This totals 96,207 square foot of construction per year (approximately five, 20,000 sq. ft. office buildings). With an assumed electric additional cooling cost of .21 kwh/sf/yr, the anticipated square feet of new office space will save an additional 20203 kWh per year for every 1°F reduction in temperature achieved through reducing heat island effect.

West Orange

West Orange adds on average 60,961[755] square feet of new commercial space and renovates on average 121,922[756] square feet of existing commercial space. This totals 182,883 square foot of construction per year (approximately five, 20,000 sq. ft. office buildings). With an assumed electric additional cooling cost of .21 kwh/sf/yr, the anticipated square feet of new office space will save an additional 38405 kWh per year for every 1°F reduction in temperature achieved through reducing heat island effect.

Willingboro Twp.

Willingboro Twp. adds on average 38,621[757] square feet of new commercial space and renovates on average 77,242[758] square feet of existing commercial space. This totals 115,863 square foot of construction per year (approximately five, 20,000 sq. ft. office buildings). With an assumed electric additional cooling cost of .21 kwh/sf/yr, the anticipated square feet of new office space will save an additional 24331 kWh per year for every 1°F reduction in temperature achieved through reducing heat island effect.

How to Do it

In adopting this green building ordinance, the municipality must consider the following; [759]

1. Involve. Representatives from existing volunteer boards, such as the Planning and Zoning Boards, environmental commission, and redevelopment and housing agencies, as well as municipal staff, especially the Zoning Official, Construction Code Official, and planner should be involved with this action.

2. Set a timeframe. Timeframes to implement the components will vary; however they can be pursued at the same time. Adopting a Green Building ordinance will take between one and three months.

3. Take into account project costs and resource needs. Developing a Green Building ordinance will require municipal staff time; however costs should be minimal and likely will be related to legal professional fees.

4. Execute. Train local planners, building inspectors, and other local officials on sustainable landscaping practices as these are the main points of contact between the jurisdiction and private building interests. Offer information on websites and host free workshops run by sustainable landscaping design experts for local residents and businesses.

Resources

A comprehensive source funding resources on state, local, utility, and federal incentives can be found at http://www.dsireusa.org/

U.S. EPA. Urban Heat Island Effect. http://www.epa.gov/hiri/index.htm

Department of Energy. Cool Roof Calculator.
http://www.ornl.gov/sci/roofs+walls/facts/CoolCalcEnergy.htm

U.S. EPA Energy Star Roofing Comparison Calculator. http://www.roofcalc.com/

Lawrence Berkeley Laboratory. Heat Island Group. Cool Pavements.
http://eetd.lbl.gov/HeatIsland/Pavements/

WASTE REDUCTION MEASURES

1. **Reduce solid waste generation through green purchasing**
2. **Minimize GHG emissions from waste through management**
3. **Encourage recycling of residential construction and demolition waste**
4. **Encourage recycling of commercial construction and demolition waste**

1. Reduce solid waste generation through green purchasing

Introduction/Summary

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."[760] 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.

A municipality 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.[761] Because energy is consumed in the waste creation and disposal processes, reducing waste overall mitigates energy use and therefore greenhouse gas emissions.

A commitment to Environmentally Preferable Purchasing can be made by outlining standards and procedures for selecting products based on environmental and health criteria and adopting these guidelines as an official Green Purchasing Policy. Guidelines for product selection may include the following: purchasing products with an eco-label certification where applicable; purchasing environmentally-preferable paper products based on recycled content for printer/copier paper, office supplies, and sanitary paper products; choosing environmentally-preferable supplies for operations and maintenance; replacing toxic chemicals used for cleaning, pest control, and landscaping with healthier alternatives; and selecting recycled plastics or other sustainable materials for lumber and parks equipment. Incorporating these selection preferences will offer a broad range of environmental impacts. However, this measure focuses specifically on the benefits of reducing solid waste generation by selecting products with minimal packaging and by switching to reusable or more durable items when available.

Reduce solid waste generation through green purchasing

	Municipal Government	Community-Wide
Initial Municipal Costs ($)	$ 4,320	
Rebate/Subsidy ($)	$ -	
Net Capital Cost ($)	$ 4,320	
Lifetime Municipal Costs ($)	$ 68,232	
Lifetime of Measure (Years)	30	
CO2 Reductions (Tons)	5,006	5,006
Waste Savings (Tons)	6,042	6,042
Waste Savings ($)	$ 105,831	$ 105,831

Costs/Impacts

This scenario shows the costs and benefits[762] of reducing packaging waste in local government operations by 25 percent.[763] Administrative costs for developing and implementing a Green Purchasing Policy are included.[764] Benefits are shown in avoided costs of waste disposal[765] and the associated reduction in greenhouse gas emissions. In this scenario, it is assumed that the policy is designed so that the overall budget for procurement does not increase. Instead, cost savings from avoided purchases and bulk purchases are directed toward the higher incremental costs of some environmentally preferable products.[766]

Local Fiscal Impacts

Lifetime of measure	
Initial Cost	Staff time for 3 month policy development: $4,320
subsidy	
Cost after subsidy	
Annual Cost	Ongoing staff time (annual): $5,400
Annual Savings	Waste disposal avoided = tons packaging waste reduced * 0.5982 * $75
Years to Payback	
Net Present Value	

Social and Environmental Impacts

	Government
GHG reduction	Emissions reduced = tons packaging waste reduced * 1.025 $MTCO_2E$
kWh/Therms/gallons reduced	
Criteria Air Pollutants	
Other	

Input needed:

Tons of waste generated annually by government operations OR Number of local government employees

Calculation Notes:

To scale benefits for this measure, begin with the number of tons of waste generated annually by government operations. If this figure is not available, a rough estimate of waste generation can be calculated using a figure of 0.59 tons per government employee per year.

Next, multiply by 0.308 to get a rough estimate of the annual tons of waste generated in the "containers and packaging" category. Use that estimate of tons of packaging waste generated to complete the following calculations.

T_{pw} = tons of packaging waste generated annually by government operations
R_{pw} = reduction in tons of packaging waste generated annually by government operations

Estimate baseline annual tons of packaging waste:
T_{pw} = # of government employees * 0.59 * 0.308

Estimate reduction in annual tons of packaging waste:
R_{pw} = T_{pw} * 0.25

Calculate annual avoided costs of solid waste disposal:
$ saved = R_{pw} * 0.5982 * $75

Estimate Emissions Reductions:
$MTCO_2E$ reduced = R_{pw} * 1.025 $MTCO_2E$

Capital Administrative Costs:
96 hours (in 3 months) * $45/hour = $4,320

Annual Administrative Costs:
10 hours/month * 12 months * $45/hour = $5,400

Assumptions used to generate these formulas are referenced in the end notes section.

How to Do It

1. **Assemble a Green Purchasing Team** to improve purchasing practices and find more environmentally friendly products and services. Purchasing personnel, operations and maintenance personnel, as well as representatives of all departments who purchase goods and services should be involved. The team should publicize the effort to gather internal as well as public support and set overall goals related to improving energy efficiency, reducing health hazards, increasing the purchase of recycled or recyclable products, etc.

2. **Collect baseline data on current procurement policies and products purchased**.

3. **The team should continue by researching the most practical green purchasing choices and drafting a formal Green Purchasing Policy.** While this measure focuses on the potential benefits from reductions in packaging waste, a Green Purchasing Policy will ideally evaluate products based on a broad range of environmental and health attributes in addition to standard cost and performance criteria. As outlined by the EPA,[767] the following environmental attributes should be considered when evaluating potential product purchases: energy efficiency, recycled content, recyclability, water efficiency, resource conservation, greenhouse gas emissions, waste prevention, renewable material percentages, adverse effects to workers, animals, plants, air, water, and soil, toxic material content, packaging, and transportation.

   Some environmentally preferable purchasing products are more expensive. Others can be purchased at no additional cost or even save money immediately. Evaluate potential savings over the lifetime of a product to determine whether the incremental cost of a more efficient product will pay for itself (e.g., energy saving light bulbs will reduce energy bills). Some communities choose to set a specific cap, in the range of 3-15%[768], for the incremental cost a purchaser may spend for a green product over a standard product. This enables, but sets limits on, the purchase of slightly higher cost green items. Another tactic is to use funds saved from a cheaper alternative to purchase more expensive products. For instance, use funds from energy savings to purchases non-toxic cleaners that protect employee health. Cost savings can also be achieved by eliminating unnecessary product usage and switching to reusable or more durable products whenever possible. For example, reduce paper purchases by setting all printers and copiers to default to double sided printing and reduce food service waste by switching to reusable cups and plates instead of disposables.

Because product packaging contributes significantly to solid waste generation, the Green Purchasing Policy should aggressively seek out products with reduced packaging. Disposal of packaging waste becomes the responsibility of the facilities or maintenance department and contributes to costs for waste disposal. A number of tactics may be implemented to reduce product packaging and the associated disposal costs.

Strategies to reduce packaging include:

- Communicate to suppliers a desire for minimal order packaging
- Choose products that are durable or reusable instead of disposable or low quality items that must be replaced frequently
- Select concentrated forms of liquid products
- Select items that are not individually wrapped
- Buy in bulk: purchase larger quantities by the case less frequently instead of smaller quantities shipped in multiple boxes more frequently
- Consolidate orders from multiple departments to minimize shipping costs and packing containers
- Ask for shipments to be sent in returnable containers
- Return cardboard boxes and packaging materials to distributors for reuse
- Return, reuse, or rebuild packaging containers such as wooden pallets
- Use reusable boxes to distribute product orders among different departments and locations

4. **Once a Green Purchasing Policy has been finalized, it should be officially adopted by the local governing body**. To implement the new policy, staff must be trained, and new policies must be disseminated to all departments. The new guidelines should be integrated into purchasing documents and communicated to product vendors.

5. **After purchasing green products, evaluate the Green Purchasing Program** on an ongoing basis to reassess needs, satisfaction with products, and accrued benefits.

Resources

Sample Environmental Purchasing Policies and Ordinances:

Rutgers Green Purchasing . http://purchasing.rutgers.edu/green/

Portland, Oregon, Sustainable Procurement Policy. http://www.portlandonline.com/shared/cfm/image.cfm?id=204110

Berkeley, California, Environmentally Preferable Purchasing Policy. http://www.besafenet.com/ppc/docs/purchasing/PU_BPP.pdf

Oakland, California 2007 ordinance to reduce waste, purchase environmentally safe products, purchase products that use recycled content. http://clerkwebsvr1.oaklandnet.com/attachments/17021.pdf

Seattle, Washington Green Purchasing Program. http://www.cityofseattle.net/purchasing/grnpurchhome.htm

New Jersey Department of Environmental Protection:

Green Purchasing: A Guide for Local Governments & Communities http://www.nj.gov/dep/opsc/docs/green_purchasing_guide_local_governments.pdf

Buy Recycled in New Jersey. www.nj.gov/dep/dshw/recycling/buy_recy

New Jersey Department of the Treasury Division of Purchase and Property

Cooperative Purchasing State Green Contracts. http://www.state.nj.us/treasury/purchase/greencontracts.shtml

Association of New Jersey Recyclers (ANJR) Buy Recycled Products Directory: http://www.anjr.com/buyrecycled/how_to_use.html

Environmental Protection Agency:

Environmentally Preferable Purchasing. http://www.epa.gov/opptintr/epp/index.htm

Resource Conservation Comprehensive Procurement Guidelines. http://www.epa.gov/epawaste/conserve/tools/cpg/index.htm

Database of Environmental Information for Products and Services. http://yosemite1.epa.gov/oppt/eppstand2.nsf

North American Green Purchasing Initiative

Includes "Eco-Eval" Green Purchasing Self Assessment Tool. http://www.nagpi.net

Responsible Purchasing Network (RPN) Purchasing Guides. http://www.responsiblepurchasing.org/purchasing_guides/all/index.php

US Communities Government Purchasing Alliance Going Green Program. http://www.gogreencommunities.org/

Northeast Recycling Council (NERC Environmental Benefits Calculator. http://www.nerc.org/documents/environmental_benefits_calculator.html

Massachusetts Environmentally Preferable Products Procurement Program

EnviroCalc (Environmental Benefits and Cost Savings Calculator for Purchasers)

http://www.mass.gov/?pageID=afterminal&L=6&L0=Home&L1=Budget%2c+Taxes+%26+Procurement&L2=Procurement+Information+%26+Resources&L3=Procurement+Programs+and+Services&L4=Environmentally+Preferable+Products+%28EPP%29+Procurement+Program&L5=Download+Publications%2c+Reports+and+Tools&sid=Eoaf&b=terminalcontent&f=osd_epp_es_dlpub_envirocalc&csid=Eoaf

Environmental Defense Fund Paper Calculator: http://www.edf.org/papercalculator/

2. Minimize GHG emissions from waste through management

Introduction:

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.[769]

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.[770] In addition, landfills are the largest source of methane (CH_4), which is over 20 times more effective at trapping heat than carbon dioxide (CO_2).[771] 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. Conduct a Waste Audit of Municipal Buildings/Facilities or Schools

A waste audit is very useful because it focuses on both recycling and waste reduction. Furthermore, conducting waste audits on municipal and public buildings will help determine the type and quantity of waste that is being produced.[772] Consequently, the information provided from the audit can be useful when designing an effective waste reduction strategy.

2. Adopt a Pay-as-You-Throw Program (PAYT)

The majority of municipal governments charge for garbage collection by a flat rate or through property taxes; however, this system does not provide incentives to reduce waste. A pay-as-you-throw program will treat trash like electricity or other utility services. Higher fees are assessed when more trash is thrown away.[773]

Currently, 12 New Jersey towns have adopted a PAYT system. Overall, studies have shown these towns recycle more and produce less waste than neighboring towns that use a traditional waste collecting method.[774]

3. Implement a Compost Waste Reducing Program

Compost material makes up a significant portion of MSW. According to the EPA, yard trimmings and food residuals collectively make up 26% of the nation's MSW.[775] A good way to lower compost waste is by adopting the "Grass-Cut it and Leave it" program. The purpose of the "Grass-Cut it and Leave it" program is to educate community members about the benefits of leaving grass clippings on the lawn once they are done mowing.

Furthermore, encouraging community members to implement a backyard composting system will also help reduce unnecessary compost waste. Unlike recycling paper and plastics, composting is a little more complex; therefore, providing education on how to design an effective backyard composting system can help increase community participation and lower waste consumption.

4. Implement a Waste Reduction Education Program

In 1960, the average American citizen produced 2.86 pounds of trash per day. Over the years, this number has steadily increased and is now 4.62 pounds.[776] One way to address this concern is by educating community members about the importance of recycling, reducing, and reusing their waste materials. This can be achieved by providing educational materials on the municipal website, distributing pamphlets, or conducting educational assemblies with community members.

Municipalities can also choose to enroll in the EPA WasteWise program. The WasteWise program offers technical support and resources on how to **reduce** unnecessary waste consumption. Also, the program is nationwide, and provides networking opportunities for its enrolled members.[777]

Minimize GHG from Waste through Management

	Municipal Government	Community-Wide
Initial Municipal Costs ($)	$ 337,483	
Rebate/Subsidy ($)	$ -	
Net Capital Cost ($)	$ 337,483	
Lifetime Municipal Costs ($)	$ 337,483	
Lifetime of Measure (Years)	10	
CO2 Reductions (Tons)		58,000
Waste Savings (Tons)		25,000
Waste Savings ($)		$ 796,051

Cost/Impacts:

Costs associated with implementing this measure will vary depending on the course of action taken. Costs are illustrated separately for each strategy as well as combined for a comprehensive waste management program. Municipalities can use their recycling grant funds to help pay for each of these programs.

1. Conduct a Waste Audit of Municipal Buildings/Facilities or Schools

A waste auditor will have to compile detailed information on the content of the waste being disposed and recycled within each facility. Audits can be carried out by an existing staff member, which will reduce additional costs.

During instances when audits cannot be performed in-house, municipalities can also hire an outside consultant that is likely to charge $1,000 to $3,000 for each audit, depending on the size of the building being inspected.[778]

2. Adopt a Pay as You Throw Program (PAYT)

Implementing a PAYT program can take up a significant amount of time and resources. Some communities may be able to adopt the measure without changing their current administrative structure, whereas others may need to alter their existing waste collecting and accounting methods.[779] Additionally, adequate monitoring and enforcement policies are also required in order to successfully carry out the program. Overall, expenses associated with enforcing a PAYT program are largely dependent on the town's current regulatory structure.

Because of these factors, costs to adopt a PAYT program can vary substantially amongst municipalities. For a comprehensive look at the administrative and enforcement costs associated with implementing a PAYT program, please refer to the following EPA guideline:

> http://www.epa.gov/epawaste/conserve/tools/payt/top1.htm

3. Implement a Compost Waste Reducing Program

Both the Grass-Cut it and Leave it and backyard composting strategies will require staff time devoted towards educating community members. Financial costs to perform these measures are minimal, but it may be beneficial to provide educational and promotional materials as well. Many resources are available on the NJ DEP website.

To enhance the effectiveness of the backyard composting program, it is advantageous to provide composting bins for community members. Composting bins will increase the costs to conduct the measure, but will also provide additional incentive for community members to participate in the program. To eliminate purchasing costs, municipalities may want to also consider selling the composting bins for the same price as purchased. However, this strategy will not eliminate expenses associated with procurement of composting bins.

4. Implement a Waste Reduction Education Program

Overall, costs to implement the waste reduction education program are minimal.

The majority of costs for this measure will be attributed to staff time. Staff hours will need to be designated towards designing and coordinating an effective education program. Educational and promotional materials may also contribute to costs; however, various educational materials may already be available. Enrolling in the EPA WasteWise program is free, but will also require staff time.

The following table details the costs of adopting all of the recommended waste reduction strategies:

Combined Costs to Implement all of the Waste Management Strategies

Category	**Costs**
Waste Audit Cost780	$884.62
PAYT Projected Implementation Costs781	= number of households multiplied by 10
Bins for Backyard Composting Program782	=0.13% of community households multiplied by $49.63.
Procurement Expenses for Purchasing Composting Bins783	$598.56
Combined Educational and Outreach Expenses784	= number of households multiplied by 3.25
Total Costs	X

Impact Savings:

The following tables demonstrate the savings associated with achieving a 5% annual reduction in non-recycled MSW:

Impact Savings Achieved Through a 5% Decrease in Municipal Solid Waste by Recycling.785

Impact	Savings
Total MSW Waste Reduced (Tons)786	Total MSW (11,815.87 tons) multiplied by .05 = 590.79
CO2 (Tons)787	Every ton of landfilled MSW recycled = savings

	of 1.67 tons of CO_2. = (838.63)

Impact Savings Achieved Through a 5% Decrease in Municipal Solid Waste by Source Reduction.[788]

Impact	Savings
Total MSW Waste Reduced (Tons)	590.79
CO_2 (Tons)[789]	Every ton of landfilled source reduced MSW = savings of 2.32 tons of CO_2. = 1165.04 tons CO_2
Methane (Tons CO_2)[790]	Methane savings = 0.079 ton CO_2 for every ton of source reduced landfilled waste(590.79X.85X.079) = 39.67 tons CO_2
NO (lbs)[791]	NO savings= 12.52 lbs per ton of combusted MSW (590.79X.15X12.52)= 1,109.51 lbs NO
SO_2 (lbs)[792]	SO_2 savings= 5.03 lbs per ton of combusted MSW (590.79X.15X5.03)= 445.75 lbs SO_2

How to do it:

1. Before selecting which strategy(s) to implement, appoint the local Certified Recycling Professional (CRP) to manage all waste reduction responsibilities. For instances where a CRP is unavailable, the Rutgers Office of Continuing Education provides guidance on how to obtain certification. To learn more about the certification process, please visit the following link:

http://www.cpe.rutgers.edu/programs/NJ-recycling-recertification.html

The CRP should work alongside municipal staff members and community volunteers throughout planning and implementation of waste reduction activities.

2. Implement one or more of the following strategies to achieve the targeted 5% reduction in MSW:

- Conduct a Waste Audit on Municipal Building/Facilities or Schools
- Adopt a Pay As You Throw Program
- Implement a Compost Waste Reducing Program
- Implement a Waste Reduction Education Program

Conduct a Waste Audit of Municipal Buildings/Facilities or Schools:

Performing a waste audit on municipal buildings is important because it will help determine the types and quantity of waste being generated.[793] The information collected from the audit can be used to set specific recycling and waste reduction goals.

a. The Solid Waste Policy Group at Rutgers University provides guidance and information on how to conduct a waste audit. http://www.cook.rutgers.edu/~envpurchase/basics_cycle_audits.htm#top
b. If feasible, conduct a waste audit in public schools. San Mateo County, California provides in-depth information on how to perform a waste audit at public schools
c. http://www.recycleworks.org/schools/s_audits.html

Adopt a Pay As You Throw Program:

Implementing a Pay as You Throw Program is an effective way to reduce MSW. PAYT charges households by how much waste they generate. In contrast, the majority of municipalities charge a flat rate, regardless of the amount of trash being collected. Unlike traditional waste collecting methods, the PAYT program provides a strong economic incentive for community members to reduce waste and recycle.

Below are some of the various strengths associated with a PAYT Program[794]:

- It is fair, and it allows residents to control their waste expenses.
- It provides a market-based incentive to reduce waste.
- Waste reduction isn't mandatory for the PAYT program. Those who do not want to reduce their waste load are not required to, but they will pay more.
- PAYT programs are efficient. In comparison, a curbside pickup can be costly because it requires trucks, drivers, ect. A PAYT program doesn't

necessarily need this, because residents can dispose of their recyclables at drop off centers.

- The program does not discriminate against specific types of recyclable material. PAYT encourages residents to recycle all forms of recyclable material in order to reduce their waste load.
- The program is relatively quick to adopt. Most PAYT programs can be implemented within three months.

Because of these benefits, thousands of communities across the country have adopted Pay as You Throw.[795]

a. The first step to implementing a PAYT system is to determine the current cost of providing waste management services. Because the PAYT program will alter the price of collecting waste, it is important to make sure the new prices will sufficiently cover the expenses associated with waste management.

   For example, failing to set an adequate pricing system can create funding problems. In 1999, Austin, Texas implemented a PAYT system. However, the city was quickly losing revenue from trash fees because the pricing structure was not sufficient enough to cover waste management expenses.[796]

   To learn how to design the most effective PAYT pricing structure, please refer to the following EPA manual:

   http://www.epa.gov/epawaste/conserve/tools/payt/pdf/rsdhandbook.pdf

b. Once the pricing structure is established, it is important to design a PAYT program that is specifically tailored for the community. PAYT programs vary amongst towns and municipalities. Some towns charge by weight, whereas others charge by the number of trash cans or bags.

   The EPA features a variety of useful information associated with PAYT, such as maps, case studies, and research articles. The following EPA link provides detailed guidance on how to create the most practical and effective PAYT program:

   http://www.epa.gov/epawaste/conserve/tools/payt/index.htm

Compost Waste Reducing Programs

Grass- Cut it and Leave it: The "Grass- Cut it and Leave it" program reduces compost waste by encouraging residents to leave grass clippings on their lawn after mowing. Not only does this lower MSW, but lawn clippings also provide healthy and necessary fertilizer for lawns. Consequently, the program helps strengthen residential lawns while eliminating unnecessary compost waste.

a. To adopt the "Grass-Cut it and Leave it" program, design an educational and outreach campaign. The following link includes a sample brochure: http://www.state.nj.us/dep/dshw/recycling/brochures/recycling%20brochures/grass.pdf
b. Once the educational campaign is designed; actively promote the program throughout the community
c. Throughout the duration of the program, continue to examine participation and waste reduction rates in order to make any necessary adjustments to the program to increase its overall effectiveness.

Backyard Composting Program: In addition to the "Grass-Cut it and Leave it" program, it is also beneficial to educate community members about the importance of composting food and yard scraps. Composting is a little more complicated than recycling paper and plastic; as a result, teaching community members how to design a backyard composting system is an effective way to reduce MSW.

a. Appoint the CRP to organize a backyard composting workshop or seminar. The workshop can coincide with other community activities or it can be a separate event.
b. Design promotional and educational materials to be distributed at the workshop. The CRP should work alongside municipal officials and community volunteers during this stage.
c. Select composting bins to buy for the purpose of distribution. The most cost-efficient method is to purchase the bins in bulk. The following purchasing options are available to local governments seeking to purchase conservation equipment in bulk:

    - The New Jersey Cooperative Purchasing Program –Allows local governments to achieve cost savings by purchasing equipment and services under existing State contracts. Not only does the size of the program allow for volume-driven cost reductions, but it also saves municipalities money by eliminating redundant solicitation and/or negotiation costs.[797] Additionally, Executive Order 11 (April 22, 2006), which requires that all State entities with purchasing or procurement authority select Energy Star products when available, ensures that the State's Cooperative Purchasing Program will provide contracts for energy efficient equipment.[798]
      http://www.state.nj.us/treasury/purchase/coop_agency.shtml

- The U.S. Communities Government Purchasing Alliance (U.S. Communities) A national cooperative purchasing alliance that offers a variety of green products through its Going Green Program.[799] http://www.gogreencommunities.org/?sid=200910160

- ENERGY STAR Quantity Quotes Website – Connects bulk purchasers with suppliers of ENERGY STAR qualified products and facilitates the negotiation of discounted prices.[800] **http://www.quantityquotes.net/default.aspx**

d. Monitor participation rates and impacts to determine the overall effectiveness of the program. The information gathered can be used to make any necessary adjustments.

Implement a Waste Reduction Education Program:

Educating community members about the importance of recycling, reducing, and reusing their waste materials can help lower MSW.

a. Design an educational program that encourages community members to recycle, reduce, and reuse their waste materials. The following EPA link includes detailed information and recommendations that municipalities can utilize for their education program: http://www.epa.gov/epawaste/wycd/community.htm
b. Communities should also consider enrolling in the EPA WasteWise program. WasteWise is a nationwide program that offers free technical support and resources on how to reduce unnecessary waste consumption. In addition, the program has thousands of participating communities and provides networking opportunities for its members. To enroll in the EPA WasteWise program, please visit the following link: http://www.epa.gov/osw/partnerships/wastewise/index.htm
c. **3.** After implementing one or more of the waste reduction strategies, record and document the overall municipal waste savings that are being achieved. Maintain an inventory that categorizes the waste materials that are being discarded and recycled. Some of this information can be provided from the waste audit program. The CRP can then use this information to see where progress is being made and which areas need improvements or adjustments.

Resources:

EPA Waste Reduction Model (WARM): The WARM model calculates the emission savings achieved by type and amount of waste material recycled. http://www.epa.gov/climatechange/wycd/waste/calculators/Warm_UsersGuide.html

Waste Material Data: http://www.environmentalistseveryday.org/publications-solid-waste-industry-research/profiles-garbage-waste-age-magazine/index.php

EPA site on MWR strategies.
http://www.epa.gov/epawaste/partnerships/wastewise/wrr/sl_resources.htm

NJ DEP Information on source reduction.
http://www.state.nj.us/dep/dshw/recycling/source_red.htm

Sustainable Jersey: PAYT.
http://sustainablejersey.com/actiondesc.php?arr_num=134&id_num=14!9

Sustainable Jersey: Grass- Cut it and Leave it.
http://sustainablejersey.com/actiondesc.php?arr_num=135&id_num=14!10

Sustainable Jersey: Backyard Composting.
http://sustainablejersey.com/actiondesc.php?arr_num=136&id_num=14!11

3. Encourage recycling of residential construction and demolition Waste

Introduction

Numerous benefits can be achieved by diverting a portion of 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, a municipality 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.[801]

Reduce Residential construction & demo waste with recycle programs

	Municipal Government	Community-Wide
Initial Municipal Costs ($)	$ -	
Rebate/Subsidy ($)	$ -	
Net Capital Cost ($)	$ -	
Lifetime Municipal Costs ($)	$ -	
Lifetime of Measure (Years)	10	
CO2 Reductions (Tons)		82
Waste Savings (Tons)		50
Waste Savings ($)		$ 1,592

Costs/Impacts

Although there is an additional on site cost on the account of labor hours needed to sort construction debris, money is saved on recycling costs. In New Jersey, average tipping fees at local recycling facilities range from $5 - $46 per ton. Typical disposal costs are substantially higher, ranging from $75-$98 per ton.

In choosing to recycle construction and demolition debris over typical disposal, a savings of approximately $55.00 per ton can be assumed.

<u>Scenario (building scale):</u>

Overall residential construction and demolition debris average 4.39 pounds per square foot[802]. The average square footage of a single family home constructed in 2008 has risen to approximately 2,750 square foot.[803] At 4.39 pounds per square foot, a typical 2,750 sq. ft. home will create approximately 12,073 pounds, or 6.04 tons, of construction and demolition debris.

Typical disposal cost for removal of 12,073, or 6.04 tons, pounds of construction and demolition debris would be approximately $522.46.[804] If 75% or 4.53 tons of the construction and demolition debris for this same 2,750 square foot home were recycled, disposal costs would be substantially less at approximately $266.52.[805] Every home that recycles 75% of construction and demolition debris will save $255.94 in addition to savings related to reduced permit fees.

In addition to cost reductions, there will also be greenhouse gas emissions reductions associated with diverting 75% of total construction and demolition debris from a traditional trash disposal facility. Every new home constructed that recycles 75% of construction and demolition debris will equate to a total reduction of 6.75 Metric Tons of Carbon Equivalent (MTCE).[806]

Scenario (municipality –wide):

Based on participations rates of similar green building incentive programs nationwide, assume a 5% annual increase in the percentage new residential projects that will take advantage of reduced permit fees for recycling of construction and demolition debris. By the time this ordinance is in place for four years, a 20% level of participation is anticipated.

East Orange

The City of East Orange adds on average, 41 units per year. [807] On this forth year, it is anticipated that 8 of the 41 units will take advantage of reduced permit fees. If 75% or an average of 4.53 tons of the construction and demolition debris per new home were recycled, East Orange will reduce its residential construction and demolition debris by 36.24 tons annually.

Edison

The City of Edison adds on average, 184 units per year. [808] On this forth year, it is anticipated that 37 of the 184 units will take advantage of reduced permit fees. If 75% or an average of 4.53 tons of the construction and demolition debris per new home were recycled, Edison will reduce its residential construction and demolition debris by 167.61 tons annually.

Fort Lee

The City of Fort Lee adds on average, 91 units per year. [809] On this forth year, it is anticipated that 18 of the 91 units will take advantage of reduced permit fees. If 75% or an average of 4.53 tons of the construction and demolition debris per new home were recycled, Fort Lee will reduce its residential construction and demolition debris by 81.54 tons annually.

Howell Twp.

Howell Twp. adds on average, 141 units per year. [810] On this forth year, it is anticipated that 28 of the 141 units will take advantage of reduced permit fees. If 75% or an average of 4.53 tons of the construction and demolition debris per new home were recycled, Howell Twp. will reduce its residential construction and demolition debris by 126.84 tons annually.

Middletown

The City of Middletown adds on average, 82 units per year. [811] On this forth year, it is anticipated that 16 of the 82 units will take advantage of reduced permit fees. If 75% or an average of 4.53 tons of the construction and demolition debris per new home were recycled, Middletown will reduce its residential construction and demolition debris by 72.48 tons annually.

Montclair

The City of Montclair adds on average, 25 units per year. [812] On this forth year, it is anticipated that 5 of the 25 units will take advantage of reduced permit fees. If 75% or an average of 4.53 tons of the construction and demolition debris per new home were recycled, Montclair will reduce its residential construction and demolition debris by 22.65 tons annually.

Parsippany – Troy Hills

The City of Parsippany adds on average, 65 units per year. [813] On this forth year, it is anticipated that 13 of the 65 units will take advantage of reduced permit fees. If 75% or an average of 4.53 tons of the construction and demolition debris per new home were recycled, Parsippany will reduce its residential construction and demolition debris by 58.89 tons annually.

Perth Amboy

The City of Perth Amboy adds on average, 48 units per year. [814] On this forth year, it is anticipated that 10 of the 48 units will take advantage of reduced permit fees. If 75% or an average of 4.53 tons of the construction and demolition debris per new home were recycled, Perth Amboy will reduce its residential construction and demolition debris by 45.30 tons annually.

Plainfield

The City of Plainfield adds on average, 27 units per year. [815] On this forth year, it is anticipated that 6 of the 27 units will take advantage of reduced permit fees. If 75% or an average of 4.53 tons of the construction and demolition debris per new home were recycled, Plainfield will reduce its residential construction and demolition debris by 22.65 tons annually.

West Orange

The City of West Orange adds on average, 67 units per year. [816] On this forth year, it is anticipated that 13 of the 67 units will take advantage of reduced permit fees. If 75% or an average of 4.53 tons of the construction and demolition debris per new home were recycled, West Orange will reduce its residential construction and demolition debris by 58.89 tons annually.

Willingboro Twp.

Willingboro Twp. adds on average, 47 units per year. [817] On this forth year, it is anticipated that 9 of the 47 units will take advantage of reduced permit fees. If 75% or an average of 4.53 tons of the construction and demolition debris per new home were recycled, Willingboro Twp. will reduce its residential construction and demolition debris by 40.77 tons annually.

How to do it

1. Pass an ordinance that requires commercial and residential new construction and major renovation projects to recycle at least 75% of construction and demolition debris.

In adopting this green building ordinance, the municipality must consider the following; [818]

2. **Involve.** Representatives from existing volunteer boards, such as the planning and zoning boards, environmental commission, and redevelopment and housing agencies, as well as municipal staff, especially the zoning official, construction code official, and planner should be involved with this action.

3. **Set a timeframe.** Adopting a green building policy will take between one and three months.

4. **Take into account project costs and resource needs.** Developing a green building policy will require municipal staff time; however costs should be minimal and likely will be related to legal professional fees.

5. **Execute.** In order to compensate for revenue lost through reduced permit fees, the municipality should develop two construction fee formulas; one for conventional building, and a second formula for green building. In determining both formulas, the municipality must project an anticipated level of participation in the reduced permit fee incentive. Revenue lost from reduce permit fees can be recovered by raising permit fees for conventional building.

Resources:

Bergen County Utilities Authority (BCUA) Recycling Market Directory. http://www.bcua.org/

Hudson County Improvement Authority Recycling Homepage. http://www.hcia.org/

BCUA Recycling Homepage http://www.bcua.org/SolidWaste_Recycling.htm

Waste Management, Inc. http://www.wm.com

Recycling Construction and Demolition Wastes: A Guide for Architects and Contractors – (includes case studies) .http://www.mass.gov/dep/recycle/reduce/cdrguide.pdf

Construction and Demolition Waste Management in the Northeast in 2006 http://www.newmoa.org/solidwaste/CDReport2006DataFinalJune302009.pdf

4. Encourage recycling of commercial construction and demolition waste

Introduction

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.[819]

Reduce Commercial construction & demo waste with recycle programs

	Municipal Government	Community-Wide
Initial Municipal Costs ($)	$ -	
Rebate/Subsidy ($)	$ -	
Net Capital Cost ($)	$ -	
Lifetime Municipal Costs ($)	$ -	
Lifetime of Measure (Years)	10	
CO2 Reductions (Tons)		9
Waste Savings (Tons)		50
Waste Savings ($)		$ 1,592

Costs/Impacts

Although there is an additional on site cost on the account of labor hours needed to sort construction debris, money is saved on recycling costs. In New Jersey, average tipping fees at local recycling facilities range from $5 - $46 per ton. Typical disposal costs are substantially higher, ranging from $75-$98 per ton.

In choosing to recycle construction and demolition debris over typical disposal, a savings of approximately $55.00 per ton can be assumed.

Scenario(building scale):

Nonresidential demolition debris weighs an average of 4.34 pounds per square foot[820]. Constructing a 20,000 square foot commercial building will create approximately 43.4 tons of construction and demolition debris.

Typical disposal cost for removal of 43.4 tons of construction and demolition debris would be approximately $3,754.[821] If 75% of this same 20,000 square foot commercial building were recycled, disposal costs would be approximately $1,915.[822] Every 20,000 square foot office that recycles 75% of construction and demolition debris will save $1,839 in addition to savings related to reduced permit fees.

In addition to cost reductions, there will also be greenhouse gas emissions reductions associated with diverting 75% of total construction and demolition debris from a traditional trash disposal facility. Every 20,000 square foot commercial building that recycles 75% of construction and demolition debris will equate to a total reduction of .75 Metric Tons of Carbon Equivalent (MTCE).[823]

Scenario (municipality–wide):

Based on participations rates of similar green building incentive programs nationwide, assume a 5% annual increase in the percentage new residential projects that will take advantage of reduced permit fees for using a micro-irrigation system. By the time this ordinance is in place for four years, a 20% level of participation is anticipated.

East Orange

The City of East Orange adds on average 62,931[824] square feet of new office space, or 3.15 (20,000 sq. ft. office buildings) per year. If after four years, a 20% level of participation is anticipated, 12,586 square feet or .63 (20,000 sq. ft office buildings) are expected take advantage of the reduced permitting fees for recycling of construction and demolition debris.

If constructing a 20,000 square foot commercial building will create approximately 43.4 tons of construction and demolition debris, these .63 (20,000 sq. ft office buildings) will create 27.31 tons of construction and demolition debris. If 75% of these 27.31 tons were recycled, East Orange would reduce its total commercial construction and demolition debris by 20.48 tons annually.

Edison

The City of Edison adds on average 232,512[825] square feet of new office space, or 11.63 (20,000 sq. ft. office buildings) per year. If after four years, a 20% level of participation is anticipated, 46,502 square feet or 2.33 (20,000 sq. ft office buildings) are expected take advantage of the reduced permitting fees for recycling of construction and demolition debris.

If constructing a 20,000 square foot commercial building will create approximately 43.4 tons of construction and demolition debris, these 2.33 (20,000 sq. ft office buildings) will create 100.91 tons of construction and demolition debris. If 75% of these 100.91 tons were recycled, Edison would reduce its total commercial construction and demolition debris by 75.68 tons annually.

Fort Lee

The City of Fort Lee adds on average 124,310[826] square feet of new office space, or 6.22 (20,000 sq. ft. office buildings) per year. If after four years, a 20% level of participation is anticipated, 24,862 square feet or 1.24 (20,000 sq. ft office buildings) are expected take advantage of the reduced permitting fees for recycling of construction and demolition debris.

If constructing a 20,000 square foot commercial building will create approximately 43.4 tons of construction and demolition debris, these 1.24 (20,000 sq. ft office buildings) will create 53.95 tons of construction and demolition debris. If 75% of these 53.95 tons were recycled, Fort Lee would reduce its total commercial construction and demolition debris by 40.46 tons annually.

Howell Twp..

Howell Twp.. adds on average 177,660[827] square feet of new office space, or 8.88 (20,000 sq. ft. office buildings) per year. If after four years, a 20% level of participation is anticipated, 35,532 square feet or 1.78 (20,000 sq. ft office buildings) are expected take advantage of the reduced permitting fees for recycling of construction and demolition debris.

If constructing a 20,000 square foot commercial building will create approximately 43.4 tons of construction and demolition debris, these 1.78 (20,000 sq. ft office buildings) will create 77.10 tons of construction and demolition debris. If 75% of these 77.10 tons were recycled, Howell Twp. would reduce its total commercial construction and demolition debris by 57.83 tons annually.

Middletown

The City of Middletown adds on average 91,897[828] square feet of new office space, or 4.59 (20,000 sq. ft. office buildings) per year. If after four years, a 20% level of participation is anticipated, 18,379 square feet or .92 (20,000 sq. ft office buildings) are expected take advantage of the reduced permitting fees for recycling of construction and demolition debris.

If constructing a 20,000 square foot commercial building will create approximately 43.4 tons of construction and demolition debris, these .92 (20,000 sq. ft office buildings) will create 39.88 tons of construction and demolition debris. If 75% of these 39.88 tons were recycled, Middletown would reduce its total commercial construction and demolition debris by 29.91 tons annually.

Montclair

The City of Montclair adds on average 35,936[829] square feet of new office space, or 1.80 (20,000 sq. ft. office buildings) per year. If after four years, a 20% level of participation is anticipated, 7,187 square feet or .36 (20,000 sq. ft office buildings) are expected take advantage of the reduced permitting fees for recycling of construction and demolition debris.

If constructing a 20,000 square foot commercial building will create approximately 43.4 tons of construction and demolition debris, these .36 (20,000 sq. ft office buildings) will create 15.59 tons of construction and demolition debris. If 75% of these 15.59 tons were recycled, Montclair would reduce its total commercial construction and demolition debris by 11.70 tons annually.

Parsippany – Troy Hills

The City of Parsippany adds on average 616,256[830] square feet of new office space, or 30.81 (20,000 sq. ft. office buildings) per year. If after four years, a 20% level of participation is anticipated, 123,251 square feet or 6.16 (20,000 sq. ft office buildings) are expected take advantage of the reduced permitting fees for recycling of construction and demolition debris.

If constructing a 20,000 square foot commercial building will create approximately 43.4 tons of construction and demolition debris, these 6.16 (20,000 sq. ft office buildings) will create 267.46 tons of construction and demolition debris. If 75% of these 267.46 tons were recycled, Parsippany would reduce its total commercial construction and demolition debris by 200.59 tons annually.

Perth Amboy

The City of Perth Amboy adds on average 23,719[831] square feet of new office space, or 1.19 (20,000 sq. ft. office buildings) per year. If after four years, a 20% level of participation is anticipated, 4,744 square feet or .24 (20,000 sq. ft office buildings) are expected take advantage of the reduced permitting fees for recycling of construction and demolition debris.

If constructing a 20,000 square foot commercial building will create approximately 43.4 tons of construction and demolition debris, these .24 (20,000 sq. ft office buildings) will create 10.29 tons of construction and demolition debris. If 75% of these 10.29 tons were recycled, Perth Amboy would reduce its total commercial construction and demolition debris by 7.72 tons annually.

Plainfield

The City of Plainfield adds on average 32,069[832] square feet of new office space, or 1.60 (20,000 sq. ft. office buildings) per year. If after four years, a 20% level of participation is anticipated, 6,414 square feet or .32 (20,000 sq. ft office buildings) are expected take advantage of the reduced permitting fees for recycling of construction and demolition debris.

If constructing a 20,000 square foot commercial building will create approximately 43.4 tons of construction and demolition debris, these .32 (20,000 sq. ft office buildings) will create 13.92 tons of construction and demolition debris. If 75% of these 13.92 tons were recycled, Plainfield would reduce its total commercial construction and demolition debris by 10.43 tons annually.

West Orange

The City of West Orange adds on average 60,961[833] square feet of new office space, or 3.05 (20,000 sq. ft. office buildings) per year. If after four years, a 20% level of participation is anticipated, 12,192 square feet or .61 (20,000 sq. ft office buildings) are expected take advantage of the reduced permitting fees for recycling of construction and demolition debris.

If constructing a 20,000 square foot commercial building will create approximately 43.4 tons of construction and demolition debris, these .61 (20,000 sq. ft office buildings) will create 26.45 tons of construction and demolition debris. If 75% of these 26.45 tons were recycled, West Orange would reduce its total commercial construction and demolition debris by 19.84 tons annually.

Willingboro Twp.

The City of Willingboro Twp. adds on average 38,621[834] square feet of new office space, or 1.93 (20,000 sq. ft. office buildings) per year. If after four years, a 20% level of participation is anticipated, 7,724 square feet or .39 (20,000 sq. ft office buildings) are expected take advantage of the reduced permitting fees for recycling of construction and demolition debris.

If constructing a 20,000 square foot commercial building will create approximately 43.4 tons of construction and demolition debris, these .39 (20,000 sq. ft office buildings) will create 16.76 tons of construction and demolition debris. If 75% of these 16.76 tons were recycled, Willingboro Twp. would reduce its total commercial construction and demolition debris by 12.57 tons annually.

How to do it

1. **Enact policy that requires new construction and major renovation projects to recycle** at least 75% of construction and demolition debris.

In adopting this green building ordinance, the municipality must consider the following; [835]

2. **Involve.** Representatives from existing volunteer boards, such as the planning and zoning boards, environmental commission, and redevelopment and housing agencies, as well as municipal staff, especially the zoning official, construction code official, and planner should be involved with this action.

3. **Set a timeframe.** Adopting a green building policy will take between one and three months.

4. **Take into account project costs and resource needs.** Developing a green building policy will require municipal staff time; however costs should be minimal and likely will be related to legal professional fees.

5. **Execute.** In order to compensate for revenue lost through reduced permit fees, the municipality should develop two construction fee formulas; one for conventional building, and a second formula for green building. In determining both formulas, the municipality must project an anticipated level of participation in the reduced permit fee incentive. Revenue lost from reduce permit fees can be recovered by raising permit fees for conventional building.

Resources:

Bergen County Utilities Authority (BCUA) Recycling Market Directory. http://www.bcua.org/

Hudson County Improvement Authority Recycling Homepage. http://www.hcia.org/

BCUA Recycling Homepage http://www.bcua.org/SolidWaste_Recycling.htm
Waste Management, Inc. http://www.wm.com

Recycling Construction and Demolition Wastes: A Guide for Architects and Contractors (includes case studies).
http://www.mass.gov/dep/recycle/reduce/cdrguide.pdf

Construction and Demolition Waste Management in the Northeast in 2006 http://www.newmoa.org/solidwaste/CDReport2006DataFinalJune302009.pdf

EDUCATION and OUTREACH MEASURES

1. Implement an Education and Enforcement Campaign to Reduce Vehicle Idling

2. Establish Policies for Personal Behavioral Modifications

1. Implement an Education and Enforcement Campaign to Reduce Vehicle Idling

Introduction/Summary

The transportation sector is a significant contributor to the United States' annual greenhouse gas emissions. In 2007, the transportation sector was responsible for "33 percent of carbon dioxide (CO_2) emissions from fossil fuel combustion, 26 percent of methane (CH_4) emissions from fossil fuel combustion, and 67 percent of nitrous oxide (N_2O) emissions from fossil fuel combustion."[836] Nearly two-thirds (61%) of these emissions were attributed to light duty vehicles, including passenger cars and light-duty trucks.[837] In addition to reducing air quality, the pollutants emitted in vehicle exhaust have been linked to the development of such diseases as cancer, asthma, and heart disease.[838] Given the negative impacts associated with vehicle idling, efforts to minimize voluntary idling (i.e., idling that occurs when the vehicle is not being driven in traffic) have the potential to significantly improve community health.

Furthermore, vehicle idling is not economical for vehicle owners. In terms of fuel consumption, it is inefficient to idle for longer than ten seconds. Idling for longer than ten seconds consumes more fuel than would be consumed by turning off and restarting the engine. Additionally, an idling engine does not run at optimum operating temperature or condition. As a result of incomplete fuel combustion, fuel residues may cause damage to the engine, shortening the engine's lifetime and reducing fuel efficiency.[839] Therefore, it is not economical for vehicle owners to engage in excessive idling.

Although New Jersey law prohibits vehicles from idling for more than three minutes, most drivers are unaware of this law and few municipalities enforce it.[840] 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.

Education and Enforcement to reduce Idling

	Municipal Government	Community-Wide
Initial Municipal Costs ($)	$ 988	
Rebate/Subsidy ($)	$ -	
Net Capital Cost ($)	$ 988	
Lifetime Municipal Costs ($)	$ 7,478	
Lifetime of Measure (Years)	15	
CO2 Reductions (Tons)		28,829
NOx Reductions (Lbs)		-
SO2 Reductions (Lbs)		-
Gasoline Savings (Gallons)		2,947,500
Gasoline Savings ($)		$5,609,217.42

Costs/Impacts

The costs to local governments of implementing an anti-idling education and enforcement campaign include the outreach costs associated with informing community members of the harm caused by idling and the costs associated with increased enforcement of anti-idling laws. In contrast, the impacts of an anti-idling campaign would be measured in terms of the resulting reduction in fuel usage and greenhouse gas emissions. These costs and impacts are discussed in more detail below.

Performing Outreach

To promote an anti-idling campaign, the municipality will need to conduct an outreach campaign to inform residents of the harm caused by idling. The upfront costs of an outreach campaign will include the cost of promotional materials (e.g., pamphlets and no-idling signs), which is estimated to be $558.[841] The cost of promotional materials will also be included in the annual costs of continued program operation, however the annual cost of promotional materials will be a reduced cost of $167 per year.[842]

Additionally, staff time will be needed for preparing materials and performing outreach. To ensure that these activities are adequately covered, the municipality should hire a part-time outreach coordinator to oversee program implementation or should designate 10% of an existing position to performing these duties. A part-time outreach coordinator is estimated to cost $4,300 per year.[843] Please note that the outreach coordinator is expected to be responsible for promoting all of the municipality's energy efficiency and sustainability projects, not just the anti-idling campaign. Therefore, the labor costs of the outreach coordinator will be shared between all of these programs. Additionally, the calculations provided here include the cost of a part-time staff person, but the cost would be considerably less if volunteers were used.

Increasing Enforcement

Increased enforcement of anti-idling laws would likely result in greater reductions in idling than the sole implementation of an anti-idling education campaign. Enforcement of anti-idling laws is normally incorporated into regular patrols at little to no cost, however municipalities could experience increased costs if additional staff time is specifically devoted to anti-idling enforcement activity. Because costs are negligible and fines for anti-idling violations are not expected to yield significant revenues[844], the estimates provided below do not include costs and impacts associated with increased enforcement of anti-idling laws.

Summary of Costs/Impacts

Estimates of the costs and impacts of a sample anti-idling campaign are provided below. These estimates are based on an educational campaign implemented in a typical New Jersey municipality.[845]

Local Fiscal Impacts

Lifetime of Measure	Indefinite
Initial Cost[846]	$4,858
Subsidy/Incentive	N/A
Initial Cost after Subsidy	$4,858
Annual Cost[847]	$4,467
Years to Payback	
Net Present Value	

The following table provides an estimate of the fuel usage and greenhouse gas emissions impacts that could be achieved from implementation of the sample anti-idling education program described above.

Fuel Usage and Emissions Impacts Impacts/Savings (Annual)	Per Capita	Per Municipality
Fuel Savings (gallons) [848] Gasoline	3.93	31,871.74
Emissions Savings (metric tons)[849] CO_2	0.03	280.46

How to Do It

1. **Develop and pass an anti-idling resolution.** An anti-idling resolution serves to educate the public on the negative impacts of idling and the existence of anti-idling laws. Additionally, the public endorsement of an anti-idling campaign will help to make the enforcement of anti-idling laws a priority for local authorities (i.e., local police).
2. **Create a municipal policy on enforcement of anti-idling laws.** Instructions should be included that outline how anti-idling laws should be enforced. When creating enforcement instructions, refer to the enforcement authority references provided in the resources section below. Additionally, the municipality should work with the police department to ensure that warnings and tickets are distributed.
3. **Ensure that the municipal policy includes no-idling requirements for municipally-owned vehicles.** In addition to community-wide enforcement of anti-idling laws, it is also important to ensure that municipally-owned vehicles are not idling. No-idling requirements should apply to all municipally-owned vehicles, including police vehicles, with exceptions for situations in which enforcement will infringe upon safety. Although some emergency circumstances require idling police or ambulance vehicles, other situations do not. A policy that directs officers and personnel as to when and when not to idle can help save money and reduce pollution without compromising safety. For example, in Plymouth, Massachusetts, fire department support vehicles are not allowed to idle while personnel conduct inspections, deliver or pick up supplies, pick up personnel, or when a vehicle arrives at a destination. Exceptions include when running the engine is in the best interests of public safety or the safety of firefighters, such as heating a vehicle to rehab personnel or keep them warm when working in low temperatures.
4. **Ensure that the municipal policy covers municipal and school contractors.** Vehicles operated by municipal and school contractors, such as garbage trucks and school buses, should also be subject to municipal no-idling requirements.
5. **Develop and initiate an anti-idling public education campaign.** Public education campaigns can include public service announcements, newsletters, brochures and websites. For legal purposes, no-idling policies should use the three minute maximum idle time stipulation; however, public education campaigns should emphasize that idling for longer than ten seconds is inefficient. For sample anti-idling educational materials, see the public outreach references provided in the resources section below.
6. **Target enforcement efforts toward locations where idling is common.** Areas near schools, banks, convenience stores, public libraries, drive-thru restaurants, and post offices are prime areas to target anti-idling education and enforcement. No-idling signs, which can be purchased from

NJDEP, should be posted and increased enforcement should be applied in these areas.

7. **Engage community members in policy enforcement efforts.** Encourage community members to promote no-idling efforts. Possible community partners include local schools, which could distribute warnings at school drop off and pick up locations, and business owners, who could post no-idling signs in their parking lots. Cooperation with local school districts and school bus companies to reduce unnecessary idling around schools is highly recommended. NJDEP has developed anti-idling pledges for each of these entities to sign as demonstrations of their commitment to this important regulation. In addition, police officers stationed in areas surrounding schools for the purpose of issuing traffic violations should be reminded that excessive idling is a violation.
8. **Evaluate the anti-idling campaign.** Track outreach efforts and the number of warnings or tickets issued. Additionally, targeted locations should be observed for improved compliance and new target locations should be identified when necessary.

Resources

<u>New Jersey Air Quality</u>

NJDEP, Air Monitoring Website -http://www.njaqinow.net/Default.htm

<u>General Information on Idling</u>

NJDEP Diesel Risk Reduction Program.
http://www.state.nj.us/dep/stopthesoot/index.htm

Clean Water Action, Idle Free New Jersey.
http://cleanwateraction.org/node/155

United States Environmental Protection Agency Compilation of Anti-Idling Regulations.
http://www.epa.gov/smartway/documents/420b06004.pdf

Puget Sound Clean Air Agency.
http://www.pscleanair.org/actions/vehicles/individuals.aspx

<u>Anti-Idling Resolutions</u>

Clean Water Action's Sample No-Idling Resolution.
http://cleanwateraction.org/files/publications/nj/noidlingresolutionmuni.pdf

<u>Anti-Idling Enforcement Authority</u>

NJDEP Diesel Risk Reduction Program-http://stopthesoot.org/sts-idle-enforce.htm

Anti-Idling Public Outreach

No-Idling Zone Signs

No-Idling Zone Signs from NJDEP. http://stopthesoot.org/sts-no-idle-sign.htm

No-Idling Educational Materials from Clean Water Action. http://cleanwateraction.org/node/141

No-Idling Pledge Forms

No-Idling Pledge Forms from NJDEP. http://www.state.nj.us/dep/stopthesoot/sts-pledge.htm

Public Service Announcements

No-Idling Public Service Announcement from Summit, NJ . http://www.youtube.com/watch?v=1z5LTKaF1Pw&eurl=http://www.summitgreen.org/index.html

2. Establish Policies for Behavioral Modifications

Introduction

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[850]. 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.

Establish municipal policies for behavioral modifications

	Municipal Government	Community-Wide
Initial Municipal Costs ($)	$ -	
Rebate/Subsidy ($)	$ -	
Net Capital Cost ($)	$ -	
Lifetime Municipal Costs ($)	$ -	
Lifetime of Measure (Years)	30	
CO2 Reductions (Tons)	2.979	2.979
NOx Reductions (Lbs)	9.692	9.692
SO2 Reductions (Lbs)	34.131	34.131
Electricity Savings (MWh)	6.626	6.626
Electricity Savings ($)	$ 448.995	$ 448.995
Natural Gas Savings (MMBtu)	405	405
Natural Gas Savings ($)	$ 2.085	$ 2.085

Costs/Impacts

There are no costs associated with developing and implementing this policy other than those associated with staff time.

Typical activities and their impacts include:

Turning off computers--Computers used during an eight hour work day and turned off overnight can reduce electricity usage by the following:

> 0.0053[851] X population = number of computers expected to have
>
> Expected # computers X 130watts[852] each X 16 hours off X (1/1000) = savings (kWh)

Using inkjet printers instead of laser printers--Because inkjet printers use significantly less energy than Laser printers, using the Inkjets whenever possible can save approximately 18.3 kW/year[853].

*Lower the thermostat three degrees in winter and raise the temperature 3 degrees in summer--a*nnual savings related to adjusting the thermostat 3 degrees is equivalent to a 3% reduction[854] in energy usage.

Turn off lights--Depending on the size of the building, turning off lights overnight and when not in use can easily save 120,000 kWh annually[855].

Local Fiscal Impacts

Lifetime of measure	Indefinite
Initial Cost	$ 0
Subsidy	$ 0
Cost after subsidy	$ 0
Annual Savings/Cost	
Years to Payback	
Net Present Value	

How to Do It

1. Convene a meeting of municipal leaders, facility managers, business administrator, and personnel directors.
2. Review energy bills for the past six to twelve months to identify baseline usage and costs related to electricity and heating fuels.
3. Identify appropriate policies that govern staff behavior and facility management to reduce energy usage related to lighting, heating, cooling, and operation of office equipment. Discuss proposals with staff to get input and engage those responsible for implementing the policy.

4. After the governing body adopts the policy, the personnel directors can share expectations with the rest of the staff and outline the intended outcomes in terms of energy and cost savings.

5. On a monthly basis, the business administrator can share the energy savings realized with the staff to recognize successes and motivate continued compliance with the policy.

Resources

US DOE Work Place Energy Savings.
http://www1.eere.energy.gov/femp/services/energy_aware_oec.html

Energy Savings for Office Buildings.
http://www.accenv.com/documents/EnergyMeasuresforTenants.pdf

Energy Consumption in Offices and Conservation Tips.
http://www.esource.com/escrc/0013000000DDMedAAH-0/BEA1/CEA/CEA-03

Green Computing.
http://ecenter.colorado.edu/energy/projects/green_computing.html

Office Equipment Energy Conservation.
http://www.aps.com/main/_files/services/BusWaysToSave/OfficeEquipment.pdf

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[1] U.S. Department of Energy. 2009. Reduce Hot Water Use for Energy Savings. http://www.energysavers.gov/your_home/water_heating/index.cfm/mytopic=13050 (accessed December 11, 2009).

[2] Based on an estimate of annual staff time Middlesex County spent on activities related to the bulk purchase of compost bins, including Division of Solid Waste Management, Purchasing Department, County Counsel, and Comptroller staff time, it was assumed that 24 hours of staff time would be allocated to procurement activities. Applying the median hourly wage of $24.94 for Purchasing Agents, Except Wholesale, Retail and Farm Products (Standard Occupational Classification [SOC] code 131023) employed in Local Government (North American Industry Classification System [NAICS] industry code 999300), the cost of increased procurement activity would be approximately $598.56. This cost would likely be incurred annually, as municipalities would purchase new conservation equipment each year. Middlesex County, Division of Solid Waste Management. E-mail correspondence with Michael Kosty, Principle Accountant, ivision of Solid Waste Management. (November 19, 2009; December 14, 2009); Bureau of Labor Statistics, U.S. Department of Labor. n.d. Occupational Employment Statistics (OES), May 2008 National Occupational Employment and Wage Estimates. http://www.bls.gov/oes/2008/may/oes131023.htm#ind (accessed October 27, 2009).

[3] The items included in the cost of promotional materials envision efforts to engage residents at green fairs or posting flyers in city buildings. The cost of a poster, 500 flyers, a roll of tape, a pack of pens, a pack of paper, an easel, a folding table, and a folding chair were included. Additional outreach efforts that are not considered in the costs above include direct mailings and advertisements in local papers, among others. Year to year, flyers may need to be reproduced and additional pens, paper, and tape may need to be purchased. The chairs, table, and posters should be reused. Price estimates were based on prices listed on Kinkos, Sears, and Office Max websites.

[4] Outreach Coordinator Salaries. http://www.indeed.com/salary/Outreach-Coordinator.html (accessed December 22, 2009).

[5] For illustrative purposes, cost estimates are provided for a municipal program in which 100 composters are purchased for distribution to community members. Based on data from an existing program in Middlesex County that purchases composters in bulk and sells them to residents at discounted prices, it is estimated that the average municipal purchase price for a composter is $49.63 per composter. Thus, it would cost the municipality $4,963.00 to purchase 100 composters. Also included in the initial cost is the staff time required for increased procurement activity ($598.56) and the initial cost of promotional materials ($160.00). The staff time required for increased procurement activity is also included in the annual cost estimate; however, it was important to include it as an initial cost as well because the program cannot begin without the initial purchasing of conservation products. Middlesex County, Division of Solid Waste Management. E-mail correspondence with Michael Kosty, Principle Accountant, Division of Solid Waste Management. (November 19, 2009).

[6] Annual costs include the costs associated with purchasing 100 composters ($4,963.00 annually), purchasing promotional materials ($45 annually), salary for an outreach coordinator ($4,300 annually), and staff time devoted to increased procurement activities ($598.56 annually).

[7] These estimates are based upon the following assumptions: (1) all municipally-purchased composters are purchased by community residents for household use; and (2) households receiving a composter begin composting all of their food waste and yard trimmings. Emissions savings do not reflect emissions reductions resulting from the composting of paper products because the EPA figures used to estimate emissions reductions did not include an analysis of paper composting. For this reason, potential emissions savings may be understated. United States Environmental Protection Agency. 2006. Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks, 3rd ed. http://epa.gov/climatechange/wycd/waste/downloads/fullreport.pdf (accessed December 11, 2009). (EPA Solid Waste Management Report)

[8] Estimated impacts are reported only in terms of GHG emissions savings, and not in terms of energy savings, for two reasons. First, the EPA Solid Waste Management Report that was used to prepare these estimates provides estimates of avoided utility emissions; however, it does not provide a breakdown by type of energy savings. This is likely because any reduction in utility emissions would likely result from a diversion in energy production from one method to another rather than from a reduction in actual energy usage. Second, the only actual reduction in energy usage would likely stem from a reduction in transportation needed to transport municipal solid waste (MSW) from the source to the disposal location. Because the EPA Solid Waste Management Report bases its estimates on a central composting scenario, which requires the transport of MSW to a central disposal site, it did not address this reduction in energy usage. The EPA Solid Waste Management Report does, however, estimate the average emissions resulting from the transport of MSW to disposal locations. The average emissions resulting from the transport of MSW to disposal locations were subtracted from the total emissions associated with composting MSW in a central location to estimate the emissions associated with backyard composting. For these reasons, only emissions savings data is provided here because this information was most readily accessible and because it can be made to reflect energy savings from reduced transportation needs.

[9] Emissions savings were computed using MSW data from the New Jersey Department of Environmental Protection (NJDEP) and emissions factors from the EPA Solid Waste Management Report. The following provides a brief outline of the steps taken to reach the estimate provided in this report.

> (1) NJDEP's solid and hazardous waste website provides information on MSW generation and disposal by type of waste. The types of waste that can be composted include food waste, yard waste, and paper products. As mentioned above, the EPA's emissions estimates do not include information on the emissions impacts of composting paper. For this reason, only food and yard waste were considered compostable for the purposes of this report. 2007 MSW generation and disposal information is provided below for these compostable substances. (Please note that NJDEP lists central composting as recycling in its reports. However, NJDEP has verified that where it indicates food or yard waste was recycled this waste was actually composted.)

2007 Municipal Solid Waste Generation by Disposal Method and Type of Waste

	Total Generation (Tons)	Centrally Composted (Tons)	Not Composted (Tons)
Food Waste	1,601,747.32	316,477.15	1,285,270.17
Yard Waste	2,164,523.40	1,444,617.24	719,906.16

New Jersey Department of Environmental Protection. 2009. 2007 Material Specific Recycling Rates in New Jersey. http://www.state.nj.us/dep/dshw/recycling/stat_links/07%20materials.pdf (accessed December 10, 2009).

(2) The population of New Jersey was estimated to be 8,653,126 in 2007. Using this population estimate, the following per capita compostable waste generation numbers were computed for 2007.

2007 Per Capita Municipal Solid Waste Generation by Disposal Method and Type of Waste

	Total Generation (Tons)	Centrally Composted (Tons)	Not Composted (Tons)
Food Waste	0.185	0.037	0.149
Yard Waste	0.250	0.167	0.083

United States Census Bureau. n.d. http://factfinder.census.gov/servlet/DTTable?_bm=y&-geo_id=04000US34&-ds_name=PEP_2008_EST&-mt_name=PEP_2008_EST_G2008_T001 (accessed December 10, 2009).

(3) Assuming that composters would be purchased for household use, average household waste generation numbers were estimated by multiplying per capita waste generation (broken down by disposal method and type of waste) by average household size as estimated by the U.S. Census Bureau (2.68 persons per household in 2000). The resulting household waste generation estimates are provided below.

2007 Household Municipal Solid Waste Generation by Disposal Method and Type of Waste

	Total Generation (Tons)	Centrally Composted (Tons)	Not Composted (Tons)
Food Waste	0.496	0.099	0.399
Yard Waste	0.670	0.448	0.222

United State Census Bureau. New Jersey QuickFacts. http://quickfacts.census.gov/qfd/states/34000.html (accessed December 14, 2009).

(4) The MSW generated in New Jersey that is not recycled or composted is either incinerated or landfilled. In 2005, 15% of this remaining MSW was incinerated and 85% was landfilled. Assuming that the method of waste disposal did not drastically change between 2005 and 2007, these percentages were applied to 2007 household MSW generation as shown below. Because the assumption was made that all households receiving a composter will compost all of their food and yard waste, these estimates serve as the estimated reduction in household compostable waste disposed of off-site due to the purchase of a composter. For example, due to the purchase of a composter, it is estimated that a household will reduce the amount of food waste that is centrally composted by 0.099 tons annually. (Please note that these waste reductions may be overstated due to the fact that all per capita MSW generation was attributed to households when in reality a proportion of this per capita MSW is actually generated by businesses. However, this may serve to correct a portion of the underestimated that occurs due to the exclusion of paper products in this analysis.)

2007 Household Municipal Solid Waste Generation by Disposal Method and Type of Waste - Expanded

	Total Generation (Tons)	Centrally Composted (Tons)	Not Composted (Tons)		
			Incinerated	Landfilled	Total
Food Waste	0.496	0.099	0.060	0.339	0.399
Yard Waste	0.670	0.448	0.033	0.189	0.222

New Jersey Department of Environmental Protection, Division of Science, Research & Technology. 2008. Solid Waste and Recycling. In New Jersey's Environment Trends. http://www.nj.gov/dep/dsr/trends2005/pdfs/solidwaste.pdf (accessed December 10, 2009).

(5) Once waste reduction estimates were established, emissions savings were estimated by applying emissions factors from the EPA Solid Waste Management Report as described below.

a. The EPA Solid Waste Management Report provides an estimate of net emissions resulting from central composting. The net emissions (MTCE) per ton of MSW centrally composted are -0.050. Net emissions include soil carbon sequestration and transportation emissions. Since backyard composting does not involve the transportation of waste, it was assumed that the emissions saved from backyard composting as opposed to central composting were equal to the emissions resulting from the transport of MSW to central composting sites. However, due to rounding, the EPA's estimated net emissions for central composting did not equal the sum of soil carbon sequestration (-0.07 MTCE/ton) and transportation emissions (0.01 MTCE/ton). For ease of use, it was assumed that the emissions figures were -0.065 MTCE/ton for soil carbon sequestration and 0.015 MTCE/ton for transportation to composting. Therefore, the emissions saving per ton of MSW diverted from central composting to backyard composting is estimated to be 0.015 MTCE. Applying this emissions reduction factor to the estimated household MSW diversion from central composting to backyard composting, it is estimated that household use of a composter will result in annual emissions reductions equal to 0.0082 MTCE per household annually.

b. The EPA Solid Waste Management Report estimates that landfill net emissions are equal to 0.200 MTCE/ton for food waste and -0.060 MTCE/ton for yard waste. Based on the information provided above, it was estimated that the net emissions associated with backyard composting are equal to -0.065 MTCE/ton for both food and yard waste. Emissions saved from the diversion of MSW from landfills to backyard composting was calculated by subtracting backyard composting net emissions from landfill net emissions for each type of waste. This results in a savings of 0.265 MTCE/ton of food waste diverted from a landfill to backyard composting and a savings of 0.005 MTCE/ton of yard waste diverted from a landfill to backyard composting. Applying these emissions factors to the estimated household MSW diversion from landfills to backyard composting, it is estimated that household use of a composter will result in annual emissions reductions equal to 0.0908 MTCE per household annually.

c. The EPA Solid Waste Management Report estimates that MSW incineration net emissions are equal to -0.050 MTCE/ton for food waste and -0.060 MTCE/ton for yard waste. Based on the information provided above, it was estimated that the net emissions associated with backyard composting are equal to -0.065 MTCE/ton for both food and yard waste. Emissions saved from the diversion of MSW from incineration to backyard composting was calculated by subtracting backyard composting net emissions from incineration net emissions for each type of waste. This results in a savings of 0.015 MTCE/ton of food waste diverted from incineration to backyard composting and a savings of 0.005 MTCE/ton of yard waste diverted from incineration to backyard composting. Applying these emissions factors to the estimated household MSW diversion from incineration to backyard composting, it is estimated that household use of a composter will result in annual emissions reductions equal to 0.0011 MTCE per household annually.

d. Summing all of the estimated emissions reductions resulting from diversion of MSW to backyard composting, it is estimated that use of a composter will result in annual savings of 0.1001 MTCE per household.

[10] Estimate based upon household purchase rates in Middlesex County. As of mid-December, Middlesex County had sold 367 compost bins to residents during 2009. Based upon 2008 American Community Survey 3-year estimates, Middlesex County has 272,381 households. Therefore, assuming that all composters were purchased for household use, 0.13% of Middlesex County households purchased a composter from the County during 2009. Middlesex County, Division of Solid Waste Management. E-mail correspondence with Michael Kosty, Principle Accountant, Division of Solid Waste Management. (December 14, 2009); United State Census Bureau. Middlesex County, New Jersey: Selected Social Characteristics in the United States: 2006-2008. http://factfinder.census.gov/servlet/ADPTable?_bm=y&-geo_id=05000US34023&-qr_name=ACS_2008_3YR_G00_DP3YR2&-ds_name=ACS_2008_3YR_G00_&-_lang=en&-_sse=on (accessed December 17, 2009).

[11] The Department of the Treasury, State of New Jersey. n.d. Cooperative purchasing home page. http://www.state.nj.us/treasury/purchase/coop_agency.shtml (accessed October 15, 2009).

[12] State of New Jersey Executive Order #11. 2006. The Official Web Site for The State of New Jersey. http://www.state.nj.us/infobank/circular/eojsc11.htm. (accessed October 16, 2009).
[13] U.S. Communities Government Purchasing Alliance. n.d. Going Green Program. http://www.gogreencommunities.org/?sid=200910160 (accessed October 16, 2009).

14 ENERGY STAR. n.d. ENERGY STAR Quantity Quotes. http://www.quantityquotes.net/default.aspx (accessed October 16, 2009).
15 When making bulk purchases outside of the New Jersey Cooperative Purchasing Program, local governments must ensure that all purchases are made in accord with the State's procurement laws.
[16] New Jersey Department of Community Affairs. E-mail correspondence with Marc Pfeiffer, Deputy Director, Division of Local Government Serives. (November 3, 2009).

[17] LED City. http://www.ledcity.org/ Accessed 11/19/09.
[18] Consortium for Energy Efficiency (CEE). http://www.cee1.org/gov/led/led-main.php3 Accessed 11/19/09.
[19] Lighting Resource Center (LRC). http://www.lrc.rpi.edu/resources/newsroom/pr_story.asp?id=178 Accessed 11/19/09.
[20] CEE. http://www.cee1.org/gov/led/led_press_kit.pdf Accessed 11/16/09
Watt levels for traffic signals and LED replacements vary. The 150 watt level is commonly used for traffic signals, as is the 25 watt LED replacement.
[21] CEE. http://www.cee1.org/gov/led/led_press_kit.pdf Accessed 11/16/09.
Initial Conversion Cost: (cost of LED signal + maintenance cost) – (cost per incandescent signal – maintenance cost). Formula represents the initial cost difference in converting a standard traffic signal to LED.
Total Lifetime Savings: Savings to be accrued during the lifetime of measure. LED traffic signals have an expected lifespan of 7 years. (total maintenance savings + total energy savings) – (costs of LED light – costs of standard incandescent signal and replacements)
Maintenance costs are figured at $150/per year. Incandescent bulbs are replaced every year for a $150 maintenance fee. In comparison, LEDs last seven years, thus avoiding annual maintenance costs. Total lifetime savings are explained in the following table. Energy costs are derived from CEE average price of 10 cents per kWh.

Cost Comparison Between Standard Incandescent Signal and LED Signal

Measure	Incandescent	LED
Cost Per Signal	$3	$75
Cost during LED lifetime (7 years)	$21	$75
Lifetime Maintenance Costs	$1,050	$150
Lifetime Energy Costs	$391.20	$47.20
Total Cost	$1,462.20	$272.20

[22] LED City. ICLEI Climate Innovation Invitational: Ann Arbor's LED Streetlight Program. 2007. P. 4. http://www.ledcity.org/lib/resources/Ann%20Arbor%20LED%20Summary.pdf Accessed 11/17/09.
As with traffic signals, watt levels for street lights can vary among municipalities. The 100 watt street globes are commonly used for neighborhood and sidewalk lighting. 45 watt LED replacement is common for 100 watt lights.
[23] LED City. ICLEI Climate Innovation Invitational: Ann Arbor's LED Streetlight Program. 2007. P. 4. http://www.ledcity.org/lib/resources/Ann%20Arbor%20LED%20Summary.pdf Accessed 11/17/09.
Initial Cost: (cost of LED light + maintenance cost) – (cost per standard globe – maintenance cost). Formula represents the initial cost difference in converting to LED.
Total Lifetime Savings: Savings to be accrued during the lifetime of measure. LED street lights have an expected lifespan of 10 years. (total maintenance savings + total energy savings) – (costs of LED light – costs of standard street globe light and replacements)
Energy costs are set at 7 cents per kWh. Maintenance Costs are projected at $268 per bulb replacement. Standard street globes are replaced every two years with a $268 maintenance fee.

Cost Comparison Between Standard Street Globe and LED Light[23]

Measure	Standard	LED
Cost Per Bulb (initial cost)	$35	$400
Cost during LED lifetime (10 years)	$175	$400
Lifetime Maintenance Costs	$1,341	$268
Lifetime Energy Costs	$325	$156
Total Cost	$1,841	$824

[24] CEE http://www.cee1.org/gov/led/led_press_kit.pdf Accessed 11/16/09.
7-year lifetime is defined by the expected lifetime of one LED traffic signal.
[25] LED City. ICLEI Climate Innovation Invitational: Ann Arbor's LED Streetlight Program. 2007. P. 4.
http://www.ledcity.org/lib/resources/Ann%20Arbor%20LED%20Summary.pdf Accessed 11/17/09.
Lifetime is based on average lifespan for 45 watt LED streetlight, which is projected at 10 years. Standard 100 Watt street bulbs have an average lifespan of two years. The following table compares the impacts between standard lighting and LED lighting:

Impact Comparison Between Standard Incandescent Signal and LED Signal				
Measure	Annual Incandescent	Lifetime (7 year) Incandescent	Annual LED	Lifetime (7 year) LED
Energy (kWh)	559	3,912	67	472
CO2 (lbs)	849.68	5,946.24	101.84	717.44
NO2 (lbs)	1.57	10.95	.19	1.32
SO2 (lbs)	3.63	25.43	.44	3.07
Impact Comparison Between Standard Street Globe Light and LED Street Light				
Measure	Annual Standard	Lifetime (10 year) Standard	Annual LED	Lifetime (10 year) LED
Energy (kWh)	438	4,380	210	2,100
CO2 (lbs)	665.76	6,657.6	319.2	3,192
NO2 (lbs)	1.23	12.3	.59	5.9
SO2 (lbs)	2.85	28.5	1.37	13.7

[26] NYSERDA. "A How-to Guide to Effective Energy Efficient Street Lighting for Municipal Elected/Appointed Officials" 2002. http://www.rpi.edu/dept/lrc/nystreet/how-to-officials.pdf P. 14
Accessed 12/09/09.

[27] World of LEDs. "How to Spend your Stimulus Funds on LED Street Lighting" http://worldofleds.blogspot.com/2009/06/how-to-spend-your-stimulus-funds-on-led.html Accessed 11/23/09.
[28] NYSERDA. "A How-to Guide to Effective Energy Efficient Street Lighting for Municipal Elected/Appointed Officials" 2002. http://www.rpi.edu/dept/lrc/nystreet/how-to-officials.pdf P. 11 Accessed 12/09/09.
[29] NYSERDA. "A How-to Guide to Effective Energy Efficient Street Lighting for Municipal Elected/Appointed Officials" 2002. http://www.rpi.edu/dept/lrc/nystreet/how-to-officials.pdf P. 11 Accessed 12/09/09.
[30] NYSERDA. "A How-to Guide to Effective Energy Efficient Street Lighting for Municipal Elected/Appointed Officials" 2002. http://www.rpi.edu/dept/lrc/nystreet/how-to-officials.pdf P. 19 Accessed 12/09/09.
[31] NYSERDA. "A How-to Guide to Effective Energy Efficient Street Lighting for Municipal Elected/Appointed Officials" 2002. http://www.rpi.edu/dept/lrc/nystreet/how-to-officials.pdf P. 19 Accessed 12/09/09.
[32] NYSERDA. "A How-to Guide to Effective Energy Efficient Street Lighting for Municipal Elected/Appointed Officials" 2002. http://www.rpi.edu/dept/lrc/nystreet/how-to-officials.pdf P. 16 Accessed 12/09/09.
[33] World of LEDs. "How to Spend your Stimulus Funds on LED Street Lighting" http://worldofleds.blogspot.com/2009/06/how-to-spend-your-stimulus-funds-on-led.html Accessed 11/23/09.
[34] New Jersey Clean Energy Program (NJCEP). http://www.njcleanenergy.com/residential/programs/community-partners-initiative-0 Accessed 9/9/09.
[35] Environmental Protection Agency (EPA). http://www.epa.gov/cppd/climatechoice/anhc.htm Accessed 10/7/09.
[36] NJCEP. http://www.njcleanenergy.com/residential/programs/nj-energy-star-homes/nj-energy-star-homes Accessed 10/7/09.
[37] EPA. Technology Adoption Plan: Advanced New Home Construction 2008 P. 8 Accessed 10/7/09.

[38] Indeed.com. http://www.indeed.com/salary/Outreach-Coordinator.html Accessed 8/11/09.
[39] EPA: http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_HERS Accessed 10/12/09. The following data chart compares efficiency levels and energy expenses among 2006 IECC minimum code homes, ENERGY STAR-rated homes, and Climate Choice homes:

Efficiency Comparisons Among 2006 IECC Minimum Code Home, ENERGY STAR Home, and Climate Choice Home[39]			
Measure	2006 IECC Code Home	ENERGY STAR Home	Climate Choice Home
HERS Index Rating[39]	100	77	50
Site Energy (Btu/s.f.-year)	46.5	42.7	26.2
Annual Utility Expenses	$1,941	$1,592	$1,055
Annual Energy Usage (MWh)	8.976	8.388	2.604
Annual Energy Usage (therms)	936	660	360

Annual CO_2 Emissions (tons)	12.298	10.236	4.085
Annual NO_2 Emissions (lbs)	33.744	29.558	10.603
Annual SO_2 Emissions (lbs)	58.344	54.522	16.926

[40] Currently, the program has not encountered any problems with local building codes; however, inspection procedures and building code requirements vary among communities. Because Climate Choice homes are built with advanced equipment and technology, certain aspects throughout the construction process may create difficulties for some local building inspectors.

Climate Choice homes utilize solar energy technology that replaces traditional heating and insulation equipment. Climate Choice homes may also feature Micro-Combined Heat and Power (MCHP), which combines a fuel cell with an energy-efficient furnace or boiler to generate both heat and electricity. MCHP is a new technology designed to replace standard furnaces and boilers. Consequently, these differences may not directly correspond with local building codes that are outdated in respect to solar and MCHP technology. To avoid these unnecessary problems, the outreach coordinator may want to consult with local building inspectors beforehand to make sure they are aware of the potential differences associated with the construction of Climate Choice homes.

[41] New Jersey Clean Energy Program (NJCEP). http://www.njcleanenergy.com/residential/programs/community-partners-initiative-0 Accessed 9/9/09.
[42] ENERGY STAR. http://www.energystar.gov/index.cfm?c=new_homes.nh_benefits Accessed 9/17/09.
[43] NJCEP. http://www.njcleanenergy.com/residential/programs/nj-energy-star-homes/what-nj-energy-star-homes/what-nj-energy-star-homes Accessed 9/9/09.
[44] Indeed.com. http://www.indeed.com/salary/Outreach-Coordinator.html Accessed 8/11/09.
[45] New Jersey Board of Public Utilities (NJ BPU). New Jersey's Clean Energy Program Report 19 Aug. 2008 P.69. Accessed 9/17/09.

Impact savings derived from 7,137 committed program participants. The BPU defines committed participants as, "the number of participants that will result from an outstanding contractual commitment for program participation made since program inception, but scheduled for installation in future reporting periods." savings are based on 12-month period.

[46] NJCEP. New Jersey Clean Energy Program: Protocols to Measure Resource Savings. P. 10. Accessed 11/13/09. Lifetime savings are defined as the savings to be accrued over the expected life of a measure installed during the program year. For the New Jersey ENERGY STAR Homes program, lifetime savings are projected at 20 years.
[47]Center for Energy, Economic, and Environmental Policy (CEEEP). Cost-Benefit Analysis of the New Jersey Clean Energy Program Energy Efficiency Programs. 9 Jan. 2008 P. 22. Accessed 9/17/09.
Based on actual saving reported in 2008.
[48] BPU. http://www.njcleanenergy.com/commercial-industrial/programs/pay-performance. Accessed 10/7/09.
[49] BPU. http://www.njcleanenergy.com/commercial-industrial/programs/programs. Accessed 9/30/09.
[50] New Jersey Board of Public Utilities. (n.d.) "Pay for Performance." http://www.njcleanenergy.com/commercial-industrial/programs/pay-performance (accessed December 1, 2009).
[51] Incentive 1 provides money to offset the cost of developing an Energy Reduction Plan for each Pay for Performance project, but will only be paid upon submission of the plan.

[52] Incentives are based on the projected level of electricity and gas savings, which will be "trued-up" after one year based on actual savings.

[53] A completed report verifying energy reductions based on one year of post-implementation results is required. Incentives for electricity savings and natural gas savings will be paid based on actual savings, provided that the minimum performance threshold of 15% savings has been achieved.

[54] NJ BPU. http://www.njcleanenergy.com/files/file/Pay%20for%20Performance/P4P%20incentive%20structure%20-%20final.pdf. Accessed 11/20/09.

[55] NJ Clean Energy Program. Protocols to Measure Resource Savings.New Jersey Board of Public Utilities. December 2007.

[56] The lifetime of a CHP system comes from New Jersey's Clean Energy Program. A representative of New Jersey's Clean Energy Program provided annual and lifetime energy savings for the four CHP projects installed through New Jersey's Clean Energy Program in 2008. (Note: Prior to 2009, New Jersey's Clean Energy Program operated a separate CHP program, which was combined with the Pay for Performance Program in 2009. Because no data is yet available for CHP projects installed under the Pay for Performance Program, the figures used in this estimate are from the previous CHP program. Representatives of New Jersey's Clean Energy Program have verified that the old and new CHP programs are essentially the same and are comparable for this purpose.) To determine the lifetime used for the CHP systems, lifetime energy savings was divided by annual energy savings to determine the lifetime of the systems in years. This calculation resulted in a lifetime of 12 years for each installed system. New Jersey's Clean Energy Program. E-mail correspondence with Valentina Rozanova, Energy Engineer. (November 18, 2009)

[57] The cost of the Energy Reduction Plan and installing the recommended upgrades are included in this calculation. The cost of the installation is based up on the energy savings anticipated, the corresponding incentives for electricity and gas savings in Phases II and II. This equation was used to calculate the cost of participating in the rest of the program (it covers equipment installation and the Post-Construction Benchmarking Report. 2*[13,158 *(.11+.07)+55512*(1.1+.7)] = 204,580. A multiplier of 2 was used since the incentives are supposed to cover up to 50% of the cost of the total program costs.

[58] Due to the recent launch of the Pay for Performance program, no data is available for energy or emissions savings. To calculate the savings, a number of assumptions were made based on data made available through the Energy Information Administration.

1. There are 465,987 commercial and 13,579 industrial businesses in New Jersey. Source: EIA. http://www.eia.doe.gov/cneaf/electricity/esr/table5.html. Accessed 10/8/09.
2. Because the number of commercial businesses so greatly outnumbers the number of industrial customers, we assume that a greater proportion of participants in the Pay for Performance program will be commercial businesses.
3. Therefore, the electricity and natural gas savings presented in this report reflect savings by a commercial business that achieves the minimum energy reduction of 15%.
4. The electricity and natural gas consumption reported below is likely skewed to be less than the actual energy consumptions of businesses that will participate in the Pay for Performance program due to the program's minimum requirement of an average annual peak demand over 200 kW.
5. The average New Jersey commercial customer consumes 87720 kWh/year. This number is based on EIA's monthly commercial consumption of 7310 kWh. Source: EIA. http://www.eia.doe.gov/cneaf/electricity/esr/table5.html. Accessed 10/8/09.
6. The average New Jersey commercial customer consumes .36 million cubic feet of natural gas per year. This number is based on EIA's report that all New Jersey commercial customers consumed 168,602 million cubic feet of natural gas in 2008, and the statistic that there are 465,987 commercial customers in New Jersey. Sources: EIA http://tonto.eia.doe.gov/dnav/ng/ng_cons_sum_dcu_SNJ_a.htm and http://www.eia.doe.gov/cneaf/electricity/esr/table5.html. Accessed 10/8/09.
    a. This is equal to 370,080 therms. To convert millions of cubic feet to therms, the following conversion was used: cu ft = 1,028 Btu and 1 therm = 100,000 Btu. Source: EIA http://tonto.eia.doe.gov/kids/energy.cfm?page=about_energy_conversion_calculator-basics. Accessed 10/8/09.

7. In achieving the 15% energy reduction, assume that natural gas and electric savings will each contribute an equal amount to the overall goal. The authors acknowledge that based on EIA's reports of natural gas and electricity consumption in commercial buildings in New Jersey, natural gas consumption is 25% greater than that of electricity (see calculation in part (a)). However, parts (b) and (c) explain why electricity consumption and savings may be greater than expected, leading to the conclusion that natural gas and electric savings will each contribute equally to the overall goal.
    a. To convert natural gas usage (million cubic feet) to a kilowatt-hour equivalent the following calculation was performed: .36 million cubic ft. *1,000,000 cubic feet* 1028 Btu/1 cu. Ft*1 kWh/3,412 Btu = 109,012 kWh. This is approximately 25% more than reported 87720 kWh/yr of electricity consumed (see note (5)).
    b. A representative of the Pay for Performance program indicated that most buildings can achieve the greatest energy savings through electricity demand reductions.[58] This implies that the proportion of electricity to natural gas savings illustrated below may be skewed, disproportionately favoring natural gas savings. Source: Personal correspondence with William Steets of the NJ Clean Energy Program. October 8, 2009.
    c. Additionally, the ratio of natural gas consumption to electricity consumption calculated above does not reflect the national average (approximately 32% of a commercial building's fuel use is from natural gas while 55% comes from electricity). As compared to buildings on a national scale a 15% energy reduction calculated using the numbers given in notes (5) and (8a) will demonstrate exaggerated savings of natural gas. Source: EIA. http://tonto.eia.doe.gov/kids/energy.cfm?page=us_energy_commercial-basics. Accessed 10/8/09.

[59] (87720 kWh)*(.15) = 13158 kWh.

[60] (370,080 therm)*(.15) = 55,512 therms.

[61] Energy savings estimates are from New Jersey's Clean Energy Program. Annual electricity (kWh) and natural gas (therm) savings were provided for all for CHP projects installed through New Jersey's Clean Energy Program in 2008. Annual electricity and natural gas savings were converted to BTUs for further analysis. For each of the four 2008 projects, energy savings per kW of electricity generation was calculated. Average energy savings per kW of electricity generation was then calculated by summing the energy savings per kW of electricity generation for each project and dividing by the total number of projects (4).

[62] To estimate the energy and emissions savings associated with an average CHP system, it was necessary to identify the average annual electric generation of a CHP system. Based on the four CHP projects installed through New Jersey's Clean Energy Program in 2008, the average CHP system installed through New Jersey's Clean Energy Program generates 319 kW of electricity annually. Using this information, the "per CHP system" savings estimates were developed by multiplying savings per kW by 319.

[63] To more precisely estimate expected emissions savings, it was necessary to estimate the proportion of annual energy savings per kW of electricity generation attributable to electricity savings and natural gas savings. To do this, electricity savings as a percentage of total energy savings was calculated for each of the four 2008 projects. Based upon this information, it was determined that, on average, 21.26% of a project's total energy savings can be attributed to electricity savings. (This estimate is based on the one project that resulted in electricity savings during 2008.) It was assumed that the same percentage of energy savings per kW of electricity generation could be attributed to electricity savings. Using this assumption, it was estimated that 4,764,969 BTUs of energy savings per kW of electricity generation result from electricity savings. The remaining energy savings per kW of electricity generation, 17,647,869 BTUs, is attributed to natural gas savings. These savings amounts were then used to estimate emissions savings per kW of electricity generation.

[64] Steps 1-8 are the same as those set forth by the NJ BPU on their website. http://www.njcleanenergy.com/commercial-industrial/programs/pay-performance-participation-steps. Accessed 11/19/09.

[65] NJ BPU. http://www.njcleanenergy.com/files/file/Pay%20for%20Performance/Pay%204%20Performance%20Application%2002-05_09%20e.pdf. Accessed 12/22/09.

[66] New Jersey Board of Public Utilities. (n.d.) 2009 Pay for Performance Program Combined Heat & Power Application Package. http://www.njcleanenergy.com/files/file/Pay%20for%20Performance/P4P%20CHP%20Application%20Package%20-%20Final%20e.pdf (accessed October 22, 2009).

[67] NJ BPU. http://www.njcleanenergy.com/files/file/Pay%20for%20Performance/Pay%204%20Performance%20Application%2002-05_09%20e.pdf. Accessed 11/19/09.
[68] New Jersey Board of Public Utilities. http://www.njcleanenergy.com/residential/programs/community-partners-initiative-0 Accessed 9/23/09.
[69] http://www.indeed.com/salary/Outreach-Coordinator.html
[70] The BPU may provide flyers and other promotional materials. Additionally, towns may have some of the supplies listed here. The list above gives an estimate of the cost of promotional materials in the event that a town must create them from scratch. Price estimates were based on prices listed on Kinkos, Sears, and Office Max websites. The items included in the cost of promotional materials envision efforts to engage residents at green fairs or posting flyers in city buildings. The cost of a poster, 500 flyers, a roll of tape, a package of pens, a package of paper, an easel, a folding table, and a folding chair were included. Additional outreach efforts that are not considered in the costs above include direct mailings and advertisements in local papers, among others. Year to year, flyers may need to be reproduced and additional pens, paper, and tape may need to be purchased. The chairs, table, and posters should be reused.
[71] On average, heating and cooling systems account for 56% of energy use in a home. Air conditioners alone consume 5% of all electricity produced in the United States. U.S. DOE. http://www.energysavers.gov/your_home/space_heating_cooling/index.cfm/mytopic=12300 and http://www.energysavers.gov/your_home/space_heating_cooling/index.cfm/mytopic=12370. Accessed 9/23/09.
[72] http://www.njcleanenergy.com/residential/programs/community-partners-initiative/public-outreach-campaigns. Accessed 9/23/09.
[73] NJ BPU. http://www.njcleanenergy.com/residential/programs/cooladvantage/cooladvantage-program. Accessed 9/23/09.
[74] NJ BPU. http://www.njcleanenergy.com/residential/programs/cooladvantage/cooladvantage-program. Accessed 9/23/09.
[75] The report, "New Jersey's Clean Energy Report submitted to the New Jersey Board of Public Utilities," was the source of information for calculating the electricity and emissions savings resulting from the Warm & Cool Advantage program. The electricity and natural gas savings below are based on 2007 numbers. In 2007, there were 25,740 participants in the program. This number was used to calculate the "per participant" energy and emissions savings. Additionally, the annual savings are the savings resulting from installations performed under the Warm & Cool Advantage program during the 2007 program year. Lifetime savings are the savings that are expected to accumulate over the lifetime of equipment installed during the 2007 program year. In the report, the Warm & Cool Advantage program is called the Residential HVAC. The Residential HVAC program and the Warm & Cool Advantage programs were confirmed to be synonymous by representatives of the BPU's Community Partners Initiative.
"New Jersey's Clean Energy Report submitted to the New Jersey Board of Public Utilities." August 19, 2008. New Jersey Clean Energy Program. Accessed 9/14/09. http://www.njcleanenergy.com/files/file/Library/BPURpt4Q07Master%20Rev%20081908%20Final.pdf.
[76] New Jersey Board of Public Utilities. Clean Energy Program. http://www.njcleanenergy.com/renewable-energy/programs/cleanpower-choice-program/new-jersey-cleanpower-choice-program. Accessed 10/22/09/
[77] New Jersey Board of Public Utilities. Clean Energy Program. http://www.njcleanenergy.com/renewable-energy/programs/cleanpower-choice-program/resources/faqs/faqs. Accessed 11/12/09.
[78] Ibid.
[79] Additional options are available through individual Clean Power Marketers. Please contact individual companies for more information about these additional options.
[80] It is assumed that one 1 MWh of renewable electricity off-sets 1 MWh of electricity from the traditional fuel mix.
[81] The incentive is available if 3% of residences enroll in the program per BPU Community Partners Enrollment form. http://www.njcleanenergy.com/files/file/Community%20Partners%20Initiative/Enrollment%20Forms/CPI%20Enrollment%20Form%202009.pdf accessed 12/22/09
[82] This number is based on end of year data for 2008. The annual energy generation of 24,613 MWh was divided by the number of participants enrolled in the program, 14,456, to obtain the per participant annual generation figure.

"New Jersey Clean Energy Program Report YTD through 4th Quarter." New Jersey Board of Public Utilities. http://njcleanenergy.com/files/file/Library/NJCEP4Q08RPT.pdf. Accessed 11/18/09.

[83] The program is focused on the electric sector, which explains why no significant natural gas savings are accrued. There may be limited natural gas savings as natural gas does contribute to a small percentage of New Jersey's electricity mix.

[84] The emissions savings are based on the emissions rates for each of the pollutants listed. Emissions rates were applied to each of the CleanPower Marketers' annual electricity savings, and the results are recorded in the table.

[85] "New Jersey Clean Energy Program Report submitted to the New Jersey Board of Public Utilities, Reporting Period: Year-to-Date through Fourth Quarter 2008 (January 1, 2008 through December 31, 2008)." http://www.njcleanenergy.com/files/file/Library/NJCEP4Q08RPT.pdf (accessed November 6, 2009). (2008 New Jersey Clean Energy Program Report.)

[86] Office of Energy Efficiency & Renewable Energy, U.S. Department of Energy. (Updated January 22, 2009.) "Energy Savers Tips on Saving Energy & Money at Home: Appliances." http://www1.eere.energy.gov/consumer/tips/appliances.html (accessed November 6, 2009).

[87] ENERGY STAR. (n.d.) "Appliances." http://www.energystar.gov/index.cfm?c=appliances.pr_appliances (accessed November 6, 2009).

[88] New Jersey Board of Public Utilities. (n.d.) "Programs." http://www.njcleanenergy.com/residential/programs/programs (accessed November 6, 2009).

[89] New Jersey Board of Public Utilities. (n.d). "Join Today: Become a Community Partner today. Simply complete these 3 steps." http://www.njcleanenergy.com/residential/programs/community-partners-initiative/join-today (accessed November 6, 2009).

[90] The lifetime for each appliance comes from the 2008 New Jersey Clean Energy Program Report. To determine the lifetime used for each appliance in this report, lifetime energy savings was divided by annual energy savings to determine the lifetime of the appliance in years. This calculation resulted in the following lifetimes by appliance: 10 years for room air conditioners, 15 years for clothes washers, and 10 years for dehumidifiers.

[91] To estimate the energy, water, and emissions savings resulting from the distribution of 50 rebates, it was necessary to first estimate the mix of appliance types that would receive rebates. Based upon 2008 rebate information contained in the 2008 New Jersey Energy Program Report, it was determined that 33% of total rebates were for room air conditioners, 54% of rebates were for clothes washers, and 13% of total rebates were for dehumidifiers in 2008. These same proportions were used to estimate the mix of rebates for 50 rebates referred under the CPI program. This resulted in an estimate of 16 rebates for room air conditioners, 27 rebates for clothes washers, and 7 rebates for dehumidifiers. The savings in each category resulting from 50 rebate referrals was determined by multiplying per unit savings for each appliance by the number of appliances receiving a rebate and then totaling these products.

[92] Energy savings estimates taken from the 2008 New Jersey Clean Energy Program Report. Annual energy savings is provided for the 41,832 appliance rebates (13,691 for room air conditioners, 22,761 for clothes washers, and 5,380 for dehumidifiers) distributed by NJ BPU in 2008. Annual energy savings estimates were divided by the number of 2008 rebates to determine annual energy savings per unit. Calculations for each appliance type were done separately.

[93] Water savings estimates were determined using assumptions outlined in ENERGY STAR's "Life Cycle Cost Estimate for 1 ENERGY STAR Qualified Residential Clothes Washer" savings calculator. This savings calculator operates under the following assumptions: (1) the annual water consumption of an ENERGY STAR qualified clothes washer is 5,637 gallons per year and (2) the annual water consumption of a conventional clothes washer is 12,179 gallons per year. Based upon these assumptions, it was estimated that a single ENERGY STAR qualified clothes washer saves 6,542 gallons per year. ENERGY STAR. (2009). "Life Cycle Cost Estimate for 1 ENERGY STAR Qualified Residential Clothes Washer." http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/CalculatorConsumerClothesWasher.xls (accessed November 6, 2009). (ENERGY STAR Clothes Washer Savings Calculator.)

[94] Emissions savings estimates taken from the 2008 New Jersey Clean Energy Program Report. Annual emissions savings estimates were divided by the number of 2008 rebates to determine lifetime energy savings per unit. Calculations for each appliance type were done separately.

[95] Energy savings estimates taken from the 2008 New Jersey Clean Energy Program Report. Lifetime energy savings estimates were divided by the number of 2008 rebates to determine lifetime energy savings per unit. Calculations for each appliance type were done separately.
[96] Water savings estimates were determined using the ENERGY STAR Clothes Washer Savings Calculator. . Using the assumptions in the calculator, it was estimated that a single ENERGY STAR qualified clothes washer saves 6,542 gallons per year. Lifetime water savings was then determined by multiplying 6,542 gallons by 15 years (the lifetime of a clothes washer as used in the 2008 New Jersey Clean Energy Program Report).
[97] Emissions savings estimates taken from the 2008 New Jersey Clean Energy Program Report. To determine lifetime savings, annual savings estimates were multiplied by the appliance lifetimes used in the same report. Lifetime emissions savings estimates were divided by the number of 2008 rebates to determine lifetime energy savings per unit. Calculations for each appliance type were done separately.
[98] NJCEP. http://www.njcleanenergy.com/files/file/Residential%20Programs/RefrigeratorFreezerRecycling/Sheet3_facts_NJ.pdf Accessed 9/25/09.
[99] JACO Environmental Inc. https://www.jacoinc.net/weborder/rebatex.aspx?ProgramID=73 Accessed 9/25/09.
[100] NJCEP. http://www.njcleanenergy.com/files/file/Residential%20Programs/RefrigeratorFreezerRecycling/Sheet3_facts_NJ.pdf Annual emissions are based on a 12-month period. Data scaled to 20 units to match community incentive bonus. Data based on comparing modern refrigerator standards with average emissions for 20-year old refrigerators. Accessed 9/25/09.

[101] NJ BPU. http://www.nj.gov/bpu/newsroom/news/pdf/20090728.pdf Accessed 9/30/09.

[102] NJCEP. http://www.njcleanenergy.com/residential/programs/home-performance-energy-star/home-performance-energy-star-r Accessed 9/9/09.
[103] NJCEP. http://www.njcleanenergy.com/residential/programs/home-performance-energy-star/home-performance-energy-star-r Accessed 9/9/09.
[104] NJCEP. http://www.njcleanenergy.com/residential/programs/home-performance-energy-star/home-performance-energy-star-r Accessed 9/9/09.

[105] NJCEP. http://www.njcleanenergy.com/files/file/Community%20Partners%20Initiative/Enrollment%20Forms/CPI%20Enrollment%20Form%202009.pdf Accessed 9/9/09.

[106] New Jersey Board of Public Utilities (NJ BPU). New Jersey's Clean Energy Program Report 19 Aug. 2008 P.21. Accessed 9/9/09. Impact savings are derived from 20 total household participants from a 2008 NJ BPU study. Annual savings are based on 12-month period, lifetime savings are defined as the savings to be accrued over the expected life of a measure installed during the program year.

[107] Piper, James. "The Benefits of VFDs in HVAC Systems" Facilitiesnet: VFDs in HVAC Systems (2009), http://www.facilitiesnet.com/hvac/article/The-Benefits-of-VFDs-In-HVAC-Systems--11278 (accessed 12/12/ 2009).

[108] Turkel, Solomon S. 1999. Understanding variable speed drives (Part 2). EC&M Apr 1. http://ecmweb.com/mag/electric_understanding_variable_speed_3/index.html (accessed 12/12/2009).
[109] Bernier, Michael A, and Bernard Bourret. 1999. Pumping energy and variable frequency drives. ASHRAE Journal. 37.

[110] NJ's Clean Energy Program. Commercial, Industrial and Local Government: Technologies-Motors and Drives. http://www.njcleanenergy.com/commercial-industrial/technologies/motors-and-drives/motors-and-drives (accessed 12/12/2009).
[111] U.S. Energy Information Administration. Overview of Commercial Buildings, 2003. http://www.eia.doe.gov/emeu/cbecs/cbecs2003/overview1.html (accessed 01/14/2010).

[112] RSMeans CostWorks – 2009 National, Repair & Remodeling. http://www.meanscostworks.com/ (accessed 1/11/2010)

[113] Yaskawa. Lower Your Operating Costs With Variable Frequency Drives. Energy Savings Worksheet. http://www.yaskawa.com/site/AboutYEA.nsf/about/Energy-Efficiency.html (accessed 01/15/2010).

[114] Yaskawa. Lower Your Operating Costs With Variable Frequency Drives. Energy Savings Worksheet. http://www.yaskawa.com/site/AboutYEA.nsf/about/Energy-Efficiency.html (accessed 01/15/2010).

[115] NJ BPU Protocol.

[116] California Energy Commission. Water/Wastewater Efficiency: Variable frequency drives. http://www.energy.ca.gov/process/pubs/vfds.pdf (accessed 12/12/2009).

[117] Rowan University Clean Energy Program. Energy Technology Case Studies: Variable frequency drives. http://www.rowan.edu/colleges/engineering/clinics/cleanenergy/Rowan%20University%20Clean%20Energy%20Program/Energy%20Efficiency%20Audits/Energy%20Technology%20Case%20Studies/energy_technology_case_studies.html (accessed 12/12/2009).

[118]Phillips, Jeff. 2003. Contractors help confirm VFD savings. ACHR News. May 30. http://www.achrnews.com/Articles/Technical/fe041300f5c5a010VgnVCM100000f932a8c0____ (accessed 12/12/2009). Based on a study of two floors where Floor 7 operated on a VFD HVAC system and Floor 8 operated on a Constant Air Volume System, the difference in kWh is 77,948kWh (29,960kWh versus 108,000kWh, respectively).

[119] NJ's Clean Energy Program. Commercial, Industrial and Local Government: Variable Frequency Drive Incentives. http://www.njcleanenergy.com/misc/commercial-industrial/variable-freq-drives (accessed 01/19/2010).

[120] annual electricity savings * rate of electricity = 39,157kWh * $0.14/kWh = $5,482
For more detailed NJ rates, see: http://www.eia.doe.gov/cneaf/electricity/st_profiles/new_jersey.html
[121] RSMeans CostWorks – 2009 National, Repair & Remodeling. http://www.meanscostworks.com/ (accessed 1/11/2010)

[122] Capital Cost – Incentives (at $120/hp) – Monthly Savings (annual savings/12 months)*Months = 0
$3,090 - $1,200 – $456.83*Months = 0
Months = $1,890/$456.83
Months = 4.14

[123] Case study showing payback of 1.2 yrs. Bhaduri, A. 2001. The Use of Variable Frequency Drives in Existing HVAC Installations. Air Conditioning and Refrigeration Journal. http://www.ishrae.in/journals/2001july/article01.html (accessed 01/15/2010).
[124] NJ's Clean Energy Program. Commercial, Industrial and Local Government: Equiptment Incentives. http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/tools-and-resources/equipment-incentives/equi (accessed 12/12/2009).

[125] NJ's Clean Energy Program. Commercial, Industrial and Local Government: Equiptment Incentives. http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/tools-and-resources/equipment-incentives/equi (accessed 12/12/2009).

[126] O&M Best Practices Guide, Release 2.0, "Commissioning Existing Buildings" ch.7 (2004) (http://www1.eere.energy.gov/femp/pdfs/OM_7.pdf)

[127] Building Commissioning: A Golden Opportunity for Reducing Energy Costs and Greenhouse-Gas Emissions, "Summary of the 2009 Assessment" by, Dr. Evan Mills (2009) (http://cx.lbl.gov/2009-assessment.html) ~ $0.30/ft^2$ estimated cost for commissioning existing buildings

[128] Building Commissioning: A Golden Opportunity for Reducing Energy Costs and Greenhouse-Gas Emissions, "Summary of the 2009 Assessment" by, Dr. Evan Mills (2009) (http://cx.lbl.gov/2009-assessment.html) ~ 16% median whole-building energy savings

[129] Cost-Effectiveness and Impact Analysis of Adoption of Standard 90.1-2007 for New York State (http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf) ~ To be implemented in New Jersey in the near future: Assumed 16% better performance than ASHRAE 90.1-2007 base of 11.85 kwh/sf/yr.

[130] Cost-Effectiveness and Impact Analysis of Adoption of Standard 90.1-2007 for New York State (http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf) ~ To be implemented in New Jersey in the near future: Assumed 16% better performance than ASHRAE 90.1-2007 base of 4.76 kbtu/sf/yr.

[131] 1 kBtu=100 therm; 15,232 kBtu/100= 152.32 therms

[132] 11.85 kWh/sf/yr (ASHRAE 90.1 - 2007) * .16= 1.9 kWh/sf

[133] 4.76 kBtu/sf/yr (ASHRAE 90.1 - 2007) ÷ 1000 = 0.00476 MMBtu/sf

[134] New Jersey SmartStart Buildings (2008) - Program Guide (pg's 3-17) (http://www.njcleanenergy.com/files/file/NJSSB%20Program%20Guide/NJSSB%20Program%20Guide%20Rev%201-28-09.pdf)

[135] "While additional research is needed to further pinpoint the costs and resulting benefits of commissioning new and existing buildings, numerous case studies have demonstrated resulting O&M-related energy efficiency improvements on the order of 5% to 30% covering a wide range of building uses. The resulting simple payback periods are typically less than 2 years and often less than 0.5 year" (http://www1.eere.energy.gov/femp/pdfs/OM_7.pdf)

[136] "The cost of commissioning is dependent upon many factors including a building's size and complexity, and whether the project consists of new construction or building renovation. In general, the cost of commissioning a new building ranges from 0.5 to 1.5 percent of the total construction cost, as shown in the table. For an existing building, never before commissioned, the cost of retrocommissioning can range from 3 to 5 percent of the total operating cost." (http://www1.eere.energy.gov/buildings/commercial/commissioning.html)

[137] Capital Costs/Annual Cost Savings = 6,000/5472= 1.1 years

[138] Building Commissioning: A Golden Opportunity for Reducing Energy Costs and Greenhouse-Gas Emissions, "Summary of the 2009 Assessment" by, Dr. Evan Mills (2009) (http://cx.lbl.gov/documents/2009-assessment/LBNL-Cx-Cost-Benefit.pdf) - Refer to page 15 of 65 for a newer retrocommissioning process overview.

[139] NJ Office of Clean Energy. ENERGY STAR programmable thermostats. http://www.njcleanenergy.com/residential/programs/nj-energy-star-homes/builder-information/guidelines/tutorials/tutorial-energy-0 (accessed 2/11/2010)

[140] Flex Your Power - Commercial Sector Product Guides. Programmable thermostats. http://www.fypower.org/com/tools/products_results.html?id=100133 (accessed 2/11/2010)

[141] Ibid.

[142] Alliance to Save Energy. Saving energy 101: the programmable thermostat. 2009. http://ase.org/content/article/detail/5275 (accessed 2/11/2010)

[143] ($202/$0.113) – ($150/$0.113) = 460 kWh where $202 is the cost of cooling energy from a conventional unit in Newark, NJ, and $150 is the cost of cooling energy from an ENERGY STAR unit. $0.113 is the unit fuel cost for cooling in $/kWh. Energy Star. Programmable Thermostat. Savings Calculator. http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/CalculatorProgrammableThermostat.xls (accessed 2/11/2010)

[144] ($841/$1.33) – ($689/$1.33) = 114 therms where $841 is the cost of heating energy from a conventional unit in Newark, NJ and $689 is the cost of heating energy from an ENERGY STAR unit. $1.33 is unit fuel cost for cooling in $/Therm. Energy Star. Programmable Thermostat. Savings Calculator. http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/CalculatorProgrammableThermostat.xls (accessed 2/11/2010)

[145] Energy Star. Programmable Thermostat Savings Calculator. http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/CalculatorProgrammableThermostat.xls (accessed 2/11/2010)

[146] Energy Star Programmable Thermostat Savings Calculator. http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/CalculatorProgrammableThermostat.xls

- ❖ The Energy Star Calculator Assumes an average price of $92 for an Energy Star programmable thermostat and $73 for a conventional thermostat. The difference of the two are $19 but depending on the model of the new programmable thermostat, the incremental cost could be greater.

[147] Incremental cost/annual cost savings = ($19/$203)= .093 or .1 years

[148] Refer to the assumptions and calculations in endnotes v and vi.

[149] For detailed descriptions of automatic and programmable thermostat types see: Flex Your Power - Commercial Sector Product Guides. Programmable thermostats. http://www.fypower.org/com/tools/products_results.html?id=100133

[150] See ibid. for purchasing tips and strategies for maximizing energy and cost savings.

[151] Efficient Products.org. Survey of Plug Loads. 2006. http://www.efficientproducts.org/product.php?productID=11 (accessed 02/10/2010).

[152] Williams, Kandy. Power management software is a little to no cost way to go green and save green. Enterprise Management Quarterly. 2008. http://www.emqus.com/index.php?/emq/article/power_management_software_is_a_little_to_no_cost_way_to_go_green_and_save_green_576 (accessed 02/10/2010).

[153] Sator, Spencer. Managing Office Plug Loads. Table 2: Annual energy consumptions of different computer types. p.4. 2008. Energy Managers Quarterly. 2008. http://www.cityofpaloalto.org/civica/filebank/blobdload.asp?BlobID=15887 (accessed 02/10/2010).

[154] Sator, Spencer. Managing Office Plug Loads. Table 1: Average annual plug loads of common office items. p.3. 2008. Energy Managers Quarterly. 2008. http://www.cityofpaloalto.org/civica/filebank/blobdload.asp?BlobID=15887 (accessed 02/10/2010).

[155] USA Technologies. Energy Management System for refrigerated vending machines. http://www.coolcontrolplus.com/web%20downloads/VendingMiser_Spec_Sheet.pdf (accessed 02/10/2010).

[156] The Energy Conservation Store. VendingMiser Products Price Sheet. http://www.savesyouenergy.com/syeproducts/Vending%20Miser%20Price%20Sheet.shtml

[157] A standard desktop/LCD monitor combination uses 106 watts (refer to power management software scenario above). Assume operation is 8,760 hrs/yr without power management and 2,340 hrs/yr with power management software installed.
10 desktops/monitors * 106 watts per desktop/monitor = 1,060 watts
1,060 watts * 1 hours = 1,060 watt hours ÷ 1000 = 1.06 kWh total used
Before Power Management Software:

1.06 kWh (for 10 desktops/monitors) * 8,760 hrs/yr = 9,286 kWh/yr
After installing Power Management Software:
1.06 kWh (for 10 desktops/monitors) * 2,340 hrs/yr = 2,480 kWh/yr

Annual Energy Savings: 9,286 kWh/yr – 2,480 kWh/yr = 6,806 kWh/yr
Energy savings per unit (one desktop/monitor): 6,806 kWh/yr ÷ 10 = 680.6 kWh/yr
Note: Computers operating all year round is the extreme end of their operational use.

[158] Before Vending Miser
Annual energy consumption = 2 vending machines * 3,318kWh = 6,636 kWh/yr

After installing Vending Miser:
If energy consumption is reduced by 46%, then
0.54* 6,636 kWh = 3,583 kWh/yr

Annual Energy Savings: 6,636 kWh/yr – 3,583 kWh/yr = 3,053 kWh/yr
Energy Savings per unit (vending machine): 3,053 kWh/yr ÷ 2= 1,527 kWh/yr

[159] NJ Smart Start Buildings Program
http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings (accessed 02/10/2010).

[160] Energy Star - Easy Save (for a network of computers)
http://www.energystar.gov/index.cfm?c=power_mgt.pr_pm_easy_save
Energy Star - EZ Wizard (for individual computers)
http://www.energystar.gov/index.cfm?c=power_mgt.pr_pm_wizard
EPA - EZ Wizard Power Management Tool
http://www.epa.gov/itprogrm/ezenglish.html
Commercial Software Packages
http://www.energystar.gov/index.cfm?c=power_mgt.pr_power_mgt_comm_packages

[161] Tufts University - Office of Sustainability. Vending Misers. 2009.
http://sustainability.tufts.edu/?pid=39 (accessed 02/10/2010).

[162] Steven Winter Associates, Inc. Local Government Energy Program
Energy Audit Final Report for Township of Hopewell. p19. November 2009.
http://www.njcleanenergy.com/files/file/LGEA%20PDFs/Hopewell%20Township%20-%20Public%20Works%20Garage%20Energy%20Audit%20Final%20Report.pdf (accessed 02/10/2010).

[163] [Average Payback] = [Capital Cost] ÷ [annual cost savings]

Average Payback = $265 ÷ $213.78
Average Payback = 1.2 years

[164] Tufts University - Office of Sustainability. Vending Misers. 2009.
http://sustainability.tufts.edu/?pid=39 (accessed 02/10/2010).

[165] Energy Star. Power Management: Activating power management features in enterprises.
http://www.energystar.gov/index.cfm?c=power_mgt.pr_power_mgt_enterprises (accessed 02/10/2010).
[166] Energy Use in Commercial Buildings. 2003.
http://tonto.eia.doe.gov/energyexplained/index.cfm?page=us_energy_commercial (accessed 02/05/2010).
[167] Whole Building Design Guide. Documents & References > CCB > Environmental Library > Green Seal > Green Seal Reports: Occupancy sensors. http://www.wbdg.org/ccb/GREEN/REPORTS/cgrsens.pdf (accessed 1/12/2010).

[168] Whole Building Design Guide Resource Pages. Electric Lighting Controls. 2009. http://www.wbdg.org/resources/electriclighting.php (accessed 1/12/2010).

[169] Average room sizes approximated from Whole Building Design Guide: Space Types - Example Program. June 2009. http://www.wbdg.org/design/ (accessed 02/05/2010).
1 open large office = 180 SF
12 private offices = 120 SF ea * 12 = 1,440 SF
2 public toilets = 120 SF ea * 2 = 240 SF
1 cafeteria = 4,000 SF
1 auditorium/multi-purpose = 8,000 SF estimated
2 conference rooms = 760 SF ea. * 2 = 1,520 SF
Subtotal = 15,380 SF
Miscellaneous & circulation space = 4,620 SF
[170] Minimum coverage areas for sensor types are applied as followed:

Wall Switches	= 300 SF (for smaller areas, i.e. bathrooms, private offices) 1 open large office, 12 private offices, 2 public toilets = 15 sensors
Ceiling Mount	= 1,500 SF (for larger areas, i.e. conference rooms, auditoriums) 1 cafeteria, 1 auditorium, 2 conference rooms = 8 sensors
Total sensors	= 23 sensors

http://www.greenseal.org/resources/reports/CGR=Sensors.pdf (accessed 02/05/2010).

[171] This is an average. In some cases, savings up to 45% are possible. See CA.gov's Best Practices Manual. http://www.green.ca.gov/EPP/building/sensors.htm (accessed 02/05/2010).
For more specific reductions based on type of space, see Land-of-Sky Regional Council's fact sheet on Occupancy Sensors: http://www.energync.net/resources/docs/pubs/occupancy.pdf (accessed 02/05/2010).
[172] 64 Watts * 400 T-8 fixtures (2-lamp 32 W) = 25,600 Watts used total
25,600 Watts total * 2,600 hours/yr (50 hours per week * 52 weeks per year) / 1000 = 66,560 kWh/yr
25,600 Watts total * 780 hours/yr (35 hours per week * 52 weeks per year) / 1000 = 19,968 kWh/yr
[173]Annual cost savings = [electric savings] * [rate of electricity]
19,968 kWh*$0.14/kWh=$2,795.52
[174] Lightsearch.com. Resource Center Light Guide: Occupant Sensors. http://www.lightsearch.com/resources/lightguides/sensors.html (accessed 1/12/2010).
[175] Assuming a building operates an average 2,600 hours/year, running 400 T-8 lamps (64 Watts), implementing dual-technology occupancy sensors can reduce electricity usage by approximately 30% per fixture (1,040 hours per year).
Original scenario:
64 Watts * 1 Fixture = 64 Watts/fixture * 2,600 hours/yr = 166,400 watt hours/yr / 1000 = 166.4 kWh/yr
30% usage reduction:
64 Watts * 1 Fixture = 64 Watts/fixture * 780 hours/yr = 49,920 watt hours/yr / 1000 = 49.9 kWh/yr/lighting fixture

[176] NJ Office of Clean Energy. Lighting Control Prescriptive Incentive. http://www.njcleanenergy.com/misc/commercial-industrial/lighting-control (accessed 02/05/2010).
[177] RS Means Cost Works. Occupancy Sensors, infrared, ceiling mounted = $109 (bare material) + $56 (bare labor) = $165 - $20 BPU incentive = $145
[178][average payback in years] = [average capital cost per unit]*[number of sensors/units] / [annual cost savings]
years = ($165/unit-$20 BPU incentive)*23 / $2,795.52
years = $3335/$2,795.52
years = 1.19 years, or, 1 year and 3 months
[179] Flex Your Power.org, "Central HVAC System: Controls and Load Reductions." http://www.fypower.org/bpg/module.html?b=offices&m=Central_HVAC_System (accessed 12/17/2009).

[180] Nelson, David. 2008. Energy Efficient Lighting. Whole Building Design Guide. Accessed August 7, 2009 (http://www.wbdg.org/resources/efficientlighting.php?r=minimize_consumption)

[181] A two-lamp T-12 40-Watt fixture with magnetic ballasts has a total wattage of 80 Watts. By replacing the T-12 fixture with a two-lamp T-8 32-Watt fixture with electronic ballasts, the total wattage would be reduced to 60.2 Watts per fixture and the space light levels and light quality would remain very similar. Assume that a two-lamp T-12 40-Watt lamp with magnetic ballasts uses 80 Watts (40 Watts x 2 lamps = 80 Watts) while a two-lamp T-8 32-Watt lamp with electronic ballasts uses 60.2 Watts (32 Watts x 2 lamps = 64 Watts) – (3.84 Watts saved from electronic ballasts)*. The total energy savings of a two-lamp T-8 32 Watt fixture with an electronic ballast over a two-lamp T-12 40-Watt fixture with a magnetic ballast is: (80 Watts – 64 Watts) + 3.84 watts = 19.8 Watts per fixture.

Assume a facility uses the lights 10 hours a day for 365 days/year; the lights are on 3650 hours/year. Annual electric savings is equal to 19.8 Watts x 3650 hrs = 72,270 Watt-hrs/unit. In a 20,000 sq. ft building with 1 fixture/50 ft., there are 400 fixtures, so whole building savings is equal to 400 units x 72,270 Watt-hrs = 28,908 kWh.

*Switching from magnetic to electronic ballasts saves an additional 6% on energy: 64 Watts x 0.06 = 3.84 Watts.

[182] New Jersey Retail Electricity Price Forecast for Commercial Buildings = $.14/kWh PJM Wholesale Electricity Prices for 2006-2008 http://www.pjm.com/markets-and-operations/energy/real-time/monthlylmp.aspx

[183] The expected lamp life of a T-8 lamp is approximately 30,000 burn-hours compared to 20,000 burn-hours for T-12 lamps. This corresponds to approximately 15 years (Source: average lifetime of "lighting upgrades" from CEEEP BPU program evaluation 2008).

[184] The expected lamp life of a T-5 lamp is approximately 30,000 burn-hours compared to 20,000 burn-hours for T-12 lamps. This corresponds to approximately 15 years (Source: Average lifetime of "lighting upgrades" from CEEEP BPU Program Evaluation 2008).

[185] A two-lamp T-12 40-Watt fixture with magnetic ballasts has a total wattage of 80 Watts. By replacing the T-12 fixture with a two-lamp T-8 32-Watt fixture with electronic ballasts, the total wattage would be reduced to 60.2 Watts per fixture and the space light levels and light quality would remain very similar. Assume that a two-lamp T-12 40-Watt lamp with magnetic ballasts uses 80 Watts (40 Watts x 2 lamps = 80 Watts) while a two-lamp T-8 32-Watt lamp with electronic ballasts uses 60.2 Watts (32 Watts x 2 lamps = 64 Watts) – (3.84 Watts saved from electronic ballasts)*. The total energy savings of a two-lamp T-8 32 Watt fixture with an electronic ballast over a two-lamp T-12 40-Watt fixture with a magnetic ballast is: (80 Watts – 64 Watts) + 3.84 watts = 19.8 Watts per fixture.

Assume a facility uses the lights 10 hours a day for 365 days/year; the lights are on 3650 hours/year. Annual electric savings is equal to 19.8 Watts x 3650 hrs = 72,270 Watt-hrs/unit or 72.27 kWh/unit *Switching from magnetic to electronic ballasts saves an additional 6% on energy: 64 Watts x 0.06 = 3.84 Watts.

[186] Assume that a two-lamp T-12 40-Watt fixture uses 80 Watts while a two-lamp T-5 28-Watt fixture with electronic ballasts uses 52.2 Watts.* The total energy savings of a two-lamp T-5 28-Watt fixture with electronic ballasts over a two-lamp T-12 40-Watt fixture with magnetic ballasts is: (80 Watts – 56 Watts) + 3.84 Watts = 27.8 Watts per fixture.

Using the same assumptions for facility lighting as above, annual electric savings is equal to 27.8 Watts x 3650 hrs = 101,470 Watt-hrs/unit or 101.47 kWh/unit. Whole building savings is equal to 400 units x 101,470 Watt-hrs = 40,588 kWh.

* (28 Watts x 2 lamps) – (3.84 Watts saved from electronic ballasts) = 52.2 Watts.

[187] Assume that a regular incandescent light bulb uses 100 watts while a cfl uses 26 watts

100 watts x (3650 hours) = 365,000/1000 = 365 kWh/year

26 watts x 3650 hours = 94,900/1000= 94.9kWh/year

365-94.9= 270.1 kWh/yr/unit saved x 400 cfls = 108,040 kWh/year

[188] Annual Cost Savings (2-lamp T-8 32-watt with electronic ballast): Assume that the cost of 1 kWh of electricity is $0.14

19.8 Watts x .14 = $2.77 saved per unit

$2.77 x 400 = $1108.00 saved for an entire 20,000 sq. ft. building

[189] Annual Cost Savings (2-lamp T-5 28-watt with electronic ballast): Assume that the cost of 1 kWh of electricity is $0.14

27.8 Watts x .14 = $3.89 saved per unit

$3.89 x 400 = $1556.00 saved for an entire 20,000 sq. ft. building

[190] Annual Cost Savings (26-watt CF): Assume that the cost of 1 kWh of electricity is $0.14

74 watts x .14 = $10.36

$10.36 x 400 = $4144 for an entire 20,000 sq. ft. building

[191] Center for Energy, Economic & Environmental Policy. 2009. CEEP Commercial & Industrial Cost-Benefit Model. High Efficiency recessed or surfaced mounted fluorescent fixtures (4ft T-8 2-lamp = $48.89) http://policy.rutgers.edu/ceeep/publications/

[192] Center for Energy, Economic & Environmental Policy. 2009. CEEP Commercial & Industrial Cost-Benefit Model. High Efficiency recessed or surfaced mounted fluorescent fixtures (4ft T-5 2-lamp = $88.66) http://policy.rutgers.edu/ceeep/publications/

[193] Center for Energy, Economic & Environmental Policy. 2009. CEEP Commercial & Industrial Cost-Benefit Model. High Efficiency recessed or surfaced mounted fluorescent fixtures (26-watt CFL= $20.00) http://policy.rutgers.edu/ceeep/publications/

[194] (Capital Incremental Costs/Annual Cost Savings) = $9,556 ($23.89 *400 fixtures)/ $4,047.12 = 2.4 years

[195] $25,464 (($88.66-$25)* 400) / $5,682.32(101.47*.14*400) = 4.5 years

[196] $8,000 ($20*400) / $15,125.60 (270.1 *.14 *400) = 0.5 years

[197] Savings Analysis Worksheet, "LED Exit Signs". http://www.focusonenergy.com/files/Document_Management_System/Business_Programs/ledexitsigns_worksheet.pdf (accessed 01/18/2010).

[198] Energy Information Administration. Average Retail Price of Electricity to Ultimate Customers by End-Use Sector, by State: New Jersey. Aug 2009. Commercial kWh rate. http://www.eia.doe.gov/cneaf/electricity/epm/table5_6_a.html (accessed 01/18/2010).

[199] Annual electric savings = incandescent electric usage – LED electric usage
= ((40watts*8,760hrs) /1,000kW)*10 fixtures = 3,504 kWh - ((5watts *8,760hrs) / 1,000kW)*10 fixtures = 438 kWh
= 3,504 kWh – 438 kWh
= 3,066 kWh

[200] Annual cost savings = incandescent operational cost – LED operational cost
= $490.56 - $61.32(cf. Chart 1: Incandescent vs. LED Operational Costs)

= $429.24

[201] 1 Incandescent 2-bulb fixture = 40 Watts (refer to footnote #2)

- 40 Watts x 1 Exit Sign = 40 Watts/Sign x 8760 hours/yr = 350,400 watt hours/yr / 1000 = 350.4 kWh/yr

1 LED 2-bulb fixture = 5 Watts (refer to footnote #2)

- 5 Watts x 1 Exit Sign = 5 Watts/Sign x 8760 hours/yr = 43,800 watt hours/yr / 1000 = 43.8 kWh/yr

Annual MWh savings = 350.4 kWh/yr – 43.8 kWh/yr = 306.6 kWh/yr difference = .307 MWh/yr

[202] 1 Fluorescent 2-bulb fixture = 14 Watts (refer to footnote #2)

- 14 Watts x 1 Exit Sign = 14 Watts/Sign x 8760 hours/yr = 122,640 watt hours/yr / 1000 = 122.6 kWh/yr
- 5 Watts x 1 Exit Sign = 5 Watts/Sign x 8760 hours/yr = 43,800 watt hours/yr / 1000 = 43.8 kWh/yr

Annual MWh savings = 122.6 kWh/yr – 43.8 kWh/yr = 78.8 kWh/yr difference = .079 MWh/yr

[203] NJ Office of Clean Energy. Equipment Incentives. (http://njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/tools-and-resources/equipment-incentives/equi (accessed 01/18/2010).

[204] $122*10 LED exit signs - $1,220
[205] RS Means Cost Works. Exit Lights, LED, Standard, Single face, ceiling or wall mount= $73 (bare material) + $49 (bare labor) = $122
[206] RS Means Cost Works
Incandescent Exit Lights= $42 (bare material) = $49 (bare labor = $91
LED exit Lights ($122) – Incandescent Lights ($91)= $31

[207] RS Means Costs Works
Fluorescent Exit Lights = $65 (bare material) = $49 (bare labor) = $114
LED exit Lights ($122) – Fluorescent exit Lights ($114) = $8
[208] For replacing incandescent signs to LED:
Incremental Costs / Annual Costs = ($31 for 10 LED exit signs [$31 x 10 LED exit signs]) / $429.24 = $310 / $429.24 =
0.72 years, for replacing10 fluorescent exit signs with 10 LED exit signs
For replacing fluorescent signs to LED:
Incremental Costs / Annual Costs = ($8 for 10 LED exit signs [$8 x 10 LED exit signs]) / $110.32 = $80 / $110.32 = 0.73 years, for replacing10 incandescent exit signs with 10 LED exit signs
Payback Period w/ Equipment Incentive:
For replacing incandescent signs to LED:

- For Equipment Incentive of $20 per fixture (refer to Resources section below):

Incremental Costs / Annual Costs = ($11 for 10 LED exit signs [$11 x 10 LED exit signs]) / $429.24 = $110 / 429.24 =
0.3years, for replacing 10 fluorescent exit signs with 10 LED exit signs

- For Equipment Incentive of $10 per fixture (refer to Incentives and Resources sections below):

Initial Costs / Annual Costs = ($21for 10 LED exit signs [$21 x 10 LED exit signs]) / $429.24 = $210 / 429.24 = 0.5 years, for replacing 10 fluorescent exit signs with 10 LED exit signs
[209] Flex Your Power.org, "Central HVAC System: Controls and Load Reductions."
http://www.fypower.org/bpg/module.html?b=offices&m=Central_HVAC_System (accessed 12/17/2009).

[210] Energy Star Assumptions: Electricity Emission Carbon Factor = 1.54 lb CO_2/kWh
www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/Calc_Exit_Signs.xls (accessed 01/18/2010).
[211]Black, Sam. 2009. Day-cleaning janitorial services gaining steam as property managers look for new ways to save money. Minneapolis St. Paul Business Journal. Aug 7, 2009.
http://twincities.bizjournals.com/twincities/stories/2009/08/10/focus1.html?t=printable (accessed 01/28/2010).
[212] U.S. Department of Energy. 2009. Energy Databook. Typical Office Building

http://buildingsdatabook.eere.energy.gov/TableView.aspx?table=3.6.8 (accessed 01/29/2010)

[213]Klein, Levin, & Cloutier. 2005. No-Cost Energy-Savings Strategies. IREM First.
http://www.iremfirst.org/if/knowledgebase/Energy%20Conservation/goldStandard/No-Cost%20Energy-Savings%20Strategies;jsessionid=8CB3BC8CA9C30DD5E7C32B4CD69E0573 (accessed 01/28/2010).

[214] American Institute for Cleaning Sciences. Day Cleaning Electric Consumption Calculator. http://www.aics.com/daycleaning.html (accessed 01/28/2010). Assume 1 lighting fixture every 50 ft (20,00 sq. ft. /50= 400 lighting fixtures)

[215] 55 Hour Week operation (Day Cleaning not in effect)

60watts (2-lamp 32-watt T-8 fixture with electronic ballasts = 64 watts * .06 savings from electronic ballast) * (55 hrs/week * 52 weeks/yr) = 171,600 watt hrs/yr/T-8 fixture

171,600 watt hrs/yr/T-8 lamp /1000 watts = 172 kWh/yr/T-8 fixture

172 kWh/yr/T-8 lamp x $0.14 kWh = $24.08 to operate one T-8 fixture/yr

$24.08 T-8 /yr * 400 lamp fixtures in the 20,000 sq. ft. building = $9,632spent on electricity for an 55 hour operational week

[216] 45 Hour Week operation (Day Cleaning in effect)

60 watts (2-lamp 32-watt T-8 fixture with electronic ballasts = 64 watts * .06 savings from electronic ballast) * (45 hrs/week * 52 weeks/yr) = 140,400watt hrs/yr/T-8 lamp fixture

140,400 watt hrs/yr/T-8 lamp /1000 watts = 140 kWh/yr/T-8 lampfixture

140 kWh/yr/T-8 lamp x $0.14 kWh = $19.60 to operate one T-8 lamp fixture/yr

$19.60 T-8 lamp fixture/yr * 400 lamp fixtures in the 20,000 sq. ft. building = $7,840spent on electricity for an 45 hour operational week

[217] kWh savings:

172 kWh/yr/T-8 lamp (55 hour week) – 140 kWh/yr/T-8 lamp (45 hour week) = 32 kWh/yr/T-8 lamp fixture

32 kWh/yr/T-8 lamp saved * 400 lamp fixtures in the 20,000 sq. ft. building = 12,800 kWh/yr saved by switching to day cleaning (at 100% lamp efficiency)

[218]Annual cost savings:

$9,632 (55 hour week) - $7840 (45 hour week) = $1792

[219] kWh savings: 172 kWh/yr/T-8 lamp (55 hour week) – 140 kWh/yr/T-8 lamp (45 hour week) = 32 kWh/yr/T-8 lamp fixture

32 kWh/yr/T-8 lamp saved * 400 lamp fixtures in the 20,000 sq. ft. building = 12,800 kWh/yr saved by switching to day cleaning (at 100% lamp efficiency)

[220] Cleaning and Maintenance Management. Going from night to Day Cleaning can save money, put pride in your cleaning operation. (Frank, Spencer, Rathey, & Jurecki, 2006). http://www.cmmonline.com/articleprint.asp?print=1&IndexID=6636065 (accessed 01/19/2010).

[221] In New Jersey municipalities presently cannot require compliance with a green building standard that exceeds the State's Uniform Construction Code, nor require green building certification such as Leadership in Energy and

Environmental Design (LEED) or Energy Star. What is allowable is for a municipality to encourage adherence to a green building standard or guideline or to encourage green building generally.

[222] LEED is an internationally recognized green building certification system, providing third-party verification that a building was designed and built using strategies aimed at improving performance relating to the following; energy efficiency, water efficiency, CO_2 emissions reduction, improved indoor environmental quality, and stewardship of resources and sensitivity to their impacts.
http://www.usgbc.org/DisplayPage.aspx?CMSPageID=1988

[223] The ICC-700-2008 National Green Building Standard was created in 2007 from a partnership of the National Association of Home Builders (NAHB) and the International Code Council (ICC). This standard was developed in compliance with the requirements of the American National Standards Institute (ANSI). It defines green building for single and multifamily homes, residential remodeling projects and site development projects while still allowing for the flexibility required for regionally-appropriate best green practices.
http://www.nahbgreen.org/Guidelines/ansistandard.aspx

[224] The HERS Index is a scoring system established by the Residential Energy Services Network (RESNET). Scoring is compared to a reference home built to the specifications of the 2006 International Energy Conservation Code. This reference home scores a HERS Index of 100, while a net zero energy home scores a HERS Index of 0. The lower a home's HERS Index, the more energy efficient it is in comparison to the HERS Reference Home.
http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_HERS

[225] http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_HERS

[226] Gregory H. Kats. 2003. Green Building Costs and Financial Benefits. A Report to California's Sustainable Building Taskforce. October 2003. (accessed 12/7/2009) http://www.usgbc.org/ShowFile.aspx?DocumentID=1992

[227] Assumption – Single Family Home Square Footage
(http://www.nahb.org/fileUpload_details.aspx?contentID=80051)
Average of Average Square Feet of Floor Area sold in the northeast between 1978 and 2008.

[228] International Code Council. Building Valuation Data – 2009 (accessed 12/7/2009)
http://www.iccsafe.org/cs/Documents/BVD.pdf

[229] New Jersey Retail Electricity and Natural Gas Price Forecast for Residential Buildings. Energy Information Administration. Annual Energy Outlook 2009. (March 2009) and PJM Wholesale Electricity Prices for 2006-2008
http://www.pjm.com/markets-and-operations/energy/real-time/monthlylmp.aspx

[230] Annual Electric Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 8.9 kWh/sf/yr, totaling 1.78 kWh/sf/yr.

[231] Annual Gas Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 13.89 kBtu/sf/yr, totaling 2.78 kBtu/sf/yr.

[232] kBtu to therm conversion
1 therm = 100,000 btukBtu = 1000 Btu
1 Btu = 0.000009993 therms
7,645 kBtu = 7,645,000 Btu
7,645,000 Btu = 76.4 therms

[233] New Housing Unit Assumption – East Orange
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 570 new homes anticipated from 2004-2018, an average growth of 41 homes per year is assumed

[234] Permit Fee Reduction Assumption – East Orange
With 8 homes receiving 50% permit fee reductions of $1546.75 per home, East Orange will receive $12,374 less in permit fee revenue.

[235] New Housing Unit Assumption - Edison
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task
With 2,573 new homes anticipated from 2004-2018, an average growth of 184 homes per year is assumed

[236] Permit Fee Reduction Assumption – Edison

With 37 homes receiving 50% permit fee reductions of $1546.75 per home, Edison will receive $57,230 less in permit fee revenue.
[237] New Housing Unit Assumption – Fort Lee
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 1,268 new homes anticipated from 2004-2018, an average growth of 91 homes per year is assumed
[238] Permit Fee Reduction Assumption – Fort Lee
With 18 homes receiving 50% permit fee reductions of $1546.75 per home, Fort Lee will receive $27,842 less in permit fee revenue.
[239] New Housing Unit Assumption – Howell Twp
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 1,980 new homes anticipated from 2004-2018, an average growth of 141 homes per year is assumed
[240] Permit Fee Reduction Assumption – Howell Twp
With 28 homes receiving 50% permit fee reductions of $1546.75 per home, Howell Twp will receive $43,309 less in permit fee revenue.
[241] New Housing Unit Assumption - Middletown
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 1149 new homes anticipated from 2004-2018, an average growth of 82 homes per year is assumed
[242] Permit Fee Reduction Assumption – Middletown
With 16 homes receiving 50% permit fee reductions of $1546.75 per home, Middletown will receive $24,748 less in permit fee revenue.
[243] New Housing Unit Assumption - Montclair
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 352 new homes anticipated from 2004-2018, an average growth of 25 homes per year is assumed
[244] Permit Fee Reduction Assumption – Montclair
With 5 homes receiving 50% permit fee reductions of $1546.75 per home, Montclair will receive $7,734 less in permit fee revenue.
[245] New Housing Unit Assumption - Parsippany
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 903 new homes anticipated from 2004-2018, an average growth of 65 homes per year is assumed
[246] Permit Fee Reduction Assumption – Parsippany
With 13 homes receiving 50% permit fee reductions of $1546.75 per home, Parsippany will receive $20,108 less in permit fee revenue.
[247] New Housing Unit Assumption – Perth Amboy
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 677 new homes anticipated from 2004-2018, an average growth of 48 homes per year is assumed
[248] Permit Fee Reduction Assumption – Perth AmboyWith 10 homes receiving 50% permit fee reductions of $1546.75 per home, East Orange will receive $15,477 less in permit fee revenue.

[249] New Housing Unit Assumption - Plainfield
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 374 new homes anticipated from 2004-2018, an average growth of 27 homes per year is assumed
[250] Permit Fee Reduction Assumption – Plainfield
With 6 homes receiving 50% permit fee reductions of $1546.75 per home, Plainfield will receive $9,281 less in permit fee revenue.
[251] New Housing Unit Assumption – West Orange
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 934 new homes anticipated from 2004-2018, an average growth of 67 homes per year is assumed

[252] Permit Fee Reduction Assumption – West Orange
With 13 homes receiving 50% permit fee reductions of $1546.75 per home, West Orange will receive $20,108 less in permit fee revenue.
[253] New Housing Unit Assumption – Willingboro Twp
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1

With 655 new homes anticipated from 2004-2018, an average growth of 47 homes per year is assumed
[254] Permit Fee Reduction Assumption – Willingboro Twp
With 9 homes receiving 50% permit fee reductions of $1546.75 per home, Willingboro Twp will receive $13,921 less in permit fee revenue.
[255] Lifetime of building component assumption:
(http://www.nahb.org/fileUpload_details.aspx?contentID=99359)
20 year lifetime of measure based upon expected lifetime of major building components.
[256] Lifetime of policy assumption:With consideration taken to reflect revisions to LEED 2009 which is subject to revision every two years, ASHREA 90.1 which is subject to revision every 3 years and NJ IECC which is also subject to revision every three years, a maximum five year lifetime of policy is assumed.

[257] Annual Electric Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 8.9 kWh/sf/yr, totaling 1.78 kWh/sf/yr.
[258] Annual Gas Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 13.89 kBtu/sf/yr, totaling 2.78 kBtu/sf/yr.
[259] Gregory H. Kats 2003

[260] In New Jersey municipalities presently cannot require compliance with a green building standard that exceeds the State's Uniform Construction Code, nor require green building certification such as Leadership in Energy and Environmental Design (LEED) or Energy Star. What is allowable is for a municipality to encourage adherence to a green building standard or guideline or to encourage green building generally.

[261] www.sustainablejersey.com

[262] Gregory H. Kats. 2003. Green Building Costs and Financial Benefits. A Report to California's Sustainable Building Taskforce. October 2003. (accessed 12/7/2009) http://www.usgbc.org/ShowFile.aspx?DocumentID=1992
[263] Annual Electric Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 11.85 kwh/sf/yr, totaling 2.37 kwh/sf/yr.
[264] Annual Gas Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 4.76 kBtu/sf/yr, totaling .95 kBtu/sf/yr.

[265] kBtu to therm conversion
1 therm = 100,000 kBtu = 1000 Btu
1 Btu = 0.000009993 therms
19,000 kBtu = 19,000,000 Btu
19,000,000 Btu = 189.87 therms

[266] New Jersey Retail Electricity and Natural Gas Price Forecast for Commercial Buildings. Energy Information Administration. Annual Energy Outlook 2009

[267] Lifetime of building component assumption:
30 year lifetime of measure based upon expected lifetime of major building components.

[268] Lifetime of policy assumption:

With consideration taken to reflect revisions to LEED 2009 which is subject to revision every two years, ASHREA 90.1 which is subject to revision every 3 years and NJ IECC which is also subject to revision every three years, a maximum five year lifetime of policy is assumed.

[269] Annual Electric Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 11.85 kwh/sf/yr, totaling 2.37 kwh/sf/yr.

[270] Annual Gas Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 4.76 kBtu/sf/yr, totaling .95 kBtu/sf/yr.
[271] Gregory H. Kats 2003

[272] Sustainable Jersey www.sustainablejersey.com
[273] Green Building Certification Institute (accessed 12/7/2009)
http://www.gbci.org/DisplayPage.aspx?CMSPageID=211
& LEED 2009 Version 3 Reference Guide
[274] LEED is an internationally recognized green building certification system developed by the U.S. Green Building Council (USGBC) providing 3rd-party verification that a building or community was designed and built using strategies aimed at improving performance across a variety of metrics: energy savings, water efficiency, CO_2 emissions reduction, improved indoor environmental quality, and stewardship of resources and sensitivity to their impacts. On April 27, 2009, USGBC launched LEED v3.LEED Rating Systems – which streamlined LEED rating systems into 3 overarching categories: Green Building Design & Construction, Green Interior Design & Construction and Green Building Operations & Maintenance. www.usgbc.org

[275] ASHRAE 90.1-2007 is a set of guidelines that provides minimum requirements for the energy efficient design of buildings. www.ashrae.org
[276] In New Jersey municipalities presently cannot require compliance with a green building standard that exceeds the State's Uniform Construction Code, nor require green building certification such as Leadership in Energy and Environmental Design (LEED) or Energy Star. What is allowable is for a municipality to encourage adherence to a green building standard or guideline or to encourage green building generally.

[277] The Global Warming Response Act (GWRA) (P.L. 2007, c. 112) calls for reducing GHG emissions to 1990 levels by 2020, approximately a 25 percent reduction below estimated 2020 business-as-usual (BAU) emissions, followed by a further reduction of emissions to 80 percent below 2006 levels by 2050.
[278] Gregory H. Kats. 2003. Green Building Costs and Financial Benefits. A Report to California's Sustainable Building Taskforce. October 2003. (accessed 12/7/2009) http://www.usgbc.org/ShowFile.aspx?DocumentID=1992
[279] International Code Council. Building Valuation Data – 2009 (accessed 12/7/2009)
http://www.iccsafe.org/cs/Documents/BVD.pdf
[280] Annual Electric Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 11.85 kWh/sf/yr, totaling 2.37 kWh/sf/yr.
[281] Annual Gas Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 4.76 kBtu/sf/yr, totaling .95 kBtu/sf/yr.
[282] kBtu to therm conversion
1 therm = 100,000 kBtu = 1000 Btu
1 Btu = 0.000009993 therms
19,000 kBtu = 19,000,000 Btu
19,000,000 Btu = 189.87 therms

[283] New Jersey Retail Electricity and Natural Gas Price Forecast for Commercial Buildings. Energy Information Administration. Annual Energy Outlook 2009
[284] New Square Footage Growth Assumption – East Orange
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 881.034 between the years 2004-2018, it is assumed that 62,931 square feet of growth can be anticipated annually.

[285] Annual Electric Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 11.85 kWh/sf/yr, totaling 2.37 kWh/sf/yr.
[286] Annual Gas Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 4.76 kBtu/sf/yr, totaling .95 kBtu/sf/yr.
[287] New Square Footage Growth Assumption – Edison
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 3,255,172 between the years 2004-2018, it is assumed that 232,512 square feet of growth can be anticipated annually.
[288] Annual Electric Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 11.85 kWh/sf/yr, totaling 2.37 kWh/sf/yr.
[289] Annual Gas Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 4.76 kBtu/sf/yr, totaling .95 kBtu/sf/yr.
[290] New Square Footage Growth Assumption – Fort Lee
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 1,740.345 between the years 2004-2018, it is assumed that 124,310 square feet of growth can be anticipated annually.
[291] Annual Electric Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 11.85 kWh/sf/yr, totaling 2.37 kWh/sf/yr.
[292] Annual Gas Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 4.76 kBtu/sf/yr, totaling .95 kBtu/sf/yr.
[293] New Square Footage Growth Assumption – Howell
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 2,487.241 between the years 2004-2018, it is assumed that 177,660 square feet of growth can be anticipated annually.
[294] Annual Electric Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 11.85 kWh/sf/yr, totaling 2.37 kWh/sf/yr.
[295] Annual Gas Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 4.76 kBtu/sf/yr, totaling .95 kBtu/sf/yr.
[296] New Square Footage Growth Assumption – Middletown
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 1,286,552 between the years 2004-2018, it is assumed that 91,897 square feet of growth can be anticipated annually.
[297] Annual Electric Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 11.85 kWh/sf/yr, totaling 2.37 kWh/sf/yr.
[298] Annual Gas Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 4.76 kBtu/sf/yr, totaling .95 kBtu/sf/yr.
[299] New Square Footage Growth Assumption – Montclair
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 503,103 between the years 2004-2018, it is assumed that 35,936 square feet of growth can be anticipated annually.
[300] Annual Electric Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)

Assumed 20% better performance than ASHRAE 90.1-2007 base of 11.85 kWh/sf/yr, totaling 2.37 kWh/sf/yr.
[301] Annual Gas Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 4.76 kBtu/sf/yr, totaling .95 kBtu/sf/yr.
[302] New Square Footage Growth Assumption – Parsippany – Troy Hills
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 8,627,586 between the years 2004-2018, it is assumed that 616,256 square feet of growth can be anticipated annually.
[303] Annual Electric Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 11.85 kWh/sf/yr, totaling 2.37 kWh/sf/yr.
[304] Annual Gas Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 4.76 kBtu/sf/yr, totaling .95 kBtu/sf/yr.
[305] New Square Footage Growth Assumption – Perth Amboy
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 332,069 between the years 2004-2018, it is assumed that 23,719 square feet of growth can be anticipated annually.
[306] Annual Electric Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 11.85 kWh/sf/yr, totaling 2.37 kWh/sf/yr.
[307] Annual Gas Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 4.76 kBtu/sf/yr, totaling .95 kBtu/sf/yr.
[308] New Square Footage Growth Assumption – Plainfield
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 448.966 between the years 2004-2018, it is assumed that 32,069 square feet of growth can be anticipated annually.
[309] Annual Electric Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 11.85 kWh/sf/yr, totaling 2.37 kWh/sf/yr.
[310] Annual Gas Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 4.76 kBtu/sf/yr, totaling .95 kBtu/sf/yr.
[311] New Square Footage Growth Assumption – West Orange
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 853,448 between the years 2004-2018, it is assumed that 60,961 square feet of growth can be anticipated annually.
[312] Annual Electric Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 11.85 kWh/sf/yr, totaling 2.37 kWh/sf/yr.
[313] Annual Gas Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 4.76 kBtu/sf/yr, totaling .95 kBtu/sf/yr.

[314] New Square Footage Growth Assumption – Willingboro Twp
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 540,690 between the years 2004-2018, it is assumed that 38,621 square feet of growth can be anticipated annually.
[315] Annual Electric Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 11.85 kWh/sf/yr, totaling 2.37 kWh/sf/yr.
[316] Annual Gas Savings Assumption

(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 4.76 kBtu/sf/yr, totaling .95 kBtu/sf/yr.
[317] Lifetime of building component assumption:
30 year lifetime of measure based upon expected lifetime of major building components.
[318] Lifetime of policy assumption:

With consideration taken to reflect revisions to LEED 2009 which is subject to revision every two years, ASHREA 90.1 which is subject to revision every 3 years and NJ IECC which is also subject to revision every three years, a maximum five year lifetime of policy is assumed.

[319] Annual Electric Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 11.85 kWh/sf/yr, totaling 2.37 kWh/sf/yr.
[320] Annual Gas Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 4.76 kBtu/sf/yr, totaling .95 kBtu/sf/yr.

[321] Gregory H. Kats 2003

[322] Sustainable Jersey www.sustainablejersey.com
[323] The ICC-700-2008 National Green Building Standard was created in 2007 from a partnership of the National Association of Home Builders (NAHB) and the International Code Council (ICC). This standard was developed in compliance with the requirements of the American National Standards Institute (ANSI). It defines green building for single and multifamily homes, residential remodeling projects and site development projects while still allowing for the flexibility required for regionally-appropriate best green practices.
http://www.nahbgreen.org/Guidelines/ansistandard.aspx
[324] http://greensource.construction.com/news/2009/090317ANSI.asp

[325] Gregory H. Kats. 2003. Green Building Costs and Financial Benefits. A Report to California's Sustainable Building Taskforce. October 2003. (accessed 12/7/2009) http://www.usgbc.org/ShowFile.aspx?DocumentID=1992
[326] Assumption – Single Family Home Square Footage
(http://www.nahb.org/fileUpload_details.aspx?contentID=80051)
Average of Average Square Feet of Floor Area sold in the northeast between 1978 and 2008.
[327] Total Construction Costs:
$150/sf * 450sf = $67,500
$75/sf*1800sf = $135,00
[328] International Code Council. Building Valuation Data – 2009 (accessed 12/7/2009)
http://www.iccsafe.org/cs/Documents/BVD.pdf
[329] New Jersey Retail Electricity and Natural Gas Price Forecast for Residential Buildings. Energy Information Administration. Annual Energy Outlook 2009. (March 2009) and PJM Wholesale Electricity Prices for 2006-2008
http://www.pjm.com/markets-and-operations/energy/real-time/monthlylmp.aspx
[330] Annual Electric Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 8.9 kWh/sf/yr, totaling 1.78 kWh/sf/yr.
[331] Annual Gas Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 13.89 kBtu/sf/yr, totaling 2.78 kBtu/sf/yr.
[332] kBtu to therm conversion
1 therm = 100,000 btukBtu = 1000 Btu
1 Btu = 0.000009993 therms
6,255 kBtu = 6,255,000 Btu
6,255,000 Btu = 62.5 therms
[333] Existing Housing Unit Assumption – East Orange

Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 570 new homes anticipated from 2004-2018, an average growth of 41 homes per year is assumed.
Assume twice as many homes will be renovated, totaling 82
[334] Existing Housing Unit Assumption – Edison
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 184 new homes anticipated from 2004-2018, an average growth of 41 homes per year is assumed.
Assume twice as many homes will be renovated, totaling 368
[335] Existing Housing Unit Assumption – Fort Lee
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 1,268 new homes anticipated from 2004-2018, an average growth of 91 homes per year is assumed
Assume twice as many homes will be renovated, totaling 182.
[336] Existing Housing Unit Assumption – Howell Twp
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 1,980 new homes anticipated from 2004-2018, an average growth of 141 homes per year is assumed
Assume twice as many homes will be renovated, totaling 282.
[337] Existing Housing Unit Assumption - Middletown
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 1149 new homes anticipated from 2004-2018, an average growth of 82 homes per year is assumed
Assume twice as many homes will be renovated, totaling 164.
[338] Existing Housing Unit Assumption - Montclair
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 352 new homes anticipated from 2004-2018, an average growth of 25 homes per year is assumed
Assume twice as many homes will be renovated, totaling 50.
[339] Existing Housing Unit Assumption - Parsippany
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 903 new homes anticipated from 2004-2018, an average growth of 65 homes per year is assumed
Assume twice as many homes will be renovated, totaling 130.
[340] Existing Housing Unit Assumption – Perth Amboy
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 677 new homes anticipated from 2004-2018, an average growth of 48 homes per year is assumed
Assume twice as many homes will be renovated, totaling 96.
[341] Existing Housing Unit Assumption - Plainfield
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 374 new homes anticipated from 2004-2018, an average growth of 27 homes per year is assumed
Assume twice as many homes will be renovated, totaling 54.
[342] Existing Housing Unit Assumption – West Orange
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 934 new homes anticipated from 2004-2018, an average growth of 67 homes per year is assumed
Assume twice as many homes will be renovated, totaling 134.
[343] Existing Housing Unit Assumption – Willingboro Twp
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 655 new homes anticipated from 2004-2018, an average growth of 47 homes per year is assumed
Assume twice as many homes will be renovated, totaling 94.
[344] Lifetime of building component assumption:
(http://www.nahb.org/fileUpload_details.aspx?contentID=99359)
20 year lifetime of measure based upon expected lifetime of major building components.
[345] Lifetime of policy assumption:

With consideration taken to reflect revisions to LEED 2009 which is subject to revision every two years, ASHREA 90.1 which is subject to revision every 3 years and NJ IECC which is also subject to revision every three years, a maximum five year lifetime of policy is assumed.

[346] Annual Electric Savings Assumption

(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 8.9 kWh/sf/yr, totaling 1.78 kWh/sf/yr.
[347] Annual Gas Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 13.89 kBtu/sf/yr, totaling 2.78 kBtu/sf/yr.
[348] Gregory H. Kats 2003

[349] www.sustainablejersey.com

[350] In New Jersey municipalities presently cannot require compliance with a green building standard that exceeds the State's Uniform Construction Code, nor require green building certification such as Leadership in Energy and Environmental Design (LEED) or Energy Star. What is allowable is for a municipality to encourage adherence to a green building standard or guideline or to encourage green building generally.

[351] LEED Green Building Operation & Maintenance (GBOM) is a rating system designed to lower operational costs while increasing occupant productivity in a environmentally responsible manner.
https://www.usgbc.org/ShowFile.aspx?DocumentID=3617
[352] Portfolio Manager is an interactive energy management tool. By using Portfolio Manager an existing commercial building can be assessed based on overall energy efficiency and water consumption. Efficiency improvements can be verifies and EPA recognition can be received for superior energy performance.
http://www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager
[353] Energy Star for Buildings. 2009. (accessed 12/7/2009)
http://www.energystar.gov/index.cfm?c=business.bus_bldgs
[354] Leonardo Academy. 2008. The Economics of LEED for Existing Buildings
http://redesign.leonardoacademy.org/download/2009-5-29RevisedReportEconomicsLEEDEB.pdf

[355] Carrick. A. (2009) RSMeans' Dollars-per-Square-Foot Construction Costs: Office Buildings and Public StructuresRSMeans http://www.reedconstructiondata.com/news/2009/04/rsmeans-dollars-per-square-foot-construction-costs-office-buildings-and-pub/
[356] International Code Council. Building Valuation Data – 2009 (accessed 12/7/2009)
http://www.iccsafe.org/cs/Documents/BVD.pdf
[357] Annual Electric Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 11.85 kwh/sf/yr, totaling 2.37 kwh/sf/yr.
[358] Annual Gas Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 4.76 kBtu/sf/yr, totaling .95 kBtu/sf/yr.

[359] kBtu to therm conversion
1 therm = 100,000 kBtu = 1000 Btu
1 Btu = 0.000009993 therms
19,000 kBtu = 19,000,000 Btu
19,000,000 Btu = 189.87 therms

[360] New Jersey Retail Electricity and Natural Gas Price Forecast for Commercial Buildings. Energy Information Administration. Annual Energy Outlook 2009
[361] Existing Commercial Space Renovation Assumption – East Orange
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 881.034 between the years 2004-2018, it is assumed that 62,931 square feet of growth can be anticipated annually. From the 62,931 square feet of new office construction, it is assumed twice as much space will be renovated at the same time, totaling 125,862 square feet of existing commercial space

[362] Annual Electric Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 11.85 kwh/sf/yr, totaling 2.37 kwh/sf/yr.
[363] Annual Gas Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 4.76 kBtu/sf/yr, totaling .95 kBtu/sf/yr.
[364] Existing Commercial Space Renovation Assumption - Edison
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 3,255,172 between the years 2004-2018, it is assumed that 232,512 square feet of growth can be anticipated annually. From the 232,512 square feet of new office construction, it is assumed twice as much space will be renovated at the same time, totaling 465,024 square feet of existing commercial space

[365] Annual Electric Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 11.85 kwh/sf/yr, totaling 2.37 kwh/sf/yr.
[366] Annual Gas Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 4.76 kBtu/sf/yr, totaling .95 kBtu/sf/yr.
[367] Existing Commercial Space Renovation Assumption – Fort Lee
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 1,740.345 between the years 2004-2018, it is assumed that 124,310 square feet of growth can be anticipated annually. From the 124,310 square feet of new office construction, it is assumed twice as much space will be renovated at the same time, totaling 248,620 square feet of existing commercial space

[368] Annual Electric Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 11.85 kwh/sf/yr, totaling 2.37 kwh/sf/yr.
[369] Annual Gas Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 4.76 kBtu/sf/yr, totaling .95 kBtu/sf/yr.
[370] Existing Commercial Space Renovation Assumption - Howell
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 2,487.241 between the years 2004-2018, it is assumed that 177,660 square feet of growth can be anticipated annually. From the 177,660 square feet of new office construction, it is assumed twice as much space will be renovated at the same time, totaling 355,320 square feet of existing commercial space

[371] Annual Electric Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 11.85 kwh/sf/yr, totaling 2.37 kwh/sf/yr.
[372] Annual Gas Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 4.76 kBtu/sf/yr, totaling .95 kBtu/sf/yr.
[373] Existing Commercial Space Renovation Assumption – Middletown
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 1,286,552 between the years 2004-2018, it is assumed that 91,897 square feet of growth can be anticipated annually. From the 91,897 square feet of new office construction, it is assumed twice as much space will be renovated at the same time, totaling 183,794 square feet of existing commercial space

[374] Annual Electric Savings Assumption

(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 11.85 kwh/sf/yr, totaling 2.37 kwh/sf/yr.
[375] Annual Gas Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 4.76 kBtu/sf/yr, totaling .95 kBtu/sf/yr.
[376] Existing Commercial Space Renovation Assumption – Montclair
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 503,103 between the years 2004-2018, it is assumed that 35,936 square feet of growth can be anticipated annually. From the 35,936 square feet of new office construction, it is assumed twice as much space will be renovated at the same time, totaling 71,872 square feet of existing commercial space

[377] Annual Electric Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 11.85 kwh/sf/yr, totaling 2.37 kwh/sf/yr.
[378] Annual Gas Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 4.76 kBtu/sf/yr, totaling .95 kBtu/sf/yr.
[379] Existing Commercial Space Renovation Assumption – Parsippany – Troy Hills
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 8,627,586 between the years 2004-2018, it is assumed that 616,256 square feet of growth can be anticipated annually. From the 616,256 square feet of new office construction, it is assumed twice as much space will be renovated at the same time, totaling 1,232,512 square feet of existing commercial space

[380] Annual Electric Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 11.85 kwh/sf/yr, totaling 2.37 kwh/sf/yr.
[381] Annual Gas Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 4.76 kBtu/sf/yr, totaling .95 kBtu/sf/yr.

[382] Existing Commercial Space Renovation Assumption – Perth Amboy
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 332,069 between the years 2004-2018, it is assumed that 23,719 square feet of growth can be anticipated annually. From the 23,719 square feet of new office construction, it is assumed twice as much space will be renovated at the same time, totaling 47,438 square feet of existing commercial space

[383] Annual Electric Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 11.85 kwh/sf/yr, totaling 2.37 kwh/sf/yr.
[384] Annual Gas Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 4.76 kBtu/sf/yr, totaling .95 kBtu/sf/yr.
[385] Existing Commercial Space Renovation Assumption - Plainfield
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 448.966 between the years 2004-2018, it is assumed that 32,069 square feet of growth can be anticipated annually. From the 32,069 square feet of new office construction, it is assumed twice as much space will be renovated at the same time, totaling 64,138 square feet of existing commercial space

[386] Annual Electric Savings Assumption

(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 11.85 kwh/sf/yr, totaling 2.37 kwh/sf/yr.
[387] Annual Gas Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 4.76 kBtu/sf/yr, totaling .95 kBtu/sf/yr.
[388] Existing Commercial Space Renovation Assumption – West Orange
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 853,448 between the years 2004-2018, it is assumed that 60,961 square feet of growth can be anticipated annually. From the 60,961 square feet of new office construction, it is assumed twice as much space will be renovated at the same time, totaling 121,922 square feet of existing commercial space

[389] Annual Electric Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 11.85 kwh/sf/yr, totaling 2.37 kwh/sf/yr.
[390] Annual Gas Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 4.76 kBtu/sf/yr, totaling .95 kBtu/sf/yr.
[391] Existing Commercial Space Renovation Assumption – Willingboro Twp
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 540,690 between the years 2004-2018, it is assumed that 38,621 square feet of growth can be anticipated annually. From the 38,621 square feet of new office construction, it is assumed twice as much space will be renovated at the same time, totaling 77,242 square feet of existing commercial space

[392] Annual Electric Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 11.85 kwh/sf/yr, totaling 2.37 kwh/sf/yr.
[393] Annual Gas Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 4.76 kBtu/sf/yr, totaling .95 kBtu/sf/yr.
[394] Lifetime of building component assumption:
30 year lifetime of measure based upon expected lifetime of major building components.
[395] Lifetime of policy assumption:With consideration taken to reflect revisions to LEED 2009 which is subject to revision every two years, ASHREA 90.1 which is subject to revision every 3 years and NJ IECC which is also subject to revision every three years, a maximum five year lifetime of policy is assumed.

[396] Annual Electric Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 11.85 kwh/sf/yr, totaling 2.37 kwh/sf/yr.
[397] Annual Gas Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 20% better performance than ASHRAE 90.1-2007 base of 4.76 kBtu/sf/yr, totaling .95 kBtu/sf/yr.

[398] Gregory H. Kats 2003

[399] Sustainable Jersey www.sustainablejersey.com

[400] California Energy Commission. (2000) "How to Hire an Energy Auditor." Available for download at: http://www.energy.ca.gov/reports/efficiency_handbooks/400-00-001C.PDF

[401] Energy Performance should be evaluated on a regular basis. It is recommended that a comprehensive energy audit be performed every 5-7 years.

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[402] NJ Board of Public Utilities (BPU) Office of Clean Energy Municipal Audit Program (www.njcleanenergy.com/lgea)
[403] Energy Star: Office Equipment http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductCategory&pcw_code=OEF (accessed 01/28/2010).
[404] U.S. Department of Energy. 2009. Energy Databook. Commercial Building 2006 Commercial Energy End-Use Splits, by Fuel Type (Quadrillion Btu) http://buildingsdatabook.eere.energy.gov/docs/xls_pdf/3.1.4.pdf (accessed 1/29/2010).
[405] U.S. EPA Energy Star. Lighting, Appliances, Office Equipment http://www.energystar.gov/index.cfm?c=pt_reps_res_retail.pt_reps_res_retail (accessed 1/29/2010).

[406] Summary of Assumptions for EPA ENERGY STAR Savings Estimates: ENERGY STAR Preliminary Draft Computer Specification, Version 4.0. 2005. pg. 2.
http://www.energystar.gov/ia/partners/prod_development/revisions/downloads/computer/Assumptions_Prelim_Draft_Comp_Spec.pdf (accessed 01/28/2010).
Computer Server Unit Energy Savings = 306 kWh/yr (pg. 9) = 0.306 MWh/yr/unit
Commercial Laptop Unit Energy Savings = 5 kWh/yr (pg. 8) = 0.005 MWh/yr/unit

[407] Energy Star Value Assumptions for 'Desktop (CPU)'
http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/Calc_Computer_bulk.xls (accessed 01/28/2010).
Idle: 69.0 Watts (Non-ES) - 46.0 Watts (ES) = 23.0 Watts x 5,853 hours/yr (avg.) = 134,619 watt hours/yr = 0.1346 MWh/yr
Sleep: 3.0 Watts (Non-ES) - 2.0 Watts (ES) = 1.0 Watts x 439 hours/yr (avg.) = 439 watt hours/yr = 0.0004 MWh/yr
Off: 2.0 Watts (Non-ES) - 1.0 Watts (ES) = 1.0 Watts x 2,467 hours/yr (avg.) = 2,467 watt hours/yr = 0.0025 MWh/yr
Total: 0.1346 MWh + .0004 MWh + .0025 MWh = 0.1375 MWh or 137.5 kWh per year/unit
Note: 'Active' Mode not a criterion as per Energy Star 5.0 Specification

[408] Energy Star Value Assumptions for 'Monitor (LCD)'
http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/Calc_monitors.xls (accessed 01/28/2010).
Note: Hours/yr values are taken from 'With Power Management Enabled' values consistently for ES and Non-ES LCD Monitors
Active: 41.0 Watts (Non-ES) - 28.0 Watts (ES) = 13.0 Watts x 803 hours/yr (avg.) = 10,439 watt hours/yr = 0.0104 MWh/yr
Sleep: 3.0 Watts (Non-ES) - 2.0 Watts (ES) = 1.0 Watts x 5,492 hours/yr (avg.) = 5,492 watt hours/yr = 0.0055 MWh/yr
Off: 2.0 Watts (Non-ES) - 1.0 Watts (ES) = 1.0 Watts x 2,467 hours/yr (avg.) = 2,467 watt hours/yr = 0.0025 MWh/yr
Total = 0.0104 MWh + .0055 MWh + .0025 MWh = 0.0184 MWh or 18.4 kWh saved per year/unit

[409] Energy Star Value Assumptions for 'Residential Refrigerators'
http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/Consumer_Residential_Refrig_Sav_Calc.xls (accessed 01/28/2010).
Note: Seven options/styles are available for switching from a conventional model to an ENERGY STAR model. 0.095 MWh/unit to 0.133 MWh/unit is the range of energy savings a buyer can expect to have if they upgrade their conventional model to the same model with an ENERGY STAR label. For example: An ENERGY STAR Manual Defrost Refrigerator uses 95kWh (0.095 MWh) less energy per year than the conventional model. An ENERGY STAR Side Mount Freezer with through-the-door ice uses 133kWh (0.133 MWh) less energy per year than the conventional model. The other five options/styles fall within this range in energy savings per year.

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[410] Energy Star Value Assumptions for 'Water Coolers'
http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/CalculatorLeasingWaterCooler.xls (accessed 01/28/2010).
Hot/Cold Water Cooler:
2.190 kWh/day (Non-ES) - 1.200 kWh/day (ES) = .99 kWh/day x 365 days = 361.35 kWh/yr = 0.361 MWh saved per year/unit
Cold Water Cooler:
0.290 kWh/day (Non-ES) - 0.160 kWh/day (ES) = .13 kWh/day x 365 days = 47.45 kWh/yr = 0.048 MWh saved per year/unit

[411] Enhancing the Value of Public Building Improvement Projects with Energy Star Qualified Projects. 2009. p.3. http://www.epa.gov/RDEE/documents/arra_publicbldgs.pdf (accessed 02/01/2010).

[412] Energy Star Value Assumptions: Desktop (CPU)
(http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/Calc_Computer_bulk.xls)
Idle: 69.0 Watts (Non-ES) - 46.0 Watts (ES) = 23.0 Watts x 5,853 hours/yr (avg.) = 134,619 watt hours/yr = .1346 MWh/yr
Sleep: 3.0 Watts (Non-ES) - 2.0 Watts (ES) = 1.0 Watts x 439 hours/yr (avg.) = 439 watt hours/yr = .0004 MWh/yr
Off: 2.0 Watts (Non-ES) - 1.0 Watts (ES) = 1.0 Watts x 2,467 hours/yr (avg.) = 2,467 watt hours/yr = .0025 MWh/yr
Total = .1346 MWh + .0004 MWh + .0025 MWh = .1375 MWh or 137.5 kWh per year/unit
NOTE: 'Active' Mode not a criterion as per Energy Star 5.0 Specification

[413] Energy Star Value Assumptions: Monitor (LCD)
(http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/Calc_monitors.xls)
Note: Hours/yr values are taken from 'With Power Management Enabled' values consistently for ES and Non-ES LCD Monitors
Active: 41.0 Watts (Non-ES) - 28.0 Watts (ES) = 13.0 Watts x 803 hours/yr (avg.) = 10,439 watt hours/yr = .0104 MWh/yr
Sleep: 3.0 Watts (Non-ES) - 2.0 Watts (ES) = 1.0 Watts x 5,492 hours/yr (avg.) = 5,492 watt hours/yr = .0055 MWh/yr
Off: 2.0 Watts (Non-ES) - 1.0 Watts (ES) = 1.0 Watts x 2,467 hours/yr (avg.) = 2,467 watt hours/yr = .0025 MWh/yr
Total = .0104 MWh + .0055 MWh + .0025 MWh = .0184 MWh or 18.4 kWh saved per year/unit

[414] Energy Star Value Assumptions: Residential Refrigerators
(http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/Consumer_Residential_Refrig_Sav_Calc.xls)
NOTE: 7 options/styles are available for switching from a conventional model to an ENERGY STAR model. .095 MWh/unit to .133 MWh/unit is the range of energy savings a buyer can expect to have if they upgrade their conventional model to the same model with an ENERGY STAR label. For example: An ENERGY STAR Manual Defrost Refrigerator uses 95kWh (.095 MWh) less energy per year than the conventional model. An ENERGY STAR Side Mount Freezer with through-the-door ice uses 133kWh (.133 MWh) less energy per year than the conventional model. The other 5 options/styles fall within this range in energy savings per year.

[415] Refrigerator/Freezer Recycling Program (Refer to website below for eligibility requirements)

http://njcleanenergy.com/residential/programs/refrigerator-freezer-recycling-program (accessed 02/05/2010).

[416] Climate Savers Computing: Computer and server buyers. 2009.

http://www.climatesaverscomputing.org/learn/membership-information/computer-and-server-buyers (accessed 01/28/2010).
Estimation that ENERGY STAR rated computer servers that benefit from 60kWh efficiency per year can payback the savings from that efficiency in 2-3 years with less than a $30 cost premium for that computer server.

[417] Rental Assumptions based on rental costs of $9/mo for a Hot/Cold Water Cooler and a $7/mo cost for a Cold Water Cooler.
http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/CalculatorLeasingWaterCooler.xls (accessed 01/28/2010).

[418] Climate Savers Computing: Computer and server buyers.2009.
http://www.climatesaverscomputing.org/learn/membership-information/computer-and-server-buyers (accessed 01/28/2010).
Estimation that ENERGY STAR rated computer servers that benefit from 60kWh efficiency per year can payback the savings from that efficiency in 2-3 years with less than a $30 cost premium for that computer server.

[419] ENERGY STAR Appliances - water cooler addendum.xlsx

[420] Average Paybacks calculated with the following equation for each appliance:
[average incremental cost] - [annual cost savings]*[years] = 0
Or:
[average payback in years] = [average incremental cost] / [annual cost savings]

[421] [average payback in years] = [average incremental cost] / [annual cost savings]
years = (1 unit * $30) / $112
years = $30 / $112
years = 0.27 ≈ 3.21 months

[422] [average payback in years] = [average incremental cost] / [annual cost savings]
years = (10 units * $42/unit) / $192.50
years = 2.18

[423] [average payback in years] = [average incremental cost] / [annual cost savings]
years = (10 units * $78/unit) / $25.76
years = 30.28 years

[424] [average payback in years] = [average incremental cost] / [annual cost savings]
years = (2 units * $30/unit) /$37.24
years = 1.61

[425] There is no difference in cost between an ENERGY STAR model and conventional model. However, there are costs savings to be had through lower energy bills. The following shows the net annual costs to lease (2) water coolers.
[annual cost to rent] – [annual cost savings] = net annual cost
(hot/cold): $216 - $101.22 = $113.78
(cold only): $168 - $101.22 = $66.78
ENERGY STAR Appliances – water cooler addendum 2

[426] Energy Star Special Offers and Rebates: New Jersey area.

http://www.energystar.gov/index.cfm?fuseaction=rebate.rebate_locator_submit (accessed 01/28/2010).

[427] FYP Best Practice Guide: Commercial Office Buildings: Central HVAC System – Controls and Load Reduction. http://www.fypower.org/bpg/module.html?b=offices&m=Central_HVAC_System (accessed 01/19/2010).

[428] CEG PROPOSAL NO. 9C08127. Lawrence Twp. Senior Center Audit. 2009

[429] CEG PROPOSAL NO. 9C08127. Lawrence Twp. Senior Center Audit. 2009

[430] Arlington VA - Building Energy Report Cards. "Site Energy Intensity and Source Energy Intensity." Oct 28, 2009. http://www.arlingtonva.us/Portals/Topics/AIRE/page69144.aspx (accessed 12/17/2009).

[431] CEG PROPOSAL NO. 9C08127, Lawrence Twp. Senior Center Audit. 2009.

[432] If cost of natural gas = $1.07/therm; annual energy savings = 1,000 therms; annual cost savings = $1,070:
$5,000 (capital cost) / $1,070 per year = 4.67 years

[433] Flex Your Power.org, "Central HVAC System: Controls and Load Reductions." http://www.fypower.org/bpg/module.html?b=offices&m=Central_HVAC_System (accessed 12/17/2009).

[434] If 1 therm = 29.3kWh then 1,000 therms = 29,307.1 kWh; 7.3lbs GHG reduced for every 10kWh:
29,307.1kWh / 10kWh = 2,931
2,931 * 7.3 lbs GHG = 21,396.3 lbs reduced

[435] 10% (minimum savings) * 10,000 therms (average annual energy usage) = 1,000 therms

[436] A town may decide to own and operate the PV systems installed on government buildings. This means that the town will be responsible for purchasing, permitting, installation, operation, and repair of the PV modules over their lifetime. Generating solar electricity on the customer side of the meter has some benefits. The solar power is essentially free on a per kilowatt hour basis since it is produced on-site. In turn, the onsite generation offsets the amount of electricity that the facility will need to purchase from the local utility, leading to reductions in electric utility bill. Any load not met by the PV installation's generation will be met by utility provided electricity, paid at the municipality's current rate. Additionally, the facilities with the PV installations can claim to be using green power. This green power attribute is associated with the Solar Renewable Energy Credits (SRECs) that are created through the generation of solar energy. Typically, 1 megawatt-hour of renewable electricity generation equals 1 SREC. (Cory, Karlynn, Coughlin, Jason and Coggeshall, Charles. "Solar Photovoltaic Financing: Deployment on Public Property by State and Local Governments." NREL. May 2008. Hereafter referred to as Solar PV Financing). SRECs are a tradable commodity and may serve as a revenue stream for the city. New Jersey has strong policies in place to generate high values for SRECs, which may account for 40% - 80% of a project's revenue stream. However, once the SRECs are sold the facility can no longer claim to be powered by solar energy. Lastly, ownership allows a town to recognize the benefits of the PV system for the entire lifetime of the system (approximately 25 years) rather than the 15 year limit of the PPA model and .

While owning PV systems is admirable and may work for some municipalities, making the economic case for ownership is sometimes tough. First, the electricity savings produced alone are likely not enough to justify the installation of a PV system. (Solar PV Financing) Second, many of the federal incentives available to local governments to help finance solar installations are not available or may not be available in the future. Specifically, the Clean Renewable Energy Bonds offered by the IRS are currently fully subscribed to and the Renewable Energy Production Incentive authorized by Congress is regularly underfunded and thus difficult to count on as a significant source of project funding as appropriations must be renewed by Congress. (DSIRESOLAR. North Carolina Solar Center and the Interstate Renewable Energy Council. Funded by the U.S. Department of Energy. http://dsireusa.org/solar/incentives/incentive.cfm?Incentive_Code=US45F&re=1&ee=1. Accessed 11/4/09 and Solar PV Financing) Issuing municipal bonds (general obligation bonds, revenue bonds, or energy bonds) is another way to finance PV projects, but some options require voter approval, are limited by how much debt the municipality can incur, and have proven difficult to bring to market. (Solar PV Financing) Fourth, operating and maintaining solar equipment is not within the usual business line of local governments, but ownership of the systems leaves

O&M costs (for repairs or simply to ensure maximum generation) with the town. Fifth, the municipality must be familiar with the state's renewable energy policies and incentives including net metering, interconnection standards, and SREC tracking and trading – a policy landscape that is constantly in flux. Such tenuous financing options, ongoing financial responsibility for system operation and maintenance, and the need to be well-versed in the state and federal government's renewable energy policies make ownership of PV equipment through balance sheet financing and municipal bonds a risky investment. A town interested in ownership may also have system benefit charge (SBC) program funds available to help with financing. In New Jersey, the total annual funds available for all SBC programs in 2008 (including clean energy and energy efficiency) was $102 million. (Solar PV Financing)

Municipalities may find that they lack the resources necessary to make clean energy investments cost-effective, leading to difficulties executing a PPA contract on their own. (Toolan, Kevin. *Earth Day: Alternative energy comes of age*. Star Ledger. April 22, 2009. http://service.govdelivery.com/docs/NJSOMER/NJSOMER_68/NJSOMER_68_20090812_071200_en.pdf. Accessed 12/3/09) This could be due to the amount of viable space to install solar energy, buildings' electric loads, or any number of other reasons. The town of Lambertville in Hunterdon County faced this obstacle so they approached their Public School Board of Education, West Amwell Township and its Public School Board of Education, and others – creating the South Hunterdon Renewable Energy Co-op - to pool their resources in a way that would entice a solar provider to enter into a PPA with the Co-op members. In February 2009 the NJ Department of Community Affairs Division of Local Government Services approved the co-op initiative. (Lambertville Environmental Commission. http://www.lambertvillenj.org/filestorage/170/182/2009-02-18_LEC_Minutes.pdf. Accessed 12/4/09) As of September 2009 the Co-op was preparing a Request for Qualifications for a PPA. (Hunterdon County Chamber of Commerce. Chamber in Actoin. Volume 32, No. 9. September 2009. http://www.hunterdon-chamber.org/downloads/September_2009NL.pdf. Accessed 12/4/09.) While the results of the process have yet to be determined, this is an example of an out-of-the-box approach to increasing municipal solar capacity.

Another innovative way to minimize the cost and risk of hosting PV installations is to implement a county-wide effort to coordinate the finance, design, acquisition, installation, operation, and maintenance of PV equipment. Through revenue bonds, the county would finance a PPA to which all participating municipalities would be served. The county would enter into agreements with the participating municipalities as well as a provider (contracted through a competitive bidding process and giving the provider tax ownership of the systems) to carry out the PPA. This scheme takes advantage of the county's strong bond rating which gives it (and through it the provider) access to capital at a very low cost while also allowing the provider to take advantage of federal benefits afforded to private solar companies. The county and the provider can together leverage a large suite of federal tax benefits and low cost capital. (Pearlman, Stephen. *Memorandum*. DeCotiis, Fitzpatrick, Cole & Wisler, LLP. April 3, 2009. Hereafter referred to as Memorandum) and) This cooperative PPA is a hybrid version of municipal bonds used by some municipalities for ownership purposes and the PPA model used by others. It allows smaller municipalities to have access to a PPA. The overall process looks fairly similar to the PPA implementation process described below in the "How To" section.

Morris County, New Jersey has utilized the cooperative PPA approach and installed solar panels on approximately 7,000,000 square feet of roof space. Over forty local governments have signed on to the cooperative. (Memorandum) More information on this hybrid approach can be obtained by contacting the Morris County Improvement Authority at P.O. Box 900 Morristown, NJ 07963-0900 Phone: (973) 285-6020 Fax: (973) 285-6464 jbonanni@co.morris.nj.us.

[437] Under Section 7701 (e) of the Internal Revenue Code, a solar PPA with a tax-exempt host must be structured as a "service contract" rather than an operating lease transaction to ensure that all tax benefits can be properly realized. Most PPAs meet the requirements of a service contract so these terms will be used interchangeably in this paper. Bolinger, Mark. "Financing Non-Residential Photovoltaic Projects: Options and Implications." LBNL-1410E. Lawrence Berkeley National Laboratory. January 2009. http://eetd.lbl.gov/ea/EMS/reports/lbnl-1410e.pdf. Accessed 11/5/09. (hereafter referred to as Financing Non-Residential Photovoltaic Projects).

[438] Financing Non-Residential Photovoltaic Projects.

[439] For calculation purposes, it is assumed that the price of electricity produced under the PPA is 5% below current utility electric rates. This assumption is the high end of Lawrence Berkeley National Lab's range of 0 – 5%. Financing Non-Residential Photovoltaic Projects.

[440] SolarCity's presentation to the National Association of Regulatory Utility Commissioners states that a minimum price of 5% below utility rates is needed to entice commercial customers to enter into PPAs. http://www.narucmeetings.org/Presentations/SolarCity-Arfin-NARUC.pdf. Accessed 11/4/09. (hereafter referred to as SolarCity Presentation).
[441] Solar PV Financing.
[442] *Ibid.*
[443] *Ibid.*
[444] As used in the modeling illustrated in Financing Non-Residential Photovoltaic Projects.
[445] Think Energy. http://www.thinkenergy.net/press_release/pdf/19/PV_Opportunities_in_New_Jersey.pdf. Accessed 11/5/09

[446] Since municipal facilities are closes to commercial facilities, it is assumed that municipalities will also want to see at least a 5% price point below their current utility rate reflected in the PPA price. SolarCity Presentation.

[447] Solar PV Financing.
[448] The energy and emissions savings below assume that one kilowatt hour generated by the solar panels will off-set an equal amount of electricity that would have been provided by the electric utility. The installation size used for the calculations below is 100 kW – the minimum system size assumed necessary to implement the PPA model as stated above. Please note, however, that the specific model of PV installation ownership will not impact the energy or emissions savings.
[449] An annual capacity factor of 13.5% was applied to a 100 kW system. This yearly output was then multiplied by the 8,760 hours (production hours assumed for the year). Personal communication with Andrew Cottrell of the Center for Energy, Economic & Environmental Policy at Rutgers University, The State University of New Jersey. Communication on 11/11/09.
[450] The lifetime impacts will be 1602.89 MWh. This number is derived from applying a .5% annual kWh degredation rate to the total annual system output of 118.26 MWh. The point is that the output of the system declines over the lifetime of the system. Gabel, Steve. *Solar Project Development Somerset County*. Gabel Associates. April 2009. http://service.govdelivery.com/docs/NJSOMER/NJSOMER_68/NJSOMER_68_20090812_071200_en.pdf. Accessed 12/3/09.

[451] This section describes steps a municipality could take to host PV systems through a PPA.
[452] *Ibid.*
[453] "The Customer's Guide to Solar Power Purchase Agreements." The Rahus Institute. October 2008. http://www.californiasolarcenter.org/sppa.html. Accessed 12/4/09. (hereafter referred to as Rahus Institute SPPA).
[454] 200kW is cited by the U.S. Department of Energy as the minimum system size that will interest a provider. "Solar Powering Your Community: A Guide For Local Governments." U.S. Department of Energy. http://www.solaramericacities.energy.gov/resources/guide_for_local_governments/ Accessed 11/11/09. (hereafter cited as Solar Power Your Community)
[455] Solar Power Your Community.
[456] Solar PV Financing.

[457] Solar Powering Your Community.
[458] Rahus Institute SPPA.
[459] *Ibid.*

[460] *Ibid.*
[461] USEPA, http://www.epa.gov/smartway/documents/drivertraining.pdf 10/26/09

[462] The costs for Driver Training assume that a fuel efficiency component is added to an existing in-house employee training schedule and that each driver completes a short online green driving training course. Therefore the costs are for the online training module and to train an existing employee to provide the in-house instruction. It is assumed that green driver training can be incorporated to an existing safety training schedule so additional staff time for training is not counted as a cost. For the first year, the costs include an instructor training course fee of $1,935 as well as costs of an online green driver training module at $20 per driver. As refresher courses are recommended, these costs are assumed to be incurred every three years. During intervening years, only new hires would undergo the training. New hire training costs are estimated using an average of 19% annual turnover.

- The Instructor Training Course Fee of $1,935 is from the Smith System Driver Improvement Institute and applies to a comprehensive course for driver training instructors which covers safety topics as well as fuel efficiency and other material relevant to green fleets. Note that the actual costs of training a trainer might be lower for a training program that focuses solely on the fuel efficiency portion. http://www.smith-system.com/onroad.shtml#intst_training 12/3/09
- In addition to the fees for instructor training, the ongoing training costs of $20 per employee per year come from email communication with the sales staff of Advanced Driver Training Services which offers an online "Driving Green" training module. This course costs $10-$20 per driver, depending on volume. It is assumed that this is a continuing annual cost as drivers are asked to complete a refresher course each year. http://www.adtsweb.com/adts.drivegreen.html 11/30/09
- 19% average turnover is a rounded average of Bureau of Labor Statistics data for state and local government employees hires from 2000-2008, as a percentage of total employees. http://www.bls.gov/jlt/ 12/22/09

[463] NJ OCE http://www.njcleanenergy.com/commercial-industrial/programs/alternative-fuels/biodiesel-fuel-rebate-program/biodiesel-fuel-rebate 8/10/09

[464] USDOE http://www.afdc.energy.gov/afdc/pdfs/afpr_jul_09.pdf 11/12/09

[465] Note regarding fuel efficiency of biodiesel: because the energy content per gallon of B20 is approximately 11% less than diesel, vehicles using this blend are expected to achieve 2.2% (20 percent x 11 percent) fewer miles per gallon of fuel. EIA, DOE http://www.eia.doe.gov/oiaf/analysispaper/biodiesel/index.html 8/7/09However, most users of biodiesel report no noticeable difference in fuel economy http://www.afdc.energy.gov/afdc/fuels/biodiesel_alternative.html 11/30/09Therefore, the calculations of biodiesel costs has not been altered to account for this 2.2% difference.

[466] USDOE http://www.afdc.energy.gov/afdc/fuels/biodiesel_benefits.html 8/7/09
[467] http://www.biodiesel.org/pdf_files/fuelfactsheets/emissions.pdf 8/10/09

[468] EPA Emission Facts: Average Carbon Dioxide Emissions Resulting from Gasoline and Diesel Fuel, CO2 emissions from a gallon of diesel = 10.1 kg/gallon. Given 1,000 kg per metric ton, this converts 0.0101 metric tons of carbon dioxide per gallon of diesel fuel. http://www.epa.gov/OMS/climate/420f05001.htm#calculating 11/30/009
[469] Emissions factors for diesel fuel: 1 mg/km N20, 1 mg/km CH4, for CNG 27-70 mg/km N20, 215-725 mg/km CH4
http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_3_Ch3_Mobile_Combustion.pdf 12/22/09
[470] Vehicle prices from NJ State Contracts:

Prius http://www.state.nj.us/treasury/purchase/noa/contracts/t2094.shtml 11/30/09Cobalt http://www.state.nj.us/treasury/purchase/noa/contracts/t0099.shtml 11/30/09

[471] http://www.fueleconomy.gov/feg/sbs.htm 11/30/09 The Toyota Prius was compared with the Chevrolet Cobalt Sedan in the fueleconomy.gov calculator showing 12.7 barrels of oil consumed per year by the Cobalt vs. 6.9 barrels consumed by the Prius. This is converted to gallons by multiplying by 42 gallons per barrel to generate 289.8 gallons consumed by the Prius and 533.4 gallons consumed by the Cobalt, a savings of 243.6 gallons per year.

Annual figures were calculated based on the default inputs of annual mileage of 15,000 miles (45% highway driving, 55% city driving).
[472] USDOE Natural Gas Vehicle Cost Calculator http://www.afdc.energy.gov/afdc/vehicles/natural_gas_calculator.html 11/30/09
[473] http://www.fueleconomy.gov/feg/sbs.htm 11/30/09 shows a carbon footprint of 6.3 tons CO2 for a regular Honda Civic compared to 5.4 tons of CO2 for the Natural Gas model of the Honda Civic. Annual figures were calculated based on the default inputs of annual mileage of 15,000 miles (45% highway driving, 55% city driving).
[474]Proposed Rulemaking: Light-Duty Vehicle Greenhouse Gas Emissions Standards and Corporate Average Fuel Economy Standards http://epa.gov/otaq/climate/regulations.htm 12/22/09
[475] Proposed Rulemaking: Light-Duty Vehicle Greenhouse Gas Emissions Standards and Corporate Average Fuel Economy Standards http://epa.gov/otaq/climate/regulations.htm 12/22/09
[476] Sample Green Driving Online Training Providers:

Green Driver http://www.greendriver.com/home/ 12/22/09
Driving Green http://www.adtsweb.com/adts.drivegreen.html 12/22/09
PHH GreenFleet http://www.phharval.com/home/news-and-media/press-releases/185-phh-arval-launches-phh-greenfleet-driver-training 12/22/09
FuelClinic Fleet Ecosystem http://www.fuelclinic.com/index.cfm/page/fuelclinic_for_fleets 12/22/09

[477] http://www.afdc.energy.gov/afdc/fuels/biodiesel_alternative.html 12/22/09
[478] http://www.nrel.gov/vehiclesandfuels/pdfs/43672.pdf 8/7/09

[479] http://www.biodiesel.org/resources/oems/default.shtm 8/10/09

[480] http://www.nrel.gov/vehiclesandfuels/pdfs/43672.pdf 8/7/09

[481] http://www.nrel.gov/vehiclesandfuels/pdfs/43672.pdf 8/7/09

[482] Data from http://www.kiplinger.com/tools/hybrid_calculator/index.html 10/26/09

[483] Data from http://www.state.nj.us/treasury/purchase/coop_purchase_contracts.shtml 10/26/09

[484] New Jersey Board of Public Utilities. Clean Energy Program. http://www.njcleanenergy.com/residential/programs/community-partners-initiative/join-today. Accessed 11/12/09.
[485] New Jersey Board of Public Utilities. Clean Energy Program. http://www.njcleanenergy.com/residential/programs/community-partners-initiative-0 Accessed 11/12/09.
[486] New Jersey Board of Public Utilities. Clean Energy Program. http://www.njcleanenergy.com/files/file/SmallWindModelOrdinance111907.pdf. Accessed 11/12/09.
[487]New Jersey Board of Public Utilities. Clean Energy Program. http://www.njcleanenergy.com/files/file/SmallWindModelOrdinance111907.pdf. Accessed 11/12/09.
[488] New Jersey Board of Public Utilities. Clean Energy Program. http://www.njcleanenergy.com/files/file/SmallWindModelOrdinance111907.pdf. Accessed 11/12/09.
[489] New Jersey Board of Public Utilities. Clean Energy Program. http://www.njcleanenergy.com/renewable-energy/technologies/wind/small-wind-systems/small-wind-systems. Accessed 11/12/09.

[490] It is assumed that one 1 MWh of renewable electricity off-sets 1 MWh of electricity from the traditional fuel mix.
[491] The amount of energy produced by a wind energy system that is constructed as a result of the passage of the small wind ordinance is based on the maximum capacity of a wind energy system permitted by the NJ Clean Energy Program's model wind ordinance, 100 kW. This amount is then multiplied by a capacity factor of 25% and then by 8760 hours (to get a kilowatt hours calculation of wind energy generation per year). Capacity factors for wind resources in New Jersey range from 25 – 45% and most wind resources in New Jersey are of Class 1 or 2 quality. http://www.njcleanenergy.com/renewable-energy/technologies/wind/faqs#Anchor-What-47857.
[492] The capacity factor assumption was corroborated with a 23% capacity factor for wind in the mid-Atlantic region. http://www.nrel.gov/wind/integrationdatasets/pdfs/eastern/2008/zavadil_assumptions.pdf

[493] Additional support for the 25% capacity factor assumption was gleaned from the CPUC GHG Model which noted that Class 3 wind has a capacity factor of 27.2%. www.ethree.com/GHG/16%20Wind%20Assumptions%20v5.doc
[494] However, it should be noted that PJM Interconnection uses a class average capacity factor of only fourteen percent. http://www.pjm.com/~/media/committees-groups/working-groups/rpmwg/20080122/20080122-item-03-offering-wind-resources.ashx.
[495] The ordinance will specify the zoning designation for wind energy systems. Depending on how the small wind ordinance is written, wind energy systems may not be allowed in every land use zone within a municipality. Additional items specified in the small wind ordinance like minimum lot size, setback requirements, and noise levels may further restrict the amount land that is appropriate for wind turbines.
[496] This measure applies primarily to electricity generation and off-sets. A small amount of natural gas might be off-set as it makes up a small portion of New Jersey's fuel mix.
[497] New Jersey Board of Public Utilities. Clean Energy Program. http://www.njcleanenergy.com/files/file/SmallWindModelOrdinance111907.pdf. Accessed 11/12/09.
[498]New Jersey Board of Public Utilities. Clean Energy Program. http://www.njcleanenergy.com/files/file/SmallWindModelOrdinance111907.pdf. Accessed 11/12/09.

[499] Actions adapted from Sustainable Jersey website, http://www.sustainablejersey.com/action.php?pagename=act7tb&actid=3, (accessed 11/19/09).
[500] Cambridge Systematics, Inc, Moving Cooler: an analysis of transportation strategies for reducing greenhouse gas emissions Washington, D. C.: Urban Land Institute, 2009)..
[501] http://www.epa.gov/otaq/cert/mpg/fetrends/420s07001.htm
[502] http://www.eia.doe.gov/oiaf/1605/coefficients.html

[503] Reid Ewing, et al., *Growing Cooler: Evidence on Urban Development and Climate Chan*ge (Washington, D.C.: Urban Land Institute, October 2007), 58.
[504] Transportation Research Board (TRB), *Driving and the Built Environment: The Effects of the Effects of Compact Development on Motorized Travel, Energy Use, and CO2 Emissions*, Special Report No. 298 (Washington, D.C.: TRB, 2009), 2-4.
[505] *Ibid.*

[506] Anthony Downs, *Stuck in Traffic: Coping with Peak Hour Congestion* (Washington, D.C.: The Brookings Institution and the Lincoln Institute of Land Policy, 1992), 86, (quoting Boris S. Pushkarev and Jeffrey M. Zupan, *Public Transportation and Land Use Policy* (Bloomington, Ind.: Indiana University Press, 1977) , 177).

[507] A summary of commuter tax benefits can be found at http://www.nctr.usf.edu/clearinghouse/commutebenefits.htm and IRS guidance is published in Publication 15-B, http://www.irs.gov/publications/p15b/index.html.
[508] Employees will be paid $1 for every day that they are not parking at the workplace. Parking is still provided at the former rate (which may be free) for employees when they choose to drive.
[509] *Moving Cooler , op. cit.* , Technical Appendices, B-54.
[510] http://www.epa.gov/otaq/cert/mpg/fetrends/420s07001.htm
[511] http://www.eia.doe.gov/oiaf/1605/coefficients.html

[512] http://www.state.nj.us/transportation/commuter/smartmoves/tmaprograms.shtm

[513] http://www.commuterchoice.com/

[514] http://www.vtpi.org/tdm/index.php

[516] http://www.state.nj.us/transportation/community/srts/funding.shtm

[517] The NewJersey public school year is 180 days. It is assumed that fewer students participate during cold or inclement weather.
[518] Based on unpublished surveys conducted in 2009 and provided by the by the Voorhees Transportation Center at Rutgers University. A school in Perth Amboy, NJ reported 39% of students traveling in a family vehicle while two schools in Parsippany, NJ reported 46% and 56% traveling by family vehicle.
[519] http://www.epa.gov/otaq/cert/mpg/fetrends/420s07001.htm
[520] http://www.eia.doe.gov/oiaf/1605/coefficients.html

[521] Sustainable Jersey. http://sustainablejersey.com/action.php?pagename=act8tb&actid=3 Accessed 10/21/09.
[522] Sustainable Jersey. http://sustainablejersey.com/action.php?pagename=act8tb&actid=4 Accessed 10/21/09.

[523] Based on data from these sources, we assumed a 2% improvement in local sales. According to a 2008 study by the Institute for Local Self-Reliance, communities that designed a buy local campaign experienced a 3.2% decline in local holiday shopping sales from the previous year. In contrast, local businesses that were not participating in a buy local campaign experienced a 5.6% drop in sales. (Business Week. http://www.businessweek.com/smallbiz/content/feb2009/sb20090226_752622.htm Accessed 11/6/09.) A Buy Local Campaign survey completed by the Institute for Local Self Reliance noted the following:

In the last few years, "Buy Local" campaigns have been launched by local business alliances in more than three dozen communities. Independent retailers in these cities reported an average gain in sales of about 2% over the 2006 holiday season, while those in cities without "Buy Local" campaigns saw an increase of less than 0.5%. (Institute for Local Self Reliance. http://www.newrules.org/retail/news/survey-finds-buy-local-campaigns-boosted-holiday-spending-independent-stores Accessed 11/4/09.)

For more information about the survey – visit http://www.newrules.org/sites/newrules.org/files/images/ibf_survey_2007.pdf or contact Stacy Mitchell at the Institute for Local Self-Reliance at 207-774-6792.

[524] Based on information from the Institute for Local Self Reliance and the Business Alliance for Local Living Economies (BALLE). livingeconomies.org: Accessed 10/29/09.

[525] American Water Resources Association (AWRA). "Residents' Assessment of an Urban Outdoor Water Conservation Program in Guelph, Ontario" Journal of the American Water Resources Association. 43.2 P. 427-439 (2007). Accessed 11/9/09.

[526] NJ DEP. http://www.njssi.org/uploaded_documents/waterordinance.pdf Accessed 11/6/09.

[527] Sustainable Jersey. http://sustainablejersey.com/editor/doc/act9tb3sa1.pdf Accessed 11/6/09.

[528] Water Resources Center (WRC). "Do Residential Water Demand Side Management Policies Measure Up? An Analysis of Eight California Water Agencies" Journal of Environmental Economics and Management 40.1 P. 14 (2000). Accessed 11/10/09.

Data estimates derived from eight participating California urban water agencies. Ordinance specifications and requirements varied amongst communities. The price increase was set 10% higher than the previous year, and the educational and awareness program strategies varied amongst the participating communities.

[529] AWRA. "Use and Effectiveness of Municipal Water Restrictions during Drought in Colorado" Journal of the American Water Resource Association. 43.2 P. 81 (2004). http://sciencepolicy.colorado.edu/admin/publication_files/resource-296-water_restrictions_jawra.pdf Accessed 11/6/09.

Savings derived from the following AWRA study measuring the effectiveness of implementing a 2 day/per week seasonal watering ordinance. The results showed an average net use water decrease of 30% in comparison to the previous two summers without a water ordinance. Percent net water use savings are based on reported savings from the following three Colorado cities: Fort Collins, Boulder, and Louisville. Seasonal period for water conservation ordinance was May 1st through August 31st.

Unlike the 29% improvement specified in the WRA study, the 30% reduction is based off results from an actual ordinance with a 2-day per week watering limit. It parallels the ordinance that is being recommended in this measure, whereas the 29% reduction is an estimate used to display how ordinances are more effective than awareness programs and price increases. The 29% figure is an average compiled from various California ordinances that had different benchmarks. Even though both reductions are similar, the 30% reduction is more representative of the proposed conservation ordinance.

[530] Based on 30% net use water savings from AWRA study. Equivalent domestic commercial unit (EDCU) water consumption is derived from available municipal data. During instances where EDCU municipal data is unavailable, the EDCU is calculated at 300 gallons/per day. 300 gallon/day average provided by Michael A. Dimino, P.E. mdimino@wmua.manalapan.nj.us

[531] Malcolm Pirnie and NYSERDA. Energy Smart Focus Program for NY's Water and Wastewater Sources. 17 Aug. 2007. P. 6 http://www.nyserda.org/Programs/Environment/Hudson%20Valley%20Presentation%20for%20web%20posting.pdf Accessed 11/15/09.
Total energy savings are based on the following averages. Total energy savings are representative of the entire water-use cycle.

National averages for each step in water-use cycle:

Raw water pumping and water treatment: 350 kWh/mg

Finished Water Distribution: 1,150 kWh/mg

Wastewater collection: 150 kWh/mg

Wastewater treatment: 1,050 kWh/mg

The energy devoted to water and wastewater treatment is largely dependent on the size of the treatment plant. Consequently, energy savings for these steps in the water-use cycle can vary substantially amongst municipalities. Overall, the national averages for those steps are a rough estimate, and are not representative of all treatment facilities. Water distribution and wastewater collection impacts are more definitive. Pages 8 and 9 in the following link provide a more detailed breakdown on energy consumption based on the size of treatment plant and total water use:

http://www.nyserda.org/Programs/Environment/Hudson%20Valley%20Presentation%20for%20web%20posting.pdf

[532] Sustainable Jersey. http://sustainablejersey.com/editor/doc/act9tb3sa1.pdf Accessed 11/6/09.

[533] The Watersense designation is a partnership program sponsored by the U.S. Environmental Protection Agency and plumbing fixture manufacturers, allowing the consumer to select water efficient products with by looking for a label designation backed by independent testing and certification. http://www.epa.gov/WaterSense/

[534]http://www.drinktap.org/consumerdnn/Home/WaterInformation/Conservation/WaterUseztatistics/tabid/85/Default.aspx

[535] http://www.epa.gov/watersense/docs/newhome_resource_manual.pdf

[536] http://factfinder.census.gov/servlet/SAFFFacts

[537] Water Saved Per Capita Per Day Assumption

11,000 gallons of water per household per year saved, typical househould size = 2.6 4,231 gallons of water per person per year saved, or 11.6 gallons per day.
[538] Cost per gallon of water:
(http://www1.eere.energy.gov/femp/technologies/eep_faucets_showerheads_calc.html#output)
$4.00/1000 gallons
[539] http://www.epa.gov/watersense/calculate_your_water_savings.html
[540] New Housing Unit Assumption – East Orange
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 570 new homes anticipated from 2004-2018, an average growth of 41 homes per year is assumed
[541] http://www.epa.gov/watersense/calculate_your_water_savings.html
[542] New Housing Unit Assumption - Edison
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 2,573 new homes anticipated from 2004-2018, an average growth of 184 homes per year is assumed

[543] http://www.epa.gov/watersense/calculate_your_water_savings.html
[544] New Housing Unit Assumption – Fort Lee
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 1,268 new homes anticipated from 2004-2018, an average growth of 91 homes per year is assumed
[545] http://www.epa.gov/watersense/calculate_your_water_savings.html
[546] New Housing Unit Assumption – Howell Twp
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 1,980 new homes anticipated from 2004-2018, an average growth of 141 homes per year is assumed
[547] http://www.epa.gov/watersense/calculate_your_water_savings.html
[548] New Housing Unit Assumption - Middletown
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 1149 new homes anticipated from 2004-2018, an average growth of 82 homes per year is assumed
[549] http://www.epa.gov/watersense/calculate_your_water_savings.html
[550] New Housing Unit Assumption - Montclair
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 352 new homes anticipated from 2004-2018, an average growth of 25 homes per year is assumed
[551] http://www.epa.gov/watersense/calculate_your_water_savings.html
[552] New Housing Unit Assumption - Parsippany
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 903 new homes anticipated from 2004-2018, an average growth of 65 homes per year is assumed
[553] http://www.epa.gov/watersense/calculate_your_water_savings.html
[554] New Housing Unit Assumption – Perth Amboy
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 677 new homes anticipated from 2004-2018, an average growth of 48 homes per year is assumed

[555] http://www.epa.gov/watersense/calculate_your_water_savings.html
[556] New Housing Unit Assumption - Plainfield
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 374 new homes anticipated from 2004-2018, an average growth of 27 homes per year is assumed
[557] http://www.epa.gov/watersense/calculate_your_water_savings.html
[558] New Housing Unit Assumption – West Orange
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 934 new homes anticipated from 2004-2018, an average growth of 67 homes per year is assumed
[559] http://www.epa.gov/watersense/calculate_your_water_savings.html
[560] New Housing Unit Assumption – Willingboro Twp
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 655 new homes anticipated from 2004-2018, an average growth of 47 homes per year is assumed
[561] http://www.epa.gov/watersense/calculate_your_water_savings.html
[562] Water Saved Per Capita Per Day Assumption

11,000 gallons of water per household per year saved, typical household size = 2.6
4,231 gallons of water per person per year saved, or 11.6 gallons per day.

[563] www.sustainablejersey.com
[564] The Watersense designation is a partnership program sponsored by the U.S. Environmental Protection Agency and plumbing fixture manufacturers, allowing the consumer to select water efficient products with by looking for a label designation backed by independent testing and certification. http://www.epa.gov/WaterSense/

[565] Daily water use assumptions:
(http://www.aquacraft.com/Publications/resident.htm)
Faucet: 8.1 minutes per capita per day.
[566] See daily water use assumptions:
(http://www.aquacraft.com/Publications/resident.htm)
Toilet: 5.05 flushes per day
[567] Assume 5.82 - 7.03 gallons of water per SF per year for baseline case (Energy Policy Act of 1992 assumptions)

[568] Water Cost Savings Assumption
Average annual water assumption of 25,560 gallons assumed by taking average of 23,000 – 28,120 gallons.
Cost per gallon of water: $4.00/1000 gallons
(http://www1.eere.energy.gov/femp/technologies/eep_faucets_showerheads_calc.html#output)
[569] Annual Gas Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 8% of ASHRAE 90.1-2007 base of 4.76 kBtu/sf/yr, used for water heating, totaling .38 kBtu/sf/yr.
Assumed 20% reduction of .076 kBtu/sf/yr.

[570] The Watersense designation is a partnership program sponsored by the U.S. Environmental Protection Agency and plumbing fixture manufacturers, allowing the consumer to select water efficient products with by looking for a label designation backed by independent testing and certification. http://www.epa.gov/WaterSense/

[571] www.sustainablejersey.com
[572] The Watersense designation is a partnership program sponsored by the U.S. Environmental Protection Agency and plumbing fixture manufacturers, allowing the consumer to select water efficient products with by looking for a label designation backed by independent testing and certification. http://www.epa.gov/WaterSense/

[573] Daily water use assumptions:
(http://www.aquacraft.com/Publications/resident.htm)
Faucet: 8.1 minutes per capita per day.
[574] See daily water use assumptions:
(http://www.aquacraft.com/Publications/resident.htm)
Toilet: 5.05 flushes per day
[575] Assume 5.82 - 7.03 gallons of water per SF per year for baseline case (Energy Policy Act of 1992 assumptions)

[576] Water Cost Savings Assumption
Average annual water assumption of 25,560 gallons assumed by taking average of 23,000 – 28,120 gallons.
Cost per gallon of water: $4.00/1000 gallons
(http://www1.eere.energy.gov/femp/technologies/eep_faucets_showerheads_calc.html#output)
[577] New Square Footage Growth Assumption – East Orange
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 881.034 between the years 2004-2018, it is assumed that 62,931 square feet of growth can be anticipated annually.
[578] Existing Commercial Space Renovation Assumption – East Orange
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1

With an anticipated additional square footage of 881.034 between the years 2004-2018, it is assumed that 62,931 square feet of growth can be anticipated annually. From the 62,931 square feet of new office construction, it is assumed twice as much space will be renovated at the same time, totaling 125,862 square feet of existing commercial space

[579] http://www.eia.doe.gov/emeu/cbecs/cbecs2003/lighting/lighting1.html

[580] (http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
[581] New Square Footage Growth Assumption – Edison
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 3,255,172 between the years 2004-2018, it is assumed that 232,512 square feet of growth can be anticipated annually.
[582] Existing Commercial Space Renovation Assumption – Edison
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 3,255,172 between the years 2004-2018, it is assumed that 232,512 square feet of growth can be anticipated annually. From the 232,512 square feet of new office construction, it is assumed twice as much space will be renovated at the same time, totaling 465,024 square feet of existing commercial space
[583] http://www.eia.doe.gov/emeu/cbecs/cbecs2003/lighting/lighting1.html

[584] (http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
[585] New Square Footage Growth Assumption – Fort Lee
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 1,740.345 between the years 2004-2018, it is assumed that 124,310 square feet of growth can be anticipated annually.
[586] Existing Commercial Space Renovation Assumption – Fort Lee
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 1,740.345 between the years 2004-2018, it is assumed that 124,310 square feet of growth can be anticipated annually. From the 124,310 square feet of new office construction, it is assumed twice as much space will be renovated at the same time, totaling 248,620 square feet of existing commercial space
[587] http://www.eia.doe.gov/emeu/cbecs/cbecs2003/lighting/lighting1.html

[588] (http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
[589] New Square Footage Growth Assumption – Howell
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 2,487.241 between the years 2004-2018, it is assumed that 177,660 square feet of growth can be anticipated annually.
[590] Existing Commercial Space Renovation Assumption – Howell
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 2,487.241 between the years 2004-2018, it is assumed that 177,660 square feet of growth can be anticipated annually. From the 177,660 square feet of new office construction, it is assumed twice as much space will be renovated at the same time, totaling 355,320 square feet of existing commercial space
[591] http://www.eia.doe.gov/emeu/cbecs/cbecs2003/lighting/lighting1.html

[592] (http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
[593] New Square Footage Growth Assumption – Middletown
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 1,286,552 between the years 2004-2018, it is assumed that 91,897 square feet of growth can be anticipated annually.
[594] Existing Commercial Space Renovation Assumption – Middletown
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1

With an anticipated additional square footage of 1,286,552 between the years 2004-2018, it is assumed that 91,897 square feet of growth can be anticipated annually. From the 91,897 square feet of new office construction, it is assumed twice as much space will be renovated at the same time, totaling 183,794 square feet of existing commercial space

[595] http://www.eia.doe.gov/emeu/cbecs/cbecs2003/lighting/lighting1.html

[596] (http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
[597] New Square Footage Growth Assumption – Montclair
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 503,103 between the years 2004-2018, it is assumed that 35,936 square feet of growth can be anticipated annually.
[598] Existing Commercial Space Renovation Assumption – Montclair
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 503,103 between the years 2004-2018, it is assumed that 35,936 square feet of growth can be anticipated annually. From the 35,936 square feet of new office construction, it is assumed twice as much space will be renovated at the same time, totaling 71,872 square feet of existing commercial space

[599] http://www.eia.doe.gov/emeu/cbecs/cbecs2003/lighting/lighting1.html

[600] (http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
[601] New Square Footage Growth Assumption – Parsippany – Troy Hills
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 8,627,586 between the years 2004-2018, it is assumed that 616,256 square feet of growth can be anticipated annually.
[602] Existing Commercial Space Renovation Assumption – Parsippany – Troy Hills
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 8,627,586 between the years 2004-2018, it is assumed that 616,256 square feet of growth can be anticipated annually. From the 616,256 square feet of new office construction, it is assumed twice as much space will be renovated at the same time, totaling 1,232,512 square feet of existing commercial space
[603] http://www.eia.doe.gov/emeu/cbecs/cbecs2003/lighting/lighting1.html

[604] (http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
[605] New Square Footage Growth Assumption – Perth Amboy
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 332,069 between the years 2004-2018, it is assumed that 23,719 square feet of growth can be anticipated annually.
[606] Existing Commercial Space Renovation Assumption – Perth Amboy
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 332,069 between the years 2004-2018, it is assumed that 23,719 square feet of growth can be anticipated annually. From the 23,719 square feet of new office construction, it is assumed twice as much space will be renovated at the same time, totaling 47,438 square feet of existing commercial space
[607] http://www.eia.doe.gov/emeu/cbecs/cbecs2003/lighting/lighting1.html

[608] (http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
[609] New Square Footage Growth Assumption – Plainfield
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 448.966 between the years 2004-2018, it is assumed that 32,069 square feet of growth can be anticipated annually.
[610] Existing Commercial Space Renovation Assumption – Plainfield

Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 448.966 between the years 2004-2018, it is assumed that 32,069 square feet of growth can be anticipated annually. From the 32,069 square feet of new office construction, it is assumed twice as much space will be renovated at the same time, totaling 64,138 square feet of existing commercial space
[611] http://www.eia.doe.gov/emeu/cbecs/cbecs2003/lighting/lighting1.html

[612] (http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
[613] New Square Footage Growth Assumption – West Orange
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 853,448 between the years 2004-2018, it is assumed that 60,961 square feet of growth can be anticipated annually.
[614] Existing Commercial Space Renovation Assumption – West Orange
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 853,448 between the years 2004-2018, it is assumed that 60,961 square feet of growth can be anticipated annually. From the 60,961 square feet of new office construction, it is assumed twice as much space will be renovated at the same time, totaling 121,922 square feet of existing commercial space
[615] http://www.eia.doe.gov/emeu/cbecs/cbecs2003/lighting/lighting1.html

[616] (http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
[617] New Square Footage Growth Assumption – Willingboro Twp
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 540,690 between the years 2004-2018, it is assumed that 38,621 square feet of growth can be anticipated annually.

[618] Existing Commercial Space Renovation Assumption – Willingboro Twp
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 540,690 between the years 2004-2018, it is assumed that 38,621 square feet of growth can be anticipated annually. From the 38,621 square feet of new office construction, it is assumed twice as much space will be renovated at the same time, totaling 77,242 square feet of existing commercial space
[619] http://www.eia.doe.gov/emeu/cbecs/cbecs2003/lighting/lighting1.html

[620] (http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
[621] Annual Gas Savings Assumption
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 8% of ASHRAE 90.1-2007 base of 4.76 kBtu/sf/yr, used for water heating, totaling .38 kBtu/sf/yr.
Assumed 20% reduction of .076 kBtu/sf/yr.

[622] The Watersense designation is a partnership program sponsored by the U.S. Environmental Protection Agency and plumbing fixture manufacturers, allowing the consumer to select water efficient products with by looking for a label designation backed by independent testing and certification. http://www.epa.gov/WaterSense/

[623] www.sustainablejersey.com
[624] The Watersense designation is a partnership program sponsored by the U.S. Environmental Protection Agency and plumbing fixture manufacturers, allowing the consumer to select water efficient products with by looking for a label designation backed by independent testing and certification. http://www.epa.gov/WaterSense/

[625] Daily water use assumptions:
(http://www.aquacraft.com/Publications/resident.htm)
Faucet: 8.1 minutes per capita per day.
[626] See daily water use assumptions:

(http://www.aquacraft.com/Publications/resident.htm)
Toilet: 5.05 flushes per day
[627] http://factfinder.census.gov/servlet/SAFFFacts
[628] http://www.epa.gov/watersense/calculate_your_water_savings.html
[629] Water Saved Per Capita Per Day Assumption
11,000 gallons of water per household per year saved, typical household size = 2.6 4,231 gallons of water per person per year saved, or 11.6 gallons per day.
[630] Cost per gallon of water:
(http://www1.eere.energy.gov/femp/technologies/eep_faucets_showerheads_calc.html#output)
$4.00/1000 gallons
[631] http://www.epa.gov/watersense/calculate_your_water_savings.html
[632] New Housing Unit Assumption – East Orange
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 570 new homes anticipated from 2004-2018, an average growth of 41 homes per year is assumed
[633] http://www.epa.gov/watersense/calculate_your_water_savings.html
[634] New Housing Unit Assumption - Edison
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 2,573 new homes anticipated from 2004-2018, an average growth of 184 homes per year is assumed
[635] http://www.epa.gov/watersense/calculate_your_water_savings.html
[636] New Housing Unit Assumption – Fort Lee
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 1,268 new homes anticipated from 2004-2018, an average growth of 91 homes per year is assumed
[637] http://www.epa.gov/watersense/calculate_your_water_savings.html
[638] New Housing Unit Assumption – Howell Twp
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 1,980 new homes anticipated from 2004-2018, an average growth of 141 homes per year is assumed
[639] http://www.epa.gov/watersense/calculate_your_water_savings.html
[640] New Housing Unit Assumption - Middletown
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 1149 new homes anticipated from 2004-2018, an average growth of 82 homes per year is assumed
[641] http://www.epa.gov/watersense/calculate_your_water_savings.html
[642] New Housing Unit Assumption - Montclair
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 352 new homes anticipated from 2004-2018, an average growth of 25 homes per year is assumed
[643] http://www.epa.gov/watersense/calculate_your_water_savings.html
[644] New Housing Unit Assumption - Parsippany
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 903 new homes anticipated from 2004-2018, an average growth of 65 homes per year is assumed
[645] http://www.epa.gov/watersense/calculate_your_water_savings.html
[646] New Housing Unit Assumption – Perth Amboy
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 677 new homes anticipated from 2004-2018, an average growth of 48 homes per year is assumed
[647] http://www.epa.gov/watersense/calculate_your_water_savings.html
[648] New Housing Unit Assumption - Plainfield
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 374 new homes anticipated from 2004-2018, an average growth of 27 homes per year is assumed
[649] http://www.epa.gov/watersense/calculate_your_water_savings.html
[650] New Housing Unit Assumption – West Orange
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 934 new homes anticipated from 2004-2018, an average growth of 67 homes per year is assumed
[651] http://www.epa.gov/watersense/calculate_your_water_savings.html
[652] New Housing Unit Assumption – Willingboro Twp
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1

With 655 new homes anticipated from 2004-2018, an average growth of 47 homes per year is assumed
[653] http://www.epa.gov/watersense/calculate_your_water_savings.html
[654] Water Saved Per Capita Per Day Assumption
11,000 gallons of water per household per year saved, typical household size = 2.6
4,231 gallons of water per person per year saved, or 11.6 gallons per day.

[655] The Watersense designation is a partnership program sponsored by the U.S. Environmental Protection Agency and plumbing fixture manufacturers, allowing the consumer to select water efficient products with by looking for a label designation backed by independent testing and certification. http://www.epa.gov/WaterSense/

[656] D.J. Nowak and D. E. Crane, "Carbon Storage and Sequestration by Urban Trees in the USA," *Environmental Pollution* 16 (2008), 381.
[657] H. Akbari, "Shade Trees Reduce Building Energy Use and CO_2 Emissions from Power Plant Emissions," *Environmental Pollution*, 116 (2002), S119-S-126, S124, Table 4. Carbon can be converted to CO_2 by multiplying by 3.67. Kilograms can be converted to pounds by multiplying by 2.2. Thus, 4.6 to 11.6 kg per tree of carbon is equivalent to 16.8 to 41.8 kgs of CO_2 per year, or 37 to 92 lbs. per year.
[658] These descriptions have been adapted from a toolkit by Sustainable Jersey found at: http://www.sustainablejersey.com/editor/doc/act9tb5sa1.pdf (trees and woodland management) ; http://www.sustainablejersey.com/editor/doc/act9tb2sa1.pdf (natural resources protection ordinances).
[659] American Forests, "Setting Urban Tree Canopy Goals," http://www.americanforests.org/resources/urbanforests/treedeficit.php.
[660] Data on existing tree canopy coverage for New Jersey municipalities as of 1990 can be found in a U.S. Department of Agriculture Forest Service report entitled: "Connecting People With Ecosystems in the 21st Century: An Assessment of Our Nation's Urban Forests": http://www.fs.fed.us/pnw/pubs/gtr490/gtr490.pdf .This report contains tables of tree canopy cover estimates for New Jersey communities. See Table 94 –"Percentage of tree cover, land and water area, total population, and population density for urban places and places within urbanized areas in New Jersey" on pages 260 to 269 of the document's appendix. The direct link to the document's Appendix is found at:http://www.fs.fed.us/pnw/pubs/gtr490/Dw_appendix%201%20on.pdf.Communities can also estimate tree canopy coverage using the NJDEP's Land Use/Land Coverage geographic information systems (GIS) mapping information available for all New Jersey communities. The forest data information can be used to do an initial estimate of the existing percentage of forest/tree coverage in a municipality.

[661] Clinton J. Andrews, "Greenhouse Gas Emissions Along the Rural-Urban Gradient," formcoming in the *Journal of Environmental Planning and Management* (July 23, 2008), http://policy.rutgers.edu/faculty/andrews/Andrews20080724.pdf. This article lists various data sources for land cover and assumptions about CO_2 release, including data on land use and land cover from the New Jersey Department of Environmental Protection.

[662] http://www.epa.gov/reg3esd1/garden/benefits.htm
[663] http://www.epa.gov/air/community/details/yardequip_addl_info.html
[664] http://www.addisonindependent.com/200907college-adopts-no-mow-policy
[665] Mow able area reduction assumptions:
20 acre reduction in mow able area at Middlebury College
20 acres saves 1000 hours of labor annually
50 hours of labor saved per acre
20 acres saves 670 gallons of fuel
33.5 gallons of fuel per acre
[666] http://ag.udel.edu/udbg/sl/vegetation/Turf_Grass_Madness.pdf
[667] http://www.epa.gov/air/community/details/yardequip_addl_info.html
[668] www.sustainablejersey.com

[670] http://www.epa.gov/air/community/details/yardequip_addl_info.html
[671] http://www.epa.gov/reg3esd1/garden/benefits.htm
[672] http://www.addisonindependent.com/200907college-adopts-no-mow-policy
[673] Mow able area reduction assumptions:
20 acre reduction in mow able area at Middlebury College
20 acres saves 1000 hours of labor annually
50 hours of labor saved per acre
20 acres saves 670 gallons of fuel
33.5 gallons of fuel per acre
[674] http://ag.udel.edu/udbg/sl/vegetation/Turf_Grass_Madness.pdf
[675] http://www.epa.gov/air/community/details/yardequip_addl_info.html

[676] www.sustainablejersey.com

[678] http://www.ecosmart.gov/
[679] http://www1.eere.energy.gov/consumer/tips/landscaping.html
[680] Assumption – Single Family Home Square Footage
(http://www.nahb.org/fileUpload_details.aspx?contentID=80051)
Average of Average Square Feet of Floor Area sold in the northeast between 1978 and 2008.

[681] New Jersey Retail Electricity and Natural Gas Price Forecast for Residential Buildings. Energy Information Administration. Annual Energy Outlook 2009. (March 2009) and *PJM Wholesale Electricity Prices for 2006-2008 http://www.pjm.com/markets-and-operations/energy/real-time/monthlylmp.aspx*
[682] Annual electric savings assumptions:
(http://www1.eere.energy.gov/consumer/tips/landscaping.html),
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 60% of 8.90 kwh/sf/yr electrical energy use intensity for state of New York is used by air conditioning, totaling 5.34 kwh/sf/yr. Savings associated with shading assumed to be 25% of 5.34 kwh/sf/yr, totaling 1.33 kwh/sf/yr
[683] Annual gas savings assumptions:
(http://www1.eere.energy.gov/consumer/tips/landscaping.html),
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 60% of 13.89 kBtu/sf/yr electrical energy use intensity for state of New York is used by heating, totaling 8.33 kBtu/sf/yr. Savings associated with wind break assumed to be 25% of 8.33 kBtu/sf/yr, totaling 2.08 kBtu/sf/yr
[684] kBtu to therm conversion
1 therm = 100,000 btukBtu = 1000 Btu
1 Btu = 0.000009993 therms
5,720 kBtu = 5,720,000 Btu
5,720,000 Btu = 57.2 therms
[685] New Housing Unit Assumption – East Orange
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 570 new homes anticipated from 2004-2018, an average growth of 41 homes per year is assumed
[686] New Housing Unit Assumption - Edison
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 2,573 new homes anticipated from 2004-2018, an average growth of 184 homes per year is assumed
[687] New Housing Unit Assumption – Fort Lee
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 1,268 new homes anticipated from 2004-2018, an average growth of 91 homes per year is assumed
[688] New Housing Unit Assumption – Howell Twp
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 1,980 new homes anticipated from 2004-2018, an average growth of 141 homes per year is assumed
[689] New Housing Unit Assumption - Middletown

Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 1149 new homes anticipated from 2004-2018, an average growth of 82 homes per year is assumed
[690] New Housing Unit Assumption - Montclair
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 352 new homes anticipated from 2004-2018, an average growth of 25 homes per year is assumed
[691] New Housing Unit Assumption - Parsippany
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 903 new homes anticipated from 2004-2018, an average growth of 65 homes per year is assumed
[692] New Housing Unit Assumption – Perth Amboy
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 677 new homes anticipated from 2004-2018, an average growth of 48 homes per year is assumed
[693] New Housing Unit Assumption - Plainfield
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 374 new homes anticipated from 2004-2018, an average growth of 27 homes per year is assumed
[694] New Housing Unit Assumption – West Orange
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 934 new homes anticipated from 2004-2018, an average growth of 67 homes per year is assumed
[695] New Housing Unit Assumption – Willingboro Twp
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 655 new homes anticipated from 2004-2018, an average growth of 47 homes per year is assumed

[696] www.sustainablejersey.com

[697] Center for Urban Forest Research. 2010. ecoSmart Design Software. http://www.ecosmart.gov/
[698] U.S. Department of Energy. 2010. Energy Efficient and Renewable Design. Energy Tips: Landscaping http://www1.eere.energy.gov/consumer/tips/landscaping.html
[699] New Jersey Retail Electricity and Natural Gas Price Forecast for Residential Buildings. Energy Information Administration. Annual Energy Outlook 2009. (March 2009) and *PJM Wholesale Electricity Prices for 2006-2008 http://www.pjm.com/markets-and-operations/energy/real-time/monthlylmp.aspx*
[700] Annual Electric Savings Assumption
http://www1.eere.energy.gov/consumer/tips/landscaping.html),
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 60% of 11.85 kwh/sf/yr electrical energy use intensity for state of New York is used by air conditioning, totaling 7.11 kwh/sf/yr. Savings associated with shading assumed to be 25% of 7.11 kwh/sf/yr, totaling 1.77 kwh/sf/yr.
[701] Annual Gas Savings Assumption
(http://www1.eere.energy.gov/consumer/tips/landscaping.html),
(http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf)
Assumed 60% of 4.76 kBtu/sf/yr electrical energy use intensity for state of New York is used by heating, totaling 2.86 kBtu/sf/yr. Savings associated with wind break assumed to be 25% of 2.86 kBtu/sf/yr, totaling .71 kBtu/sf/yr
[702] kBtu to therm conversion
1 therm = 100,000 btukBtu = 1000 Btu
1 Btu = 0.000009993 therms
14,200 kBtu = 14,200,000 Btu
14,200,000 Btu = 141.9 therms
[703] New Square Footage Growth Assumption – East Orange
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 881.034 between the years 2004-2018, it is assumed that 62,931 square feet of growth can be anticipated annually.
[704] New Square Footage Growth Assumption – Edison
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 3,255,172 between the years 2004-2018, it is assumed that 232,512 square feet of growth can be anticipated annually.

[705] New Square Footage Growth Assumption – Fort Lee
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 1,740.345 between the years 2004-2018, it is assumed that 124,310 square feet of growth can be anticipated annually.
[706] New Square Footage Growth Assumption – Howell
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 2,487.241 between the years 2004-2018, it is assumed that 177,660 square feet of growth can be anticipated annually.
[707] New Square Footage Growth Assumption – Middletown
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 1,286,552 between the years 2004-2018, it is assumed that 91,897 square feet of growth can be anticipated annually.
[708] New Square Footage Growth Assumption – Montclair
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 503,103 between the years 2004-2018, it is assumed that 35,936 square feet of growth can be anticipated annually.
[709] New Square Footage Growth Assumption – Parsippany – Troy Hills
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 8,627,586 between the years 2004-2018, it is assumed that 616,256 square feet of growth can be anticipated annually.
[710] New Square Footage Growth Assumption – Perth Amboy
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 332,069 between the years 2004-2018, it is assumed that 23,719 square feet of growth can be anticipated annually.
[711] New Square Footage Growth Assumption – Plainfield
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 448.966 between the years 2004-2018, it is assumed that 32,069 square feet of growth can be anticipated annually.
[712] New Square Footage Growth Assumption – West Orange
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 853,448 between the years 2004-2018, it is assumed that 60,961 square feet of growth can be anticipated annually.
[713] New Square Footage Growth Assumption – Willingboro Twp
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 540,690 between the years 2004-2018, it is assumed that 38,621 square feet of growth can be anticipated annually.

[714] www.sustainablejersey.com

[715] http://www.state.nj.us/dep//opsc/docs/Heat_Island.pdf
[716] U.S. Green Building Council. 2008. LEED for Homes. Sustainable Sites Credit 3.
http://www.usgbc.org/DisplayPage.aspx?CMSPageID=147#2008
[717] http://www.epa.gov/heatisland/impacts/index.htmw37k
[718] Assumption – Single Family Home Square Footage
(http://www.nahb.org/fileUpload_details.aspx?contentID=80051)
Average of Average Square Feet of Floor Area sold in the northeast between 1978 and 2008.
[719] New Housing Unit Assumption – East Orange
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 570 new homes anticipated from 2004-2018, an average growth of 41 homes per year is assumed
[720] New Housing Unit Assumption - Edison
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 2,573 new homes anticipated from 2004-2018, an average growth of 184 homes per year is assumed
[721] New Housing Unit Assumption – Fort Lee

Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 1,268 new homes anticipated from 2004-2018, an average growth of 91 homes per year is assumed
[722] New Housing Unit Assumption – Howell Twp
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 1,980 new homes anticipated from 2004-2018, an average growth of 141 homes per year is assumed
[723] New Housing Unit Assumption - Middletown
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 1149 new homes anticipated from 2004-2018, an average growth of 82 homes per year is assumed
[724] New Housing Unit Assumption - Montclair
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 352 new homes anticipated from 2004-2018, an average growth of 25 homes per year is assumed
[725] New Housing Unit Assumption - Parsippany
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 903 new homes anticipated from 2004-2018, an average growth of 65 homes per year is assumed
[726] New Housing Unit Assumption – Perth Amboy
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 677 new homes anticipated from 2004-2018, an average growth of 48 homes per year is assumed
[727] New Housing Unit Assumption - Plainfield
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 374 new homes anticipated from 2004-2018, an average growth of 27 homes per year is assumed
[728] New Housing Unit Assumption – West Orange
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 934 new homes anticipated from 2004-2018, an average growth of 67 homes per year is assumed
[729] New Housing Unit Assumption – Willingboro Twp
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 655 new homes anticipated from 2004-2018, an average growth of 47 homes per year is assumed
[730] www.sustainablejersey.com
[731] http://www.state.nj.us/dep//opsc/docs/Heat_Island.pdf
[732] ANSI/ASHRAE/USGBC/ISE. 2009. Standard 189.1 – 2009, Standard for the Design of High-Performance Green Buildings Except Low Rise Residential Buildings. http://www.ashrae.org/publications/page/927

[733] http://www.epa.gov/hiri/resources/pdf/CoolPavesCompendium.pdf
[734] http://www.epa.gov/hiri/mitigation/pavements.htm
[735] http://www.epa.gov/hiri/mitigation/pavements.htm

[736] http://www.epa.gov/heatisland/impacts/index.htmw37k
[737] New Square Footage Growth Assumption – East Orange
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 881.034 between the years 2004-2018, it is assumed that 62,931 square feet of growth can be anticipated annually.
[738] Existing Commercial Space Renovation Assumption – East Orange
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 881.034 between the years 2004-2018, it is assumed that 62,931 square feet of growth can be anticipated annually. From the 62,931 square feet of new office construction, it is assumed twice as much space will be renovated at the same time, totaling 125,862 square feet of existing commercial space
[739] New Square Footage Growth Assumption – Edison
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 3,255,172 between the years 2004-2018, it is assumed that 232,512 square feet of growth can be anticipated annually.
[740] Existing Commercial Space Renovation Assumption – Edison
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1

With an anticipated additional square footage of 3,255,172 between the years 2004-2018, it is assumed that 232,512 square feet of growth can be anticipated annually. From the 232,512 square feet of new office construction, it is assumed twice as much space will be renovated at the same time, totaling 465,024 square feet of existing commercial space

[741] New Square Footage Growth Assumption – Fort Lee
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 1,740.345 between the years 2004-2018, it is assumed that 124,310 square feet of growth can be anticipated annually.

[742] Existing Commercial Space Renovation Assumption – Fort Lee
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 1,740.345 between the years 2004-2018, it is assumed that 124,310 square feet of growth can be anticipated annually. From the 124,310 square feet of new office construction, it is assumed twice as much space will be renovated at the same time, totaling 248,620 square feet of existing commercial space

[743] New Square Footage Growth Assumption – Howell
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 2,487.241 between the years 2004-2018, it is assumed that 177,660 square feet of growth can be anticipated annually.

[744] Existing Commercial Space Renovation Assumption – Howell
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 2,487.241 between the years 2004-2018, it is assumed that 177,660 square feet of growth can be anticipated annually. From the 177,660 square feet of new office construction, it is assumed twice as much space will be renovated at the same time, totaling 355,320 square feet of existing commercial space

[745] New Square Footage Growth Assumption – Middletown
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 1,286,552 between the years 2004-2018, it is assumed that 91,897 square feet of growth can be anticipated annually.

[746] Existing Commercial Space Renovation Assumption – Middletown
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 1,286,552 between the years 2004-2018, it is assumed that 91,897 square feet of growth can be anticipated annually. From the 91,897 square feet of new office construction, it is assumed twice as much space will be renovated at the same time, totaling 183,794 square feet of existing commercial space

[747] New Square Footage Growth Assumption – Montclair
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 503,103 between the years 2004-2018, it is assumed that 35,936 square feet of growth can be anticipated annually.

[748] Existing Commercial Space Renovation Assumption – Montclair
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 503,103 between the years 2004-2018, it is assumed that 35,936 square feet of growth can be anticipated annually. From the 35,936 square feet of new office construction, it is assumed twice as much space will be renovated at the same time, totaling 71,872 square feet of existing commercial space

[749] New Square Footage Growth Assumption – Parsippany – Troy Hills
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 8,627,586 between the years 2004-2018, it is assumed that 616,256 square feet of growth can be anticipated annually.

[750] Existing Commercial Space Renovation Assumption – Parsippany – Troy Hills
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 8,627,586 between the years 2004-2018, it is assumed that 616,256 square feet of growth can be anticipated annually. From the 616,256 square feet of new office construction, it is

assumed twice as much space will be renovated at the same time, totaling 1,232,512 square feet of existing commercial space

[751] New Square Footage Growth Assumption – Perth Amboy
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 332,069 between the years 2004-2018, it is assumed that 23,719 square feet of growth can be anticipated annually.

[752] Existing Commercial Space Renovation Assumption – Perth Amboy
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 332,069 between the years 2004-2018, it is assumed that 23,719 square feet of growth can be anticipated annually. From the 23,719 square feet of new office construction, it is assumed twice as much space will be renovated at the same time, totaling 47,438 square feet of existing commercial space

[753] New Square Footage Growth Assumption – Plainfield
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 448.966 between the years 2004-2018, it is assumed that 32,069 square feet of growth can be anticipated annually.

[754] Existing Commercial Space Renovation Assumption – Plainfield
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 448.966 between the years 2004-2018, it is assumed that 32,069 square feet of growth can be anticipated annually. From the 32,069 square feet of new office construction, it is assumed twice as much space will be renovated at the same time, totaling 64,138 square feet of existing commercial space

[755] New Square Footage Growth Assumption – West Orange
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 853,448 between the years 2004-2018, it is assumed that 60,961 square feet of growth can be anticipated annually.

[756] Existing Commercial Space Renovation Assumption – West Orange
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 853,448 between the years 2004-2018, it is assumed that 60,961 square feet of growth can be anticipated annually. From the 60,961 square feet of new office construction, it is assumed twice as much space will be renovated at the same time, totaling 121,922 square feet of existing commercial space

[757] New Square Footage Growth Assumption – Willingboro Twp
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 540,690 between the years 2004-2018, it is assumed that 38,621 square feet of growth can be anticipated annually.

[758] Existing Commercial Space Renovation Assumption – Willingboro Twp
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 540,690 between the years 2004-2018, it is assumed that 38,621 square feet of growth can be anticipated annually. From the 38,621 square feet of new office construction, it is assumed twice as much space will be renovated at the same time, totaling 77,242 square feet of existing commercial space

[759] Sustainable Jersey www.sustainablejersey.com

[760] Environmental Protection Agency. "Environmentally Preferable Products Final Guidance Brochure." http://www.epa.gov/epp/pubs/eppbro.htm Accessed 10 Dec 09

[761] Environmental Protection Agency. "Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2008" http://www.epa.gov/waste/nonhaz/municipal/pubs/msw2008rpt.pdf Accessed 10 Dec 09

According to this report, "containers and packaging" represented 30.8% by weight of all US municipal solid waste (before recycling) in 2008.

[762] Benefits are scaled for this measure based on the number of tons of waste generated annually by government operations. If this figure was not available, a rough estimate of waste generation was calculated using a figure of 0.59 tons per government employee per year.

The figure of 0.59 tons of solid waste generated per government employee per year is an estimate provided by the California Integrated Waste Management Board. http://www.ciwmb.ca.gov/WASTECHAR/WasteGenRates/Institution.htm Accessed 14 Dec 09

Next, the tons of waste generated was multiplied by 0.308 to estimate annual tons of waste generated in the "containers and packaging" category.

Environmental Protection Agency. "Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2008" http://www.epa.gov/waste/nonhaz/municipal/pubs/msw2008rpt.pdf Accessed 10 Dec 09

According to page 6 of this report, "containers and packaging" represented 30.8% by weight of all US municipal solid waste (before recycling) in 2008.

Therefore, the estimated tons of packaging waste was generated by the following calculation:

T_{pw} = tons of packaging waste generated annually by government operations

Estimate baseline annual tons of packaging waste:

$$T_{pw} = \text{\# of government employees} * 0.59 * 0.308$$

[763] This measure calculates the benefits of achieving a hypothetical target of 25% reduction in product packaging waste. This target and emissions reduction data are based on the following report:

Environmental Protection Agency. "Opportunities to Reduce Greenhouse Gas Emissions through Materials and Land Management Practices." Page A-23. http://www.epa.gov/oswer/docs/ghg_land_and_materials_management.pdf Accessed 14 Dec 09

The EPA study calculated the greenhouse gas benefits of reducing packaging waste nationwide by hypothetical scenarios of 50% and 25%. The benefits of this measure have been calculated using the 25% scenario. This assumes that the local government will aggressively overhaul purchasing to eliminate unnecessary products, minimize disposable products, select bulk items with less packaging and negotiate with vendors regarding shipping methods and the reuse of items such as wooden palates.

The EPA results estimate 40,821,000 of $MTCO_2E$ reduction if 39,810,000 tons (50%) of packaging waste were reduced. This takes into account national averages for the current mix of packaging waste inputs and for the amount of each packaging material which is recycled, land filled or combusted. Division produces a benefit of about 1.025 $MTCO_2E$ in predicted reductions for each ton of packaging waste reduced.

The estimated tons of packaging waste generated were used to complete the following calculations:

Estimate reduction in annual tons of packaging waste:

$$R_{pw} = T_{pw} * 0.25$$

Estimate Emissions Reductions:

$$MTCO_2E \text{ reduced} = R_{pw} * 1.025\ MTCO_2E$$

[764] For administrative costs, staff time estimates are roughly suggested by the "amount of time spent working on EPP program/purchasing" survey results from the Northeast Recycling Council.

Northeast Recycling Council, Inc. "Environmentally Preferable Purchasing by Northeast States: Compilation of Survey Responses." April 14, 2009. Pages 6-7. http://www.nerc.org/documents/environmentally_preferable_purchasing_by_northeast_states.pdf Accessed 10 Dec 09

Survey responses pertained to state employee time spent working on EPP and varied widely by state. For New Jersey, 5-10 hours a month were reported. In this analysis, 10 hours per month has been used as an estimate for the ongoing administrative costs. It is assumed that additional staff time will be needed for EPP program startup and policy development. This is estimated as 20% of one full time position, (1 day per week = 32 hours per month) for three months. A general estimate of $45 per hour labor costs was based on salary estimates for a purchasing manager in New Jersey ranging from $60,000 to $120,000.

Salary information from Indeed.com
http://www.indeed.com/jobs?q=purchasing&l=new+jersey&rbt=Purchasing+Manager&jtid=1a9e79a164995102 Accessed 10 Dec 09

Administrative costs were therefore estimated as follows:

Capital Administrative Costs:

96 hours (in 3 months) * $45/hour = $4,320

Annual Administrative Costs:

10 hours/month * 12 months * $45/hour = $5,400

[765] NJDEP finds that average solid waste disposal costs of at least $75 per ton.

New Jersey Department of Environmental Protection. "Recycling in New Jersey: Economic Benefits of Recycling." http://www.state.nj.us/dep/dshw/recycling/economic.htm Accessed 10 Dec 09

Calculations in the EPA report mentioned above, "Opportunities to Reduce Greenhouse Gas Emissions through Materials and Land Management Practices," assumed 40.18% of packaging waste being recycled and the rest disposed of via landfill or combustion. This translates to 59.82% land filled or combusted.

Therefore, the waste disposal cost savings were estimated as follows:

Calculate annual avoided costs of solid waste disposal: $ saved = R_{pw} * 0.5982 * $75

[766] For the purposes of this cost analysis, it is assumed that the Green Purchasing Policy is designed to implement EPP within existing purchasing budgets. With an emphasis on packaging waste reduction, items should be purchased in larger quantities which may also lower the per-unit price. Products with less packaging may also be offered at lower prices because of the resources saved by the producer. Additional savings could be received when making purchases through cooperative agreements. Finally, savings can be achieved by eliminating the use of unnecessary products (such as reducing paper usage by providing documents electronically) or switching to reusable items. These savings can be used to offset the costs of some environmentally preferable products that may be purchased at a slightly higher cost than conventional counterparts if they offer a higher value in health and environmental benefits.

Support for the potential costs savings is provided by reports of overall cost savings by several EPP programs. The State of Massachusetts, for example, finds that statewide EPP program generated over $2 million in cost savings for FY2007-2008.

The Massachusetts Environmentally Preferable Products Procurement Program Annual Report for Fiscal Years 2007-2008. Page 17. http://www.mass.gov/Eoaf/docs/osd/epp/anul_report_0708.doc Accessed 10 Dec 09

Seattle, Washington, realized direct cost savings of $3.14 million from their EPP program in 2002 and King County saved $580,000 in 2003.

Liddell, Beth. "Environmentally Preferable Purchasing Programs and Strategies: Integrating Environmental and Social Factors into Procurement Practices." Pacific Northwest Pollution Prevention Resource Center. Page 30. http://www.pprc.org/pubs/epp/epp_programs_and_strategies.pdf Accessed 10 Dec 2009

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[767] Environmental Protection Agency. "State and Local Government Pioneers: How State and Local Governments Are Implementing Environmentally Preferable Purchasing Practices." November 2000. Page 3. http://www.epa.gov/epp/pubs/case/statenlocal.pdf Accessed 10 Dec 09

[768] Environmental Protection Agency. "State and Local Government Pioneers: How State and Local Governments Are Implementing Environmentally Preferable Purchasing Practices." November 2000. Page 12. http://www.epa.gov/epp/pubs/case/statenlocal.pdf Accessed 10 Dec 09

[769] Environmental Protection Agency (EPA). Municipal Solid Waste in the United States: 2007 Edition http://www.epa.gov/epawaste/nonhaz/municipal/pubs/msw07-rpt.pdf P.2. Accessed 11/30/09.

[770] Air and Waste Management Association. http://www.westernclimateinitiative.org/archived_comments/98422.pdf The Impact of Municipal Solid Waste Management on Greenhouse Gas Emissions in the United States. 2002 P. 1001 Accessed 2/4/10.

[771] EPA. http://www.epa.gov/methane/. Accessed 2/4/10.

[772] Sustainable Jersey. http://sustainablejersey.com/action.php?pagename=act12tb&actid=2&subactid=1 Accessed 12/10/09.

[773] American City and County "The Pay as you Throw Payoff" http://americancityandcounty.com/mag/government_payasyouthrow_payoff/ Accessed 12/2/09.

[774] Sustainable Jersey. http://sustainablejersey.com/action.php?pagename=act12tb&actid=2&subactid=2 Accessed 12/10/09.

[775] EPA. http://www.epa.gov/osw/conserve/rrr/composting/index.htm Accessed 12/10/09.

[776] EPA. Municipal Solid Waste in the United States: 2007 Edition http://www.epa.gov/epawaste/nonhaz/municipal/pubs/msw07-rpt.pdf P.5. Accessed 11/30/09.

[777] Sustainable Jersey. http://sustainablejersey.com/action.php?pagename=act12tb&actid=2&subactid=7 Accessed 12/10/09.

[778] Sustainable Jersey. http://sustainablejersey.com/listview.php?pagename=act12tb&actid=2&subactid=1&actionlist=5 Accessed 12/10/09.

[779] EPA. http://www.epa.gov/epawaste/conserve/tools/payt/top1.htm Accessed 12/15/09.

[780] Indeed.com. http://www.indeed.com/salary?q1=recycling+coordinator&l1= Accessed 2/11/10.
Solid Waste District. http://www.solidwastedistrict.com/projects/waste_audit.htm Accessed 2/11/10.
Municipal building audits should be conducted by a recycling coordinator or individual with a similar background or job description. A typical waste audit for a medium-sized facility (3 stories or less, 100 or fewer employees) will take about one week of labor to conduct. The week of labor is devoted to planning the audit, collecting the waste, sorting the waste, and analyzing the building's waste patterns. The labor to perform a single waste audit on a medium-sized facility will cost roughly $884.62 (Annual recycling coordinator salary/52).

[781] Massachusetts Department of Environmental Protection (MDEP). Waste Reduction Program Assessment and Analysis for Massachusetts.
http://www.mass.gov/dep/recycle/priorities/tellrep.pdf P. 6. Accessed 2/8/10.
The MDEP provides $10 per household to municipalities that adopt the PAYT program. Currently, over 100 municipalities in MA utilize PAYT. The $10 per household grant is designed to cover PAYT implementation costs. Note: $10 projections are based on estimated implementation costs. Because costs to adopt a PAYT program can vary substantially among municipalities, it is recommended to follow the guideline established by the EPA throughout the implementation stage.

[782] Estimate based upon household purchase rates in Middlesex County. As of mid-December, Middlesex County had sold 367 compost bins to residents during 2009. Based upon 2008 American Community Survey 3-year

estimates, Middlesex County has 272,381 households. Therefore, assuming that all composters were purchased for household use, 0.13% of Middlesex County households purchased a composter from the County during 2009. Middlesex County, Division of Solid Waste Management. E-mail correspondence with Michael Kosty, Principle Accountant, Division of Solid Waste Management. (December 14, 2009); United State Census Bureau. Middlesex County, New Jersey: Selected Social Characteristics in the United States: 2006-2008. http://factfinder.census.gov/servlet/ADPTable?_bm=y&-geo_id=05000US34023&-qr_name=ACS_2008_3YR_G00_DP3YR2&-ds_name= ACS_2008_3YR_G00_&-_lang=en&-_sse=on (accessed December 17, 2009).

It is estimated that the average municipal purchase price for a composter is $49.63 per composter.

Note: Providing bins is optional. Municipalities can still carry out the strategy without providing composting bins, or they could sell the bins to community members to recoup purchasing costs. This will eliminate bin purchasing costs but not procurement costs.
Middlesex County, Division of Solid Waste Management. E-mail correspondence with Michael Kosty, Principle Accountant, Division of Solid Waste Management. (November 19, 2009).

[783] Based on an estimate of annual staff time Middlesex County spent on activities related to the bulk purchase of compost bins, including Division of Solid Waste Management, Purchasing Department, County Counsel, and Comptroller staff time, it was assumed that 24 hours of staff time would be allocated to procurement activities. Applying the median hourly wage of $24.94 for Purchasing Agents, Except Wholesale, Retail and Farm Products (Standard Occupational Classification [SOC] code 131023) employed in Local Government (North American Industry Classification System [NAICS] industry code 999300), the cost of increased procurement activity would be approximately $598.56. This cost would likely be incurred annually, as municipalities would purchase new conservation equipment each year.

Middlesex County, Division of Solid Waste Management. E-mail correspondence with Michael Kosty, Principle Accountant, Division of Solid Waste Management. (November 19, 2009; December 14, 2009); Bureau of Labor Statistics, U.S. Department of Labor. n.d. Occupational Employment Statistics (OES), May 2008 National Occupational Employment and Wage Estimates. http://www.bls.gov/oes/2008/may/oes131023.htm#ind (accessed October 27, 2009).

[784] EPA. http://www.epa.gov/epawaste/conserve/tools/payt/faq.htm#admin. Accessed 2/4/10.
For Seattle, WA, the costs devoted towards environmental education programs were around $3.25 per household per year. $3.25 per household per year figure includes educational and outreach expenses for all of the strategies.

A good way to save money associated with education and outreach is by assigning existing staff members to educate and inform residents on the waste reduction programs. Staff members with a background in public relations and graphic design are recommended. Local volunteers can also help promote the programs.
[785] Recycling represents the savings achieved by recycling the reduced amount of waste.
[786] EPA. Municipal Solid Waste in the United States: 2007 Edition
http://www.epa.gov/epawaste/nonhaz/municipal/pubs/msw07-rpt.pdf P.1. Accessed 11/30/09.
Total waste reduced is the same, whether in the form of recycling or waste reduction.
Based on available municipal data multiplied by 5% reduction.

NJ DEP. http://www.nj.gov/dep/dshw/recycling/stat_links/07%20disposal%20rates.pdf. Accessed 2/4/10.

In 2007, the state of NJ produced 6 ,687,781 tons of MSW. There are 566 municipalities in NJ. On average, annual MSW generation per municipality is equal to 11,815.87 tons. This figure is used when municipal data is unavailable.

[787] NJDEP: http://www.nj.gov/dep/dshw/recycling/env_benefits.htm Accessed 12/3/09.
Every ton of landfilled MSW recycled produces a savings of 1.67 tons of CO2. 1.67*502.17(Landfilled waste)=838.63

[788] Source Reduction impacts represent the savings achieved by not producing the waste.

[789] WasteAge. http://wasteage.com/mag/waste_land_disposal_msw/ Accessed 12/15/09.
Every ton of source reduced MSW produces a savings of 2.32 tons of CO2. This represents land filled waste, and not incineration.
According to the EPA, burning MSW also emits CO2. However, emitted carbon dioxide from MSW burning is considered part of the Earth's natural carbon cycle. The EPA states, "the plants and trees that make up the paper, food, and other biogenic waste remove carbon dioxide from the air while they are growing, which is returned to the air when this material is burned."
The majority of NJ non-recycled waste is land filled. According to the NJ DEP, New Jersey produced 21.6 million tons of solid waste in 2005. Out of this, 11.4 million tons was recycled, and 10.2 million was disposed in either landfills or combusted. 1.5 million tons was combusted, consisting of 15% of total non-recycled waste. The remaining 85% was land filled.
Sources: NJDEP. http://www.nj.gov/dep/dsr/trends2005/pdfs/solidwaste.pdf Accessed 12/14/09.
EPA. http://www.epa.gov/RDEE/energy-and-you/affect/municipal-sw.html Accessed 2/11/10.

[790] EPA. "Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks" (2006) P. 89.
EPA states that net CH4 emissions from landfills are equivalent to 0.290 MTCE/ per wet ton mixed MSW. 12/44 MTCE is equal to one ton CO2. .290 MTCE X 12/44 = .079 ton CO2. Methane gas is produced when the MSW is exposed to natural light.
Mixed MSW is defined as the waste material that is typically discarded by households and collected by curbside pickup. Mixed MSW does not include white goods suck as large appliances, or industrial waste.

[791] EPA. http://www.epa.gov/RDEE/energy-and-you/affect/municipal-sw.html Accessed 2/11/10.
One ton of combusted MSW produces 12.52 lbs of NO. According to EPA, 15% of NJ MSW is combusted. NO is produced when the MSW is burned.

[792] Hamon Research. Air Pollution Control From Waste to Energy Plants: What do we do Now? 1997. P. 20. Accessed 2/10/10.
Average municipal waste combusting facility produces 5.03 tons of SO2/per ton combusted MSW. According to the NJ DEP, 15% of MSW is combusted. SO2 is produced when the MSW is burned.

[793] Sustainable Jersey. http://sustainablejersey.com/action.php?pagename=act12tb&actid=2&subactid=1 Accessed 12/10/09.

[794] Reason.org. Variable Rate or "Pay-as-you-Throw" Waste Management. P. 7 (2002): http://reason.org/files/a4e176b96ff713f3dec9a3336cafd71c.pdf Accessed 12/2/09.

[795] EPA. http://www.epa.gov/epawaste/conserve/tools/payt/index.htm Accessed 12/15/09.

[796] American City and County "The Pay as you Throw Payoff" http://americancityandcounty.com/mag/government_payasyouthrow_payoff/ Accessed 12/2/09.

[797] The Department of the Treasury, State of New Jersey. n.d. Cooperative purchasing home page. http://www.state.nj.us/treasury/purchase/coop_agency.shtml (accessed October 15, 2009).

[798] State of New Jersey Executive Order #11. 2006. The Official Web Site for The State of New Jersey. http://www.state.nj.us/infobank/circular/eojsc11.htm. (accessed October 16, 2009).

[799] U.S. Communities Government Purchasing Alliance. n.d. Going Green Program. http://www.gogreencommunities.org/?sid=200910160 (accessed October 16, 2009).

[800] ENERGY STAR. n.d. ENERGY STAR Quantity Quotes. http://www.quantityquotes.net/default.aspx (accessed October 16, 2009)

[801] http://www.epa.gov/epawaste/conserve/rrr/imr/cdm/reducing.htm

[802] http://www.epa.gov/epawaste/conserve/rrr/imr/cdm/pubs/cd-meas.pdf

[803] Assumption – Single Family Home Square Footage (http://www.nahb.org/fileUpload_details.aspx?contentID=80051)
Average of Average Square Feet of Floor Area sold in the northeast between 1978 and 2008.

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[804] C&D Disposal Cost Assumption
Assumed average cost of $86.50 per ton, 12,073 pounds, or 6.04 tons of debris, totaling $522.46
[805] C&D 75% Recycle Cost Assumption
Assumed average cost of $30.00 per ton, 4.53 tons (75% of 6.04 tons) totaling $135.90
Assumed average cost of $86.50 per ton, 1.51 tons (25% of 6.04 tons) totaling $130.62
Total waste C&D disposal costs if 75% recycled; $266.52
[806] http://www.epa.gov/climatechange/wycd/waste/calculators/Warm_Form.html
Note: Construction and demolition waste generated from Asphalt Shingles, and Gypsum Wall Board not included in MTCE reduction calculations.
[807] New Housing Unit Assumption – East Orange
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 570 new homes anticipated from 2004-2018, an average growth of 41 homes per year is assumed
[808] New Housing Unit Assumption - Edison
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 2,573 new homes anticipated from 2004-2018, an average growth of 184 homes per year is assumed
[809] New Housing Unit Assumption – Fort Lee
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 1,268 new homes anticipated from 2004-2018, an average growth of 91 homes per year is assumed
[810] New Housing Unit Assumption – Howell Twp.
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 1,980 new homes anticipated from 2004-2018, an average growth of 141 homes per year is assumed
[811] New Housing Unit Assumption - Middletown
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 1149 new homes anticipated from 2004-2018, an average growth of 82 homes per year is assumed
[812] New Housing Unit Assumption - Montclair
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 352 new homes anticipated from 2004-2018, an average growth of 25 homes per year is assumed
[813] New Housing Unit Assumption - Parsippany
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 903 new homes anticipated from 2004-2018, an average growth of 65 homes per year is assumed
[814] New Housing Unit Assumption – Perth Amboy
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 677 new homes anticipated from 2004-2018, an average growth of 48 homes per year is assumed
[815] New Housing Unit Assumption - Plainfield
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 374 new homes anticipated from 2004-2018, an average growth of 27 homes per year is assumed

[816] New Housing Unit Assumption – West Orange
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 934 new homes anticipated from 2004-2018, an average growth of 67 homes per year is assumed
[817] New Housing Unit Assumption – Willingboro Twp.
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With 655 new homes anticipated from 2004-2018, an average growth of 47 homes per year is assumed
[818] Sustainable Jersey www.sustainablejersey.com
[819] http://www.epa.gov/epawaste/conserve/rrr/imr/cdm/reducing.htm

[820] http://www.epa.gov/epawaste/conserve/rrr/imr/cdm/pubs/cd-meas.pdf
[821] C&D Disposal Cost Assumption
Assumed average cost of $86.50 per ton, 43.4 tons of debris, totaling $3,754
[822] C&D 75% Recycle Cost Assumption
Assumed average cost of $30.00 per ton, 32.55 tons (75% of 43.4 tons) totaling $976.50
Assumed average cost of $86.50 per ton, 10.85 tons (25% of 43.4 tons) totaling $938.53

Total waste C&D disposal costs if 75% recycled; $1915
[823] http://www.epa.gov/climatechange/wycd/waste/calculators/Warm_Form.html
Note: Construction and demolition waste generated from Asphalt Shingles, and Gypsum Wall Board not included in MTCE reduction calculations.
[824] New Square Footage Growth Assumption – East Orange
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 881.034 between the years 2004-2018, it is assumed that 62,931 square feet of growth can be anticipated annually.
[825] New Square Footage Growth Assumption – Edison
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 3,255,172 between the years 2004-2018, it is assumed that 232,512 square feet of growth can be anticipated annually.
[826] New Square Footage Growth Assumption – Fort Lee
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 1,740.345 between the years 2004-2018, it is assumed that 124,310 square feet of growth can be anticipated annually.
[827] New Square Footage Growth Assumption – Howell
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 2,487.241 between the years 2004-2018, it is assumed that 177,660 square feet of growth can be anticipated annually.
[828] New Square Footage Growth Assumption – Middletown
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 1,286,552 between the years 2004-2018, it is assumed that 91,897 square feet of growth can be anticipated annually.
[829] New Square Footage Growth Assumption – Montclair
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 503,103 between the years 2004-2018, it is assumed that 35,936 square feet of growth can be anticipated annually.
[830] New Square Footage Growth Assumption – Parsippany – Troy Hills
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 8,627,586 between the years 2004-2018, it is assumed that 616,256 square feet of growth can be anticipated annually.
[831] New Square Footage Growth Assumption – Perth Amboy
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 332,069 between the years 2004-2018, it is assumed that 23,719 square feet of growth can be anticipated annually.
[832] New Square Footage Growth Assumption – Plainfield
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 448.966 between the years 2004-2018, it is assumed that 32,069 square feet of growth can be anticipated annually.
[833] New Square Footage Growth Assumption – West Orange
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 853,448 between the years 2004-2018, it is assumed that 60,961 square feet of growth can be anticipated annually.
[834] New Square Footage Growth Assumption – Willingboro Twp.
Council on Affordable Housing, Third Round Consultants Reports, Chapter 5:97, Appendix F (2008), Task 1
With an anticipated additional square footage of 540,690 between the years 2004-2018, it is assumed that 38,621 square feet of growth can be anticipated annually.

[835] Sustainable Jersey www.sustainablejersey.com
[836] United States Environmental Protection Agency. 2009. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2007. http://www.epa.gov/climatechange/emissions/usinventoryreport.html (accessed December 23, 2009).

[837] United States Environmental Protection Agency. 2009. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2007. http://www.epa.gov/climatechange/emissions/usinventoryreport.html (accessed December 23, 2009).
[838] Burgess, Edward, and Melissa Peffers. 2008. Idling Gets You Nowhere: The Health, Environmental and Economic Impacts of Engine Idling in New York City. Environmental Defense Fund. http://www.environmentaldefence.org/documents/8193_Idling_Gets_You_Nowhere.pdf (accessed December 23, 2009).
[839] Hinkle Charitable Foundation. n.d. Anti-Idling Primer: Every Minute Counts. http://www.thehcf.org/antiidlingprimer.html (accessed December 23, 2009).
[840] United States Environmental Protection Agency, Office of Transportation and Air Quality. 2006. Compilation of State, County, and Local Anti-Idling Regulations. http://www.epa.gov/smartway/documents/420b06004.pdf (accessed December 23, 2009).
[841] Costs for promotional materials include cost of purchasing no-idling signs and cost of producing promotional materials (e.g., anti-idling brochures, etc.). These costs were estimated as follows.

(1) No-idling signs should be posted at locations where idling is common, such as schools and public facilities. For the purposes of this estimate, it was assumed that no-idling signs would first be placed at schools and public libraries.
    a. New Jersey contains 2,500 schools and 312 public libraries, resulting in a total of 2,812 of these targeted buildings. Given that New Jersey contains 566 municipalities, the average municipality would contain approximately 5 of these targeted buildings. Additionally, it was assumed that 4 no-idling signs would be installed at each targeted location. Therefore, it is estimated that each New Jersey municipality implementing an anti-idling campaign will install 20 no-idling signs. State of New Jersey Department of Education. n.d. New Jersey Public Schools Fact Sheet. http://www.state.nj.us/education/data/fact.htm (accessed December 23, 2009); New Jersey Library Association. n.d. Library Trivia. http://www.njla.org/presskit/trivia.html#2 (accessed December 23, 2009).
    b. No-idling signs can be purchased from the New Jersey Department of Environmental Protection at a price of $14.50 per sign. Adding in the cost of shipping ($24), the total cost of purchasing 20 no-idling signs is $314.00. New Jersey Department of Environmental Protection, Diesel Risk Reduction Program. n.d. No Idling Sign Order Form. http://stopthesoot.org/signorderform.pdf (accessed December 23, 2009).

(2) The cost of producing promotional materials was estimated based upon the production expenses incurred by the City of Mississauga, Canada during the first year of its anti-idling education campaign.
    a. During this period, the City spent $20,040.74 (U.S. dollars) on production costs. Although these production costs were minimal due to the fact that the City used pre-designed promotional materials, these reduced costs are applicable in New Jersey because New Jersey municipalities also have access to pre-designed materials. Transport Canada, Urban Transportation Showcase Program. 2004. Case Studies in Sustainable Transportation: Mississauga, Ontario. http://www.tc.gc.ca/Programs/environment/utsp/docs/casestudiespdf/cs08e_idlefreezone.pdf (accessed December 23, 2009); Bank of Canada. n.d. 10-Year Currency Converter. http://www.bankofcanada.ca/en/rates/exchform.html (accessed December 23, 2009). June 15, 2001 conversion rates used to convert Canadian dollars to U.S. dollars.
    b. At the time the program was implemented, Mississauga had a population of approximately 624,000. Therefore, the City spent approximately $0.03 per resident on production costs. Per capita production costs can be used to estimate the production costs for municipalities of various sizes. ICLEI Local Governments for Sustainability. n.d. City of Mississauga, Canada. http://www.iclei.org/index.php?id=1182 (accessed December 23, 2009).
    c. Median municipal population in New Jersey was estimated to be 8,119 in 2008. With this in mind, it was assumed that the typical New Jersey municipality implementing an anti-idling education campaign would have a population of 8,119. State of New Jersey Department of Labor and Workforce Development. n.d. Estimates of Resident Population by Municipality. http://lwd.dol.state.nj.us/labor/lpa/dmograph/est/est_index.html#mun (accessed December 23, 2009).

d. The production costs per resident incurred by the City of Mississauga, Canada ($0.03) were then applied to the population of the typical New Jersey municipality. As a result, the production costs incurred by a typical New Jersey municipality implementing an anti-idling education campaign were estimated to be $243.57.

(3) Summing the estimated costs of purchasing no-idling signs and producing promotional materials results in total promotional costs of approximately $558.00.

[842] Reduced annual cost of promotional materials is based upon the assumption that annual costs will be approximately 30% of the initial costs associated with promotional materials. Annual costs include costs associated with producing new promotional materials and replacing no-idling signs as needed.

[843] Indeed. 2009. Outreach Coordinator Salaries. http://www.indeed.com/salary/Outreach-Coordinator.html (accessed December 22, 2009).

[844] Phone conversation with Bruce McArthur, Bernards Township CFO and Town Administrator, February 8, 2010.

[845]As described above, it was assumed that the typical New Jersey municipality implementing an anti-idling education campaign would have a population of 8,119.

[846] Upfront costs include the costs associated with purchasing no-idling signs ($314), producing promotional materials (approximately $244), and salary for an outreach coordinator ($4,300 for first year).

[847] Annual costs include the costs associated with purchasing promotional materials ($167 annually) and salary for an outreach coordinator ($4,300 annually).

[848] The following provides a brief outline of the steps taken to estimate fuel savings resulting from implementation of the sample municipal anti-idling education campaign.

(1) This estimate is based upon the assumption that the anti-idling education campaign will be focused on passenger vehicles. Therefore, it was assumed that all fuel savings resulting from the campaign can be attributed to passenger vehicles.

(2) Estimates of the amount of time individuals voluntarily idle their cars per day range from 5 to 10 minutes. For purposes of estimation, it was assumed that the average car is voluntarily left idling for 7.5 minutes per day. Hinkle Charitable Foundation. n.d. Anti-Idling Primer: Every Minute Counts. http://www.thehcf.org/antiidlingprimer.html (accessed December 23, 2009).

(3) After the first year of its anti-idling education campaign, the City of Mississauga, Canada observed a 12% decrease in the average idling duration observed at municipal facilities. Using this information, it was assumed that New Jersey municipalities could achieve similar reductions in idling duration due to implementation of a similar anti-idling campaign. Additionally, it was assumed that the same reduction in idling duration would occur for all passenger vehicles in the municipality. Based on these assumptions, it was estimated that implementation of an anti-idling education campaign would result in a 12% reduction in voluntary idling. This results in an average reduction in voluntary idling equal to 0.90 minutes per car per day, or 328.50 minutes per car annually. ICLEI Local Governments for Sustainability. n.d. City of Mississauga, Canada. http://www.iclei.org/index.php?id=1182 (accessed December 23, 2009).

(4) To determine the number of cars in a typical New Jersey municipality, the number of cars per capita in the United States (0.478 in 1999) was multiplied by the population of a typical New Jersey municipality (8,119). As a result, it is estimated that a typical New Jersey municipality would contain 3,880.88 cars. NationMaster.com. n.d. Transportation Statistics. http://www.nationmaster.com/graph/tra_car-transportation-cars (accessed December 23, 2009).

(5) Next, the estimated average annual reduction in voluntary idling per car resulting from an anti-idling education campaign (328.50 minutes) was multiplied by the number of cars estimated to be contained in a typical New Jersey municipality (3,880.88 cars), resulting in the estimate that implementation of an anti-idling education campaign in a typical New Jersey municipality would result in a reduction of 1,274,869.74 minutes of voluntary car idling annually.

(6) It is estimated that 2 minutes of vehicle idling uses approximately the same amount of fuel needed to travel one mile. Additionally, the Federal Highway Administration uses an average fuel efficiency value of 22.1 miles per gallon (2001) for passenger cars. If the average passenger car travels 22.1 miles per gallon, then the average passenger car uses 0.05 gallons of fuel to travel one mile. Therefore, every 2 minutes of car

idling uses approximately 0.05 gallons of fuel and every 1 minute of car idling uses 0.025 gallons of fuel. California Energy Commission, Consumer Energy Center. n.d. Should I Shut Off the Motor When I'm Idling My Car. http://www.consumerenergycenter.org/myths/idling.html (accessed December 23, 2009); United States Environmental Protection Agency. 2005. Emissions Facts: Greenhouse Gas Emissions from a Typical Passenger Vehicle. http://www.epa.gov/OMS/climate/420f05004.htm (accessed December 23, 2009).

(7) To determine the annual reduction in fuel usage resulting from implementation of an anti-idling education campaign in a typical New Jersey municipality, the estimated annual reduction in voluntary car idling for an average New Jersey municipality (1,274,869.74 minutes) was multiplied by the average car fuel usage per minute of idling (0.025 gallons) to get an annual fuel savings estimate of 31,871.74 gallons.

(8) Finally, it was assumed that all of the fuel savings would be in the form of gasoline savings. This was assumed because EPA's fact sheet on estimating greenhouse gas emissions from a typical passenger vehicle only provides guidance on how to determine greenhouse gas emissions produced per gallon of gasoline. Therefore, it is estimated that the annual fuel saving associated with the implementation of an anti-idling education campaign in a typical New Jersey municipality is 31,871.74 gallons of gasoline. United States Environmental Protection Agency. 2005. Emissions Facts: Greenhouse Gas Emissions from a Typical Passenger Vehicle. http://www.epa.gov/OMS/climate/420f05004.htm (accessed December 23, 2009).

(9) Per capita fuel savings was calculated by dividing the estimated annual municipal gasoline savings (31,871.74 gallons) by the population of a typical New Jersey municipality (8,119) to get estimated annual per capita savings of 3.93 gallons of gasoline. This per capita savings estimate can be used to estimate impacts for municipalities of various sizes.

[849] The EPA estimates that the CO_2 emissions from a gallon of gasoline are equal to 19.4 pounds per gallon. Applying these emissions to the estimated annual municipal gasoline savings estimated above (31,871.74 gallons), it is estimated that the implementation of an anti-idling education campaign in a typical New Jersey municipality would result in CO_2 emissions savings equal to 618,311.76 pounds, or 280.46 metric tons, annually. Per capita emissions savings was calculated by dividing the estimated annual emissions savings (280.46 metric tons of CO_2) by the population of a typical New Jersey municipality (8,119) to get estimated annual per capita emissions savings of 0.03 metric tons of CO_2. This per capita savings estimate can be used to estimate impacts for municipalities of various sizes. (Only CO_2 emissions savings were estimated because the emissions of other greenhouse gases, such as CH_4 and N_2O, are related to vehicle miles traveled rather than fuel consumption.) United States Environmental Protection Agency. 2005. Emissions Facts: Greenhouse Gas Emissions from a Typical Passenger Vehicle. http://www.epa.gov/OMS/climate/420f05004.htm (accessed December 23, 2009).

[850] E Source. Accessed 11/2/09 http://www.esource.com/escrc/0013000000DDMedAAH-0/BEA1/CEA/CEA-03

[851] Based on 2008 census data http://www.montgomery.nj.us/, Montgomery Township has a population of 23K. The municipal staff have 122 computers (Montgomery Township, 11/2/09). We assumed a ratio of computers to population served = .0053.

[852] APS. Accessed 11/2/09 http://www.aps.com/main/_files/services/BusWaysToSave/OfficeEquipment.pdf

[853] Assuming the inkjets save 88w/hour X 1hour/3600 seconds X average 30 seconds per job X 100 print jobs/day X 250 work days/year X (1kw/1000w) = 18.333kW/year

University of Colorado Environmental Center. Accessed 11/2/09 http://ecenter.colorado.edu/energy/projects/green_computing.html

[854] US DOE. Accessed 11/2/09 http://www.energysavers.gov/your_home/space_heating_cooling/index.cfm/mytopic=12720

Assuming that the local government already adjusts the thermostat for hours in which the building is not occupied, the calculation of energy savings is based on altering the thermostat by 3 degrees during an 8 hour work day in which the building is occupied for 8 hours.

[855] Assuming that an average building is 20,000 square feet and that lighting consumes 1.5 watts per square foot of floor space, turning off lights overnight will produce electricity savings based on the following equation:

Building square footage (20,000sq ft) X 1.5 watts X 16 hours overnight savings X 250 work days/year = 120K kWh/year. APS. Accessed 11/2/09 http://www.aps.com/main/_files/services/BusWaysToSave/OfficeEquipment.pdf