South Berwick Greenhouse Gas Emissions Inventory

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Report Created by

Jennifer Andrews and Anne Stephenson
Buttoned-Up Home

South Berwick Greenhouse Gas Inventory Report

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Introduction

Climate change is quickly becoming a bottom-line management issue for forward thinking communities. Energy costs are rising, carbon regulation is developing, climate impacts have begun posing long-term risks, and citizens are increasingly looking for climate leadership as one indicator of progressive community management.

What follows is a summation of the "carbon footprint" of South Berwick's municipal operations, based on data gathered internally from fuel and electricity bills, real estate holding records, and human resources information. The goal of this report is to allow the town of South Berwick to move forward in both creating and implementing long-term carbon management policies, procedures and projects.

Reduction Standards

Although the town of South Berwick is not obligated to implement a carbon emissions cap or reduction plan, it is helpful to know what goals have been adopted by other towns, states and countries. Moving forward, the town should use the information supplied in this report to establish goals that are feasible and appropriate given the town's technical and financial constraints. The following standards may provide guidance in South Berwick's goal-setting process:

- The Kyoto Protocol mandates an average reduction goal of 5.2% over 1990 levels. Although the United States never signed the Kyoto Protocol, it was assigned a reduction goal of 7%.
- The New England Governors and Eastern Canadian Premiers (NEG/ECP) Climate Change Action Plan, announced in 2001, commits the region to reduce greenhouse gas emissions to 1990 levels by 2010, 10% below 1990 levels by 2020 and by 75-85% in the long term.
- In U.S. Conference of Mayors Climate Protection Agreement, participating cities commit to take following three actions:
  - Strive to meet or beat the Kyoto Protocol targets in their own communities, through actions ranging from anti-sprawl land-use policies to urban forest restoration projects to public information campaigns;
  - Urge their state governments, and the federal government, to enact policies and programs to meet or beat the greenhouse gas emission reduction target suggested for the United States in the Kyoto Protocol -- 7% reduction from 1990 levels by 2012; and
  - Urge the U.S. Congress to pass the bipartisan greenhouse gas reduction legislation, which would establish a national emission trading system

Greenhouse Gas Emissions Inventory Overview: 2004-2008

The results of South Berwick's first-ever greenhouse gas inventory indicate the town's greenhouse gas emissions have grown rapidly over the past five years: they've jumped by more than 12% since 2004. It also demonstrates that, though operations of buildings, and to a lesser degree streetlights, are a significant element of the town's carbon footprint, South Berwick's greatest arena of carbon reduction opportunity is its fleet.

Emissions by Activity:

The following table reports values for total greenhouse gas emissions over five years:

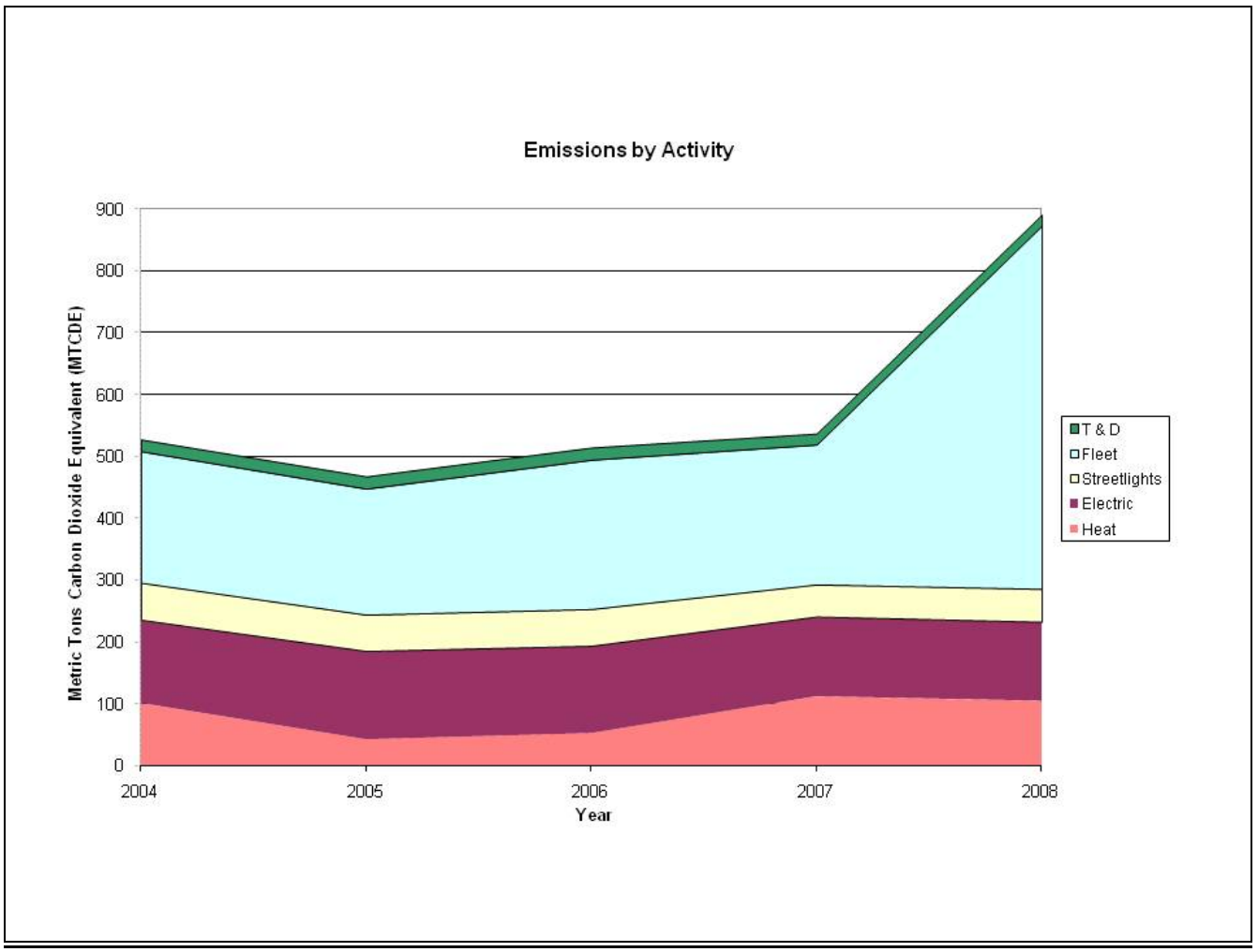
Table 2: Metric Tons Carbon Dioxide Equivalent (MTCDE)[1]

Year	Buildings			Streetlights	Fleet	T & D Loss	Total
	Heat	Electric	TOTAL				
2008	105.3	127.0	232.3	53.7	287.8	17.9	591.6
2007	112.6	128.1	240.7	52.5	226.3	17.9	537.3
2006	52.9	140.9	193.8	59.6	241.6	19.8	514.9
2005	42.7	142.5	185.2	59.1	203.8	19.9	468.1
2004	101.5	134.0	235.5	60.4	212.7	19.2	527.9

South Berwick's fleet is its single-largest source of emissions, producing 287.8 MTCDE in 2008. This is nearly half of the total; it is more than the 232.3 MTCDE generated in 2008 for electricity use and on-site fuel combustion in buildings combined. South Berwick's streetlights, though not approaching the impact of its buildings or vehicles, contributed nearly 10% of the overall GHG footprint in 2008. Emissions from other direct sources (i.e. fertilizer application and refrigerant loss), and indirect emissions from electricity transmission and distribution losses, were minor contributions to South Berwick's overall emissions profile.

[1] Metric Tons Carbon Dioxide Equivalent (MTCDE) is a standard measure of the combination the six internationally-reported greenhouse gases: carbon dioxide (CO_2), methane (CH_4), nitrous oxides (N_20), sulpher hexafluoride (SF_6), perflourocarbon (PFC), and hydroflouracarbon (HFC). This is the typical metric used to report entity level greenhouse gas emissions. One MTCDE is the equivalent of 113 gallons of gasoline, or to the carbon sequestered by 25 trees for 10 years.

Figure 1: Emissions by Activity



Emissions by Scope:

Typically in entity level GHG inventories, a distinction is made between different types of "direct" and "indirect" emissions sources. Some municipal emissions are "direct"—most notably, the fossil fuel combustion that happens in South Berwick-owned or operated buildings and vehicles. Such directly-produced emissions are categorized as "Scope 1" emissions. These emissions have risen nearly 25% over the past five years due to the rise in fleet-related emissions.

There are also emissions produced as a consequence of generating electricity for South Berwick's consumption; even though the fossil fuel combustion or other activity used to generate South Berwick's power do not happen on-site, such emissions could be said to be at-least-partially a consequence of South Berwick's operations. Such indirectly-

produced emissions from power consumption are categorized as “Scope 2” emissions. South Berwick’s Scope 2 emissions have been reduced since 2004.

Finally, there are GHG emissions which happen more indirectly as a result of South Berwick’s operations—those from employee business travel or commuting, for example. All such indirectly-produced emissions types, reporting of which is considered completely discretionary, are catalogued as “Scope 3” emissions.

When doing any public reporting, it is customary to provide emissions totals for each of these categories. This inventory determined that South Berwick’s Scope 1 and 2 emissions are as indicated in Table 2 (below). While the initial hope had been to report certain Scope 3 emissions (such as directly-financed outsourced travel and commuting) for South Berwick’s first GHG inventory, there is currently not enough available data to include any reliable estimates of such Scope 3 sources at this time. Recommendations for data collection strategies that will enable the inclusion of such Scope 3 sources in subsequent South Berwick inventories follow in subsequent sections.

Table 2: Total Emissions by Scope

Year	Scope 1	Scope 2	Scope 3	Total
2008	393.1	180.6	17.9	591.6
2007	338.9	180.6	17.9	537.3
2006	294.5	200.5	19.8	514.9
2005	246.6	201.6	19.9	468.1
2004	314.2	194.5	19.2	527.9

Trends and Implications of Inventory Results:
Examination of the five-year emissions trajectory shows that the more-than-10% increase between 2004 and 2008 has not been entirely linear.

The main driver of this trend seems to be fleet-related emissions. While emissions from the fleet dropped from 2004 to 2005, they’ve risen precipitously since then. This is not typical for more densely populated communities; however, it is indicative of South Berwick’s physical size (35 square miles) and the demands that size makes in terms of road maintenance, services, etc. It also reflects significant fleet purchases over the past five years.

Emissions from the use of electricity for both buildings and streetlights dropped at a rate of 7% since 2004; however, it is important to note that both of these sources dropped, not because reduced electricity consumption (*it* continued to rise modestly) but rather due to updated information about the sources of electricity generation from the e-Grid database starting in 2007, reflecting a less carbon-intensive generation mix for this region.

Emissions from on-site stationary sources (propane, heating oil and waste oil, combined), which made up nearly 17% of South Berwick’s emissions in 2008, are at roughly the same level they were five years ago.

Inventory Methodology

As a rule, municipal greenhouse gas inventories represent an estimation (rather than an exact measurement) of greenhouse gas emissions. This estimate is obtained by cataloguing data about the extent of municipal activities resulting in GHG emissions, and applying coefficients that account for the volume of GHGs that each unit of those activities generates. For example, for every gallon of fuel oil or gasoline burned, or every kWh of electricity used, there is an "emissions factor" that captures the typical amount of GHGs emitted in each of these chemical interactions. A formula multiplying the number of gallons or kilowatts by the appropriate emissions factor is used to provide a chemical estimate of greenhouse gases emitted; these products are then summed to provide a complete picture of estimated emissions

This South Berwick inventory uses an adapted version of Clean Air-Cool Planet's Campus Carbon Calculator™, to track the emissions of the six major types of internationally-tracked greenhouse gases (CO_2, N_2O, CH_4, PCF, HFC, CFC) resulting from the town's operations.[2] Each gas is tracked separately in the inventory software, but in the final tally the impact of each gas is benchmarked against carbon dioxide (CO_2), the most numerous GHG—for example, methane (CH_4), often emitted from landfills, traps 23 times as much heat energy in the atmosphere as carbon dioxide—to provide one combined measure of climate impact: metric tons of carbon dioxide equivalent (MTCDE). For South Berwick, which does not do its own solid waste or wastewater treatment but rather exports them, the primary GHG is carbon dioxide (CO_2) emitted as a result of fossil fuel combustion, either directly in heating systems or vehicles, or indirectly (by a utility), for electricity.

Inventory Boundaries:

As in any accounting analysis, an important aspect of entity-level (e.g. community, corporate or campus) GHG accounting is determining what research parameters or boundaries will apply. There are three types of relevant boundaries to apply to the data collection process in the completion of a municipal GHG inventory: temporal, organizational, and operational. The boundary decisions made in regard to South Berwick's inventory are as follows:

Temporal – The inventory comprises data from fiscal years 2004-2008; before 2004, good datasets are less available.

Organizational – The inventory looks at the town's emissions from all of the facilities and equipment it controls.

Operational – Following the conventions of the GHG Protocol, the international standard for greenhouse gas accounting, South Berwick's inventory accounts for all direct, on-site emissions-generating activities including combustion of fossil fuels in its building heating systems and its fleet vehicles (categorized as "Scope 1" emissions by The GHG Protocol), as well as the emissions associated with production of the electricity it

[2] For more about the Campus Carbon Calculator™ used to complete the inventory, see Appendix 2

consumes for lighting, power and heat (categorized as “Scope 2” emissions). In addition, this GHG inventory attempts to estimate the GHG impact of directly financed outsourced travel (categorized as “Scope 3” emissions).

Table 3: Activity Data Sources by Scope

Category	Operational Arena Data	Emissions Source Activity
Scope 1 (Direct)	Buildings – heat	Propane, #2 fuel oil, waste oil
	Fleet	Gasoline, diesel fuel
	Equipment	Refrigerant use
Scope 2 (Imported energy)	Buildings – heating and cooling	Electricity generation
	Buildings – power	Electricity generation
	Streetlights - power	Electricity generation
Scope 3 (Indirect)	Directly financed outsourced travel	Vehicle fuel and jet fuel combustion
	Buildings – cooling and power generation	T&D losses from electric

Data Collection Strategies, Sources and Gaps

Stationary Sources (Buildings – Heat)

Total gallons of propane or fuel oil for each building were provided by P. Gagnon and Son, South Berwick’s fuel vendor. We only had access to direct fuel invoices for the year 2008, so cannot vouch for the accuracy of the fuel totals for the other years; nor did we have fuel costs for any years except 2008.

Aside from the lack of direct access to invoices for 2004-2007, we note one important omission in this data: records indicated that the town garage is heated using waste oil, but specific quantities of this fuel were not indicated. Even though this is likely to represent a relatively small amount of fuel, waste oil is particularly carbon intensive; it will be important to start tracking and reporting this data in order to get a truly accurate picture of South Berwick’s direct emissions from its facilities portfolio.

Electricity

There were two different sources for electricity consumption input data: invoices for streetlights, and spreadsheets logging kWh consumption by month for each town facility.

Fleet

Estimating emissions from transportation requires some information regarding the amount of fuel burned. Instead of relying on explicit records of fuel purchased, the inventory required extrapolation based on fuel purchases.

Outsourced Travel

Currently, the only data available related to outsourced travel were total dollar amounts spent by each department on all travel modes combined. This

information was not sufficiently detailed to allow for a reasonably defensible estimate of business travel by air, train, bus or personal vehicle. For this reason, this category was omitted from the inventory.

Recommendations for Improved and Expanded Data Collection

Data Management and Reporting:

South Berwick had a fairly high-quality, robust dataset from which to create its baseline greenhouse gas (GHG) inventory for Scope 1 and 2 emissions. That said, ongoing work will be necessary to maintain, update, and expand upon its GHG inventory in order to gain an increasingly sophisticated and actionable understanding of its true carbon impact or "footprint." In addition, since South Berwick expressed interest in reporting with broader operational boundaries in the long run (i.e. include Scope 3 emissions from directly financed outsourced travel) the town will likely need to alter and improve data collection systems for these activities. Some basic recommendations follow:

- Maintain archive of (thoroughly annotated) input data for 2003-2007 GHG inventory and for every year thereafter; this should be housed with a central person/office who will be responsible for updating the inventory, and senior management should have this data archived as well.
- Expand initial inventory to include the impacts of employee commuting and business-related travel. This will require asking employees/ departments to submit more detailed records regarding their mode of transportation and distance traveled, in addition to the travel costs. Such information requests could be added to regular expense report forms and department budget/expense summaries. It will also require asking employees to take an annual survey of their commuting habits. This s
- Consider ways to automate data collection so it can be a shared responsibility and be logged in a way that lends itself to completing the annual GHG inventory easily and efficiently (e.g. different departments upload their figures quarterly to one shared file or Google doc that aggregates the data automatically)
- Begin using the Solutions Module in South Berwick's Campus Carbon Calculator™ software to regularly analyze the cost/MTCDE reduced of any energy or transportation decision under consideration, including fleet or facility upgrades, in order to maximize value of energy and carbon management initiatives. Staff may benefit from training on how to use the Calculator.

Emissions Results by Municipal Function

Buildings – Activity, Cost and Emissions Analysis

South Berwick's buildings are very diverse, both in terms of age and architecture and in terms of function and use. They make up between 35%-40% of the town's emissions profile, and as such represent significant opportunities for carbon reduction. The graphs below provide different perspepctives on each building's relative efficiency and the opportunties relative to both emissions and cost reductions.

Figure 2: Total MMBTU per sq. ft

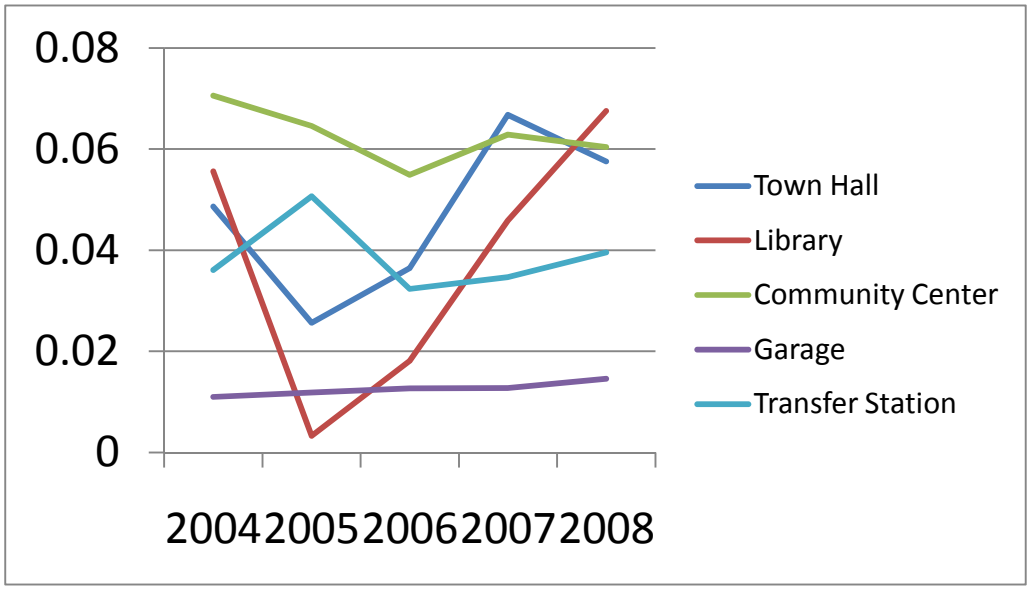
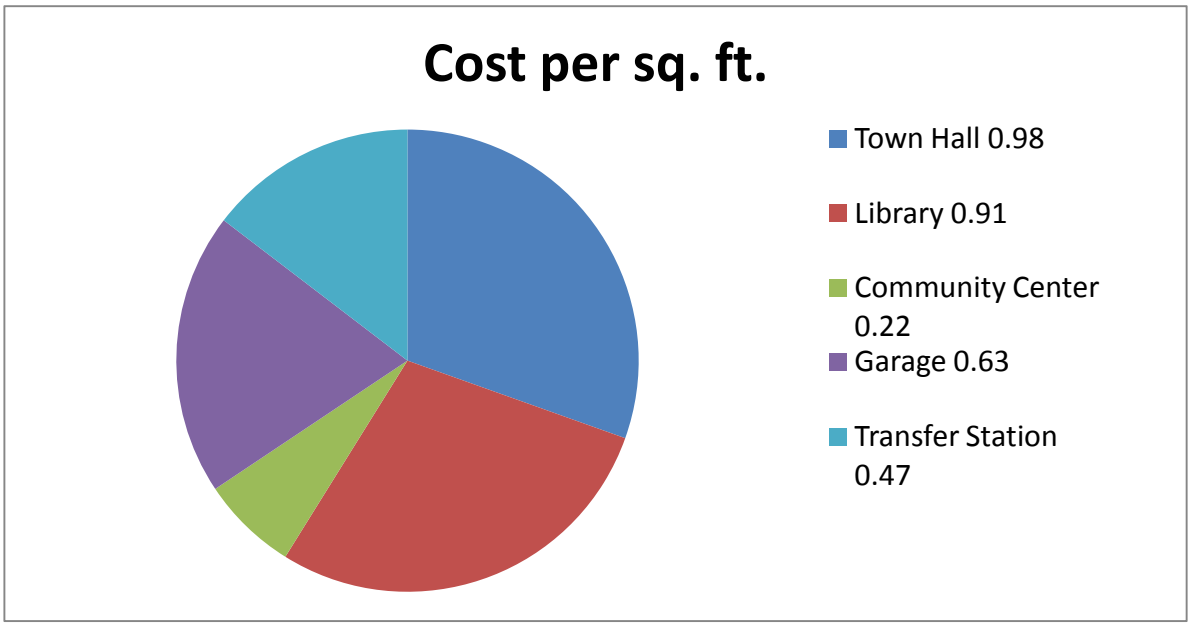


Figure 3: 2008 Building Costs per sq. ft



Streetlights - Activity, Cost and Emissions Analysis

South Berwick's streetlights represent 9% of its total emissions.

Table 4: Streetlight Energy and Costs

	Number Streetlights	Total KWh	Total Cost
2008	225	130,986	$42,649.15
2007	221	129,089	$41,835.05
2006	217	127,200	$39,832.79
2005	214	126,020	$37,266.94
2004	214	128,877	$35,249.76

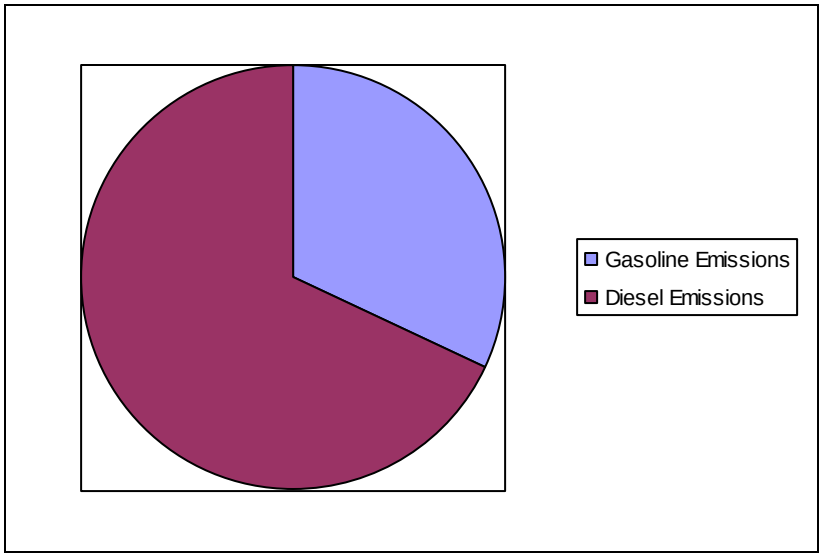
Fleet - Activity, Cost and Emissions Analysis

Table 5: Estimated Fleet Fuel Usage

	Gasoline Fleet	Diesel Fleet
	Gallons	Gallons
FY 2004	8,472	13,602
FY 2005	8,017	13,127
FY 2006	10,561	14,627
FY 2007	9,491	14,052
FY 2008	10,402	19,348

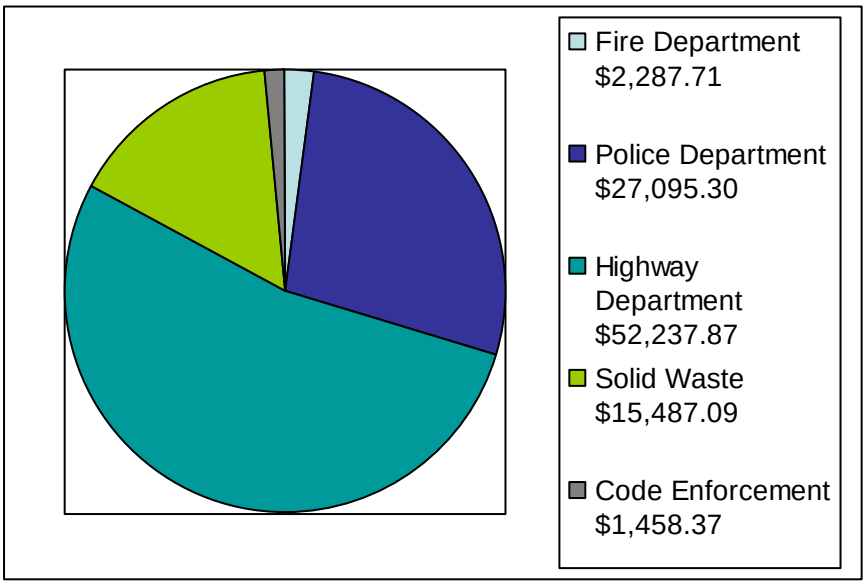
Figure 4: Total Emissions from Fleet

FY 2008 = 287.8 MT eCO_2



South Berwick's fleet is its single-biggest source of emissions; given South Berwick's large geographic area this is not surprising

Figure 5: FY 2008 Fleet Fuel Costs by Department



Preliminary Recommendations for Emissions Mitigation Strategies

Climate leadership hinges on two basic activities: An active, internal effort by management and staff to consistently reduce organizational emissions over the long-term; and, a willingness to proactively share successes and challenges related to these efforts with stakeholders, peers or community members, in order to contribute to encourage and empower others in similar efforts. While the most detailed analysis in this report focuses on the specific projects South Berwick can undertake in the short term to facilitate direct carbon reductions, the additional recommendations related to the long-term, educational nature of these efforts should also be carefully considered.

Direct Carbon Reduction Measures

There are four fundamental ways of reducing carbon emissions, as indicated in the schematic at right: conservation (avoidance), efficiency (reduction), fuel or process switching (replacement), and offsetting. The data collected while doing the inventory can help focus the arenas in which carbon management is undertaken, but within those arenas, it is important to pursue projects that represent all four management approaches.

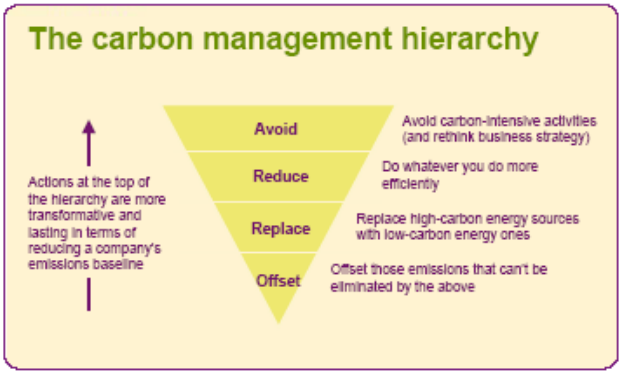


Figure 6: Carbon Management Hierarchy (From Getting to Zero: Defining Corporate Carbon Neutrality, 2008, http://www.cleanair-coolplanet.org/documents/zero.pdf)

Having completed South Berwick's greenhouse gas inventory, the next step is to identify short-term recommendations for carbon reductions. While the suggestions that follow do not include specifications regarding scale or precise costs, it will be important for South Berwick to conduct a life-cycle cost-benefit analysis of potential carbon reduction measures to ensure strategic mitigation strategies. The Solutions Module of the Campus Carbon Calculator™ v6 can be utilized to undertake such an analysis. In essence, this analysis provides model for how to introduce carbon management as another metric of organizational efficiency and success.

A preliminary scan of the energy use and energy cost numbers collected for the South Berwick inventory indicated that transportation represents not only a prime target area for emissions reductions, but also for cost savings, since the costs of transportation fuel have nearly doubled over five years while the demand has risen much more modestly. The same is true to a notable degree for electricity, and to a lesser degree for heating fuels.

Buildings

- As noted, there are likely unrealized opportunities to improve building efficiency in all of South Berwick's facilities. We recommend starting with discussing opportunities for free walk-through audits for town facilities from CMP. After realizing the energy savings from low-hanging fruit such as installing power strips, CFL light bulbs, automatic light switches, reducing hot water temperatures, and thermostat settings, we recommend investment-grade energy audits of the library and the town hall, since these facilities appear to be the most energy intensive to operate.

- Investment-grade energy audits of municipal facilities in the area have uncovered potential projects worth many thousand in energy savings including installing multiple heating zones, air leakage reduction measures, and combined heat-and-power generation.

South Berwick Library

- Building energy intensity is highly linked to occupant behavior: for this reason, we recommend undertaking a series of interviews with a sampling of staff in each facility to uncover potential behavioral adjustments or educational opportunities targeted at staff and other building users.

Streetlights

- South Berwick's sodium and metal halide fixtures are already more efficient than earlier technologies including incandescent and mercury vapor fixtures. However, recently a number of LED street light applications have been tested in other communities and have been found to be both more energy efficient and to have better light and color quality. Additionally, LED fixtures have a longer life span than sodium or metal halide fixtures, and therefore have reduced maintenance and operation costs.

- An Oakland California street lighting demonstration project, coordinated by the U.S. Department of Energy (DOE), Pacific Gas & Electric (PG&E), and the City of Oakland, replaced fourteen 121 Watt HPS (high pressure sodium) luminaires (100 nominal Watts) with fourteen 78 Watt LED luminaires. The new LED luminaires drew roughly 35% (43 Watts) less than the HPS luminaires. At about 4,100 annual hours of operation, annual electrical savings are estimated to be approximately 178 kWh per luminaire replaced. The LED luminaires yielded an annual combined energy and maintenance savings of $42 per luminaire when compared to HPS luminaires.

- We suggest inviting the South Berwick Energy Efficiency Council to investigate the energy savings and possible payback timelines for switching the town's

streetlights to more efficient LED technologies. Although we can anticipate saving up to 35% of the electricity consumed by these lamps, a large portion of the streetlight electricity costs are dedicated to delivery charges, and are not solely based on electric consumption. With that in mind, an evaluation of the placement and effectiveness of town lights is recommended, in order to determine if any luminaires may be deaccessioned.

Fleet

- Begin running all diesel vehicles on Biodiesel for increased efficiency and reduced carbon emissions. We project that South Berwick will save 10 cents per gallon based on ¼ MPG increase in efficiency and based on $2.50 diesel (a conservative price estimate). A conservative estimate of total dollar savings for FY 2009 with the bio blend would be $1934.80 for the year, with an estimated 21,670 pounds CO2 reduced.[3]

- There are no costs associated with the conversion of the engines to run on biodiesel fuel. All of Keene's 77 Public Works Department vehicles have run on B20 biodiesel fuel since 2002. Using biodiesel also helped Keene to lower the particulate emissions of their fleet vehicles. According to the Keene Department of Public Works, "Workers inside the fleet maintenance facility have also benefited by the reduction in fumes, reporting better air quality and subsequently fewer headaches!"[4]

- Explore the opportunities for on-site gasoline and diesel fueling from a vendor to reduce fueling man-hours and ease data collection for fleet fuel use.

- South Berwick should consider requiring that all new vehicles purchased by the town for municipal use are the most fuel-efficient vehicle allowable for the job. A number of area municipalities have successfully transitioned some of their fleet over to hybrid vehicles and have subsequently achieved significant fuel savings.

- Additionally, current vehicles in every department shall be evaluated to determine if the size and the fuel type of the vehicles are appropriate based on the frequency and the type of usage. Where feasible, South Berwick could purchase smaller vehicles for each department and explore the possibility of vehicle sharing across departments.

- South Berwick should explore the opportunities for bicycle and Segway for police department use on downtown patrols to reduce the fuel costs of the police department.

[3] These carbon reduction figures are based on running a B7 blend (typically vehicles are started on a B5 blend and bumped-up to a B20 blend after a trial period).

[4] Clean Air-Cool Planet Community Toolkit (http://www.cleanair-coolplanet.org/for_communities/biodiesel.php).

Administrative Policies:

In order to be ensure that this initiative is successful and creates maximum institutional benefit, goals, benchmarks and policies need to be put in place to sustain a carbon reduction initiative over time. We recommend that, to the extent it has not already done so, South Berwick implement the following strategies and structures between now and July 2010, to ensure long-term success in its goal of being a leader in the fight against climate change.

- Include updated annual carbon footprint data in annual report, annual sustainability report, or a stand-alone document published annually and made readily accessible on the South Berwick website. Ensure that town council is formally briefed, in a question-and-answer session, on the latest inventory results.
- Create a data collection policy for staff travel, staff commuting, and per-vehicle fuel use for more precise data for the next greenhouse gas inventory. Staff business travel was not included in this inventory because it was travel costs were not broken down by hotel, meal, and travel type and mileage. All staff reimbursement forms should include these categories moving forward.
- Fertilizer information was not available for this inventory. Please require the grounds vendor to document lbs of fertilizer used, quantity, and percentage nitrogen for FY 2009.
- Create a designated, long-term funding mechanism for carbon reductions. Consider creation of a revolving fund in which accrued savings from energy efficiency investments are targeted to additional energy/carbon initiatives.
- When considering capital improvement investments, integrate consideration of the total potential carbon reduction, and associated dollar/MTCDE cost, of a given measure into the cost-benefit analysis and executive decision-making rubric. (This cost/MTCDE figure can be arrived at using the adapted Campus Carbon Calculator South Berwick will have in-house.)
- Consider including energy/carbon management into job descriptions to a greater extent (e.g. managers are responsible for convening annual or bi-annual meetings for employees to consider/discuss opportunities for on-site carbon reductions; or expected to implement office policies that are mindful of carbon impacts.)
- Consider incentivizing employees to contribute actively and meaningfully to South Berwick's carbon reduction efforts; e.g. a small rebate toward a more fuel efficient vehicle, a small percentage of the energy savings for innovative conservation ideas.)

- Convene relevant staff and stakeholders (e.g. management, Select Board, or Energy Efficiency Committee) to brainstorm ways to share results of South Berwick inventory with key stakeholders, including employees, tax payers, and area towns (e.g. newsletter, website, article in local papers, annual report, etc.
- Consider urging employees to take the Carbon Challenge (http://carbonchallenge.sr.unh.edu/), and perhaps providing incentives for them to do so.

CONCLUSION: NEXT STEPS

The greenhouse gas inventory and climate action planning process is not a discrete enterprise, but rather, iterative. South Berwick should plan on updating its GHG inventory inputs in the Campus Carbon Calculator, v6, when information is available for FY 2009 and every year thereafter. Along with this report, we are providing South Berwick with a customized copy of the Campus Carbon Calculator, v6.3; it includes the new "solutions module" to help South Berwick quantify the carbon impact of various future business decisions. Designated staff or committee members may benefit from training on how to use this module. In this way, South Berwick is empowered to expand its carbon management efforts through 2009 and beyond, as it engages more and more of its relevant staff and community members in its efforts.

APPENDIX A: Data Sources

Fleet

Gallons of fuel used in the fleet were estimated based on costs and fuel needs of fleet vehicles using a methodology applied in other municipal inventories when no per-vehicle fuel use is available. In order to evaluate if all fleet vehicles are the most fuel efficient possible, and to determine the amount of fuel used per vehicle, a fuel log per vehicle must be started.

Fleet vehicle information was pulled from South Berwick Town Files, along with a percentage of fuel use divided between diesel and gas. Total fuel costs per department were gathered by Kim Perry from end-of-year department budget reports. Fuel use was then estimated using an average cost of fuel provided by the New Hampshire Department of Energy and Planning and the Maine Department of Energy Websites.

Information on Biofuel savings and Keene NH Biofuel program was taken from the Clean Air-Cool Planet Community Toolkit (http://www.cleanair-coolplanet.org/for_communities/biodiesel.php).

Buildings

FY 2004-2008 fuel and electricity data was provided by Kim Perry from archival billing data.

Streetlights

CMP Monthly Bills, Streetlight Account 449-026-5635-011, 2004-2009

"Outdoor Lighting with LEDs" Department of Energy (available at http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/oakland_demo_brief.pdf)

APPENDIX B: About the Campus Carbon Calculator™

The Campus Carbon Calculator™ is an Excel-based open-sourced greenhouse gas calculation tool designed for entity level GHG inventories. It is use by more than 2500 colleges and universities, communities and organizations worldwide, and is the tool of record for greenhouse gas (GHG) inventories in higher education, including those campuses pledging to become "carbon neutral" under the American College and University President's Climate Commitment (ACUPCC).

For institutions embarking upon climate action, the first step is always the same: determine the campus's greenhouse gas footprint so you can create the best plan for how to tackle it. The Campus Carbon Calculator's results allow an organization to gauge its energy efficiency, identify opportunities and priorities for emissions reductions, note emissions trends and, if undertaken annually, mark progress. New modules available in Version 6 of the Calculator also assist campuses in evaluating and strategically bundling their emissions reduction options, based on quantitative analyses of the financial and emissions-related impact of potential policies and projects.

The Campus Carbon Calculator™ was created in partnership between Clean Air-Cool Planet and the University of New Hampshire, by a graduate-level CA-CP fellow working closely with UNH campus staff and faculty to complete that school's first institutional greenhouse gas inventory. This template, adapted from a series of workbooks created by the Intergovernmental Panel on Climate Change (IPCC) for national inventories and based on UNH's experience, was then made available for exclusive use by more than a dozen CA-CP campus partners in the Northeast, and through a process of stakeholder engagement and feedback, was refined continuously through three subsequent versions.

Version 4 of the Calculator was made publicly available on CA-CP's website in March 2005. Recognizing the value in promoting standardized carbon accounting methods, CA-CP undertook a joint review with the World Resources Institute and ICLEI-Local Governments for Sustainability at that time, for the purpose of ensuring a basic level of compatibility between this campus tool and those that were already emerging as the standard tools for the business and municipal sectors. Since, then, CA-CP has made sure that the Campus Carbon Calculator™ is in fundamental accord with agreed-upon best practices for carbon accounting, including the guidance set forth by the Greenhouse Gas Protocol (www.ghgprotocol.org), upon which broad reporting programs like the Climate Registry are based.

For more information, visit www.cleanair-coolplanet.org/toolkit

APPENDIX C: FLEET INVENTORY BY DEPARTMENT

Fire Department Fleet

2004	2005	2006
1987 Pierce Arrow 1988 Pumper 2003 Ferrara Ladder Truck 1993 Freightliner Tanker 1997 Ford F250 Pickup 1980 Ford Pumper	1987 Pierce Arrow 1988 Pumper 2003 Ferrara Ladder Truck 1993 Freightliner Tanker 1997 Ford F250 Pickup 1980 Ford Pumper 1993 Utility Jeep 1992 Ford Crown Vic	1987 Pierce Arrow 1988 Pumper 2003 Ferrara Ladder Truck 1993 Freightliner Tanker 1997 Ford F250 Pickup 1980 Ford Pumper 1993 Utility Jeep 1992 Ford Crown Vic 2001 Chevrolet Suburban 1500

2007	2008
1987 Pierce Arrow 1988 Pumper 2003 Ferrara Ladder Truck 1993 Freightliner Tanker 1997 Ford F250 Pickup 1980 Ford Pumper 1993 Utility Jeep 1992 Ford Crown Vic 2001 Chevrolet Suburban 1500	1987 Pierce Arrow 1988 Pumper 2003 Ferrara Ladder Truck 1993 Freightliner Tanker 1997 Ford F250 Pickup 1980 Ford Pumper 1993 Utility Jeep 2001 Chevrolet Suburban 1500

Solid Waste Fleet

2004	2005	2006	2007	2008
None	2005 Sterling SLT9500—Roll Off	2005 Sterling SLT9500—Roll Off	2005 Sterling SLT9500—Roll Off	2005 Sterling SLT9500—Roll Off

Code Enforcement Fleet

2004	2005	2006	2007	2008
None	None	2000 Ford Crown Vic	2000 Ford Crown Vic	2000 Ford Crown Vic

Police Department Fleet

2004	2005
2000 Ford Crown Vic (2) 2001 Ford Crown Vic 1998 Ford Explorer 2003 Ford Expedition 1996 Ford Crown Vic 1992 Ford Crown Vic 1995 Ford Crown Vic 1997 Ford Crown Vic	2000 Ford Crown Vic (2) 2001 Ford Crown Vic 1998 Ford Explorer 2003 Ford Expedition 1996 Ford Crown Vic 2004 Ford Crown Vic 1997 Ford Crown Vic (Animal Control)

2006		2007	2008
2000 Ford Crown Vic 2001 Ford Crown Vic 1998 Ford Explorer 2003 Ford Expedition 1996 Ford Crown Vic 2004 Ford Crown Vic 2006 Ford Crown Vic 2005 ATV and Trailer 1997 Ford Crown Vic (Animal Control)		2000 Ford Crown Vic 2001 Ford Crown Vic 1998 Ford Explorer 2003 Ford Expedition 1996 Ford Crown Vic 2004 Ford Crown Vic 2006 Ford Crown Vic (2) 2005 ATV and Trailer 1997 Ford Crown Vic (Animal Control)	2000 Ford Crown Vic 2001 Ford Crown Vic 1998 Ford Explorer 2003 Ford Expedition 2004 Ford Crown Vic 2006 Ford Crown Vic (2) 2005 ATV and Trailer 2000 Ford Ranger Pickup 2006 Ford Explorer

Highway Department Fleet

2004	2005
1995 Ford F350 XL 1Ton Dump Truck 2000 Ford Ranger 2000 Sterling L7500 Dump 1989 Ford L9000 Dump Truck 2001 Sterling L7500 Dump Truck 2003 Ford F550 1997 Ford F450 1991 Ford/Plow/Sander 2002 Sterling L7500 1996 Ford F150	1995 Ford F350 XL 1Ton Dump Truck 2000 Ford Ranger 2000 Sterling L7500 Dump 1989 Ford L9000 Dump Truck 2001 Sterling L7500 Dump Truck 2003 Ford F550 1997 Ford F450 1991 Ford/Plow/Sander 2002 Sterling L7500 1996 Ford F150 2005 Ford F350 1989 Ford L9000 Retrofit

2006	2007	2008
1995 Ford F350 XL 1Ton Dump Truck 2000 Ford Ranger 2000 Sterling L7500 Dump 1989 Ford L9000 Dump Truck 2001 Sterling L7500 Dump Truck 2003 Ford F550 1997 Ford F450 1991 Ford/Plow/Sander 2002 Sterling L7500 1996 Ford F150 2005 Ford F350 1989 Ford L9000 Retrofit 2006 Ford F250	1995 Ford F350 XL 1Ton Dump Truck 2000 Ford Ranger 2000 Sterling L7500 Dump 1989 Ford L9000 Dump Truck 2001 Sterling L7500 Dump Truck 2003 Ford F550 1997 Ford F450 1991 Ford/Plow/Sander 2002 Sterling L7500 1996 Ford F150 2005 Ford F350 1989 Ford L9000 Retrofit 2006 Ford F250 2007 GMC	1995 Ford F350 XL 1Ton Dump Truck 2000 Sterling L7500 Dump 1989 Ford L9000 Dump Truck 2001 Sterling L7500 Dump Truck 2003 Ford F550 2002 Sterling L7500 1996 Ford F150 2005 Ford F350 1989 Ford L9000 Retrofit 2006 Ford F250 2007 GMC 2008 Ford F350

APPENDIX D: STREETLIGHT INVENTORY

Streetlight Type	Number of Units	Average Operating Cost per Month
Sodium Enclosed 70W	84	$11.51
Sodium Enclosed 100W	26	$13.71
Sodium Enclosed 150W	4	$17.48
Sodium Enclosed 250W	12	$25.17
Metal Halide Cut Off 400W	10	$40.83
Sodium Post Top 100W	8	$14.01
Sodium Cut Off 70W	42	$12.07
Sodium Cut Off 100W	10	$14.01
Sodium Flood 400W	4	$35.39
Sodium Sp Mgse Close-In 250W	1	$39.03
Metal Halide Cut Off 175W	14	$23.55
Sodium Cut Off 250W	2	$26.19
Sodm Spc Grnvl S 100W	1	$25.81
Metal Halide Cut Off 250W	1	$29.88
Sodium Cut Off 50W	4	$11.00
Sodium Cut Off 150W	2	$10.29