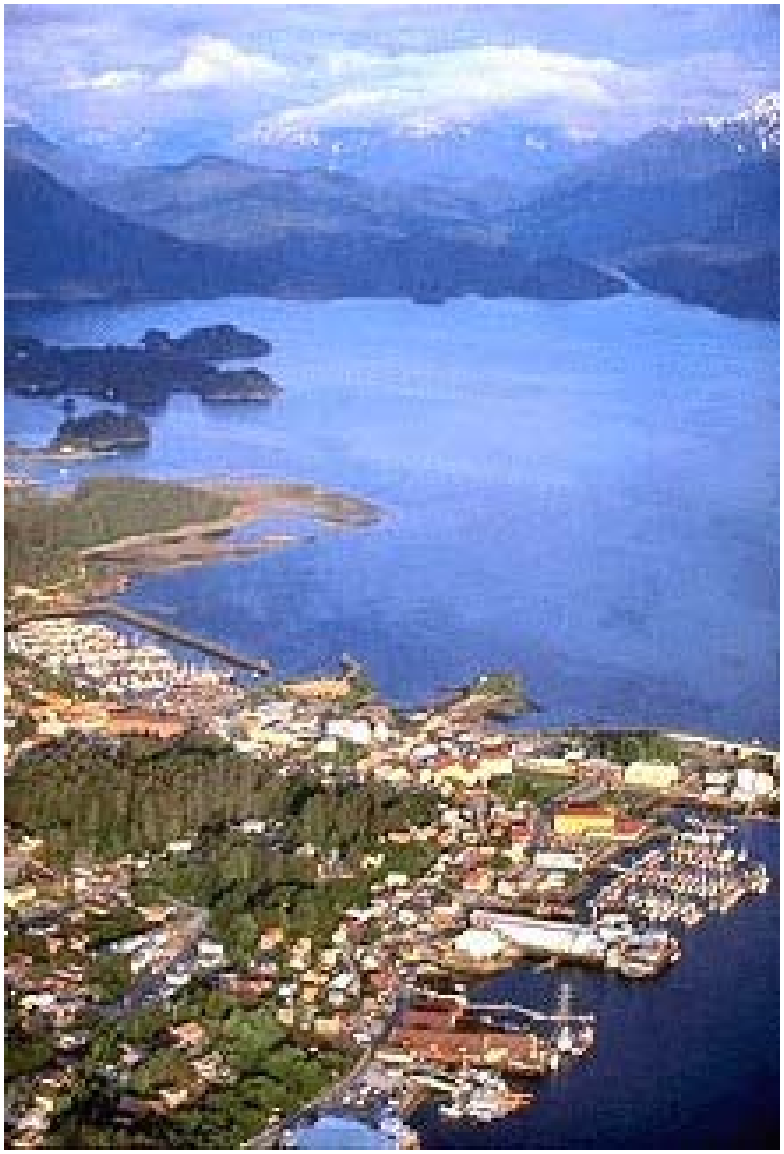
# City and Borough of Sitka



www.sitka.net/section1.shtml

# Greenhouse Gas Inventory Report

**August 2008**

# Acknowledgments

This Report would not have been possible without the help and support of several people.

Much gratitude to everyone who provided data for the community and municipal inventories. Your contributions were essential to the completion of this project.

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# Table of Contents

# Executive Summary

**The debate is over**. The overwhelming scientific consensus is that human-induced global warming is one of the greatest environmental challenges facing this generation and those to come. Since 1850 the mean annual temperature of the earth's atmosphere system has increased over 2.16° Fahrenheit (1.2° Celsius). In the last century the increase has been about 1.43°F (0.74°C), with most of the increase coming during the past 50 years.

**The time to act is now.**

In May of 2007 the Intergovernmental Panel on Climate Change (IPCC), the most senior and authoritative body providing scientific advice to global policy makers, reported that to prevent a global mean temperature increase of greater than 3.6° to 4.32°F (2.0° to 2.4°C), greenhouse gas emissions must peak no later than 2015, be 50-85% less in 2050 than they were in 2000, and then be maintained at a concentration below approximately 450 parts per million (equivalent CO2). If these steps are not taken, and global temperatures rise beyond this threshold, "serious or catastrophic" impacts can be expected, such as rising sea levels, crop failures, loss of biodiversity, and increases in extreme weather events such as droughts, floods, and forest fires. Northern latitudes are particularly vulnerable to impacts of climate change: Alaska is likely to be affected more by climate change than any other region of the United States. Melting sea ice and rising sea levels threaten coastal communities and marine mammal populations, while melting permafrost and extreme weather events can damage important infrastructure. Additionally, Alaska's forests and fisheries, integral components of Alaska's economy and culture, are both at risk from global climate change.

> "Global warming is now local warming"
>
> – Terry Tempest Williams

**Sitka must do its part**. Although the United States accounts for only 4% of the world's population, it produces 25% of the world's greenhouse gases. Local governments are in a unique position to address this situation, as many of the most effective initiatives for dealing with climate change originate in the actions of local communities. Choices made at the local level, in areas from transportation to land-use to energy-consumption, are the fundamental factors determining the magnitude of humans' impact on the climate.

On April 8th, 2008, the City and Borough of Sitka recognized this by passing a motion to become a member of ICLEI- Local Governments for Sustainability. By doing so, Sitka joined over 600 other local governments and became a participant in the Cities for Climate Protection Campaign, a program designed to empower communities to take action to reduce greenhouse gas emissions and improve the general quality of living within their municipalities. The campaign incorporates five milestones:

1. Conduct a baseline emissions inventory and forecast
2. Adopt an emissions reduction target
3. Develop a Local Climate Action Plan
4. Implement policies and measures
5. Monitor and verify results.

This document is a report on the completion of the first milestone, the baseline emissions inventory and forecast, which found that in 2003, Sitka released 91,677 tons of equivalent CO2 (eCO2). The inventory is meant to be a resource for the community at large and the Sitka Climate Action Taskforce (to be formed in the fall of 2008) in particular, and should be used to set goals and to develop measures to reduce greenhouse gas emissions. Additionally, the inventory will provide a basis for comparison when evaluating results of future community actions.

# Introduction

## Introduction to Climate Change Science

The Earth's atmosphere is naturally composed of a number of gases that act like the glass panes of a greenhouse, retaining heat to keep the temperature of the Earth stable and hospitable for life at an average temperature of 60 degrees Fahrenheit. Carbon dioxide ($CO_2$) is the most prolific of these gases. Other contributing gases include methane ($CH_4$), nitrous oxide ($NO_2$), ozone ($0_3$) and halocarbons. Without the natural warming effect of these gases the Earth's surface temperature would be too cold to support life.

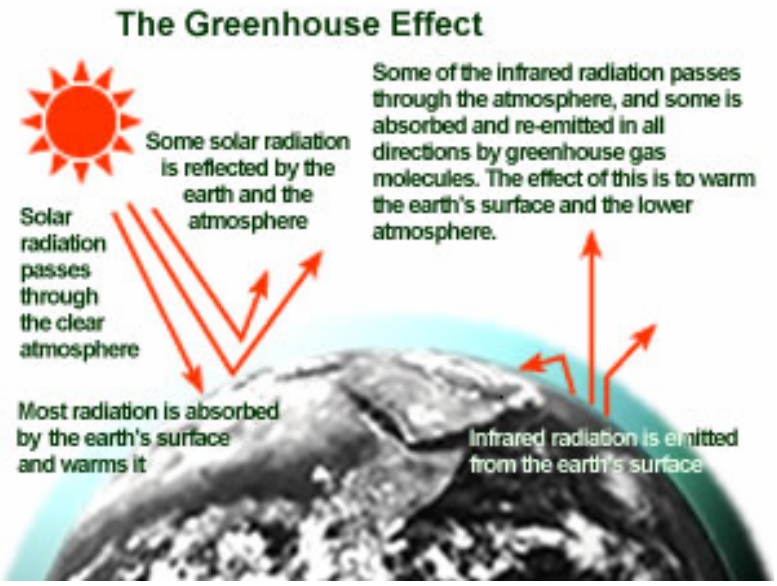



**Figure 1. The greenhouse effect**
**Source: US Environmental Protection Agency, 2005**

However, by the end of the 1970s scientists began to recognize that human actions have been altering the composition of the atmosphere. Many human activities, most notably the burning of fossil fuels, produce greenhouse gases. Since 1750, the beginning of the Industrial Revolution, the atmospheric concentration of carbon dioxide has increased by 31%, reaching levels unprecedented in at least the past 650,000 years. The elevated concentration of carbon dioxide and other greenhouse gases released into the atmosphere by humans has had a destabilizing effect on the global climate, fueling the phenomenon commonly referred to as global warming.

In 2007 The IPCC stated, "Warming of the global climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global mean sea level." **Global warming is happening, and it is happening now**. The global average surface temperature increased during the 20th century by about 1°F.[1] According to NASA scientists, the 1990s were the warmest decade of the century, and the first decade of the 21st century is well on track to be another record-breaker. However, the climate and the atmosphere do not react in a linear fashion to increased greenhouse gases. That is to say that you cannot simply predict that for each ton of carbon dioxide emitted from a power plant or a vehicle's tailpipe, the Earth will warm a certain amount. The Earth's climate has a number of feedback loops and tipping points that scientists fear will accelerate global warming beyond the rate at which it is currently occurring. For example, as $CO_2$ emissions have increased in recent human history, the oceans have been absorbing a significant portion of these gases, but as the oceans become more permeated with $CO_2$, scientists anticipate they will reach a saturation point, after which each ton of anthropogenic emissions of $CO_2$ will have a more substantial impact. Another example of this compounding can be found in the polar ice caps. Ice is highly reflective and acts effectively like a giant mirror, reflecting the sun's rays back into space. As the planet warms and some of this ice melts away, a darker land or ocean surface is revealed. This darker surface will tend to absorb more heat, accelerating the speed at which the planet warms with each ton of greenhouse gas emitted.

> "Warming of the global climate system is unequivocal"
> –IPCC, 2007

Since the 1970s many scientists have acknowledged the human influence on climate change, but today there exists an overwhelming scientific consensus that human-produced greenhouse gases are the principal drivers of global warming. In May of 2007 the IPCC released their *4th Assessment Report*, a document providing a comprehensive review of climate studies and climate databases from around the world. It was an extensive project, involving over 800 contributing

[1] United Nations Intergovernmental Panel on Climate Change (IPCC) Third Assessment Report. "Climate Change 2001: Synthesis Report. Summary for Policy Makers" http://www.ipcc.ch/pub/un/syreng/spm.pdf

authors, over 450 lead writers, and over 2500 expert scientific reviewers and took 6 years to complete. **Their final conclusion:** There is greater than 90% confidence that the atmospheric buildup of human-induced greenhouse gases is responsible for the global warming observed since the mid-20th century. The consequences of global warming, from environmental to health impacts, are therefore not only affecting humanity, but are being caused by humanity. This conclusion is a reaffirmation of consensuses made by countries around the world. In 2005, National Academies of Science representing each of the G8 nations as well as India, China, and Brazil joined together and released a statement on climate change, in which they wrote, "there is now strong evidence that significant global warming is occurring... it is likely that most of the warming in recent decades can be attributed to human activities. This warming has already led to changes in the Earth's climate." This conclusion and that of the IPCC has not been refuted by any major scientific study.

> "Most of the observed increase in globally averaged temperatures since the mid-20th century is *very likely* due to the observed increase in anthropogenic greenhouse gas concentrations."
>
> -IPCC 4th Assessment Report, 2007

## Effects and Impacts of Climate Change

Changes in temperature and climate will have a dramatic impact on plants and animals that are adapted to conditions that will no longer prevail. Surface temperatures are on course to increase by between 2.5 and 10.5°F by the year 2100, with regions in the northern parts of North America and Asia heating by 40% above the mean increase.[2] In addition to causing average temperature increases, rising levels of greenhouse gases have a destabilizing effect on a number of different microclimates, conditions and systems.

The increase in the temperature of the oceans is projected to accelerate the water cycle, thereby increasing the severity and rate of both storms and drought, which, along with decreased snow pack, could disrupt ecosystems, agricultural systems and water supplies.

Globally, snow cover has decreased by 10% in the last forty years. Average sea level has risen between 1/3 and 2/3 of a foot over the course of the 20th century and is projected to rise by at least another 1/3 of a foot and possibly up to almost 3 feet by the year 2100.[3] These coastal infringements on such a large scale could

[2] Ibid
[3] Ibid

lead to not only significant environmental and ecosystem disturbances, but also major population displacement and economic upheaval.

Additionally, global warming is expected to impact the health of millions of people around the world. For example, increases in malnutrition due to decreased crop yield, increased disease and deaths due to extreme weather events, increased cardio-respiratory diseases (caused by elevated ground-level ozone concentrations in urban areas), and changes in spatial distribution of some infectious diseases are all projected consequences of global climate change. Many of these negative health impacts will be felt most in developing countries, especially considering the fact that developing nations often lack the resources to effectively mitigate climate change or adapt to its effects. The unequal global distribution of the impacts of global warming is particularly troubling considering that rich, developed nations are generally disproportionately responsible for the rise of greenhouse gas emissions.

Northern latitudes are also especially vulnerable to global warming. Arctic and sub-arctic regions are now warmer than they have been in at least the past 400 years, and are projected to increase another 1 to 3 degrees C by 2030. According to the *Alaska Climate Impact Assessment* completed in 2006 for the Alaska State Legislature, "the State of Alaska is at the leading edge of impacts resulting from a warming climate." The most significant of these changes are expected to be: 1) Thawing of ice and permafrost; 2) Changes to forests; 3) Changes to marine ecosystems; and 4) Changes to subsistence lifestyles. These, and other impacts of global climate change, are already being felt around the state, with considerable implications for Alaska's environment and economy. For example, according to a study by the Institute for Social and Economic Research at the University of Alaska Anchorage, these impacts are expected to raise the cost of repair and replacement of Alaskan infrastructure projects by as much as $6.1 billion by 2030.

The principal expected impacts of global warming in Alaska, taken from the report *Impacts of Climate Change in the United States*, a scientific assessment completed by the United States Global Change Research Program, are reported in Box 1.

**Box 1. Impacts of Climate Change in the Alaska[4]**

*Thawing of the ice and permafrost*

Thawing of permanently frozen ground (permafrost), retreat and thinning of sea ice, and reduction of the amount of time that rivers and lakes are frozen is already underway and projected to continue. Thawing that has already occurred is consistent with the modeled effects of greenhouse warming. Continued warming is likely to cause widespread alterations to the lifecycles, habitats and health of ecosystems and marine mammals, consequently harming subsistence livelihoods. Widespread damage to buildings and infrastructure and disruption of transport may also result from projected warming. Damage from warming that has already occurred is estimated to be about $35 million per year. In the longer term, benefits to

[4] "Impacts of Climate Change in the United States" http://www.climatehotmap.org/impacts/alaska.html

**Box 1. Continued**

transport and offshore oil production are possible as additional sea routes become available for longer periods of the year, which will have significant implications for trade and national defense.

*Forests*
Both fire and insect disturbance have increased sharply in recent years, at least partly offsetting gains in forest productivity from recent warming. Future warming is likely to increase these stresses, eventually bringing large-scale landscape transformation as boreal forest advances into present tundra and mixed forest into present boreal forest. Other climate-induced effects projected include an increase in forest fire intensity and frequency and an increase in gale force winds resulting in more blowdown.

*Marine ecosystems and fisheries*
Alaskan and Bering Sea marine ecosystems are strongly influenced by changes in climate and climate variability, although their mechanisms are not fully understood. Changes in climate is likely to cause changes in these systems, in the form of altered stream flow, nutrient content, water temperature, and vertical stability of coastal waters. There is a good chance that further climate change will bring large-scale changes in both commercial and subsistence fisheries, but understanding of the potential magnitude or even direction of change is very limited.

*Subsistence livelihoods*
Fish, marine mammals and wildlife populations have been displaced, reduced and access to them has been decreased due to warming that has already occurred and the thawing, sea ice retreat and ecosystem shifts that resulted. As a consequence, subsistence hunting and fishing have been significantly affected. While some specific subsistence resources may grow more abundant (such as salmon near the northern limit of their range), many resources are likely to diminish further, even in the near term.

*Other concerns*
Other issues covered by the National and Regional Assessments include the effects of warming on bird migration, coastal wetlands, agriculture, and tourism. Changes in freshwater balance and storm surge levels due to some sea level rise and altered river flow levels could lead to flooding of coastal wetlands and impairment of seabird and shorebird breeding. The impact to agriculture is mixed: warming could lead to a longer growing season, but increased soil erosion and loss of organic materials are also projected which could create problems for agriculture. Reindeer populations may decline due to decreased availability and quality of forage.

**Sitka is not immune to the impacts of global warming**. As a coastal community, dependent on natural resources, we can expect to feel many of the effects predicted at the state level. How these effects will be experienced in Sitka is difficult to predict, however, some examples are already being observed throughout Southeast. For example, in 2007 the City and Borough of Juneau completed a report on the predicted impacts on Juneau of climate change, which included information on regional snow cover and changes to forests. The warming spring temperatures caused by climate change have led to premature tree de-hardening and snow melts. The lack of snow means that tree roots have no insulation against subsequent cold weather, and are vulnerable to freezing to death. This event appears to be responsible for the widespread decline of yellow

cedar in the region. The decrease in depth and duration of snow cover is expected to increase, especially for areas near sea level, such as Sitka (Figure 2). Additionally, die-offs of trees and warming temperatures are expected to increase the frequency of forest fires. Degraded air quality from these fires will contribute to increases in respiratory difficulties for people in surrounding areas. The Juneau report also states that injuries and deaths (especially within the boating community) may increase due to increases in storm frequency and intensity.

Several possible benefits of climate change exist. The *Alaska Climate Impact Assessment* identified the potential global warming to enhance agricultural production, increase salmon abundance in the northern limits of their range, increase tourism, and increase availability of sea routes within the state. However, it is believed that the benefits from these positive changes will be significantly outweighed by the cost of the negative impacts of climate change.

It is important to note that there is very little variability in short-term predictions of the average global temperature in the next twenty to thirty years. However, the long-term outcome will be governed by decisions made today. This phenomenon is due to the significant inertia in the climate system: the impact of gases already in the atmosphere will not become apparent until further into the future.

Moreover, despite the proliferation of energy saving technologies, existing power plants and vehicles will continue to be used. The short and medium-term implications of climate change are unavoidable. But the long-term impacts that will be felt between 2040 and 2100 have a high range of variability.

## Action Being Taken on Climate Change

**National Action:** With the rise of global climate change to the forefront of the world's attention, many countries have developed plans to mitigate global warming. Despite this, the United States has failed to take any significant actions to reduce greenhouse gas emissions at the national level. Today, United States greenhouse gas emissions have increased 17% relative to 1990 levels.

**State Action:** Many states have begun to consider the affects of climate disruption. As of May of 2008, 44 states, including Alaska, had completed greenhouse gas emissions inventories. 30 states had completed Climate Change Action Plans, while 7 states have plans in progress.

**Local Action:** A great deal of work is being done at the local level on climate change. ICLEI—Local Governments for Sustainability has been a leader on both the international and local level for more than ten years, representing over 770 local governments around the world. ICLEI was launched in the United States in 1995 and has grown to over 260 cities and counties providing national leadership on climate protection and sustainable development.

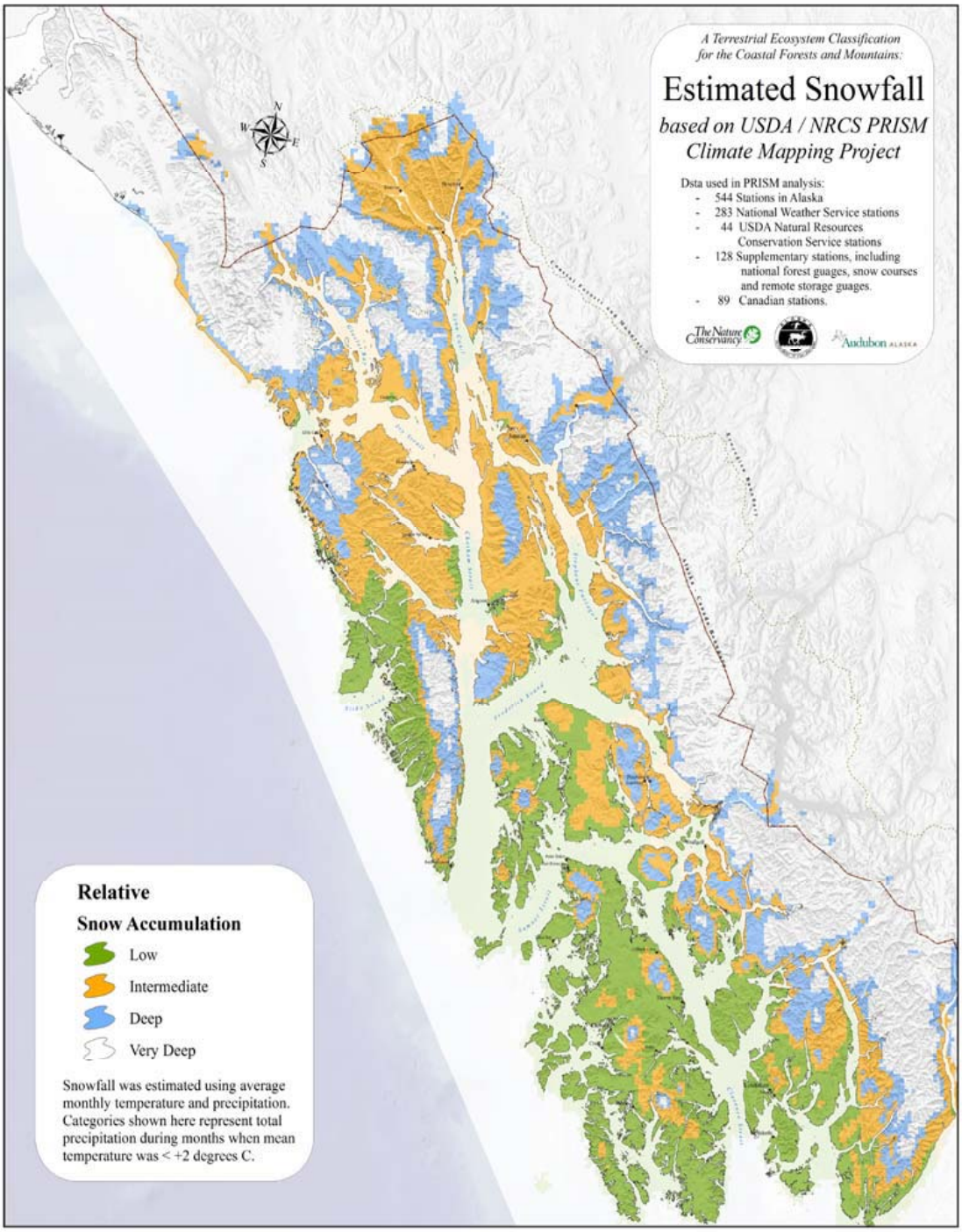



**Figure 2. Relative Snow Accumulation in Southeast Alaska**
**Source: The Nature Conservancy**

Additionally, over 300 mayors, representing 49 million Americans, have joined the U.S. Mayors' Climate Protection Agreement (MCPA), a national effort to

promote climate protection and the goals of the Kyoto Protocol- an international agreement addressing global warming pollution and ratified by 164 countries.[5]

## ICLEI and the Cities for Climate Protection Campaign

ICLEI's mission is to improve the global environment through local action. The Cities for Climate Protection (CCP) Campaign is ICLEI's flagship campaign designed to educate and empower local governments worldwide to take action on climate change. ICLEI provides resources, tools, and technical assistance to help local governments measure and reduce greenhouse gas emissions in their communities and their internal municipal operations.

ICLEI's CCP Campaign was launched in 1993 when municipal leaders, invited by ICLEI, met at the United Nations in New York and adopted a declaration that called for the establishment of a worldwide movement of local governments to reduce greenhouse gas emissions, improve air quality, and enhance urban sustainability. The CCP Campaign achieves these results by linking climate change mitigation with actions that improve local air quality, reduce local government operating costs, and improve quality of life by addressing other local concerns. The CCP Campaign seeks to achieve significant reductions in U.S. greenhouse gas emissions by assisting local governments in taking action to reduce emissions and realize multiple benefits for their communities.

ICLEI uses the performance-oriented framework and methodology of the CCP Campaign's Five Milestones to assist U.S. local governments in developing and implementing harmonized local approaches for reducing global warming and air pollution emissions, with the additional benefit of improving community livability. The milestone process consists of:

- Milestone 1: Conduct a baseline emissions inventory and forecast
- Milestone 2: Adopt an emissions reduction target
- Milestone 3: Develop a Climate Action Plan for reducing emissions
- Milestone 4: Implement policies and measures
- Milestone 5: Monitor and verify results

On April 8th 2008, the City and Borough of Sitka adopted a resolution to take action for climate protection and joined more than 600 communities around the world that are participating in ICLEI's Cities for Climate Protection Campaign. The results from the completion of the first Milestone, the baseline emission inventory and forecast, are reported here.

[5] http://www.seattle.gov/mayor/climate/

# Greenhouse Gas Emissions Inventory

## Methodology

ICLEI's Cities for Climate Protection methodology allows local governments to systematically estimate and track greenhouse gas emissions from energy and waste related activities at the community-wide scale and those resulting directly from municipal operations. The municipal operations inventory is a subset of the community-scale inventory.

Once completed, these inventories provide the basis for creating an emissions forecast and reduction target, and enable the quantification of emissions reductions associated with implemented and proposed measures.

### *Clean Air and Climate Protection Software*

To facilitate local government efforts to identify and reduce greenhouse gas emissions, ICLEI developed the Clean Air and Climate Protection (CACP) Software package with Torrie Smith Associates. This software estimates emissions derived from energy consumption and waste generation within a community. The CACP software determines emissions using specific factors (or coefficients) according to the type of fuel used. Emissions are aggregated and reported in terms of equivalent carbon dioxide units, or $eCO_2$. Converting all emissions to equivalent carbon dioxide units allows for the consideration of different greenhouse gases in comparable terms. For example, methane is twenty-one times more powerful than carbon dioxide in its capacity to trap heat, so the model converts one ton of methane emissions to 21 tons of $eCO_2$.

The emissions coefficients and methodology employed by the software are consistent with national and international inventory standards established by the Intergovernmental Panel on Climate Change (1996 Revised IPCC Guidelines for the Preparation of National Inventories) and the U.S. Voluntary Greenhouse Gas Reporting Guidelines (EIA form1605).

It must be noted that, although the software provides Sitka with a sophisticated and useful tool, calculating emissions from energy use with precision is difficult. The model depends upon numerous assumptions, and it is limited by the quantity and quality of available data. With this in mind, it is useful to think of any specific number generated by the model as an approximation, rather than an exact value.

### *Inventory Sources and Creation Process*

The creation of an emissions inventory required the collection of information from a variety of sectors and sources. These data were entered into the software to create a community emissions inventory and a municipal emissions inventory.

The community inventory represents all energy use within Sitka and its contribution to greenhouse gas emissions. The municipal inventory is a subset of the community inventory, and includes energy use and emissions derived from internal government operations.

There are two main reasons for completing separate emissions inventories for community and municipal operations. First, the government is committed to action on climate change, and has a higher degree of control to achieve reductions in its own municipal emissions than those created by the community at large. Second, by proactively reducing emissions generated by our own activities, the city government takes a visible leadership role in the effort to address climate change. This is important for inspiring local action in the broader community, and neighboring jurisdictions.

The community inventory and the municipal operations inventory are based on the 2003 calendar year. Data was also collected for 2006, to provide information on an intermediate year.

When calculating Sitka's emissions inventory, it was necessary to rely on existing data sources. The data available was not always ideal for use in the CACP software and assumptions and conversions were often required to calculate the necessary data inputs. For example, estimates of gas and oil fuel consumption were based on the sales tax collected by the city from local fuel distributors. These estimates were inherently less accurate than those that could have been made based on company sales records, because sales tax is generated from the sale of all products offered by the company- not just fuels. However, as sales records were impossible to access, tax revenue was the best available source.

Comprehensive explanations of all data sources used, and assumptions and decisions made, in the production of Sitka's community and municipal inventories are available from city staff.

The data collected for the community and municipal inventories do not include all emissions that could be identified. For example, data on air travel was not collected even though, on a per capita basis, air travel is often one of the greatest sources of greenhouse gas pollution. The local government has relatively little influence over individual residents' air travel choices, and much of that travel is associated with other, larger regional airports. Therefore the accuracy of any attempt to quantify such emissions would be highly questionable, and its utility as a policy tool would be relatively minimal. The following sources of emissions are not included in this data set:

- Air travel
- Ferry Travel
- Marine Shipping
- Upstream energy from consumer products and food

The exclusion of these categories is the norm for ICLEI community inventories. Nevertheless, it is important to recognize that these sources are significant contributors to regional and national emission production.

The omission of upstream energy from consumer products in particular is an important factor to keep in mind. One will note that the waste sector is reported as producing negative emissions. This is explained by the fact that all of Sitka's waste (other than sewage sludge from the waste water treatment plant) is shipped to the Roosevelt Regional Landfill in Washington, a facility that has a methane recovery rate of approximately 95%. This means that the vast majority of the methane produced by Sitka's decomposing waste is captured and burned to produce electricity, the final result being that more carbon equivalent is buried and trapped in the landfill than is added to the atmosphere. The balance remains negative even when emissions produced from shipping the waste from Sitka to Roosevelt are taken into account. However, if it was possible to quantify the emissions produced in the entire life cycle of our community's waste, specifically from upstream energy use, this component of the inventory would be significantly larger. A summary of emissions and waste life cycle stage is provided in figure 3.

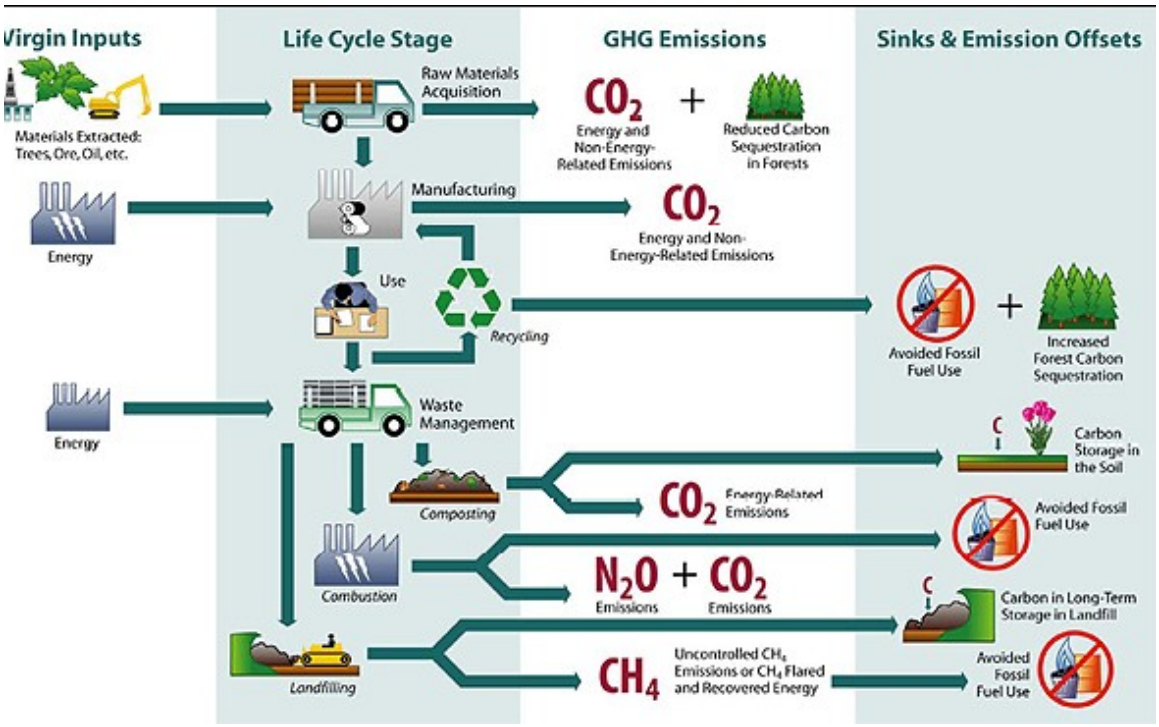



**Figure 3. Greenhouse Gas Sources and Sinks in the Waste Sector**
**Source: City of Bellingham Greenhouse Gas Emissions Inventory**

Reducing, Reusing, and Recycling (in that order) are all important elements of any climate change mitigation efforts, and should not be discounted simply because of the methane recovery capability of the Roosevelt Landfill.

## Inventory Results

### *Community Emissions Inventory*

In the base year 2003 the community of Sitka emitted approximately 91,677 tons of $eCO_2$. The greatest source of emissions was the Residential sector, which contributed 30.93%, followed closely by both the Road and Marine Transportation sectors, which were responsible for 27.86% and 28.88% respectively. The Commercial sector, which releases 14.97% of Sitka's emissions, includes all commercial, industrial and public authority facilities. Table 1 and figure 4 show the breakdown of 2003 community emissions by sector.

The greatest contributor to emissions produced by the Residential and Commercial sectors was the burning of heating fuel. Almost all electricity produced and used in Sitka is hydroelectric- historically only 1% (or less) of Sitka's electricity has been produced by diesel generators- and is therefore virtually emissions-free. Consequently, community-wide electricity use was responsible for only 1.35% of total emissions released. While it is obvious that electricity use is not the highest priority when addressing Sitka's greenhouse gas emissions, conservation in this sector allows the electric utility to provide increased service to a broader customer base. Specifically, conscious consumption of the resource will enable the electric department to meet the demand of patrons using electricity as an alternative or a complement to liquid fuels, a substitution that can reduce emissions and result in savings.

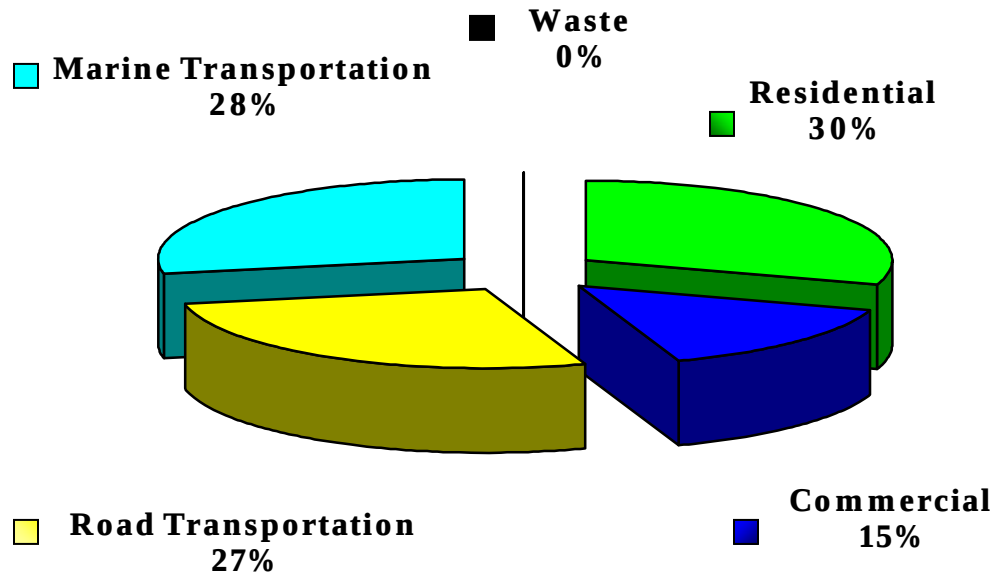
The Marine Transportation sector includes both recreational and commercial vessels.

**Table 1. Community Greenhouse Gas Emissions by Sector 2003**

| | Equiv CO2 (Tons) | Equiv CO2 (%) |
|---|---|---|
| **Residential** | 28,354 | 30.93% |
| **Commercial** | 13,728 | 14.97% |
| **Road Transportation** | 25,538 | 27.86% |
| **Marine Transportation** | 26,481 | 28.88% |
| **Waste** | -2,423 | 0.00% |
| **Total (Without Waste)** | 91,677 | 100.00% |

In the intermediate year of 2006, Sitka emitted approximately 95,602 tons of eCO2, an increase of 3,925 tons from 2003 levels. As in 2003, the Residential and Transportation sectors were the largest contributors to Sitka's emissions profile. However, in 2006, Marine Transportation was the single greatest sector, accounting for approximately 35% of total emissions. The Residential sector energy consumption was about equal in the baseline and intermediate years,

**Figure 4. Sitka Community Greenhouse Gas Emissions 2003, Equivalent CO2 (%)**

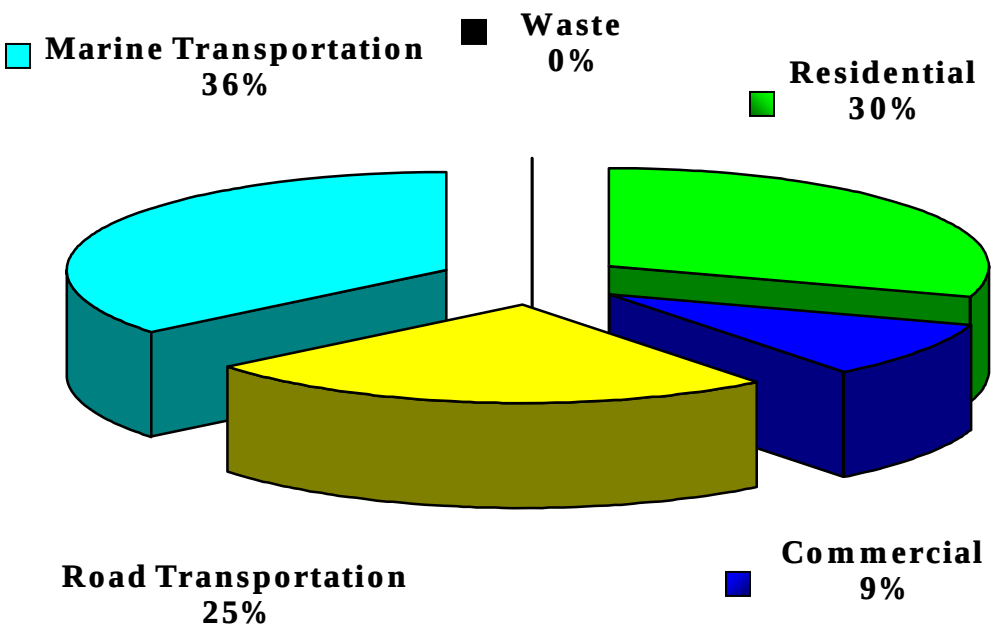



Commercial sector emissions decreased and emissions from the Transportation sectors increased. Table 2 and Figure 5 show the breakdown of 2006 community emissions by sector.

**Table 2. Community Greenhouse Gas Emissions by Sector 2006**

| | Equiv CO2 (Tons) | Equiv CO2 (%) |
|---|---|---|
| **Residential** | 28,705 | 30.03% |
| **Commercial** | 8,931 | 9.34% |
| **Road Transportation** | 23,776 | 24.87% |
| **Marine Transportation** | 34,190 | 35.76% |
| **Waste** | -2,640 | 0.00% |
| **Total (Without Waste)** | 95,620 | 100.00% |

**Figure 5. Sitka Community Greenhouse Gas Emissions 2006, Equivalent CO2 (%)**

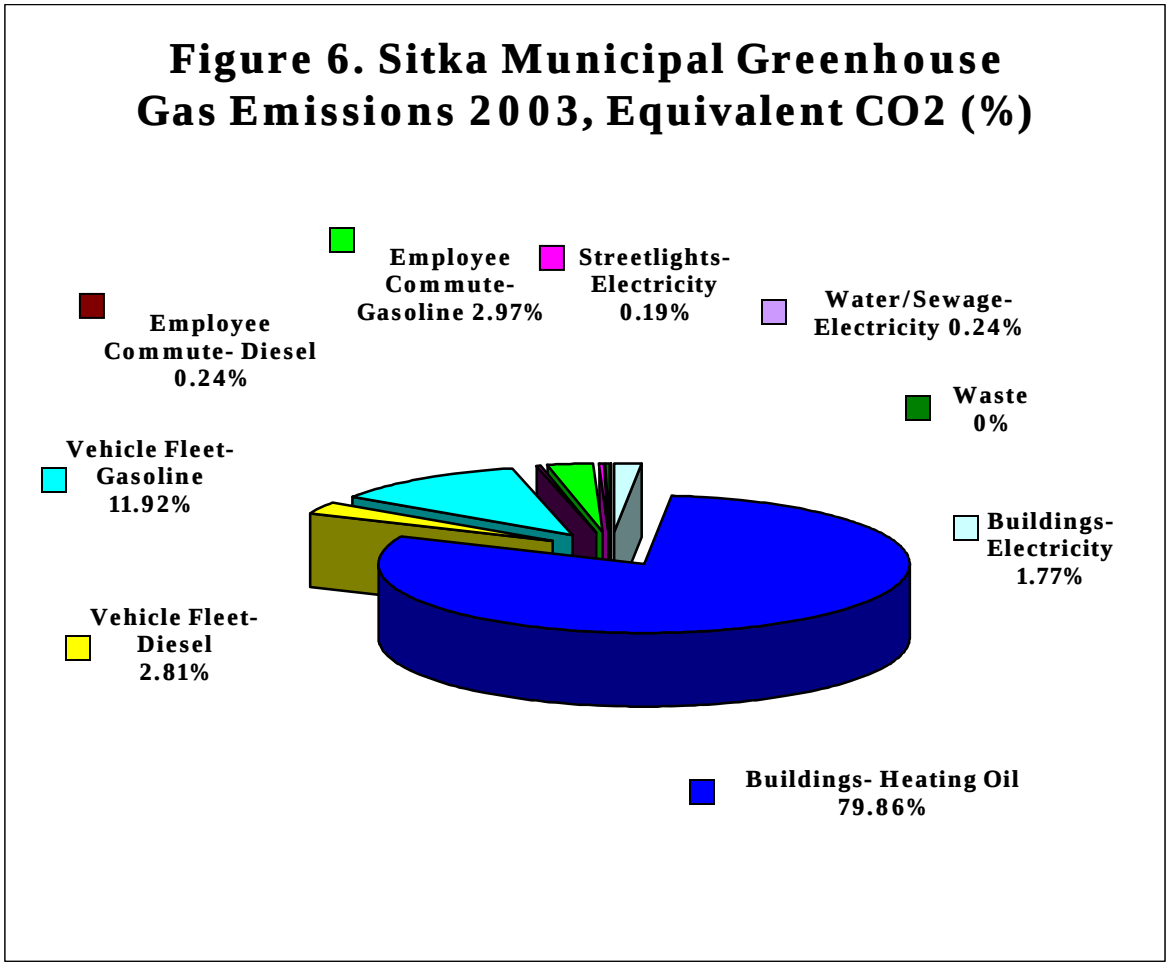



***Municipal Operations Emissions Inventory***

In the base year of 2003, Sitka's municipal operations generated 3,732 tons of $eCO_2$. City facilities were responsible for 81.6% of these emissions, with the city municipal vehicle fleet accounting for 14.7% of total emissions. Table 3 and Figure 6 show the breakdown of municipal operations emissions by sector. Municipal emissions in Sitka constitute about 4% of the City's total emissions. Local government emissions typically fall between 2 to 5 percent of overall community emissions. As a minor contributor to total emissions, actions to reduce municipal energy use may have a limited impact on Sitka's overall community emissions levels. However, municipal action has symbolic value and demonstrates leadership that extends beyond the magnitude of emissions actually reduced.

**Table 3. Sitka's Municipal Emissions Summary 2003**

| | Equivalent CO2 (Tons) | Equivalent CO2 (%) | Cost ($) |
|---|---|---|---|
| **Buildings- Electricity** | 66 | 1.77% | 671,990 |
| **Buildings- Heating Oil** | 2,981 | 79.86% | 302,393 |
| **Vehicle Fleet- Diesel** | 105 | 2.81% | 14,461 |
| **Vehicle Fleet-Gasoline** | 445 | 11.92% | 63,002 |
| **Employee Commute- Diesel** | 9 | 0.24% | |
| **Employee Commute- Gasoline** | 111 | 2.97% | |
| **Streetlights-Electricity** | 7 | 0.19% | 103,504 |
| **Water/Sewage-Electricity** | 9 | 0.24% | 86,311 |
| **Waste-** | -600 | 0.00% | |
| **Total (Waste not Included)** | 3,733 | 100% | 1,241,661 |

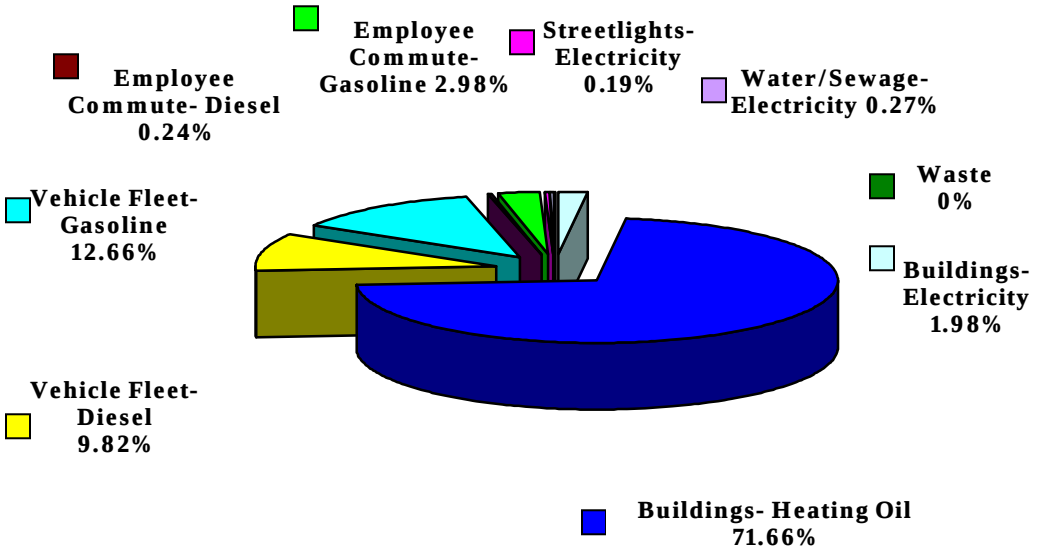



In 2006, Sitka's municipal operations emitted approximately 3728 tons of eCO2. The sector and source breakdown are shown in table 4 and figure 7.

**Table 4. Sitka's Municipal Emissions Summary 2006**

| | Equivalent CO2 (Tons) | Equivalent CO2 (%) | Cost ($) |
|---|---|---|---|
| **Buildings- Electricity** | 74 | 1.98% | 696,450 |
| **Buildings- Heating Oil** | 2679 | 71.66% | 580,250 |
| **Vehicle Fleet- Diesel** | 366 | 9.82% | 47,683 |
| **Vehicle Fleet-Gasoline** | 472 | 12.66% | 118,139 |
| **Employee Commute- Diesel** | 9 | 0.24% | |
| **Employee Commute- Gasoline** | 111 | 2.98% | |
| **Streetlights-Electricity** | 7 | 0.19% | 105,159 |
| **Water/Sewage-Electricity** | 10 | 0.27% | 99,687 |
| **Waste-** | -600 | 0.00% | |
| **Total (Waste not Included)** | 3728 | 100% | 1,647,368 |

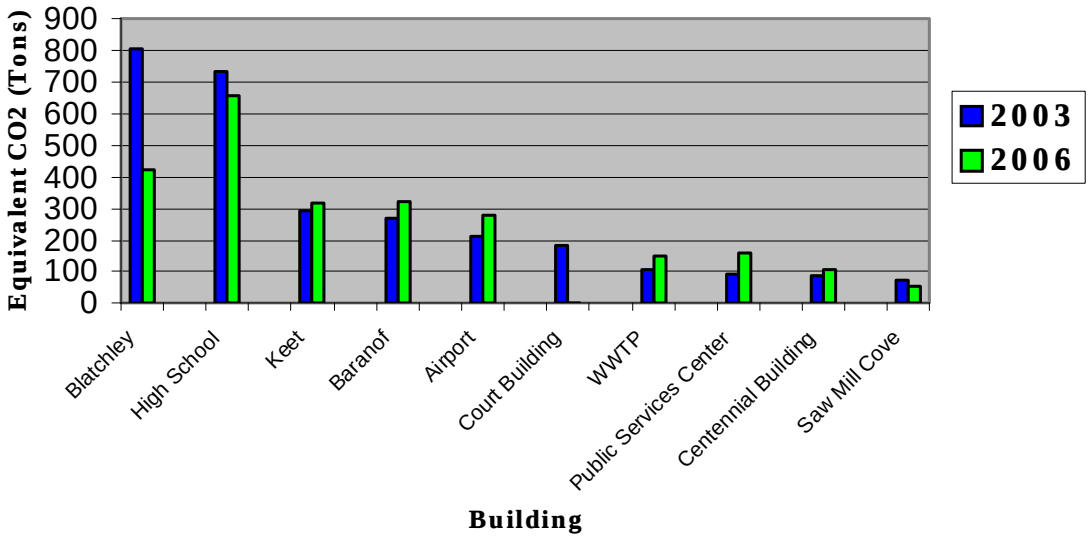
**Figure 7. Sitka Municipal Operations Greenhouse Gas Emissions 2006, Equivalent CO2 (%)**




Between 2003 and 2006 total emissions remained nearly the same, decreasing by 5 tons. While most sectors of municipal operations actually increased their total emissions in this time period, the Building sector, the largest municipal contributor of greenhouse gases, decreased its emissions by 294 tons, leading to a

decrease in the net-total of city emissions. Figure 8 shows the 10 greatest emissions contributors among city buildings for 2003 and 2006. While most buildings maintained similar energy consumption patterns between the baseline and intermediate years, some showed significant changes. Blatchley Middle School decreased total emissions by 385 tons of eCO2. This is due to the fact that during this time period an electric boiler was installed at the school, allowing a decrease of annual heating oil use by 33,873 gallons. Additionally, the installation of an electric boiler at the court building decreased the facility's emissions to almost nothing.

**Figure 8. Sitka Municipal Facilities Greenhouse Gas Emissions 2003 & 2006**




# Greenhouse Gas Emissions Forecast and Reduction Targets

## Projection

Based on the community and municipal operations emissions inventories developed for Sitka for the base year 2003, the next step was to forecast future emissions generated in our community. In 2020 we can expect to produce 93,513 tons of eCO2 in a business-as-usual scenario, meaning that that is the prediction of 2020 emissions if no climate change mitigation measures are taken. This actually represents a decrease of 588 tons of eCO2 from 2003 levels. This can be explained by the fact that Sitka's population is expected to remain almost exactly the same between the baseline year and 2020 and because Road Transportation

emissions are expected to decrease slightly due to projected changes in average vehicle emissions factors.

### Potential Reduction Targets

The Climate Action Task Force, which will be formed in the fall of 2008, will be responsible for setting an emissions reduction target.

The Kyoto Protocol target of 7% below 1990 levels was the target the United States agreed to in principal at the 1997 United Nations Council of Parties meeting, but has yet to be ratified in Congress. Several European nations set similar goals and some have begun action towards meeting them. IPCC research suggests that we would need to achieve as much as an 80% reduction below 1990 levels by 2050 in order to reverse global warming and stabilize the climate.

**"IPCC research suggests that we would need to achieve as much as an 80% reduction below 1990 levels by 2050 in order to reverse global warming and stabilize the climate."**

Local factors that should be considered in selecting the target reduction percentage include estimation of the effects of implemented and planned programs and policies, an approximate assessment of future opportunities to reduce emissions, and targets adopted by peer communities. For example, Homer's Climate Action Plan, which was released in 2007, calls for a 20% reduction of their baseline greenhouse gas emissions by 2020. If Sitka were to set the same goal, we would need to decrease our annual emissions to approximately 73,000 tons eCO2 by 2020.

# Using Sitka's Greenhouse Gas Emissions Inventory

### The Climate Action Task Force

The Sitka Climate Action Task Force is scheduled to be formed and begin work on a Climate Action Plan by the end of the 2008 calendar year. Ideally, this task force will represent the diverse lifestyles and people who make up Sitka's community. The group will work over the course of several months to develop climate change mitigation efforts specific to Sitka's unique energy profile and circumstances.

The task force will consider emissions production across various sectors of the community (as reported by the inventory), as well as resources available and potential costs and co-benefits, to determine the most beneficial and feasible measures to reduce greenhouse gas emissions to achieve the reduction target by 2020. Additionally, The CACP Software can be used to calculate the expected and actual changes in greenhouse gas emissions against the 2003 community and municipal inventories. This will allow Sitka to measure and evaluate our progress as we approach the target year.

According to a 2005 survey of ICLEI member cities, communities who have developed Climate Action Plans have collectively reduced greenhouse gas emissions by 23 million tons, leading to $535 million in annual savings. Measures developed by the task force can also result in additional benefits aside from reductions in cost and greenhouse gas emissions. For example, efforts to decrease annual vehicle miles traveled can create a more walkable community, while switching to more efficient wood stoves can reduce particulate air pollutants.

By developing a Climate Action Plan that specifically addresses the priorities determined in the baseline emissions inventory, Sitka will be able to take steps to create a more sustainable community.

***Example Municipal Measure***
As seen in Figure 8, Sitka High School is one of the largest contributors to greenhouse gas emissions out of all municipal facilities. If it was decided to increase energy efficiency of this building by 25% by 2020, we could expect an annual reduction in greenhouse gas emissions of 182 tons of eCO2 and annual savings of $90,424, if electricity and heating oil costs remain at current levels ($0.09/kWh, $4.50/gallon). If detailed information on the actual changes to Sitka High School was included in the CACP software program, it could also determine how many years it would take to make up the initial costs of the measure implementations.

# Conclusion

Global climate change is a real and pressing phenomenon, and if we do not address it the consequences to our environment, lifestyles and even to our health will be severe. While this is a global problem, both the effects and causes can be found at home, therefore local communities must do their part. By reducing the amount of greenhouse gases emitted by its community, Sitka joins hundreds of other American cities in stemming the tide of global warming and the numerous threats associated with it. It will require both persistence and adaptability to make the necessary changes to our energy consumption patterns, but we *can* make them. **The time to act is now.**

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