



**GREENHOUSE GAS BASELINE
MUNICIPAL & COMMUNITY
2009 INVENTORY**



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Introduction to Climate Change

The Greenhouse Effect and Global Warming

The greenhouse effect is a natural warming process that is essential for life on Earth. When discussing the greenhouse effect it is important to identify the major chemical contributors; these gases (water vapor, carbon dioxide, methane, and nitrous oxide) are special because of their ability to absorb incoming (solar) and outgoing (infrared) radiation. The problem with the greenhouse effect lies within the quantities, absorption characteristics, and life-spans of these gases in the atmosphere.

Water vapor being the most abundant greenhouse gas (GHG) in the atmosphere is a strong absorber but also has the shortest life-span so its long term global warming effects are negligible.

Carbon dioxide, methane, and nitrous oxide on the other hand are much larger contributors to global warming, because of their strong absorption properties, long life-spans, and increasing concentrations since the dawn of the Industrial Revolution (1750).

As these gas concentrations continue to increase so does the amount of energy absorbed by the atmosphere. This increase in absorbed energy increases the average global temperature, I know what you are thinking warmer weather in Washington sounds like a great idea but there are consequences for even the slightest warming. Small changes in average temperature cause undesirable climate effects for the Northwest.

(Source: IPCC AR4 synthesis report Sec. 2.2 Drivers of climate change)

Climate Change in the Pacific Northwest (PNW)

To prevent misconceptions when addressing climate change in the Pacific Northwest (PNW), it is important to acknowledge the impacts of both **natural** weather variability and **human-caused** climate change ('global warming') on PNW resources. The following summary of impacts was compiled by the University of Washington's Climate Impacts Group, based on extensive scientific research and modeling.

Natural Variable Climate Impacts

Weather changes from day to day, creating large and small impacts on our natural habitat. Changes, such as in precipitation and temperature, may be subtle or they may have noticeable impacts on the region's mountain snowpack, river flows and flooding, the likelihood of summer droughts, forest productivity, forest fire risk, salmon abundance, and quality of coastal and near-shore habitat.

Potential & Existing Human-caused Climate Change Impacts on PNW Resources

Water

- Decreased mountain snowpack
- Earlier snowmelt
- Higher winter stream flow in rivers that depend on snowmelt
- Higher winter stream flow in rain-fed river basins if winter precipitation increases in the future as projected
- Lower summer stream flow in rivers that depend on snowmelt (most rivers in the PNW)
- Earlier peak (spring) stream flow in rivers that depend on snowmelt (most rivers in the PNW)
- Decreased water for irrigation, fish, and summertime hydropower production
- Increased conflict over water
- Increased urban demand for water

Salmon

- Increasing winter floods that can wash-out egg clusters
- decreased summer stream flow
- increased water temperature
- decreased available habitat and food supply

Forests

- Seedling regeneration may be altered by:
 - Increase in high snow forests
 - Decrease in dry forests
- Tree growth may be affected by
 - Increase in high snow forests
 - Decrease in dry (east-side) forests
- Increases in forest fires
- Overall, the PNW is likely to see increased forest growth region-wide over the next few decades followed by decreased forest growth as temperatures increase and overwhelm the ability of trees to make use of higher winter precipitation and higher carbon dioxide.
- Potential for extinction of local populations and loss of biological diversity if environmental shifts outpace species migration and adaptation rates and interact negatively with population dynamics.

Coastline

- Increased coastal erosion and beach loss due to rising sea levels
- Increased landslides due to increased winter rainfall
- Permanent inundation, especially in south Puget Sound around Olympia
- Increased coastal flooding due to sea level rise and increased winter stream flow from interior and coastal watersheds

Shoreline's Commitment to Climate Protection

About Shoreline

The City of Shoreline stretches north from Seattle's city line to Snohomish County and from the east shore of Puget Sound to the City of Lake Forest Park. It has 3.4 miles of shoreline, with 330 acres of park land/open space inside its 12.3 square miles of area. With a population of 54,580, Shoreline is Washington's 15th largest city. It is primarily residential with more than 70 percent of the households being single-family residences. Over the years, the Shoreline community has been known for its numerous parks, strong neighborhoods, large backyards, trees and excellent schools.

US Mayor's Climate Protection Agreement

To help protect Shoreline's community and natural environment, the City Council authorized Mayor Robert Ransom to sign the U.S. Mayors Climate Protection Agreement, City Resolution No. 242, on April 24, 2006.

RESOLUTION NO. 242

A RESOLUTION OF THE CITY OF SHORELINE, WASHINGTON, AUTHORIZING SUPPORT FOR THE U.S. CONFERENCE OF MAYORS CLIMATE PROTECTION AGREEMENT

WHEREAS, the 73rd Annual U.S. Conference of Mayors amended and endorsed the U.S. Mayors Climate Protection Agreement which reads:

Mayors Climate Protection Agreement

- A. We urge the federal government and state governments to enact policies and programs to meet or beat the target of reducing global warming pollution levels to 7 percent below 1990 levels by 2012, including efforts to reduce the United States' dependence on fossil fuels and accelerate the development of clean, economical energy resources and fuel-efficient technologies such as conservation, methane recovery for energy generation, waste to energy, wind and solar energy, fuel cells, efficient motor vehicles, and biofuels; and
- B. We urge the U.S. Congress to pass bipartisan greenhouse gas reduction legislation that includes 1) clear timetables and emissions limits and 2) a flexible, market-based system of tradable allowances among emitting industries; and
- C. We will strive to meet or exceed Kyoto Protocol targets for reducing global warming pollution by taking actions in our own operations and communities such as:
 - 1) Inventory global warming emissions in City operations and in the community, set reduction targets and create and action plan;
 - 2) Adopt and enforce land-use policies that reduce sprawl, preserve open space, and create compact, walkable urban communities;
 - 3) Promote transportation options such as bicycle trails, commute trip reduction programs;

- 4) Increase the use of clean, alternative energy by, for example investing in “green tags” advocating for the development of renewable energy resources, recovering land fill methane for energy production, and supporting the use of waste to energy technology;
- 5) Make energy efficiency a priority through building code improvements, retrofitting city facilities with energy efficient lighting and urging employees to conserve energy and save money;
- 6) Purchase only Energy Star equipment and appliances for City use;
- 7) Practice and promote sustainable building practices using the U.S. Green Building Council’s LEED program or a similar system;
- 8) Increase the average fuel efficiency of municipal fleet vehicles; reduce the number of vehicles; launch an employee education program including anti-idling messages; convert diesel vehicles to bio-diesel;
- 9) Evaluate opportunities to increase pump efficiency in water and wastewater systems; recover wastewater treatment methane for energy production;
- 10) Increase recycling rates in City operation and in the community;
- 11) Maintain healthy urban forests; promote tree planting to increase shading and to absorb CO₂; and
- 12) Help educate the public, schools, other jurisdictions, professional associations, business and industry and about reducing global warming pollution.

WHEREAS, the City Council supports the three proposals of the Mayors Protection Agreement including suggested local measures to promote energy efficiency and reduce harmful emissions that are feasible and cost effective for Shoreline; now therefore

BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF SHORELINE, WASHINGTON:

That the Mayor is authorized to execute on behalf of the City Council a statement of support for the U.S. Mayors Climate Protection Agreement and the City Clerk shall file the statement with officials coordinating support on behalf of the U.S. Conference of Mayors.

City Council Goal

From 2007 through 2009, the City Council further supported climate protection initiatives through one of its own goals, i.e. to ‘create a sustainable community.’

ICLEI Membership

To comply with the proposed reductions of the Mayors Climate Protection Agreement, the City of Shoreline partnered with ICLEI (International Council for Local Environmental Initiatives) since 2007.

ICLEI is an international membership association of local governments dedicated to climate protection and sustainable development. It is currently known as ICLEI-Local Governments for Sustainability. In the U.S., there are more than 600 cities, towns and

counties working with ICEI to reduce GHGs and to create sustainable communities. Locally, more than 30 Washington jurisdictions, such as: Edmonds, Kirkland, Seattle, Snohomish County and Shoreline belong to ICLEI.

ICLEI's 5 Milestones

To assist jurisdictions develop benchmarks that result in the implementation of an effective Climate Action Plan, the following 5 Milestones were developed:

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

Shoreline's Baseline Inventory

Municipal Inventory

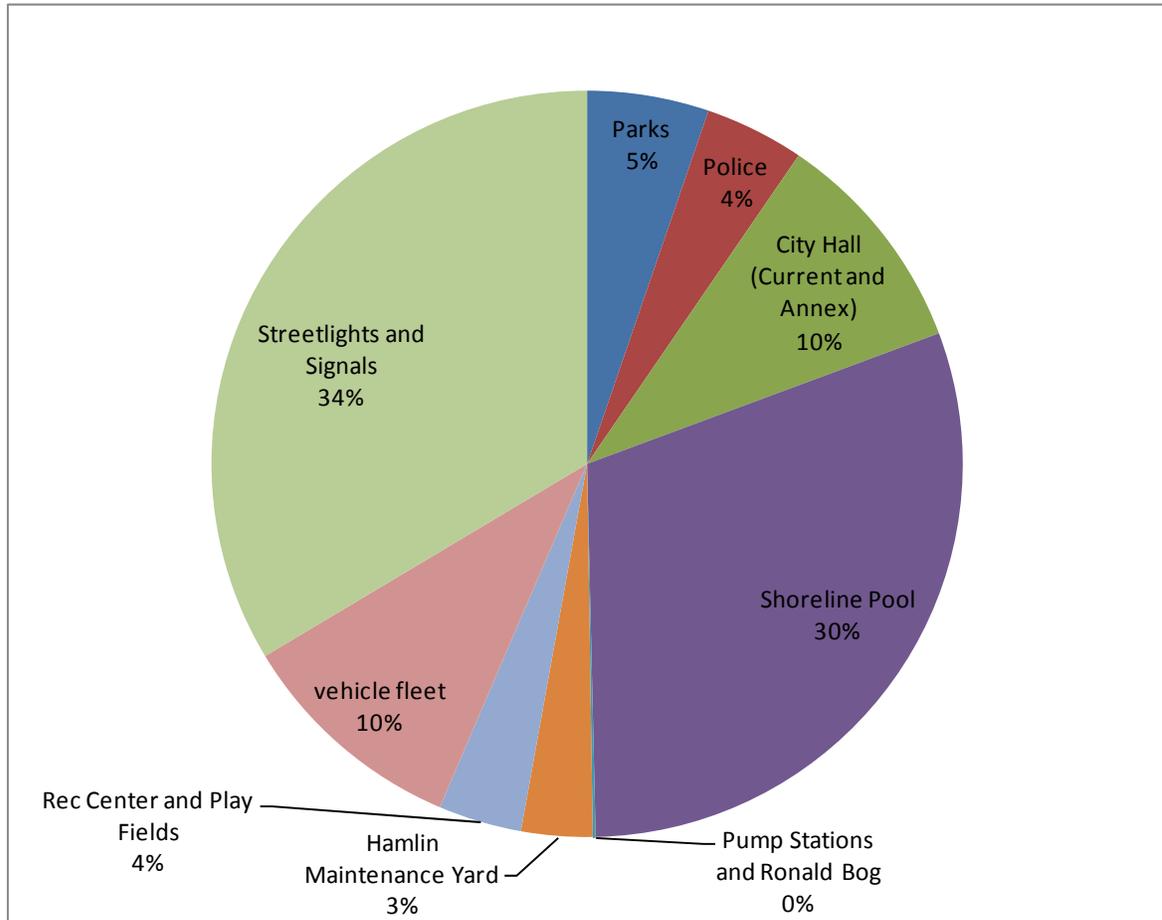
GHG emissions are created when the City performs operation and maintenance activities for the following nine sectors: the City Hall, Parks, Police, Shoreline Pool, Richmond Highlands Recreation Center/Recreational Fields, Hamlin Maintenance Yard, Municipal Vehicle Fleet, Streetlights/Signals, and Ronald Bog/Pump Stations.

Based on the data and calculations from 2009, each sector was ranked according to CO₂e units (see table 2.1). CO₂e describes the amount of CO₂ that a GHG that would have to have, in order to create the same global warming potential as CO₂. CO₂e allows GHGs to be compared according to their global warming potential over a specified period of time, often 100 years.

Table 1. Municipal Usages and GHG Emissions (2009)

| Government Operations | Electricity (kWh) | Natural Gas (therms) | Fuel (gal) | Cost (\$) | CO₂e (tons) |
|-------------------------------|------------------------------|---------------------------------|-----------------------|----------------------|-----------------------------------|
| Streetlights and Signals | 1,828,774 | 0 | 0 | \$308,229 | 831 |
| Shoreline Pool | 443,360 | 93,481 | 0 | \$119,527 | 750 |
| Vehicle Fleet | 0 | 0 | 20,182 | \$43,588 | 247 |
| City Hall (Current and Annex) | 534,216 | 0 | 0 | \$31,779 | 242 |
| Parks | 287,548 | 0 | 0 | \$18,992 | 130 |
| Police | 163,414 | 5,539 | 0 | \$17,860 | 106 |
| Rec Center and Play Fields | 140,369 | 4,192 | 0 | \$15,080 | 89 |
| Hamlin Maintenance Yard | 166,877 | 0 | 0 | \$10,626 | 76 |
| Pump Stations/Ronald Bog | 2,518 | 0 | 0 | \$778 | 3 |
| Total | 3,567,086 | 103,212 | 20,182 | \$566,459 | 2,474 |

Figure 1. Percentage Municipal CO₂e Emissions (2009)



Recommendations

- Streetlights & Signals:** Upgrade to LED lighting
- Shoreline Pool:** Upgrade facilities or reduce hours of operation
- Vehicle Fleet:** Upgrade to fuel efficient vehicles
- City Hall:** New facility upgraded to LEED-Gold certified
- All facilities:** Continue to monitor facilities and operations for efficiencies

Community Inventory

When reviewing the GHG emissions for the residential and commercial sectors in Shoreline's community, it is important to compare the size of each sector to the amount of emissions. The community is roughly comprised of 90% residential, single and multi-family homes; 10% commercial; and less than 1% industrial.

The residential sector, which also represents the largest proportion in the community, is responsible for 62% of the total CO₂e emitted. The commercial sector is small, but responsible for 23% of the total CO₂e. The industrial sector is minuscule in size, and contributes 6% of the CO₂e. (See Tables 2, 3, and 4 and Figure 2.)

Table 2. Community Usages and CO₂e Emissions (2009)

| Community | Electricity (kWh) | Natural Gas (therms) | Fuel Oil (gal) | Waste (tons) | Total CO ₂ e (tons) |
|---------------------------------------|-------------------|----------------------|----------------|--------------|--------------------------------|
| Residential (single and multi-family) | 295,181,454 | 9,419,961 | 292,000 | 11,894 | 195,488 |
| Commercial | 86,788,275 | 5,126,690 | 0 | 11,401 | 72,292 |
| Industrial | 16,136,697 | 2,313,406 | 0 | 0 | 20,874 |
| Total | 398,106,426 | 16,860,057 | 292,000 | 23,295 | 288,654 |

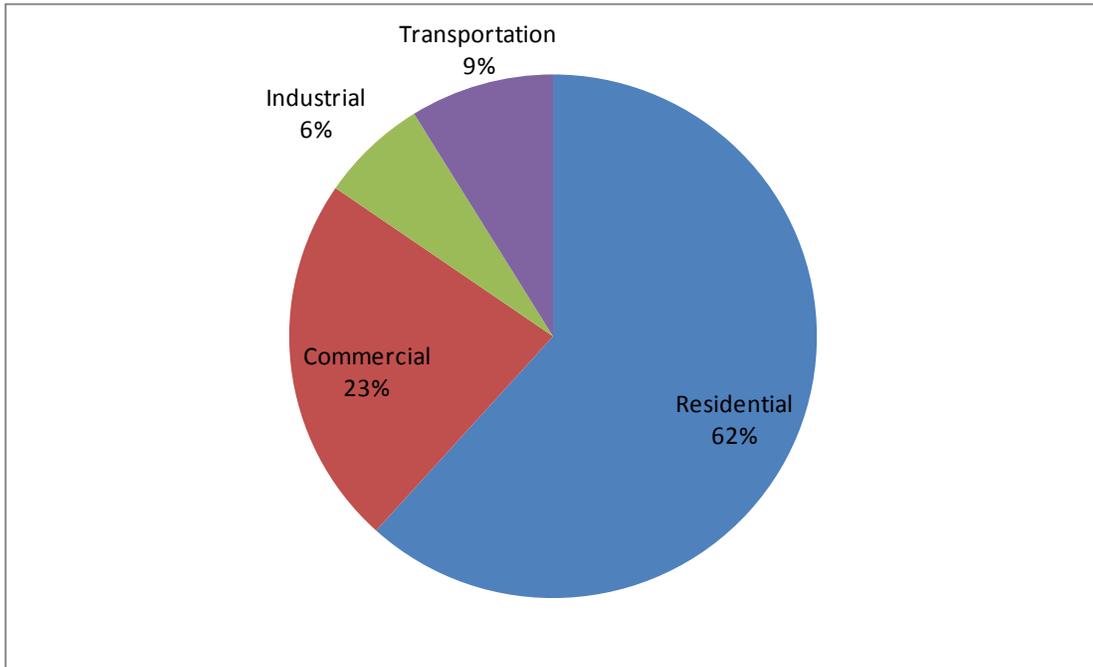
Table 3. Community CO₂e Emissions (2009)

| Community CO ₂ e | Electricity CO ₂ e (tons) | Natural Gas CO ₂ e (tons) | Fuel Oil CO ₂ e (tons) | Waste CO ₂ e (tons) | Total CO ₂ e (tons) |
|---------------------------------------|--------------------------------------|--------------------------------------|-----------------------------------|--------------------------------|--------------------------------|
| Residential (Single and Multi-family) | 134,081 | 55,237 | 3,284 | 2,885 | 195,487 |
| Commercial | 39,422 | 30,062 | 0 | 2,808 | 72,292 |
| Industrial | 7,330 | 13,544 | 0 | | 20,874 |
| Total | 180,833 | 98,843 | 3,284 | 5,693 | 288,653 |

Table 4. Community Transportation and CO₂e Emissions (2009)

| Community | Vehicle Miles Traveled | Gasoline CO ₂ e (tons) | Diesel CO ₂ e (tons) | Total CO ₂ e (tons) |
|----------------|------------------------|-----------------------------------|---------------------------------|--------------------------------|
| Transportation | 43,413,025 | 23,497 | 4,566 | 28,063 |

Figure 2. Community CO2e Emissions (2009)



Recommendations

- Electrical Usage:** Provide incentives and education of more efficient practices, e.g. SustainableWorks 2011 audits and retrofit projects in the Shoreline community
- Natural Gas:** Encourage upgrading to new, more efficient systems
- Transportation:** Motivate use of bus use, car pools, biking and walking