Juneau Climate Action & Implementation Plan

November 2011

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CITY & BOROUGH OF JUNEAU
ALASKA'S CAPITAL CITY

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Table of Contents

Executive Summary i
Part 1 Background & Emissions Inventory ii
1.1 Introduction 3
1.1.1 Juneau's Commitment to Reducing Greenhouse Gas Emissions 4
1.1.2 Energy Production and Consumption in Juneau 5
1.1.3 Greenhouse Gas Dynamics 6
1.2 Plan Development 7
1.2.1 Government Oversight 7
1.2.2 Public Outreach and Involvement 7
1.2.3 Formal Public Review 8
1.3 Juneau Greenhouse Gas Emissions Inventories 10
1.3.1 Overview of 2007 and 2010 Inventories 10
1.3.2 Juneau's Energy Sources, 2010 11
1.3.3 Juneau Community Energy Use and Emissions, 2010 11
1.3.4 CBJ Energy Use and Emissions, 2010 12
1.3.5 GHG and Energy Use Comparison, 2007 and 2010 13
Part 2 Setting Emissions Targets 1
2.1 Reduction Targets 17
2.1.1 Juneau's 2007 Reduction Targets 17
2.1.2 Emissions Reduction Targets in Other Jurisdictions 17
2.1.3 Setting New Targets for Juneau 18
2.1.4 Future Targets and Ongoing Review 20
Part 3 Actions & Implementation 21
3.1 Introduction to Implementation 23
3.1.1 How to Use this Plan 23
3.1.2 Estimates of Potential GHG Reductions 23
3.1.3 Cost of Implementation 23
3.1.4 Top Actions 24
3.2 Buildings 27
3.3 Transportation and Land Use 36
3.4 Utilities 47
3.5 Mining and Non-Highway Equipment 56

3.6 Renewable Energy and Alternative Systems 59
3.7 Food Production 62
3.8 CBJ Staffing 64
References 65
Appendix 1 – List of Meetings 67
Appendix 2 – Building Code Information 68
Appendix 3 – Public Input 71

Executive Summary

The objective of the Juneau Climate Action Plan is to lower Juneau's greenhouse gas (GHG) emissions by decreasing area wide consumption of energy in general and fossil fuels in particular. This Plan, which includes a 2010 inventory of local energy use and GHG emissions, sets new emissions reduction targets and suggests actions that government, businesses, and the community can take to meet these targets. Every individual in Juneau stands to benefit from cost savings that flow from energy conservation and reductions in fossil fuel consumption.

Juneau currently benefits from widespread use of clean hydropower for electricity. In general, hydropower provides fairly economical energy while limiting GHG emissions. However, even with the recent addition of the Lake Dorothy hydroelectric facility, Juneau's hydropower supply remains limited. The community's challenge is to use its clean energy wisely in order to stretch existing hydroelectric capacity as far as possible, limiting the need to use back-up diesel generators.

GHG emission and energy use inventories for Juneau completed for 2007 and 2010 provide both a snapshot of annual conditions and a baseline for setting reduction targets. The table below shows that overall community energy use (measured in million British thermal units, MMBtu) decreased 13% and GHG emissions declined 10% between 2007 and 2010. Although this is good news, when comparing snapshots of energy use and GHG emissions from two nonconsecutive years, it is important to keep in mind variables, such as weather and economics, that may have influenced use and emissions in each of the two years but that may not necessarily show a trend of altered patterns over time.

JUNEAU'S TOTAL ENERGY USE AND GHG EMISSIONS 2007 & 2010

	2007	2010	% Change
Energy Use (MMBtu)	7,212,181	6,249,370	-13%
GHG Emissions ($MTCO_2e$)	440,545	396,747	-10%

Based on population forecasts, Juneau's energy use and GHG emissions will continue to climb. To avoid this, a 25% community-wide emissions reduction target to be achieved by the year 2032 is recommended. This target is in line with emission reduction targets set in other jurisdictions and, given the implementation strategies set out in this Plan, is achievable for Juneau.

In order to meet the emission reduction target of 25% by 2032, a combination of the actions recommended in this Plan will need to be accomplished. Adopting this Plan does not mean that the CBJ commits to completing all actions, rather that it commits to working towards the GHG

emission reduction targets set in Part 2. The CBJ, the state and federal governments, and business and homeowners will select actions to complete based on an analysis of cost effectiveness, available technology, and potential emissions reduction. In 2011, when the Plan was adopted, the CBJ was facing a budget shortfall of $7 million and it is important that this Plan not commit the CBJ to funding new capital projects.

As a summary, the top actions for the community and the CBJ are listed below. This list is not prioritized or exhaustive, but rather includes the actions which can be completed in the next five years and will have the greatest impact in reducing energy use and GHG emissions in Juneau.

Top Actions

- Support existing state and federal weatherization programs for homes and public buildings. As of the end of 2010, 455 Juneau home owners had completed the Alaska Housing and Finance Corporation Home Energy Rebate Program and 607 home owners were working on energy retrofits. On average, homes completed see a reduction in energy use of 12,000 pounds CO_2 per year. The State has allocated $37.5 million to fund the rebate program for the 2011-2012 fiscal year and will be considering long-term funding in the next legislative session.

  The Alaska Energy Revolving Loan Fund is a state program that funds retrofits to schools and state, municipal, and UAS buildings. Savings from energy efficiency upgrades are used to repay the loan.

  Provide new local programs for weatherization, energy efficient upgrades, and new renewable energy systems for commercial, rental housing, or multi-family buildings.

  Examples are:

  - Energy efficiency rebate for commercial, rental, non-profit, and industrial buildings. (Montgomery County Maryland will pay for 50% of approved energy efficiency upgrades up to a set maximum).
  - Property tax exemptions. (The Town of Bedford, New Hampshire has property tax exemptions for the installation of renewable energy systems; the assessed value of the home would remain the same after improvements are made).

- Update the local building code to increase energy efficiency requirements for all new commercial and residential buildings. Currently the CBJ is enforcing the requirements of the 2006 International Residential Code. Adopting the 2012 IECC code would lead to an estimated 30% reduction in energy use in new buildings and could be applied to both residential and commercial structures (Marquam George, Personal Communication October 20, 2011).

The 2012 IECC includes new requirements for doors, windows, skylights, HVAC systems, insulation, and better air sealing. The 2012 code also requires more thorough testing of the performance of finished buildings. For a 2,400 square foot two-storey house it is estimated that the additional cost to meet these standards would be $6,000. The annual energy savings would be approximately $400 based on current electrical rates, giving a 15-year return on investment (Marquam George, Personal Communication October 20, 2011. See Appendix 2).

- Encourage federal, state, and local government agencies to conserve energy and increase energy efficiency in buildings and operations, share information and expertise on weatherization, energy efficient technology, and take a leadership role in reducing local energy use.

  Currently, each level of government has been working to decrease energy used for buildings and operations:

  - The Federal government is aiming to reduce GHG emissions from federal operations by 28% by 2020. Examples of Juneau projects include the USCG windmill at the subport and seawater heat pump and windmill at the NOAA Ted Stevens Laboratory.
  - The Alaska Legislature passed HB 306 last session, which sets standards for all new buildings over 10,000 sq. ft. and requires that 25% of state buildings undergo energy efficiency retrofits by 2020.
  - The CBJ adopted Ordinance 2010-42 requiring new buildings costing over $5,000,000 meet LEED certification. The CBJ has also completed energy audits on the water and waste water systems, Centennial Hall, and the Augustus Brown Swimming Pool.

  Additional actions for CBJ include:

  - Holding regular meetings that bring together private business, university, federal, state and local agency personnel working on energy efficiency and renewable energy systems to share information and expertise and to find areas for collaboration.
  - Requiring the completion of life cycle energy audits and cost analyses prior to retrofitting CBJ buildings.
  - Implementing recommended retrofits and improvements to CBJ buildings identified through energy audits.

- Partner with the University and non-profits to develop local professional expertise in weatherization, energy efficient systems, and new energy saving technology by providing opportunities for CBJ personnel and contractors to receive installation and maintenance training. This expertise is needed to support the operation of new energy efficient systems and could be a growth sector for the community. Multi-agency collaboration on training could lead to additional funding opportunities.

- Support energy efficiency and renewable energy pilot projects in Juneau. These projects will gather good Juneau-specific data on new and changing technologies such as solar, wind, and geothermal, in order to be better prepared for the economics of tomorrow. These projects could have an educational component and be associated with local schools where data is gathered on the effectiveness of various technologies in Juneau.

- Inform residents of existing incentives for and energy cost savings related to energy efficient vehicles. Provide local incentives for the purchase of fuel efficient vehicles. The current average overall fuel efficiency for vehicles on the road is 20 mpg. Incentives could be put in place for vehicles that meet target fuel efficiency (such as greater than 40 mpg).

  Examples of existing local programs are:

  - Free parking for hybrid electric vehicles (Los Angeles).
  - Rebate for purchase of new hybrid electric vehicle (City of Riverside, CA).
  - Exemption from local sales tax for purchase of new fuel efficient vehicle (many communities).

- Evaluate the assembly-adopted 2008 Transit Development Plan to determine which actions will garner the greatest reductions in GHG emissions and energy use. The plan recommends that CBJ consider limiting future fleet purchases to alternative fuel vehicles such as hybrid-electric vehicles. Consider, for example, adding a hybrid-electric bus for the downtown circular loop.

- Improve the Cross-Juneau Bikeway as described in the assembly-adopted 2009 Juneau Non-Motorized Transportation Plan. This involves bringing each route segment up to standard; adding consistent signage and producing a route map for visitors and residents; making the route a priority for year round maintenance, sweeping, and snow removal; and in the long term developing a separated path from Sunny Point to Vanderbilt Hill to bypass Lemon Creek.

- Coordinate with the Juneau Commission on Sustainability and the CBJ Green Team to implement a public outreach and education campaign. Educate local businesses and homeowners on the potential benefits and energy savings from energy conservation and upgrading to more energy efficient systems. Develop a website that provides information on energy conservation and energy efficiency and connects residents and business owners to local services and expertise. Institute an annual award program that recognizes local businesses and individuals who help further the goals of the Climate Action Plan.

- Allocate CBJ staff and resources to implement the Climate Action Plan. Given current budget constraints, tasks could be assigned to several existing CBJ staff, the Juneau Commission on Sustainability, and the CBJ Green Team. When economic conditions change and the CBJ budget allows, an Energy Manager could be hired to provide leadership on energy conservation and GHG reductions. The savings that would result from increased energy efficiency in CBJ buildings and operations could defray or fully cover the cost of the position.

- Develop an Energy Plan for Juneau. This plan would identify and evaluate the technical and economic feasibility of renewable energy sources (including hydroelectric, biomass, solar, tidal, and wind) that will be available to meet the community's future need. The Energy Plan will need to be flexible enough to respond to changing conditions and will need to examine the full range of renewable energy options and the relative costs. Completion of an Energy Plan would require input from other levels of government and the private sector.

Part 1

Background & Emissions Inventory

1.1 Introduction

The objective of the Juneau 2012 Climate Action Plan is to lower Juneau's greenhouse gas (GHG) emissions by decreasing area wide consumption of energy in general and fossil fuels in particular. The following plan, which includes a 2010 inventory of local energy use and GHG emissions, sets new emissions reduction targets and suggests actions that government, businesses, and the community can take to meet these targets. Evidence gathered in the two Juneau GHG emissions inventories performed to date, for 2007 and 2010, tell us that, as a general rule, measures taken to reduce GHG emissions lead to reduced energy costs, and measures taken to reduce energy costs lead to reduced GHG emissions. Therefore, by meeting some or all of the emissions reduction targets set out in this Plan, not only will Juneau reduce its contribution to the global problem of GHG emissions, but families, businesses, and government agencies will benefit from lowered energy costs.

This Plan focuses on conserving energy to reduce energy costs and decrease GHG emissions. Continued uncertainty surrounding oil prices and supply make reducing the community's dependence on fossil fuels especially important. By conserving energy, increasing the use of sustainable transportation modes, constructing and retrofitting buildings for increased energy efficiency, expanding recycling, and consuming more locally harvested food, Juneau stands to become a more self-sufficient community. In addition, new jobs will be created, more money will be retained in the local economy, quality of life will improve, and local government, businesses, and individual households will enjoy energy cost savings. Notwithstanding individual views on issues such as global warming, the importance of clean energy, or the need for Juneau to reduce the size of its "carbon footprint," every individual in Juneau stands to benefit from cost savings that flow from energy conservation and reductions in fossil fuel consumption.

Juneau currently benefits from widespread use of clean hydropower for electricity. In general, hydropower provides fairly economical energy while limiting GHG emissions. However, even with the recent addition of the Lake Dorothy hydroelectric facility, Juneau's hydropower supply remains limited.[1] The community's challenge, therefore, is to use its clean energy wisely in order to stretch existing hydroelectric capacity as far as possible, limiting the need to use back-up diesel generators. These generators, deployed in times of low power plant reservoir levels and during power supply emergencies, are not only expensive and inefficient but emit high quantities of GHGs.

To abate the fluctuating and increasing costs of burning home heating oil, many consumers in Juneau are switching from systems that use fossil fuel to systems that use electricity. Currently, demand from "non-firm" (e.g. dual-fuel facilities, Greens Creek mine, and cruise ships) customers can use all electricity not used by the community's regular users. In an effort to keep electricity demand from outpacing generation capacity, the Juneau Climate Action Plan includes

[1] Energy capability in Juneau depends on precipitation. In a very dry year, energy capability is 357 gigawatt-hours per year (GWh); in an average year, energy capability is 420 GWh per year; in the wettest years, energy capability is 518 GWh per year. In 2010, total GWh consumed was 396; had there been additional energy produced, it could have been used by non-firm customers. . Personal communication, Scott Willis, May 2011.

recommendations aimed at conserving energy, increasing overall energy efficiency, and reducing fossil fuel use.

Several studies have found that the implementation of strategies to conserve energy use, such as increasing public transit ridership, weatherizing homes, and upgrading to more efficient appliances and heating systems, has a positive impact on local economies. Making appliances and buildings more energy efficient has saved California businesses and residents an estimated $56 billion over the past 30 years, and the California Energy Commission projects an additional $23 billion will be saved by 2013 (California Green Innovation Index, 2008). Expanded public transit and updated land use policies have resulted in 20% fewer miles traveled by car each day in Portland, Oregon's metro region and approximately $2.6 billion in savings per year (Portland's Green Dividend, 2007).

Juneau has ample opportunity both to decrease our GHG emissions and increase our ability to meet our energy needs for heat, lighting, transportation, and communications by investing in energy conservation and efficiency. This Climate Action Plan sets out an array of strategies and actions for Juneau to undertake to meet clean energy goals while increasing community security and self-sufficiency. By implementing this Plan, Juneau can become a model of energy efficiency and save money in the process. The Climate Action Plan is for use by individuals, companies, institutions, nonprofit organizations, planners, elected officials and other decision makers, and citizens' committees and boards concerned with local economic growth and resource management, environmental health, and global security.

1.1.1 Juneau's Commitment to Reducing Greenhouse Gas Emissions

Since 2007, when the Assembly passed Resolution 2397, which made the Borough a full member of the International Council for Local Environmental Initiatives (ICLEI) and a participant in the Cities for Climate Protection Campaign, local government has been actively committed to reducing GHG emissions. Juneau joined over 1,200 local governments worldwide pledging to complete ICLEI's five-milestone process to combat climate change by

1. conducting a baseline emissions inventory and forecast;
2. adopting an emissions target;
3. developing a climate action plan for reducing emissions;
4. implementing policies and measures; and
5. monitoring and verifying results.

With the completion of its 2007 GHG Emissions Inventory, Juneau passed the first ICLEI milestone. By estimating the emissions from all activities within borough boundaries, both emissions generated by government facilities and operations and those produced by the community, the 2007 emissions inventory established the CBJ's baseline for setting GHG reduction targets.

In November 2009, the Assembly passed the second ICLEI milestone by adopting a resolution that established GHG reduction goals. For government facilities and operations, the goal was

set at a 1% reduction in emissions by 2012. The goal for community-wide GHG reduction was 20% by 2012, with the understanding that most of this goal would be met by the extension of electricity to Greens Creek Mine.

The 2012 Juneau Climate Action Plan proposes new targets for GHG reductions that, if adopted and implemented, will ensure the CBJ reaches the third and fourth ICLEI milestones.

Since launching this effort to reduce GHG emissions, the CBJ has added ground source heat pumps at the airport and at its new aquatic center, thereby reducing fossil fuel consumption at both of these major facilities. A better-insulated roof and new windows have been installed at the Juneau Arts and Culture Center, and electrical power has been extended to the Eaglecrest Ski Area, reducing that facility's need to run diesel generators. In addition, the CBJ Assembly has adopted the 2008 Comprehensive Plan, the 2008 Capital Transit Development Plan, and 2009 Non-Motorized Transportation Plan, each of which includes policies and actions that will help the CBJ reduce GHG emissions while meeting other goals.

Recent Energy Conservation and Efficiency Projects

- CBJ airport and pool geothermal
- USCG wind turbine
- NOAA seawater heat pump
- Alaskan Brewery CO_2 recovery system
- Juneau School District energy reduction program
- AEL&P energy efficient lighting

Recently, several other projects that reduce GHG emissions have been completed in the community by non-municipal government entities, including a wind generator at the U.S. Coast Guard station, Sealaska's installation of a wood pellet boiler to heat its downtown office building, and the seawater heat pump system installed at the Ted Stevens Marine Research Institute at Lena Point. The Juneau Economic Development Council is working with the Southeast Alaska Renewable Energy Seed Cluster Working Group to determine the conditions under which the Southeast Alaska renewable energy industry could develop, adding more jobs, wealth, and prosperity in the region.

1.1.2 Energy Production and Consumption in Juneau

In Juneau, energy is consumed for transportation (43%), buildings (40%), mining (12%), and powering various kinds of heavy equipment (5%). Energy is defined as "the capacity for doing work" and can come from renewable sources, such as wind, solar, or hydro, and nonrenewable sources, such as coal, gas, and oil. The burning of fossil fuels generates 75% of local energy used, mostly for transportation and home heating. Electricity, which powers most lighting, appliances, and some building heating systems, provides the remaining 25% of energy consumed in the borough.

The community's electricity is produced by the privately-owned Alaska Electric Light & Power Company (AEL&P), which generates power at two main hydroelectric facilities: Snettisham and Lake Dorothy.[2] Additional capacity is provided by smaller hydroelectric facilities at Gold Creek, Annex Creek, and Salmon Creek. Diesel generators at Auke Bay, Gold Creek, and Lemon

[2] AEL&P's current generating capacity (the amount of power that it can produce at any single moment in time) is 102 MW. Snettisham's capacity is 78.2 MW and Lake Dorothy's capacity is 14.3 MW. The utility's energy-producing capability (GWh) varies depending on the amount of water in each reservoir.

Creek provide back-up electricity during outages at the Snettisham or Lake Dorothy plants or along the transmission lines. Hydroelectric power generation produces limited GHG emissions compared to other methods of generation, is produced locally, and is charged to consumers at lower rates that are more stable than fossil fuel prices.

The first phase of the Lake Dorothy project, which was completed in 2009, boosted electric generation capacity in the area by 20%. The second phase, to be constructed sometime in the future as loads grow and funding allows, could supply an additional 15%. AEL&P's 14,500 customers consumed almost 400 million kilowatt-hours of electrical energy in 2010.

In late 2006, a transmission line connected the Hecla Greens Creek Mining Company ("Greens Creek mine") on Admiralty Island to the AEL&P power grid. The mine now purchases excess electrical power from AEL&P, reducing the mine's energy costs and GHG emissions. Because its ability to purchase electricity depends on there being an excess available, the mine must revert to diesel generators at times when water levels at the AEL&P facilities drop, eliminating the excess. Increased conservation of electricity by Juneau residents, business, and government would increase the amount of hydropower available for Greens Creek and other non-firm customers like cruise ships and reduce the use of diesel generators, thereby reducing the borough's greenhouse gas emissions.

1.1.3 Greenhouse Gas Dynamics

The earth is habitable because of a natural greenhouse effect brought about by water vapor and carbon dioxide and other atmospheric gases. Without this warming effect, the earth's temperature would be below zero Fahrenheit. Throughout earth's history, the climate has changed, regulated naturally by a combination of orbital forces, which determine how much sun hits the earth, and the total concentration of GHGs in the atmosphere.

The three most common GHGs are carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). With the rise of industrialism in the mid-1800s, human activity began altering the balance of gases in the atmosphere, primarily by emitting more carbon dioxide by burning fossil fuels. As a result, carbon dioxide has gone up over 35% since pre-industrial times. This changes the greenhouse effect and traps radiation that would otherwise escape to space, producing warming. The consequent warming has a variety of effects; not just increasing surface temperatures but also melting ice and changes in the hydrological cycle and rainfall. Since 1970, these effects have occurred to a degree far beyond the previous natural variability for global mean temperatures.

The global warming record shows an average warming of 1.3°F over the past century (EPA, 2009). According to the National Oceanic and Atmospheric Administration, seven of the eight warmest years on record since 1900 have occurred since 2001. Scientists predict the effects of climate change will be most pronounced in areas closest to the poles. Impacts, including coastal erosion, increased storms, retreating sea ice, and melting permafrost, are already being felt in many parts of Alaska. According to the Alaska Department of Transportation and Public Facilities, the state already spends $11 million per year to repair permafrost-affected roads and expects that costs will go up as the climate warms.

In 2007, Juneau Mayor Bruce Botelho convened a Scientific Panel on Climate Change to study potential effects of climate change on Juneau. The panel's report predicts climate change-related ecological impacts to the area's general ecology, including terrestrial vegetation and the marine environment, as well as to the Borough's infrastructure needs (CBJ, 2007).

1.2 Plan Development

1.2.1 Government Oversight

Project management for this Climate Action Plan was provided by the Deputy City Manager. The Juneau Commission on Sustainability, the CBJ government Green Team, a staff committee working on environmental issues, and representatives from the Community Development, Engineering, and Public Works departments provided input, information, and guidance throughout the process of preparing this Plan.

The Juneau Commission on Sustainability (JCOS), an assembly-appointed board, is charged with promoting the economic, social, environmental, and governmental well-being of Juneau and its inhabitants, now and in the future. The four-member GHG subcommittee of the JCOS provided direct and ongoing guidance throughout plan development. Work sessions were held with this group on January 27, February 10, February 28, March 14, March 28, April 11, April 26, May 17, and September 28, 2011, and all were open to the public. Sessions were held with the entire JCOS on March 2, April 6, July 6, and September 7, 2011. Members of the JCOS provided recommendations on the overall development of the Plan, strategies for public outreach, and specific actions to lower energy use and GHG emissions.

The Green Team, a committee of CBJ government staff, works on environmental issues arising from local government operations and activities. At meetings held with this group on February 16, April 20, and September 21, 2011, Green Team members provided input on both the overall Plan direction and specific goals and actions.

As CBJ staff will be responsible for implementing many of this Plan's recommendations, it has been important to work with each relevant department. Department heads were sent a copy of the GHG emissions inventory and asked to explain how changes in the department's buildings or operations may have led to changes in emissions and energy use between 2007 and 2010. In addition, individual meetings were held with representatives from Public Works, Engineering, Finance, and Community Development.

1.2.2 Public Outreach and Involvement

Reducing community GHG emissions will require that residents participate by, for example, buying more fuel-efficient vehicles, turning down thermostats, weatherizing homes, riding transit, and car pooling. The development of a plan and implementation actions that are practical and effective in Juneau requires input from community members.

Between February and May of 2011, 225 residents completed an online survey designed to gauge the public's attitudes about and participation in energy saving actions. As a self-selected set of the population, survey respondents were likely already interested in energy savings and GHG emission reductions.

Of the survey respondents,

- over 80% indicated that reducing household spending on electricity, heating oil, or gasoline is important or very important;
- virtually all have participated in one or more energy savings actions; most common actions included switching to energy efficient light bulbs and appliances, walking, biking, car-pooling, or taking the bus to work;
- more than 50% have reduced the amount of fuel used to heat their home or generate hot water since 2007;
- 33% have reduced the number of vehicle miles driven since 2007;
- 45% have participated in a state or federal program providing incentives for energy use reduction;
- when asked how to motivate people to reduce energy, heating fuel, or gasoline use, most suggested financial incentives such as rebates, tax breaks, low interest loans, and grants for energy reduction actions.

In an effort to gather specific information related to buildings and energy efficiency, two focus group meetings were held. The first group, which met on March 30, 2011, concentrated on methods to increase the energy efficiency of building enclosures; a second meeting, held on April 1, 2011, focused on increasing the energy efficiency of building heating systems. At both of these meetings, knowledgeable local residents and experts provided specific recommendations for the relevant sections of the draft Plan.

A public meeting hosted by the JCOS was held on Wednesday, May 25, 2011, in the CBJ Assembly Chambers. At this meeting, members of the public were asked to review goals and actions from sections of the draft plan, indicate their opinions regarding the relative importance of actions, and provide suggestions for additional actions. The draft plan and comment forms were also made available on the project website for those unable to attend the meeting.

A second public meeting, held in coordination with the JCOS, was held on Wednesday, October 5, 2011, at the Mendenhall Public Library. At this meeting, an overview of the GHG Inventory and draft Climate Action Plan were presented. The focus of the meeting was on the Top Actions for reducing energy use and GHG emissions.

1.2.3 Formal Public Review

Two work sessions were held with the Juneau Assembly Committee of the Whole. On August 1, 2011, the GHG Emissions Inventory and draft Climate Action Plan were presented. The discussion was focused on the results of the 2010 inventory, a comparison with the 2007 inventory, and the first draft of the recommended actions.

A second Juneau Assembly Committee of the Whole meeting was held on October 31, 2011. At this meeting an overview of the GHG Inventory and draft Climate Action Plan were presented. The focus of the meeting was on the Top Actions for reducing energy use and GHG emissions. Comments made by the Assembly led to revisions to the executive summary and the list of top actions.

The Juneau Climate Action Plan was adopted by the CBJ Assembly on November 14, 2011 by Resolution 2593.

1.3 Juneau Greenhouse Gas Emissions Inventories

1.3.1 Overview of 2007 and 2010 Inventories

GHG emission and energy use inventories for Juneau completed for 2007 and 2010 provide both a snapshot of annual conditions and a baseline for setting reduction targets. This chapter covers highlights from the two inventories. Details can be found in the complete documents, titled *City and Borough of Juneau Inventory of Greenhouse Gas Emissions for the Calendar Year 2007* and *2010 Greenhouse Gas Emissions Inventory*, which will both be available on the JCOS website.

The emission inventories are based on the community's internal energy economy. Unlike most communities, because of its isolation, accurate information on internal energy use can be obtained from the small number of local fuel distributors, the Borough's sole electrical utility, (AEL&P), the airport, and the area's two mining companies. The 2007 and 2010 GHG inventories are limited to the borough's internal economy and exclude external energy consumption related to fuel purchased outside of Juneau for services such as barge and air transport and cruise ships. The methodology applied in the inventories involved the collection of energy, fuel, and vehicle data, and the calculation of GHG emissions based on fuel types and uses. The inventory employed standard international protocols and methodology[3] used to determine metric tons of carbon dioxide equivalent (MTCO2e)[4] for three greenhouse gases: carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O).

As shown in Table 1.1, between the initial GHG inventory taken for 2007 and the latest inventory prepared for the year 2010, Juneau reduced both the amount of energy the community consumed and the amount of greenhouse gases it emitted. Several factors contributed to these improvements, as discussed in more detail in Section 1.3.5.

TABLE 1.1 JUNEAU'S TOTAL ENERGY USE AND GHG EMISSIONS 2007 & 2010

	2007	2010	% Change
Energy Use (MMBtu[5])	7,212,181	6,249,370	-13%
GHG Emissions ($MTCO_2e$)	440,545	396,747	-10%

[3] In the inventories, ICLEI's Local Government Operations Protocol was used to determine energy consumption (e.g., fuel use, electricity use) and emission factors. See the 2010 inventory for more detail on calculating GHG emissions, emission factors, a comparison with 2007 emission factors, and energy used.

[4] CO2e is an abbreviation for carbon dioxide equivalent, the internationally recognized measure of GHG emissions. This measure is used to report the equivalent weight of carbon dioxide in metric tons (MTCO2e) (1,000 kilograms or 2,205 pounds). The global warming potential from each GHG is based on the amount of carbon dioxide that would have the same global warming potential measured over a specified time period.

[5] MMBtu is a unit of energy (one million British thermal units); in this report, units fuels, electricity, and wood have been converted to MMBtu for comparison.

1.3.2 Juneau's Energy Sources, 2010

Petroleum supplies 75% of Juneau's energy and accounts for 92% of the area's GHG emissions (see Table 1.2). Hydroelectricity supplies 20% of Juneau's energy and produces virtually no GHGs. The remaining 5% of energy used in Juneau is from burning wood and propane that produces 6% of the area's GHG emissions.

TABLE 1.2 TOTAL ENERGY USE AND GHG BY SOURCE 2010

	% of Total Energy Consumed	% of Total GHG Emissions Produced
Petroleum	75%	92%
Electricity	20%	0%
Wood	3%	4%
Propane	2%	2%
Waste	-	2%
TOTAL	**100%**	**100%**

1.3.3 Juneau Community Energy Use and Emissions, 2010

Figure 1 below, which shows the total ***ENERGY*** used by sector in Juneau, includes energy derived from petroleum, wood, propane, and electricity. Buildings represent the greatest single energy use sector in Juneau, accounting for 40%. If highway, air, and marine transportation are combined, the Transportation sector uses 43% of the community's energy. The two mines use 12%, and Equipment & Non-Highway Vehicles use 5%.

Figure 2 shows the total ***GHG EMISSIONS*** produced by each sector. Energy use correlates to emissions in most sectors. In 2010, the Transportation sector contributed 55% of GHG emissions, with over half of that (29%) from activities involving Highway Transport. Buildings produced 28% of community GHG, primarily from petroleum-based energy used for space and hot water heating. Of the two large mines in the borough, Greens Creek used about 90% more energy than Kensington in 2010, but, because Greens Creek switched from oil to electricity with installation of an undersea cable in late 2006, Greens Creek and Kensington contributed the same amount (5%) of GHG emissions that year. Kensington began production in late June 2010, so emissions estimates for Kensington, which only include stationary equipment, cover only about half the year.

Figure 1. Total ***ENERGY*** use for Juneau Community by Sector, 2010

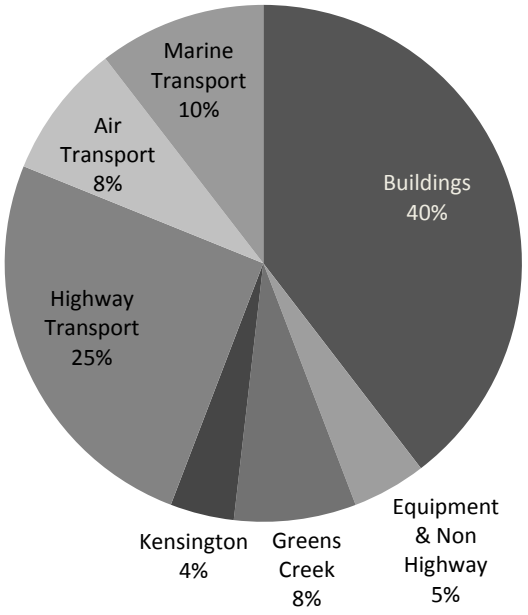
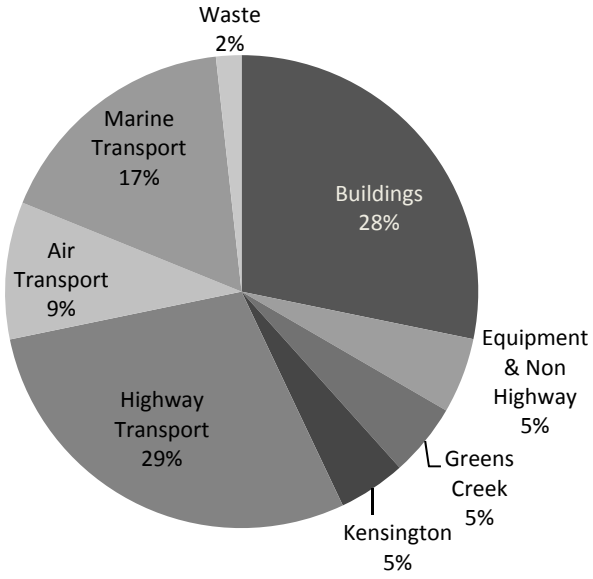


Figure 2. Total ***GREENHOUSE GAS EMISSIONS*** from Juneau Community by Sector, 2010

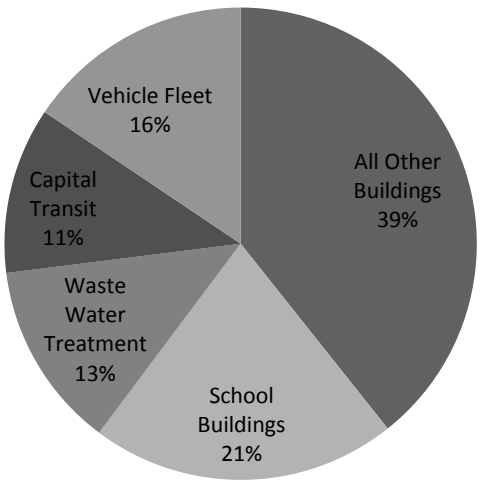


1.3.4 CBJ Energy Use and Emissions, 2010

Local government accounted for 4.5% of total community energy use and a little over 3% of total community GHG emissions in 2010. The Borough purchased about 1.25 million gallons of fuel in 2010 and almost 31 million kWh of electricity. Figure 3 illustrates local government's 2010 ***GHG EMISSIONS*** by sector.

The sectors of Schools, Waste Water Treatment, and All Other Buildings produced 73% of local government GHG emissions, and the Transportation sector produced 27%. Lighting and water pumping contribute essentially nothing to GHG emissions totals because these activities are powered mostly by electricity.

Figure 3. ***GREENHOUSE GAS EMISSIONS*** for ***CBJ*** Buildings and Operations by Sector, 2010



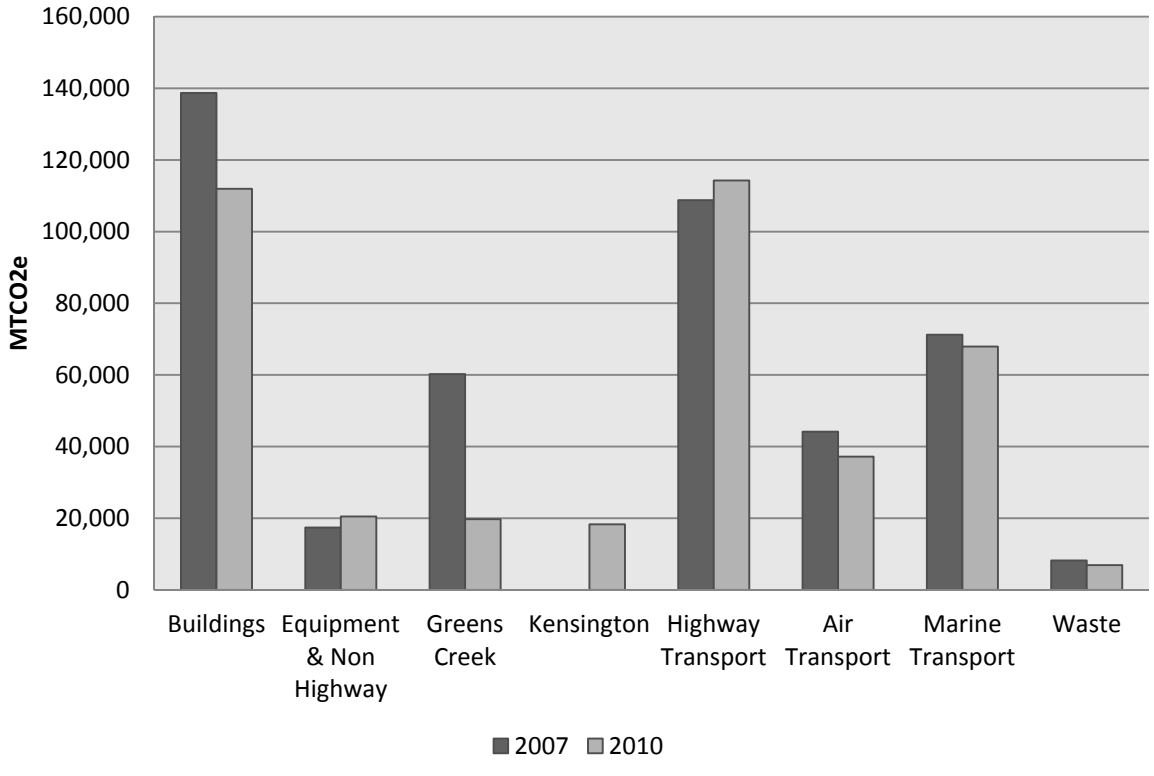
1.3.5 GHG and Energy Use Comparison, 2007 and 2010

Overall community energy use (measured in MMBtu) decreased 13% and GHG emissions declined 10% between 2007 and 2010. Figure 5 shows these GHG emission changes by sector. Although this is very good news, when comparing snapshots of energy use and GHG emissions from two nonconsecutive years, it is important to keep in mind variables that may have influenced use and emissions in each of the two distinct years but that may not necessarily signify a trend of altered patterns over time. These include factors like relative discrepancies in the availability, accuracy, and reliability of collected data, revisions in the Local Government Operations Protocol for measuring emissions, variations in economic productivity, differing degree heating days, and the construction or demolition of buildings.

Many of the conservation habits begun by residents after the 2008 avalanche have been continued resulting in an 8% decrease in electricity demand.

According to the National Oceanographic and Atmospheric Administration, in 2007 Juneau experienced nearly twice as much snowfall and temperatures were significantly colder than in 2010. The price of heating fuel and gas was also approximately 20% higher in 2010 compared to 2007. The economic downturn that started in 2008 may have led to decreased commercial activity and decreased energy use. Perhaps most significantly, in the spring of 2008 an avalanche destroyed the main hydroelectric line that connects the Snettisham plant to Juneau. This caused a 500% increase in electricity costs for 45 days, which inspired Juneau residents and businesses to change their energy consumption habits, resulting in a 25% decrease in electricity demand during the supply disruption. According to a recent study, many of the

Figure 5. Comparision of Community GHG EMISSIONS, 2007 & 2010



conservation habits begun then have continued, resulting in an 8% reduction in electricity demand (Leighty, 2011).

The above-cited factors played a role in the reductions in Juneau's energy consumption and GHG emissions in 2010 compared to 2007, as did some combination of increasing energy efficiency and switching from diesel to electricity. Although it is difficult to determine all of the reasons behind Juneau's improved emissions numbers, Greens Creek's reduction of its GHG emissions by 67% via conversion of diesel power to electricity, which contributed over 6% to the decrease in community-wide GHG emissions between 2007 and 2010, was key.

Part 2

Setting Emissions Targets

2.1 Reduction Targets

2.1.1 Juneau's 2007 Reduction Targets

In 2007, the Assembly adopted Resolution 2502, setting a 1% GHG emission reduction target for municipal buildings and operations and a 20% emission reduction for the entire community by 2012. These targets used the 2007 emission levels as a baseline.

As noted earlier, community-wide GHG emissions were reduced by 10% between 2007 and 2010. Despite this positive trend, Juneau remains unlikely to meet the targeted 20% reduction in emissions by 2012. This target was based on an overall reduction in fuel energy use, and Greens Creek Mine converting primarily to electricity.

Local government achieved a GHG emission reduction of 9.5% between 2007 and 2010, exceeding the 1% reduction target. Careful monitoring of local government energy use is needed in order to maintain and deepen these reductions in the future. The targeted emissions reductions were keyed to the installation of ground source heat pumps at the airport, the substitution of electricity for diesel generation at Eaglecrest, roof and window repairs at the JACC, and upgrades at the City Museum.

Juneau community GHG emissions are expected to rise in 2011, owing to two major developments. First, Kensington's mining operations, not yet up to speed in 2010, have been operating fully for all of 2011. Second, in the first half of 2011, water levels at the hydro facilities have been lower than in 2010. As a result, less hydro-power will have been made available for dual fuel users such as Greens Creek mine in 2011; as of July 2011, the mine had already used diesel generators more than in all of 2010. These changes were not anticipated when the initial 2012 targets were set.

2.1.2 Emissions Reduction Targets in Other Jurisdictions

Around the world, nations, regions, states, and communities have set targets for reducing GHG emissions. Many communities base emission reduction targets on existing agreements, such as the Kyoto Protocol, or on targets set by their state, county, or region. Other communities set higher or lower targets based on the will of local residents and politicians, estimated population and economic growth, and what is feasible given local conditions. Many communities set two target ranges, with an end target 20 to 50 years into the future and closer-in intermediate targets. Table 2.1 presents examples of some targets set by other jurisdictions.

TABLE 2.1 GHG EMISSION TARGET REDUCTIONS IN OTHER JURISDICTIONS			
	% Target Reduction	**Baseline for Reduction**	**Target Completion Year**
1997 Kyoto Protocol	5%	1990	2012
2007 European Union	20%	1990	2020
2010 U.S. Fed. Government	28%	2010	2020
2005 U.S. Mayors	7%	1990	2012
State of Oregon	Stabilize 10% 75%	1990 1990 1990	2010 2020 2050
State of Washington	Stabilize 25% 50%	1990 1990 1990	2020 2035 2050
Berkley, CA (2009)	80%	2000	2050
Homer, AK (2007)	20%	2000	2020
Bellingham, WA (2005)	7% 28%	2000 2000	2012 2020

2.1.3 Setting New Targets for Juneau

Juneau's current GHG emission reduction targets will expire in 2012. New targets are required in order to keep moving toward lowered energy consumption, energy costs, and GHG emissions.

Figure 6 depicts Juneau's GHG emissions forecast. The 2007 GHG emissions level of 448,739 $MTCO_2e$ is shown as a baseline. The forecast uses an average of the 2007 and 2010 GHG per capita emissions and multiplies this by Juneau's projected population of 36,584 for 2032 based on the high population growth scenario prepared by the Alaska Department of Labor and Workforce Development. The increase in forecasted GHG emissions were Juneau to make no reductions can be seen in Figure 6.

The forecast shows that, if no action is taken, Juneau's GHG emissions will begin to go up again almost immediately. To avoid this scenario, a 25% community-wide emissions reduction target to be achieved by the year 2032 is recommended. Table 2.2 breaks down this recommended 2032 target into five-year intervals, showing projected emissions levels under the high population growth scenario and targeted levels of emissions reductions at each interval.

Figure 6. Juneau Community Emissions Forecast

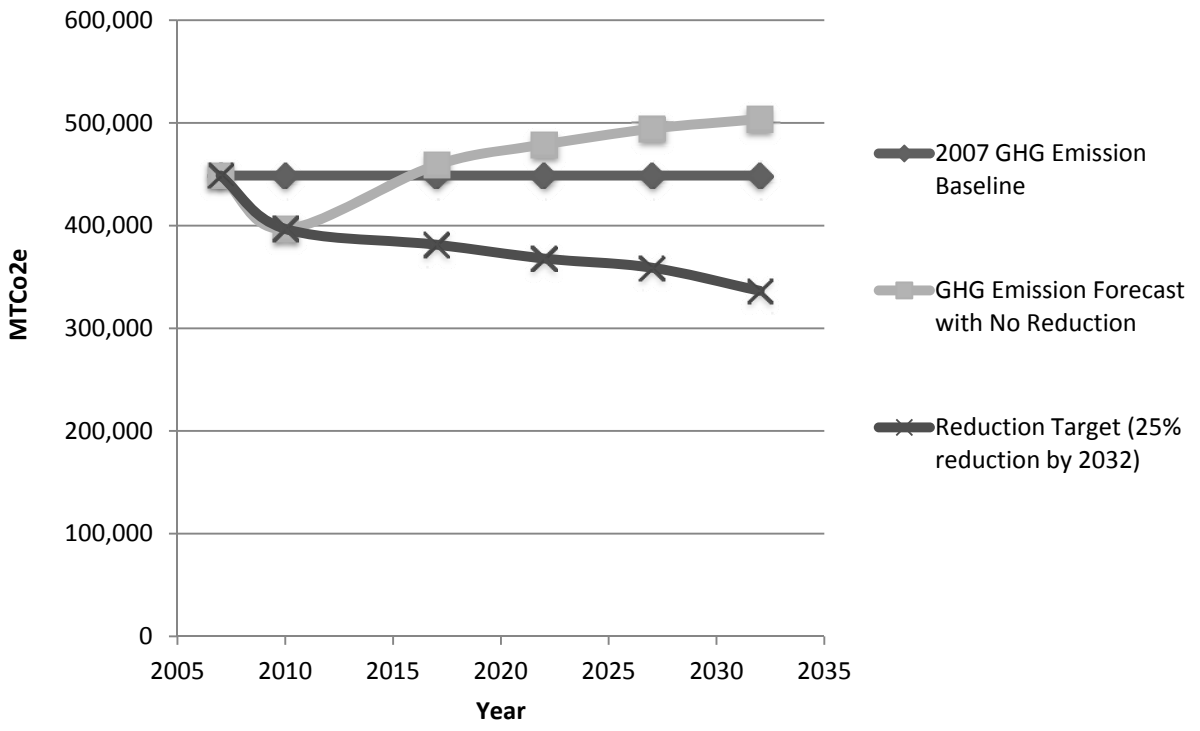


TABLE 2.2. JUNEAU'S GHG EMISSION TARGETS				
Years to Complete	**Year**	**Reduction Target Based on 2007 Levels**	**Target $MTCO_2e$ Level**	**$MTCO_2e$ Reduction Required Under High Pop. Growth Scenario***
-	2007	Baseline	448,700	-
5	2017	10%	381,400	-92,000
10	2022	18%	368,000	-112,000
15	2027	20%	359,000	-136,400
20	2032	25%	336,600	-168,300
*Shows the total reduction in $MTOCO_2e$ that would be required given the Alaska Department of Labor and Workforce Development's high population growth scenarios.				

The proposed emissions reduction target of 25% over 20 years is in line with targets set in other jurisdictions and, given the implementation strategies set out in this Plan, is achievable for Juneau. Over the next 20 years, factors such as deviation from the population prediction,

changes in mining activity, or the development of new energy saving technologies will make meeting the targets either more or less difficult.

Many paths may be taken to reach an emissions reduction of 25% by 2032. The implementation actions in this Plan, summarized in Table 2.3, focus on emissions related to buildings and transportation, which together account for 83% of local emissions. These sectors also represent areas that are possible for local government and the broader community to influence by adopting new technologies and by changing behaviors.

TABLE 2.3 JUNEAU'S GHG EMISSION REDUCTION

Sector	$MTCO_2e$ Reduction Based on 2007 Levels and High Population Growth	% Reduction Based on 2007 Levels
Transportation and Land Use	100,000	15%
Buildings	46,000	7%
Waste, Food Production, Renewable Energy and Alternative Systems, Equipment and Non-Highway, and Industrial Uses	22,000	3%
TOTAL REDUCTION BY 2032	**168,000**	**25%**

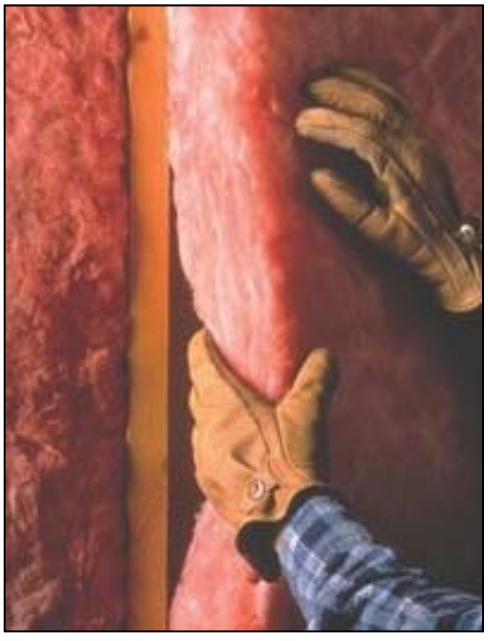
2.1.4 Future Targets and Ongoing Review

Changes in technology, the population, and economic trends will influence both future emissions inventories and Juneau's ability to meet emission reduction targets set in this Plan. In order to monitor the implementation progress, an emissions inventory will need to be completed every three to five years.

Targets will need to be reviewed and adjusted periodically to ensure that emission reductions are being achieved. When the Climate Action Plan is next updated, longer term emissions reduction targets should be set. This could include 10, 25, and 50 year targets, rather than the 5, 10, 15, and 20 year targets set in this document.

Part 3

Actions & Implementation



3.1 Introduction to Implementation

This section of the Plan sets out goals, strategies, and short and long-term actions for reducing energy use and GHG emissions in each of the following sectors: buildings, transportation and land use, utilities, mining, food production, and local government funding and staffing.

3.1.1 How to Use this Plan

In order to meet the emission reduction target of 25% by 2032, a combination of the actions recommended in various sectors will need to be accomplished. It will not be necessary to complete all of the recommended actions. Adopting this plan does not mean that the CBJ commits to completing all actions, but rather that it commits to working toward the GHG emission reduction targets set in Part 2.

The CBJ, the state and federal governments, and business and home owners will select actions to complete based on an analysis of cost effectiveness, available technology, and potential GHG emission reductions.

3.1.2 Estimates of Potential GHG Reductions

Wherever possible, an estimate of the amount of GHG reduction projected for each goal is presented. These estimate the level of reduction possible by reaching the goal and thus can assist policy makers and the public choose how to implement this Plan.

Information from ICLEI's Climate and Air Pollution Planning Assistant tool version 1.5 was used, with variables adjusted based on local conditions where appropriate. Where insufficient data were available to accommodate a reasonable projection of the emissions reductions to be achieved by accomplishing a goal, no projection was made.

3.1.3 Cost of Implementation

Implementing the actions in this plan will have costs to all levels of governments and to the general public. In many cases, though, making changes that reduce energy use will be more expensive up front and will result in lower energy costs in the future.

Specific costs of projects and actions are not included in this Plan. It is intended that the actions be implemented over the next 20 years; over time, costs, available technology, and priorities will shift. As policies are updated, new buildings are developed, and renovations are planned, the costs and benefits of each energy efficiency upgrade will need to be evaluated and decisions made at the time about which implementing actions will be cost effective.

3.1.4 Top Actions

As a summary, the top actions for the community and the CBJ are listed below. This list is not prioritized or exhaustive, but rather includes the actions that can be completed in the next five years and will have the greatest impact in reducing energy use and GHG emissions in Juneau.

- Support existing state and federal weatherization programs for homes and public buildings. As of the end of 2010, 455 Juneau home owners had completed the Alaska Housing and Finance Corporation Home Energy Rebate Program and 607 home owners were working on energy retrofits. On average, homes completed see a reduction in energy use of 12,000 pounds CO_2 per year. The State has allocated $37.5 million to fund the rebate program for the 2011-2012 fiscal year and will be considering long-term funding in the next legislative session.

  The Alaska Energy Revolving Loan Fund is a state program that funds retrofits to schools and state, municipal, and UAS buildings. Savings from energy efficiency upgrades are used to repay the loan.

  Provide new local programs for weatherization, energy efficient upgrades, and new renewable energy systems for commercial, rental housing, or multi-family buildings.

  Examples are:

  - Energy efficiency rebate for commercial, rental, non-profit, and industrial buildings. (Montgomery County Maryland will pay for 50% of approved energy efficiency upgrades up to a set maximum).
  - Property tax exemptions. (The Town of Bedford, New Hampshire has property tax exemptions for the installation of renewable energy systems; the assessed value of the home would remain the same after improvements are made).

- Update the local building code to increase energy efficiency requirements for all new commercial and residential buildings. Currently the CBJ is enforcing the requirements of the 2006 International Residential Code. Adopting the 2012 IECC code would lead to an estimated 30% reduction in energy use in new buildings and could be applied to both residential and commercial structures (Marquam George, Personal Communication October 20, 2011).

  The 2012 IECC includes new requirements for doors, windows, skylights, HVAC systems, insulation, and better air sealing. The 2012 code also requires more thorough testing of the performance of finished buildings. For a 2,400 square foot two-storey house it is estimated that the additional cost to meet these standards would be $6,000. The annual energy savings would be approximately $400 based on current electrical rates, giving a 15-year return on investment (Marquam George, Personal Communication October 20, 2011. See Appendix 2).

- Encourage federal, state, and local government agencies to conserve energy and increase energy efficiency in buildings and operations, share information and expertise on weatherization, energy efficient technology, and take a leadership role in reducing local energy use.

  Currently, each level of government has been working to decrease energy used for buildings and operations:

  - The Federal government is aiming to reduce GHG emissions from federal operations by 28% by 2020. Examples of Juneau projects include the USCG windmill at the subport and seawater heat pump and windmill at the NOAA Ted Stevens Laboratory.
  - The Alaska Legislature passed HB 306 last session, which sets standards for all new buildings over 10,000 sq. ft. and requires that 25% of state buildings undergo energy efficiency retrofits by 2020.
  - The CBJ adopted Ordinance 2010-42 requiring new buildings costing over $5,000,000 meet LEED certification. The CBJ has also completed energy audits on the water and waste water systems, Centennial Hall, and the Augustus Brown Swimming Pool.

  Additional actions for CBJ include:

  - Holding regular meetings that bring together private business, university, federal, state and local agency personnel working on energy efficiency and renewable energy systems to share information and expertise and to find areas for collaboration.
  - Requiring the completion of life cycle energy audits and cost analyses prior to retrofitting CBJ buildings.
  - Implementing recommended retrofits and improvements to CBJ buildings identified through energy audits.

- Partner with the University and non-profits to develop local professional expertise in weatherization, energy efficient systems, and new energy saving technology by providing opportunities for CBJ personnel and contractors to receive installation and maintenance training. This expertise is needed to support the operation of new energy efficient systems and could be a growth sector for the community. Multi-agency collaboration on training could lead to additional funding opportunities.

- Support energy efficiency and renewable energy pilot projects in Juneau. These projects will gather good Juneau-specific data on new and changing technologies such as solar, wind, and geothermal, in order to be better prepared for the economics of tomorrow. These projects could have an educational component and be associated with local schools where data is gathered on the effectiveness of various technologies in Juneau.

- Inform residents of existing incentives for and energy cost savings related to energy efficient vehicles. Provide local incentives for the purchase of fuel efficient vehicles. The current

average overall fuel efficiency for vehicles on the road is 20 mpg. Incentives could be put in place for vehicles that meet target fuel efficiency (such as greater than 40 mpg).

Examples of existing local programs are:

- Free parking for hybrid electric vehicles (Los Angeles).
- Rebate for purchase of new hybrid electric vehicle (City of Riverside, CA).
- Exemption from local sales tax for purchase of new fuel efficient vehicle (many communities).

- Evaluate the assembly-adopted 2008 Transit Development Plan to determine which actions will garner the greatest reductions in GHG emissions and energy use. The plan recommends that CBJ consider limiting future fleet purchases to alternative fuel vehicles such as hybrid-electric vehicles. Consider, for example, adding a hybrid-electric bus for the downtown circular loop.

- Improve the Cross-Juneau Bikeway as described in the assembly-adopted 2009 Juneau Non-Motorized Transportation Plan. This involves bringing each route segment up to standard; adding consistent signage and producing a route map for visitors and residents; making the route a priority for year round maintenance, sweeping, and snow removal; and in the long term developing a separated path from Sunny Point to Vanderbilt Hill to bypass Lemon Creek.

- Coordinate with the Juneau Commission on Sustainability and the CBJ Green Team to implement a public outreach and education campaign. Educate local businesses and homeowners on the potential benefits and energy savings from energy conservation and upgrading to more energy efficient systems. Develop a website that provides information on energy conservation and energy efficiency and connects residents and business owners to local services and expertise. Institute an annual award program that recognizes local businesses and individuals who help further the goals of the Climate Action Plan.

- Allocate CBJ staff and resources to implement the Climate Action Plan. Given current budget constraints, tasks could be assigned to several existing CBJ staff, the Juneau Commission on Sustainability, and the CBJ Green Team. When economic conditions change and the CBJ budget allows, an Energy Manager could be hired to provide leadership on energy conservation and GHG reductions. The savings that would result from increased energy efficiency in CBJ buildings and operations could defray or fully cover the cost of the position.

- Develop an Energy Plan for Juneau. This plan would identify and evaluate the technical and economic feasibility of renewable energy sources (including hydroelectric, biomass, solar, tidal, and wind) that will be available to meet the community's future need. The Energy Plan will need to be flexible enough to respond to changing conditions and will need to examine the full range of renewable energy options and the relative costs. Completion of an Energy Plan would require input from other levels of government and the private sector.

3.2 Buildings

As is true for most communities across the country, buildings in Juneau use more energy than any other sector (40%) and emit a significant share of Juneau's greenhouse gases (second only to transportation). According to the 2010 GHG inventory, buildings were responsible for 28% of all Juneau GHG emissions and for 60% of local government's emissions. No greater opportunity exists for stretching Juneau's limited clean hydroelectricity supply than increasing energy efficiency of building structures and systems borough-wide. The following steps are recommended to reach the greatest reductions in energy and GHG emissions:

1. **Energy retention.** Improve building energy retention through weatherization techniques like replacing inefficient windows and doors and increasing building insulation.
2. **Energy efficiency.** Reduce energy consumption by installing more energy efficient systems and appliances.
3. **Fossil fuel reduction.** Convert space and water heating systems from fuel oil to hydro-source electricity.

By following these steps, building operation and maintenance cost savings and GHG emissions reductions can be achieved.

In homes, stores, government, and commercial offices and other facilities, energy is used to heat and cool spaces, heat water, and power lights, appliances, electronics, and machinery. Industrial activities, such as conveyor belts, pumps, and other commercial energy demands, except for those related to mining activities, fall into this sector. The burning of heating fuel to heat space and water is responsible for 85% of the GHGs emitted from Juneau's building sector, and the burning of wood and propane is responsible for the majority of the remaining emissions load.

Home Energy Rebate

As of the end of 2010, 455 Juneau home owners have completed the AFHC energy rebate program and 607 home owners were working on energy retrofits. The average energy savings amounts to reductions of 12,000 pounds of CO_2 emissions per year.

Increases in fuel oil prices continue to run up the cost of heating homes, businesses, and government facilities. Older, energy inefficient buildings will become increasingly expensive to heat over time. Rising energy costs can be expected to continue to motivate building owners to take steps to reduce energy consumption in order to save money.

In residential buildings, most energy is consumed to heat space and water. In commercial buildings, space and water heating, and lighting account for the most energy use. Better weatherization of existing buildings, enhanced thermal standards for new and renovated structures, and installation of more energy efficient systems represent key tools for

Co-Benefits of Building Goals

- Improved indoor and outdoor air quality
- Reduced operational and maintenance costs
- Increased resale values

reducing energy use, energy costs, and GHG emissions in Juneau. Weatherization includes measures such as adding insulation and replacing doors and windows. Once a building's energy retention capacity has been enhanced, further savings can be achieved through installation of more energy efficient appliances, machinery, and heating systems, including programmable thermostats. In Juneau, the final step to reducing costs and GHG emissions, after a building's energy retention and demand have been lowered, is to switch from fossil fuel to hydro-electricity.

Building Goals	Potential GHG Reduction $MTCO_2e$
2010 GHG emissions from Building Sector: 112,000 MTCO2e **To meet 2032 goals, Building Sector reduction target: 46,000 MTCO2e**	
Goal B-1: Reduce energy consumption in, and GHG emission produced by, Borough government buildings. (*Estimate: 30% emission reduction for CBJ buildings*).	2,000
Goal B-2: Reduce energy consumption in, and GHG emissions produced by, state and federal buildings. (*Estimate: 30% emission reduction for state and federal buildings*).	3,000
Goal B-3: Reduce energy consumption in, and GHG emissions produced by, commercial buildings. *(Estimate: 30% emission reduction for commercial buildings).*	14,000
Goal B-4: Reduce energy consumption in, and GHG emissions produced by, residential buildings. *(Estimate: 30% of existing houses completed AFHC-type weatherization; 25% of new houses super-insulated; 75% of new houses meet new energy efficiency standards).*	27,000
Total Reduction from Building Sector	**46,000**

Goal B-1: Reduce energy consumed in, and emissions produced by, Borough government buildings

Local government should lead the way in modeling energy conservation and energy efficiency. Buildings are responsible for 60% of local government's total GHG emissions, with most coming from schools, the hospital, and the airport. Overall emissions from CBJ government buildings have gone down 4% since the 2007 inventory. Emissions from schools, however, went up 20%, primarily due to the opening of Thunder Mountain High School. Emissions from all other local government buildings have fallen 14% since 2007.

The Juneau School District Energy Saving Initiative Program, begun in 2007, focuses on increasing efficiency and conservation in all schools by monitoring the behavior of employees and students. In the program's first two years, the Juneau School District (JSD) saved over one million dollars by following its energy education and policy guidelines. Other actions taken to reduce energy use in government buildings include putting a new roof and windows on the

Juneau Arts and Humanities Center and developing ground source heat pumps at both the renovated airport and new Dimond aquatic center.

The following tables recommend measures to reduce energy consumption, energy-related expenses, and GHG emissions related to local government operations.

Strategy B1-A. Set energy efficiency standards for all new local government buildings, leased space, and equipment.	
Short-Term Actions	**Responsible Party**
• Set energy efficiency standards for all new local government buildings. Use specific standards that exceed the minimum baselines of such standards as the American Society of Heating, Refrigeration and Air-Conditioning Engineers Energy Efficiency Standard (ASHRAE 90.1 or 90.2), for example, the 10 BTUs per square foot of heated floor area standard. New buildings should aim to achieve a 50% reduction in energy use per square foot compared to existing buildings. GHG emissions abatement and energy efficiency need to be incorporated into the early stages of building design.	CBJ government
• Establish a policy that sets minimum energy efficiency standards for space leased by local government. The base standard could be set at 10 BTUs per square foot of heated floor area.	CBJ government
• Establish a policy that requires equipment purchased or leased by local government to meet specified energy efficiency standards, such as Energy Star.	CBJ government
• When new construction or upgrades are completed, commission the systems to ensure they are working at maximum efficiency.	CBJ government
• Adopt a policy requiring that all new CBJ government buildings undergo a life cycle analysis and that this information be used to make decisions about energy efficiency and alternative systems.	CBJ government

Strategy B1-B. Reduce energy consumed in and GHG emissions produced by local government buildings	
Short-Term Actions	**Responsible Party**

• Over the next two years, conduct energy audits on 75% of CBJ buildings (including schools and the hospital). AHFC is currently offering a program that will fund the audits in exchange for providing building data as part of their benchmarking efforts. Audits should be completed on "worst energy offenders" first, and lighting and appliances should be included. Based on the recommended energy conservation opportunities identified in the energy audits, create a schedule for increasing each building's energy efficiency. Implement identified efficiency measures, starting with high priority recommendations.	CBJ government
• Establish a local government-wide energy efficiency policy that provides employees with guidelines and requirements for efficient use of the facility, such as by turning off unneeded lights and computers, setting thermostats appropriately, and other energy saving behaviors.	CBJ government
• Mount a campaign to educate employees on the importance of saving energy. Give rewards to employees or departments that make quantifiable contributions toward meeting the government's energy conservation goals.	CBJ government
• Commit to an annual maintenance program and ongoing monitoring for local government building heating systems to ensure systems are running at optimum efficiency.	CBJ government
• Support CBJ staff in becoming Association of Energy Engineers Energy Managers LEED-accredited professionals. Ensure personnel responsible for maintaining systems receive the required training.	CBJ government
• Set up a system to monitor heating oil, water, and electricity use. Determine if tracking should be done by building, division, or department, and select a system that is easy to install, wireless, and web-based (for example, www.esightenergy.com).	CBJ government
Long-Term Actions	**Responsible Party**
• As staffing and space needs change, ensure space is not wasted in offices, workshops, garages, and storage areas. Consider setting guidelines for the amount of space in square feet required for each office.	CBJ government
• Require departments or divisions to pay for fuel/energy out of their own budgets. Designate a staff person to be responsible for overall energy use in each department, division, or building.	CBJ government
• Continue to implement high, medium, and low-priority measures recommended by the energy audits for local government buildings.	CBJ government
• Continue to seek funding from state, federal, and other sources for energy efficiency upgrades. Currently, loans are available for this purpose from the Alaska Energy Efficiency Revolving Loan Fund Program. Consider using Energy Savings Performance Contracts—a method of financing capital projects whereby a private contractor will guarantee a minimum level of energy cost savings resulting from capital upgrades. Make grant writing for energy efficiency-related projects a priority.	CBJ government

Goal B-2: Reduce energy consumed in and emissions produced by state and federal buildings

The Federal Government has over 20 buildings in Juneau; the largest of these include the Federal Building at 285,000 sq. ft. and the Ted Stevens Marine Research Institute at 66,000 sq. ft. Coast Guard facilities and the U.S. Post Office each also own and/or occupy several buildings. The Ted Stevens Marine Research Institute has switched from fuel oil to a geothermal heat system that uses sea water. The Federal Building is a dual fuel heat facility that can be heated using electricity or fuel oil. This building historically used electricity intermittently for heating but, since October 2010, has been using electricity exclusively. There are also several U.S. Forest Service buildings and a new Weather Service building.

In 2009, Federal Executive Order 13514 (Federal Leadership in Environmental, Energy and Economic Performance) required all federal government agencies to reduce vehicle fleet petroleum use by 30% by 2020, improve water efficiency by 26% by 2020, achieve 50% recycling and waste diversion by 2015, and implement net zero energy building by 2030.

The State of Alaska owns or leases over 40 buildings in Juneau, making it responsible for the largest single-owner share of buildings in the community. All of the state-owned buildings are heated with fuel oil. The University of Alaska Southeast campus includes some dual fuel buildings that use electric heat when it is available.

In 2010, the Alaska Legislature passed House Bill 306, which requires all new state government buildings over 10,000 sq. ft. to comply with the most up-to-date version of energy efficiency standards published by the American Society of Heating, Refrigerating and Air-Conditioning Engineers. In addition, energy efficiency retrofits must be made to at least 25% of state buildings over 10,000 sq. ft. by 2020. Legislative and court buildings were exempted from the law.

Strategy B2-A. Reduce energy use in and GHG emissions from new and existing State buildings

Short-Term Actions	**Responsible Parties**
• Encourage the State to continue to update energy efficiency standards for new State buildings. New buildings should show a 50% reduction in energy requirements per square foot compared to existing buildings.	Local and state governments
• Encourage the State to update policies regarding leased buildings to set minimum enclosure energy efficiency standards for leased space.	Local and state governments
• Encourage the State to continue to make energy upgrades to existing buildings by securing funding and considering the use of Energy Savings Performance Contracts.	Local and state governments

• Consider ways to reduce energy used by the State's computer network. (Examples include purchasing Energystar machines and using virtualization to reduce the number of physical servers, thus reducing the energy required to power and cool them.)	Local and state governments
Long-Term Actions	**Responsible Party**
• Encourage the State to continue to update energy efficiency standards for new State buildings.	Local and state governments

Strategy B2-B. Increase collaboration among the CBJ, State, and Federal Governments

Short-Term Actions	**Responsible Party**
• Set up regular meetings with representatives from local, state, and federal government to share ideas, resources, strategies, and innovations for decreasing energy use in public buildings.	Local, state, and federal governments

Goal B-3: Reduce energy consumed in and emissions produced by commercial and industrial buildings*

* Private sector non-residential buildings

Strategy B3-A. Reduce energy use and GHG emissions in new commercial and industrial buildings

Short-Term Actions	**Responsible Party**
• Update the building code to increase energy efficiency requirements for new commercial and industrial buildings. Code should look to exceed minimum standards, such as those laid out by the American Society of Heating, Refrigeration and Air-Conditioning Engineers Energy Efficiency Standard (ASHRAE 90.1 and 90.2).	CBJ government

Strategy B3-B. Reduce energy use and GHG emissions in existing commercial and industrial buildings

Short-Term Actions	**Responsible Party**
• Launch a community awareness campaign to promote energy efficiency. Actions could include the installation and use of programmable thermostats, weatherization strategies, and new and/or alternative heating systems. Connect businesses and nonprofits with information on state, federal, or other resources that provide financing for energy efficiency improvements.	CBJ government/ community

• Identify largest local energy/heating fuel consumers and work with them to establish and meet energy efficiency targets.	CBJ government/ community
• Set up an award program for business/building owners that have implemented innovative measures to reduce energy consumption. Organize annual tour of award winners to showcase changes local businesses are making.	CBJ government/ community
• Lobby the state to continue and expand funding for the commercial energy audit program and the revolving loan fund for commercial energy projects. This program is currently available to the CBJ government.	CBJ government
• Encourage real estate agents to include information about energy usage and energy efficiency upgrades when selling commercial buildings.	Private sector
• Research financing options to support an incentive program to encourage building owners to undertake energy retrofits. Incentives could include low interest/no interest loans, property tax breaks, or one-time grants. Consider adding new tax on fuel/electricity and using revenue to fund energy efficiency incentives. (Note: Changes to taxes may need to be supported by state statute.)	CBJ government
Long-Term Actions	**Responsible Party**
• Implement ongoing financial incentives for energy efficiency measures taken by commercial and industrial building owners.	CBJ government

Goal B-4: Reduce energy consumption in and GHG emissions produced by residential buildings

Strategy B4-A. Reduce energy use and GHG emissions in new residential buildings

Short-Term Actions	**Responsible Party**
• Update the building code to increase energy efficiency requirements for new residential buildings. Code should include specific standards, such as those laid out by the American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE 90.1). New buildings should show 50% reduction in energy requirements per square foot as compared to existing buildings.	CBJ government
• Promote energy savings technologies by incorporating them into CBJ projects and disseminating information to the public.	CBJ government
Long-Term Actions	**Responsible Party**

• Work with the State to update the Alaska Building Energy Efficiency Standard (BEES) to require more energy efficient buildings. The BEES is the standard that must be met for a new home to qualify for financing through the Alaska Housing and Finance Corporation. (Current standard is the 2006 International Energy Conservation Code (IECC) with Alaska Specific Amendments).	Local and state governments

Strategy B4-B. Reduce energy use and GHG emissions in existing residential buildings

Short-Term Actions	**Responsible Party**
• Educate the community on measures with the most potential to reduce energy consumption and save on heating costs including weatherization, thermostat management, renewable sources, micro-energy production systems, efficient electrical heating, and other new technology. Increase citizens' awareness of Energy Star products. Work with community partners, such as hardware stores, Alaska Energy Authority, and community groups on energy education. Hold annual workshop on how to get homes ready for winter. Sponsor a "button up your home" weekend around the second weekend in September. Include information on how to reduce electrical energy and water use. Participate in Energy Awareness Month (designated as October by the State of Alaska). Participate in the home show or create a new energy home show. Develop a forum for home owners to exchange information.	CBJ government/ community
• Provide homeowners with information about State and Federal funding opportunities. Actively support continued funding of energy efficiency incentive programs.	CBJ/Community
• Evaluate possible incentives local government could offer for home energy and heating efficiency improvements. (Incentives could include no/low interest loans, property tax reduction, waiving permit fees for innovative projects, using a Property Assessed Clean Energy program where the City offers a loan that is paid back through property taxes over 15 to 20 years.) Include incentives aimed at low-income residents and landlords.	CBJ government
• Lobby the State to continue the Alaska Housing Finance Corporation's Home Energy Rebate program. Investigate and come up with plan to get through the long waiting list and inertia that occurs with current program, where actions taken by owners prior to acceptance into the program have no rebate value.	Local and state governments
• Develop an annual award for homeowners who complete innovative energy projects involving both retrofits and new construction and organize a tour of worthy projects.	CBJ government
• Evaluate ways to provide incentives to home owners to carry out innovative energy projects (including solar hot water, micro-hydro, etc). Consider an annual competitive granting process.	CBJ government
Long-Term Actions	**Responsible Party**
• Implement energy efficiency incentive packages for homeowners.	CBJ government

Strategy B4-C. Support training in energy efficient systems, installation, and maintenance for local builders, electricians, and other tradespersons	
Short-Term Actions	**Responsible Party**
• Set up award program from local companies that excel at completing energy efficiency upgrades and building very energy efficient houses.	CBJ government/ community partners
• Consider local government incentives to encourage local energy-related training courses.	CBJ government/ community partners

3.3 Transportation and Land Use

Transportation represents the second greatest source of energy consumption in the United States, accounting for nearly 30% of all primary energy use and more than 70% of all oil consumption (Shuford et al., 2010). In 2010, transportation generated 58% of Juneau's total emissions— more than any other single sector. Marine transport produces 17%, air transport produces 9%, and highway transport produces 29% of total emissions. Since 2007, GHG emissions from the transportation sector have decreased by 14%.

GHG emissions from highway transportation can be reduced through two main means. One is to reduce dependence on personal motor vehicles by encouraging use of alternate modes of transportation, such as public transit, car pooling, cycling, and walking. A second way is to increase government, commercial, and individual use of fuel efficient vehicles that release fewer GHGs, including higher mileage gas-only vehicles, and hybrids and vehicles that run on renewable fuels. Expanded use of more efficient and alternative modes of transportation promises to decrease travel costs for individuals, businesses, and government fleets, while lowering the amounts local and state governments pay for road construction and maintenance.

Co-Benefits of Transportation Goals

- Improved air quality
- Reduced traffic congestion
- Improved public health
- Reduced dependence on foreign oil
- Reduced spending on fuel
- Increased community interaction

Transportation Goals	Potential GHG Reduction $MTCO_2e$
2010 GHG emissions from Transportation Sector: 219,400 MTCO2e **Reduction to meet 2032 goals for Transportation Sector: 100,000**	
Goal T-1: Reduce municipal fleet-related emissions. *(Estimate: 25% reduction in emissions from CBJ fleet.)*	900
Goal T-2: Increase Capital Transit ridership. *(Estimate: 40% increase in ridership.)*	4,300
Goal T-3: Reduce emissions per vehicle mile driven. *(Estimate: 750 electric cars replace existing vehicles and 25% of people switch to cars with at least 14 mpg efficiency.)*	49,000
Goal T-4: Increase bicycle and pedestrian trips. (*Estimate: 1000 weekly trips switched from driving to walking, 1000 weekly trips switched from driving to biking, 10% of students walk or bike to and from school.)*	200
Goal T-5: Reduce overall vehicle miles driven. (*Estimate: carpooling incentives offered to 1000 employees, with a 15% reduction in vehicle trips, 100 people join a car sharing organization, public education results in an 8% decrease in vehicle miles driven.)*	16,200
Goal T-6: Reduce emissions associated with marine transportation. *(Estimate: 22% decrease in marine emissions.)*	15,700

Goal T-7: Reduce emissions associated with air transportation. *(Estimate: 30% reduction in aviation emissions.)*	13,200
Goal T-8: Reduce vehicle miles driven by increasing mixed-use development. *(Estimate: 550 new transit-oriented dwelling units.)*	400
Total Reduction by Transportation Sector	**100,000**

Goal T-1: Reduce municipal fleet-related emissions

In 2010, the CBJ government fleet was responsible for 16% of the overall CBJ emissions, a decrease of 12% from the 2007 level. The CBJ fleet of 314 vehicles includes 132 heavy duty trucks, 125 light duty trucks and 19 passenger cars. Unlike most transportation sectors, because the fleet is under the direct control of one entity, the Borough, by changing vehicles through reorganizing operations and altering employee behavior, local government can significantly reduce government costs and area-wide GHG emissions.

Strategy T1-A. Expand local government fleet with the most energy efficient vehicles practicable.

Short-Term Actions	**Responsible Party**
• Add minimum fuel efficiency standards to criteria for purchasing bids for new vehicles so that lowest bid alone does not win the contract. Standards could include mileage, emissions, and noise.	CBJ government
• Purchase low or zero-emission vehicles or renewable fuel vehicles to test for fleet use.	CBJ government
• Revise the surplus system within city government so that older less fuel efficient vehicles are no longer shifted from one department to another but removed from the fleet.	CBJ government
• Ensure fleet is expanded only for essential purposes.	CBJ government
Long-Term Actions	
• Consider using vehicles from a car sharing organization to reduce the Borough fleet size.	CBJ government
• Modify transportation contracts to incentivize alternative/renewable fuel use (school buses, construction contracts, etc.)	CBJ government

Strategy T1-B. Reduce emissions associated with existing CBJ fleet	
Short-Term Actions	**Responsible Party**
• Improve and increase training for fleet mechanics, especially in newer energy efficient vehicles and technologies, such as hybrids and electric vehicles, and ensure required vehicle tune-ups and maintenance occur in a timely manner.	CBJ government
• Work with the ADEC, Juneau School Board, and school bus service providers to retrofit school bus fleet with equipment (such as oxidate catalysts) that reduces emissions.	CBJ government
• Implement and enforce an anti-idling campaign to restrict idling of CBJ municipal vehicles, allowing flexibility for cold conditions or other situations where increasing the number of starts would be counterproductive.	CBJ government

Goal T-2: Increase Capital Transit ridership

Capital Transit operates 16 buses, eight para-transit vans, and four utility vans. Annually, the vehicles provide 1.27 million rides and drive over 880,000 miles. Many of the fleet's buses have been replaced with low floor accessible models and all buses are equipped with bike racks.

In 2008, a CBJ Transit Development Plan was completed that sets out an "Optimum Scenario" in which CBJ would make significant changes to the Capital Transit route structure. This was developed based on input from the community and staff and involved a trunk system combined with several local circulators. The optimum scenario would provide more frequent service throughout much of the core area, reduced travel time from Auke Bay to downtown, add service to Lena Point and the AMHS terminal, and reduce travel time for most trips. It would also require more vehicles and cost more to run than the current system. Implementation of these recommended improvements should be phased in as money and vehicles become available.

GHG emissions from the Capital Transit fleet in 2010 increased 2% over 2007. This increase was due to a 33% increase in express bus frequency between Downtown and the Valley.

Strategy T2-A. Expand transit service using most energy efficient vehicles practical	
Short-Term Actions	**Responsible Party**
• Update and work to secure funding needed to implement the "optimum scenario" in the Transit Development Plan. Focus on the actions that will have the biggest impact on reducing GHG emissions and energy use.	CBJ government
Long-Term Actions	
• Purchase only alternative/renewable fuel or hybrid transit vehicles in the future.	CBJ government

• Implement all recommendations for the "optimum scenario" in the Transit Development Plan.	CBJ government
• Build a new maintenance facility to house expanding hybrid/electrical fleet.	CBJ government

Strategy T2-B. Increase public education and provide incentives to increase transit ridership

Short-Term Actions	**Responsible Party**
• Increase public education about the benefits of public transit.	CBJ government/ Community
• Offer incentives for CBJ employees to use Capital Transit. Could include discounted bus passes, prizes for individuals or departments with highest rate of transit use, etc.	CBJ government
• Encourage employers to offer incentives for employees to use transit (e.g., discount on bus pass, etc.).	Community/Federal State/UAS/CBJ
• Work with large employers to set flexible and/or staggered work hours to coordinate with transit schedule and/or reduce crowding on buses.	Community/Federal State/UAS/CBJ

Goal T-3: Reduce emissions per vehicle mile driven

Local government has relatively limited opportunity to effect the technological improvements necessary to increase vehicle fuel efficiency or lower carbon content of fuels. Individuals, businesses, and governments can, however, positively influence Juneau's average fuel efficiency when purchasing a new vehicle. Local government can provide incentives for low and zero-emission vehicles and develop the infrastructure necessary to support low carbon vehicles.

Strategy T3-A. Reduce emissions associated with existing vehicles

Short-Term Actions	**Responsible Party**
• Pass an ordinance to restrict idling of all vehicles, mount public education campaign, and enforce the ordinance. Students at JDHS launched an anti-idling campaign, and there are now anti-idling signs posted in school pick-up areas; work with students to place signs at all schools.	CBJ government/ Community
• Implement city-sponsored driver training program to improve driving habits in order to reduce fuel consumption and emissions.	CBJ government
• Hold free public workshops on climate friendly driving and vehicle maintenance techniques (e.g., correcting tire pressure).	CBJ government/ Community
• Work with local tour companies to ensure that tour buses are properly equipped and maintained to run as efficiently and cleanly as possible.	CBJ government/ Tour Companies

Long-Term Actions	Responsible Party
• Set vehicle emissions standards similar to those in California.	CBJ government/State

Strategy T3-B. Encourage the use of low-carbon emitting vehicles	
Short-Term Actions	**Responsible Party**
• Create free or designated parking spaces and metered charging stations for electric and plug-in hybrid vehicles.	CBJ government
• Develop local incentives for the purchase of fuel efficient vehicles. Examples include free parking for hybrid electric vehicles (Los Angeles), a rebate for purchase of new hybrid electric vehicles (City of Riverside, CA, and an exemption from local sales tax for purchase of new fuel efficient vehicle (many communities).	CBJ government
• Require every public building to have a minimum number of vehicle plug-ins in each parking lot and parking garage.	CBJ government
• Reduce parking fees in government-owned garages for vehicles that reach a certain high threshold of fuel-efficiency.	CBJ government
Long-Term Actions	
• Make some convenient parking areas only usable by small cars, forcing large vehicles to find parking further away.	CBJ government
• Work with tour companies to replace tour buses with more energy efficient models. Consider the feasibility and economic viability of replacing existing fleet with electric buses.	CBJ government/ private sector
• Add low-speed vehicle corridor from Downtown to the Valley by filling in the gaps at Salmon Creek and McNugget intersections.	CBJ/State

Goal T-4: Increase bicycle and pedestrian trips

In 2009, the CBJ adopted the Juneau Non-Motorized Transportation Plan, setting out a series of high, medium, and low priority recommendations to improve sidewalks, crosswalks, separated paths, and bike lanes throughout the community. The Plan also includes 12 policies with implementing actions. A few of these recommendations have been completed, some are underway, and many have yet to be started. Non-motorized improvements that are underway include the separated path from UAS to the Brotherhood Bridge, and the Under Thunder and Treadwell Ditch Trails.

Improving facilities for non-motorized transportation will decrease the number of vehicle miles driven and has the additional benefits of improving public health by increasing physical activity levels, increasing mobility for carless residents, and decreasing transportation costs.

High priority infrastructure improvements include improving the bike route from the Mendenhall Valley to Downtown way by identifying gaps, adding signs, and bringing all routes up to standards. Other recommendations are to add crosswalks at key locations, pave shoulders, add sidewalks where pedestrian traffic warrants, and improve overall pedestrian conditions along Egan Drive downtown, Mendenhall Mall Road, Glacier Highway through Lemon Creek, and in the Auke Bay area.

Strategy T4-A. Implement the Juneau Non-Motorized Transportation Plan	
Short-Term Actions	**Responsible Party**
• Work to secure funding for high priority non-motorized transportation projects outlined in the Non-Motorized Transportation Plan.	CBJ government/ State DOT
• Continue to implement recommendations in Non-Motorized Transportation Plan.	CBJ government
Long-Term Actions	
• Implement the recommendations from the Safe Routes to Schools Plan.	CBJ government/ DOT/ School District
• Begin with implementing high priority infrastructure recommendations from the Non-Motorized Transportation Plan. Once completed, work to implement medium and low priority recommendations from the Plan.	CBJ government

Strategy T4-B. Use public education and incentives to encourage residents to walk and bike	
Short-Term Actions	**Responsible Party**
• Work with employers to establish incentives for employees to commute via non-motorized transportation.	State/UAS/Community
• Install bicycle racks, showers, and other amenities at City facilities to promote bicycle use by agency employees and visitors.	CBJ government
• Host or support bike rodeos, bike to work, and other events to promote non-motorized transportation.	CBJ government/ Community Partners
• Implement community enforcement, education, and encouragement programs to promote bicycling and walking.	CBJ government/ Community Partners

Goal T-5: Reduce vehicle miles driven

Increasing the number of drivers that use car sharing or ride sharing services will decrease the overall number of miles driven in Juneau. Ride sharing reduces the number of single-occupancy trips and could work well in Juneau because many people live in the Mendenhall Valley and work downtown and large employers can offer incentives. Car sharing reduces GHG emissions because members of car share programs tend to drive less than non-members and because car share program vehicles tend to be newer and more fuel-efficient. A study of the impact of a San Francisco car share program found that members use 76% less gas then non-members and that nearly 30% of members sold a vehicle after becoming members.

Strategy T5-A. Develop a car sharing and ride sharing programs

Short-Term Actions	**Responsible Party**
• Designate free on-street parking and convenient spaces in commercial and workplace parking lots for van pool and car pool vehicles.	CBJ government/ Major Employers
• Work with community partners to set up a website for car pool networking.	CBJ government/ Community
• Work with community partners to bring a car sharing program to Juneau.	CBJ government/ Community
• Work with the community's largest employers to develop van pooling and car pooling programs.	Local, state, federal governments/ UAS/ Community
• Launch a public awareness campaign to encourage ride sharing. Focus on the convenience and potential for saving money.	CBJ government/ Community
• Provide incentives to encourage city employees to participate in ride sharing.	CBJ government

Strategy T5-B. Encourage vehicle trip consolidation

Short-Term Actions	**Responsible Party**
• Educate the public to plan ahead and consolidate vehicle trips in order to reduce vehicle miles driven.	CBJ government/ Community

Goal T-6: Reduce emissions associated with marine transportation

In 2010, marine transportation was responsible for 18% of GHG emissions in Juneau. This estimate is based on fuel purchases in Juneau for use by fishing boats, recreational boaters, and the Alaska Marine Highway System. Energy use and GHG emissions from cruise ships and barge traffic where fuel is purchased outside of Juneau is not included in the emissions inventory. GHG emissions related to marine transportation decreased just over 5% from 2007 to 2010.

Strategy T6-A. Work with recreational and commercial boaters to reduce emissions and energy use associated with marine transportation

Short-Term Actions	**Responsible Party**
• Work with community partners to hold annual workshops to teach boaters to maintain engines and boats properly for enhanced energy efficiency.	CBJ government/ Community Partners
• Work with community partners to hold workshops to inform boaters of enhanced energy efficiency engine maintenance and new technologies.	CBJ government/ Community Partners
• Develop a program to encourage the replacement of 2-stroke engines with 4-stroke engines.	CBJ government/ Community
Long-Term Actions	
• Discourage use of 2-stroke engines within the Borough. (Alaska Department of Natural Resources has prohibited 2-stroke engines on the Kenai River.)	CBJ government
• Require all cruise ships and other large commercial ships to have the capacity to plug in to Juneau's electric energy supply when in port.	State and local governments/ Cruise Ship Companies
• Mandate new commercial docks to provide electric plug-ins for cruise ships and other commercial vessels, and require that ships use electric power whenever it is available.	CBJ government
• Select energy efficient designs when choosing new vessels for the Alaska Marine Highway System.	State

Goal T-7: Reduce emissions associated with air transportation

In 2010, air transportation was responsible for 9% of the GHG emissions in Juneau. This was 16% lower than in 2007. GHG emissions are based only on aviation gas and jet fuel sold by local distributors. Alaska Airlines refuels in Juneau only when necessary. Data needed to quantify the total GHG emitted from transporting goods and people to and from Juneau were unavailable for either the 2007 or 2010 inventories.

Air transportation emits more GHGs than any other form of travel per passenger mile, and trips by air tend to cover the longest distances. GHG emissions can be expected to increase, as

demand for air travel has been growing and does not show signs of slowing. Some of this increase will be offset by the phasing in of more fuel-efficient airplanes.

In Juneau, air traffic increases significantly in the summer with tourists taking flight seeing trips by float plane and helicopter.

Strategy T7-A. Work with the aviation industry to reduce emissions and energy use	
Short-Term Actions	**Responsible Party**
• Work with local aviation companies to reduce fuel consumption in aviation.	CBJ government/ Air service providers
• Bring local aviation companies, and possibly airplane manufacturers, together to share ideas to reduce fuel use in jets and small aircraft.	CBJ government/ Air service providers

Goal T-8: Reduce vehicle miles driven by increasing mixed-use development

Community land use influences where and how people live and work, including where schools, services, shops, and recreation areas and facilities are located. Distances between homes and these locations, and the transportation options available, affect GHG emissions output. Land use planning that reduces the need to drive and encourages residents to use public transit and non-motorized transportation reduces GHG emissions.

Promoting dense, compact, walkable, mixed-use and transit oriented neighborhoods not only reduces car dependence but also reduces government and taxpayer expenditures on water and sewer lines, road construction and maintenance, and street lights. Denser development usually generates more property tax per unit of land for local government. Mixed-use development focuses on creating diverse and interesting neighborhoods that reduce the need to travel long distances, facilitate transit and other non-automotive travel, offer a mixture of housing types including affordable housing, make efficient use of infrastructure, promote social equity, and protect the community's natural assets, while maintaining and reinforcing existing communities.

Many studies have linked increased residential density with reduced driving and reduced GHG emissions. Higher density mixed-use neighborhoods make non-motorized transportation and public transit more practical, while decreasing emissions and encouraging exercise. According to the 2000 US Census, 53% of people who live in the housing-dense downtown Juneau area, extending to the flats near the Federal Building, walk to work. Community-wide, only 8% of residents walk to work.

The 2008 City and Borough of Juneau Comprehensive Plan includes principles for creating livable mixed-use communities with features typical of transit oriented development. Relevant policies are 4.3, 10.2, 10.10, and 10.13.

Local ordinance CBJ Title 49, includes several provisions designed to encourage mixed-use and transit oriented development and allowing for shared parking and parking reductions in certain areas. Some of these ideas are incorporated below.

Strategy T8-A. Plan compact, mixed-use neighborhoods	
Short-Term Actions	**Responsible Party**
• Review the zoning ordinance to determine if updates are needed to promote compact, mixed-use, higher density development and provide realistic green belts or transition areas to reduce impacts from neighborhoods.	CBJ government
• Consider increasing building height minimums or minimum residential density in transit served areas.	CBJ government
• Provide extra assistance, and possibly an expedited permitting process, for transit oriented development.	CBJ government
Long-Term Actions	**Responsible Party**
• Continue to support development of mixed-use, walkable neighborhoods in Downtown Juneau and Douglas, West Juneau, and Lemon and Switzer Creeks, around schools, Mendenhall Mall, Auke Bay and UAS. Invest in public infrastructure that will support residential development in these areas.	CBJ government

Strategy T8-B. Manage parking effectively to minimize driving demand and to encourage alternative modes of transportation	
Short-Term Actions	**Responsible Party**
• Evaluate the fee structure for public on-street and off-street parking in Downtown Juneau and support efforts to account for and capture the true and market rate for parking.	CBJ government
• Update zoning regulations to set parking maximums instead of parking minimums only.	CBJ government
Long-Term Actions	**Responsible Party**
• Continue to reduce parking requirements, consider car-lite or car-free development in certain transit served areas; set parking maximums.	CBJ government

Strategy T8-C. Improve the pedestrian environment to encourage people to take more trips on foot	
Short-Term Actions	**Responsible Party**
• Update the land use code to require better streetscaping and pedestrian amenities with new development. Changes could include requiring landscaping within parking lots, street trees, crosswalks, and pedestrian routes within parking lots, and requiring parking to be located behind, beside, in, or under new buildings so that buildings front the sidewalk.	CBJ government
• Update road and street standards to include wider sidewalks, traffic calming measures in high-pedestrian areas, and shortened pedestrian crossing distances.	CBJ government
Long-Term Actions	**Responsible Party**
• Implement recommendations from the Juneau Non-Motorized Transportation Plan to improve the pedestrian environment, including crosswalk and streetscape improvements at specific locations.	CBJ government

Strategy T8-D. Include evaluation of projected GHG emissions in the development review process	
Short-Term Actions	**Responsible Party**
• Incorporate an analysis and evaluation of the potential GHG emissions from proposed projects undergoing a development review process. Applicants wishing to develop a building or operation over a certain size threshold could be required to include potential GHG emissions for Planning Commission consideration. Update the land use code appropriately.	CBJ government

3.4 Utilities

Nearly 4% of the nation's electricity is consumed by water and wastewater utilities (Center for Sustainable Systems, 2009), and Juneau's water and wastewater systems are comparable. In 2010, 13% of Juneau's local government GHG emissions came from wastewater treatment, mostly from the use of fossil fuels to burn sewage sludge at the Juneau-Douglas Wastewater Treatment Plant.

Street lights and water pumping each accounted for less than 1% of local government emissions, as these utilities operate primarily on electricity. However, given that these two utilities together consume 5% of available electricity, opportunities for conservation need to be carefully examined.

Utilities Goals	Potential GHG Reduction $MTCO_2e$
2010 GHG emissions from utilities (CBJ water, wastewater, CBJ lights, solid waste): 8,500 MTCO2e **Reduction to meet 2032 goals, CBJ utilities: 2,300 MTCO2e**	
Goal U-1: Reduce energy consumption and GHG emissions from wastewater treatment. *(Estimate: 25% reduction in emissions from wastewater treatment.)*	600
Goal U-2: Reduce energy consumption and GHG emissions from the water system	NA
Goal U-3: Reduce overall water use in Juneau	NA
Goal U-4: Reduce GHG emissions and energy use related to street lighting	NA
Goal U-5: Reduce GHG emissions and energy use related to solid waste processing. *(Estimate: Reduce material entering landfill by 25%.)*	1,700
Total Community Reduction from Utilities Sector	**2,300**

Goal U-1: Reduce energy consumption and GHG emissions from wastewater treatment

Wastewater is pumped through pump stations to either the Mendenhall or Juneau-Douglas treatment facility. At both treatment facilities, wastewater is ground and aerated and the sludge is separated out. Water is treated using UV light and discharged to the ocean or to the Mendenhall River. At both facilities, the remaining sludge is dewatered and incinerated. Until

late 2010, dewatered sludge from the Mendenhall facility was trucked to the Juneau-Douglas facility for incineration. Since the incinerator at the Juneau-Douglas treatment plant broke down in 2010, bio-solids from both wastewater treatment plants have been disposed of in the landfill.

In November 2010, the borough began investigating alternative methods for disposing of bio-solids. Options under investigation include shipment to the Lower 48 for disposal, composting, or continuing to use the landfill.

Until its failure, the sludge incinerator at the Juneau-Douglas Wastewater Treatment Plant emitted a large portion of the 12% of area-wide GHG emissions reported in the 2010 GHG inventory for wastewater treatment. According to an energy audit of the Juneau-Douglas facility conducted by Alaska Energy Engineering LLC, incineration cost the borough $250,000 in 2008. The report found that developing a system to compost bio-solids could significantly reduce Juneau's GHG emissions from wastewater treatment and would reduce operating costs in the long term.

The 2009 Alaska Energy Engineering LLC audit of the Juneau-Douglas Wastewater Treatment Plant accompanied a concurrent audit of the Mendenhall Wastewater Treatment Plant. The two reports set out high and medium priority energy conservation opportunities only a few of which have been completed to date. These recommendations have been incorporated into the following proposed action items.

Strategy U1-A. Reduce GHG emissions and energy use associated with disposal of sewage sludge

Short-Term Actions	**Responsible Party**
• Evaluate the feasibility of composting all sewage sludge. Consider adding other compostables, such as fish or brewery waste.	CBJ government
Long-Term Actions	**Responsible Party**
• If feasible, develop a system for composting sewage sludge.	CBJ government

Strategy U1-B. Reduce GHG emissions and energy use associated with existing wastewater system

Short-Term Actions	**Responsible Party**
• Install Supervisory Control Data Acquisition System in lift stations, to eliminate the need for a staff person to visit on a daily basis.	CBJ government
• Complete the high priority Energy Conservation Opportunities outlined in the 2009 Juneau-Douglas and Mendenhall Treatment Plant Energy Audits.	CBJ government

Long-Term Actions	Responsible Party
• Complete the medium priority Energy Conservation Opportunities outlined in the 2009 Juneau-Douglas and Mendenhall Treatment Plant Energy Audits.	CBJ government

Goal U-2: Reduce GHG emissions and energy use related to the water system

The Last Chance Basin well field on Gold Creek serves as Juneau's primary water supply. This source has been used since 1959, with additional wells drilled and improvements made in 1976 and 1990. Chlorination is the only treatment this water receives.

The community's secondary water source is Salmon Creek, which is operated in conjunction with the Alaska Electric Light and Power Company's power generation plant. The power plant is fed by a reservoir in the upper reaches of the Salmon Creek watershed, and the AEL&P generator is located near sea level. After it passes through the generator facility, the borough adjusts pH and alkalinity with soda ash and chlorinates the water before it enters the distribution system. Because of seasonal high turbidity and annual maintenance on the generator by AEL&P, the Salmon Creek freshwater source is intermittent. When on line, it typically supplies about a third of the water area wide. At times when both sources are available, residents north of Hospital Drive are served by water from Salmon Creek while residents south of Hospital Drive and all of Douglas Island are served by Last Chance Basin water.

The borough maintains three steel tank water storage reservoirs (Lemon Creek, East Valley, and Auke Bay), three steel tank water storage reservoirs and pump stations (Crow Hill in Douglas, Cedar Park in West Juneau, and Lena Loop), and three pump stations that supply water to upland areas without reservoir storage (e.g., Mountain Side Estates, Lee Street, Bonnie Brae).

This water system produces 1,500 M gallons of water annually. The facilities are all powered by electricity and consumed approximately 2,500 MWh in 2008 at a cost of $206,000. In 2008, an Alaska Energy Engineering LLC energy audit of the water system estimated that by investing in energy efficiency across the system Juneau could reduce its water system-related energy costs by 25%. This study recommended high, medium, and low priority actions. Some have been completed, and many have not.

Strategy U2-A. Implement the recommendations of the 2008 energy audit to reduce energy use and emissions related to the existing water system

Short-Term Actions	Responsible Party

• Implement the High Priority actions listed in the 2008 Water System Energy Audit.	CBJ government
Long-Term Actions	**Responsible Party**
• Implement the low priority actions listed in the 2008 Water System Energy Audit.	CBJ government

Goal U-3: Reduce overall water use in Juneau

The drinking water system in Juneau produces small volumes of GHG emissions because water is moved using electrical pumps. Decreasing overall community water consumption, however, would both reduce electricity use, freeing up more hydropower for use in place of diesel generation at Greens Creek and on the cruise ship docks, and reduce the volume of wastewater to be treated—both of these reductions would have the positive effect of reducing GHG emissions from fossil fuels.

Strategy U3-A. Implement education programs and incentives to encourage residents to conserve water

Short-Term Actions	**Responsible Party**
• Expand public awareness of the importance of conserving water, including detecting and repairing leaks.	CBJ government
Long-Term Actions	**Responsible Party**
• Adopt incentive program to encourage installation of water conservation measures in existing businesses and homes.	CBJ government

Strategy U3-B. Carry out ongoing maintenance and repairs to minimize leaks in the water system.

Short-Term Actions	**Responsible Party**
• Expand leak detection and ongoing maintenance and repairs to the water distribution system.	CBJ government
Long-Term Actions	**Responsible Party**

• Upgrade and retrofit CBJ plumbing systems with water conserving technology.	CBJ government
• Assess, maintain, and repair existing plumbing fixtures and pipes in all government buildings and facilities, including building and parking lot landscaping, public rest rooms, and parks and other recreational facilities, to reduce borough-wide water consumption.	CBJ government

Strategy U3-C. Consider water metering and increasing charges to encourage water conservation

Long-Term Actions	**Responsible Party**
• Consider introducing a residential water metering program.	CBJ government

Goal U-4: Reduce GHG emissions and energy use related to street lighting

In Juneau, the State owns the street lights along State roads, local government owns street lights along most city roads, and AEL&P owns lights along some streets, parking lots, stairways, and other areas; each of these entities owns and controls approximately one-third of the community's street lights. The vast majority of street lights currently in use are high pressure sodium lights. If all of the streets lights in Juneau were replaced with energy efficient lights, energy use required to light the borough's streets would be cut in half.

Powering the street lights owned by the borough accounted for 8% of the electricity purchased by local government in 2008. Street lights directly produce no measurable GHG emissions. Electricity used to run state and AEL&P-owned lights was not broken out in the inventory.

Until recently, when AEL&P installed a new lamp, the customer (most frequently, local or state government) paid for the pole and fixture and then paid a monthly flat rate for the electricity. Under a new AEL&P system, a reduced monthly flat rate will be offered to those who pay the higher cost to have an energy efficient light fixture installed.

When street improvements are made, the old lamps are now replaced with energy efficient lights, reducing electricity consumption and saving the City money.

The Alaska Department of Transportation and Public Facilities (DOT) follows the statewide standards for the type and number of lights to be installed along various types of roadways. To date, DOT has yet to begin installing energy efficient lights routinely in the Juneau area.

Strategy U4-A. Install energy efficient street lamps.	
Short-Term Actions	**Responsible Party**
• Work with AEL&P to maximize the number of energy efficient lights in Juneau. Research what lighting technology is the best for this climate, is economical from a lifecycle perspective, and provides good lighting (Sitka has recently completed a similar study).	CBJ government/ AEL&P
• For new CBJ fixtures, install only energy efficient fixtures and bulbs.	CBJ government
• Encourage the state DOT&PF to adopt a policy requiring all new bulbs and fixtures to be energy efficient.	Local and state government

Goal U-5: Reduce GHG emissions and energy use from solid waste processing.

Nationwide, manufacturing accounts for 23% of the total energy use (Shuford, et al., 2010). Nearly all the goods purchased in Juneau are produced outside of the community's boundaries. GHG emissions associated with this production and transportation to Juneau are not included in the emissions inventories.

Traditionally, solid waste reduction involves a three-part approach: reducing, reusing, and recycling. Reduction is the most important step; buying and using fewer unneeded products, selecting products that use less packaging, and choosing durable rather than disposable items lessens a community's solid waste processing burden. Reuse involves such measures as donating used goods to charity and maintaining and repairing rather than replacing broken items. After these waste-reducing measures are achieved there will still be high volumes of solid waste, a large portion of which should be recycled.

Reducing the amount of goods that are consumed in our community will reduce the energy used to both manufacture goods and transport those goods to Juneau, and, ultimately, landfill volumes will be lowered, resulting in decreased GHG emissions from the off-gassing of landfill-produced methane.

In the average residence, compostables can account for up to 40% of solid waste by weight. Composting residential waste, fish waste, sewage sludge, and wood waste could also reduce the solid waste entering Juneau's landfill that adds to its GHG emissions.

Juneau's landfill, which is operated by Waste Management Inc., is located in the Lemon Creek drainage. The community produces an average of 33,000 tons of waste annually, with approximately 75% of it coming from residential or commercial sources and 25% from construction and demolition debris. Just over 2,000 tons of aluminum, steel, glass, plastics (#1

and #2), paper, and corrugated cardboard were recycled at the Waste Management recycling center in 2010.

Expanding local capacity to process recycled materials has the potential to reduce GHG emissions. As noted above, when less waste enters the landfill, less methane is released. Currently, recyclables must be transported by barge to the Lower 48 for processing. Local processing of this material would decrease recycling costs, as well as GHG emissions associated with barge transport.

Local government has direct control over the amount of waste generation and recycling undertaken in its buildings and at other facilities. Many buildings have adequate recycling facilities and good rates of diversion, while others do not.

Local governments, businesses, and individuals can make a difference in GHG emissions through purchasing goods that have been manufactured using methods that produce fewer GHGs, use less packaging, are more durable, are manufactured nearby, and can be reused or recycled.

Strategy U5-A. Reduce the amount of solid waste generated in Juneau

Short-Term Actions	**Responsible Party**
• Mount a campaign to educate residents about the importance of waste reduction. Campaign could encourage use of reusable bags, coffee cups, and plastic water bottles.	CBJ government/ Community
• Promote the utilization of reuse and repair businesses in outreach to businesses and residents.	CBJ government
• Work with businesses to reduce/eliminate use of disposable containers or increase use of compostable containers if composting facilities are provided.	CBJ government
• Discourage use of single-use plastic bags.	CBJ government/ Community

Strategy U5-B. Reduce waste associated with local government facilities and operations

Short-Term Actions	**Responsible Party**
• Work with CBJ departments to identify strategies for increasing recycling at Borough facilities.	CBJ government/ Friends of Recycling
• Complete an audit of waste from various departments and use results to make changes that will reduce waste.	CBJ government

• Increase reuse of surplus items. Use freecycle or other giveaway processes for non-salable surplus items.	CBJ government
• Consider updating procurement policies to promote purchasing of fewer disposable and more durable items.	CBJ government
• Adopt a sustainable procurement policy that seeks to procure all supplies, services, maintenance, construction, and architect-engineer services in a manner that promotes increased energy efficiency and reduced GHG emissions.	CBJ government

Strategy U5-C. Increase the rate of recycling in Juneau and expand capacity to process recycled material

Short-Term Actions	**Responsible Party**
• Educate the public about opportunities for waste reduction and recycling.	CBJ government/ Friends of Recycling/ Waste Contractor
• Make recycling a condition of permits issued by local government for special use and festivals and other events. Increase awareness around best practices and resources for waste reduction at events.	CBJ government/ Community
• Support efforts to increase recycling in public spaces such as the airport and Centennial Hall.	CBJ government
• Target commercial operations and institutions to increase participation in waste reduction and recycling efforts.	CBJ government/ Friends of Recycling
• Keep clothing and fabric out of the landfill by encouraging residents to recycle clothes. Consider innovative options for cloth recycling.	CBJ government/ Community
• Place recycling collection bins in neighborhoods throughout the community, e.g., at schools, shopping centers, or publicly-owned buildings.	CBJ/Recycling Contractor
• Add a free store or take-it-or-leave-it location at the landfill where reusable items can be dropped off and picked up.	CBJ government/Waste Contractor
• Extend recycling contract from 3 years to 10 years to allow bidder to invest in new infrastructure, increase space, etc.	CBJ government
• Implement a curb-side recycling service in Juneau.	CBJ government/ Recycling Contractor
• Encourage businesses to use "deconstruction" services when undertaking demolition and renovation projects, including selective dismantlement of building components for reuse and recycling.	CBJ government

Long-Term Actions	Responsible Party
• Increase capacity of the recycling center and expand the types of items that are recycled, especially plastics.	CBJ government/ Recycling Contractor
• Support local efforts to recycle paper or glass. Update the recycling contract to require contractor to use recyclables locally where possible.	CBJ government/ Recycling Contractor
• Support a Re-Build facility where construction materials can be salvaged and recycled. Could include construction materials, glass jars, etc. CBJ could donate land or provide an old warehouse or provide land for a building or use a portion of an existing warehouse.	CBJ/Community Partners

Strategy U5-D. Develop a municipal composting system

Short-Term Actions	Responsible Party
• Research and develop a municipal composting facility in a central location. Consider composting sewage sludge, fish waste, brewery waste, wood scraps, yard waste, and household compostables, drawing on the composting experiences of other communities in the region, e.g., Gustavus, Haines, and Whitehorse.	CBJ government
Long-Term Actions	**Responsible Party**
• Consider the feasibility of developing a commercial biomass recovery facility that could accept various biomass waste streams such as sewage sludge, landscape/tree residue, waste/recycled paper and cardboard, and cooking grease, for energy recovery.	CBJ government

Strategy U5-E. Consider a waste-to-energy system for Juneau

Long-Term Actions	Responsible Party
• Consider the economic feasibility of developing a waste-to-energy facility in Juneau.	CBJ government/Waste contractor

3.5 Mining and Non-Highway Equipment

Mining

In many communities, most energy is consumed by industry. This is not the case in Juneau where the local economy rests primarily on a foundation of government office work, health care, retail, and education. Industrial activity in the borough is limited to the two mines, Kensington and Greens Creek, and to several smaller manufacturing operations in town such as the Alaskan Brewing Company.

In 2010, the two mines together were responsible for approximately 10% of the community's GHG emissions. Greens Creek is tied to the AEL&P electricity grid, and, when there is excess electricity not required by the community, electrical power is used by the mine. During times of low water and/or high community energy use, Greens Creek uses diesel generators to heat and light its buildings and run much of its operation.

At the Kensington mine, gas, propane, and diesel generators are used to power all operations and facilities, and fossil fuels are used to power vehicles such as haul trucks and muckers. The mine is located north of Berners Bay and is not currently connected to the AEL&P grid. Although Juneau's existing hydroelectric energy supply is insufficient to power a second major industrial facility like the Kensington, finding a renewable source of power for the mine would have a significant impact on local GHG emissions.

GHG emissions attributable to Kensington in the 2010 inventory represent but a partial tally based on emissions the mine must report to the U.S. EPA, which requires mining operations to report their GHG emissions from stationary equipment. However, because all fuel used at the mine is purchased in Juneau, the inventory method captures Kensington fossil fuel-related emissions via sales data.

Non-Highway Equipment

The GHG Emissions Inventory measures the emissions related to fuel not used by motor vehicles licensed to operate on public ways and fuel for generators and construction equipment.

Mining and Non-Highway Equipment Goals	Potential GHG Reduction $MTCO_2e$
2010 GHG emissions from mining: 38,000 MTCO2e	
Reduction to meet 2032 goals from mining: 7,600 MTCO2e	
2010 GHG emissions from non-highway equipment: 20,477 MTCO2e	
Reduction to meet 2032 goals from non-highway equipment: 5,200 MTCO2e	

Goal MC-1: Decrease GHG emissions associated with mining operations. *(Estimate: 20% reduction in emissions from mining sector.)*	7,600
Goal MC-2: Decrease GHG emissions associated with non-highway equipment. (Estimate: *30% reduction in emissions from non-highway equipment.)*	5,200
Total Community Reduction from Mining and Non-Highway Equipment	**12,800**

Goal MC-1: Decrease GHG emissions associated with mining operations.

Strategy MC1-A. Work with local mines to reduce GHG emissions and energy use.	
Short-Term Actions	**Responsible Party**
• Support/provide incentives to encourage the use of renewable energy sources for local industrial operations.	CBJ government/ Private sector
• Incentivize and reward companies that reduce energy use, GHG emissions, and waste.	CBJ government
• Encourage local operations to implement best energy management practices to reduce energy use (e.g. turning off equipment when not in use, keeping motors in good repair, etc.).	CBJ government/ Private sector
Long-Term Actions	**Responsible Party**
• When evaluating proposals for new mines or other large industrial projects, consider the potential impact on the community's GHG emissions.	CBJ government
• Work with Coeur Alaska to bring a source of renewable energy to the Kensington mine site.	CBJ government/ Coeur Alaska

Goal MC-2: Decrease GHG emissions associated with non-highway equipment.

Strategy MC2-A. Work with local companies to reduce GHG emissions and energy use from non-highway equipment	
Short-Term Actions	**Responsible Party**
• Support/provide incentives to encourage the use of renewable energy sources for local construction and related operations.	CBJ government/ Private sector
• Incentivize and reward companies that reduce energy use, GHG emissions, and waste.	CBJ government
• Encourage local operations to implement best energy management practices to reduce energy use (e.g. turning off equipment when not in use, keeping motors in good repair, etc.).	CBJ government/ Private sector
Long-Term Actions	**Responsible Party**
• When evaluating proposals for road building or other large industrial projects, consider the potential impact on the community's GHG emissions of both construction and ongoing operation of a project.	CBJ government

3.6 Renewable Energy and Alternative Systems

Most buildings in Juneau use fuel oil for space and water heating, which collectively account for 40% of the community's GHG emissions. One way of reducing emissions from the housing sector is to encourage the use of renewable energy sources and/or to install heating systems that are more efficient, such as district heating.

Local sources of renewable energy include water geothermal, ground geothermal, ground well geothermal, air-to-air or air-to-water heat pumps, wood pellets, waste heat recovery, wind, tidal, and solar. Many of these have already been tried in Juneau, with some proving more effective than others.

District heating is a system for distributing heat generated in a centralized location for residential and commercial heating requirements such as space heating and water heating. Primary heat sources have traditionally involved cogeneration plants burning fossil fuels, but, increasingly, biomass is being employed for this purpose. Heat-only boiler stations, geothermal heating, and central solar heating are also coming into use. District heating plants are generally more efficient and provide for better pollution control than localized boilers.

Expanded use of a broad range of innovative renewable energy systems should continue to be explored by area-wide residential, government, and business consumers. Projects could focus on anything from boat motors, to mining drills, to home heating, to hot water, to building ventilation systems.

Renewable Energy Goals	**Potential GHG Reduction $MTCO_2e$**
Note: It is assumed that improvements to renewable energy systems will generally lower emissions generated by buildings. **2010 GHG emissions from buildings: 112,000 MTCO2e**	
Goal RE-1: Increase the use of alternative forms of renewable energy for residential and commercial development. *(Estimate: 5% reduction in overall emissions from buildings.)*	6,900
Goal RE-2: Develop a district heating pilot project in Juneau.	NA
Goal RE-3: Increase the community's supply of renewable energy.	NA
Total Reduction from New Renewable Energy	**6,900**

Goal RE-1: Increase use of alternative forms of renewable energy for both residential and commercial developments

Strategy RE1-A. Add incentives for and remove barriers to renewable energy projects	
Short-Term Actions	**Responsible Party**
• Update land use code and permitting regimens to allow for micro-hydroelectric and wind projects in all districts.	CBJ government
• Work with AEL&P and the State to implement net metering or energy buy back systems that will allow owners of small renewable systems to receive a credit for energy they produce.	Community partners/ AEL&P
• Develop a competitive grant process to assist businesses in installing renewable energy systems.	CBJ government/ Community Partners
Long-Term Actions	**Responsible Party**
• Consider property tax exemption for buildings with renewable energy pilot projects. (Note: Changes to taxes may require changes to state statute.)	CBJ government
• Explore commercial use of energy produced by solid waste treatment.	CBJ government/ Community partners

Goal RE-2: Develop district heating projects in Juneau

Strategy RE2-A. Develop district heating pilot projects	
Short-Term Actions	**Responsible Party**
• Evaluate subdivision and other permitting and development codes to ensure that there are no barriers to the use of district heating.	CBJ government
• Evaluate options for implementing a district heating system (possibly using a seawater heat pump) in the Willoughby District. This area would be good for a pilot project as there is a high density of publically owned properties and several properties that are ready for redevelopment.	Local, state, and federal governments/ Private Sector Partners

• Perform a city-wide study investigating district heating options for such complexes as UAS, Vintage Park, the prison complex, the Hospital area, etc.	Local, state, and federal governments/ Private Sector Partners
Long-Term Actions	**Responsible Party**
• If feasible, implement a district heating system in the Willoughby District.	Local, state, and federal governments/ Private Sector Partners
• Pursue funding to implement other feasible district heating projects in Juneau.	CBJ government

Goal RE-3: Increase Juneau's supply of renewable energy

Strategy RE3-A. Develop an energy plan for Juneau to ensure sufficient renewable energy resources for future growth that reduce/eliminate GHG emissions.

Short-Term Actions	**Responsible Party**
• Develop an Energy Plan for the community to identify and evaluate the economics of renewable energy sources (including hydroelectric, biomass, solar, tidal, and wind) that will be able to meet the community's needs in the future. The Energy Plan will need to be flexible enough to respond to changing conditions and will need to examine the full range of renewable energy potential and relative costs.	Local, state, and federal governments/ Private Sector Partners
Long-Term Actions	**Responsible Party**
• Consider the feasibility of other potential hydroelectric sources to meet future needs such as Phase 2 Lake Dorothy (capacity of 94 GWh) and Sweetheart Lake (136 GWh).	AEL&P/Juneau Hydropower Inc/Other Private Sector
• Implement the recommendations of the Energy Plan to identify and develop local renewable energy sources.	Local, state, and federal governments/ Private Sector Partners

3.7 Food Production

The overwhelming majority of the food consumed in Juneau is produced elsewhere. GHG emissions associated with land clearing, livestock, transportation, fertilizer and chemical production, processing, packaging, and running farm equipment generated outside of Juneau are not captured in Juneau's GHG inventories. Food production systems are complex, making it difficult anywhere to measure the GHG emissions from the food production sector. Because Juneau imports virtually all of its non-seafood food from outside sources, it is not possible to quantify food production GHG emissions for the Borough. However, general findings regarding the relationship of food production to increasing GHG emissions that are true for most places hold true for Juneau.

For example, the production of dairy and red meat is responsible for a large share of food-related GHG emissions, with red meat estimated to be responsible for 150 percent more GHG emissions than chicken or fish (DeWeerdt, 2009). At a global level, the UN Food and Agriculture Organization has estimated that livestock accounts for 18 percent of all greenhouse gas emissions—more than all forms of fossil fuel-based transport combined.

Food consumed in the U.S. is estimated to travel on average 1,500 to 2,000 from farm to table. Because Juneau is located 890 miles north of Seattle, the port from which most of the community's food is shipped, it is safe to assume that food sold in Juneau comes from at least 1,500 to 2,000 miles away.

When food is produced, processed, and distributed near where it is consumed, transportation miles are minimized as are the associated pollutants. Locally grown food offers many social and economic benefits. Growing a garden can not only provide a cheap source of healthy food, but when done across a community, can help to insulate residents from the volatile oil prices paid for food production that get passed along to consumers in food prices. Finally, organic food production requires less fossil fuel inputs then conventional systems, which reduces greenhouse gas emissions.

While the following set of objectives may not have a large impact on local GHG emissions, increasing local food production represents a topic of growing community interest.

Food Production Goal	**Potential GHG Reduction $MTCO_2e$**
Note: No estimate is provided because it is assumed that this goal will have minimal potential to reduce local GHG emissions.	
Goal F-1: Increase local food production.	NA
Total Reduction from New Renewable Energy	**NA**

Goal F-1: Increase local food production

Strategy F1-A. Increase access to locally produced organic food for the community by supporting efforts to build more complete and sustainable local food production and distribution systems	
Short-Term Actions	**Responsible Party**
• Promote and continue to expand the Juneau farmers market. Consider developing an outdoor covered space that could be used as a market and for other uses.	CBJ government/ Community Partners
• Support/promote commercial agriculture at a scale that the available land in Juneau can support. Focus on agriculture that does not require large land areas.	CBJ government/ Community Partners
• Update land use codes to allow for increased personal use animal husbandry, agriculture, and community gardens.	CBJ government
• Encourage and support existing community gardens as well as neighborhood initiatives to launch additional community gardens. Consider avalanche chutes as possible locations.	CBJ government/ Community Partners
• Support local efforts to provide training to residents in farming and gardening techniques.	CBJ government/ Community Partners
• Support local seafood sales on or near the downtown waterfront.	CBJ government/ Community Partners
• Provide gardening information to residents. This could include information on techniques, seeds, local tips and other resources. Work with local partners such as 4H, UAS agriculture, and the Jensen-Olson Arboretum.	CBJ government/ Community Partners
Long-Term Actions	**Responsible Party**
• Partner with other Southeast Alaska communities to develop a regional food production plan.	CBJ government/ Regional Communities/ Community Partners
• Increase the amount of local food (including local or regional fish) served in school lunches. (Examples of school greenhouses found in Barrow and Sitka school lunch programs.)	CBJ government/ School District
• Consider planting edible plants instead of ornamentals on CBJ lands.	CBJ government
• Consider innovative techniques, such as using waste heat for greenhouses or growing vegetables in old mine shafts.	CBJ government/ Community Partners

3.8 CBJ Staffing

Accomplishing the goals set out in this Plan and meeting the adopted GHG emission reduction targets will require considerable effort and resources from both the local government and the wider community.

The "Responsible Party" for many of the actions recommended in this Plan is the CBJ government, oftentimes working in conjunction with the community at large or a partner or partners. To ensure sufficient attention is paid to meeting these targets, a new position responsible for updating the emissions inventory, carrying out the public outreach plan, monitoring energy use across the borough and in local government departments, securing funding required for energy efficiency upgrades and new programs, making sure existing plans are implemented, and generally overseeing CBJ energy incentive programs should be created.

One option is to assign implementation actions from this plan to various CBJ staff positions. A range of positions, including safety officer, building inspector/plans examiners, building maintenance staff, planners, and finance analysts, could perform and provide oversight and feedback on recommended actions.

The preferable option would be to hire a new Energy Manger to focus on implementing this Plan. Duties would include:

- Complete the emissions inventory updates.
- Develop and maintain the Climate Action Plan/energy efficiency website.
- Develop and maintain a system for monitoring energy use in CBJ buildings and operations.
- Set up ongoing education opportunities for CBJ staff and the public.
- Apply for grants to carry out energy efficiency upgrades and related projects. Manage grant funding once received.
- Work with departments and maintenance staff to ensure that the CBJ fleet is as efficient as possible.
- Research energy efficiency systems and technology.
- Develop and oversee the energy efficiency award program.
- Coordinate with community partners, the CBJ Green Team, and the JCOS.
- Develop and administer grant and/or incentive programs.

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Appendix 1 – List of Meetings

The following meetings were held during the development of the Juneau Climate Action Plan.

Juneau Commission on Sustainability
March 2, 2011
April 6, 2011
July 6, 2011
September 7, 2011

Juneau Commission on Sustainability – GHG Sub-Committee
January 27, 2011
February 10, 2011
February 28, 1011
March 14, 2011
March 28, 2011
April 11, 2011
April 26, 2011
May 17, 2011
September 28, 2011

CBJ Green Team
February 6, 2011
April 20, 2011
September 21, 2011

Public Meetings
May 25, 2011
October 5, 2011

CBJ Assembly Committee of the Whole
August 1, 2011
October 31, 2011

Appendix 2 – Building Code Information

5 November 2011

Marquam George LLC
8752 N. Douglas Rd
Juneau, AK 99801

Skilbred Consulting
Project: CBJ – GHG Climate Action Plan

For many parts of the country adopting the IECC 2012 would probably challenge the building industry much more than in Juneau. The current CBJ residential building code is the 2006 IRC. There are only a couple of significant changes from business as usual for Juneau builders to meet the compliance changes between the two codes. Most of the thermal requirements are very similar; the biggest addition is adding a thermal break to the wood frame walls.

For this comparison and estimate I'm using a 2400 square foot house, 2 stories, electric heat, electric hot water, and downtown Juneau weather.

I believe to meet the IECC 2012 it would cost $6000 more based on the above building profile from the current code in effect.

Annual energy savings would be $400 with an annual reduction in electrical consumption of 3000 kWh based on an electrical rate of $0.1146 kWh.

Major thermal requirements of the two codes:

	IRC 2006	IECC 2012
Under floor Insulation	R-30	R-38
Crawl space wall	R-15/19	R-15/19
Fenestration	U-0.33	U-0.32
Wood frame wall	R-20 or R-13+5	R-20+5 or R-13+10
Ceiling	R-49 or 38	R-49
Skylight	U-33	U-55

The numbers I have for Juneau buildings from AHFC (BEES rated homes 1996-1999) show 111 homes built during that period with an average airtightness of 3.13 ACH50. This and the thermal break required in wood frame walls appear to be the largest obstacle between the two codes. The IECC 2012 requires airtightness testing and air leakage rates not exceeding 3.0 ACH50 for our climate zone.

Whole building ventilation is also required under the IECC, but not more than complying with the current AHFC BEES. I did not account for the 75% "high efficacy" lighting fixtures as required by the IECC since I'm unsure what the common practices are currently in Juneau.

The big parts of the $6000 increase:

$3000.	Material cost for 1" XPS rigid insulation covering the exterior sheathing ($20.00 per 4' x 8' x 1" panels)
$1625	Labor cost of installing rigid insulation. Source R.S.Means (2011), 20 minutes per 4' x 8' panel. I allocated a labor cost of $65 per hour.
$375	Airtighness testing.

The rest is increased insulation, slightly better windows, lighting etc.

In summary, a report compiled by the Pacific Northwest National Laboratory[1] for the U.S. Department of Energy estimates a total reduction in energy use of 30.6% for the projected requirements of the 2012 IECC as compared to the 2006 IECC, assuming the use of the primary compliance option that involves standard-efficiency equipment. Were the high-equipment efficiency option used, the projected savings would be 0.9% higher, at 31.5%

[1] http://www.energycodes.gov/IECC2012/documents/residential-savings-estimate.iecc-2012-proposals.6-may-2010.pdf

Appendix 3 – Public Input

Juneau Climate Action Plan
October 5, 2011- Public Meeting
Meeting Summary

Team: Amy Skilbred, Zoë Morrison, Marquam George,Kim Kiefer
Members of the JCOS: Steve Benke, Nancy Waterman, Ava Bornstein, Kate Troll, Lisa Wiessler
Members of the Public: Bill Leighty, Michael Hekkers, Ben Creary

- Suggestion to add more information to the potential GHG reduction targets listed for each goal. *(This will be completed before next COW meeting on Oct 31).*
- Comment about using the term "alternative energy". Better to use term "renewable energy". *(Will change plan to remove term "alternative energy").*
- Comment about types of energy efficient light bulbs having other problems; unintended consequences of energy efficiency upgrades. *(Will check the plan to ensure that we recommending energy efficient light bulbs as opposed to specific types of light bulbs).*
- Important to recognize the steps already taken by governments, business, etc. *(A section or box with information about local energy reduction/efficiency projects will be added to the Plan).*
- In order to move the bus fleet from diesel to electricity a bus barn is needed. (*Check if this is in Capital Transit Plan and consider adding to list of long term actions).*
- Helpful to add some local success stories to the Plan to make it more personal. (*Will add information about number of homes that have used the AHFC energy rebate program, information about post-avalanche energy conservation).*
- Suggestion to refer to the Energy Cluster Working Group in the Plan. *(Consider adding this to the section on local actions that have taken place or are underway. Don't want to refer to all energy plans underway; but should include those that are most relevant.)*
- Suggestion to add a recommendation that all proposed CBJ buildings should undergo a life cycle analysis before construction. (*Will add this as an action in the CBJ building section).*
- Comment about including light rail as a transportation alternative. *(Best to limit transit suggestions to those in the Plan that has been adopted by CBJ Assembly).*
- Building code update; could add recommendation about adopting the ICC International Building Code 2012 version. *(Will talk to Marquam and come up with a plan for what to recommend for building code updates).*

Next Steps

- Make changes to plan as per recommendations from public meeting by October 26.
- Committee of the Whole meeting October 31, 6:00 pm
- Make changes to plan as per recommendations from COW
- Introduction to Assembly November 14 (tentative)
- Public Hearing November 28 (tentative)

Zoe Morrison

From: Barbara Sheinberg [bsheinberg@gci.net]
Sent: Sunday, August 28, 2011 2:32 AM
To: Zoe Morrison
Subject: Fwd: JCAP draft 8-11 Review Comments

Sent from my iPhone

Begin forwarded message:

> **From:** Robert Deering <rcdeering@gmail.com>
> **Date:** August 27, 2011 11:53:29 PM AKDT
> **To:** bsheinberg@gci.net
> **Cc:** Robert Deering <robert.c.deering@uscg.mil>
> **Subject: JCAP draft 8-11 Review Comments**
>
> Hi Barb,
>
> Here are my comments so far. There may be more (of course) :)
>
> 1. It would make commenting simpler if you allowed commenting in the Adobe Acrobat document properties section. Then one could insert comments directly into the document. Might make comment management more difficult, but if it yields more comments, that's the goal...right?
>
> 2. To be out front on my perspective, it's my opinion, after extensive analysis, that biomass will have to be a significant portion of our region's energy portfolio if we're going to achieve meaningful GHG reductions, as well as improve our energy security and economic vitality. Many of my comments will come from that basis. Shocking, I know.
>
> 3. Emissions Inventory - acknowledges that 2010 had significantly fewer heating degree days (it was a warmer winter) than 2007, but fails to quantify what affect that had on heating fuel usage (and no doubt other fuel usage such as plowing, snow removal, and airport runway maintenance). I suspect our improvements in efficiency aren't quite as great as this inventory might suggest. Recommend an abundance of caution making projections and generalizations based on only two data points.
>
> 4. EI - Claims that propane represents 2% of building emissions. I suspect that 2% of building heating was NOT derived from propane as this is a very expensive energy source. Perhaps a very few homes are heated with propane, and some on-demand water heaters. The more likely usage is as a cooking fuel, in some barbeques, gas stoves, with the largest quantity being used in restaurant applications. Recommend a little more research into this number. A sampling of local restaurants to quantify their propane usage will shed more light on this number.
>
> 5. EI - Appendix V has the community emissions table which totals community emissions. It shows CO2 emissions from wood energy to be 4% of total emissions for the community. Likewise, the Action Plan table 1.2 lists wood as a contributor to the total GHG percentage. However, Chapter 13.1.2.5 of the Local Government Operations Standards states that:

"Following established international greenhouse gas management principles, emissions of CO2 from combustion of biomass are not included as a Scope 1 source because the carbon concerned is of biogenic origin and would have been emitted to the atmosphere through the natural process of decay. However, in order to more completely represent the local government's energy use, the total CO2 released from biomass combustion should be reported as an information item. This should include CO2 from biomass combustion in both stationary and mobile sources."

In accordance with the protocol you're following, it appears that emissions from wood should not be tallied in the overall inventory. If you continue to include biomass emissions in the inventory, contrary to the inventory protocols, then biomass will be effectively excluded as a contributor to achieving GHG reduction goals. Do we really want to arbitrarily take our most powerful available tool off of the table?

Also note that in Action Plan section 1.1.1, final paragraph, you highlight the Sealaska conversion to pellets as a project which reduces GHG's. How can that be if you're including them in the inventory?

If you make a separate note of emissions from biomass combustion, it would also be appropriate to include a reference to: Life Cycle Impacts of Forest Management and Wood Utilization on Carbon Mitigation: Knowns and Unknowns (Lippke et al. 2011 - Univ of Washington). This recent report is the first to apply systematic life cycle analysis to forest bioenergy development.
http://www.corrim.org/pubs/articles/2011/FSG_Review_Carbon_Synthesis.pdf

A summary analysis of the paper can be found here:
http://www.dovetailinc.org/files/DovetailLCABioenergy0711.pdf

6. JCAP Sect 3.2 Buildings - Numerous comments here:

- Again, this section continues to include wood burning as a emitter of GHG's, contrary to the protocol basis for this report, as well as the most recent academic analysis.

- GHG reduction strategy #3 is: 'Convert from fuel oil to hydro-based electricity' for heating buildings. Unfortunately, this strategy will INCREASE GHG's not reduce them. AELP's energy capacity is rapidly being consumed by exactly this activity, and all reserve capacity will be consumed long before 2032...more like 2020 or earlier. What this means is that, first, AELP will cut off its interruptible customers, Greens Creek (they've been off much of 2011) and Princess. These customers will shift to diesel electrical generation at 30% efficiency, producing far greater net GHG's than the oil boilers (80% efficiency) that they replaced. Once all of the interruptible demands are shed, AELP will either have to increase rates or start augmenting hydro generation with diesel generation, again generating unnecessary CO2 and expense.

- Using heat pumps for building heating is better, but it still adds load to the grid. And replacing a oil boiler with a heat pump does not displace the resulting GHG's emitted by the diesel generator. If AELP has to run diesel generators to operate heat pumps...that's a big GHG loser.

- "Increasing fuel oil costs directly increase the cost of heating homes and businesses. Older buildings that tend to be less energy efficient will become increasingly expensive to heat. High energy costs will continue to motivate building owners to reduce their energy consumption in order to save money."
This statement is a bit of an assumption. Perhaps some businesses will close and some people will leave Juneau. Others will switch to cheaper electrical heat, causing the issues I've outlined

above. It needs to be noted that increasing energy costs will damage the Juneau economy. Many older buildings cannot be significantly upgraded without considerable, sometimes unjustifiable expense. If a weatherization incentive program does not continue, the capital expenses of these upgrades may make them unattainable.

- "While space and water heating consume energy in commercial buildings, ventilation is their largest energy use."
Do you have a citation for that claim? And a definition of 'commercial buildings'?

- JCAP p.25, bottom - E.O. 12148 is from 1979 and relates to Emergency Management. I think you're actually referring to E.O 13514.

- While this section identifies many generalities and mandates for pursuing better energy performance, it doesn't actually quantify what those activities will achieve. How was the reduction goal for buildings established with no numerical milestones to base it on?

- And most importantly, why was biomass not identified as an important tool for achieving these goals? This appears to be a deliberate decision which warrants public discussion before it becomes enshrined as policy in this document. Note that the Juneau Commission on Sustainability recently passed a motion to support biomass heating for public buildings. Clearly there's a misalignment in priorities that needs to be resolved.

- The USDA-commissioned Renewable Energy Cluster Workgroup has established a draft goal of a 20% conversion from heating oil to biomass for building heating in Southeast, with a 1% conversion each year thereafter until the sustainable supply limit has been reached. Assuming supply constraints allow, that would be a 32% reduction in building emissions by 2032, and would go a long way toward meeting the Juneau goals...assuming GHG's from biomass are properly excluded.

- Couple the biomass conversions with building efficiency improvements and most of Juneau's goals could be met in the building sector.

- Furthermore, if biomass conversions were targeted toward electric resistance building heating, that would free up that electrical capacity for other uses which would yield a far better GHG return such as heat pumps, or better yet mine and cruise ship power, and electric cars (more on that soon).

7. JCAP Sect. Transportation - again, several comments:

- Electric cars and plug-in hybrids are on their way. Nearly every major car manufacturer has models in the pipeline for release in the next 2 years. Juneau is an ideal place for electrics - our limited road system eliminates 'range anxiety'. As more models hit the market and the technology matures and is refined, electrics will compete with gas cars in price. More importantly, their operating costs will be far lower. My calculations of published performance of a Nissan Leaf indicates that at Juneau gas and electricity prices a comparable gas car would need to achieve 145 mpg.

- Assuming electrics prove reliable and safe, as the Leaf appears to be, the transformation of the Juneau auto market could happen rapidly, as other disruptive technologies such as cell phones, iPads, and flat-screen TV's have shown. In 20 year I would expect a substantial percentage of

cars will be electric...reducing Juneau emissions by 10% themselves.

- Significant penetration into the Juneau passenger car market could add substantial demand on AELP's capacity (I estimate up to 20%, assuming Lake Dorothy Ph II is built). All the more reason to free up AELP capacity from 'low-value' building heating. Converting an 80% efficient boiler to electric doesn't compare with converting a 20% gas car to electric.

- Goal T-8 - Recommend a closer analysis of the effects from the Willoughby District development, if it happens, as well as the potential siting of the new State building in the Valley. Seems like 1% could be low.

- Strategy T-3B - I don't see plugs adding much value in Juneau where commute distances aren't that far. More effective incentives would be to require that zero-emission vehicles are given free, preferred location parking, next to handicap parking stalls.

- Another parking strategy would be to make a significant number of public parking stalls only suitable for small cars. Big pickups would be forced to the most inconvenient parking areas.

- As a boat owner, marine fuel use seems too high at 17% of the total. Something is skewing that number. Where does AMHS fuel come into this value, and what strategies might Juneau utilize to reduce ferry emissions? Recommend that fuel used by AMHS and Alaska Airlines be excluded from these goals.

- Banning 2-stroke engines strikes me as a pointless effort which will provoke animosity far exceeding any benefits. Most larger marine engines have been converted by now because older 2-strokes are inefficient and expensive to operate. Banning the remaining few won't accomplish much, but will generate a helluva fight. Choose your battles.

- I like the plug-in cruise ship dock idea. I've initiated USCG vessel energy audits in Alaska (first ones ever in the agency) and we're finding very large energy savings from shore power reductions due to efficiency, even on our newest cutters. My expectation would be that other commercial boats home-ported in Juneau have similar dockside power consumption. Recommend shore power energy audits for all comm'l vessels in Juneau.

- Any idea what percentage of the air transport emissions come from helicopters? Any thoughts on disincentivizing their usage through tax policy? Hell, you're proposing to ban 2-stroke outboards, so a tax penalty on nonessential helicopter trips doesn't seem too radical. How about at least requiring passengers sign a statement acknowledging the impacts their helicopter ride will produce...complete with pictures, like cigarette warning labels. (Do I sound biased on that one?)

Goal U-4 - Streetlights - Sitka Electric Utility recently completed a study of different streetlight technologies. They purchased examples of each technology, installed them on adjacent lightpoles, and allowed the public to vote on the ones they liked the best from a light quality perspective. They also metered each individual light and tracked maintenance costs in this climate. Recommend that CBJ contact Chris Brewton at Sitka Electric Utility for results of their testing.

Strategy U5-A - While reducing/eliminating single-use plastic bags is a laudable goal, I suspect that from a GHG perspective, the more plastic that's sequestered in our landfill, the better. That becomes a carbon sink. I doubt that the amount of energy manufacturing/transporting a bag is

more than the energy (carbon) contained in it. This is an example where GHG goals may collide with other values.

Strategy U5-C - A significant amount of waste entering our landfill is reusable material, especially used construction materials. Other communities have 'Take-It-Or-Leave-It' programs where reusable items can be dropped off or picked up from a center co-located at the landfill. These are items not suitable for a Salvation Army setting. These systems have been very successful and would work well in Juneau. I have more info on this one.

Strat U5-D - There is a potential for a commercial biomass processing facility to be established in Juneau. Such a facility could potentially accept various biomass waste streams such as WWTP sludge, landscape/tree residue, waste/recycled paper and cardboard, cooking grease, etc. for energy recovery.

- Why isn't the usage of solid waste for power generation being raised as an option? Yes, it generates GHG's, but it will anyway in a landfill. If some of that energy can used to either displace oil consumption or to produce electricity, which could then power electric cars or heat pumps, it's a net GHG savings. This is potentially a significant opportunity that shouldn't be dismissed without consideration.

Goal M-1 - The most obvious opportunity there is to run power lines out to Kensington so they can shut off their generators. Yeah, the mine is unpopular. But it's a reality now that's spewing CO2. Making power must be costing them around 50 cents per kWh, like it is in Hoonah and Angoon. AELP could sell power for 30 cents and everyone comes out ahead.

Goal RE-2 - Nice job on the description of district heating. The Willoughby DH system stands a real possibility of happening. Federal funding for a study is being identified. Stakeholders are coming together. Seawater source heat pump will not be feasible, even for the new SLAM/LAMP facility, per project architect. If it happens it will be far more than a 'pilot', it will be the largest biomass project in the State by far (it will beat the Coast Guard's project in Sitka, which is underway now and will be the largest when complete next summer).

Goal RE-2 - A city-wide study should be performed for other DH possibilities, such as the University, Vintage Park, the prison complex, the Hospital area, etc. Funding for studies is available.

Goal RE3-A - Lake Dorothy Phase II will yield 80 GWh, not 94 GWh per my communications with Scott Willis. Confirm number.

CBJ Energy Manager - Such a position could pay for itself many times over...

OK, that's all for now.

Cheers!

Bob Deering

Zoe Morrison

From: Michael Hekkers [mikehekkers@yahoo.com]
Sent: Tuesday, October 11, 2011 12:07 PM
To: Zoe Morrison
Subject: Re: Climate Action Plan - Public Meeting

Zoe, here are my comments.

The 20 year goal is admirable, but we also need to set a goal for a longer term like 2050. This should be a high priority and should be set as soon as possible. The top 10 actions should all be evaluated to see if any increased actions would simply get us to 2032 or possibly to a 2050 goal. For example, could building insulation standards be increased to 2050 standards instead of raising them again in 20 yrs.

Action 1. Expand this to include current (<5 years) energy ratings as a part of disclosures for the sale of residences and commercial buildings. Work with various agencies and Coeur Alaska to get power lines to Kensington, one of the largest point source polluters.

Action 2. Add a local building code that would set minimum energy ratings for existing buildings that would be enforceable upon sale of the property or every 5 years.

Action 4. Expand this to partner with JEDC to encourage a local business to develop the training and equipment for drilling coils/wells for ground-source heat pumps.

Action 5. Expand this to work with AEL&P and the state to implement net-metering and encourage AEL&P to add the additional 15% power to Lake Dorothy. Incentives should also include reduced kwh pricing via AEL&P for those with heat pumps or similar greater than 100% efficiency (over electrical resistance) units. Ban electrical resistance heating in favor of heat pumps. Consider large-scale district heating projects like a well field under existing city streets for neighborhood ground-source heat pumps.

Action 6. Add a local carbon tax on all fossil fuels: gasoline, aviation fuel, heating oil, diesel fuel, propane. Use this fund building and transportation incentives. Based on 2010 figures of 1.25 million gallons of fuel sold, a $0.25/gallon sales tax would generate $312,500.

Action 7. Expand to start planning for electric buses.

Action 8. Include the #50 Vanderbilt Hill to Sunny point path as a high priority to make the Cross-Juneau Bikeway safer. Also connect Sunny point with the EVAR/Dike/Wetlands trail. Make both on the wetlands side of Egan and make Juneau's own Coastal Trail!

Action 10 An Energy Manager position would ensure consistent application of the the Climate Action Plan and facilitate planning, public outreach, and education campaigns.

Thanks Mike Hekkers

Zoe Morrison

From: Ben [ben@pacificu.edu]
Sent: Tuesday, October 25, 2011 8:46 PM
To: askilbred@gci.net; zmorrison@gci.net
Subject: Comments on the Draft Juneau Climate Action Plan

Dear Ms. Skilbred and Ms. Morrison,

Thank you for your October 5th presentation and the draft Climate Action Plan. I found that the draft plan really did help me understand the energy situation in Juneau and charted some expectations and goals for the future, and I appreciate the work that's been done. I hope these comments are received as constructive rather than simply critical. Also, can this be forwarded to the people on the commission? Will comments be discussed at all with the public?

After reading through the draft plan, I come away thinking that while the action items may sound like a lot, much of the energy reduction will occurr without any action by the local government. Perhaps I'm wrong in that. This makes me wish the city could try to be more aggressive, but thinking about it, it is hard to see where the city can make big gains. It also makes me a bit reluctant to devote much time into looking into this, if substantial individual efforts can only achieve rather limited gains. Also, my intuition is that certain bigger projects (e.g. improved bus plan) are somewhat speculative in the carbon benefits (e.g. bus driving more frequently means more fuel use).

I am particularly interested in seeing that the comment on the LED street lights gets to the assembly, but perhaps I should send that directly to them to make sure.

My comments are as follows:

1. The Climate Action Plan does not clearly distinguish between projections which would occur under a "no-action" plan and which would occur based on different action scenarios. For example:
    1. 100,000 of the 168,000 MTCO2 reduction is from transportation. Of that, 49,000 is from more efficient vehicles and 16,200 is reduced miles driven (this I'm very skeptical of accomplishing without strategic changes in land-use). The ideas for that are good, but ideas could perhaps be given estimates on their impact and also explicitly listed by such impact. I understand this may not be feasible but it's an idea. The top transportation action is anti-idling campaigns. While this is simple and cheap, it's not clear how often people really idle - also of course the campaigning should be focused on police officers, taxi drivers, and other people who drive a lot throughout the day. I think incentives to purchase efficient cars sounds interesting, as well as continuing to explore how people can live close to where they work (e.g. relocating state offices, lobbying for work from home). A temporary credit for electric cars likely would not cost much because there's likely to be limited demand for them at current prices.
    2. For the 48,000 reduction due to buildings, 29,000 is related to residential buildings, whereas most of the B action items are not focused on residential buildings. Overall, this area is really interesting and admittedly gets really technical fast, but it would be interesting to explore how to apply 'new' standards to old buildings too.
2. There is little to no discussion of a potential low-hanging fruit, which is virtualization of computing power using servers. There have been a lot of reports of significantly reducing power consumption with this method - see for example Watts Up: Does Virtualization Really Save Energy. The State is the one to really pressure to do this, but the city can save as well. Obviously hydro that we aren't using goes to saving carbon. Plus this saves money on hardware and potentially software licenses.

3. Page 47, U-4 discusses replacing the high-pressure sodium street lights with LEDs. While LEDs are more efficient and might be most cost-effective from a lifecycle perspective, a scientific article recently discussed the fact that white LEDs suppress melatonin production significantly more than sodium lights - see Limiting the impact of light pollution on human health, environment and stellar visibility. Melatonin suppression is tied to cancer (shift workers suffer cancer at much higher rates) andmakes it more difficult to sleep, which contributes to numerous psychological and social problems (e.g. car accidents). **LEDs which have an amber shade and don't suppress melatonin will likely be on the market in a few years**, so we should wait for them - this is especially critial given the lifespan of LEDs. Individuals who are concerned can wear amber glasses that block the blue wavelength of light, but these look goofy (I wear them often; see the speculative Amber lenses to block blue light and improve sleep: a randomized trial).
4. I would appreciate a slightly more detailed discussion on the improvement to the dam. It sounds like that extra capacity could be put to work right now - so why not? Can AEL&P provide more information?

Juneau Hydropower, Inc.
PO Box 22775
Juneau, AK 99802
www.juneauhydro.com
Telephone: (907) 789-2775
Fax: (907) 375-2973

October 7, 2011

Kim Kiefer, Deputy City Manager and Climate Action Plan Project Manager
Amy Skilbred, Skilbred Consulting
Zoe Morrison, Sheinberg and Associates
155 S. Seward Street
Juneau, AK 99801

RE: Public comments related to the CBJ Draft Climate Action Plan October 2011

Dear Project Manager and consultants,

I have printed a copy of the August draft CBJ Climate Action Plan, reviewed the document and would like to make some public comments as a part of the public review process/record.

The CBJ Climate Action Plan and Implementation plan is a good follow up document to the original 2007 baseline document presented in 2009 but I would like to make some comments/suggestions to help improve the final document.

1. The document perhaps could be strengthened by addressing the role of fuel prices and the related consumer energy economics that affect substitution of energy sources within the CBJ. Fossil based prices alone, compared to electricity rates is perhaps the single most determining factor in energy selection, substitution, level of usage and therefore creation and dispersion of GHG in the CBJ.

Every public utility in Southeast Alaska has reported (it is a matter of public record reported in numerous Southeast radio and Southeast community newspaper articles) massive increase in electrical conversions as a consumer substitute to increasing diesel costs. Wrangell has reported a 45% increase in their electrical demand in the last three years attributable from diesel oil heat to electric conversions. Sitka and Ketchikan are scrambling to bring new hydropower projects on line quickly. The oil conversion to electric heat phenomenon where low cost hydropower exists is also well documented in regional public energy meetings, the Southeast Integrated Resource Plan meetings, and the 2011 Alaska Rural Energy conference. Therefore this issue should be given utmost consideration in the CBJ Climate Action Plan because this single factor materially impacts our CBJ GHG emission reductions and goals more than any other factor. Our CBJ draft Climate Action and Implementation Plan does not directly address the growing trend of rising cost of diesel fuel and the directly correlated economic substitution of electrical heat that occurs (is occurring) when citizens/ratepayers vote with their pocket book for lower cost fuel. Economic voting with the family pocketbook is irrespective and mostly inconsequential of educational level or concern for green house gasses, but nonetheless is a quantifiable consumer behavior that

impacts CBJ GHG emissions. Planned conservation measures and efficiencies are only the demand side of the equation for the overall Juneau solution toward reducing GHG. The climate action and implementation plan must also address supply side clean fuel capacity.

As a result of our regional hydropower potential, the home, business and public building conversion from diesel to electric based heating should be encouraged for two reasons: lower energy costs and reduction of GHG. A third related reason is energy security. Energy security is increased when a community relies on localized energy resources rather than importing fossil fuels into the CBJ. Eliminating the risk of future volatility stemming from short, medium and long term oil price increases further increases our local energy security and continued progress on reducing locally produced GHG emissions.

Additionally, the Climate Action and Implementation plan could directly address or economically explain for CBJ citizens the "substitution" that is occurring in CBJ and Southeast Alaska. For example, the current CBJ "break even" point for converting from diesel based heat to electrical heat has already been economically breached as illustrated in the attached ***CBJ fuel cost calculation sheet.*** Economic migration from space heating diesel fuel to higher efficiency and lower cost electric usage would have positive impacts on GHG until such time as all potential hydropower capacity is exhausted…or new sources developed. Therefore a key long term goal of the Climate Action Plan must be to encourage additional hydropower capacity to meet the current and future energy needs of the CBJ as cleaner and lower cost hydropower replaces more expensive diesel for CBJ heating needs.

It is difficult to know exactly where the CBJ consumer oil to electric tipping point is, but it exists. A tipping point should not be confused with an economic breakeven point. The recent AELP rate increase will have little impact to slow the current trend of conversions because we are already well past the breakeven point. The current CBJ break even point for conversion is illustrated in the attached document based on fuel comparison formulas developed by Northern South Dakota University. Further, the conversion rate and trend is predicated on the price of diesel/electricity rate substitution...and oil over the longer term is expected to rise and continue to rise for the indefinite future. For instance, #1 diesel was selling in Juneau just two years ago for $2.99 a gallon (source DCRA http://www.commerce.state.ak.us/dca/pub/Fuel_Report_July_2009_web.pdf). Today's price of #1 diesel at $4.10 a gallon represents a 27% increase in just two years. A future $5.00 a gallon price represents merely an 18% increase from today's price. Therefore, before the current Climate Action and Implementation is updated again, we could very well be paying $5.00 a gallon for diesel. Regardless of your personal opinion for or against this hypothesis and where oil prices are headed, there is a macroeconomic consensus in virtually all financial publications and from the US Energy Information Agency that the long term expectation is that home heating oil prices will rise. The financial consensus that oil will continue to rise, reduces the CBJ municipal, business and family decision risk of converting from expensive oil space heating to lower cost hydropower electricity based heating.

I think we can agree that the economic forces are and will continue to work in our CBJ energy market environment. Perhaps, the draft Climate Plan should include a discussion of basic economics of energy substitution in the final version of the CBJ Climate Action Plan and point out the role that energy substitution (as a variable) will have in either helping reduce GHG with available hydropower or negatively impacting GHG and emissions predicated by more wood burning and other alternatives that will occur once current CBJ hydropower capacity is exhausted if new sources are not soon added.

I also think the draft climate plan can, as a scenario, overlay the fact that Juneau is a "brown" community whereby the majority of our building and home space heating needs are from diesel and the market shift could be traumatic if oil prices spike and create a “tipping point” that materially increases the demand for low cost hydropower (as recently experienced in Wrangell).

100% conversion from oil to electric in the CBJ is unrealistic within the next few years. Moreover, a 100% conversion of our CBJ heating needs to electric would require a "doubling" of the CBJ/AELP hydropower capacity that does not currently exist. However, an incremental percentage shift from oil to electric predicated on an oil price spike could lead to a tipping point and local hydropower capacity volatility. The time to plan for eventual higher diesel fuel costs is now so Juneau mitigates an impending clean energy capacity shortfall and allows maximum effective decrease in CBJ derived GHG.

I would suggest perhaps incorporating in the final climate plan a trend analysis the cost of home heating fuel in the CBJ with an outlook to the future cost relative to the cost of a kWh and the imputed cost of a Btu of energy generated from each fuel source vs. the new AELP consumer kWh rate. Conveniently, British Thermal Units are a common denominator from different fuel sources and a cost comparison per Btu will help the CBJ decision makers and members of the public understand the crossroad energy situation we are in and allow a process to be developed to better plan for the energy security for the CBJ. This tool is important because consumers (vote with their pocketbook) will move in the direction of price...and ***not*** **necessarily** at the direction of a commission climate plan. Therefore a good plan will anticipate consumer behavior and harmonize the economic reality with the different CBJ conversion scenarios. For instance, what capacity of hydropower will we need if we convert all our schools to ground source heat pumps? What if we convert all municipal buildings to higher efficient electric heat? The University of Alaska campus? All Federal buildings? State office buildings? A good GHG planning tool would be to give the citizens of Juneau an understanding of what hydropower capacity is required in order to understand and then take well thought out and planned actions to migrate our community heating systems from fossil fuels to clean hydropower electric.

2. In regards to the electrification potential of Kensington Mine, there is a statement in the draft plan on page 50 that reads, “The location of the mine north of Berners Bay makes it currently expensive and impractical to connect to the AEL&P...". However there is no reference given in the report as to the fair and reasonable cost of this potential infrastructure…or why this is a stated assumption and from whom. If the electrification of Kensington power line was properly

sized and competitively bid with local contractors, it could be cost effective and amortized over the life of the mine. According to APT President and CEO, Bob Grimm, Skagway and Haines are interconnected by a submarine cable of 22 miles for a reported cost of $7 million dollars. The energy cost savings of electrifying the Kensington mine to the Juneau grid would save the mine more in energy cost reduction than the cost of the transmission line perhaps in as little as one year. The draft climate plan is destined to miss its goals and projections if it fails to include a plan to electrify the Kensington Mine and the potential AJ Mine with clean lower cost hydropower.

As the draft climate plan rightfully concludes, profound CBJ GHG reductions could be found if the Kensington Mine was electrified by hydropower, but a side benefit is that lower energy costs could also extend the economic life of the mine by substantially reducing its operating costs while simultaneously safeguarding the environment from any potential fuel spill mishap. I would suggest that perhaps it is best that an unsubstantiated statement of "currently expensive and impractical" with regards to electrifying the Kensington Mine be removed from the final plan document because it is not factually substantiated by independent feasibility studies.

Further, due to the combination of low precipitation periods and electrical conversions, the Greens Creek Mine has been on diesel generation for many months in 2011 and demonstrates how GHG gas emissions is mostly affected by CBJ hydropower capacity and further demonstrates demand for CBJ additional hydropower capacity.

3. Electrification of all visiting cruise ships entering and using the Juneau port facilities should be a long term goal to not only provide cleaner downtown air for all Juneau citizens, but also to reduce the CBJ GHG reductions in a meaningful and tangible manner. If hydropower capacity exists, all cruise ships companies should be encouraged to save money by using less expensive electricity and thereby tangibly reducing GHG by connecting to shore power.

4. The CBJ Climate Action and Implementation plan should also endorse and set goals for additional reviews for the feasibility and economic viability for exploring and replacing tour busses as well as CBJ Capital transit busses, over time, with electric busses currently and successfully operating in many US and European urban areas. Reviewing how other Northern climate communities have integrated electrical busses into public and private transportation fleets may provide good economic and operating models for examples of long term GHG reductions (as well as fuel cost savings) for our CBJ Capital transit and school bus systems. Reduction of diesel emissions from these public and private transit sources would not only reduce GHG, but would make the downtown tourism areas and school yards cleaner and more enjoyable for visitor, local student and local citizen alike. In addition, it is cheaper to operate electric drive busses and therefore reduction of green house gasses from public and private transportation systems may also lead to lower operating costs for the CBJ, our school system and private operators.

5. Lastly, under RE-3 long term actions I would like to request that final Climate Action and Implementation Plan include the Sweetheart Lake Hydroelectric Project as another permitted and economically viable source of electricity for Juneau that is being developed for Juneau's future hydropower electrical capacity needs. As a matter of public record, the Sweetheart Lake Hydroelectric Project which is being developed to produce 30 MW capacity and produce 136 GWh for the community of Juneau. The project is federally permitted, has a federal power site classification designation, is identified and protected as a federal hydropower asset in US Public Land Order 221, and is listed in the Southeast Integrated Resource Plan. The project will interconnect the 138 kV Snettisham cable beyond the Snettisham avalanche chute.

Therefore, if economically induced electrical conversions impact our CBJ hydropower capacity/supply as previously discussed, our community will have another large clean hydropower source being developed for Juneau's future. The Sweetheart Lake Hydroelectric Project should be considered as an additional renewable energy insurance policy for the City and Borough of Juneau as a hedge against impending future oil cost increases. I would also ask that CBJ hydropower planning, development and transmission line considerations be examined and reviewed as part of the Climate Action Plan for the economic sustainability of our community as a beginning step to mitigate the impending impacts on our community as oil prices increase to an eventual "oil to electric conversion tipping point" that is perhaps building pressure based on macroeconomic principles and predicted consumer behavior.

More information can be found on the Sweetheart Lake Hydroelectric Project at www.juneauhydro.com.

Lastly, our company requests that our written comments and supporting documentation be entered and incorporated as an appendix to the final report along with all other written comments submitted from Juneau citizens, organizations and businesses.

Sincerely,

Duff W. Mitchell
Business Manager

Office Phone 907-789-2775
Cell Phone 907-723-2481

CBJ Fuel Cost Comparison

What fuel is more cost effective for home heating? Diesel #1 VS. Residential Rate Electricity?

As of 9/15/2011 source of local information: **AELP September 2, 2011 Electrical rate for General Residential versus #1 Fuel Oil Juneau Delta Western September 15, 2011**

All calculations from NDSU formula from Fuel Cost Comarison ch source: http://www.ag.ndsu.edu/pubs/ageng/structu/ae1015a.pdf

North Dakota State University

					Juneau cost as of 9-15-11	
Electric Resitance Kwh	3413 Btu	kWh	**100%** Efficiency of Electric Resistance heating		**$ 0.1088**	AELP avg
#1 fuel oil diesel	135,000 Btu	gallon	**70%** Efficiency of diesel space heating		**$ 4.10**	Delta Western

Comparative Cost Equation

Comparative Cost Fuel Formula =

$$\frac{\textit{Heat Value Fuel A x Heating Efficiency Fuel A}}{\textit{Heat Value Fuel B x Heating Efficiency Fuel B}} \; X \; \textit{Cost of Fuel B}$$

Fuel A	**Electricity**
CBJ Rate 10 General Residential Electricity @ kWh	
Nov-May	0.1194
June-Oct	0.0982
avg kWh	**0.1088**
source: AELP Website	

Fuel B	**#1 Diesel**
CBJ diesel # 1 @ gallon	
9/15/2011 Delta	**$ 4.10**

source: Delta Western Juneau

$$\frac{\textit{3413 Btu/kWh} \times \textit{100\% efficiency}}{\textit{135,000 Btu/gal} \times \textit{70\% efficiency}} \; X \; \textit{\$4.10 gallon}$$

EQUALS:

3413 / (135,000.70)* | *X 4.10* | **$ 0.148 kWh cost equivalent to generate heat Btu from current Juneau diesel price**

Fuel advantage of electricity versus #1 home heating diesel in CBJ 9/15/2011 **$ 0.148** less **$ 0.1088** equals **$ 0.039 kWh**

Current Juneau Residential SAVINGS of Electric Heat vs. Oil Heat

Businesses with lower ARLP rates save more by converting from oil to electric heat

Economically, there is a 4 cent per kWh advantage to burn electricity for home heating needs over diesel fuel for home heating at current Juneau fuel prices.

Breakeven cost of diesel heating versus electrical heating in Juneau

$$\frac{135{,}000 \text{ Btu/gal} \times 70\% \text{ efficiency}}{3413 \text{ Btu/kWh} \times 100\% \text{ efficiency}} \times \$.1088 \text{ kWh} = \$ \; 3.01 \text{ gallon}$$

BREAKEVEN POINT to convert from oil to electric heat

***Factoid-at todays fuel prices in Juneau, CBJ Govt. could convert all Municipal owned buildings and schools from diesel heat to electricity and save taxpayers 25% on heating public buildings. on energy dollars spent to heat Municipal owned buildings and schools. As an added bonus converting from oil to electric heat will reduce CBJ Green House Gas emissions.

What is the tipping point where Juneau will be economically incentivized to convert from oil heat to lower cost hydropower electricity?

Tipping point is the level at which the momentum for change becomes unstoppable. The point at which an object is displaced from the state of stable equilibrium into a new, different state.

What is the oil tipping point where oil to electric conversions pass the point of no return? $5.00 a gallon? $6.00 a gallon? $7.00 a gallon? $8.00 a gallon?

Fuel Cost Comparison Chart

Heating Efficiency	Equivalent Price of Each Fuel																	
100%	2	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0	Electric Resistance kWh (3,413 Btu / kWh)
200%	4	5	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0	Heat Pump (Air Source) kWh (3,413 Btu / kWh)
350%	7	8.75	10.5	12.3	14.0	15.8	17.5	19.3	21.0	22.8	24.5	26.3	28.0	29.7	31.5	33.2	35.0	Heat Pump (Earth Source) kWh (3,413 Btu / kWh)
92%	0.54	0.67	0.81	0.94	1.08	1.21	1.35	1.48	1.62	1.75	1.89	2.02	2.15	2.29	2.43	2.56	2.69	Natural Gas $ / Therm High Efficiency (100,000 Btu / Therm)
75%	0.44	0.55	0.66	0.77	0.88	0.99	1.10	1.21	1.32	1.43	1.54	1.65	1.76	1.87	1.98	2.09	2.19	Natural Gas $ / Therm Low Efficiency (100,000 Btu / Therm)
70%	0.55	0.69	0.83	0.97	1.11	1.25	1.38	1.52	1.66	1.80	1.94	2.08	2.21	2.35	2.49	2.63	2.76	#1 Fuel Oil (Diesel Fuel) $ / Gal. (135,000 Btu / Gal.)
70%	0.57	0.72	0.86	1.00	1.15	1.29	1.43	1.58	1.72	1.87	2.01	2.15	2.30	2.44	2.58	2.73	2.87	#2 Fuel Oil and Diesel Fuel $ / Gal. (140,000 Btu / Gal.)
75%	0.4	0.51	0.61	0.71	0.81	0.91	1.01	1.11	1.21	1.31	1.41	1.51	1.62	1.72	1.82	1.92	2.02	Propane $ / Gal. (92,000 Btu / Gal.)
92%	0.5	0.62	0.74	0.87	0.99	1.12	1.24	1.37	1.49	1.62	1.74	1.87	1.98	2.11	2.23	2.35	2.48	Propane $ / Gal. High Efficiency (92,000 Btu / Gal.)
75%	0.28	0.35	0.43	0.50	0.57	0.64	0.71	0.78	0.85	0.92	0.99	1.06	1.14	1.21	1.28	1.35	1.42	Methanol $ / Gal. (64,700 Btu / Gal.)
75%	0.3	0.37	0.44	0.52	0.59	0.66	0.73	0.81	0.88	0.95	1.03	1.10	1.18	1.25	1.33	1.40	1.48	Ethyl Alcohol 160 Proof $ / Gal. (67,200 Btu / Gal.)
75%	0.33	0.42	0.50	0.58	0.67	0.75	0.83	0.92	1.00	1.08	1.17	1.25	1.33	1.41	1.49	1.58	1.66	Ethyl Alcohol 180 Proof $ / Gal. (75,600 Btu / Gal.)
75%	0.37	0.46	0.55	0.65	0.74	0.83	0.93	1.02	1.11	1.20	1.30	1.39	1.48	1.57	1.66	1.75	1.84	Ethyl Alcohol 200 Proof $ / Gal. (84,000 Btu / Gal.)
75%	0.53	0.66	0.80	0.93	1.06	1.20	1.33	1.46	1.59	1.73	1.86	2.00	2.12	2.26	2.39	2.52	2.65	Gasohol (90 / 10) $ / Gal. (120,900 Btu / Gal.)
75%	0.54	0.68	0.82	0.95	1.09	1.23	1.36	1.50	1.63	1.77	1.91	2.04	2.18	2.32	2.45	2.59	2.72	Gasoline Unleaded $ / Gal. (124,000 Btu / Gal.)
70%	0.53	0.66	0.80	0.93	1.06	1.20	1.33	1.46	1.59	1.73	1.87	2.04	2.13	2.27	2.40	2.53	2.66	Vegetable Oil $ / Gal. (130,000 Btu / Gal.)
65%	68.56	85.7	102.84	119.98	137.12	154.26	171.40	188.54	205.68	222.82	239.96	257.10	274.24	291.38	308.52	325.66	342.80	Sunflower Oil Meal $ / Ton (9,000 Btu / lb)
65%	61.7	77.13	92.56	107.98	123.41	138.84	154.26	169.69	185.11	200.54	215.97	231.39	246.82	262.25	277.67	293.10	308.52	Sunflower Hulls $ / Ton (8,100 Btu / lb @ 8% moisture)
65%	4.57	5.71	6.85	8.00	9.14	10.28	11.43	12.57	13.71	14.85	16.00	17.14	18.28	19.42	20.57	21.71	22.85	Sunflower Seeds $ / Cwt. (12,000 Btu / lb @ 8% moisture)
65%	1.81	2.27	2.72	3.17	3.63	4.08	4.53	4.98	5.44	5.89	6.35	6.80	7.25	7.70	8.16	8.61	9.06	Shelled Corn $ / Bushel (8,500 BTU / lb @ 15.5% moisture)
65%	1.99	2.49	2.98	3.48	3.98	4.47	4.97	5.47	5.96	6.46	6.96	7.46	7.95	8.45	8.95	9.44	9.94	HRS Wheat (Grain) $ / Bushel (8,700 Btu / lb @ 13.5% moisture)
65%	1.5	1.87	2.25	2.62	3.00	3.37	3.75	4.12	4.50	4.87	5.25	5.62	5.99	6.37	6.75	7.12	7.49	Barley (Grain) $ / Bushel (8,200 Btu / lb @ 12.5% moisture)
65%	57.13	71.42	85.70	99.98	114.27	128.55	142.84	157.12	171.40	185.69	199.97	214.25	228.53	242.82	257.10	271.39	285.67	Wheat and Barley Straw $ / Ton (7,500 Btu / lb @ 8% moisture)
50%	30.23	37.78	45.34	52.90	60.45	68.01	75.57	83.13	90.68	98.24	105.79	113.35	120.91	128.67	136.02	143.58	151.14	Wood (Air Tight Stove) $ / 64 cft (½ standard cord) 65% Wood and 35% Air (6,200 Btu / lb @ 20% moisture) 40 lb / cft of Solid Wood
65%	50.27	62.85	75.42	87.99	100.56	113.13	125.70	138.27	150.84	163.40	175.97	188.54	201.11	213.68	226.25	238.82	251.39	Coal (Lignite) $ / Ton (6,600 Btu / lb @ 12% moisture)

Example 1:
Compare the cost of electricity at $.04 / kWh, 100% efficiency, to the cost of propane at 92,000 Btu / Gal in a 75% efficient furnace.

Example 2:
Compare the cost of natural gas at $.81 / CCF in a 92% efficient furnace to the cost of propane at 92,000 Btu / Gal in a 75% efficient furnace.

Comparative Cost Equation:

$$\text{Comparative Cost Fuel A} = \left[\frac{\text{Heat Value Fuel A} \times \text{Heating Efficiency Fuel A}}{\text{Heat Value Fuel B} \times \text{Heating Efficiency Fuel B}}\right] \times \text{Cost of Fuel B}$$

$$\text{Example 1: Propane Cost} = \left[\frac{92{,}000 \text{ Btu / Gal.} \times .75 \text{ Heating Efficiency}}{3{,}413 \text{ Btu / kWh} \times 1.00 \text{ Heating Efficiency}}\right] \times .04 \text{ Electricity Cost / kWh} = \$.81 \text{ per Gal. Propane}$$

$$\text{Example 2: Propane Cost} = \left[\frac{92{,}000 \text{ Btu / Gal.} \times .75}{100{,}00 \text{ Btu / CCF} \times .92}\right] \times \$.81 / \text{CCF} = \$.61 / \text{gallon}$$

Zoe Morrison

From: Steve Behnke [srbehnke@ak.net]
Sent: Friday, October 21, 2011 11:32 AM
To: Zoe Morrison; Amy Skilbred
Subject: ESCO/performance contracts?

Hi Zoe and Amy,

I was just looking at some stuff about Energy Service Companies and performance contracting. I know the state and Anchorage are doing some of this.

Does the CAP mention anything about their potential for the CBJ?

-Steve