JUNEAU COMMISSION ON SUSTAINABILITY AGENDA

March 30, 2023 at 12:00 PM

Zoom Webinar

Zoom Webinar

https://juneau.zoom.us/j/9947166989 Meeting ID: 994 716 6989 or

Phone +1 253 215 8782 US (Tacoma)

(ONLY IN EVENT THAT THE ZOOM LINK ABOVE ISN'T WORKING BY 12:05 p.m., switch over to

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Meeting ID: 857 8048 6607

Passcode: 436273)

A. CALL TO ORDER

B. LAND ACKNOWLEDGEMENT

C. ROLL CALL

D. APPROVAL OF AGENDA

E. APPROVAL OF MINUTES

1. Minutes March 1, 2023

F. PUBLIC PARTICIPATION

G. AGENDA TOPICS

2. 2021 Energy Use and GHG Inventory: Preliminary Draft Report 3: – Denise Koch (CBJ) and Sunny Sanwar (Constellation)
3. Takeaways from the 2021 Energy/GHG Inventory Update – Steve Behnke (JCOS)
4. Sustainability Session – Steve Behnke (JCOS)

H. INFORMATION ITEMS

I. COMMITTEE MEMBER / LIAISON COMMENTS AND QUESTIONS

J. NEXT MEETING DATE

Monthly Work Session	April 19, 2023 12 PM @ZOOM
Regular Meeting	May 3, 2023 12 PM @ZOOM
Monthly Work Session	May 17, 2023 12 PM @ZOOM

K. ADJOURNMENT

ADA accommodations available upon request: Please contact the Clerk's office 36 hours prior to any meeting so arrangements can be made for closed captioning or sign language interpreter services depending on the meeting format. The Clerk's office telephone number is 586-5278, TDD 586-5351, e-mail: city.clerk@juneau.org.

Juneau Commission on Sustainability (JCOS)
Wednesday, March 1, 2023, 12:00 p.m. (Noon) Zoom

1. **Call to Order**
Chair Keiser called the meeting to order at noon.

2. **Land Acknowledgement**

3. **Roll Call**
Present: Laura Achee, Jessica Barker, Steve Behnke, Marian Call, Gretchen Keiser, Duff Mitchell, Jim Powell, David Teal, Nick Waldo
Absent: None
A quorum was present.
Staff & Others Present: CBJ Staff Liaison Denise Koch, CBJ staff Dianna Robinson, Alix Pierce, Alan Steffert
Assembly Liaison Maria Gladzizewski, Lori Sowa (AEL&P), Bill Leighty, Sunny Sanwar (Constellation), Anna Canny (KTOO), Tim Leach, Paul Goodfellow, Devon Kibby

4. **Approval of Agenda**
Approved with no changes.

5. **Approval of Minutes**
Minutes for the meeting of February 1, 2023 were approved without objection.

6. **Public Participation**
Bill Leighty—asked about status of a JCOS draft letter on the proposed green corridor and use of hydrogen. Steve sent the draft to Maria Gladzizewski. She will have a conversation with Mr. Leighty after this meeting.

7. **Agenda Topics**

   1. JCOS Memo on FY24 Marine Passenger Fees
   Mr. Benke reviewed a letter to the CBJ tourism director regarding use of MPFs to complete a design/build contract and the need for and funding requirements to make progress on dock electrification and the downtown circulator project. JCOS recommends formal adoption of a comprehensive statement of plans and a timeline. **<u>Mr. Powell moved to approve finalization of the letter and sending it to Public Works. The motion passed without objection.</u>**

   2. GHG Preliminary Draft Report: 2021
   Constellation's preliminary report is posted to the JCOS website. Mr. Mitchell asked about how JCOS will handle questions and comments. Mr. Benke will be the point of contact. Mr. Mitchell and Mr. Powell asked for more visibility for the report, including posting it on the CBJ main site. Comments are open

until March 10, and then there will be a more formal roll-out of the report on March 15 and another round of comments (public).

Mr. Sanwar stated that the report contains more narrative than was included in the powerpoint presentation to JCOS. Commissioners had numerous questions and comments—essentially, we want to ensure that the information tracked now and in the future is as accurate, understandable, and useful as possible. The narrative is critical to public interest/acceptance. We want to lay out how tracking GHG emissions can lead to better decisions in the future. Mr. Sanwar will attend the March 15 work session and address commissioner comments at that meeting.

Steve Behnke, JCOS Energy Committee, will arrange an Energy Committee work session as soon as possible with all JCOS members invited. The purposes are to consolidate JCOS feedback on the preliminary draft report to submit to Sonny and Denise by March 10 and to begin to outline the accompanying JCOS narrative for the community rollout of the draft report for public review.

8. Information Items

JCOS Committee Meeting dates/times

Chair Keiser stated that times available include Monday and Wednesday at 4:30 pm and Tuesday at noon. Committee chairs will work with Denise to arrange their meetings.

9. Committee/Liaison Comments and Questions

Mr. Mitchell noted that a community cleanup will occur on Earth Day in April and asked for Commission support as a partner with a multi-agency effort. The JCOS agreed.

10. Next Meetings

- March 15, 2023 work session at noon (ZOOM)
- April 5, 2023 at noon (ZOOM)
- April 19, 2023 work session at noon (ZOOM)

11. Adjournment

The meeting adjourned at 1:30 pm.

Submitted by David Teal, Secretary

2021 Energy Use and Greenhouse Gas Emissions Inventory for Juneau, Alaska

Preliminary DRAFT 3

March 30, 2023

Produced by Constellation Energy for the City and Borough of Juneau

Acknowledgements

CBJ Assembly

Juneau Commission on Sustainability

Energy Chair: Steve Behnke

Consultant Team

Sunny Sanwar, Ph.D., Constellation Energy
Alex Calder, Constellation Energy

Municipal Staff Contributors

Denise Koch, Deputy Director, Engineering & Public Works
Nate Abbott, Building Maintenance Supervisor, Parks and Rec

Others who provided information and assistance

Lori Sowa, AEL&P
Mike Satre, Hecla Mining
Michael Spencer, Alaska Housing Finance Corporation

EXECUTIVE SUMMARY

The City and Borough of Juneau (CBJ) completed greenhouse gas (GHG) emissions inventories for the years 2007[1] and 2010.[2] Those inventories quantified energy use by and emissions from both CBJ government facilities and sources in the community at large.

CBJ recently contracted with Constellation Energy to update the 2010 baseline information with 2021 energy use and GHG emissions data.[3] The purpose of the study was to get an updated analysis of energy usage and GHG emission for the community. While the study is not designed to update CBJ climate or energy policy, the findings may guide future policy or actions.

In 2021, transportation and buildings caused the most GHG emissions, 47% and 25% respectively. It is important to note that, as in the 2010 report, and consistent with the standards of the Global Protocol for Cities, the study is limited to Juneau's community boundary and the energy consumed within it (its internal energy economy). As such, it excludes external energy consumption related to activities essential to the economy such as fuel purchased outside of Juneau for cruise ships, barge and air transport, etc.

This study found that despite a slight growth in population between the years, Juneau consumed 15% less energy which created 26% fewer emissions in 2021 compared to 2010.

Energy Consumption in 2007 (MMBtu)	MT CO2e in 2007	Energy Consumption in 2010 (MMBtu)	MT CO2e in 2010	Energy Consumption in 2021 (MMBtu)	MTCO2e in 2021
7.2 million	440,000	6.3 million	416,716	5.3 million	299,965
% Change from 2007				-29%	-31%
% Change from 2010				-18%	-28%

In 2010, CBJ set an emission reduction target of 25% from the 2007 base year, or 330,408 MT CO2e to be reached by 2032[4]. The 2021 data shows that this milestone has already been achieved by the end of 2021. In 2018 the CBJ adopted a new related target in the Juneau Renewable Energy Strategy (JRES), of increasing the proportion of renewable energy to 80% of the total community energy use by 2045.[5] The 2021 data also indicates progress toward Juneau achieving its JRES target, with renewable energy (hydroelectricity) providing about 29% of total community energy use in 2021, compared to 20% in 2010. While the reduction in community GHG emissions and the increasing proportion of renewable energy are very encouraging, caution should be used when trying to detect a trend from only three points in time. There are many factors that can significantly impact future emissions.

[1] "City and Borough of Juneau Greenhouse Gas Emissions Inventory for 2007," March 2009. https://juneau.org/wp-content/uploads/2017/03/Juneau_GHG_Inventory_for_2007_FINAL.pdf
[2] "2010 Greenhouse Gas Emissions Inventory: City and Borough of Juneau," November 2011, https://juneau.org/wp-content/uploads/2018/04/GHGinventory11_16.pdf
[3] In this inventory, Global Protocol for Community-Scale Greenhouse Gas Inventories (GHG) is used to determine energy consumption (e.g., fuel use, electricity use) and appropriate emission factors.
[4] Juneau Climate Action & Implementation Plan. Available at https://juneau.org/wp-content/uploads/2018/04/CAP_Final_Nov_14.pdf
[5] CBJ Renewable Strategy https://juneau.org/engineering-public-works/jcos/renewable-energy-strategy

Community GHG emissions - 2021

Community energy and emissions analyses for the City and Borough of Juneau, AK (CBJ) were divided into the following sectors:

1. Transportation (both on-road, water borne and air transport)
2. Buildings and the built environment (both stationary combustion and purchased electricity),
3. Industrials processes
4. Solid waste treatment

The methodology applied in this updated inventory involved the collection or modeling of energy, fuel, and vehicle data, and the calculation of GHG emissions based on fuel types and uses. The inventory used the standard international protocols and methodology to determine metric tons of carbon dioxide equivalent ($MTCO_2e$) for three greenhouse gases: carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). A detailed description of the methodology can be found in the Appendix..

Emissions are generally broken down into Scope 1, 2, and 3. Scope 1 emissions refer to in boundary emissions, such as combustion of fuels for stationary uses, such as heating offices and buildings, as well as mobile use, such as in boundary transportation. Scope 2 emissions typically refers to grid supplied energy, such as electricity. Since power is generated and sold within Juneau, the Scope 2 purchased electricity is already counted as Scope 1 generation.[6]

Table 1 below provides data on total emissions from Juneau by sector and source (fuel type) as well as additional detail about each sector and source. This table and the following notes provide the information used to generate the 2021 community energy use inventory. The energy use information, combined with the emission factor information was used to generate the GHG emissions figures found here and used in the updated 2021 Juneau Greenhouse Gas Emissions. The population of CBJ increased by 1.8% from 31,387 in 2010 to 31,973 by the end of 2021.

[6] See the Appendix for more detailed discussion of the inventory scope.

Table 1. 2021 Community-wide GHG emissions

Sector	Fuel Type	Quantity	Units	MMBtu	%	$MTCO_2e$	% MT CO2e in 2007	% MT CO2e in 2010	% $MTCO_2e$ in 2021
	Heating Oil	6,572,542	gallons	6,572,542	18%	67,464	28%	22%	22.5%
	Propane	620,051	gallons	620,051	1%	3,498	1%	2%	1.2%
	Wood	1,175	cords	1,175	0%	2,510	2%	4%	0.8%
	Electricity	332,574	MWh	332,574	22%	2	1%	0%	0.0%
Built environment	**TOTAL**			**2,126,199**	**42%**	**73,475**	**32%**	**28%**	**24.5%**
Equipment	Diesel fuel	1,853,165	gallons	**266,011**	**5%**	**19,061**	**4%**	**5%**	**6.4%**
	Propane	4,003	gallons	364	0%	23	0%	0%	0%
Greens Creek	Diesel Fuel	604,300	gallons	83,394	2%	6,218	14%	5%	2.1%
	Electricity	71,099	MWh	242,661	5%	0	0%	0%	0%
	TOTAL			**83,758**	**6%**	**6,241**	**14%**	**5%**	**2.1%**
	Propane	204,785	gallons	18,637	0%	1,152	0%	0%	0.3%
Kensington[7]	Diesel Fuel	4,467,010	gallons	616,448	12%	45,749	0%	5%	15.3%
	TOTAL	**4,671,795**		**635,085**	**12%**	**46,901**	**0%**	**5%**	**15.6%**
Highway Transportation	Gasoline & Diesel	5,940,515	gallons	753,015	15%	55,039	25%	29%	18.3%
Air Transport	Ave Gas & Jet Fuel	3,909,528	gallons	522,259	10%	37,365	10%	9%	12.5%
Marine Transportation*	Gasoline & Diesel	4,800,000	gallons	464,960	9%	48,877	16%	17%	16.3%
	Electricity	764	MWh	2,606	0%	0	0%	0%	0%
Transportation	**TOTAL**			**1,742,840**	**34%**	**141,282**	**51%**	**55%**	**47.1%**
Waste	Waste		Metric			12,904		2%	**4.3%**
Total				**5,097,935**	100%	**299,965**			**100%**
Change from 2007				7,212,181 (-29%)		440,545 (-31%)			
Change from 2010				6,249,372 (-18%)		416,716 (-28%)			

[7] AEL&P transmission and distribution system ends several miles from Coeur-Kensington

Figure 1 shows the total energy used by sector, including petroleum, wood, propane, and electricity.

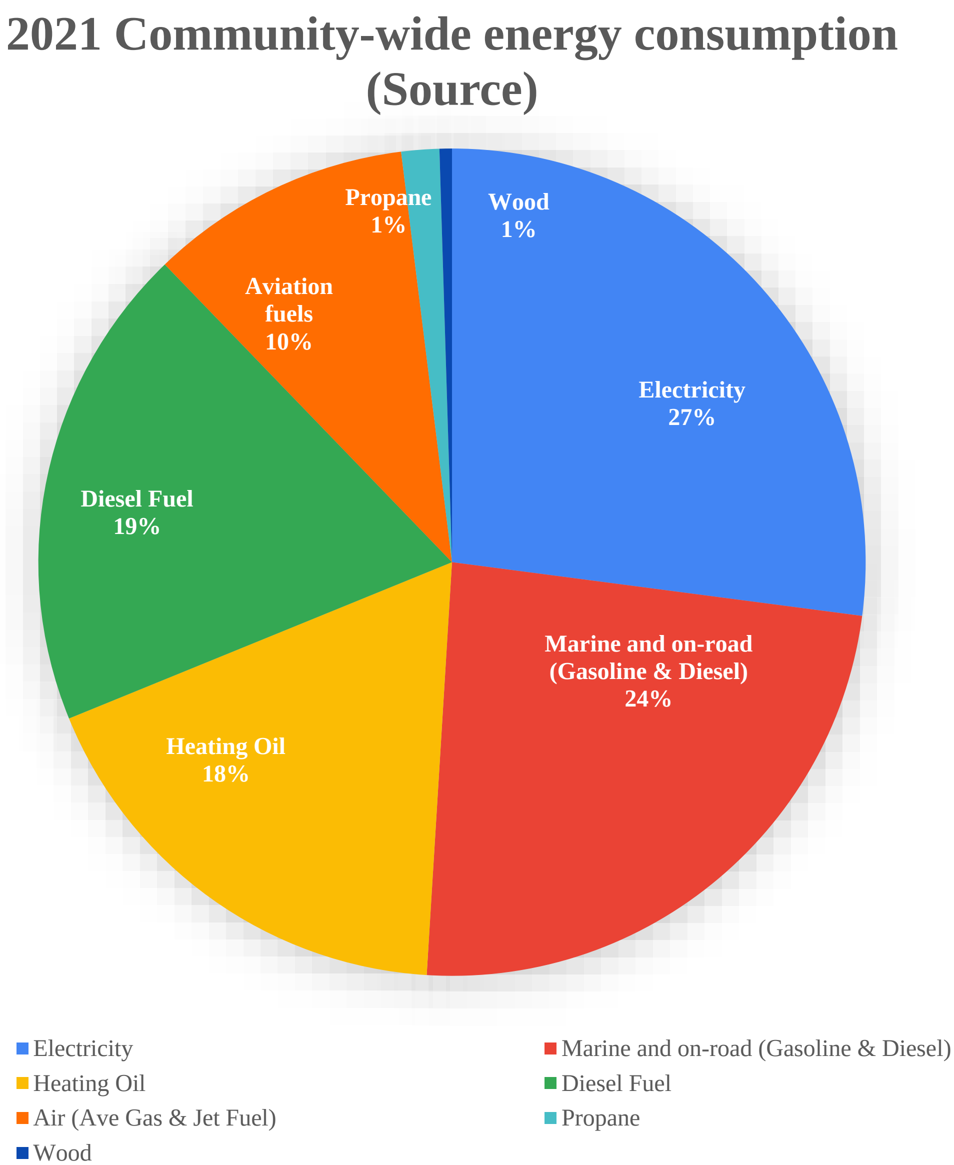
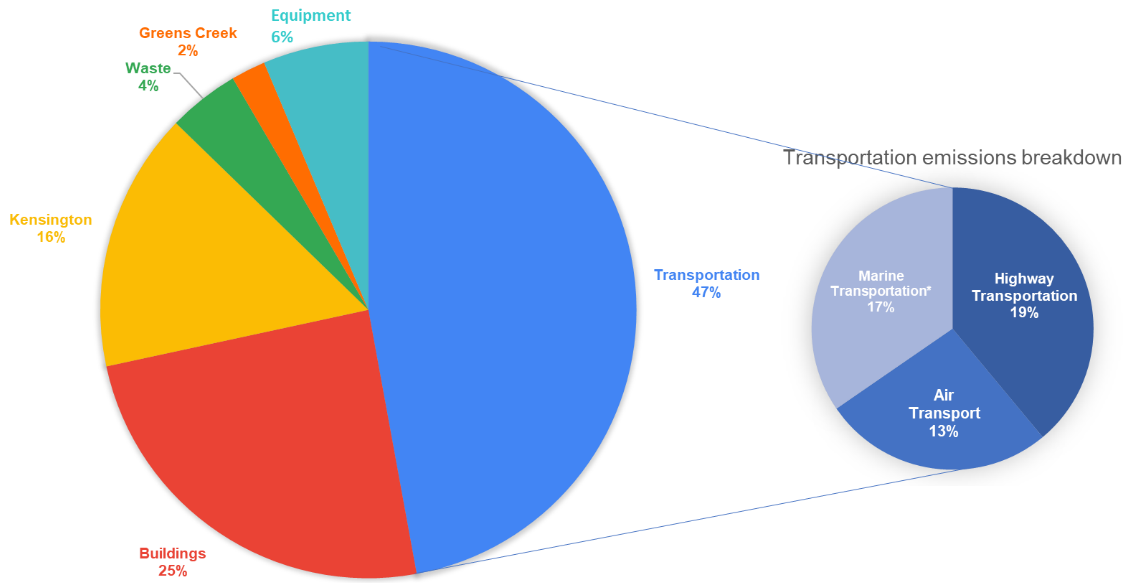


Figure 2 shows the emissions produced by each sector.[8] Energy use correlates to GHG emissions in most sectors, with the highest fuel consuming sectors, transportation and buildings, providing the greatest opportunity for future reductions in GHG emissions. In 2021, transportation contributed more than 47% of GHG emissions, with almost half (18%) coming from highway

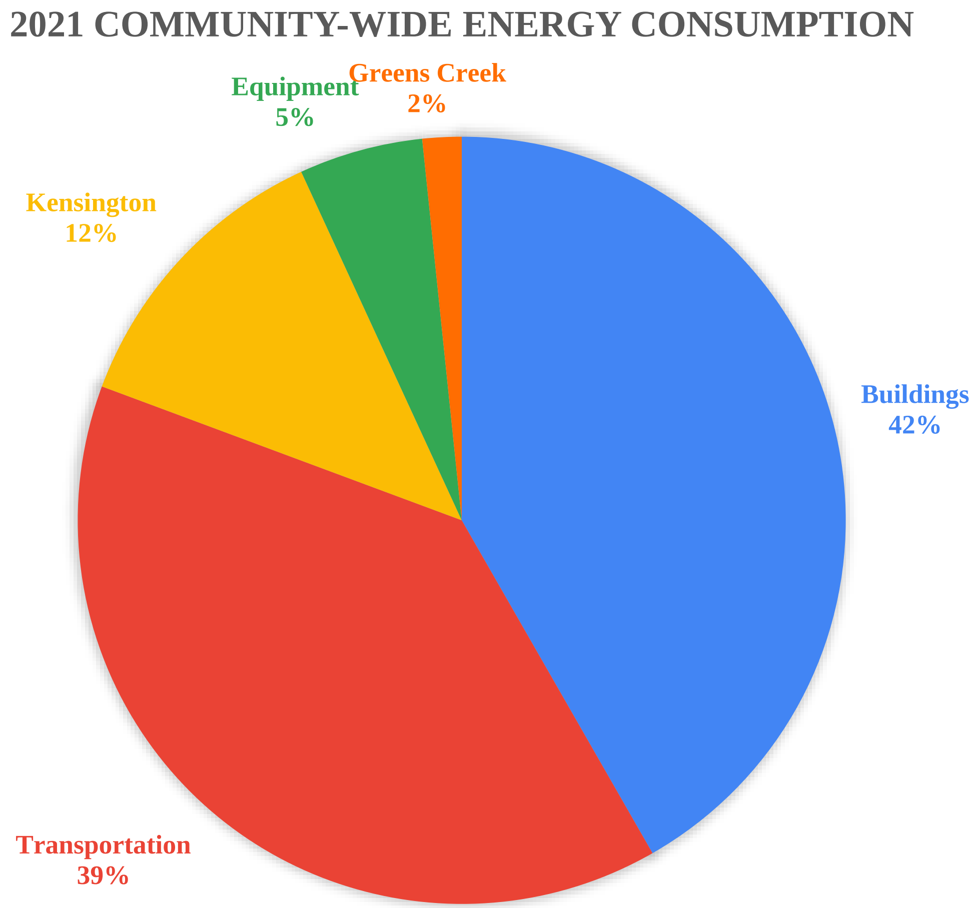
[8] NOTE: Diesel fuel for industrial usage is shown in green, where heating fuel for stationary heating in buildings is shown in yellow. Diesel fuel for transportation is shown in combination (air and marine uses) in red, along with gasoline.

transport. Buildings produced almost 25% of community GHG, primarily from petroleum-based sources used for ventilation, space heating, and hot water.

Figure 2: Community-wide GHG emissions (by sector)



As the highest energy consumers, the transportation and building sectors will provide the greatest future opportunities to reduce energy use in Juneau. Buildings represent the greatest single energy consuming sector, accounting for 42% of total energy use, as shown in Figure 3. However, when highway, air, and marine transportation are aggregated, that combined transportation sector uses 39% of the community's energy. The borough's two large mines consume 14% of total energy.



1. Buildings and the built environment: Includes energy types like electricity and fuels (diesel, propane, wood, etc.) which are in turn used in residential, commercial, and industrial buildings located within the community. Most emissions are from fuel used to heat buildings and provide hot water. Street and marina lighting was included in the built environment category, similar to building lighting, in terms of electricity usage. In 2021, liquid fuels consumption data was not provided by the respective fuel providers, as was the case in 2010 – this means that fuel actuals were obtained direct from primary data, whereas in 2021, fuel consumption was modeled based on activity.

For stationary use, unlike 2010 inventory where fuel data was directly available, a model was used that estimated energy use in BTU for the 2021 year. See Table 2.

Table 2. 2020 ACS survey estimates on CBJ heating fuel distributions.

Total occupied housing units	**12,922**	**100%**
Heating oil (Fuel oil, kerosene, etc.)	6,838	53%
Electricity	4,164	32%
Other	698	6%
Propane (Bottled, tank, or LP gas)	643	5%
Wood	242	3%

Heating oil refers to liquid fuels sold by suppliers and was estimated given fuel data was not available. A model was created that first evaluated the total heating-fuel based households in the CBJ boundary, from the American Community Survey (ACS) of the U.S. Census 2020. A similar approach was used for propane and wood. **Propane** also had historically included all propane sold by local distributors, like Amerigas and Arrowhead in 2010, and did not include propane delivered from outside Juneau to either mining operation. However, in 2021, due to the unavailability of this data, the same model was used as heating oil and fuel.

Wood energy data in 2010[9] and emissions calculations was based on the Alaska Department of Environmental Conservation Mendenhall Valley 2007 wood use survey extrapolated to the rest of the community. We applied a similar model[10] for both wood, propane and heating oil for the 2021 update – which included data for every building in the CBJ area, year-built, principal use of building, square footage and orientation, to estimate energy-use-intensity by fuel type.

Electricity includes almost all electricity sold by AEL&P in 2021, including electricity sold to cruise ships while docked in Juneau (538 MWh). In 2021, most electricity was produced by hydroelectric power with less than 0.2% provided by diesel fuel.

AEL&P provided data on consumption of electricity in 2021 within the CBJ boundary in MWh, broken down by major uses, such as residential, commercial (which included government and industrial customers) and transportation. According to supplier specific emission factors provided by AEL&P, the market-based scope 2 methodology resulted in 628.32 MT CO2e of emissions[11] which is a 6% decrease in electricity emissions, despite a 9% increase in total electricity consumption between 2010 and 2021.

Please note, the location-based emission factors from the U.S. EPA for the ASCC Miscellaneous (AKMS) EGRID subregion, which includes CBJ, are 486 lbs./MWh or 0.24 MT CO2e/MWh. This EPA subregion is a compilation of several different islanded electrical utilities throughout the state of Alaska that are not interconnected, and so these emission factors do not accurately represent electricity production for the CBJ and therefore are not used in this analysis.

[9] By calculating the total number of households likely using wood from the 2020 ACS survey. The total number of households were used to understand the cords of wood used. Previously, a similar model was used in 2010 using survey data of households to estimate number of cords and pellets per household by the number of households, to determine total energy from wood used in MMBtu.
[10] https://www.energy.gov/eere/buildings/articles/energyplus
[11] Assuming the diesel emissions of 2.24 lbs. per kWh, or 0.00102 MT CO2e per kWh at 616,000,000 kWh of diesel generation reporting in CY2021.

Table 3. AEL&P 2021 downstream delivered electricity in CBJ sectors.

Sectors	kWh usage in 2021
Commercial	168,762,235
Residential	159,844,781
Government	74,842,124
Transportation	763,621

Table 4. AEL&P 2021 upstream generation of electricity for CBJ

Electricity generation CY 2021	
Diesel generation (MWh)	616
Hydro Generation (MWh)	431,652
Total Generation	432,268
% Diesel	0.14%
% Hydro	99.86%
Gallons of diesel combusted	51,408

2. Equipment: Includes gallons of fuel not used by motor vehicles licensed to operate on public ways and fuel for generators and construction equipment. The only equipment level emissions were already accounted for by generators operated by AEL&P, or industrial facilities and mining operations, however diesel consumption from equipment usage for mobile combustion was included separately after discussing with the landfill and mining company personnel.

3. Transportation

Highway Transportation: This on-road transportation emissions included emissions from burning gallons of gasoline combusted by vehicles. While past GHG emissions from highway transportation are based on actual gallons provided by fuel distributors, given the lack of such data in 2021, a novel method to estimate vehicle miles traveled (VMT) was used, which was a recommendation in 2010.

Using the 2021 Average Annual Daily Traffic Count from the Alaska Department of Transportation & Public Facilities, the 2021 update estimated 152,063,352 miles of travel by passenger, light-duty and heavy-duty vehicles. In order to get 2021 vehicles by class codes, the inventory made use of the State of Alaska Division of Motor Vehicles' list of vehicles to determine the number of passenger cars and light and heavy trucks the inventory looked at data registered in the zip codes within City and Borough of Juneau on in December 2021, across Vehicle Class Codes. CBJ has a special attribute given its location, such that the lack of roads in or out of Juneau means that most fuels purchased in Juneau is used within borough boundaries. Since the assumptions regarding fuel usage across registered vehicles did not include electric vehicles, transportation emissions may be slightly skewed to gasoline and diesel. Electric vehicle charging was included as part of building electricity section.

Air Transportation: Emissions from air travel includes gallons of aviation gasoline and jet fuel provided by local distributors within CBJ. Generally, the fuel flowage records from the Juneau International Airport (JNU) based on reporting for the CBJ fuel flowage fee charged on all fuel sold at the airport is less than the combined amount from distributors, primarily due to less aviation gas being pumped at the airport than sold by distributors. However, in 2021, distributors' data on sold fuels were not available – so Juneau International Airport personnel provided data across all airlines and fuel types.

We also collected data on total enplanements from the Federal Aviation Administration (FAA) (306,512 enplaned passengers in 2021) with small carriers reporting directly to FAA, and not to JNU – which is why the 2021 data on enplanements was 253,170 passengers. Additionally, 1,594,283 tons of mail and 4,264,882 tons of freight being carried via the airplanes going out from CBJ. As a result, the total gallons of liquid fuels for 2021 was 3,909,529 – 170,530 gallons of aviation gasoline and 3,738,999 gallons of jet fuel, which overall was a 0.4% reduction from 2010 numbers. The 2021 sales of fuels were considered high given data over the past 7 years. There was 1.56 million gallons consumed in 2019, where consumption has typically ranged of 2.5-3 million gallons - generally affected by economic conditions, as well as varying purchasing policies of different airline companies that change year to year.

Marine Transportation: Scope 1 energy use and emissions for marine transportation totaled 4.8 million gallons of fuels and 48,877 metric tonnes of CO2e. Scope 1 emissions refer to emissions from direct combustion of fossil fuels for all riverine trips, by marine ferries and boats traveling between seaports that originate and terminate within the CBJ boundary (GPC, pg 80-81*[12]). In the 2007 and 2010 inventories marine transportation emissions included all marine gasoline and diesel sold by the fuel distributors in Juneau. These figures included fuel for the Alaska Marine Highway and other marine fuel pumped in Juneau but did not include the fuel used to ship goods to Juneau or fuel used by cruise ships, which would be scope 3 emissions. In the 2021 update, due to no data provided by fuel distributors, an alternative process was used and explained in the appendix.

Industrial processes

Greens Creek Mine: The Hecla Greens Creek Mining Company operates on Admiralty Island near Juneau. This report uses information from EPA for Greens Creek consumption information for electricity, propane, and diesel fuel used for equipment and non-highway vehicles, heating, and hot water.[13] In 2021, Greens Creek Mine used 0.604 million gallons of Distillate Fuel oil (#2), 4,003 gallons of propane, as well as 38,000 gallons of used oil, emitting the 6,603 metric tons of total emissions. Between 2007 and 2010 Greens Creek GHG emissions reduced by 67% by shifting from self-generating electricity with diesel to using hydropower from the new Lake Dorothy hydropower project. Greens Creek's data on actual fuels purchased and used each year, as opposed to the partial data reporting conducted under the Toxics Release Inventory (TRI) Program, for stationary combustion was used, which includes power and heat generation facilities. The EPA data does not include fuels consumed or combusted in mobile surface and

[12] GHG Community Protocol, pp. 80 - 81. Global Protocol for Community-Scale Greenhouse Gas Emission Inventories, available at https://www.ghgprotocol.org/sites/default/files/ghgp/standards/GHGP_GPC_0.pdf
[13] A full GHG annual report is available for the company at https://www.hecla.com/wp-content/uploads/2021-Hecla-Sustainability-Report.pdf, listing overall mobile fuel use at just over 1 million gallons of diesel and 12,000 gallons of gasoline.

underground equipment. All of the mines annual fuel used on-site is purchased from Petro Marine and delivered via fuel barge from outside of Juneau. It was not apparent which portion of the fuels were from within Juneau (Scope 1) and which portion originated outside (Scope 3).

Kensington Mine: The Coeur Alaska Kensington Gold Mine operates at the northern end of the City and Borough of Juneau in the vicinity of Berners Bay. The mine started production in June 2010. Kensington supplied information on diesel fuel and propane for stationary use (as reported to the U.S. Environmental Protection Agency) in 2021. Kensington's reported diesel fuel includes stationary fuel used for generators, non-highway vehicles, heating, and incinerators. Kensington Gold Mine had used 4.47 million gallons of Distillate Fuel oil (#2) as well as 204,785 gallons of Liquified Petroleum Gas (LPG) and emitted 46,917 metric tons of CO2e, which increased drastically (2.5x) from 2010 – at 18,285 metric tons. It is to be noted, that this significant difference from 2010 was due to the fact Kensington had just opened, and the energy use for that year reflected only half year of their regular operational activities.

Also of note, Coeur Alaska invested in a new powerhouse, with construction of the plant completed in 2019. According to Coeur Alaska, the new plant reduced fuel consumption by 25% and particulate matter by 85% thereby reducing overall emissions. Even with these efficiencies, Coeur Alaska has been seeking sustainable power solutions to reduce or eliminate reliance on diesel power generation, and to reduce greenhouse gas emissions. Coeur Alaska is in the process of exploring alternative options to reduce diesel usage and GHG emissions, such as an onsite battery bank, heat capture system, and in-pipe hydro generation.

4. **Waste:**

Juneau's privately owned solid waste landfill is located in the Lemon Creek area and includes municipal solid waste and construction/demolition debris deposited in the Capital Disposal landfill. As a point of note, Capital Disposal landfill provided total waste tons for 2007 and 2010, divided into types of waste (paper products, food waste, plant debris, wood or textiles, and all other waste). The metric ton equivalent was determined using the following standard formula, assuming 1 short ton is 0.90 metric tons with the methane coefficients applied for each type of waste. Finally, the EPA national default value for the efficiency of methane collection (75%) was applied, with an assumed 1% of methane collected escaping during the flaring process.

In 2010, amounting to 25,310 metric tons of waste (28,121.6 short tons) resulting in 26,892 metric tons of CO2e, which included 75% capture of methane through the passive flare system (with 1% of the 75% escaping) – a methodology that had changed such that waste emissions are no longer factored as net zero. This adjustment resulted in 6,925 metric tons of emissions with flaring. In 2007, total annual waste added to the landfill was 33,277 short tons, equal to 29,949 metric tons, resulting in 31,823 MT CO2e of emissions which were 8,194 metric tons with flaring – resulting in an 18% reduction. In 2021, Capitol Disposal Landfill emitted lower emissions of 12,904 mt CO2e[14] compared to the 2010 amounts of which was 26,893 mt CO2e. and a 6,925 mt CO2e w/flare. This was due to 1,539 MMBtu of diesel use, as well as 3066 MMBtu of used oil use, contributing to 341 metric tons of CO2e in 2021 for stationary

[14] According to the U.S. EPA Facility data

combustion. Additionally, 12,562 metric tons of CH4 were emitted from the landfill decomposition and processing of both organic and inorganic materials, from municipal solid waste and construction or demolition debris, into the atmosphere, accounting for a combined 12,904 metric tons of CO2e. The normalized comparison is between 12,904 mt CO2e in 2021 which is 48% of the 26,893 mt CO2e in 2010 (an eleven-year period), was already on a reduction trajectory over a three-year period from 18% in 2007. Capitol landfill additionally purchased approximately 15,325 gallons of offroad diesel for use in their non-stationary equipment. This contributed to a further 150 metric tons of emissions is significantly lower than GHG emissions from fuels community residents use in traveling back and forth from the landfill for both dropping off recycling and their residential waste.

Operational GHG emissions for CBJ government – 2021

The table provides data on total emissions from CBJ by sector and source (fuel or electric). This table and the following notes provide additional information used to generate the 2021 operational government energy use findings. The energy use information, combined with emission factor determinations under the GHG local government protocol was used as the basis for the methodology used to generate GHG emissions findings for this report based on 2021 data. Local government energy consumption and emissions analyses were divided into the following sectors, keeping in line with 2007 and 2010 inventories:

1. Facilities;
2. School facilities;
3. Wastewater treatment and drinking water;
4. Capital transit; and
5. CBJ vehicle fleet.

Government consumption and emissions data have been included in the above community-wide calculations. However, the unique ability of local government to gather building, fleet, and department-specific data, as well as the government’s enhanced ability to abate emissions through direct agency action, warrants the following separate analysis. The 2010 community GHG report also included a separate analysis of local government. Government facilities, including schools, accounted for 62% of all local government energy consumption in 2010 and accounted for 73% in 2021. Facilities, schools, and wastewater treatment plants produced 73% of government GHG emissions in 2010, vs 91% in 2021.

In 2010, the transportation sector produced 27%, while the CBJ wastewater treatment plant alone produced 13% of local government GHG emissions – however in 2021, the transportation sector produced 9% and wastewater 19% respectively. The 2021 GHG increases, compared to 2010, are driven mostly by schools and the biosolids dryer used at the wastewater utility. The Mendenhall Wastewater Treatment Plant prior to 2019 averaged about 80,000 gallons of fuel per year. Usage increased in 2019 when biosolids dryer came online. As production increased, fuel usage increased with an estimated attribution of 128,000 gallons annually. Similarly, energy usage in schools increasing after COVID could be attributed to increased amount of outside air being brought into facilities, correlating with increased fuel usage. In terms of electricity specifically, there are several electric-only facilities that have come online, as well as certain facilities converted to heat pumps since the 2010 GHG report. For instance, Dimond Park Aquatic Center and Mendenhall Valley Library accounts for a high proportion of the electricity increase.

Fleet energy and emissions included all fuel use (diesel and gasoline), provided by CBJ from an internal database tracking gallons of diesel and gasoline used by department. An alternative data source for vehicle fleet was gallons purchased (CBJ Purchasing Division); however, because CBJ indicated that the fleet database (Consumption Statistics) is a more accurate accounting of vehicle fleet fuel usage, the fleet database was used. The emissions factors for calculating metric tons of carbon dioxide equivalent (MTCO2e) for all CBJ vehicles (fleet and Capital Transit) use of gasoline and diesel included carbon dioxide (CO2) figures from local government emission factor databases. This list includes both on-road and off-road vehicles such as automobiles, trucks, Capital Transit buses, and miles driven, as well construction equipment for operational hours. In 2021 however, each vehicle had a departmental code that could be linked to other non-fleet departments, versus lumping all fuel consumption by vehicles to fleet.

This was due to data availability for vehicles, at the wastewater level (and other facilities) which were ascribed generically to fleet in 2010. As a result, direct comparison between departmental boundaries from 2010 to 2021 could be difficult, despite being more accurate representation of departmental emissions breakdown using 2021 categories. Items like government-operated lighting and water pumping, which ran on electricity in 2010, contributed essentially nothing to the government's share of area-wide GHG emissions. For 2021, lighting electricity usage was not broken down by AEL&P and were added to facilities overall power consumption.

These data trends highlight that an emphasis on increasing energy efficiency and changes in fuel consumption related to buildings, transportation, and wastewater treatment will be key to reducing both annual government operating expenditures and area wide GHG emissions in the coming years.

Energy use and data collection

Electricity and petroleum fuel (mostly diesel, fuel oil and gasoline) use in facilities, schools, wastewater and drinking water treatment, Capital Transit, and the vehicle fleet were analyzed from data sources by department. Data for CBJ electric meters was obtained from AEL&P as well as Portfolio Manager software system maintained within CBJ, whereas data for CBJ fuel tanks was obtained from CBJ reports. Facility and department name were added to the meter specific information from AEL&P. The detailed list of CBJ tanks (provided by tank number by CBJ) was paired with the fuel provider information, using tank numbers, provided usage by facility, department, and fuel type. Each tank was associated with a source (vehicle fleet, facilities, or wastewater treatment) and with a department. Similar emission factors assumptions are made for operational footprint, as were the community estimations.

All energy data were provided by CBJ, except for scope 3 data around employee commute – which, in addition to emissions related to business travel conducted in 2021, were not items that were tracked in previous inventory years, 2007 and 2010. In the 2010 report, recommendations were made in terms of how to accommodate a more accurate picture of GHG emissions from both the CBJ fleet and community fleet. First, in 2021, the annual mileage for each CBJ vehicle and equipment were tracked, in addition to the consumption in terms of miles driven or hours operated. The exact type of fuel each vehicle and equipment use were also recorded. For community emissions, the State of Alaska Division of Motor Vehicles registration data by zip code and type (see community section for more details) were used.

Overall, local government accounted for 4.5% of community -wide energy consumption and produced a little over 3% of area-wide GHG emissions in 2010, compared to 6.6% and 4.96% in 2021 – being slightly higher as a portion of community emissions attributable to government operations even as the number of employees increased over this period. The CBJ government purchased about 1.25 million gallons of fuel in 2010 and almost 37.4 million kilowatt hours of electricity, compared to 1.38 million gallons of fuel and 37.4% in 2021 – given an approximately 5% increase in CBJ full time equivalents from 463 in 2010 to 486 in 2021. Table 7 also summarizes the portions of emissions attributable to specific departments[15] within CBJ.

[15] General government included Centennial Hall, City Hall, libraries, and miscellaneous other city facilities. Lighting under the 2010 and 2007 category included street lighting, traffic signals, and all docks and harbors meters– both dock/marina lighting and private boat electricity use, which were not broken down by AEL&P in 2021.

Table 7: CBJ Operational emissions summary 2021

	FUEL			ELECTRICITY			Total			
Sector	**Gallons**	**MMBtu**	**MT CO2 e**	**kWh**	**MMBtu**	**MT CO2e**	**Total MMBtu**	**Total MTCO2e**	**% MTCO2e**	**% in 2010**
School Facilities	393,668	54,326	3,993	7,289,021	24,877	7	79,203	4,000	29%	21%
OTHER FACILITIES										
Hospital	250,358	34,549	2,547	6,021,139	20,550	6	55,099	2,553	18%	18%
Airport	19,173	2,646	193	3,174,334	10,834	3	13,480	196	1%	6%
Parks & Recreation	108,219	14,934	1,016	4,073,743	13,904	4	28,838	1,020	7%	6%
Public Works	50,937	7,029	497	2,239,370	7,643	2	14,672	499	4%	2%
General Government	24,499	3,381	247	3,344,780	11,416	3	14,797	251	2%	2%
Fire	69,291	9,562	691	634,976	2,167	1	11,729	691	5%	3%
Police	47,914	6,612	449	536,435	1,831	1	8,443	450	3%	1%
Harbors	15,602	2,153	152	1,473,797	5,030	2	7,183	154	1%	0%
Total	***979,661***	***135,193***	***9,784***	***28,787,595***	***98,251***	***29***	***233,444***	***9,814***	***71%***	***39%***
EQUIPMENT NON-FACILITY										
Wastewater	264,199	36,459	2,675	6,484,462	22,131	7	58,591	2,681	19%	13%
Water	12,759	1,761	118	1,750,513	5,974	2	7,735	119	1%	0%
Lighting	-	-	-	-	-	-	-	-	0%	0%
Total	***276,958***	***38,220***	***2,792***	***8,234,975***	***28,106***	***8***	***66,326***	***2,801***	***20%***	***13%***
FLEET[16]										
Capital Transit	127,572	17,605	1,297	230,000	785	0	18,390	1,297	9%	11%
Vehicle Fleet	463	64	4	105,305	359	0	423	4	0.03%	16%
Total	***128,036***	***17,669***	***1,301***	***335,305***	***1,144***	***0***	***18,813***	***1,301***	***9%***	***27%***
TOTAL	**1,384,654**	**191,082**	**13,878**	**37,357,875**	**127,501**	**38**	**318,584**	**13,916**	**100%**	
Change since 2010	11.08%	11.08%	10.67%	-0.21%	-0.21%	-43.13%	15.70%	10.49%		

Note: In 2010, the total operational emissions were calculated to be 12,594 MT CO_2e. For 2021, the total operational emissions increased to 13,916 MT CO_2e using the market-based scope 2 accounting, representing a 10.5% increase. Additionally, Scope 3 items such as business travel (70.89 MT CO_2e) and employee commute (1,411.35 MT CO_2e), which were not included in the past inventory of 2010, were estimated using departmental finance and imputed HR data – 1,482 MT CO_2e in 2021.

[16] Fleet vehicles and equipment, and their operational ownership or use attribution by various CBJ departments may have been different than past inventories.

CONCLUSION AND RECOMMENDATIONS

The 2021 GHG emissions inventory reveals that both energy use and GHG emissions for the overall community decreased fromthe 2010 and 2007 inventory. Figures 3a. to 3d. show the changes in energy consumption and GHG emissions, by upstream energy source, as well as downstream economic sectors, across the three years.

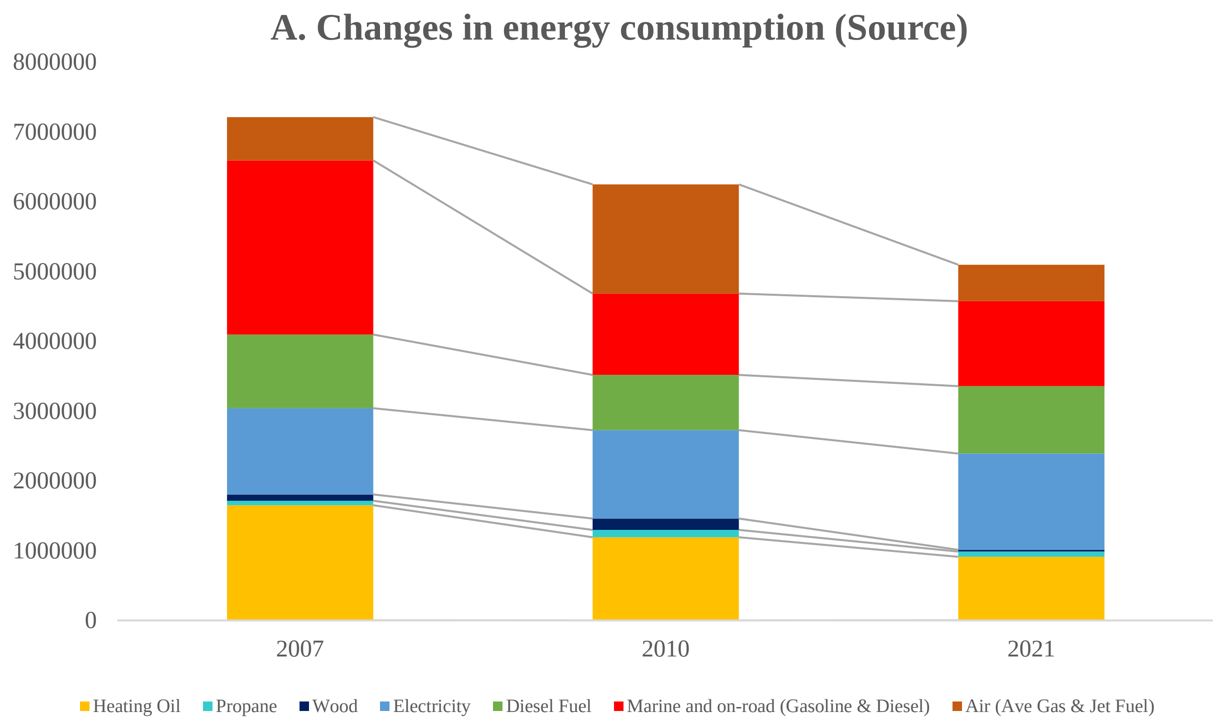
While comparing the three non-consecutive years of information over a range of11 to 14-year provides data reference points, it does not enable us to define a trend. When comparing snapshots of energy use and GHG emissions from nonconsecutive years, it is important to identify variables that may have influenced energy use and GHG emissions in each year but that may not necessarily signify a trend. These include factors like relative discrepancies in the availability, accuracy, and reliability of collected data, revisions in the emission measurement framework, variations in economic productivity, differing heating degree days,[17] and the construction or demolition of buildings.

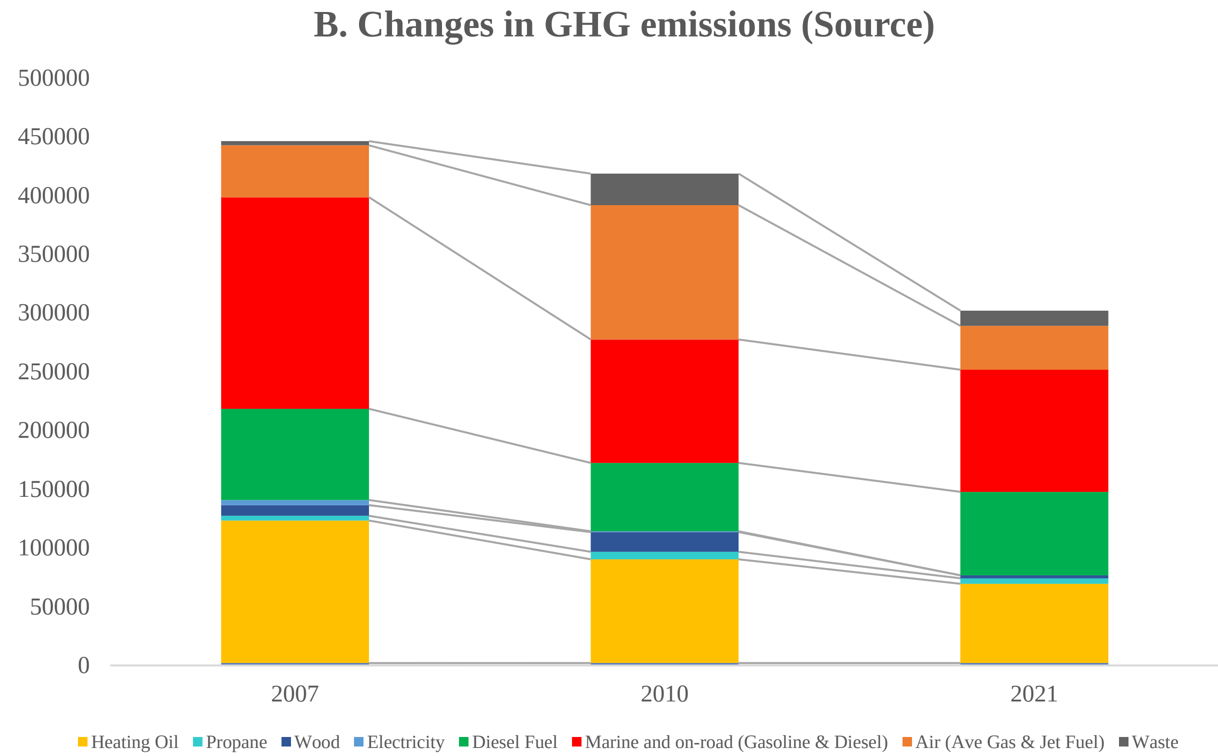
Obtaining additional reference points over the coming years would enable CBJ to identify areas of lasting improvement more readily than we can in this report, given the gaps in the years and only three data sets. To accurately identify trends in area-wide energy use and the production of GHG emissions, it is recommended that annual community-wide energy use and GHG emissions inventories be conducted for five consecutive years. After usage and emissions patterns are established, and the effectiveness of abatement efforts have been determined, it can be determined whether inventories will continue to need to be conducted annually or biennially.

As the local, state, and federal governments continue to move forward with energy efficiency and conservation measures, consideration should be given to breaking out energy use and GHG emissions from the building sector into three separate categories—such Residential Buildings, Government Buildings and Commercial Buildings. This would help to better identify and address energy-related dynamics in each of these areas. Energy use analyses of specific buildings will help i determine which buildings would produce the greatest energy savings from weatherization, energy system upgrades, and other retrofitting. CBJ should continue to track and keep records of energy use and costs and operational GHG emissions, by department and, where building or system energy audits are completed, by building and/or system. In addition, obtaining an accurate accounting of square footage for these types of buildings will help determine energy use per square foot and allows for comparisons among buildings in Juneau.

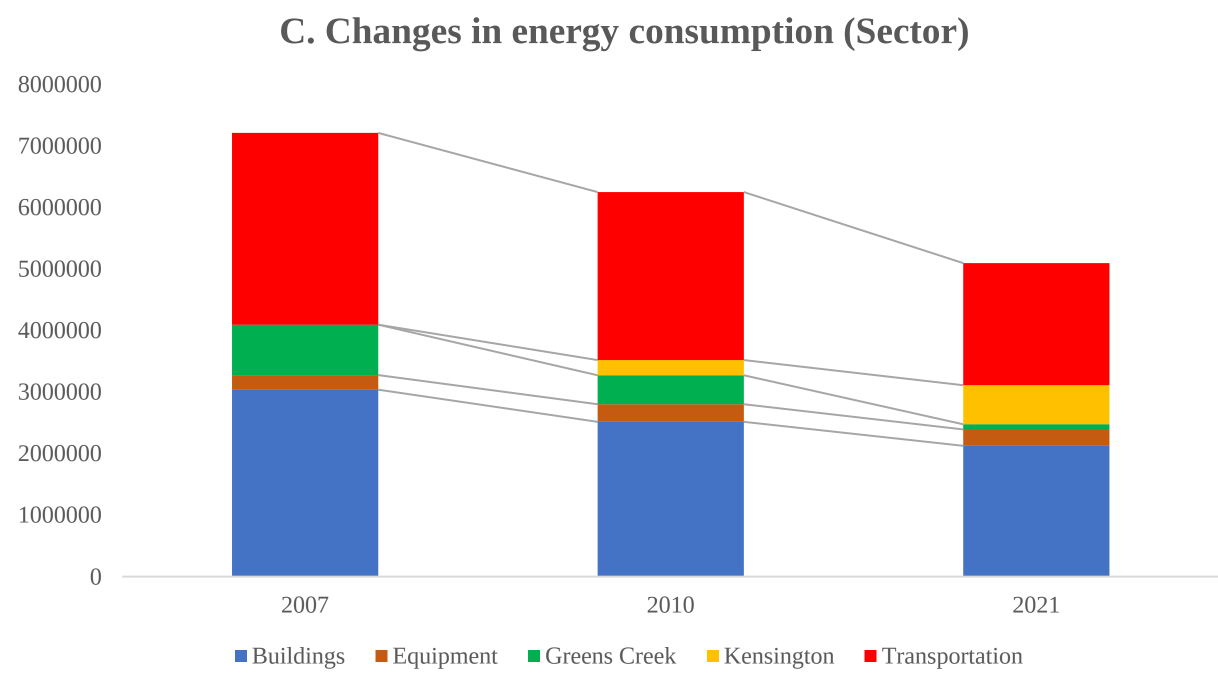
[17] The heating degree days (HDD) for 2021 were 8659, compared to 8074 for 2010 and 8656 for 2007- as such, such year-to-year variations introduce differences in GHG driven by energy use associated with greater demands. HDD will continue to be the dominant issue as heating load (demand) has a significant impact on fuel use. Juneau's electrical demand peaks in the winter, and that would translate to other direct fuels as well. Although it could change in the future with rising temperatures, CDD impacts are negligible in Juneau given there are few occurrences, with air conditioning load being uncommon. Beyond Juneau, where climates are warmer, the summer tends to be the season when loads peak because of air conditioning.

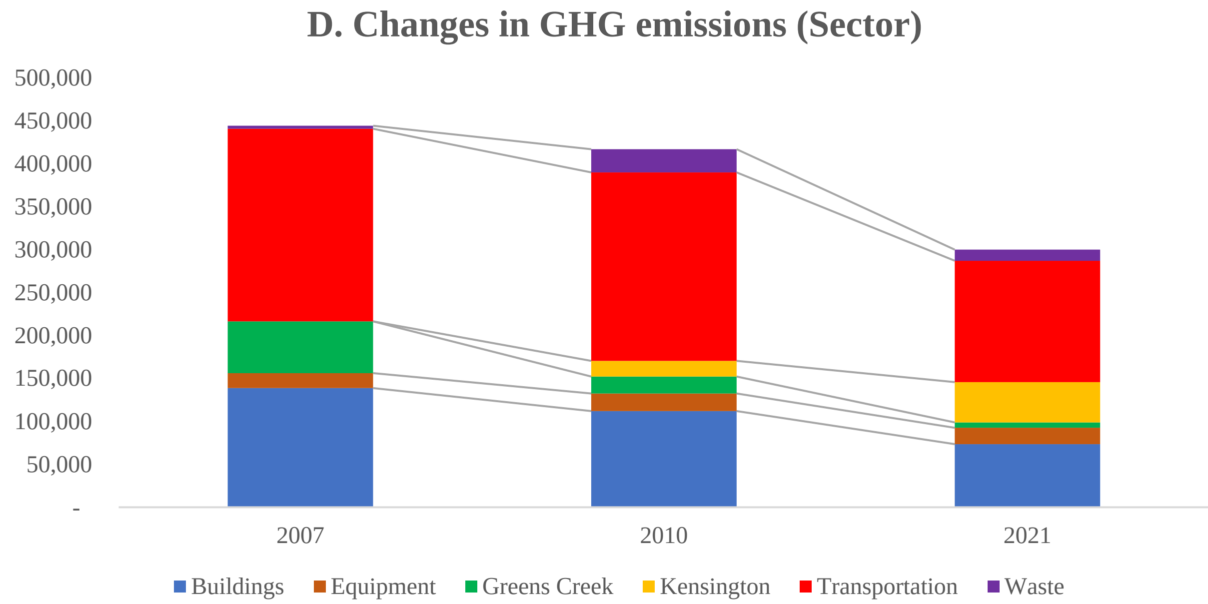
Figure 3: The charts below summarize the (a) energy and (b) emissions trend across the three inventory years, in terms of **energy source.** Energy consumption is in MMBTU units.

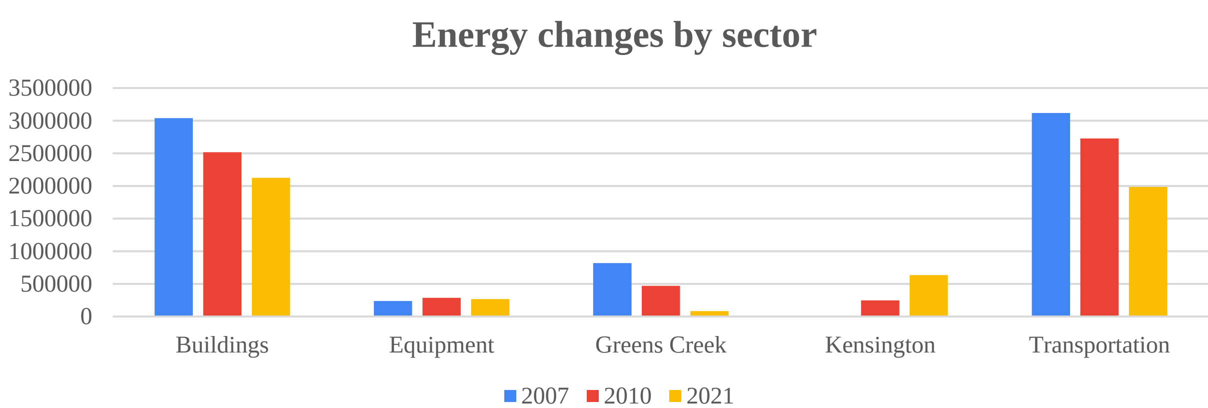


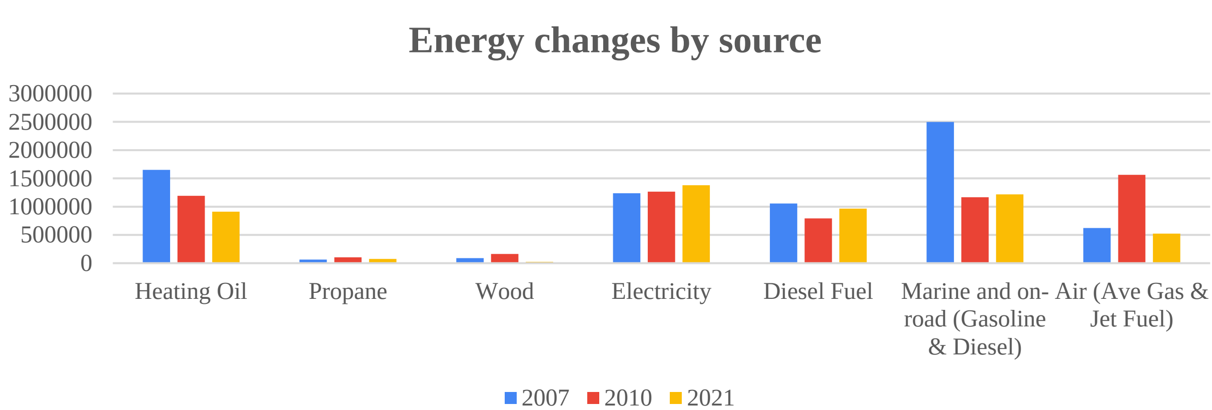


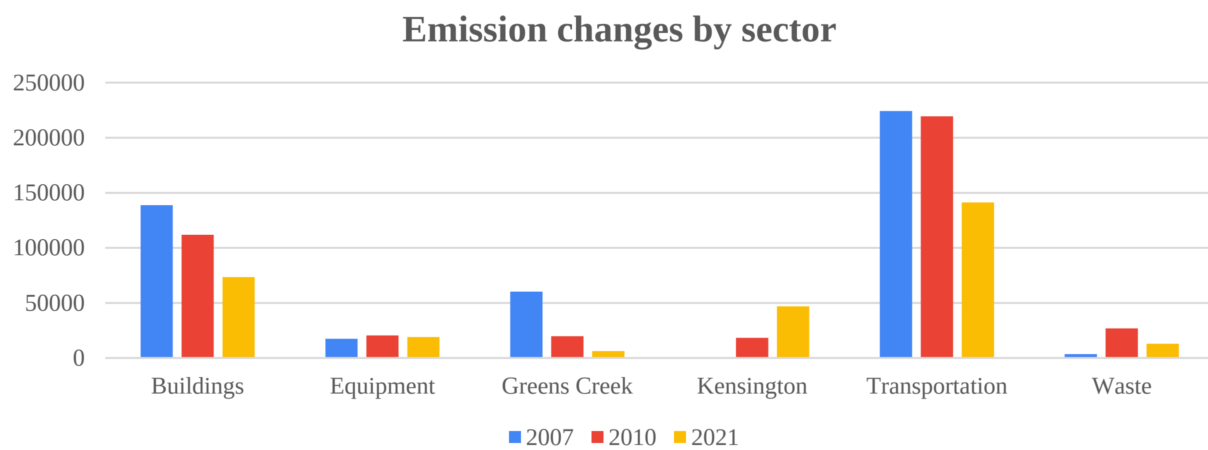
The charts below summarize the (c) energy and (d) emissions trend across the three years, in terms of **economic sectors.** Total GHG emissions is shown in MT CO_2e units.

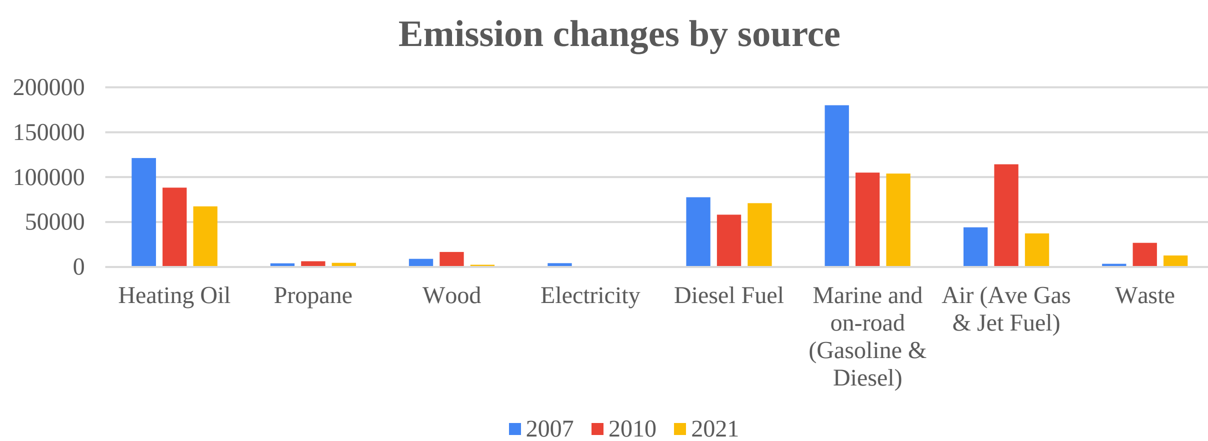



D. Changes in GHG emissions (Sector)
500,000
450,000
400,000
350,000
300,000
250,000
200,000
150,000
100,000
50,000
-
2007
2010
2021
Buildings
Equipment
Greens Creek
Kensington
Transportation
Waste


Energy changes by sector
3500000
3000000
2500000
2000000
1500000
1000000
500000
0
Buildings
Equipment
Greens Creek
Kensington
Transportation
2007
2010
2021


Energy changes by source
3000000
2500000
2000000
1500000
1000000
500000
0
Heating Oil
Propane
Wood
Electricity
Diesel Fuel
Marine and on-road (Gasoline & Diesel)
Air (Ave Gas & Jet Fuel)
2007
2010
2021


Emission changes by sector
250000
200000
150000
100000
50000
0
Buildings
Equipment
Greens Creek
Kensington
Transportation
Waste
2007
2010
2021


Emission changes by source
200000
150000
100000
50000
0
Heating Oil
Propane
Wood
Electricity
Diesel Fuel
Marine and on-road (Gasoline & Diesel)
Air (Ave Gas & Jet Fuel)
Waste
2007
2010
2021

Appendix

Methodology:

Timescale: A standardized emissions inventory report comprises all GHG emissions occurring during a calendar year. Among others, the UNFCCC, the Kyoto Protocol, the European Union, The Climate Registry, and the California Climate Action Registry all require GHG inventories to be tracked and reported on a calendar year basis - Additionally to conducting a base year inventory of emissions, a comprehensive inventory of emissions should be completed at regular intervals following the base year (2007). This report used the 2021 calendar year for the reporting year.

Boundary: The local government organization boundaries for GHG accounting were established in 2007 and are the boundaries of the City and Borough of Juneau. The Juneau GHG emissions calculation is an internal estimate of GHGs and does not include fuel for cruise ship, barge, or air travel within CBJ limits where the fuel used came from outside Juneau. It does include energy (fuel and electric) use where the energy was obtained locally (e.g., electricity supplied at Juneau's docks and airplane refueling that occurs in Juneau). The 2007 report established, and 2010 followed that approach for defining the departments, activities, and operations that constitute Juneau's community and local government for the purpose of reporting GHG emissions. The 2007 and 2010 inventory approach were duplicated to the extent feasible in the current report. Wherever changes in data reliability, calculation methods, or data display were encountered, they are noted in the text.

Activity calculation: In 2021, the calculation-based methodologies were used to quantify both the community and government-sourced GHG emissions. This methodology involves the calculation of emissions based on "activity data" and "emission factors." *Activity data* represent the relevant measurement of energy use, such as fuel consumption by fuel type (propane, heating oil, diesel, gasoline, jet fuel, etc.) and metered electricity use (mostly from AEL&P). These activity data were used in conjunction with an emission factor per unit of fuel, to determine emissions, using the following generalized equation, such that *Emissions (CO2) = Activity Data (MMBTU*[18]*) x Emission Factor (CO2 per MMBTU).*

Emission factors: Emission factors are calculated ratios relating GHG emissions to a proxy measure of activity at an emissions source. We used the emission factors provided in the GHG Accounting Protocol to convert activity data, such as energy usage, into the associated GHG emissions. Whenever emissions values were directly provided, we consulted the source U.S. EPA or the emitters directly to understand data quality. These emission factors are approved by regulatory and research bodies, and were determined by means of direct measurement, laboratory analyses, or calculations based on representative heat content and carbon content. No site-specific emission factors representative of the technology employed at specific consuming facilities were used.

[18] Here MMBtu represents one million British thermal units and is a unit of energy used to compare across different fuel quantities, like diesel vs. electricity - all units of fuels, electricity, and wood have been converted to MMBtu for purposes of comparison.

For example, in calculating emissions from stationary combustion using fuel use activity data and default emission factors by fuel type involves the following steps – First, the inventory process determined the total annual consumption of each fuel combusted at community-level sectors, as well as facilities and assets for CBJ operational footprint. Then, determine the appropriate CO2, CH4 and N2O emission factors for each fuel. Finally, calculate each fuel's CO2, CH4 and N2O emission contributions, and lastly convert CH4 and N2O emissions to MTCO2 equivalent to determine total emissions. These are reported in the tables for both 2021 community emissions, as well as the operational emissions of the local government.

Converting emissions of non-CO2 gases to units of CO2e allows greenhouse gases (GHGs) to be compared on a common basis: the ability of each GHG to trap heat in the atmosphere. In this report, non-CO2 gases have been converted to CO2e using internationally recognized Global Warming Potential (GWP) factors. CO2e is an abbreviation for carbon dioxide equivalent, the internationally recognized measure of greenhouse gas emissions.

The Intergovernmental Panel on Climate Change developed GWPs to represent the heat-trapping ability of each GHG relative to that of CO2. For example, the GWP of methane is 21 because one metric ton of methane has 21 times more ability to trap heat in the atmosphere than one metric ton of carbon dioxide. The GWP of nitrous oxide is 310. The CO2e measure is used worldwide 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 greenhouse gas is based on the amount of carbon dioxide that would have the same global warming potential measured over a specified time period.

Inventory Scopes

Emissions are generally broken down into Scope 1, 2 and 3 to show differences in control and boundaries. For instance, Scope 1 emissions refer to in-boundary emissions, such as combustion of fuels for stationary use, such as heating offices and buildings, as well as mobile use, such as in-boundary transportation, both driving, flying and marine transportation with fuels extracted within the boundary. Industrial processes, such as mining as well as waste and wastewater, are also scope 1 emission. Scope 2 emissions refers to grid supplied energy, such as power consumption. Since power is generated and sold within Juneau, the Scope 2 purchased electricity, is already counted as Scope 1 generation from hydroelectric and diesel. Scope 3 would include out-of-boundary emissions, like biosolids hauled to Oregon for disposal, transmission and distribution losses outside of boundary, any transportation outside of Juneau, or fueling of transportation vehicles outside of Juneau, as well as other indirect emissions, such as imported goods and services produced outside of Juneau. Scope 3, similar to previous studies, have been left out for the 2021 study update as well. Below are further details on scope.

Scope 1: All direct GHG emissions were recorded. Scope 1 emissions from stationary combustion cover seven sectors for CBJ and the community. For the community inventory, Scope 1 includes stationary combustion, such as fuel use in buildings and facilities located within Juneau, as well as in boundary transportation, like the movement of different classes of vehicles within the community boundary, including air, on-road as well as marine transportation.

For the operational footprint, this includes Water delivery facilities and Wastewater facilities owned and operated by CBJ, Power generation facilities owned and operated by AEL&P for the generation of electricity that is then consumed by CBJ and the broader community. Solid waste facilities, Port facilities owned by CBJ, and reported as Harbors), the Airport facilities (JIA), and finally all other buildings and facilities, form scope 1 emissions for the community.

Scope 2: Indirect GHG emissions associated with the consumption of purchased or acquired electricity, steam, heating, or cooling are irrelevant for Juneau's community-wide emissions, since Juneau's electricity supply is produced within the borough's geopolitical boundaries, there are no Scope 2 emissions. In this analysis, most emissions are considered Scope 1, with minor Scope 2 for CBJ facilities - since AEL&P power is purchased by CBJ, electricity does form the basis of their scope 2 emissions, which this report estimates on both market-based and location-based emissions. This would include electricity consumed by the facilities and transportation sources identified above in the Scope 1 paragraph, namely the residential, commercial, transportation and industrial power consumption.

Scope 3: Emissions resulting from the extraction and production of purchased materials and upstream fuels, transport-related activities in vehicles not owned or controlled by the reporting entity (e.g., employee commuting and business travel for CBJ's operational), air travel, and marine travel. The Scope 3 emissions analyzed herein include those from the following sources: wood use, waste disposal, marine transportation, and air transportation. Emissions from cruise ships, barges and some air travel, are considered scope 3, but for these modes of transportation this inventory only includes estimated emissions from fuel obtained within in Juneau, AK, in line with previous inventory studies. The distinction between scopes is relevant for reporting emissions at different levels; however, for this inventory, all scopes are embedded in total Juneau emissions for community-wide inventory.

Cruise ship emissions:

Below is an explanation of the methodology, given the GPC standards around waterborne emissions across boundaries, with the related discussions around implications for comparisons to the previous inventories in 2007 and 2010. While local fuel purchases and local marine activity differ on its impact on cruise ship emissions - in that, none of the fuels for cruise ships is purchased locally within the community. As various data sources across the years show, certain smaller vessels, such as tour vessels, purchase fuels within Juneau, whereas barges, tugboats and ferries highly likely purchase their fuels from outside of Juneau.

First, the GPC methodology was consulted in operational boundaries and recommendations on the collection of activity data (GPC, pg 80-81). According to the community protocols, marine transportation includes ships, ferries, and other boats operating within the city boundary, as well as marine-vessels whose journeys originate or end at ports within the city's boundary but travel to destinations outside of the city. While water transportation can be a significant source of emissions globally, most emissions occur during oceanic journeys outside of the boundaries of a port city, and thus not included in the calculations. IPCC Guidelines allow for exclusion of international waterborne navigation, although these journeys and their associated emissions can be useful for a city to understand the full impact of the transit connecting through the city. In this report, keeping with past two inventories for Juneau, we have only accounted for Scopes 1 and 2 emissions for marine transportation, while following recommendations to estimate scope 3 emissions, particularly for meaningful contributors, which in the case of Juneau, is cruise ships.

Scope 1 includes emissions from direct combustion of fossil fuels for all trips that originate and terminate within the city boundary - which includes all riverine trips within the city boundary as well as marine ferries and boats that travel between seaports within the city boundary (including sightseeing ferries that depart from and return to the same seaport within the city boundary). To calculate scope 1 emissions, cities usually:

1. Obtain total real fuel sales estimates of fuel loaded onto marine vessels by inquiring with shipping companies, fuel suppliers (e.g., quantity of fuels delivered to port facilities), or individual port and marine authorities, separated by geographic scale of activity. This was not available for Juneau, so alternative methodologies below were used. For example, the 2021 inventory first collected data at the Port of Juneau that had partial data for the major locations of activity for in-boundary CBJ marine fuel usage.

Table 5: Port-provided estimation for 2021

Location	**Type**	**2021 data (gallons)**
Rock dump	Petro Marine Fuel Dock	None
Bridge	Petro Marine Fuel Dock	Approx. 1.15 million
Harbor	Petro Marine Fuel Dock	885,000
Gitkof dock	Delta Western Fuel Dock	Approx. 1.15 million
Auke Bay Loading Facility	Fuel Truck Delivery	55,000
Seadrome Dock	Fuel Truck Delivery	240,000
Total		**3.45 million gallons**

Table: Port of Juneau, AK estimates of 2021 fuel gallons for marine transportation

Since it was not possible to obtain complete total real fuel sales estimates of fuel loaded onto marine vessels by inquiring with shipping companies or fuel suppliers, data was partially collected from some of the individual port and marine authorities within CBJ.

2. A representative sampling survey can be used, to identify the driver of activity at the sample site (e.g., tonnes of freight or number of people), and use driver information to scale-up the activity data to the city-scale. We used the Marinetraffic.com data for this purpose. We further estimated the distances traveled and resulting fuel usage. The main source of vessel traffic information for the vessel types, is the AIS SHIPTYPE number broadcast through AIS, which is sometimes updated with reliable third-party information – mostly for IMO registered vessels. The classification is reliable, except for small vessels, without IMO numbers, the informational integrity is a function of the crew's inputs to the AIS transponders. Records of port calls included a list of arrivals to and departures from Juneau in 2021, with deadweight (the maximum weight of cargo in metric tonnes) of cargo and passenger vessels, and with the previous and next port information, as well as nautical miles traveled. Cargo vessels include containers, dry bulk, etc., and during the 2021 calendar year there were only four calls belonging to 'Cargo' type. Tankers were not included in this category, as there were no port calls for tankers in the 2021 period. Passenger vessels include larger tourist cruise ships as well as smaller passenger vessels. Based on the tons and nautical miles of all the vessels leaving Juneau, in 2021 – for an estimated 4.8 million gallons equivalent of fuel consumption. 538 MWh of electricity was consumed by cruise ships in 2021, which was reduced significantly from 6,304 MWh in 2019, likely due to the global pandemic that began in 2020.
3. Total city activity may be determined through local, state, or national statistics or transportation agencies for the city. Particularly, a 2017 study using scaled national level data was consulted, which included Juneau level estimates using appropriate scaling factors. This used national marine navigation data through administration agencies. 2017 was the latest year available from the state, was also requested and accessed, across the various vessel types:

Table 6: State-provided data for the last year of record

Category	**Total gallons in 2017**
Bulk Carrier	956
Cruise Ships – Diesel	4,149,642
Cruise Ships – Gas Turbine	244,203
Ferries	557,548

Fishing – Diesel	232,173
Fishing – Gasoline	29,171
Tugs	8,742
Total	**5,222,435**

Table: State of Alaska estimates of 2017 fuel gallons for marine transportation: [1] U.S. EPA (2020). Technical Support Document (TSD) - Preparation of Emissions Inventories for 2016v1 North American Emissions Modeling Platform - September 2020, page 60. For in CBJ (FIPS code 02110) in-boundary fuel-based emissions.

4. Additionally, private data was also acquired to identify the main drivers of marine activity at CBJ boundary, particularly, tonnes of freight and number of people across specific vessel types, such as cruise ships. Finally, data on movement schedules to calculate distances traveled and using the distance traveled estimate to calculate fuel usage by utilizing fuel economy figures for boats: A fuel consumption estimation project was developed for the summer season of 2022. These were not actual inputs from the cruise ships, but rather based on the ships across cruise companies, vessel size given their passenger and crew capacity, taking into consideration the length of the cruises and total seasonal days in operations that range from propulsion (85%) to hoteling when docked (30%). Gallons per day per vessel type was collected from third party sources and literature articles - as well as energy content of various marine hydrocarbon fuels, like gasoline, diesel, marine gasoline oils, Ethanol - 85 and bunker fuels. Assumptions made on percentage of energy used given hours at dock and shore power. Docking in Seattle, WA and Vancouver, BC where the majority of the vessels are assumed to fuel, were ignored - given they would be accounted as scope 3 emissions.

Scope 2 emissions refers to grid-supplied energy that marine-vessels purchase and consume, typically at docks, ports or harbors - this was included in the data provided by AEL&P.

Scope 3 covers emissions from departing transboundary trips powered by direct fuel combustion, apportioned to cover those departing trips that are attributable to the city. Cities can estimate the proportion of passengers and cargo traveling from the city, using official records, manifests, or surveys to determine the apportionment. Emissions from transboundary trips can be calculated based on distance traveled from the seaport within the city to the next destination or from fuel combustion, by quantifying the combustion of fuel loaded at the stations within the city boundary - regardless, transparently documenting the methods used in the inventory reports is crucial, which was done here.

JCOS DISCUSSION DRAFT

3/14/2022 Steve Behnke

Takeaways from the 2021 Energy/GHG Inventory Update

Purpose and Scope of the Study

The analysis estimates 2021 community energy use and GHG emissions to update similar data compiled in 2007 and 2010. However, the study was not designed to explain the changes that occurred. With only 3 widely separated points in time it cannot conclude much about trends without further analysis. It was not designed to update CBJ climate or energy policy, although it can be used as a source of information for evaluating and updating policies.

Methodological Differences

The study was forced to use different methods than in 2007 and 2010. Fuel suppliers declined to provide information on fuel sales after the 2010 study, so other methods of estimating energy use were applied, consistent with the Global Greenhouse Gas Protocol (ghgprotocol.org). As in 2007 and 2010, the data for different sectors vary in quality.

Some Key Findings

Total Community Energy Use and Emissions

Juneau used less energy and had fewer GHG emissions in 2021 than in 2010 or 2007. Total community energy use in 2021 was 33% less than in 2007, while GHG emissions were 36% lower.

As noted above, the study was not designed to explain these differences, which have probably been affected by a range of different factors. Some of the differences between 2007 and 2010 are discussed in the JCAIP (2011, pp13-14).

Among the likely major causes of differences between 2010 and 2021 are significant economic and demographic changes in Juneau. For example, state jobs declined by about 18% over this period, the population aged, and the economy was particularly hard hit by the covid pandemic in 2020. In addition to other impacts, the 1.4 million cruise ship visitors in 2019 dropped to zero in 2020. These impacts continued into 2021, which saw only 10% of the 2019 visitor numbers. Visitor numbers in 2021 were only 17% of those in 2010. This must have had a significant impact on local marine and air transportation activity and fuel use which are closely tied to tourism. (Is this reflected in highway traffic, enplanement data or harbor activity for 2019 versus 2020 and 2021?).

Buildings

Buildings continue to be one of the largest energy users and GHG producers in Juneau, accounting for 26% of GHG emissions in 2021. However, in 2021 they used somewhat less total energy (-5.3%) and created much lower GHG emissions (-34%) than in 2010.

Use of electricity was 9% higher in 2021 than in 2010. Greater use of hydroelectricity appears to account for some portion of the lower GHG emissions in 2021.

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Transportation

Highway, air, and marine transportation accounted for about 36% of the total energy used and 50% of total GHG emissions in 2021.

Air and marine transportation activity and fuel sales in Juneau appear to fluctuate significantly annually, depending on routes and schedules, and where businesses decide to purchase fuels. Both are closely associated with the tourism economy.

Large cruise ships are not accounted for in this study since they do not fuel in Juneau, and they were not accounted for in 2007 or 2010. Their GHG emissions are accounted for in the places that they purchase fuel. However, they are of considerable interest because of the local air pollution and climate pollution they produce while running their diesel generators at dock.
The huge quantities of fuel they burn and climate pollution they create while underway are also of strong interest locally. One estimate is that they produce 5 times as much GHG emissions in their half-year season as the Juneau community does annually.

Mining

The two mines are major fuel users and GHG emitters, accounting for 15% of total emissions. In 2021 the Hecla Greens Creek mine used significantly less fuel and emitted less GHG than the Kensington mine, due to Greens Creek's access to hydropower from AEL&P. In 2010 mining emissions were 10% of the community total. Both mines have been taking increasing steps to track, report and reduce their GHG emissions.

Solid Waste

Juneau's landfill accounts for a relatively small proportion of total community GHG emissions, about 2% in 2021. Landfill emissions in 2021 were significantly lower than in the earlier inventories, dropping by more than 50%.

CBJ Government

The City and Borough of Juneau is a significant energy user, accounting for 6.6% of total community energy use and nearly 5% of GHG emissions in 2021. These proportions were higher than in 2010, when they accounted for 4.5% of total energy use and 3% of total emissions.

We have good data on energy use for the CBJ, in contrast to other sectors. The CBJ government purchased about 11% more fuel in 2021 than in 2010, resulting in about an 11% increase in its share of the GHG emissions, while its use of electricity stayed about the same. Major increases in fuel usage between 2010 and 2021 occurred in school buildings, (possibly attributable to increased ventilation levels during the Covid pandemic), and in the Municipal water/wastewater system (largely attributable to fuel used in the new biosolids dryer).

How can Juneau use the study's results?
What do they mean for Juneau climate and renewable energy policy?

- The 2021 update highlights major areas of energy use and sources of GHG emissions. They can help us identify the areas where Juneau residents, businesses, and the CBJ can target energy use and emissions.

- While there have been some changes, most of the mitigation strategies and actions identified in the JCAIP (2011) and the JRES (2018) continue to be relevant.

- More years of energy use data are needed to inform community trends. To what extent do the differences between 2021 and earlier inventories reflect real trends? Updates for several years in a row would provide a more complete picture. For specific sectors where there are questions we could go back and fill in existing data – for example in areas such as air travel and marine transportation where energy use and GHG emissions appear to fluctuate up and down over the years. Establishing a mechanism whereby records of Juneau diesel and gasoline fuel sales are obtained would also greatly assist in portraying the community's energy use and GHG inventory.

- The 2021 results appear to indicate that both energy efficiency and increasing electrification of the building sector are playing a role in change. With the update completed, we have an opportunity to begin to look at scenarios for increasing electrification of buildings and transportation.

- CBJ facilities and operations provide one major focus of continuing attention. The CBJ is a major energy user and GHG emitter that has increased in relative significance since 2010. This is also the area where the JCOS, CBJ staff and the Assembly can have the most influence. The JRES recommends development of a formal CBJ energy management plan that can address both cost savings and GHG emissions (Juneau Renewable Energy Strategy, 2018 p.62 and Appendix E - Draft Proposal for a CBJ Energy Management Program). Over the past two years, CBJ Maintenance and E&PW staff has developed baseline data and a more detailed tracking system for energy use which is the first step in an energy management plan.

If you have questions, comments or suggestions, please e-mail me:
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Proposed Outline for a JCOS Sustainability Session:

Juneau's Energy Picture and Actions to Reduce GHG Emissions

3/27/2023

I. Juneau's Energy Picture in 2021

- Major findings from study on energy use & GHG emissions (pie charts, summary #s)
- It's the best we know…don't get bogged down in methodology, caveats, etc.)

II. Are We Making Progress on Energy Use & Decarbonizing our Community?

- Trends from 2007 & 2010 inventories - % decreases in energy consumption and GHG emissions, by sector.
- Progress already Underway: CBJ facilities energy use tracking and upgrades, Juneau home energy upgrades under former AK Rebate program, heat pumps in 1500-1800 Juneau homes, 1 Capital Transit electric bus, 33 public EV chargers, 600+ EVs, LED street lighting, efforts by mines.
- Near-term Additional Progress: ongoing heat pump adoption (including support for lower income households), 7 more electric buses on order, CBJ dock electrification for cruise ships.
- Carbon Reduction – Quantifying examples: 1 electric bus, 1,000 heat pumps, 100 EVs, 1-2 CBJ facilities.

III. What Are Our Community Goals?

- 80% renewable by 2045. ~29% renewable (2021), up from 20% (2010)
- March 2023 IPCC Report calls for dramatic increase in efforts. U.S. goal: 50% GHG reduction by 2030, net-zero by 2050.
- Juneau has additional hydropower supply options to meet demand as the community shifts away from fossil fuels.

IV. Continued Efforts and Possible Next Steps – A Five-Year Workplan

- Identify actions, responsible party & partners, funding sources.

For example:

- *Immediate* (2023) – ongoing efforts, 2022 Energy/GHG Inventory, EV strategy, financing options for commercial bldg. upgrades, metrics to track progress.
- *Near-Term* (2024-2026) – ongoing efforts, 2023 Energy/GHG Inventory, heat pumps in multi-family housing, AK Steamship Dock electrified, energy efficient building practices & codes, revisit JCAIP & JRES and update targets.
- *Longer-Term* (2027 & beyond) – ongoing efforts, 2026 Energy/GHG Inventory