2021 GHG Emission Inventory - Juneau

Preliminary findings

February 15, 2023

Introduction

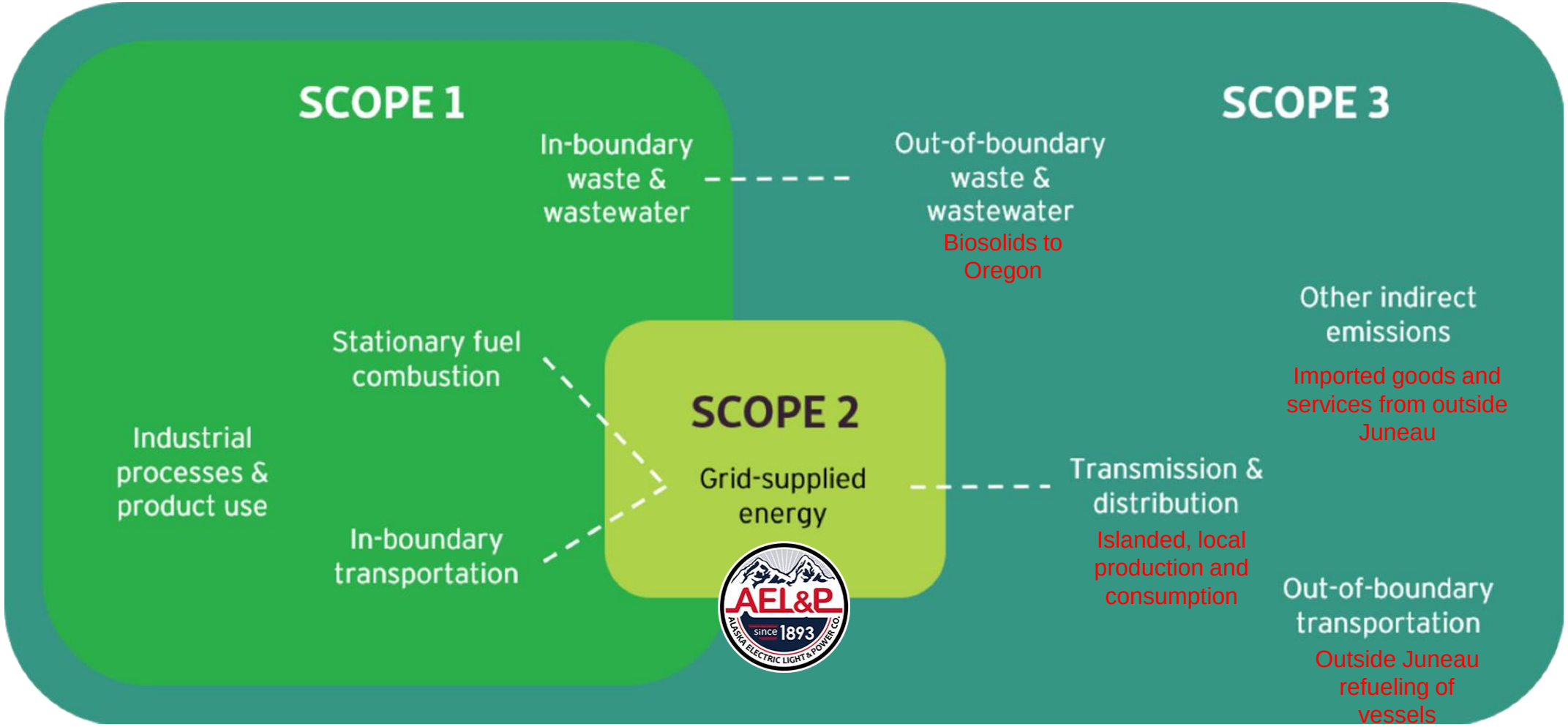
- In 2010, the City and Borough of Juneau, Alaska, completed its last greenhouse gas (GHG) emissions inventory
  - Critical in assessing opportunities for reducing GHG emissions.
  - Energy use by and emissions from both CBJ government facilities and sources in the broader community.
- 2021 update to Juneau's GHG emissions with 2021 energy use and GHG emissions data
  - AEL&P provided data on actual power consumption across all sectors
  - Liquid fuels (propane, diesel, heating oil, etc.) were “estimated” using activity data
    - Air travel fuels were provided by Juneau International Airport personnel, but marine and on-road were estimated
    - Assessor data on land and structure parcels were used to estimate energy use intensity (EUI) by building type
    - ACS Census data for 2020 was used to see borough-wide home heating fuel usage estimates
    - Multiple sources were consulted to estimate marine emissions through energy use at the dock and vessel level

Methodology

- The inventory employed standard international protocols and methodology to:
  - **Global Protocol for Community-scale Greenhouse Gas Emission Inventories*** (GPC)
  - 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), based on activity (fuel usage)
- Using EPA and NREL models, we have created proxies or energy activity
  - *See assumptions, equations and map interface for aggregate and disaggregated datasets*
- Emissions are not "weather-normalized"
  - A process to adjusts actual energy or peak outcomes to what would have happened under "normal" weather conditions – 2021 update did not compare 2010 weather to "normal weather"
  - Only applicable to energy consumption, the impact of weather for 60%+ of emissions not weather-dependent

**Developed by GHG Protocol standard developed by C40, World Resources Institute and ICLEI - Local Governments for Sustainability*

Methodology – GHG Scopes



Community emissions

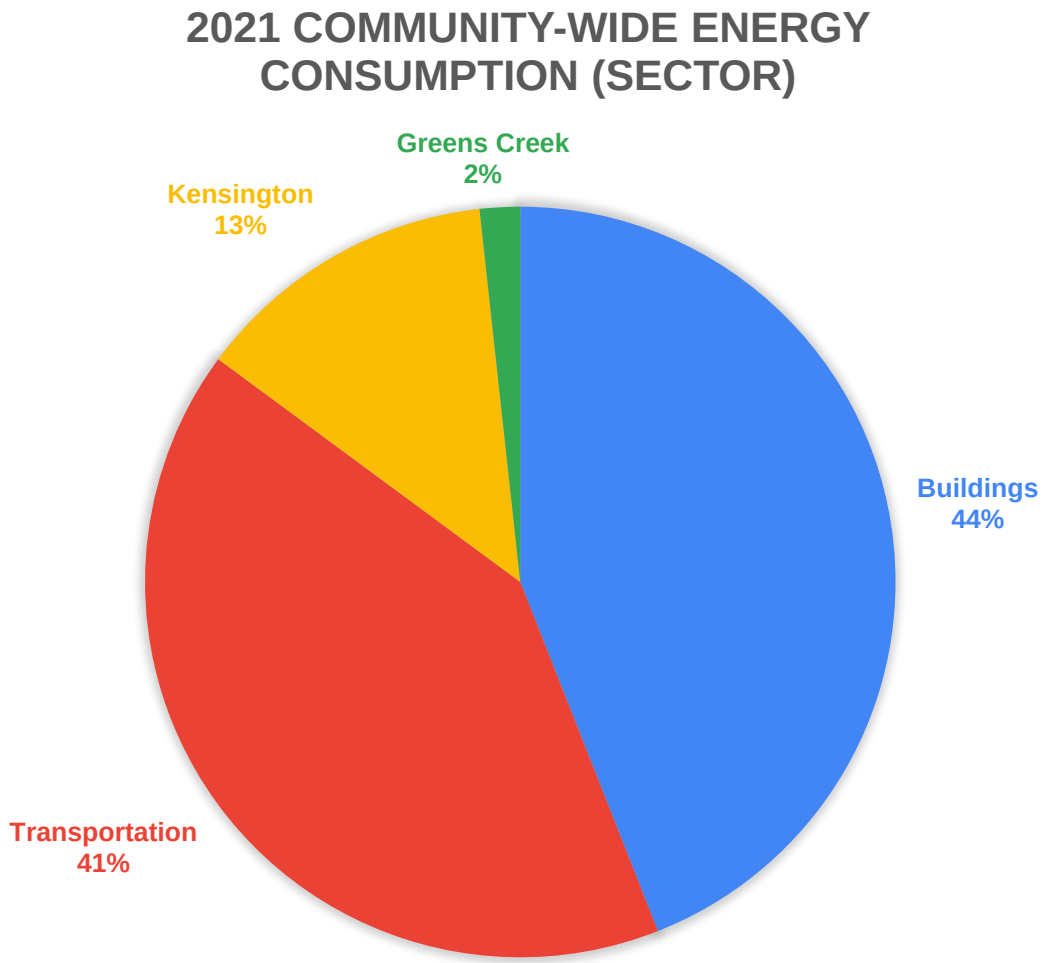
Community energy and emissions analyses for the City and Borough of Juneau, AK (CBJ) divided into following sectors:

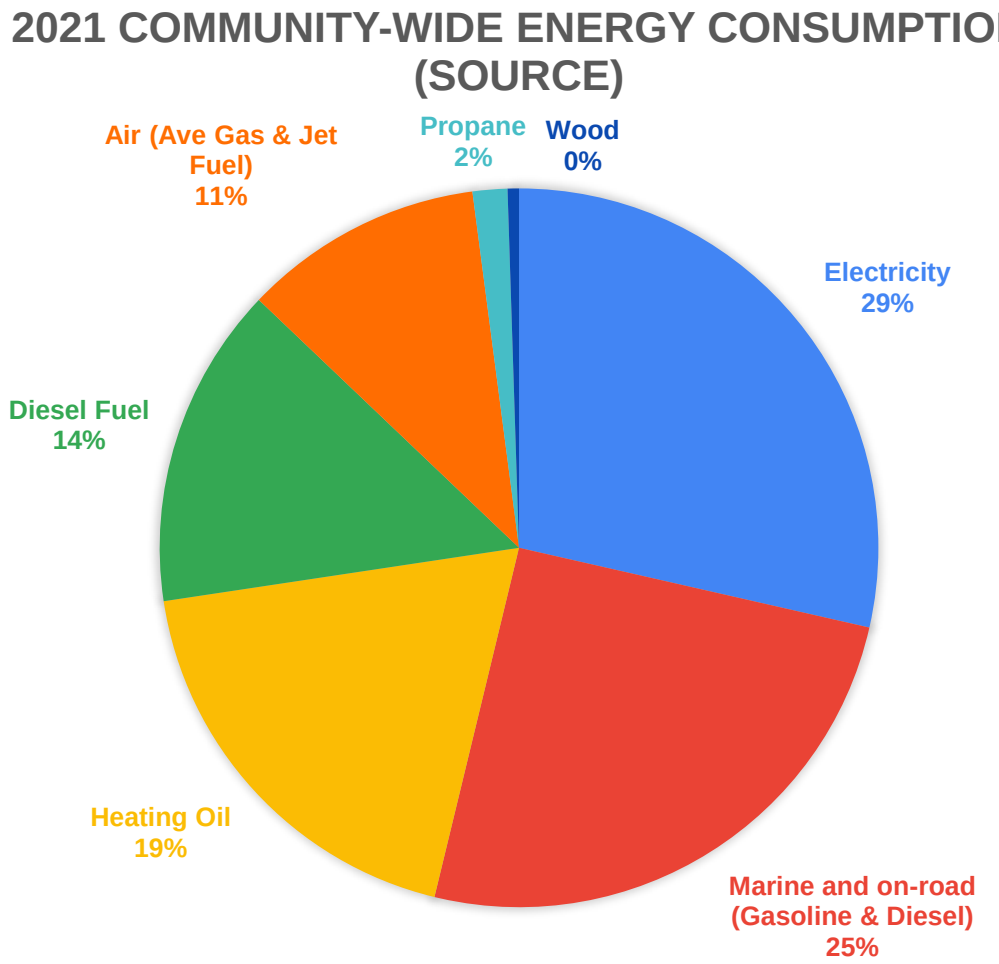
1. Transportation
    1. On-road: VMT based estimation for 2021, with data from State of AK Vehicle registrations for 2021
    2. Waterborne: Harbor fuel, state-NEI and vessel traffic information from third-party provides
    3. Air transport: JIA passenger and tons for 2021, with aviation gasoline and jet fuel logs by major airlines
2. Buildings and the built environment
    1. Both stationary combustion, fuel oil, wood, electricity, propane
    2. Purchased electricity, AEL&P provided 2021 generation and delivery of power from diesel and hydroelectric
3. Industrials processes
    1. Greens Creek Mine, reported stationary data for the 2021 EPA filing
    2. Kensington Mine, reported stationary data for the 2021 EPA filing
4. Solid waste treatment
    1. Capital Disposal landfill reported stationary data for the 2021 EPA filing

Comparison by source (energy types) and sector (breakdown above), with tracked changes relative to 2010 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 and global warming potential (GWP).

Community wide Energy (MMBtu)
2021





Juneau consumed 4.8 million MM BTU of energy

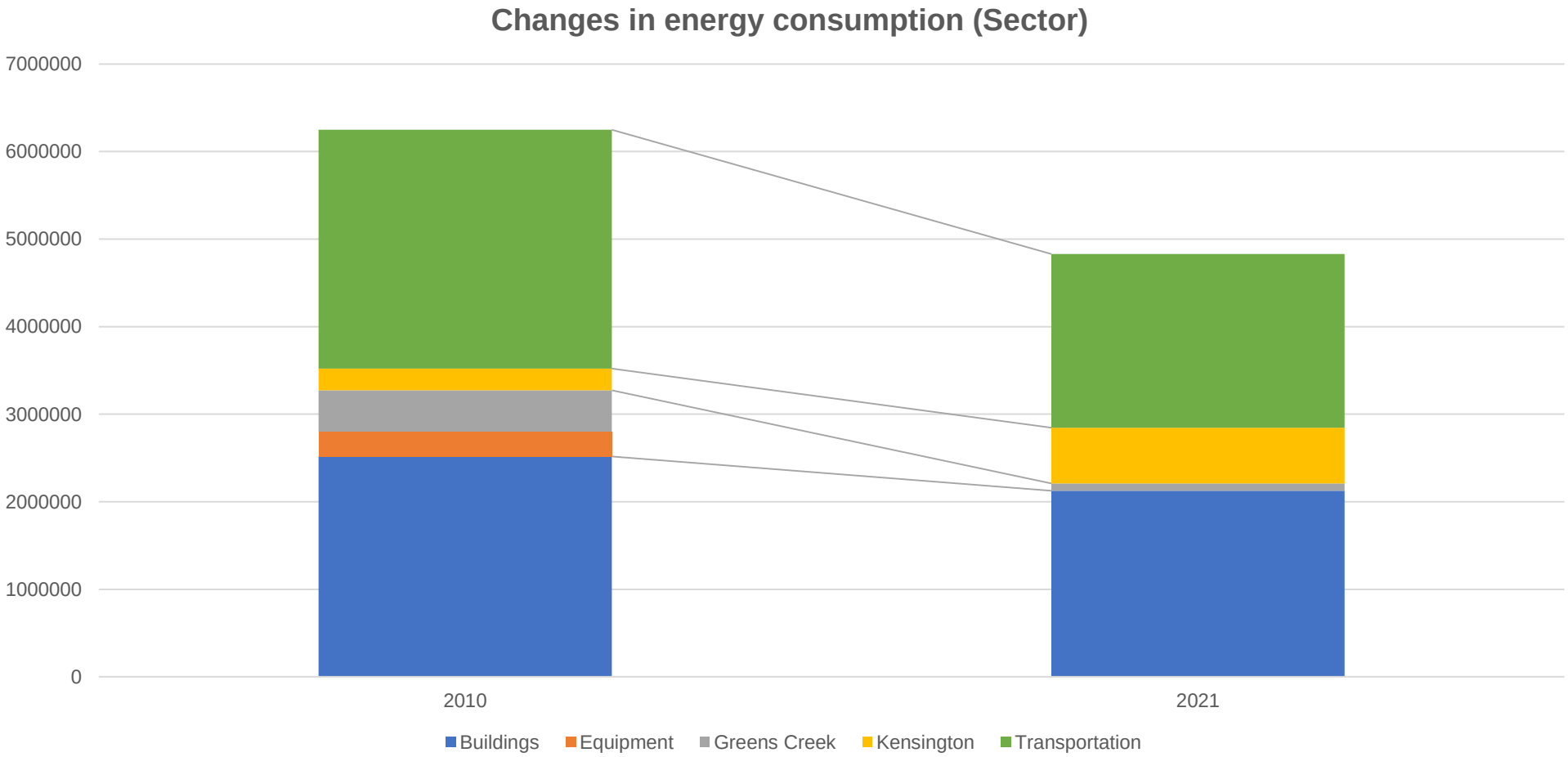
Community emissions changes between 2010 and 2021

Despite a slight population growth 2% from 2010 to 2021*

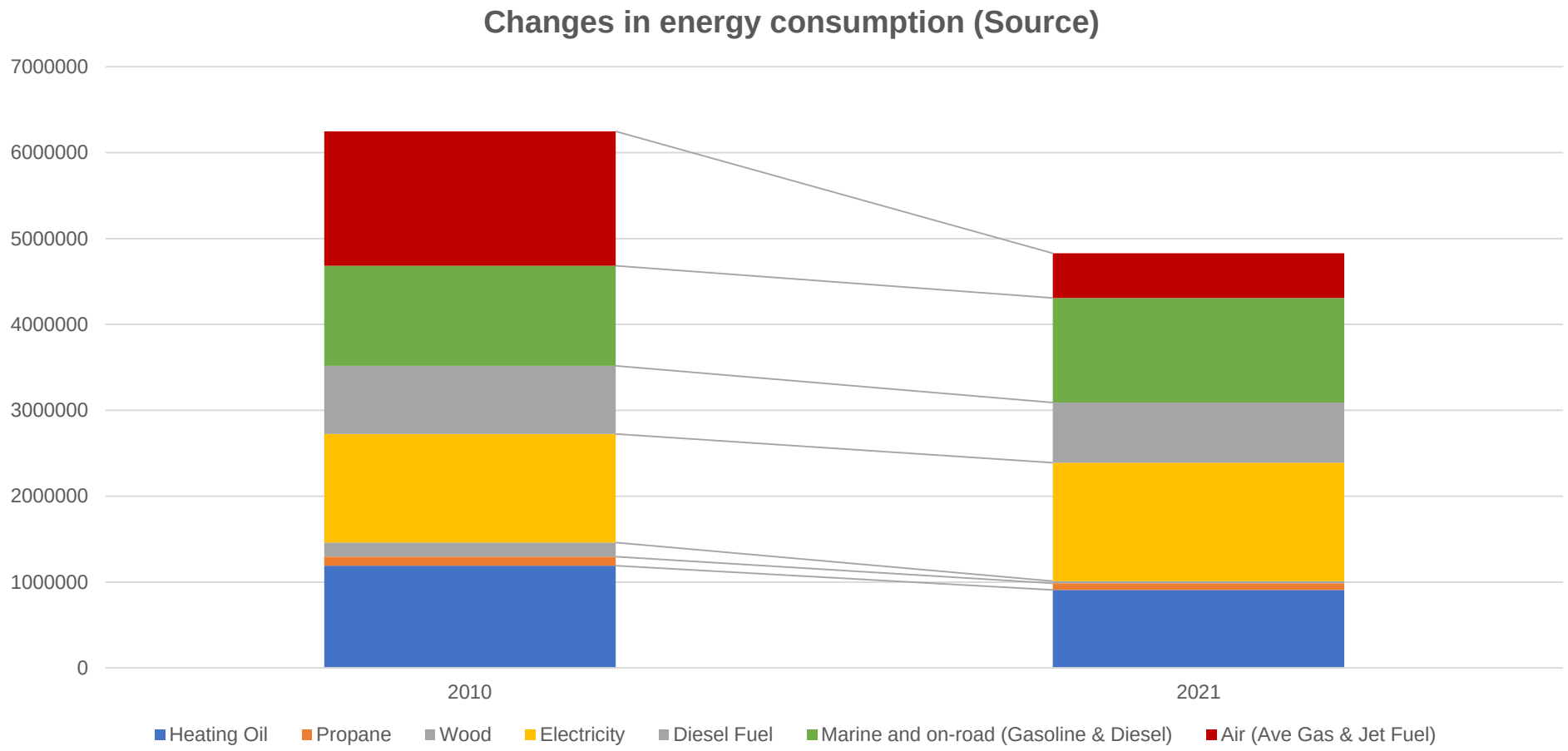
- 4.8 million MMBtu of energy - 23% reduction from 6.3 million MMBtu in 2010
- 280,802 MT CO2e in 2021 - 29% reduction in emissions from 397,000 MT CO2e in 2010

*https://www.census.gov/quickfacts/fact/table/juneaucityandboroughalaska/PST045221 and https://www.census.gov/quickfacts/fact/table/juneaucityandboroughalaska/POP010210

Community wide Energy (MMBtu) by Sector
2010 vs. 2021

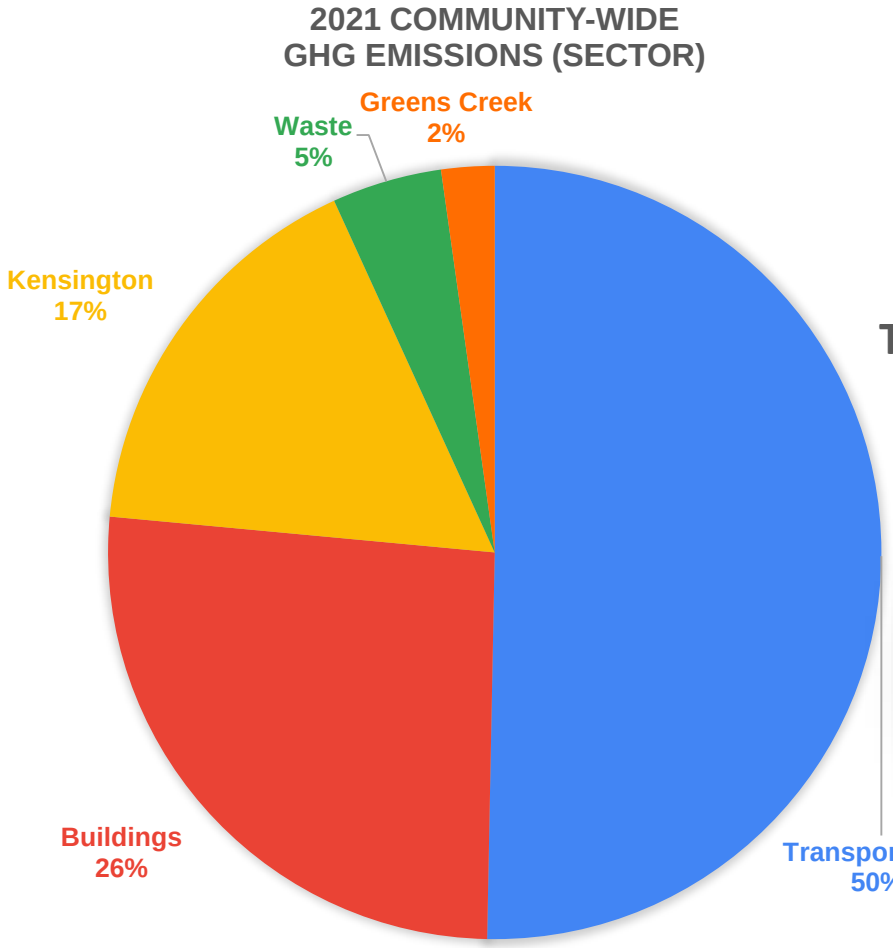


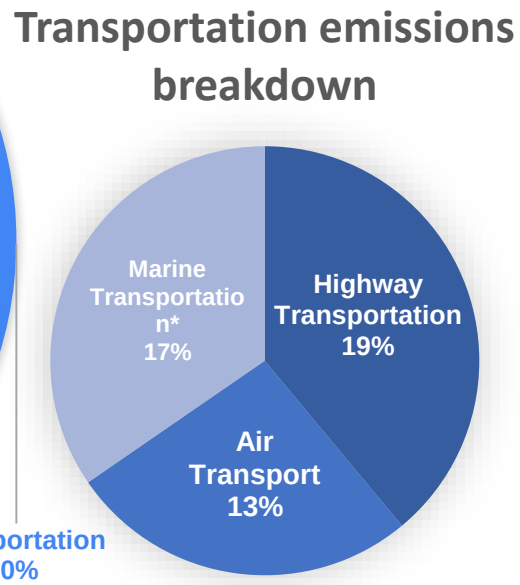
Community wide Energy (MMBtu) by Source
2010 vs. 2021

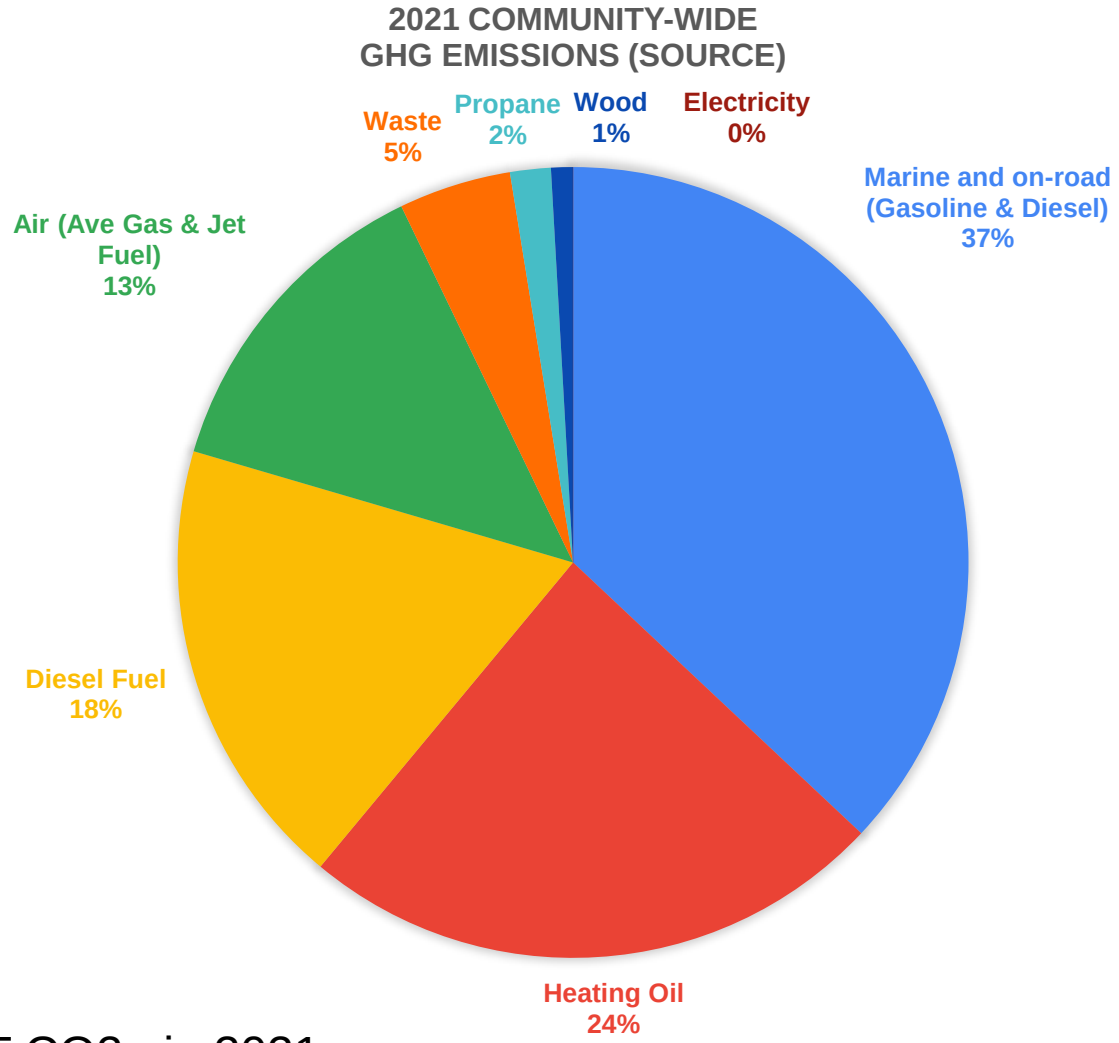


Community wide Emissions (MT CO_2e)

2021



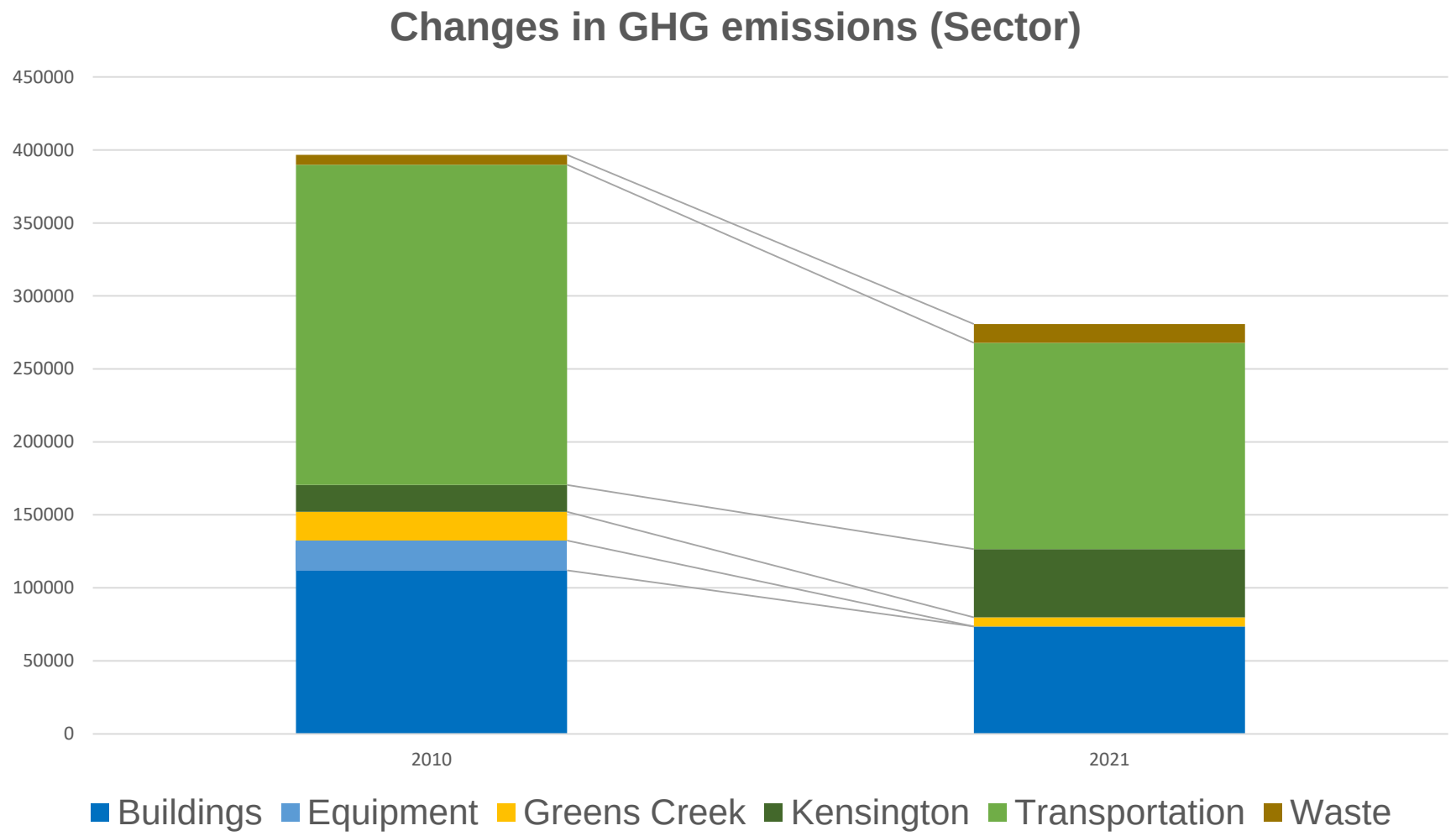




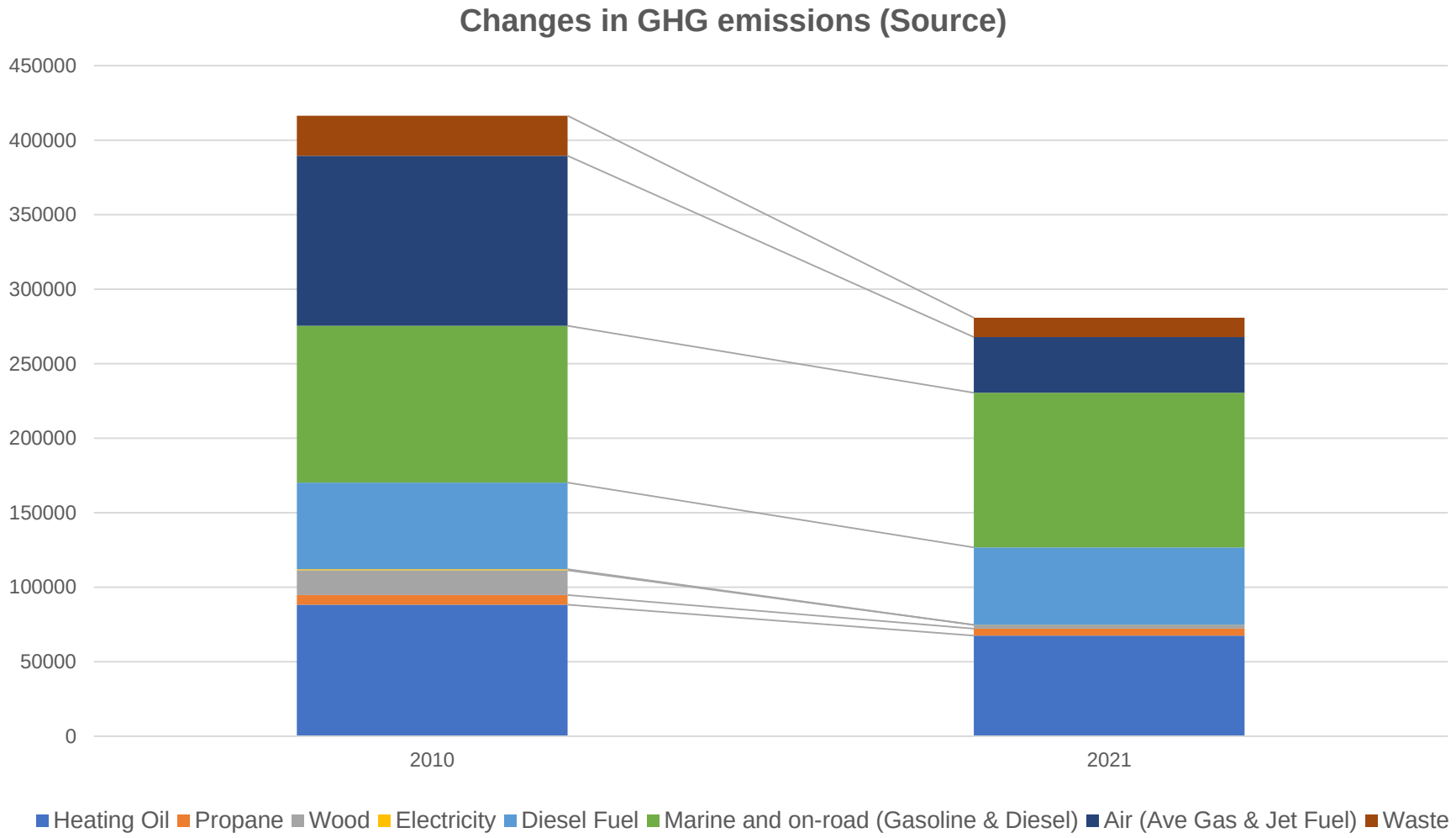
Juneau released almost 280,802 MT CO2e in 2021

Transport and buildings—produced 50% and 26% of GHG emissions respectively

Community-wide Emissions (MT CO_2e) by Sector
2010 vs. 2021



Community-wide Emissions (MT CO_2e) by Source 2010 vs. 2021



Transportation emissions – On Road

- On-road transportation emissions included emissions from burning gallons of gasoline combusted by vehicles.
  - Past GHG emissions from highway transportation are based on actual gallons provided by fuel distributors,
  - Unavailable in 2021, so alternative method was utilized

- Method to estimate vehicle miles traveled (VMT) was used, a recommendation from 2010.
  - Using the 2021 Average Annual Daily Traffic (AADT) Count from the Alaska Department of Transportation & Public Facilities,
  - 2021 vehicles by class codes, the inventory used State of Alaska Division of Motor Vehicles' list of vehicles to determine the number of passenger cars and light and heavy trucks** (data registered in the zip codes within City and Borough of Juneau on in December 2021)
  - The 2021 update estimated 152,063,352 miles of travel by passenger/light-duty (LV) and heavy-duty vehicles (MDHD), pro-rated by vehicle class and estimated fuel consumption across gasoline and diesel based on total miles driven and average mpg assumptions per vehicle class

***LV - 26,894 (92%); MDHD - 1,277 (4%) and MCY - 1,175 (4%)*

Transportation emissions - Aviation

- Collected data on total enplanements from FAA
  - 306,512 enplaned passengers in 2021
  - Small carriers reporting directly to FAA, and not to JIA
- The 2021 data on enplanements from Juneau International Airport (JIA)
  - 253,170 passengers.
  - 1,594,283 tons of mail
  - 4,264,882 tons of freight
- 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
  - 0.4% reduction from 2010 numbers.

Transportation emissions - Marine

- Marine transportation emissions includes all marine gasoline and diesel sold by the major fuel distributors within Juneau, AK
- These figures included fuel for the Alaska Marine Highway and other marine fuel pumped in Juneau
  - Not include the fuel used to ship goods to Juneau or fuel used by cruise ships
  - Electricity use of which was included with the buildings sector.
- In the 2021 update, due to no data provided by fuel distributors, an alternative process was used.
  - Consulted the State, and Port of Juneau for both traffic and fuel estimates. Last state data was from 2017, Port had partial 2021 – Port data had actual marine transportation energy, and thus emissions some locations (next slide)
  - Used Marinetraffic.com for records of port calls - a list of arrivals to and departures from Juneau in 2021
  - 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 travelled.
  - Used greenhouse gas activity estimates for CO2, CH4 and N2O per ton-mile of activity from Juneau, AK

Transportation emissions – Cruise ships

- A large portion of marine emissions is due to diesel usage in cruise ships (84% in 2017)
- In 2021, 91% of cargo weight (tons) and 26% of all miles travelled by vessels were for cruise ships
  - Based on these patterns, 82% of marine emissions, or 40,089 MT CO_2e (14% of community) attributed to cruise ships in 2021
- Records of port calls included a list of arrivals to and departures from Juneau in 2021
- Recorded 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 travelled.
  - Cargo vessels include containers, dry bulk, etc., and during the 2021 calendar year there were only four calls belong 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.
- The main source of vessel traffic information for the vessel types, AIS SHIPTYPE number broadcast via AIS
  - 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.

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**

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

Industrial processes and waste

Coeur Alaska Kensington Gold Mine supplied the EPA 2021 for stationary combustion emissions:

- Used 4.47 million gallons of Distillate Fuel oil (#2) as well as 204,785 gallons of Liquified Petroleum Gas (LPG)
- Emitted 46,917 metric tons of CO2e, which increased drastically (2.5x) from 2010 – at 18,285 metric tons.

Juneau's solid waste landfill in Capital Disposal landfill. In 2021, emitted 12,904 mt CO2e which decreased significantly from the 2010.

- 1,539 MMBtu of diesel use, and 3,066 MMBtu of used oil use, emitting 341 metric tons of CO2e in 2021, and 12,562 metric tons of CH4
- The normalized comparison is between 12,904 mt CO2e in 2021 which is 48% of the 26,893 mt CO2e in 2010.

The Hecla Greens Creek Mining supplied the EPA 2021 for stationary combustion emissions:

- Used 0.604 million gallons of Distillate Fuel oil (#2), 4,003 gallons of propane, and 38,000 gallons of used oil,
- Emitting the 6,603 metric tons of total emissions (67% reduction from 19,735 MT CO_2e in 2010)

Power sector GHG emissions

Supplier specific emission factors provided by AEL&P

- Market-based scope 2 methodology resulted in 628.32 MT CO_2e of emissions.
  - 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 (see table below)
- 6% decrease in electricity emissions, despite a 9% increase in total electricity consumption between 2010 and 2021.

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

Electricity load across sectors	**MWh in 2021**
Commercial	97,663
Government	74,842
Residential	160,068
Transportation	71,639

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%

Conclusions & Recommendations

2021 GHG emissions inventory reveals that both energy use and GHG emissions decreased for the overall community compared to the 2010 inventory.

- Comparing the two non-consecutive years of overall community GHG and energy information over an 11-year periods provides two data reference points, not necessarily a “trend”
- Two nonconsecutive years - important to identify variables that may have influenced energy use and GHG emissions in each of the two years
- The model is impacted by the availability and accuracy of collected data
- 2010 report recommended that annual energy use and GHG emissions inventories be conducted for five consecutive years. 2021 voices same recommendations.