BIG SKY SNO

SUSTAINABILITY NETWORK ORGANIZATION

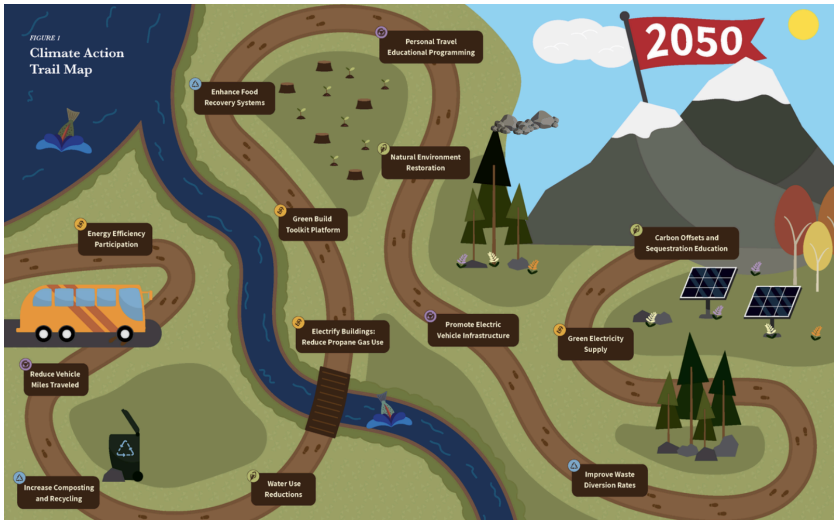
COMMUNITY GREENHOUSE GAS INVENTORY

September 2024, FINAL REPORT

Background

This greenhouse gas emissions inventory for the Big Sky Community is a crucial step in understanding and addressing our community's role in the global challenge of climate change. Naturally occurring gasses in the atmosphere determine Earth's climate by trapping solar radiation, a phenomenon known as the greenhouse effect. Extensive evidence indicates that human activities are increasing greenhouse gasses (GHG) beyond natural concentrations thereby altering the global climate. The most significant contributor is the burning of fossil fuels for transportation, electricity generation, heating and cooling, etc. which releases substantial amounts of carbon dioxide (CO_2) and other GHGs into the atmosphere. These gasses intensify the natural greenhouse effect, causing global average surface and lower atmospheric temperatures to rise.

This inventory marks a continuation of the process to track the Big Sky community carbon emissions.. Periodically quantifying emissions in Big Sky will inform further action items in the Big Sky Climate Action Plan (CAP) to reduce the community's carbon footprint. Next steps in support of the emissions reduction target of net-zero by 2050 are electrification, increasing green energy supply and reducing vehicle emissions within Big Sky.



Reducing fossil fuel use in the community has numerous benefits beyond lowering greenhouse gas emissions.[1] More efficient energy use reduces utility and transportation costs for residents, employees, and businesses. Retrofitting homes and businesses to be more energy-efficient creates regional jobs. Additionally, money saved on energy may be spent at local businesses, boosting the local economy. Reducing fossil fuel use also improves air quality protecting residents' and visitors' health.

This inventory provides a comprehensive overview of the greenhouse gas emissions generated by the activities of Big Sky residents, visitors, businesses, and institutions. The data collected will inform the development of programs aimed at effectively reducing emissions. By comparing inventories over time, the community will track the success of these actions on overall emissions. Tracking emissions at three year intervals will be an efficient way to consistently show changes over time.

Inventory Methodology

This inventory uses the approach and methods provided by the Global Protocol for Community Scale Emissions (GPC)[2]. The GPC defines what emissions must be reported and how. In addition, this inventory draws on methods from the U.S. Community Protocol[3], which provides a more detailed methodology specific to U.S. communities. Inventory calculations were performed using the Clearpath[4] tool, training and assistance was provided by ICLEI – Local Governments for Sustainability, USA and this study and report was completed by Big Sky SNO.

Greenhouse gas emissions can be quantified in two ways:

- Measurement-based methodologies refer to the direct measurement of greenhouse gas emissions (from a monitoring system) emitted from a flue of a power plant, wastewater treatment plant, landfill, or industrial facility.
- Calculation-Based methodologies calculate emissions using activity data and emission factors. To calculate emissions accordingly, the basic equation is:

Activity Data x Emission Factor = Emissions

Emissions sources in this inventory are quantified using calculation-based methodologies. Activity data refer to the relevant measurement of energy use or other greenhouse gas-generating processes such as fuel consumption by fuel type, annual metered electricity consumption, and annual vehicle miles traveled.

Known emission factors are used to convert energy usage and other activity data into associated quantities of emissions. Emission factors are usually expressed in terms of emissions per unit of

[1] http://www.ghgprotocol.org/city-accounting
[2] https://ghgprotocol.org/ghg-protocol-cities
[3] http://icleiusa.org/publications/us-community-protocol/
[4] http://icleiusa.org/clearpath/

activity data. For example, an emission factor for the generation of electricity is expressed as lbs. CO_2/kWh of electricity, which means pounds of carbon dioxide emissions per kilowatt hour generated. Emissions are commonly expressed as carbon dioxide equivalent or CO_2e. CO_2e is a metric measure used to compare the emissions from various greenhouse gasses on the basis of their global warming potential (GWP), by converting amounts of other gasses to the equivalent amount of CO_2 with the same global warming potential. The primary greenhouse gasses that are included in this study are Carbon Dioxide (CO_2), Methane (CH_4) and Nitrous Oxide (N_2O) and equated to CO_2.

Definition of Greenhouse Gas Protocol Scope 1, 2 and 3

The Greenhouse Gas Protocol defines three components for purposes of developing a GHG inventory:

1. Direct emissions (known as Scope 1): from onsite combustion and mobile sources. In Big Sky, these emissions are from the onsite combustion of Liquid Propane Gas (Propane), and Gasoline/Diesel used in vehicles and other equipment inside the defined study boundary.

2. Indirect emissions (Scope 2): from purchased electricity. In Big Sky, these emissions are from electricity supplied by NorthWestern Energy.

3. Optional emissions (Scope 3): from emissions that occur outside of the defined study boundary but are of interest such as transportation to and from Big Sky but outside of the study boundary and landfill emissions for waste generated in Big Sky but landfilled in Logan, MT.

Most frequently, Scope 1 and Scope 2 emissions data are collected because these are controlled by the owner and can be targeted with specific action plans. While Scope 3 emissions may be of interest in understanding carbon emissions in a supply chain or what is happening around us, the source of these emissions is not owned by the user, therefore may be influenced rather than controlled.

Description of the Inventories & Study Assumptions

This GHG Emissions Inventory is the second to be performed for the Big Sky Community. This study was performed during the year 2024 using available data for the calendar year of 2022. Due to updated classifications by NorthWestern Energy (NWE), Big Sky Resort (BSR) and the Yellowstone Club (YC) are now classified by NWE as “Montana Key Accounts” which fall under the Commercial Sector for this 2022 GHGI. What was considered Industrial Energy in the 2018 and 2019 reports is now categorized as Commercial Energy and represented with energy used from all other commercial business. There is no longer an Industrial Sector of energy use in Big Sky in this study, only Residential and Commercial. The 2019 data has been revised to align with this change and to allow comparisons between 2019 and 2022 study results.

Study Boundaries:
Because Big Sky has no official political boundaries, the boundaries for the study are defined by the electric service area of the two dedicated substations serving Big Sky. This service area includes all NorthWestern Energy electric customers on the Mountain (Big Sky Resort, Moonlight and scattered homes), in the Meadow (Meadow Village, Town Center, Spanish Peaks, Yellowstone Club and scattered homes west of the intersection of M64 and US191), and in the Canyon along US191 from 10 miles north of the Conoco to 20 miles south of the intersection of Highways 191 and 64 at the Conoco.

Electricity Consumption:
GHG emissions from the use of electricity are calculated as the *annual metered consumption (kWh's) x the electric generation emissions rate for the study year* (CO_2 e in lbs./kwh). All of this data was provided by NorthWestern Energy (NWE). As stated above, electricity consumption at the Yellowstone Club (YC) and Big Sky Resort (BSR) were classified as industrial in 2019 and are now reclassified as commercial.

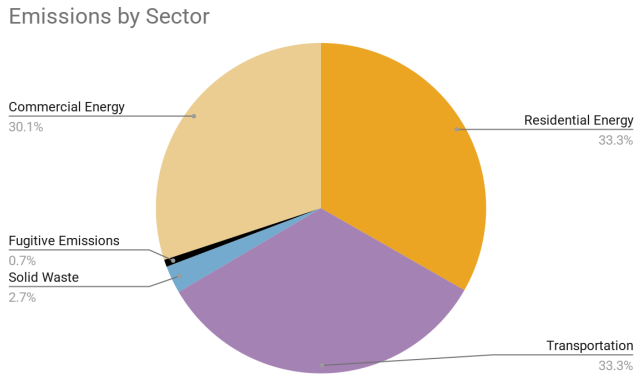
Propane Consumption – Residential & Commercial
Propane is supplied in Big Sky by a few independent companies, which did not provide actual Residential and Commercial delivered quantities. Therefore, actual propane use was provided by the YC and the BSR for all study years, while estimations were made for all other households and businesses, using State of Montana and Gallatin County statistics on how homes are heated in conjunction with updated Census fuel use data, to determine an average annual propane use per Residential and Commercial establishment. During the 2022 data gathering process, the YC provided corrected propane use data for the 2019 study. The new information identified significant quantities of propane not included in the original 2019 study, therefore the 2019 study has been modified so that an accurate comparison of 2019 vs. 2022 can be presented.

Total Emissions Analysis

2022 GHG Emissions Results

2022 emissions for all sectors are shown in **Figure 1** below. Transportation and Residential Energy were the largest contributors to Big Sky's emissions in 2022, each contributing 33.3%. Commercial Energy, totaling 30.1%, appeared to grow substantially from 2019, however this is due to the recategorization of Yellowstone Club and Big Sky Resort, as these two accounts are now reclassified as Commercial instead of Industrial. Solid Waste Emissions from collection and disposal for 2022 accounted for 2.7% of emissions, while Process & Fugitive Emissions in 2022 were 0.7%.

Figure 1: 2022 Emissions by Sector



Emissions detail for 2022 is provided in **Table 1** below which presents the annual usage data and the resulting emissions as a CO_2e, by Sector and Fuel or Source.

Emissions are listed in Metric Tons carbon dioxide equivalent ($MTCO_2e$) for the calendar year 2022 and are the result of generating electricity, burning propane, utilizing gasoline and diesel fuels for transportation, hauling and landfilling solid waste and a small number of fugitive emissions (which are inadvertent releases or leakage of propane). Total emissions for 2022 are calculated to be **165,716** $MTCO_2e$.

Table 1: 2022 Emissions by Sector, Fuel or Source

Sector	Fuel or Source	Usage	Units	Emissions
Residential Energy	Electricity	80,394,973	kWh	32,711
Residential Energy	Propane	3,847,358	Gallons	22,502
Residential Energy Total				**55,213**
Commercial Energy	Electricity	75,098,555	kWh	30,556
Commercial Energy	Propane	3,284,487	Gallons	19,210
Commercial Energy Total				**49,766**
Transportation & Mobile Sources	Gasoline	91,583,501	VMT	41,823
Transportation & Mobile Sources	Diesel	10,175,945	VMT	13,315
Transportation & Mobile Sources Total				**55,138**
Solid Waste (Scope 3)		6,515	Tons	**4,467**
Process & Fugitive Emissions	Other			**1,132**
Total 2022				**165,716**

Table 2 below shows 2022 volumes of use and the resulting emissions in MTCO2e by the source of those emissions. Electricity use is the largest contributor to total emissions at 38.2%, followed by Transportation at 33.3% and the use of Propane at 25.2%.

Table 2: 2022 Emissions by Source

Emission Source		2022 Units			
Electricity		155,493,528	kWh	63,267	38.2%
Propane		7,131,845	Gallons	41,712	25.2%
Transportation		101,909,096	VMT	55,138	33.3%
Solid Waste		6,515	Tons	4,467	2.7%
Fugitive Emissions				1,132	0.7%
Total				**165,716**	

Table 3 below compares 2022 emissions by sector and fuel or source to emissions calculated for 2019. From 2019 to 2022, the total increase of emissions over three years was 5.28% or an annual average increase of 1.76% per year. Each sector for 2019 and 2022, Commercial, Residential, Transportation, Solid Waste, and Process & Fugitive Emissions, are compared individually over the 3 years and an average annual percent change is provided for each.

Table 3: 2019 & 2022 Emissions Trends

		2019	2022	Metric Tons	2019-2022	Average/yr
Sector	Fuel or Source	Emissions	Emissions	2019 -2022 Change	% Change	
Residential Energy	Electricity	29,301	32,711	3,410	11.64%	3.88%
Residential Energy	Propane	22,199	22,502	303	1.36%	0.45%
Residential Energy Total		**51,500**	**55,213**	**3,713**	**7.21%**	**2.40%**
Commercial Energy	Electricity	30,896	30,556	(340)	-1.10%	-0.37%
Commercial Energy	Propane	19,845	19,210	(635)	-3.20%	-1.07%
Commercial Energy Total		**50,741**	**49,766**	**(975)**	**-1.92%**	**-0.64%**
Transportation & Mobile Sources	Gasoline	37,222	41,823	4,601	12.36%	4.12%
Transportation & Mobile Sources	Diesel	11,847	13,315	1,468	12.39%	4.13%
Transportation & Mobile Sources Total		**49,069**	**55,138**	**6,069**	**12.37%**	**4.12%**
Solid Waste (Scope 3) Total		**4,953**	**4,467**	**(486)**	**-9.81%**	**-3.27%**
Process & Fugitive Emissions Total		**1,147**	**1,132**	**(15)**	**-1.31%**	**-0.44%**
Total Emissions ($MTCO_2e$)		**157,410**	**165,716**	**8,306**	**5.28%**	**1.76%**

Analysis of 2019-2022 Residential & Commercial; Table 3

Residential Energy Emissions

The Residential Energy Sector consists of emissions from the use of electricity and propane (LPG). While the use of electricity increased at an annual average rate of 3.88%, propane increased at only 0.45%. The use of propane for heating makes its use dependent on the type of winter we experience. Weather data (Heating Degree Days) shows that the Gallatin County weather was about 4% colder in 2019 than in 2022.

The number of Occupied Residential Housing units within the Big Sky community boundary is also a factor. Housing units are calculated as the sum of the number of Residential electric customers served by NorthWestern Energy. For 2019, the total household count for residential electricity customers was 4,073 units. For 2022, the number of Occupied Residential Housing units in Big Sky was 4,362, an increase of 7.1% from 2019 (2.4% average per year).

Commercial Energy Emissions

Commercial Energy Sector total emissions decreased by an average annual rate of 0.64% consisting of small decreases in both electricity and propane use.

The number of commercial units within the Big Sky community boundary is the number of commercial electric customers served by NorthWestern Energy. For 2019 this total was 977 customers while in 2022 this number equaled 963 customers, leading to a decrease of 1.4% of commercial customers. However, commercial energy use in Big Sky is greatly influenced by the use of Big Sky's two largest commercial entities, YC and BSR. Together, these two businesses used 28% of all propane in 2022.

A Note on the Big Sky Population

GHG Inventories normally report Residential study results per resident as a useful reference for setting GHG emission goals. The 2020 Census reported that the permanent population of Big Sky was 3,058 in 2019, but no data has been gathered for this study regarding the impact on the real population from secondary homeowners and visitor statistics which continue to increase.

Analysis of 2019-2022 Transportation and Mobile Sources; Table 3

Transportation Emissions in 2022 were 33.3% of all emissions in Big Sky and tied with Residential as the largest source of CO_2e emissions (ref. Tables 1, 3; Figure 1). Transportation Emissions included in this study are for vehicle transportation inside the defined Big Sky community boundary. Transportation outside that boundary, such as from Bozeman/Belgrade to the Northernmost community boundary (10 mi N of the intersection of Hws 191 and 64) and from West Yellowstone to the Southernmost community boundary (20 mi S of the intersection of Hwys 191 and 64), have been calculated but are not included in this inventory.

The Clearpath software tool uses annual Vehicle Miles Traveled (VMT) and inputs from the Montana Department of Transportation regarding vehicle type, age, and fuel (gasoline, diesel, and electric), and calculates the emission factors as grams of CO_2e per Vehicle Mile Traveled (VMT) to calculate Transportation total emissions.

2022 Vehicle Miles Traveled (VMT)

VMT has been calculated using Montana Department of Transportation Average Annual Daily Traffic (AADT) data which is the total volume of vehicle traffic of a road segment for a year divided by 365. The equation for converting AADT to VMT is:

VMT/year = AADT x segment distance in miles x 365 days/year

Table 4 below presents a description of each segment, the MDT identification number of the device that collected the data, the segment length for each segment, the AADT data for each segment and the resulting VMT/year used in the 2022 study. The 2022 GHGI study uses a total of 101,909,096 in boundary miles traveled when calculating the Transportation CO_2e emissions.

Table 4: 2022 Annual VMT Calculations using AADT Data

2022 Segment Description	TCS #	Distance	AADT	VMT/Day	VMT/Year
Bozeman/Belgrade to Northern Boundary	A43	31	8,666	268,646	98,055,790
Northern Boundary to Conoco (Hwy 64)	A43	10	8,666	86,660	31,630,900
Conoco to Meadow Village and Town Center	NI-064	6	9,549	57,294	20,912,310
TC to Yellowstone Club and Spanish Peaks	55%	5	3,713	18,565	6,776,225
Town Center to Big Sky Resort and Moonlight	16-4-005	10	2,798	27,980	10,212,700
Conoco to 320 Ranch	16-4-002	12	7,392	88,704	32,376,960
320 Ranch to Southern Boundary (Black Butte)	16-4-001	8	2,214	17,712	6,464,880
Total VMT				**565,561**	**206,429,765**
Gasoline	**Total**	**In-Boundary**			**Out-Boundary**
90%	185,786,789	91,718,186			94,068,603
Diesel					
10%	20,642,977	10,190,910			10,452,067

Figure 2 below presents a graphic view of the AADT data, the approximate location of the measuring devices and study boundaries.

Figure 2: 2022 AADT Study Inputs

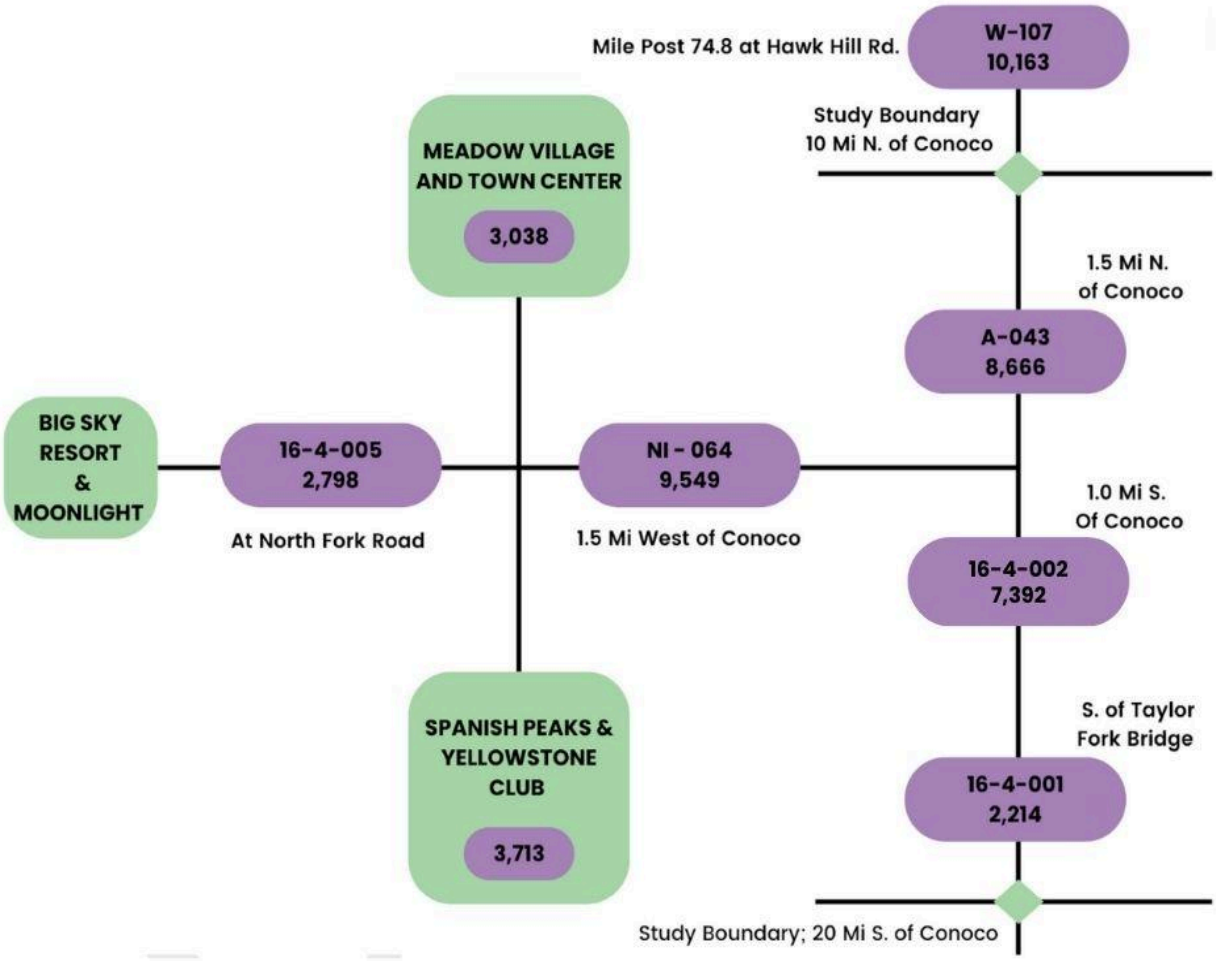


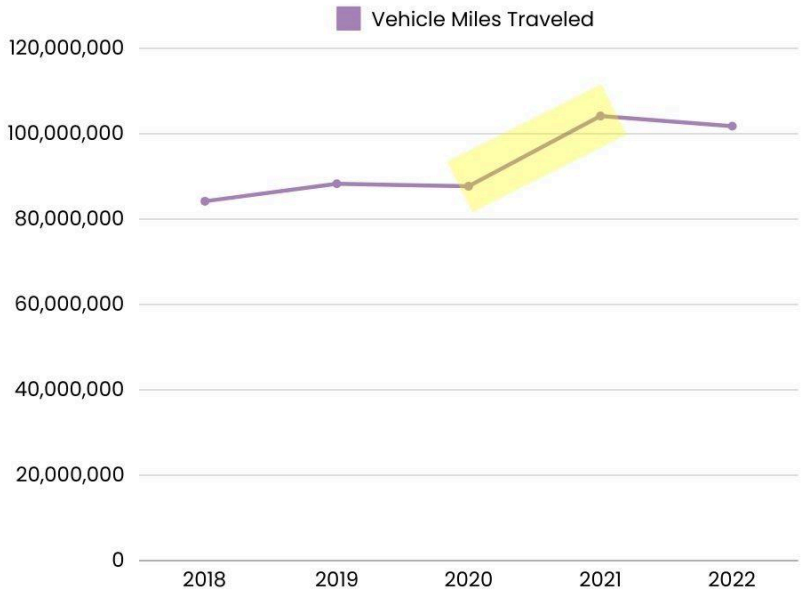
Table 5 below summarizes the changes in VMT and total transportation emissions from 2019 to 2022. VMT values are for In-Boundary travel and are taken from **Table 4**; total emissions are taken from **Table 3**. For 2019-2022 the increase of VMT was 5.15% per year while the emissions increased 4.12% per year. This difference in these annual increases is mainly that each new year the average mileage and emissions for all automobiles improves as older vehicles are retired and new models are placed into service. Currently electric vehicle use in Big Sky is small but is expected to increase as new infrastructure is built and will then impact vehicle emissions per mile traveled as well.

Table 5: Transportation 2019 & 2022 Trends

Description	2019	2022	% Change 2019-2022	Annual % Change
Vehicle Miles Traveled (VMT/year In-Boundary)	88,280,726	101,909,096	15.44%	5.15%
Total Transportation Emission (Metric Tons)	49,069	55,138	12.37%	4.12%

Figure 3 below uses Montana Department of Transportation AADT data that is available for all years to understand what happened to VMT for the period of 2018-2022 and the impact of the COVID pandemic. From 2018 to 2019 the growth in VMT was at the new normal for Big Sky of 4.86%. This is expected since 2019 was a busy growth year for the community. However, the COVID-19 crisis in the United States began in early 2020, with the first confirmed case reported on January 20, 2020, in Washington state. The crisis intensified in March 2020, when the World Health Organization (WHO) declared COVID-19 a pandemic on March 11, and widespread lockdowns and social distancing measures were implemented across the country and in Big Sky. **Figure 3** shows the impact of the lockdowns in 2020 when VMT did not increase and, in fact, decreased by 0.67%. Then, in 2021 many people engaged in a change of how they worked and played and Big Sky experienced an 18.77% increase in VMT over 2020. In our study year of 2022, VMT decreased by 2.15% from the 2021 peak establishing the basis for our 2022 study of 101,909,096 miles traveled, a 5.15% average annual growth rate for 2019-2022.

Figure 3: The Impact of COVID on VMT



Analysis – Solid Waste and Process & Fugitive Emissions

Table 3 summarizes 2019 & 2022 emissions trends and emissions data for collecting, hauling and landfilling solid waste and a small number of fugitive emissions which are inadvertent releases or leakage of propane**.**

Solid Waste Emissions

Solid Waste Emissions as a total of all emissions is small, 3.2% in 2019 and 2.7% in 2022. As discussed in the beginning of this report, landfilling of Big Sky waste is done outside of our defined study boundaries and is considered to be a Greenhouse Gas Protocol Scope 3 emission that is of interest to the Big Sky community.

Data collection for the 2019 Solid Waste GHGI was difficult because some of the waste haulers did not have good data for Big Sky. That 2019 study estimated a total of 3,824 tons of waste and used a generic list of waste composition percentages. To improve an understanding of waste in Big Sky, Big Sky SNO conducted a Solid Waste Composition Assessment for the year of 2022. The assessment found 2022 waste to be 6,515 tons and new Big Sky specific waste composition data was obtained. In addition, new information was obtained regarding the integrity of the Logan Landfill based on testing and improvements made since 2019. This 2022 study result provides a sound base for future evaluations of Solid Waste reduction efforts.

The net result of better Solid Waste data and a better understanding of Logan Landfill operations is that 2022 Solid Waste emissions were 4,467 Metric Tons, a 3.27% average annual decrease from 2019 emissions (see Figures 3 and 6).

Process and Fugitive Emissions

This is the smallest of the sectors totaling only 0.7% of all Big Sky emissions in 2022. This small number of fugitive emissions, 1,132 metric tons, is an estimate of inadvertent releases or leakage of propane while performing truck deliveries, storing and utilizing over seven million gallons of propane.

Analysis Summary

In addition to the tables and figures previously presented, the following **Table 6** presents the change in CO_2e emissions from 2019 and 2022 by emission source. While total emissions only increased 5.28% over the three years of 2019-2022 or a 1.76% average annual increase, using data from **Table 3** and **Table 6** the following helps to understand emission changes during this three year period.

1. Total Electricity emissions **increased** 1.70% per year consisting of:
    a. Residential electricity **increased** 3.88% per year
    b. Commercial electricity **was reduced** by 0.37% per year
2. Total propane emissions were **reduced** by 0.26% per year consisting of:
    a. Residential propane **increased** by 0.45% per year
    b. Commercial propane **was decreased** by 1.07% per year
3. Transportation emissions increased by 4.12%, though not in a linear manner over the 3 years; see **Figure 3** and the impact of COVID on transportation**.**

Table 6: Emissions by Source; 2019 & 2022 Trends

	2019	2022	Metric Tons	2019-2022	Average
Emission Source	CO_2eTotal	CO_2eTotal	2019 -2022 Change	% Change	Annual % Change
Electricity	60,197	63,267	3,070	5.10%	1.70%
Propane	42,044	41,712	-332	-0.79%	-0.26%
Transportation	49,069	55,138	6,069	12.37%	4.12%
Solid Waste	4,953	4,467	-486	-9.81%	-3.27%
Fugitive	1,147	1,132	-15	-1.31%	-0.44%
Total	**157,410**	**165,716**	**8,306**	**5.28%**	**1.76%**

Conclusions and Observations

Green Energy Supply: NorthWestern Energy is the sole electric utility serving the Big Sky community, providing electricity to Residential and Commercial customers. To increase green energy supply, supporting and petitioning for a renewable energy requirement for Montana can benefit NorthWestern Energy's net zero emission goals. Locally supporting Bozeman and Missoula in their endeavors with the Green Power Program can work to create change for further green energy supply to Big Sky.

Energy Efficient Buildings: This GHGI shows that, in 2022, 63% of our Big Sky carbon footprint is the result of heating, cooling and otherwise running buildings using electricity provided by NorthWestern Energy and propane provided by multiple independent suppliers

(**Table 6**). Utilizing the platform Build Better Big Sky can help Architects, Builders and Homeowners find ways to conserve, create, and innovate building design with a focus on energy efficiency and conservation.

Reduce Transportation Emissions: Emissions resulting from transportation in 2022 represent 33.3% of all emissions (**Figure 1; Table 2**), a major contributor to the Big Sky carbon footprint. Emissions from transportation from 2019 to 2022 rose by 12.37% (4.12% average per year) while Vehicle Miles Traveled increased by 15.44% (5.15% average per year) (**Table 5**) resulting in total vehicle miles traveled in 2022 of 102 million miles . This increase can be accounted for by growth in construction and tourism in and around Big Sky. Opportunities to reduce our transportation carbon footprint can be found in initiatives involving carpooling, busing, local housing and the natural aging of old vehicles in favor of new, energy efficient ones. An increased collaboration effort with Streamline Bus System, Gallatin County, and the Big Sky Transport District can increase regional mobility options.

Dealing with Big Sky Community Growth: Using the updated numbers for 2022, residential housing units grew to 4,362, an increase of 7.1% from 2019 to 2022 (2.4% average per year). Residential electricity emissions rose 3.88% per year and transportation emissions rose 4.12% per year. When communities like Big Sky strive for carbon neutrality or net zero goals, it is difficult to find solutions for this kind of continued growth in the short term. This is the reason that the CAP ultimate goal is Net Zero by 2050 but a need has been identified to establish additional short term and medium term emission goals. SNO is working on a methodology that will add the use of carbon footprint goals that will take into account the energy requirements for new housing units, hotels and other commercial establishments that will be added each year until Big Sky build out occurs.

Next Steps

1. **Continue Emission Reduction Targets:** The Big Sky community should continue to work towards short-term and long-term emission reduction targets. Aiming for carbon neutrality or net zero by 2050, setting medium term action items to reduce emissions such as a 2025 target, will help measure progress and maintain momentum towards the long-term goal. Using Business as Usual estimations from the CAP can help inform a baseline for intermediate reduction targets. Identifying targets that are environmentally, socially, and financially attainable will provide the best path towards the ultimate goal of carbon neutrality.
2. **Use the Climate Action Plan (CAP) to inform and implement progress:** Using action items laid out in the Big Sky CAP which was released in 2022 will be beneficial. This should be done through the four main categories of Energy & Buildings, Transportation, Consumption & Waste, and Natural Environment.

a. **Energy & Buildings:**
    i. Electrifying & Reducing Propane Usage: Work with local and regional experts to research, understand and educate on the development of new technologies for heating and air conditioning commercial and large buildings using electricity. Increase use of electric heat pumps when updating existing buildings and building new construction
    ii. Create a Build Better Big Sky (BBBS) Website : As a part of or as a supplement to the BBBS Website, implementing a green build materials database that identifies materials with lower embodied energy, lower water consumption, lower carbon footprint, renewable, and locally sourced options are ways to reduce confusing while promoting sustainable materials. Utilizing upgradable smart home technology in homes and businesses to optimize can increase efficiency through real time monitoring and remote operation. Also, creating simplified summary and check-list information taken from the full BBBS Website will work to assure frequent use.
b. **Transportation:**
    i. Complete Street Design: Develop and incorporate “complete street” design to add bike lanes, sidewalks, and other trail networks between the Residential and commercial centers of Big Sky: Big Sky Resort, Town Center, Meadow Village Center, the Gallatin Canyon, etc. Identifying Big Sky Area’s walkability score can impact the most necessary items to decrease transportation emissions.
    ii. Reducing Vehicle Miles Traveled: As many individuals commute to Big Sky from surrounding areas each day, it is important to collaborate with employers to subsidize transit and mobility options for employees. Working to expand shuttle services while improving public transit through the creation of a real-time bus schedule app can decrease and disincentivize use of single occupancy vehicles.
c. **Consumption & Waste:**
    i. Enhance Food Recovery Systems: Increasing food recovery is not only environmentally sustainable, but also socially and financially sustainable as well. Establishing a community-wide program to monitor and report on food rescue and waste with composting hauler(s) and Big Sky Community Food Bank can increase waste diversion and decrease food heading to the landfill. It can also provide a greater amount of food for individuals utilizing the food bank in Big Sky.
    ii. Increase Waste Diversion Rates: Increasing waste diversion rates is the best way to reduce tonnage being sent to the landfill from Big Sky. Working to create a solid waste strategic plan while conducting another

waste composition assessment by 2025 will inform the creation of a waste reduction goal and build in more waste diversion infrastructure into Big Sky.

d. **Natural Environment:**
    i. Water Use Reductions: Conducting a water audit and budget analysis for Big Sky along with utilizing resources and data from community leaders can lead to the creation of a water reduction goal by 2025. Working directly with partners like the Gallatin River Task Force to implement their Water Conservation and Drought Management plans into new developments will be imperative to the success of water reduction.
    ii. Natural Environment Restoration: Developing a community wildfire adapted strategy with Fire Adapted Big Sky can enhance emergency response, support groups that mitigate wildfire risk and work towards the creation of a wildfire adapted community. Using services such as Alpenscapes can work to bring in native landscape that is drought resistant and consumes less water can work to restore the native beauty of Big Sky while conserving resources.

Figure 5: GHG Emissions Reduction Process

Figure 5, as noted on the ICLEI website, shows the three key phases – analyze, act, and accelerate – to reduce GHG emissions and address climate change, along with the multiple steps used to support each phase.

Executive Summary

This greenhouse gas emissions inventory (GHGI) provides an in-depth analysis of Big Sky's greenhouse gas (GHG) emissions 2022, including comparisons with the 2019 GHGI. It shows the key sectors including transportation, energy, waste, and community growth. It presents Energy Use & Building Efficiency, Vehicle Miles Traveled (VMT) data, the impact of the COVID-19 pandemic on transportation, and strategies for achieving future emissions reductions. The findings are intended to inform sustainability efforts and guide the community toward the goal of carbon neutrality by 2050.

Key Findings

1. **Energy Use and Building Efficiency**

   Energy Consumption: Buildings in Big Sky account for 63% of emissions, primarily from electricity and propane usage. Residential electricity consumption grew by 3.88% per year from 2019-2022, while commercial electricity usage decreased slightly.

   Propane Emissions: While propane emissions were slightly reduced (0.79%), residential usage increased. This indicates that future reductions will need to focus on electrification and energy-efficient technologies, such as heat pumps.

   Potential Solutions: Launching & expanding the Build Better Big Sky platform to educate homeowners, builders, and architects on energy-efficient materials and technologies can help reduce future emissions from buildings.

2. **Transportation Emissions**

   Vehicle Miles Traveled (VMT): In 2022, Big Sky recorded over 101 million miles traveled, a 12.37% increase from 2019. This was driven by growth in tourism and construction. However, due to newer, more fuel-efficient vehicles, emissions rose at a slower rate (4.12% annually) compared to VMT.

   Transportation Emissions: Contributing 33.3% of Big Sky's carbon footprint, transportation remains a major challenge. Although overall emissions rose by 15.44% between 2019 and 2022, improvements in vehicle efficiency helped mitigate the impact. Initiatives to reduce these emissions include carpooling, public transit expansion, and the adoption of electric vehicles.

3. **Solid Waste and Fugitive Emissions**

   Solid Waste Emissions: Solid waste emissions declined by 9.81% from 2019 to 2022, thanks to improved data on waste composition and the efficiency of landfilling practices. Emissions from waste now represent only 2.7% of total emissions.

Fugitive Emissions: These emissions, primarily from propane leaks, remain a small fraction (0.7%) of total GHGs, but improving storage and delivery systems could further reduce this source.

4. **Growth in Big Sky**

The community experienced a 7.1% increase in residential units from 2019 to 2022. Managing emissions in the context of such rapid growth presents a challenge, especially as new developments contribute to higher energy and transportation demands. A long-term strategy to incorporate sustainability into growth plans will be critical for balancing economic development and environmental responsibility.

Opportunities for Improvement and Next Steps

1. **Continue Emission Reduction Targets:**

Big Sky should focus on setting medium-term targets to maintain progress toward its goal of carbon neutrality by 2050. This includes aiming for a 2025 reduction target, using the Climate Action Plan (CAP) to drive actions across the energy, buildings, transportation, and waste sectors.

2. **Expand Green Energy Initiatives:**

Encouraging local support for renewable energy and advocating for a state-level renewable energy mandate can help increase the share of green energy in Big Sky's electricity supply. Aligning with Bozeman and Missoula's efforts to promote green power programs could further accelerate the shift toward clean energy.

3. **Enhance Public Transit and Mobility Options:**

Reducing VMT will require stronger collaboration with public transit providers, like the Streamline Bus System, and local employers to support carpooling, shuttles, and public transportation. Implementing real-time transit apps and improving walkability in Big Sky could further reduce transportation emissions.

4. **Address Water Use and Wildfire Resilience:**

A water reduction goal for 2025 should be set, leveraging partnerships with organizations like the Gallatin River Task Force to promote conservation efforts in new developments. Additionally, developing a community wildfire adaptation strategy will enhance resilience and ensure that environmental restoration projects include drought-resistant, native plants.

Conclusion

Despite challenges posed by rapid growth, Big Sky has made progress in reducing emissions and improving data collection on waste, energy, and transportation. The 2022 data reveal both opportunities for improvement—especially in transportation and energy use—and the need for continued collaboration between public, private, and nonprofit sectors to meet the community's sustainability goals. By focusing on energy-efficient buildings, reducing transportation emissions, improving waste management, and addressing the natural environment, Big Sky is well-positioned to achieve its net zero goal by 2050.