

Jackson Hole Greenhouse Gas Emissions

Sources

14.9%

natural gas & propane

2.2%

electricity

17.4%

aviation

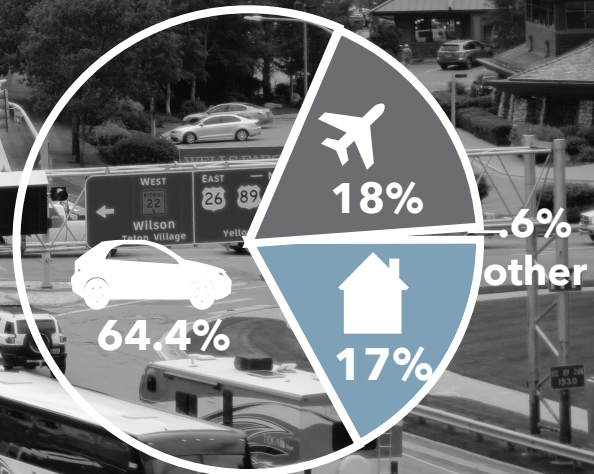
1.1%

OTHER

64.4%

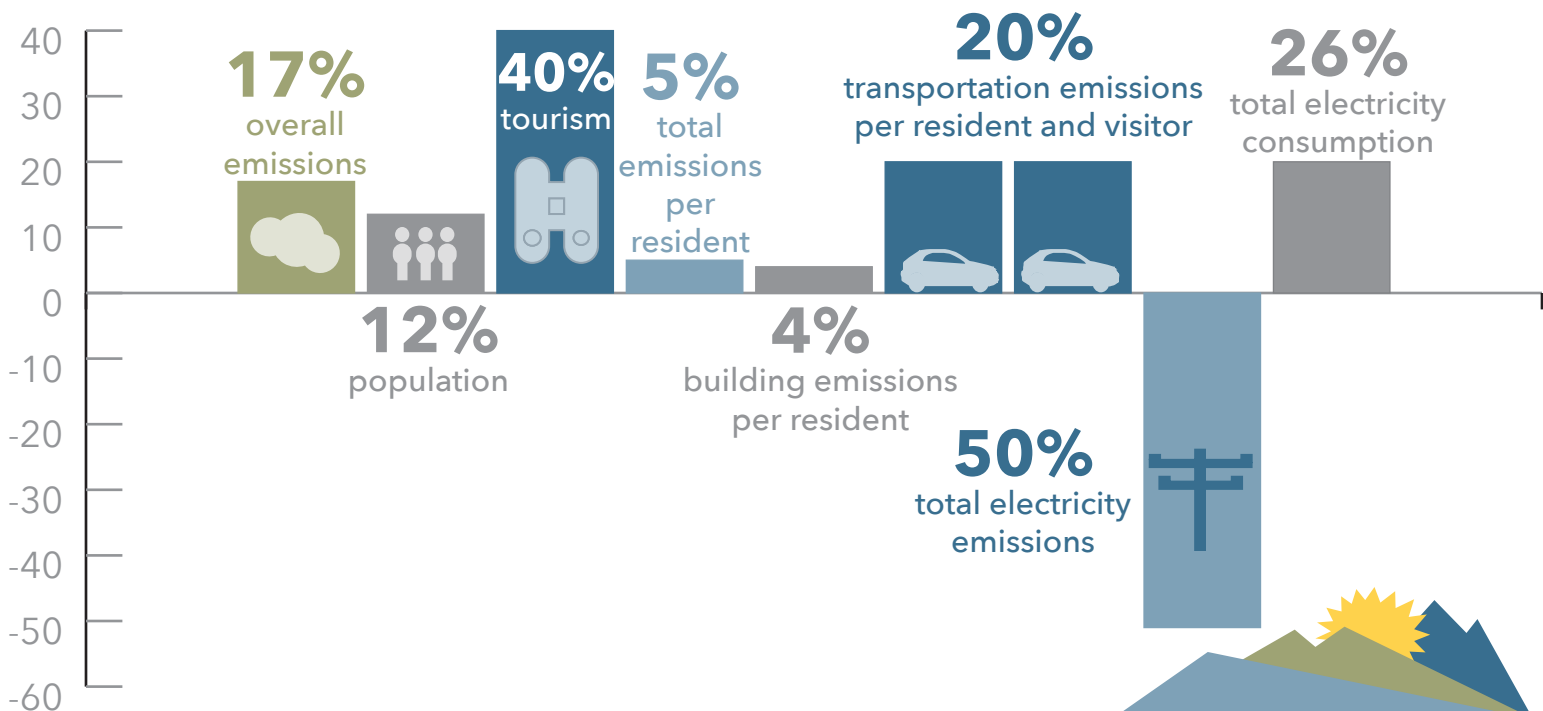
ground transportation

Sector

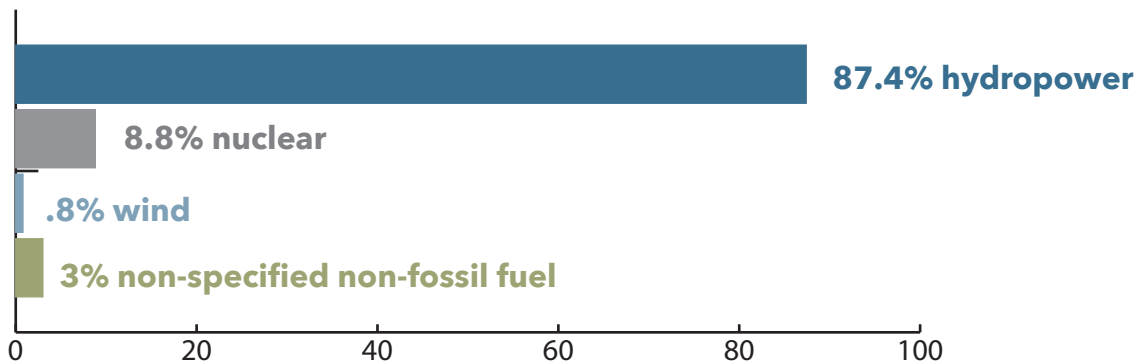


Population and Tourism growth's impact on Jackson Hole's Greenhouse Gas Emissions

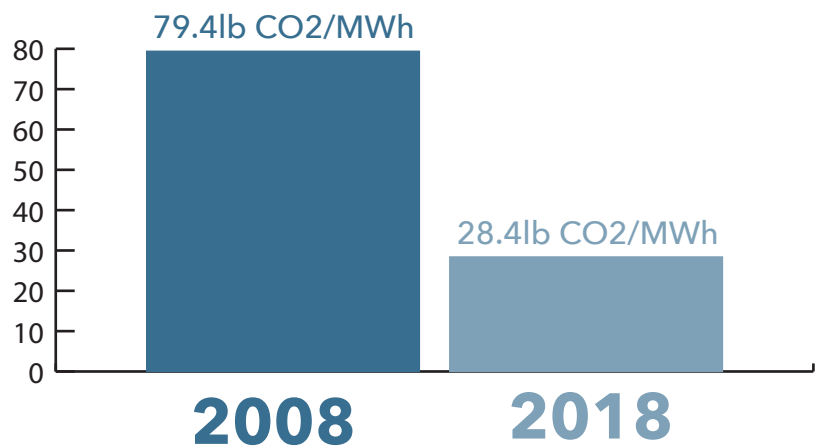
Since the 2009 GHG Emissions Inventory, Teton County has seen growth in many capacities. These trends have led to an overall increase of emissions.



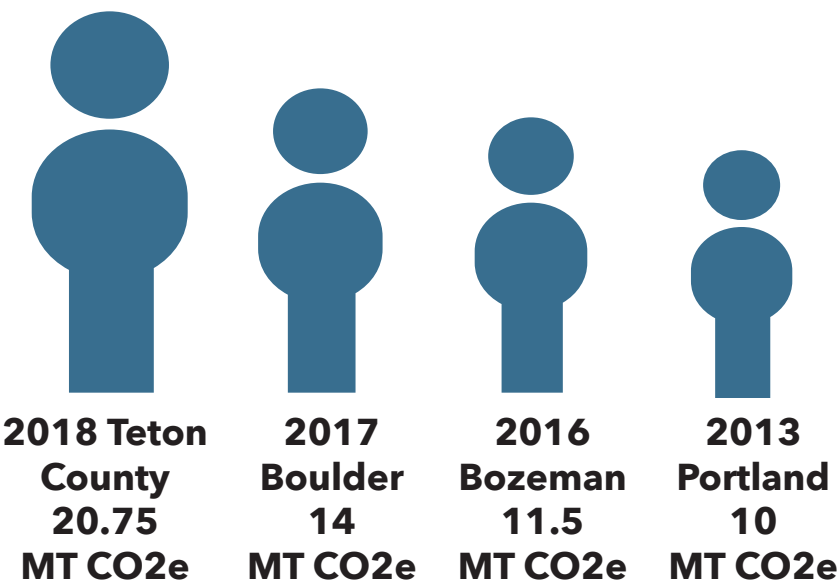
Bonneville Power Administration Electricity Supply



Bonneville Power Administration Carbon Factor Comparison



Greenhouse Gas Emissions Per Person Comparison



Total Emissions and Population Data

Year	Population	Total Emissions (tons CO2e)
2008	20,686.00	409,041.00
2018	23,081.00	478,470.00



Yellowstone-Teton Clean Cities (YTCC) in partnership with the Town of Jackson and Teton County commissioned an update to the 2009 emissions inventory. The entity that performed the original inventory, Climate Mitigation Services (CMS), was hired to update the inventory using the same methodologies and boundary as the previous report to ensure accurate comparisons over time (an apples to apples comparison).

These key takeaways are not an exhaustive explanation of everything that impacted the greenhouse gas emission findings. In addition, this is just a snapshot of projects that should be recognized, as there are many more successful programs that should be celebrated. This is a high level overview of the data as well as some suggestions as a starting point for making plans to move forward.

Based on YTCC's research into the effective coordination and reduction of greenhouse gas emissions, we have four overall key suggestions (1) develop a Climate Action Plan, while beginning easy and high impact greenhouse gas mitigation actions immediately; (2) implement the Teton County Internal Sustainability Strategy of June 2017 (2) hire a sustainability director for each the town and the county and at a minimum a joint position, to oversee the climate action plan, oversee an internal climate action committee and regularly meet with community organizations that can help carry out the climate action plan, and (3) develop one overarching ambitious goal, such as Net Zero by 2030 (suggested by the upcoming Mountain Town 2030 summit in Park City, UT). This will allow those responsible for sub goals and projects the ability to be creative and implement bold, high impact projects.

Electricity

Key Takeaways

- Total electricity consumption grew by 26%
- GHG emissions declined by 51%
- Despite an increase in electricity use, greenhouse gas emissions declined due to:
 - o Lower Valley Energy (LVE) purchases their power from Bonneville Power Administration. The carbon factor decreased 67% from an already low carbon factor. The majority of the grid mix is hydroelectric power at 87.4% and only 3% of the grid mix is fossil fuel.
- Electricity use grew in Teton County by 49% but declined in the Town of Jackson by 8%
 - o This may be due to 64 of Lower Valley Energy's 90 energy efficiency projects taking place in the Town of Jackson as well as Energy Conservation Works (ECW) many efficiency projects also taking place in the Town of Jackson

Recognition

- Lower Valley Energy and Energy Conservation Works consistently implement energy efficiency projects throughout our community. The following are just a few examples of the projects they implemented:
 - o With Specific Purpose Excise Tax Funds, Energy Conservation Works installed a 69kW photovoltaic system at the Wastewater Treatment Plant, generating over 100,000kWh annually.
 - o ECW also installed 14 energy efficient GridBee Mixers at the plant to save roughly 1.1 million kWh's annually.
 - o ECW increased the energy efficiency of the new Children's Learning Center by 47% by installing a more efficient heat pump and LED lighting.

Suggestions

- Automatically sign every new Lower Valley Energy customer up for green power with the ability to opt out.
- Continue strong relationship with Energy Conservation Works to implement building energy efficiency projects and renewable energy installations.
- Set a Net Zero or Renewable Energy mandate to be implemented by 2030.
- Enforce energy efficiency mandates for new buildings.
- Continue use of Energy Mitigation Program that offsets disproportionate energy consumption of large buildings.

Natural Gas and Propane

Key Takeaways

- There is a fairly even swap of emissions coming from natural gas and propane. This is due to LVE retiring their propane services and replacing them with natural gas, particularly completing a pipeline to Teton Village.

Ground Transportation

Key Takeaways

- Ground transportation is once again the largest greenhouse gas emission source and sector for Teton County. This is not surprising considering the low carbon factor of electricity, industry is very limited and tourism is one of the largest economic engines of our community.
 - o Approximately 50% of ground transportation greenhouse gas emissions are from tourists driving to Teton County and driving in Grand Teton National Park. A little over a quarter of total ground transportation emissions do not actually take place in Teton County, this amount is a calculation derived from the average distance a “road trip” vacation travels.
 - o The high amount of emissions from transportation provides an incentive to prioritize programs and projects that reduce vehicle miles traveled and the use of gasoline and diesel.

Recognition

- START bus was awarded funding for the purchase of up to 8 all electric transit buses.
- Yellowstone-Teton Clean Cities and Energy Conservation Works has helped fund the installation of 14 stations in Teton County with 18 ports available for charging. There are now 20 electric vehicle charging stations in Teton County.
- Every year Yellowstone-Teton Clean Cities collects data on alternative fuel, alternative vehicle and petroleum reduction strategies. Last year, Teton County fleets reduced 3,231 tons of GHG emission through alternative fuel use, fuel economy improvements, vehicle miles traveled (VMTS) reductions and idle-reduction.
- Friends of Pathways has developed a robust pathway system allowing for residents and visitors to commute and travel.
- Friends of Pathways, Town of Jackson and Community Pathways’ increased daily bike counts on Snow King avenue by 15% through the Snow King Bikeway project.
- START Bus and Friends of Pathways launched START bike, providing convenient access to bikes throughout town with 55 bikes and 12 docking stations. In 2017 250 members took 4,000 rides.

Suggestions

- Develop robust commuter behavior change program to decrease single occupancy vehicles commuting into Jackson
- Develop an ultra low emission zone that requires a fee for those driving older, dirty diesel and gasoline vehicles. London and other European cities have implemented this program.
- Create a Town and County Green Fleet purchasing policy in which the lowest emission vehicles must be purchased unless an alternative fuel is not available in for the specified vehicle type.
 - o Challenge the other communities in the Greater Yellowstone Ecosystem to also create and implement a Green Fleet purchasing policy.
- Install a DC Fast Charging station in the Town of Jackson using SPET and Energy Mitigation Plan funds.
- Require all new construction to offer electric vehicle charging or be “EV ready”.
- Require all rental car agencies to offer plug-in hybrid vehicle options.
- Require all Town of Jackson and Teton County contracts that require driving to utilize alternative fuels.
- Research and implement multi-modal transportation options
- Designate pedestrian only street areas
- Allow remote working for a portion of the work week to reduce commuting

Aviation

Key Takeaways

- Aviation emissions had no significant change in the percent of total Teton County emissions, in 2008 aviation accounted for 17.2 percent of total GHG emission and in 2019 aviation accounted for 17.4 percent of total GHG emissions.

The Jackson Hole Airport also voluntarily commissioned a greenhouse gas emissions report to coincide with the release of this Jackson Hole emissions inventory. Since the development of the 2008 Jackson Hole Inventory of Greenhouse Gas Emissions, aviation-related carbon accounting methodologies have been updated. The JAC GHG Inventory uses industry standard methodologies from the National Academy of Sciences (Airport Cooperative Research Program, Guidebook on Preparing Airport Greenhouse Gas Inventories, 2009), as well as international standards based on Airport Carbon Accreditation of the Airports Council International (ACI) (officially adopted in 2014 by ACI-North America). The airport report is attached as Appendix

The CMS report utilized the same methodologies from the 2009 Jackson Hole Greenhouse Gas Emissions Inventory, this report did not utilize the same methodologies as the airport GHG emission inventory because the intent of the 2019 emissions inventory was to provide and update to the 2009 report findings with an “apples to apples” comparison. If we used different methodology there would not be an accurate comparison over time.

For comparison’s sake, placing the emissions data from the airport methodology into the 2019 report, the airport would account for 13% of total emissions, bumping ground transportation up to 68%.

GHG Emissions by Source	CO2e 2008	CO2e 2017	% change`	JH Air CO2e 2017
Landfill	8,119	181	-97.8%	
Nitrous Oxides	182	403	121.4%	
HFCs and Refrigerants	2,101	1,182	-43.7%	
Off-Road Transportation	3,706	3,642	-1.7%	
Aviation	70,546*	83,466*	18.3%	56,636.00**
Buildings	70,360	81,787	16.2%	
Ground Transportation	254,638	308,207	21.0%	
Total	409,652	478,868	16.9%	
<p>* 2008 & 2017 Heede report & methodology - See Appendix #1</p> <p>** 2017 JH Airport report & different methodology - See Appendix #2</p> <p>Please note both reports use completely different methodologies to report CO2e totals for Aviation sector of our community.</p>				

Recognition-Jackson Hole Airport is a sustainable leader in the region and has implemented several sustainable measures in recent years, including:

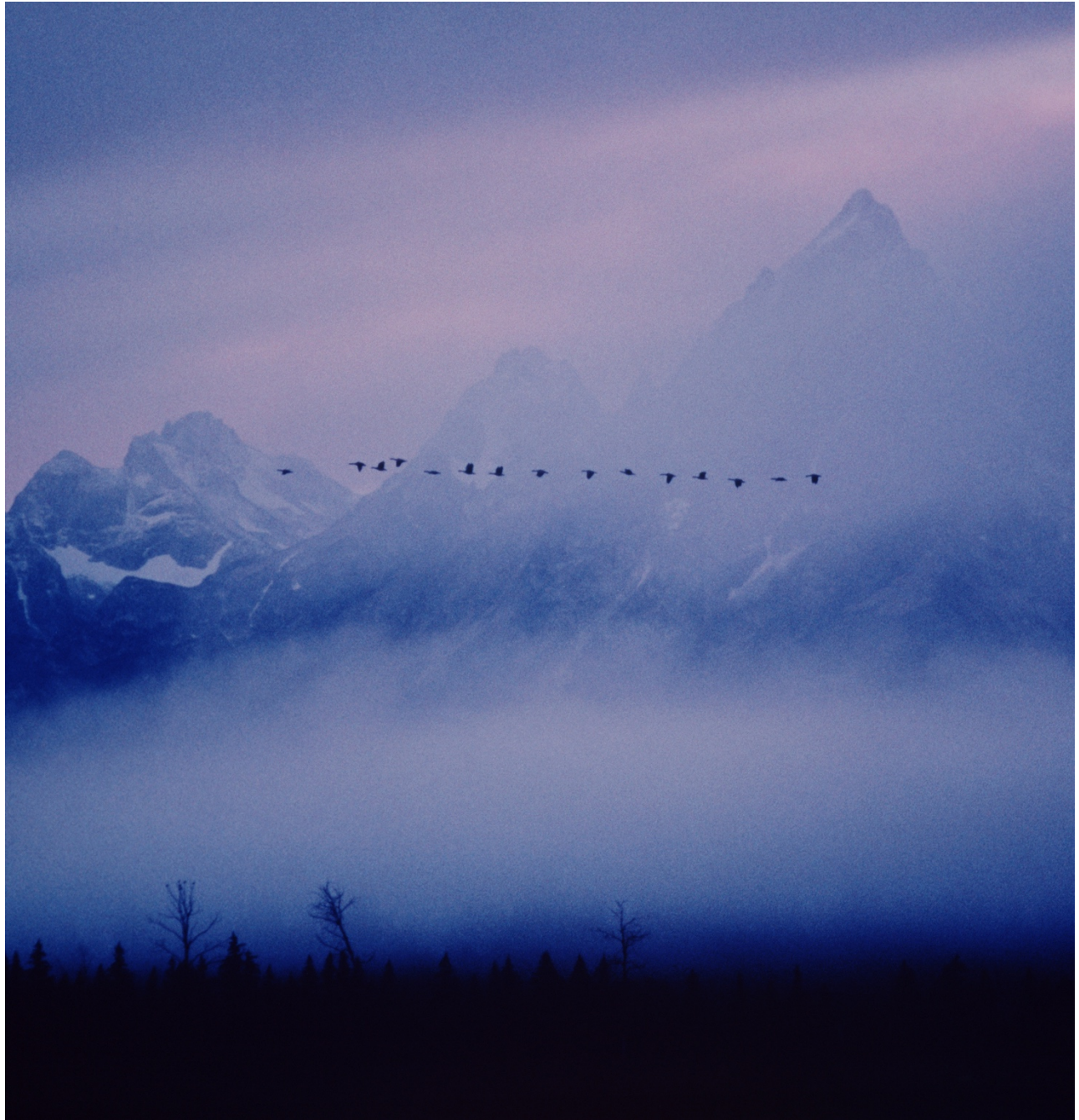
- The purchase of 2 propane trucks
- 2 all electric maintenance vehicles,
- Partnering with Yellowstone Teton Clean Cities for the installation of 6 publically available electric vehicle charging stations, they received LEED Silver Certification the Terminal Building expansion, incorporated LED lighting in the new baggage claim building, conducted an energy audit and is a two time recipient of the Green Fleet Award from Yellowstone-Teton Clean Cities.

Suggestions

- Prohibit vehicle idling by taxi vehicles and all vehicles in pickup/drop-off areas
- Require rental car companies to have plug-in hybrid vehicles options in their fleets
- Work with local partners to develop public transit to and from the Town of Jackson and Teton County.

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Jackson Hole Inventory of Greenhouse Gas Emissions, 2018



By Richard Heede
Climate Mitigation Services
8 September 2019



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Report commissioned by Yellowstone-Teton Clean Cities, Town of Jackson, and Teton County
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This report was additionally supported with financial contributions from the following organizations:



Special thanks to Community Foundation of Jackson Hole's competitive grant program for providing seed funding



Note on units: common US units are used throughout. The spreadsheets, however, estimate emissions in both US & metric units. Emissions of methane and nitrous oxide are also expressed in CO₂-equivalent terms (CH₄ = 28 x CO₂; N₂O = 265 x CO₂).



Cover: "Out of the Mist," Thomas D. Mangelsen, used with appreciation & thanks, www.mangelsen.com. Above: "Dawn's First Blush."

Summary

Jackson Hole Energy & Emissions Inventory 2017/2018

Richard Heede

An energy and emissions inventory was performed for the Jackson Hole / Teton County region in 2009 (with data for 2008) by Climate Mitigation Services. CMS was commissioned in 2018 to update the inventory using the same methodology and boundary definition.

This process involves gathering energy use data from electric and gas utilities and propane vendors that service Teton County. Fuel and emissions from driving and transportation is based on data on vehicle miles travelled on State, County, and local roadways (courtesy of State of Wyoming Dept of Transportation). Separate estimates were made for Town and County vehicle fleets (police and sheriff), school buses, the START fleet, and trucking waste ~100 miles from Teton County to Bonneville County Landfill. As in 2008, we estimate fuel use and emissions consumed by commercial air carriers and general aviation aircraft flying to Jackson Hole Airport in 2017/2018.

No surprise: energy use and emissions are up — by 17 percent — since 2008. Nearly everything has grown: population, traffic, tourism, electricity and gas usage, though electricity *emissions* are down.

Table 1 and Table 2 show total emissions by major category for 2018 and 2008, respectively. Additional discussion of the results and major energy and emission sources below.

Table 1. Summary of Jackson Hole greenhouse gas emissions 2018

SOURCE	TONS CO ₂ e	PERCENT
Electricity	10,673	2.2
Natural Gas & Propane	71,115	14.9
Ground Transportation	308,207	64.4
Air travel & aviation	83,466	17.4
Miscellaneous fuel uses	3,642	0.8
Landfill	181	0.0
Nitrous oxide	403	0.1
HFCs and refrigerants	1,182	0.2
Total	478,868	100.0

Table 2. Summary of Jackson Hole greenhouse gas emissions 2008

SOURCE	TONS CO ₂ e	PERCENT
Electricity	21,896	5.3
Natural Gas & Propane	48,464	11.8
Ground Transportation	254,638	62.2
Air travel & Aviation	70,546	17.2
Miscellaneous fuel uses	3,706	0.9
Landfill	8,119	2.0
Nitrous oxide	182	0.0
HFCs and refrigerants	2,101	0.5
Total	409,652	100.0

Fig. 1. Jackson & Teton County major emission sources in 2008 and 2018.

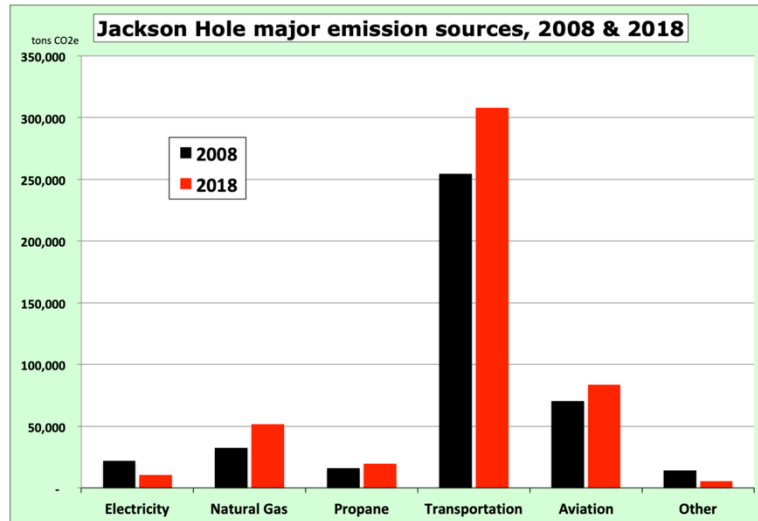


Table 3 compares 2018 to 2008, listing the same categories, and shows the percentage change for each category. Overall, emissions included in our inventory shows an increase of 16.9 percent.

Table 3. Summary of Jackson Hole greenhouse gas emissions 2008 and 2018

SOURCE	TONS CO ₂ e	2008	2018	% CHANGE
Electricity		21,896	10,673	-51.3
Natural Gas & Propane		48,464	71,115	+46.7
Ground Transportation		254,638	308,207	+21.0
Air travel & aviation		70,546	83,466	+18.3
Miscellaneous fuel uses		3,706	3,642	-1.7
Landfill		8,119	181	-97.8
Nitrous oxide		182	403	+121.0
HFCs and refrigerants		2,101	1,182	-43.8
Total		409,652	478,868	+16.9

Fig. 2. Jackson & Teton County total emissions in 2008 and 2018.

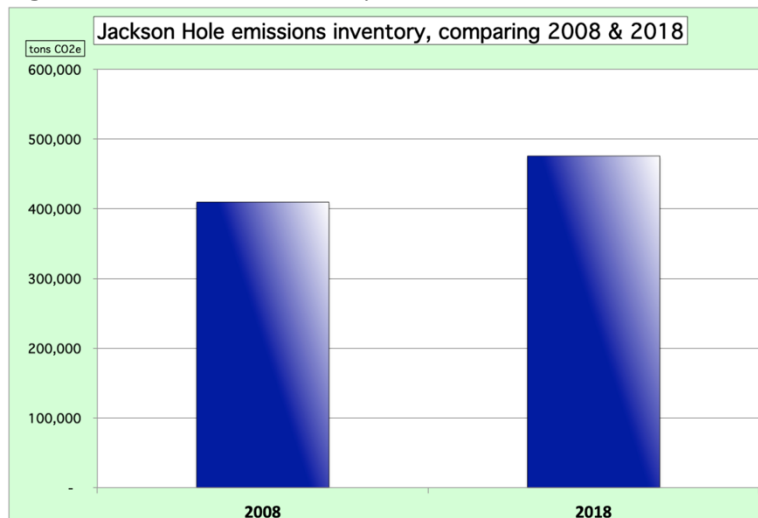


Figure 4 shows major emission sources for both 2008 and 2018, graphically showing that most sources grew by 10-20 percent, whereas electricity emissions *declined* by 51 percent — not due decreasing electricity consumption (which *increased* by 26 percent but from a lower emission factor for LVE’s power purchases from Bonneville Power Administration (also shown in Fig. 3). Propane consumption has been stable (though likely under-reports total consumption due to non-reporting by a major propane company).

Fig. 3. Jackson & Teton County major emission sources in 2008 and 2018.

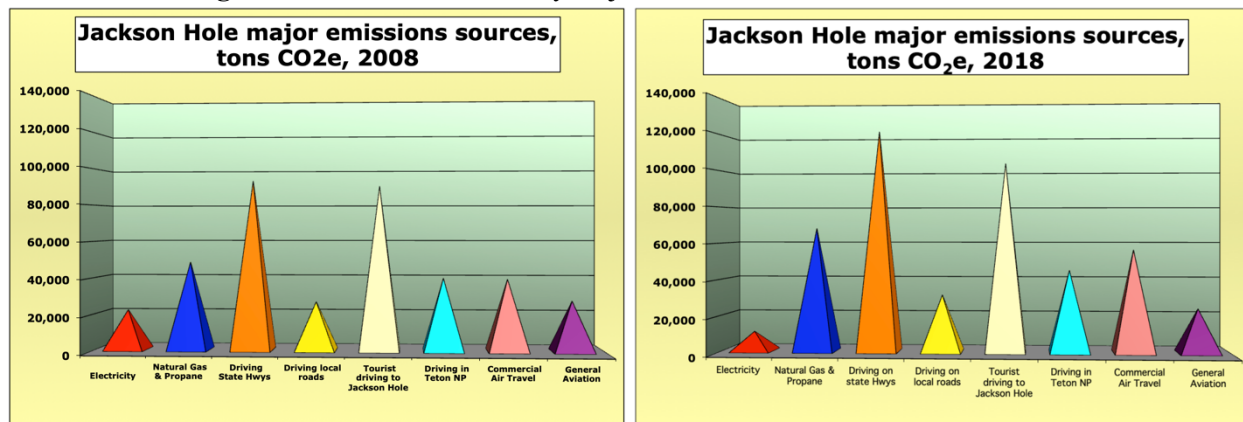
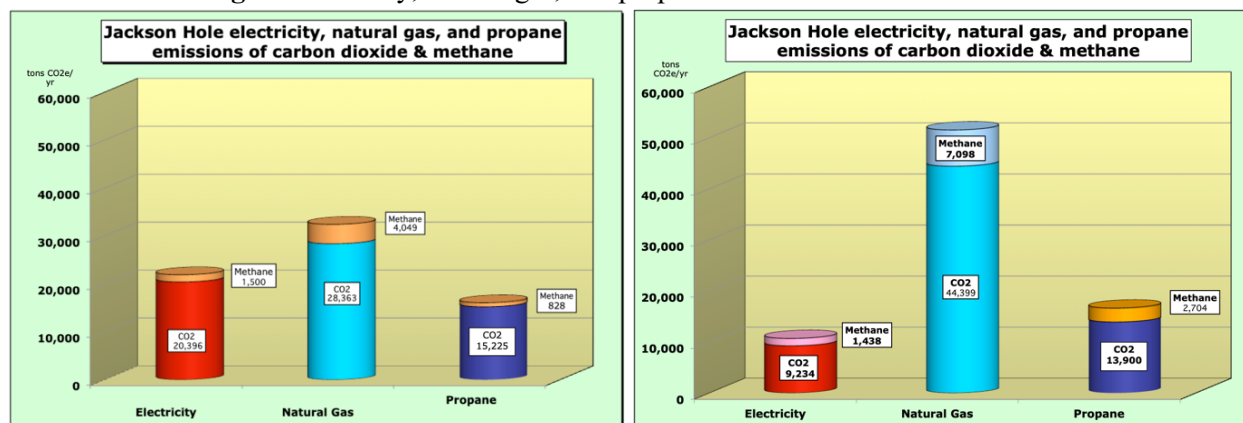
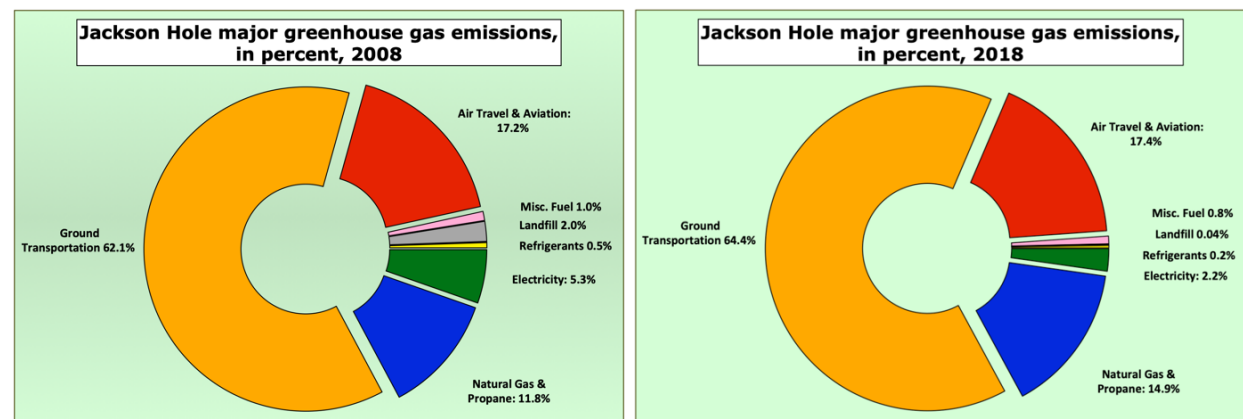
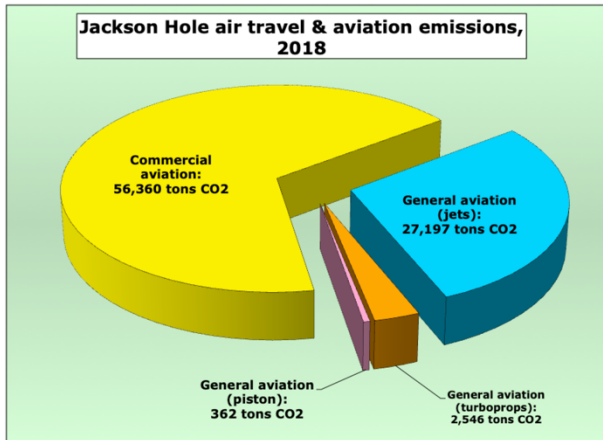
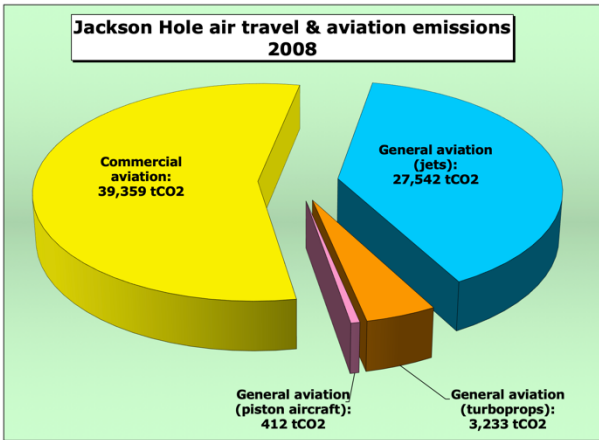
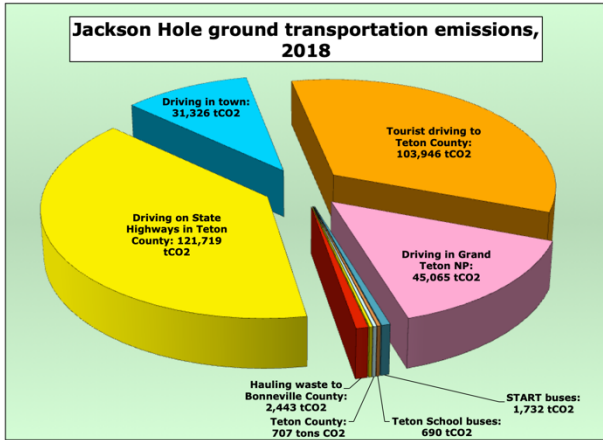
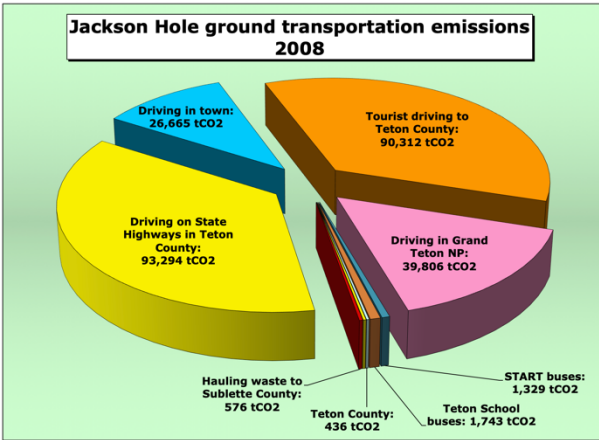


Fig. 4. Electricity, natural gas, and propane emissions in 2008 and 2018.



The figures below compare 2008 and 2018 from major emissions sources, ground transportation, and air travel and aviation emissions. Further discussion below.



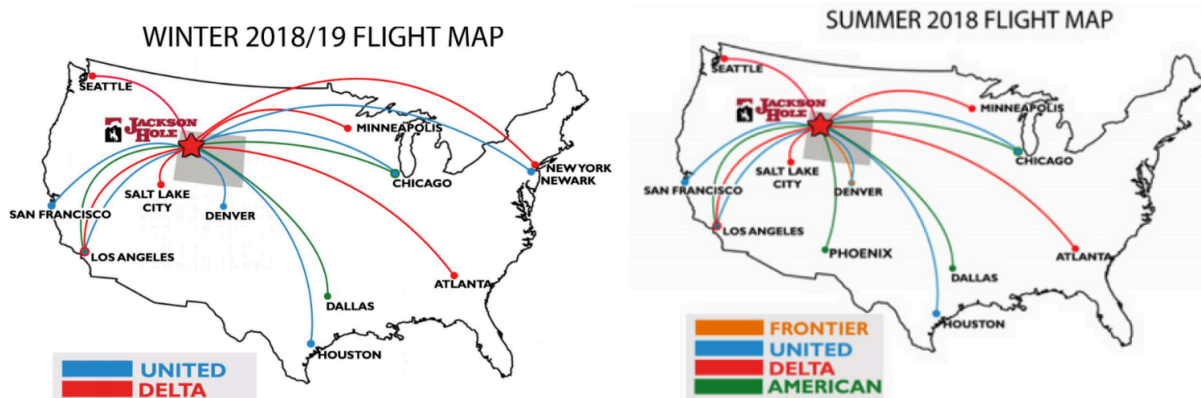


Overview

CMS quantified greenhouse gas emissions attributable to energy use in Teton County in 2017/2018 as follow-up to the community-wide “carbon footprint” we did for energy consumption and other sources in 2008. According to our analysis, community-wide emissions increased 16.9%, from 409,652 tons carbon dioxide equivalent (tCO₂e) in 2008 to 478,868 tCO₂e in 2018. Electricity sector emissions *fell* 51.3% (even though electricity consumption rose by 26 percent), natural gas and propane emissions increased 46.7%, driving and ground transportation rose 20.1%, and air travel emissions increased 18.3%. Readers are encouraged to review the many worksheets in the attached portfolio for details.

Jackson Hole: Major sources of emissions 2017/2018

Commercial air travel: in 2017/2018 season: 3,977 commercial flights departing Atlanta, Chicago, Dallas, Denver, Houston, New York (JFK and Newark), Los Angeles, Minneapolis, Phoenix, Salt Lake City, San Francisco, and Seattle for Jackson Hole Airport ranging in distance from 205 to 1,890 miles flying a total of 2.76 million miles burning on average 1.9 gallons per mile (0.52 mpg) and emitting 56,360 tCO₂.¹



Flight operations at JAC: Overall flight operations at Jackson Hole Airport (JAC) declined from 30,089 in 2008 to 27,189 in 2017. This is uncertain due to airport staff unable to clarify data provided in which the category “civil aviation” is listed in 2008 (at 2,714 operations, or take-offs and landings), but none listed in the 2017 data. The CMS methodology accounts for aviation and air travel emissions for all aircraft landing at JAC, since the objective is to quantify emissions for flights from the airport of origin to Jackson. In other words, we account for fuel and emissions in one direction, from all airports of origin *to* Jackson. The other half of the emissions, for each aircraft’s return trip, are attributed to the communities from which they originate.

General aviation (GA): As for commercial aviation, we take *half* of the annual non-air-carrier operations (air taxi, general aviation, and military totaled 19,722 operations), or 9,861 operations in 2017, and use the same methodology as in the 2008 air travel emissions inventory. Jets comprised 63 percent of flights, flew an average distance of 613 nautical miles from various airports of origin, and consumed an average of 367 gallons of jet fuel per flight (1.9 mpg). This category of GA operations burned 2.3 million gallons of jet fuel and emitted 24,197 tCO₂ in 2018, compared to 27,542 tCO₂ in 2008. General aviation overall included 9,861 operations from airports of origin to JAC, consumed 2.6 million gallons of jet fuel and avgas, and emitted 27,105 tCO₂ (compared 31,187 tCO₂ in 2008).

¹ CMS was unable to acquire complete operational data for 2017 from airport staff, and we relied on airline operational statistics for the 2017/2018 12-month season, which differ slightly from the CY 2017 data provided by airport staff. Whereas the latter show 7,467 “air carrier” operations in CY 2017, our data for 2017/2018 show 3,977 landings (which means twice that, or 7,954, in total operations).

Electricity: Lower Valley Energy (LVE) sold 625 million kWh in Teton County in 2017 (an increase of 26 percent over 2008: 494 million kWh). However, electricity sales *decreased* 8 percent within the Town of Jackson (with a corresponding increase of 49 percent in the rest of the county).

Electricity emissions: the carbon intensity of Bonneville Power Administration (BPA), which is the wholesale supplier of electricity to LVE, decreased substantially from the already-low factor in 2008 of 79.4 lb CO₂/MWh to 28.4 lb CO₂/MWh in 2017 (MWh, megawatt-hour, or 1,000 kWh). CMS calculated emissions based on its minor fossil fuel portfolio (3% “non-specified;” non-fossil fuel: 87.4 percent hydropower, 8.8 percent nuclear, and 0.8 percent wind [without RECs]). CO₂ emissions from LVE’s sales of 625 million kWh totaled 9,234 tCO₂.

BPA did not include methane emissions associated with its fossil fuel portfolio. CMS applied the US average methane emissions from fossil fuel generation: 0.00576 lb CH₄/kWh, and since the average US kWh causes the emission of 1.036 lb CO₂/kWh, this converts to 0.00556 lb CH₄/lb CO₂. Methane is 28 times as powerful a greenhouse gas per lb (per IPCC *Fifth Assessment Report*, 2013), the resulting 51 tons of methane converts to 1,438 tCO₂e, or 13.5 percent of carbon dioxide plus methane.

Emissions from Teton County’s consumption of 625 million kWh totals 10,673 tCO₂e. Due to the lower carbon factor for BPA’s power sales in 2018, electricity-related emissions *declined* by 51 percent from 2008 (21,896 tCO₂e).

Natural Gas: LVE sold 7.6 million therms (one therm is 100,000 Btu, or ~100 cubic feet of gas) in Teton County in 2017, compared to 4.9 million therms in 2008. Sales in Town increased modestly (from 3.9 to 4.2 million therms, but increased sharply in the rest of the County, presumably from infrastructure extension to residential areas outside of town). The emission factor from combustion of natural gas is 11.7 lb CO₂ per therm, and a factor for fugitive and leaked methane from the production and processing of natural gas (0.0057 tCH₄/tCO₂), adding 13.8 percent to gas-related emissions. CO₂ and methane emissions in Teton County totaled 51,497 tCO₂e in 2018, an *increase* of 59 percent over 2008 (32,411 tCO₂e).

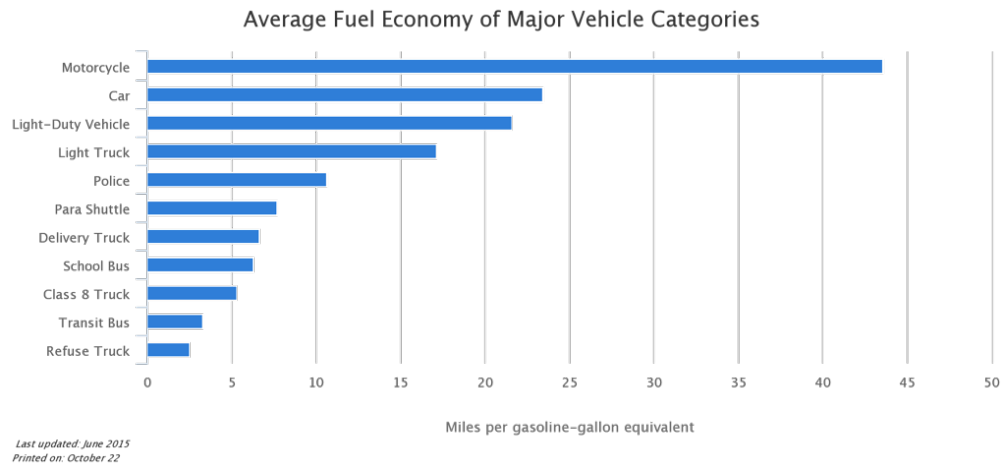
Propane: Propane serves several residential areas in Teton County, particularly beyond the natural gas grid. Sales totaled 2.7 million gallons in 2017 (though AmeriGas declined to provide sales data, and LVE stopped selling propane). We added Valley Wide Cooperative, so total sales in 2008 are not strictly comparable to 2018 sales. The emission factor for propane is 12.7 lbCO₂/gallon, plus a fugitive methane factor for the natural gas liquids derived from natural gas production of 0.0057 tCH₄/tCO₂. Based on the sales data available, emissions from propane sales are 16,914 tCO₂, plus 2,704 tCO₂ from associated methane, totaling 19,618 tCO₂e, an increase of 22 percent. (In lieu of AmeriGas sales data we averaged sales by the three vendors that did provide data, on the theory that an imperfect number is better than a certain wrong (zero) number.)

Ground transportation: Based on data supplied by Wyoming Dept of Transportation (WYDOT), 317 million miles were driven on 184 miles of State highways in Teton County in 2017 (26 million miles were by large trucks). Alicia Cox and Richard Heede completed a vehicle-type survey in Jackson and other locations in the County in order to establish the kinds of vehicles commonly driven in or through Teton County; this informs the model used to estimate fuel consumption and emissions. Passenger cars comprised 18.8 percent of all vehicles, light SUVs and pick-up trucks 29.4 percent, medium & large SUVs and pick-up trucks 40.4 percent, large two-axle trucks 3.9 percent, three-axle trucks 1.0 percent, semis 0.2 percent, RVs 4.5 percent, buses 1.0 percent, and motorcycles 0.9 percent. Each of these vehicle types have differing fuel consumption rates per mile.

CMS has separate estimates for driving within Grand Teton National Park, which totals 94 million miles, 4.5 million gallons of gasoline and diesel consumed, and emissions of 45,065 tCO₂.

Driving on other State highways total 235 million miles, 12 million gallons fuel, and 121,719 tCO₂.

Additional driving on local roads (non-State highways) results in 62 million miles driven, 3.2 million gallons of fuel, and 31,326 tCO₂.



Tourist driving: CMS attributes *one-quarter* of the average distance driven by tourists (which is in turn based on a fraction of 3.32 million visitors to Grand Teton National Park) of 637 miles from point of origin (based on a survey of license plates) and the fuel used to Teton County. The 1.43 million tourist vehicles visiting Teton County from points beyond in 2017 drove an average 159 miles (228 million miles in total), consumed 10 million gallons, and emitted 103,946 tCO₂.

CMS includes fuel and emissions attributable other transportation such as the Teton School District's school buses (62,724 gallons and 690 tCO₂), County vehicles such as Sheriff's vehicles (309 of County total of 707 tCO₂), Town of Jackson (such as Police cruisers: 239 of town's 579 tCO₂). Jackson & Teton's fuel use totals 126,251 gallons and 1,286 tCO₂.

Hauling 31,400 tons of waste from the Waste Transfer Station to the Bonneville County Landfill in Great Falls (a roundtrip of 204 miles, 117,013 gallons of diesel, and 1,363 tCO₂).

Miscellaneous fuel includes Jackson Hole Mountain Resort use of gasoline and diesel for groomers and snowmobiles (181,991 gallons, 864 tCO₂), snowmobiling at Grand Teton NP and Snow King Hill Climb, boat fuel, and construction equipment (combined 174,492 gallons, 1,778 tCO₂).

Yellowstone-Teton Clean Cities estimates that through alternative fuel use programs, fuel economy improvements, reduced vehicle miles traveled, electric vehicle charging stations, and idle-reduction strategies Teton County governments and fleets reduced emissions by 3,248 tons CO₂e in 2018.

Other sources include nitrous oxide, a strong greenhouse gas emitted by fertilizers applied to parks, golf courses, and back yards, totaling 402 tCO₂e, and loss of refrigerants from household refrigerators and freezers and automobile air conditioning units. Even slow leakage of refrigerants from the County's 13,852 households and nearly 30,000 vehicles, given that refrigerants are 1,300 times to 10,900 more powerful than carbon dioxide per pound; all told we estimate annual emissions of 1,182 tCO₂e. Compared to 2008, annual emissions of fertilizer emissions rose 121 percent (chiefly from additional golf course), and refrigerant losses declined by 44 percent (chiefly from a lower loss rate at refrigerator recycling and recovery sites).

Methane: Fugitive methane comes from a number of sources, nearly all occurring in the fuel supply chain, such as coal mining for BPA's small fossil fuel portfolio, landfill emissions, and natural gas supply. Estimated methane emissions declined by 23 percent, from 14,638 tCO₂e in 2008 to 11,309 tCO₂e in 2017 — chiefly due to a much lower methane leakage rate at Bonneville versus the 2008 disposal site at Sublette County. Note: Sublette Landfill had a fugitive methane rate nearly three times higher (34.2 vs 12.6 grams CH₄ per yard of waste-in-place).

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Annex A:  
**Boundary definition**  
*Jackson Hole Energy & Emissions Inventory*

**Boundary definition** (Town of Jackson, Jackson Hole, and Teton County except for areas west of Teton Pass and Yellowstone National Park).

**Buildings sector**

- Electricity
- Natural Gas
- Propane
- Fuel oil (if material)
- City buildings and facilities
- Special District buildings and facilities (e.g., Wastewater Treatment Facility, JH's share of County Landfill)
- School district buildings and facilities.
- Residential, commercial, government, institutional, and other building energy uses.
- Jackson Hole Mountain Resort: electricity for lifts, gondolas, tram, and snowmaking (195 acres)

**Transportation**

- About town (gasoline and diesel)
- Commuting and local driving (gasoline and diesel)
- Tourist travel (e.g., to Jackson Hole and/or Teton NP)
- Commercial vehicles: freight, delivery, trucking, trash collection, etc.
- City, County, State, and Federal vehicles (e.g., police cruisers, sheriff, snowplows, GTNP)
- Waste hauling from Waste Transfer Station to Bonneville County Landfill
- Local bus system (START)
- School buses
- Jackson Hole Mountain Resort: on-mountain diesel and gasoline for groomers and snowmobiles

**Air travel and aviation**

- Commercial air travel to Jackson Hole Airport (United, American, Delta, Frontier: all flights arriving Jackson from Atlanta, Chicago, Dallas, Denver, Houston, New York (JFK & Newark), Los Angeles, Minneapolis, Phoenix, Salt Lake City, San Francisco, and Seattle)
- Business and personal jets and turboprops flying to Jackson Hole Airport
- Locally based personal and commercial aircraft, sightseeing operators, etc.

**Other “transportation”**

- Fuel purchased at Jackson Lake marinas.
- Other (if material: snowmobiles, mowers, graders, construction equipment)

**Methane and nitrous oxide emissions**

- Wastewater Treatment Facility (deemed not material)
- Jackson Hole's share of Bonneville County Landfill (methane: if material)
- Methane emissions BPA's fossil-fired electricity for Lower Valley Energy's purchased electricity
- N<sub>2</sub>O from fertilizer application (chiefly for Town Parks and golf courses)

**References & List of Worksheets**



## Annex B: References

Note: numerous additional references are listed in individual worksheets

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Annex C:  
**List of worksheets**

1. Summary 2017/2018
2. Electricity
3. Electricity – carbon and methane factors
4. Natural Gas
5. Propane
6. Transportation - StateHighways
7. Transportation - Local Roads
8. Transportation - Grand Teton NP
9. Transportation - Tourists
10. Transportation - Misc TownSchoolCountyJHMR
11. Transportation - START
12. Transportation - TrafficData
13. Transportation – TrafficSurvey
14. Transportation – WYDOT data
15. Aviation & Air travel - Commercial
16. Aviation & Air travel - General Aviation
17. Aviation & Air travel - Landings Jan19
18. Aviation & Air travel - OpsData
19. Miscellaneous - Fertilizers
20. Miscellaneous - Landfill
21. Miscellaneous – Refrigerants



Courtesy of Thomas D. Mangelsen, and used with gratitude, [www.mangelsen.com](http://www.mangelsen.com).

|    | A | B                                                                           | C | D                             | E                                         | F                 | G                         | H                    | I                 | J              | K                | L             | M | N              | O | P      | Q |
|----|---|-----------------------------------------------------------------------------|---|-------------------------------|-------------------------------------------|-------------------|---------------------------|----------------------|-------------------|----------------|------------------|---------------|---|----------------|---|--------|---|
| 1  |   |                                                                             |   |                               |                                           |                   |                           |                      |                   |                |                  |               |   |                |   |        |   |
| 2  |   | <b>Jackson Hole</b>                                                         |   | <b>Rick Heede</b>             | Climate Mitigation Services, 970-343-0707 |                   |                           |                      |                   |                |                  |               |   |                |   |        |   |
| 3  |   | <b>Community Greenhouse Gas Emissions Inventory, 2018</b>                   |   | Last Modified: 17 August 2019 |                                           |                   |                           |                      |                   | <b>2018</b>    |                  |               |   | <b>2008</b>    |   |        |   |
| 4  |   |                                                                             |   |                               |                                           |                   |                           |                      |                   |                |                  |               |   |                |   |        |   |
| 5  |   | data not complete                                                           |   |                               |                                           |                   |                           |                      |                   |                |                  |               |   |                |   |        |   |
| 6  |   |                                                                             |   |                               |                                           |                   |                           |                      |                   |                |                  |               |   |                |   |        |   |
| 7  |   | <b>Buildings: electricity</b>                                               |   |                               |                                           |                   |                           |                      |                   |                |                  |               |   |                |   |        |   |
| 8  |   | Electricity, <b>Jackson</b> (Lower Valley Energy)                           |   | 180,954,031                   | kWh                                       | 1,845,731         | 10 <sup>6</sup> Btu       | 2,675                | tons CO2          | 2,675          | tons CO2         | 0.6%          |   | 8,119          |   | -67%   |   |
| 9  |   | Electricity, <b>Teton County</b> (Lower Valley Energy)                      |   | 443,767,058                   | kWh                                       | 4,526,424         | 10 <sup>6</sup> Btu       | 6,560                | tons CO2          | 6,560          | tons CO2         | 1.4%          |   | 12,278         |   | -47%   |   |
| 10 |   | Electricity (fugitive methane)                                              |   | 51                            | tons CH4                                  | 2,455             | 10 <sup>6</sup> Btu       | 51                   | tons CH4          | 1,438          | tons CO2e        | 0.3%          |   | 1,500          |   | -4%    |   |
| 11 |   | <b>Total electricity</b>                                                    |   | <b>624,721,089</b>            | <b>kWh</b>                                | <b>6,374,610</b>  | <b>10<sup>6</sup> Btu</b> | <b>na</b>            | <b>tons CO2e</b>  | <b>10,673</b>  | <b>tons CO2e</b> | <b>2.2%</b>   |   | <b>21,896</b>  |   | -51.3% |   |
| 12 |   |                                                                             |   |                               |                                           |                   |                           |                      |                   |                |                  |               |   |                |   |        |   |
| 13 |   | <b>Buildings: natural gas and propane</b>                                   |   |                               |                                           |                   |                           |                      |                   |                |                  |               |   |                |   |        |   |
| 14 |   | Natural Gas, <b>Jackson</b> (Lower Valley Energy)                           |   | 4,227,202                     | therms                                    | 422,720           | 10 <sup>6</sup> Btu       | 24,706               | tons CO2          | 24,706         | tons CO2         | 5.2%          |   | 22,735         |   | 9%     |   |
| 15 |   | Natural Gas, <b>Teton County</b> (Lower Valley Energy)                      |   | 3,369,466                     | therms                                    | 336,947           | 10 <sup>6</sup> Btu       | 19,693               | tons CO2          | 19,693         | tons CO2         | 4.1%          |   | 5,628          |   | 250%   |   |
| 16 |   | Natural Gas (fugitive methane)                                              |   | 254                           | tons CH4                                  | 12,115            | 10 <sup>6</sup> Btu       | 254                  | tons CH4          | 7,098          | tons CO2e        | 1.5%          |   | 4,049          |   | 75%    |   |
| 17 |   | Propane / AmeriGas                                                          |   | 667,553                       | gallons                                   | 60,970            | 10 <sup>6</sup> Btu       | 4,229                | tons CO2          | 4,229          | tons CO2         | 0.9%          |   | 6,025          |   | -30%   |   |
| 18 |   | Propane / Ferrellgas                                                        |   | 346,622                       | gallons                                   | 31,658            | 10 <sup>6</sup> Btu       | 2,196                | tons CO2          | 2,196          | tons CO2         | 0.5%          |   |                |   | na     |   |
| 19 |   | Propane / Suburban Propane                                                  |   | 919,631                       | gallons                                   | 83,993            | 10 <sup>6</sup> Btu       | 5,825                | tons CO2          | 5,825          | tons CO2         | 1.2%          |   |                |   | na     |   |
| 20 |   | Valley Wide Cooperative                                                     |   | 736,406                       | gallons                                   | 67,258            | 10 <sup>6</sup> Btu       | 4,665                | tons CO2          | 4,665          | tons CO2         | 1.0%          |   |                |   |        |   |
| 21 |   | Propane / Lower Valley Energy (no longer sells propane)                     |   |                               | gallons                                   |                   | 10 <sup>6</sup> Btu       |                      | tons CO2          |                | tons CO2         | 0.0%          |   | 9,200          |   | -100%  |   |
| 22 |   | Propane (fugitive methane)                                                  |   | 97                            | tons CH4                                  |                   | 10 <sup>6</sup> Btu       | 97                   | tons CH4          | 2,704          | tons CO2e        | 0.6%          |   | 828            |   | 227%   |   |
| 23 |   | Heating oil                                                                 |   |                               | gallons                                   |                   | 10 <sup>6</sup> Btu       |                      | tons CO2          |                | tons CO2e        | 0.0%          |   | -              |   | na     |   |
| 24 |   | <b>Total natural gas &amp; propane</b>                                      |   | <b>2,670,212</b>              | <b>gallons</b>                            | <b>1,015,661</b>  | <b>10<sup>6</sup> Btu</b> | <b>na</b>            | <b>tons CO2e</b>  | <b>71,115</b>  | <b>tons CO2e</b> | <b>14.9%</b>  |   | <b>48,464</b>  |   | 46.7%  |   |
| 25 |   |                                                                             |   |                               |                                           |                   |                           |                      |                   |                |                  |               |   |                |   |        |   |
| 26 |   | <b>Total buildings</b>                                                      |   | <b>na</b>                     | <b>gallons</b>                            | <b>7,390,271</b>  | <b>10<sup>6</sup> Btu</b> | <b>na</b>            | <b>tons CO2</b>   | <b>81,787</b>  | <b>tons CO2e</b> | <b>17.1%</b>  |   | <b>70,360</b>  |   | 16.24% |   |
| 27 |   |                                                                             |   |                               |                                           |                   |                           |                      |                   |                |                  |               |   |                |   |        |   |
| 28 |   | <b>Transportation: highway, around town, buses, and waste hauling</b>       |   |                               |                                           |                   |                           |                      |                   |                |                  |               |   |                |   |        |   |
| 29 |   | Driving on State Highways in Teton County                                   |   | 12,096,714                    | gallons                                   | 1,512,948         | 10 <sup>6</sup> Btu       | 121,719              | tons CO2          | 121,719        | tons CO2         | 25.4%         |   | 93,294         |   | 30%    |   |
| 30 |   | Highway vehicles on local roads                                             |   | 3,211,941                     | gallons                                   | 401,721           | 10 <sup>6</sup> Btu       | 31,326               | tons CO2          | 31,326         | tons CO2         | 6.5%          |   | 26,665         |   | 17%    |   |
| 31 |   | Tourist driving to Teton County (one-quarter of one-way)                    |   | 10,415,449                    | gallons                                   | 1,302,671         | 10 <sup>6</sup> Btu       | 103,946              | tons CO2          | 103,946        | tons CO2         | 21.7%         |   | 90,312         |   | 15%    |   |
| 32 |   | Driving in Grand Teton National Park                                        |   | 4,544,238                     | gallons                                   | 568,352           | 10 <sup>6</sup> Btu       | 45,065               | tons CO2          | 45,065         | tons CO2         | 9.4%          |   | 39,806         |   | 13%    |   |
| 33 |   | Transit Buses (START)                                                       |   | 155,332                       | gallons                                   | 21,544            | 10 <sup>6</sup> Btu       | 1,732                | tons CO2          | 1,732          | tons CO2         | 0.4%          |   | 1,329          |   | 30%    |   |
| 34 |   | School Buses & other fuel use (Teton School District)                       |   | 62,724                        | gallons                                   | 8,700             | 10 <sup>6</sup> Btu       | 690                  | tons CO2          | 690            | tons CO2         | 0.1%          |   | 1,743          |   | -60%   |   |
| 35 |   | Teton County fuel use (Sheriff)                                             |   | 31,508                        | gallons                                   | 4,370             | 10 <sup>6</sup> Btu       | 309                  | tons CO2          | 309            | tons CO2         | 0.1%          |   | 22             |   | 1333%  |   |
| 36 |   | Teton County fuel use (Other fuel)                                          |   | 39,011                        | gallons                                   | 4,879             | 10 <sup>6</sup> Btu       | 398                  | tons CO2          | 398            | tons CO2         | 0.1%          |   | 414            |   | -4%    |   |
| 37 |   | Town of Jackson fuel use (Police Dept.)                                     |   | 24,408                        | gallons                                   | 3,053             | 10 <sup>6</sup> Btu       | 239                  | tons CO2          | 239            | tons CO2         | 0.0%          |   | 217            |   | 10%    |   |
| 38 |   | Town of Jackson fuel use (Other fuel)                                       |   | 31,325                        | gallons                                   | 3,918             | 10 <sup>6</sup> Btu       | 340                  | tons CO2          | 340            | tons CO2         | 0.1%          |   | 258            |   | 32%    |   |
| 39 |   | Waste hauling (Transfer Station to Idaho Falls; off-road diesel, trash)     |   | 207,507                       | gallons                                   | 28,013            | 10 <sup>6</sup> Btu       | 2,443                | tons CO2          | 2,443          | tons CO2         | 0.5%          |   | 576            |   | 32.4%  |   |
| 40 |   | <b>Total highway vehicles, around town, buses, &amp; waste hauling</b>      |   | <b>30,820,157</b>             | <b>gallons</b>                            | <b>3,860,169</b>  | <b>10<sup>6</sup> Btu</b> | <b>308,207</b>       | <b>tons CO2</b>   | <b>308,207</b> | <b>tons CO2</b>  | <b>64.4%</b>  |   | <b>254,638</b> |   | 21.0%  |   |
| 41 |   |                                                                             |   |                               |                                           |                   |                           |                      |                   |                |                  |               |   |                |   |        |   |
| 42 |   | <b>Transportation: commercial and private aviation, one-way</b>             |   |                               |                                           |                   |                           |                      |                   |                |                  |               |   |                |   |        |   |
| 43 |   | Air Travel - Commercial inbound to Jackson Hole Airport (2018)              |   | 5,345,277                     | gallons                                   | 721,612           | 10 <sup>6</sup> Btu       | 56,360               | tons CO2          | 56,360         | tons CO2         | 11.8%         |   | 39,359         |   | 43%    |   |
| 44 |   | Air Travel - General Aviation (jets) (2017)                                 |   | 2,294,917                     | gallons                                   | 309,814           | 10 <sup>6</sup> Btu       | 24,197               | tons CO2          | 24,197         | tons CO2         | 5.1%          |   | 27,542         |   | -12%   |   |
| 45 |   | Air Travel - General Aviation (turboprops)                                  |   | 241,478                       | gallons                                   | 32,600            | 10 <sup>6</sup> Btu       | 2,546                | tons CO2          | 2,546          | tons CO2         | 0.5%          |   | 3,233          |   | -21%   |   |
| 46 |   | Air Travel - General Aviation (piston aircraft)                             |   | 39,423                        | gallons                                   | 4,738             | 10 <sup>6</sup> Btu       | 362                  | tons CO2          | 362            | tons CO2         | 0.1%          |   | 412            |   | -12%   |   |
| 47 |   | <b>Total commercial and private aviation</b>                                |   | <b>7,921,096</b>              | <b>gallons</b>                            | <b>1,068,764</b>  | <b>10<sup>6</sup> Btu</b> | <b>83,466</b>        | <b>tons CO2</b>   | <b>83,466</b>  | <b>tons CO2</b>  | <b>17.4%</b>  |   | <b>70,546</b>  |   | 18.3%  |   |
| 48 |   |                                                                             |   |                               |                                           |                   |                           |                      |                   |                |                  |               |   |                |   |        |   |
| 49 |   | <b>Off-road transportation: boating, ski area, snowmobiles, &amp; misc.</b> |   |                               |                                           |                   |                           |                      |                   |                |                  |               |   |                |   |        |   |
| 50 |   | Grand Teton Lodge Company (boat fuel)                                       |   | 18,052                        | gallons                                   | 2,258             | 10 <sup>6</sup> Btu       | 183                  | tons CO2          | 183            | tons CO2         | 0.04%         |   | 156            |   | 17%    |   |
| 51 |   | Signal Mountain Lodge & Leeks' Marina (boat fuel)                           |   | 16,213                        | gallons                                   | 2,028             | 10 <sup>6</sup> Btu       | 159                  | tons CO2          | 159            | tons CO2         | 0.03%         |   | 136            |   | 17%    |   |
| 52 |   | Grand Teton National Park: NPS vehicles & off-road equipment                |   | 80,873                        | gallons                                   | 10,918            | 10 <sup>6</sup> Btu       | 855                  | tons CO2          | 855            | tons CO2         | 0.18%         |   | 1,071          |   | -20%   |   |
| 53 |   | Snowmobiles (Grand Teton National Park)                                     |   | 7,072                         | gallons                                   | 884               | 10 <sup>6</sup> Btu       | 69                   | tons CO2          | 69             | tons CO2         | 0.01%         |   | 137            |   | -49%   |   |
| 54 |   | Snow King Hill Climb World Championships                                    |   | 2,486                         | gallons                                   | 311               | 10 <sup>6</sup> Btu       | 24                   | tons CO2          | 24             | tons CO2         | 0.01%         |   | 19             |   | 25%    |   |
| 55 |   | Jackson Hole Mountain Resort (diesel & biodiesel)                           |   | 156,774                       | gallons                                   | 21,164            | 10 <sup>6</sup> Btu       | 1,617                | tons CO2          | 1,617          | tons CO2         | 0.34%         |   | 1,356          |   | 19%    |   |
| 56 |   | Jackson Hole Mountain Resort (gasoline)                                     |   | 25,217                        | gallons                                   | 3,154             | 10 <sup>6</sup> Btu       | 247                  | tons CO2          | 247            | tons CO2         | 0.05%         |   | 452            |   | -45%   |   |
| 57 |   | Off-road (lawn care, gas widgets)                                           |   | 49,796                        | gallons                                   | 6,228             | 10 <sup>6</sup> Btu       | 488                  | tons CO2          | 488            | tons CO2         | 0.10%         |   | 377            |   | 29%    |   |
| 58 |   | <b>Total off-road fuel and emissions</b>                                    |   | <b>356,483</b>                | <b>gallons</b>                            | <b>46,945</b>     | <b>10<sup>6</sup> Btu</b> | <b>3,642</b>         | <b>tons CO2</b>   | <b>3,642</b>   | <b>tons CO2</b>  | <b>0.8%</b>   |   | <b>3,706</b>   |   | -1.7%  |   |
| 59 |   |                                                                             |   |                               |                                           |                   |                           |                      |                   |                |                  |               |   |                |   |        |   |
| 60 |   | <b>Total transportation</b>                                                 |   | <b>39,097,736</b>             | <b>gallons</b>                            | <b>4,975,879</b>  | <b>10<sup>6</sup> Btu</b> | <b>308,464</b>       | <b>tons CO2e</b>  | <b>395,572</b> | <b>tons CO2</b>  | <b>82.6%</b>  |   | <b>329,112</b> |   | 20%    |   |
| 61 |   |                                                                             |   |                               |                                           |                   |                           |                      |                   |                |                  |               |   |                |   |        |   |
| 62 |   | <b>Landfill (Jackson Hole's share of Teton County Landfill)</b>             |   |                               |                                           |                   |                           |                      |                   |                |                  |               |   |                |   |        |   |
| 63 |   | Electricity                                                                 |   | minimal                       | kWh                                       |                   | 10 <sup>6</sup> Btu       | -                    | tons CO2          | -              | tons CO2         | 0.00%         |   | 7              |   | -100%  |   |
| 64 |   | Propane                                                                     |   | minimal                       | gallons                                   |                   | 10 <sup>6</sup> Btu       | -                    | tons CO2          | -              | tons CO2         | 0.00%         |   | 16             |   | -100%  |   |
| 65 |   | Fuel consumption (diesel & gasoline: onsite)                                |   | 37,500                        | gallons                                   | 4,688             | 10 <sup>6</sup> Btu       | 92                   | tons CO2          | 92             | tons CO2         | 0.02%         |   | 145            |   | -36%   |   |
| 66 |   | Landfill: fugitive methane                                                  |   | 3                             | tons CH4                                  | 146               | 10 <sup>6</sup> Btu       | 3                    | tons CH4          | 88             | tons CO2e        | 0.02%         |   | 7,950          |   | -99%   |   |
| 67 |   | <b>Total landfill</b>                                                       |   | <b>various</b>                |                                           | <b>4,834</b>      | <b>10<sup>6</sup> Btu</b> | <b>95</b>            | <b>na</b>         | <b>181</b>     | <b>tons CO2e</b> | <b>0.04%</b>  |   | <b>8,119</b>   |   | -97.8% |   |
| 68 |   |                                                                             |   |                               |                                           |                   |                           |                      |                   |                |                  |               |   |                |   |        |   |
| 69 |   | <b>Nitrous Oxide sources</b>                                                |   |                               |                                           |                   |                           |                      |                   |                |                  |               |   |                |   |        |   |
| 70 |   | Teton School District athletic fields                                       |   | 1,021                         | kg N                                      | na                |                           | 32                   | kg N2O            | 9              | tons CO2e        | 0.0%          |   | 10             |   | -10%   |   |
| 71 |   | Town of Jackson & Teton County athletic fields and parks                    |   | 2,371                         | kg N                                      | na                |                           | 74                   | kg N2O            | 22             | tons CO2e        | 0.0%          |   | 24             |   | -10%   |   |
| 72 |   | Jackson Hole Golf & Tennis Club                                             |   | 6,516                         | kg N                                      | na                |                           | 203                  | kg N2O            | 59             | tons CO2e        | 0.0%          |   | -              |   |        |   |
| 73 |   | Teton Pines Country Club & Resort                                           |   | 6,308                         | kg N                                      | na                |                           | 197                  | kg N2O            | 57             | tons CO2e        | 0.0%          |   | 64             |   | -10%   |   |
| 74 |   | 3 Creek Ranch Private Golf Club                                             |   | 6,516                         | kg N                                      | na                |                           | 203                  | kg N2O            | 59             | tons CO2e        | 0.0%          |   | -              |   |        |   |
| 75 |   | Shooting Star Golf, Teton Village (estimated)                               |   | 6,725                         | kg N                                      | na                |                           | 210                  | kg N2O            | 61             | tons CO2e        | 0.0%          |   | 68             |   | -10%   |   |
| 76 |   | Snake River Sporting Club, Jackson, Wyoming                                 |   | 6,516                         | kg N                                      | na                |                           | 203                  | kg N2O            | 59             | tons CO2e        | 0.0%          |   | -              |   |        |   |
| 77 |   | Private greenspace in Teton County & Town of Jackson                        |   | 1,629                         | kg N                                      | na                |                           | 51                   | kg N2O            | 15             | tons CO2e        | 0.0%          |   | 15             |   | 2%     |   |
| 78 |   | Targhee Village Golf Course                                                 |   | 6,516                         | kg N                                      | na                |                           | 203                  | kg N2O            | 59             | tons CO2e        | 0.0%          |   |                |   |        |   |
| 79 |   | Snow King Hill Climb World Championships: nitrous fuel additive             |   | 4                             | kg N                                      | na                |                           | 1                    | kg N2O            | 1              | tons CO2e        | 0.0%          |   | 0.54           |   | 79%    |   |
| 80 |   | <b>Total nitrous oxide sources</b>                                          |   | <b>37,603</b>                 | <b>kg N</b>                               |                   |                           | <b>1,377</b>         | <b>kg N2O</b>     | <b>403</b>     | <b>tons CO2e</b> | <b>0.08%</b>  |   | <b>182</b>     |   | 121.0% |   |
| 81 |   |                                                                             |   |                               |                                           |                   |                           |                      |                   |                |                  |               |   |                |   |        |   |
| 82 |   | <b>HFCs and refrigerants</b>                                                |   |                               |                                           |                   |                           |                      |                   |                |                  |               |   |                |   |        |   |
| 83 |   | Refrigerant leakage from refrigerators, freezers, and AC units              |   | 47                            | kg HFC-134a                               | na                | 10 <sup>6</sup> Btu       | 75                   | tons CO2e         | 75             | tons CO2e        | 0.0%          |   | 66             |   | 14%    |   |
| 84 |   | Improper venting of refrigerant at appliance disposal                       |   | 11                            | kg R-12                                   | na                | 10 <sup>6</sup> Btu       | 91                   | tons CO2e         | 91             | tons CO2e        | 0.0%          |   | 1,144          |   | -92%   |   |
| 85 |   | Refrigerant leakage from vehicle air conditioners                           |   | 709                           | kg HFC-134a                               | na                | 10 <sup>6</sup> Btu       | 1,016                | tons CO2e         | 1,016          | tons CO2e        | 0.2%          |   | 892            |   | 14%    |   |
| 86 |   | <b>Total HFCs</b>                                                           |   | <b>767</b>                    | <b>kg refrigerants</b>                    |                   |                           | <b>1,182</b>         | <b>tons CO2e</b>  | <b>1,182</b>   | <b>tons CO2e</b> | <b>0.2%</b>   |   | <b>2,101</b>   |   | -43.8% |   |
| 87 |   |                                                                             |   |                               |                                           |                   |                           |                      |                   |                |                  |               |   |                |   |        |   |
| 88 |   | <b>Total</b>                                                                |   | <b>various units</b>          |                                           | <b>12,370,983</b> | <b>10<sup>6</sup> Btu</b> | <b>various units</b> |                   | <b>478,868</b> | <b>tons CO2e</b> | <b>100.0%</b> |   | <b>409,652</b> |   | 16.9%  |   |
| 89 |   |                                                                             |   |                               |                                           |                   |                           |                      |                   |                |                  |               |   |                |   |        |   |
| 90 |   | <b>Credit for LVE greenpower (Town plus County)</b>                         |   | <b>23,286,893</b>             | <b>kWh</b>                                | <b>237,526</b>    | <b>10<sup>6</sup> Btu</b> | <b>0.034</b>         | <b>lb CO2e/kW</b> | <b>398</b>     | <b>tons CO2e</b> | <b>0.1%</b>   |   | <b>611</b>     |   | -34.9% |   |

**Cell:** K2

**Comment:** Rick Heede:

This worksheet summarizes all sources of greenhouse gas emissions attributable to the community of Jackson Hole for 2018 (note: a few calculations are for 2017). See the boundary definition in the Summary Report and the set of worksheets for details. All relevant sums -- physical units, energy units, GHG emissions, and CO2e equivalent -- are linked to their respective worksheets and thus automatically updated whenever any changes are made.

**Cell:** F5

**Comment:** Rick Heede:

EPA (undated) "Natural Gas Methane Units Converter," 2 pp., [www.epa.gov/gasstar](http://www.epa.gov/gasstar); PDF in Climate / Emissions / Emissions Factors. 1 ton CH4 = 47.792 million Btu

**Cell:** B16

**Comment:** Rick Heede:

CMS estimates fugitive methane from the production, processing, pipelining, and distribution of natural gas. It is an estimate of system losses, and is not attributed to Lower Valley Energy. CMS assumes the U.S. average heating value of 1,027 Btu per cubic foot in converting tons of fugitive methane into cubic feet.

**Cell:** P35

**Comment:** Rick Heede:

In 2008 CMS reported Town and County fuel and emissions by gasoline and diesel. In 2017 CMS reports Teton Sheriff and Other and Jackson Police and Other. Hence totals are comparable but line items are not.

**Cell:** J66

**Comment:** Richard Heede:

Includes a small amount of fugitive carbon dioxide. See Landfill worksheet.

**Cell:** B90

**Comment:** Rick Heede:

LVE provided 2017 data on "green power" purchases in Jackson and the rest of Teton County within this inventory's emission boundary. This sum (23.3 million kWh, up from 13.8 million kWh in 2008) is multiplied by LVE's delivered electricity emission factor.

**Cell:** I90

**Comment:** Rick Heede:

LVE's emission factor per delivered kWh. See "Electricity" worksheet for details.