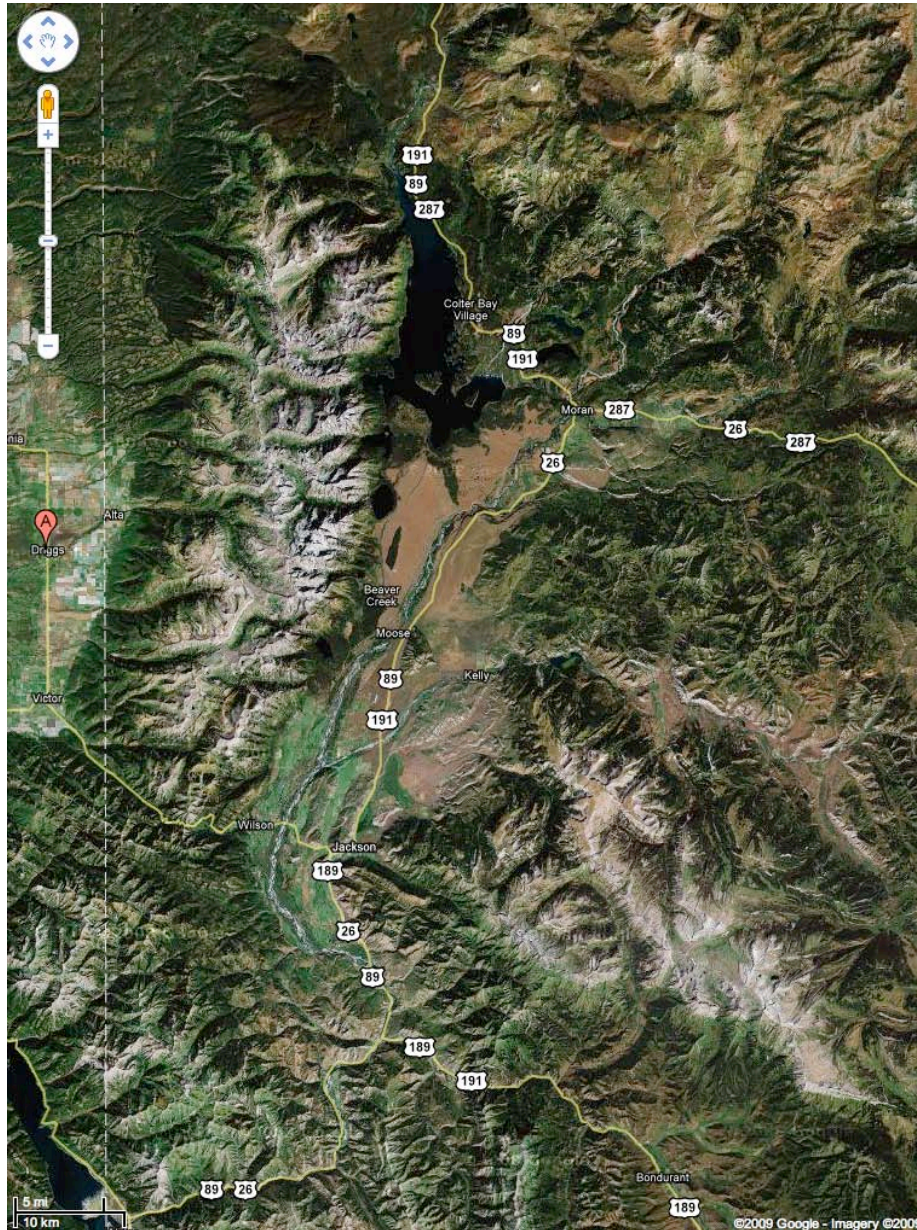
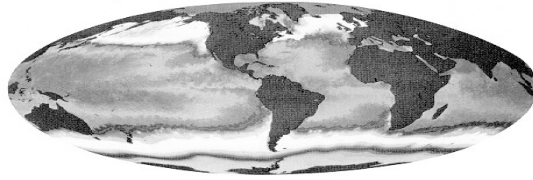


Jackson Hole Inventory of Greenhouse Gas Emissions in 2008



By Richard Heede
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9 October 2009



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Note on units: common US units are used throughout. The spreadsheets, however, estimate emissions in both US and metric units. Emissions of methane and nitrous oxide are also expressed in CO₂-equivalent terms (CO₂e). See Appendix A for conversions and emissions factors.



Cover: A high-altitude aerial image of the Jackson Hole area. Courtesy of maps.google.com.

Summary

Jackson Hole Energy & Emissions Inventory

Rick Heede

Boundary definition (Town of Jackson, Jackson Hole, and Teton County except for areas west of Teton Pass)

Buildings sector

Electricity

Natural Gas

Propane

Fuel oil (if material)

City buildings and facilities (the 10x10 report may suffice for this segment of the report¹)

Special District buildings and facilities (e.g., Wastewater Treatment Facility, JH's share of County Landfill)

School district buildings and facilities.

Discussion of residential, commercial, government, institutional, and other building types.

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, etc

City, County, State, and Federal vehicles (e.g., police cruisers, snowplows, GTNP)

Waste hauling from Waste Transfer Station to Sublette County Landfill

Local bus systems (START)

School buses

Air travel and aviation

Commercial air travel via Jackson Hole Airport (United, American, Delta, Frontier, Northwest, and SkyWest: all flights departing Jackson to DEN, DFW, MSP, SLC, CHI, ATL)

Business and personal jets and turboprops operating out of 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 County Landfill (methane: only if material)

Methane emissions BPA's fossil-fired electricity (if material) for Lower Valley Energy's purchased electricity

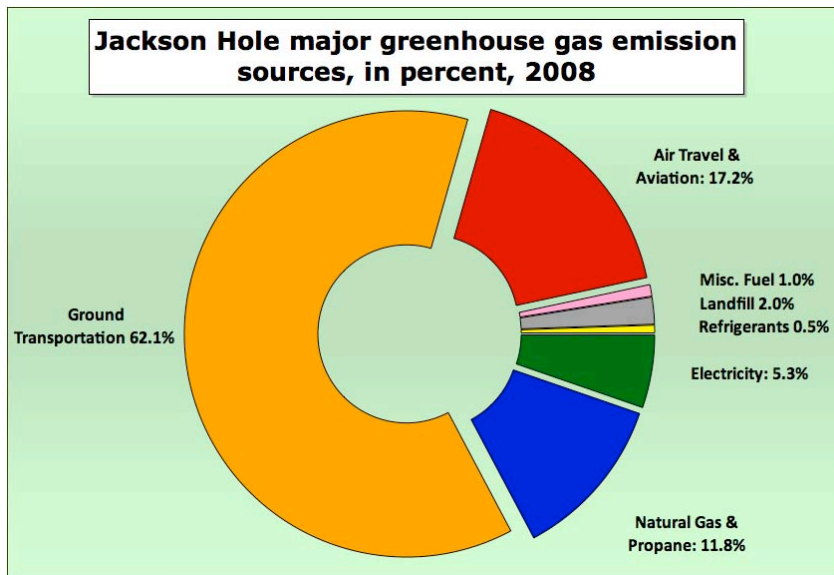
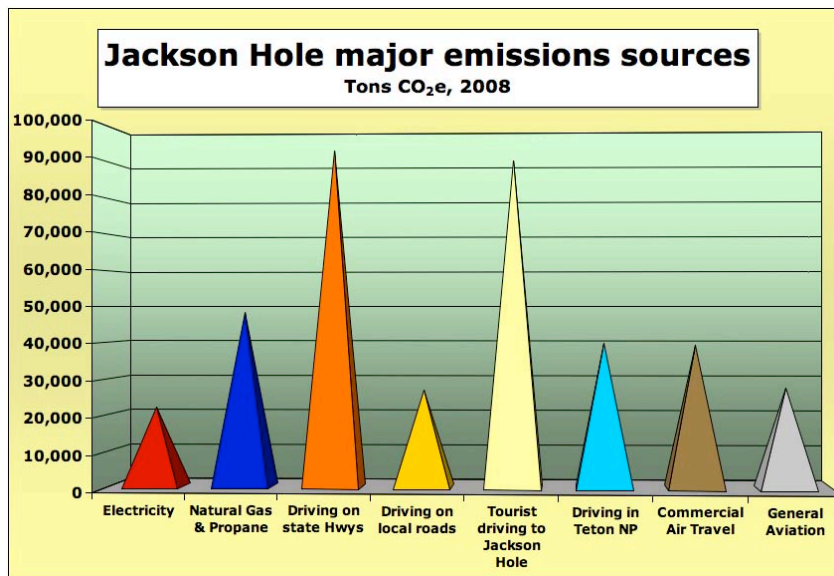
N₂O from fertilizer application (chiefly for Town Parks and golf courses)

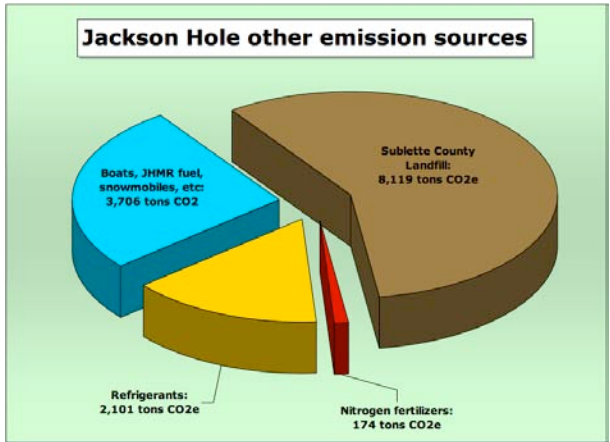
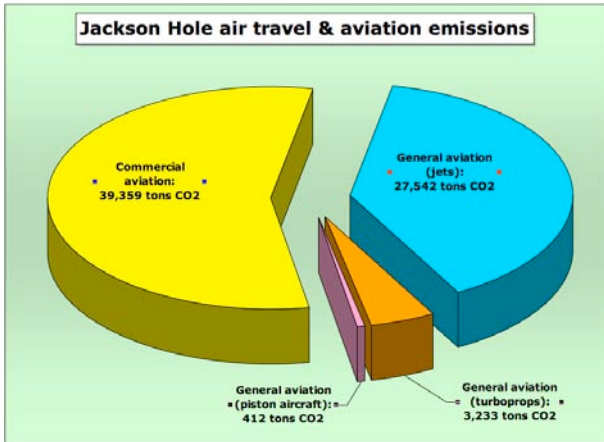
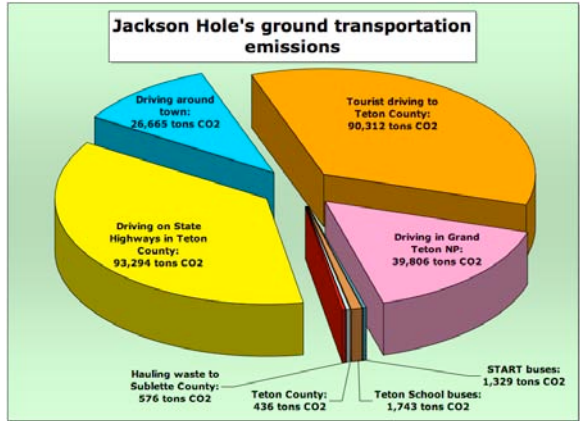
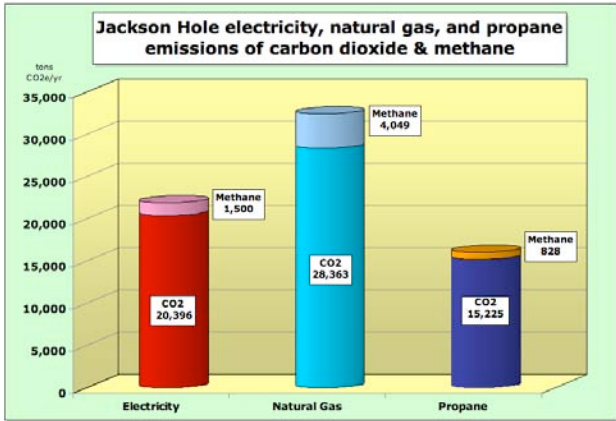
References, data sources, list of contacts

¹ CMS has not reviewed the details of the 10x10 report or the quantification and its protocol.

Table 1. Summary of Jackson Hole greenhouse gas emissions 2008

| SOURCE | TONS CO₂e | PERCENT |
|-----------------------------------|-----------------------------|----------------|
| Electricity (buildings) | 21,896 | 5.3 |
| Natural Gas & Propane (buildings) | 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 |





References

- Ackerman, Frank (2000) "Waste Management and Climate Change," *Local Environment*, vol. 5:223-229; see also Ackerman: *Waste, Recycling, and Climate Change*, www.tufts.edu/tuftsrecycles/energy.htm
- Bateman, David (1999) "Refrigerant and Air-Conditioning with Reduced Environmental Impact," *Conference on Climate Change and Ozone Protection*, 27-29Sep99; DuPont Fluoroproducts, www.earthscape.org/r1/etf01/bad02.html
- California Climate Action Registry (2007) *General Reporting Protocol Reporting Entity-Wide Greenhouse Gas Emissions*, Version 2.2, Mar07, 117 pp., www.climateregistry.org
- Danish Ministry of Environment & Energy (2003?) *Greenhouse gas emissions from international aviation and allocation options*, www2.mst.dk/udgiv/publications/2003/87-7972-489-2/html/indhold_eng.htm
- Darby, Marta, Richard Heede, & Kim Peterson (2009) *Aspen Greenhouse Gas Emissions Inventory, 2007: An update to the 2004 baseline*, for the City of Aspen's Canary Initiative, commissioned by the City of Aspen, Climate Mitigation Services, 64 pp, 14 worksheets, www.climatemitigation.com
- Davis, Stacy, Susan Diegel, & Robert Boundy (2009) *Transportation Energy Data Book*, edition 28, Oak Ridge National Laboratory, USDOE, www.cta.ornl.gov/rpts.
- Delucchi, Mark (2003) *A Lifecycle Emissions Model (LEM: Lifecycle emissions from transportation fuels, motor vehicles, transportation modes, electricity use, heating and cooking fuels, and materials*, Institute for Transportation Studies, University of California-Davis, 444 pp., www.its.ucdavis.edu/people/faculty/delucchi/index.php#LifecycleEmissions
- Ecoss Consulting (2007) *Yellowstone inventory*, Dan Olson (emailed 14July)
- Ewing, Reid, et al (2008) *Growing Cooler: The Evidence on Urban Development and Climate Change*, Urban Land Institute, 150 pp., www.uli.org
- Grand Teton National Park (2005) *Public Use reporting and Counting Instructions*, www.nps.gov/grte/parkmgmt/statistics.htm
- Heede, Richard (2008a) *Carbon In Our Daily Lives: an exploration of everyday climate impacts*, commissioned by Sopris Foundation, Aspen, Colorado, 8 pp (fully footnoted), and 2 pp (brochure only).
- Heede, Richard (2008b) *Town of Frisco Inventory of Greenhouse Gas Emissions in 2006*, commissioned by Town of Frisco, Colorado, 106 pp, plus fourteen worksheets
- Heede, Richard (2008c) *Milton Hershey School, Hershey, Pennsylvania: Inventory of Greenhouse Gas Emissions, 2006/2007*, commissioned by Milton Hershey School, 136 pp., www.mhs-pa.org
- Heede, Richard (2007) *Anybody Home? Energy Consumption and Carbon Emissions from Second Homes in Aspen*, Aspen Second Homes Energy Study, commissioned by Sopris Foundation, Aspen, 21 pp.
- Heede, Richard (2006) *Aspen Greenhouse Gas Emissions 2004: For City of Aspen's Canary Initiative*, Climate Mitigation Services, Snowmass, Colorado, 50 pp, plus 42 pp of worksheets and notes.
- International Council for Local Environmental Initiatives (2008) *Draft Local Government Operations Protocol*, with California Air Resources Board, California Climate Action Registry, ICLEI - Local Govt for Sustainability, Climate Registry, www.iclei-usa.org/programs/climate/ghg-protocol, 158 pp.
- Intergovernmental Panel on Climate Change (2007) *Climate Change 2007, Fourth Assessment Report, The Physical Science Basis*, IPCC Working Group 1, Cambridge University Press, 996 pp.
- Jackson Hole Mountain Resort (2006) *Sustainability Report for 2005*, www.jacksonhole.com/info/faq.env.asp
- Kircheggssner, David A, Stephen D. Piccot, & Sushma S. Masemore (~1997) *An Improved Inventory Of Methane Emissions From Coal Mining In The United States*, U.S. Environmental Protection Agency, Triangle Park, NC, 48 pp., www.epa.gov/ttn/chief/ap42/ch14/related/mine.pdf
- Kircheggssner, David A., Robert A. Lott, R. Michael Cowgill, Matthew R. Harrison, & Theresa M. Shires (~2000) *Estimate of Methane Emissions from the U.S. Natural Gas Industry*, US EPA: AP 42, Fifth Edition, vol. 1 chapter 14: Greenhouse Gas Biogenic Sources; www.epa.gov/ttn/chief/ap42/ch14/

- Littlejohn, Margaret (1996) *Grand Teton National Park visitor study*, Cooperative Park Studies Unit, University of Idaho (Moscow, Idaho) -- Out of Print.
- Loomis, J., & L. Caughlan (2004) *Economic analysis of alternative bison and elk management practices on the National Elk Refuge and Grand Teton National Park: a comparison of visitor and household responses*, U.S. Geological Survey, Fort Collins Science Center Open-File Report 2004-1305. 110 p.
- McKibben, Bill (2008) *Deep Economy: The Wealth of Communities and the Durable Future*, 272 pp., www.StepItUp2007.org
- National Park Service Climate Friendly Parks, CLIP software
- National Park Service (2004) *Grand Teton National Park Traffic Package*, 8 pp.
- National Park Service (2004) *Yellowstone National Park Traffic Package*, 17 pp.
- National Renewable Energy Laboratory (1998) *Life Cycle Inventory of Biodiesel and Petroleum Diesel for Use in an Urban Bus*, May1998, 314 pp. www.nrel.gov
- Sacklin, John A.; Legg, Kristin L.; Creachbaum, M. Sarah; Hawkes, Clifford L.; Helfrich, George (2000) *Winter visitor use planning in Yellowstone and Grand Teton National Parks* Author: Source: Cole, McCool, Borrie, & O'Loughlin (2000). Wilderness science in a time of change conference, volume 4: *Wilderness visitors, experiences, and visitor management*; May99; Missoula.
- Sausen, R., I. Isaksen, V. Grewe, D. Hauglustaine, D.S. Lee, G. Myhre, M.O. Köhler, G. Pitari, U. Schumann, F. Stordal and C. Zerefos (2005) "Aviation radiative forcing in 2000: An update on IPCC (1999)," *Meteorol. Zeitung*, vol. 14:555-561.
- Town of Jackson & Teton County (2006) *Pathways Master Plan*, 102 pp., www.townofjackson.com/resources/files//Town%20Services/F.%20Pathways/MasterPlanDraft092806.pdf
- Transportation Research Board, National Academy of Sciences (2009) *Guidebook on Preparing Airport Greenhouse Gas Emissions Inventories*, Airport Cooperative Research Program, FAA, ACRP #11, Brian Kim, Ian Waitz, Mary Vigilanti, & Royce Bassarab. onlinepubs.trb.org/onlinepubs/acrp/acrp_rpt_011.pdf
- U.S. Dept of Energy (2007) *Fuel Economy Guide, Model Year 2007*, www.fueleconomy.gov
- U.S. Energy Information Administration (2006) *Annual Energy Review 2005*, U.S. DOE, Washington, www.eia.doe.gov
- U.S. Energy Information Administration (2006) *Emissions of Greenhouse Gases in the United States 2005*, U.S. DOE, Washington, www.eia.doe.gov
- U.S. Environmental Protection Agency (various) *Emissions & Generation Resource Integrated Database (eGRID)*, see "Owner-Based Power Control Area" worksheet EGRDPCA000), www.epa.gov/cleanenergy/egrid/index.html
- Vincent, Richard C., Kevin William Cleary, Alberto Ayala, & Richard Corey (2004) "Emissions of HFC-134a from Light-Duty Vehicles in California," California Air Resources Board, *Society of Automotive Engineers*, May04, SAE # 2004-01-2256.
- Weber, Christopher L., & H. Scott Matthews (2008) "Food-Miles and the Relative Climate Impacts of Food Choices in the United States," *Environmental Science & Technology*, vol. 42:3508-3513.
- World Resources Institute & World Business Council for Sustainable Development (2004) *The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard*, Revised Edition, March, 112 pp., www.ghgprotocol.org
- World Resources Institute (2005) *GHG Protocol HFC Tool (Version 1.0) Calculating HFC and PFC Emissions from the Manufacturing, Installation, Operation and Disposal of Refrigeration & Air-conditioning Equipment (Version 1.0) Guide to calculation worksheets (January 2005)*
- Wuebbles, Donald (editor) (2006) *Workshop on the Impacts of Aviation on Climate Change: A Report of Findings and Recommendations*, Jun06, Cambridge, MA, 64 pp.