The City of Aspen - 2014 Government Operations GHG Inventory

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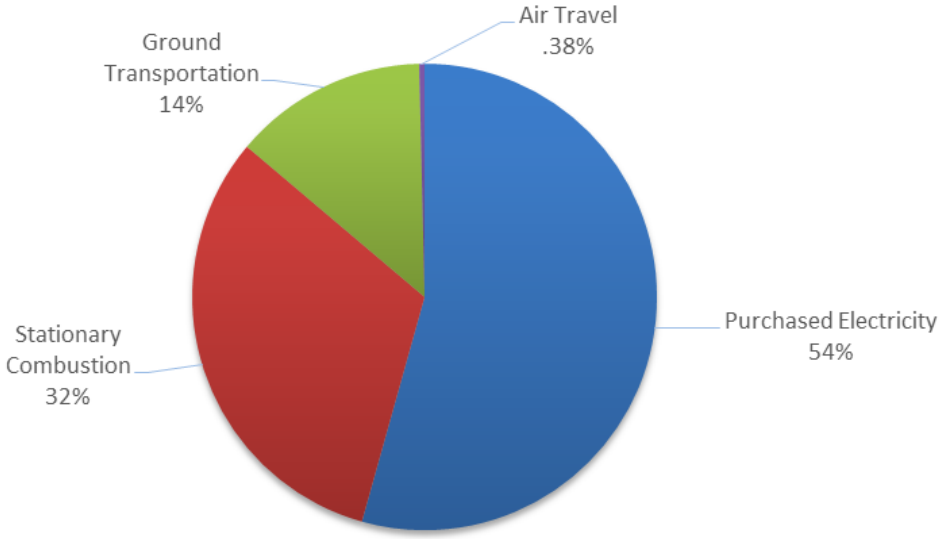
Introduction: In March 2005, the City of Aspen (COA) adopted a plan to address climate change by reducing greenhouse gas (GHG) emissions at both the 'government operations' and 'community' scales. 'Government operations' GHG emissions refer to those that are a direct result of conducting City business. 'Community' scale emissions are those that result from all sources and activities within the community (private, public, nonprofit sector and citizens). An underlying component of the City's Climate Action Plan is to reduce GHG emissions 30% below 2004 levels by 2020 and 80% below those levels by 2050 - at both the government operations and community scales. Progress in achieving the GHG reduction goals is tracked via GHG inventories. Since 2004, government operations inventories have been compiled annually, while community inventories are generally compiled every 3 years. This document is the *City of Aspen's 2013-2014 Government Operations GHG Inventory*.

2013/14 GHG Target and Executive Summary: Aspen's government operations inventories have always coincided with the 'Goals and Outcomes' (G&O) year, which runs October through September. Accordingly, this inventory quantifies emissions that occurred from October 1, 2013 through September 30, 2014 and compares them against the same time period from past years. The G&O reduction target (Citywide-G&O measure 8.b) for this year is 13% below the 2004/05 baseline. *Given that government operations emissions were reduced 42% below the baseline, the City met and exceeded this year's GHG reduction goal*. Compared to 2012/13, aggregate GHG emissions were reduced by 14%. At 47%, the electricity sector experienced the highest percentage of CO_2 reductions since the base year, followed by stationary combustion (40%) and travel (14%). The most significant reduction in emissions over the past GHG year also occurred in the electricity sector (22%), followed by transportation (14%) and stationary combustion (11%).

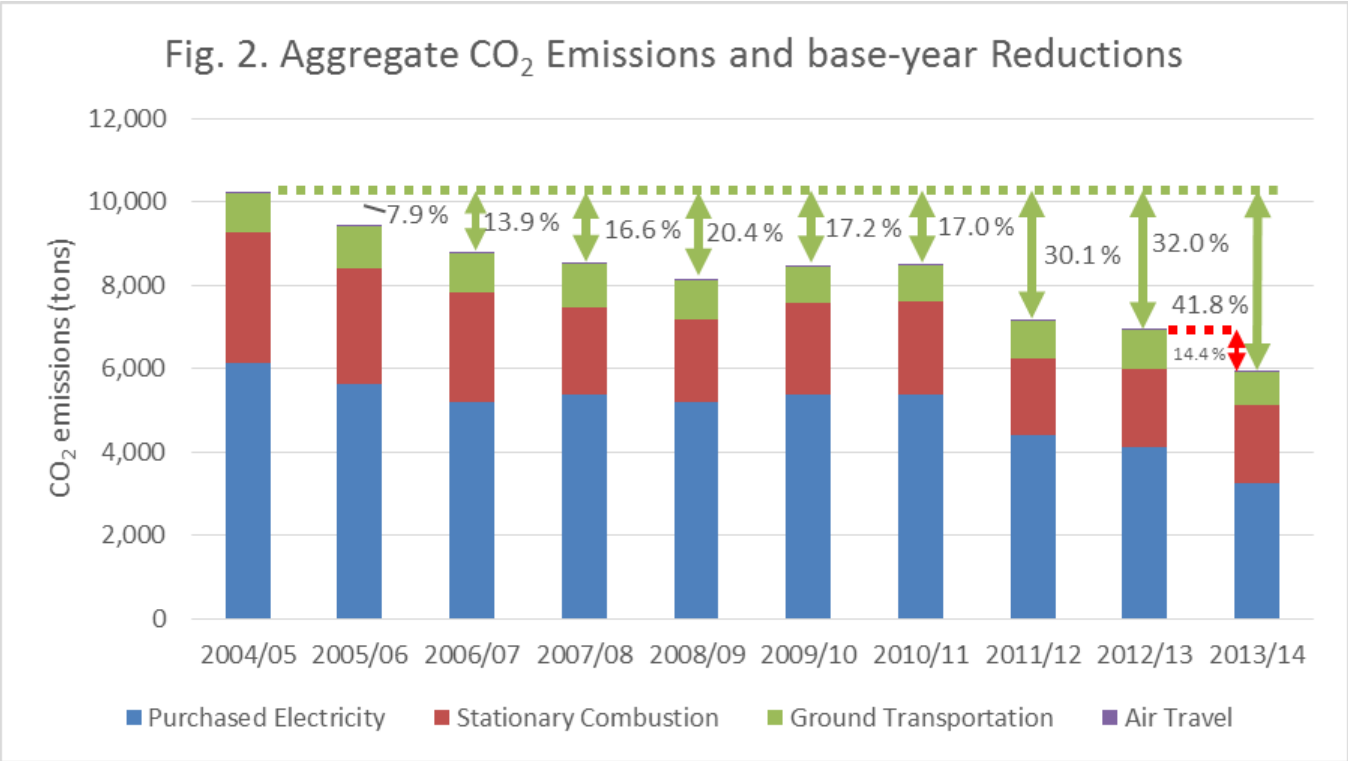
2013/14 Aggregate GHG Emissions Numbers: Aggregate GHG emissions represent the entire City GHG picture by summing the emissions from each of our 4 tracked sectors (purchased electricity, stationary combustion, ground transportation, air travel). At 54% of the total, purchased electricity represents the largest portion of the City's 2013/14 GHG emissions, followed by stationary combustion (natural gas) at 32%, ground transportation at 14% and finally air travel at .38 % (Figure 1). Generally, this breakdown tracks consistently with past years.

Fig. 1. CO_2 Emissions by Source Type, 2013/14



With the exception of the years between 2010 and 2011, aggregate emissions have been reduced each year since tracking began. Figure 2 describes emissions totals and reductions in net emissions for each year since tracking began. This year, as a whole, the City achieved:

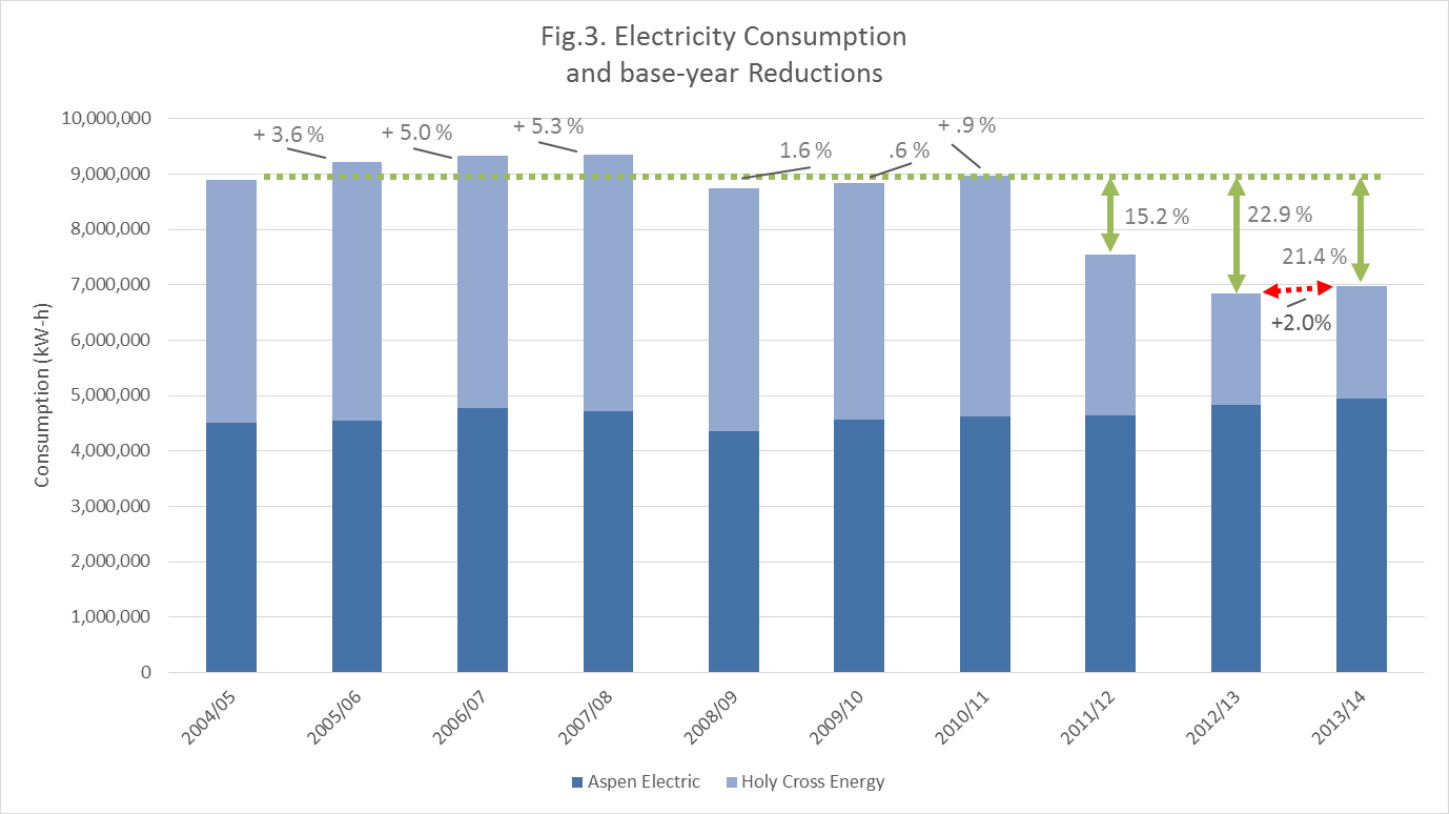
- A 42% reduction from the 2004 baseline (Fig.2.).
- A 14% percent reduction from the 2012/13 GHG year.



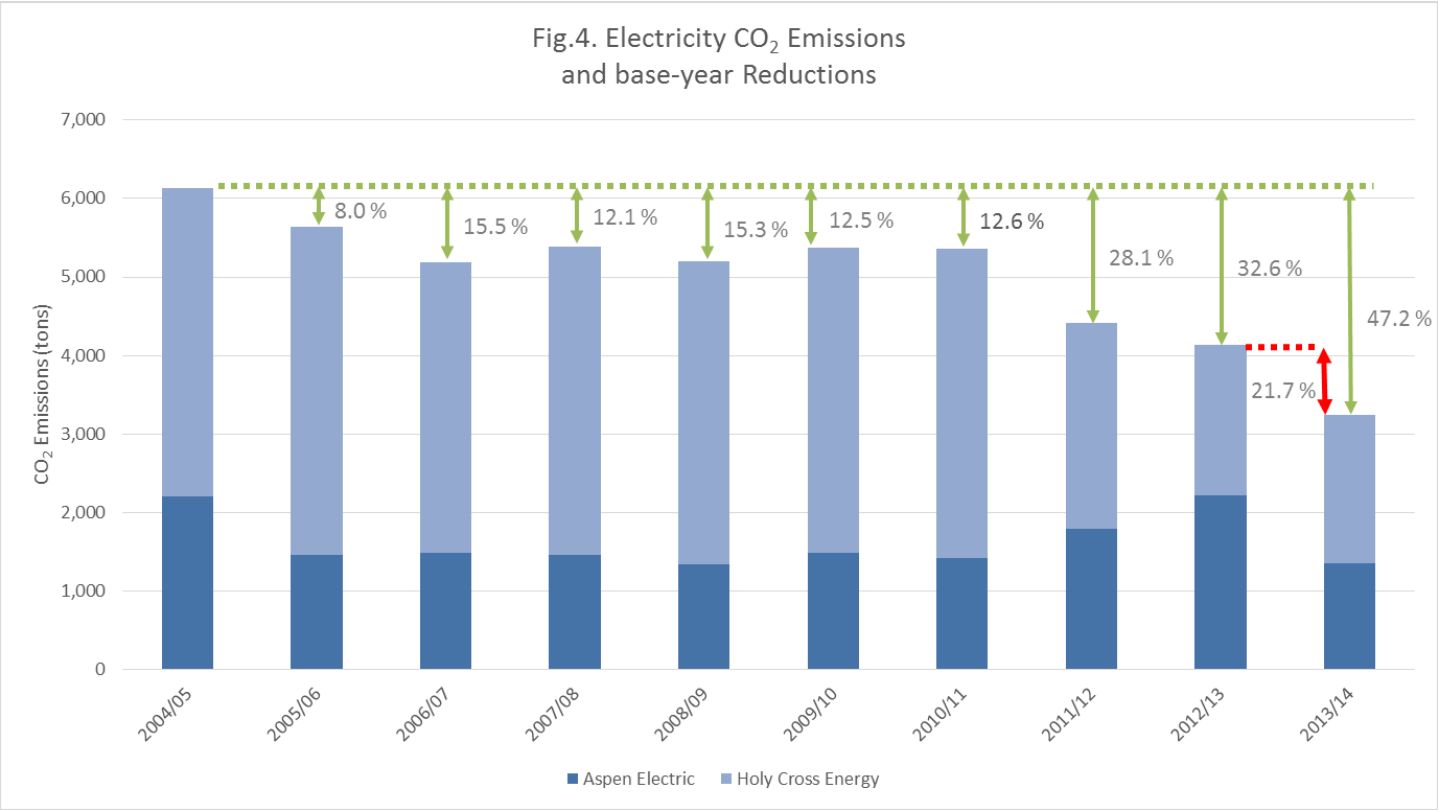
2013/14 Purchased Electricity Consumption and GHG Emissions: The City purchases electricity from Aspen Electric, a municipal electric utility which it owns and operates, and Holy Cross Energy (HCE) a cooperative distribution utility. A majority of the COA's buildings and facilities are in the Aspen Electric service area. During the 2013/14 GHG year, the City government's annual aggregate electricity consumption declined by just over 1,900 MWh compared with 2004/05 and increased by 134 MWh from 2012/13 (Appendix A). Proportionally, the bulk of this longer term consumption decrease occurred in buildings and facilities on HCE's grid, which reflects a concerted effort to shift electricity procurement to Aspen Electric, in part because of the municipal utility's smaller carbon factor. CO_2 emissions associated with the City's electricity consumption declined predominantly due to changes in Aspen Electric's underlying fuel mix and the utility's associated carbon factor (Appendix A). While Aspen Electric significantly grew the percentage of its renewable generation assets, HCE maintained a fuel

mix and an associated carbon factor identical to the previous year[1]. Aspen Electric's carbon factor was 906 lbs of CO_2/MWh in 2004/05, 947 lbs CO_2/MWh in 2012/13 and 403 lbs CO_2/MWh in 2013/14. HCE's carbon factor of 1810 lbs CO_2/MWh has dropped slightly since 2004/05 but remains equivalent to the previous year (Appendix A). Figures 3 and 4 compare electricity consumption and emissions from purchased electricity, respectively, from 2004 through the present. A review of Figures 3 and 4 reveals that:

- Electricity consumption has decreased 21% since the base year but has increased 2% since the previous year (Fig.3.)
- CO_2 emissions attributable to electricity consumption have dropped 47% since the base year and 21% since 2012/13 (Fig.4.).



[1] In actuality, HCE's portfolio changed significantly in 2014 (decxreased). Final carbon factor calculations were unavailable at the time of publication, so the 2013 factor is applied here. Updated factors will likely be available in April 2015. COA Internal GHG protocol is to use the most current available factor for the inventory year.



2013/14 Stationary Combustion Volume and GHG Emissions: The COA purchases natural gas from SourceGas - a Golden, Colorado based investor owned utility - for stationary combustion in various municipal buildings and facilities. Unlike electricity which is generated off-site and delivered through distribution lines, natural gas is delivered in pipelines and combusted on-site in boilers. After a bump in consumption during the 2012/13 year, COA's natural gas consumption declined to roughly 2011/12 levels this year (Figure 5). Consumption has declined significantly since the base year while the SourceGas carbon factor has increased from 0.1008 to 0.1102 lbs CO_2/kBtu (Appendix A). Thus, COA's reductions in natural gas related emissions can only be correlated to changes in consumption, which are typically associated with energy efficiency and conservation measures. Figures 5 and 6 show changes in natural gas consumption and CO_2 emissions from stationary combustion, respectively, from 2004 – 2014, and reveal that:

- Natural gas consumption declined 45% since the base year and 10% since last year (Fig.5.).
- CO_2 emissions attributable to stationary combustion decreased by nearly 40% since the base year and 11% since 2012/13 (Fig.6.).

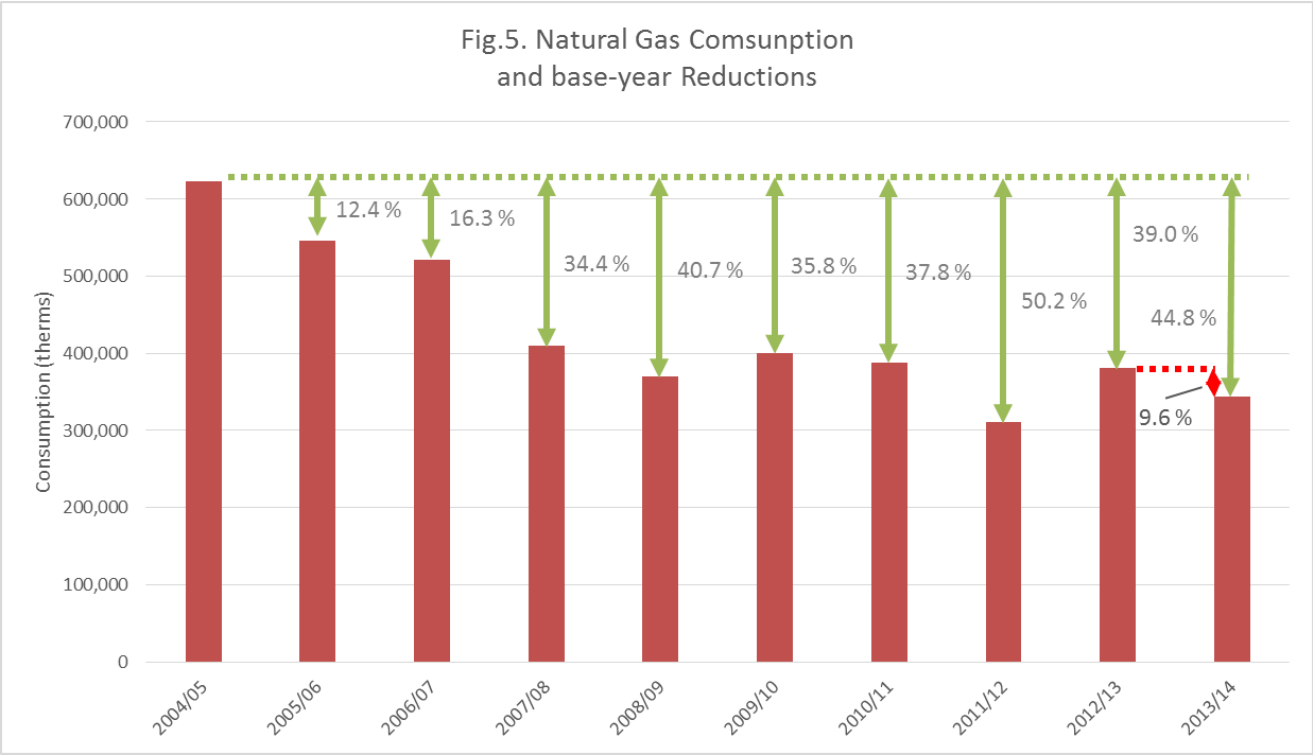


Fig.5. Natural Gas Comsunption
and base-year Reductions
Consumption (therms)
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
12.4 %
16.3 %
34.4 %
40.7 %
35.8 %
37.8 %
50.2 %
39.0 %
44.8 %
9.6 %
2004/05
2005/06
2006/07
2007/08
2008/09
2009/10
2010/11
2011/12
2012/13
2013/14

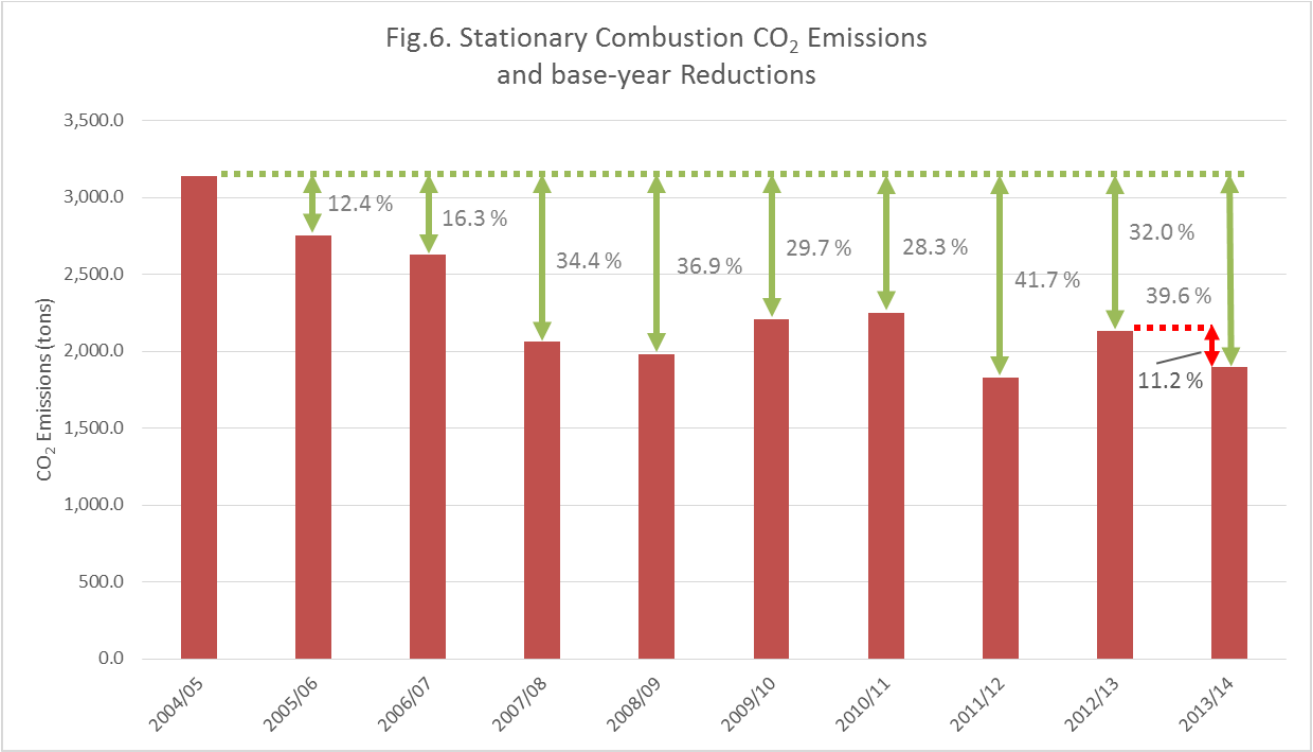
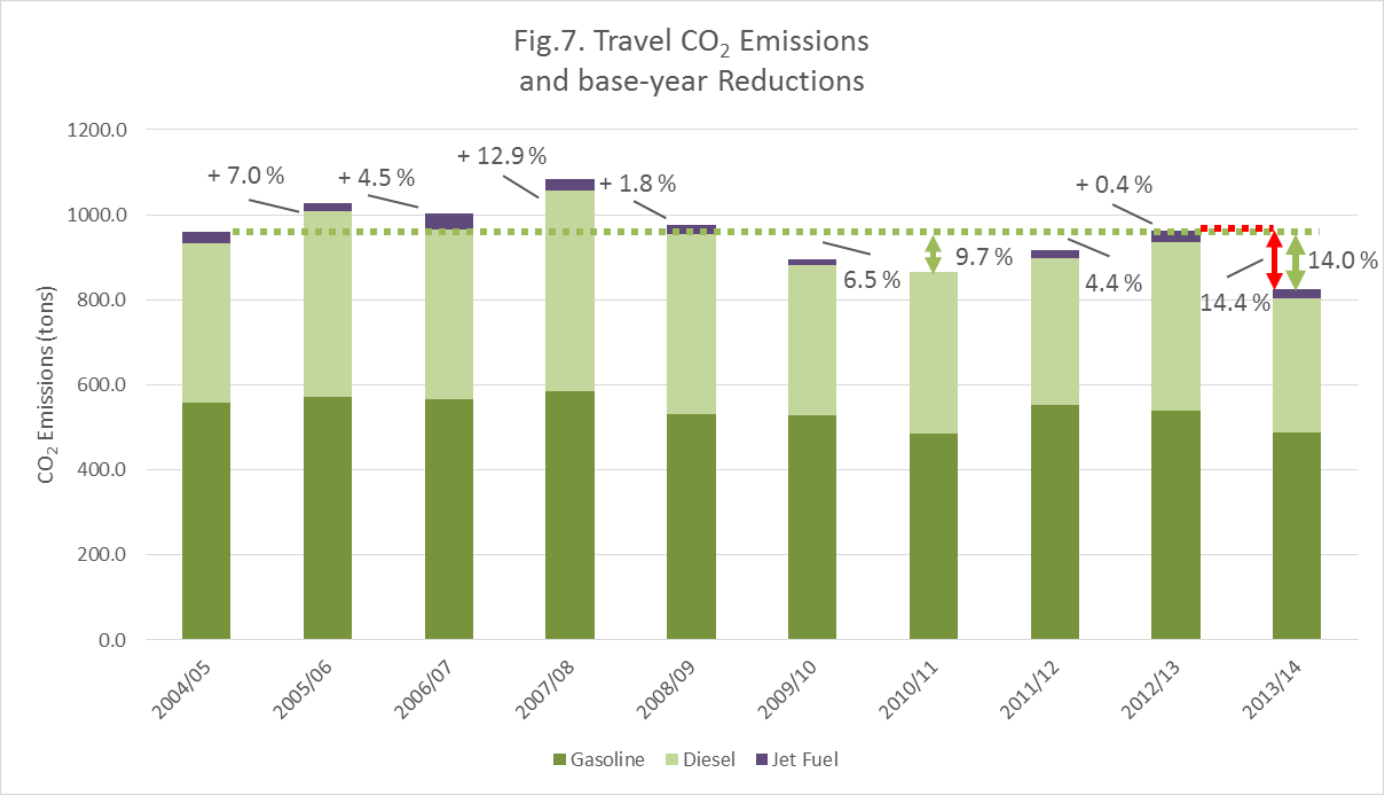


Fig.6. Stationary Combustion CO_2 Emissions
and base-year Reductions
CO_2 Emissions (tons)
3,500.0
3,000.0
2,500.0
2,000.0
1,500.0
1,000.0
500.0
0.0
12.4 %
16.3 %
34.4 %
36.9 %
29.7 %
28.3 %
41.7 %
32.0 %
39.6 %
11.2 %
2004/05
2005/06
2006/07
2007/08
2008/09
2009/10
2010/11
2011/12
2012/13
2013/14

Gasoline, Diesel and Jet Fuel Emissions 2013/14: COA combustion of gasoline and diesel results from 'fleet operations' and 'department travel' while jet fuel consumption results only from 'department travel'. 'Fleet operations' involves all gasoline and diesel consumption associated with the operation of city-owned vehicles and machinery that are fueled at the City pumps. 'Department travel' describes purchases of fuel that were made at public facilities. Typically, this occurs when employees are traveling for work in their personal vehicles or flying for work purposes. In 2013/14, consumption of all 3 fuels decreased compared to the base year and last year. All transportation-related fuel consumption numbers can be seen in Appendix A, and Figure 7 shows aggregate GHG emissions from transportation by fuel type from 2004 through 2014. Notably:

- Travel emissions have declined by 14% since the base year and 14.4% since last year (Fig.7.).
- These emissions actually exceeded 2004 levels in 5 out of the 9 years tracked, peaking in 2007/08 (Fig.7.).



Operational Indicators – Actions and Activities during the 2013/14 GHG Year: While quantifying annual emissions and changes between years is relatively straightforward, understanding why changes have occurred tends to be less accessible. Looking at the raw consumption, carbon content and emissions data can provide insights about categorical scale changes (i.e. changes in fuel mix), but falls short of revealing specific activities that occurred and influenced COA's GHG emissions during a specific year. The following section on 'Operational Indicators' discusses specific activities that occurred in GHG-related City operations during the 2013/14 year. By

maintaining a written record of these activities, current and future planners will be better able to connect the dots between changes in GHG emissions and related operational activities. The following is by no means a comprehensive record of all GHG-related changes and activities that occurred during the 2013/14 GHG year but serves as a partial account of several significant ones.

Electricity Generation: Changes in the types of resources producing the power that the City purchases directly affect GHG emissions. During the 2013/14 year, Aspen Electric, the City's municipal utility made substantial strides in reducing the carbon intensity of its electricity per unit of energy produced (Appendix A). Per Will Dolan, COA's Renewable Energy Coordinator, "the major contributors to Aspen Electric's increased renewable production for the year ending September, 2014 were twofold: 1) above-average snowfall during the winter of 2013/14 led to a particularly favorable spring runoff which, in turn, increased hydroelectric production at the City's existing generation facilities; and 2) the City began to take delivery of energy from the newly-commissioned Ridgway hydroelectric plant in March of 2014. Together, these two hydrologic factors boosted Aspen's overall renewable energy percentage considerably year-over-year. A few ancillary components further contributed to renewables' outperformance during this period—namely, efficiency upgrades completed at the Ruedi Reservoir (enhanced turbine housing aspiration and powerhouse ventilation have increased the installation's power production range to become more effective during times of high release flows) and Maroon Creek (gearbox realignment and seal replacement) facilities in 2013".

Energy Efficiency & Conservation: Just as changes in generation assets affect CO_2 emissions, so do changes in the amount of energy consumed in buildings and facilities operated by the City. During the 2013/14 GHG year, notable energy efficiency projects were deployed. The following, provided by Utility Efficiency Specialist Ryland French, describe those that relate to COA's government operations and thus directly correlate to changes in the City's purchased electricity consumption.

<u>Utilities Efficiency Grants completed in 2014:</u>

- 3 waterless urinals in Aspen Public Golf Course facilities.
- Insulating Blinds installed in the Transportation Department's offices.
- Insulating blinds installed in the Truscott Conference Room.
- Solar Powered Motion Sensor LED Lighting around Water Department.
- Water Department Pump Stations Electrical Energy Use Monitoring.
- Water Department Energy Star Refrigerator (replaced 22 year old fridge).

<u>Wheeler Opera House Efficiency Improvements:</u>

- Replacement of both custom-sized front windows, which are thirty years old, with new window systems that have a higher-integrity gas layer between glazing and glass coatings that will suppress passive solar heat in summer and cold-air temperature transfer in winter.

- Repairs to all Wheeler historic doors (nine total) that will ensure cold-air transfer is minimized through warp correction, new gaskets, full-on replacement, and all other appropriate approaches.

Building Permits and Inspections: Looking at the number of building permits and inspections over the years provides insights relating to the operations of a large department whose workload directly corresponds to development and construction intensity. COA staff must travel to each inspection site, so the number of annual inspections may relate to emissions from ground transportation. Though one might expect a correlational relationship, this is not always the case. While FY 2014 saw the greatest number of permits issued and inspections performed since 2007 and 2008 (Fig.8.), respectively, citywide GHG emissions from transportation declined significantly. Per Stephen Kanipe, COA's Chief Building Official, staff traveled on foot or by bike to inspection sites more frequently than in the past. In part, this has to do with the large number of redevelopment projects in the urban core, but also reflects a concerted effort by City staff in the building department to reduce single occupancy vehicle trips when possible. This inverse relationship suggests that workload may not directly correspond to emissions intensity, and that changes in behavior can influence and lower overall emissions even as growth is occurring.

Figure 8. Permit and Inspection Numbers by Fiscal Years, 2004 – 2014 (thru 12-16-14)

Fiscal Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Permit Totals	1739	2011	2033	1593	1334	1408	1391	1315	1547	1586
Inspection Totals	2790	4001	4163	4189	3117	2463	2665	2833	3343	3523

Further, the number of inspections performed and permits issued may serve as a sort of a proxy for COA "busyness". During a slow inspection year, it is plausible assume that portion of the City government employs fewer staff and uses less energy (and vice versa). Interestingly, the number of inspections performed and permits issued in 2014 increased slightly over 2013, as did electricity consumption. While these associations provide insights that are anecdotal at best, presenting permit and inspection numbers in this segment of the *GHG Inventory* provides additional perspective about the 2013/14 GHG year that may be useful in considering operational indicators relating to emission reductions targets, progress and strategies.

Other Operational Indicators: While by no means a comprehensive list of every City government activity that impacted emissions during the 2013/14 year, these additional indicators may provide further insights related to the past year's changes in energy consumption and GHG emissions:

- The number of City employees (including full-time, part-time, contract, intermittent, temporary) increased from approximately 396 during the 2012/13 GHG year to 405 during the 2013/14 GHG year.
- Production of treated water at the City's treatment facility increased from 1036 million gallons (MG) during the 2012/13 GHG year to 1186 MG during the 2013/14 GHG year. Given that the production and distribution of treated water by the City of Aspen Utilities uses approximately 997 kWh of electricity per

MG, this increase in water production alone corresponds to an additional 149,550 kWh of consumed electricity over the past year.

- Because the Aspen Pitkin County Housing Authority (APCHA) and a significant number of the City's police staff moved out of the Pitkin County building and into newly City-rented facilities during the 2013/14 GHG year, the corresponding additional electricity use is now being tracked in our government operations inventory. Previously, only a small portion of APCHA and the City PD's electricity and consumption were reflected in the City's government operations inventories. Now, the City is fully tracking the energy consumption and associated emissions of these two new (albeit temporary) facilities.

Conclusion: The City of Aspen is making significant progress in reducing CO_2 emissions associated with its overall operations. It has met and exceeded the 2013/14 reduction target as specified by G&O measure 8.b. This achievement keeps the City on track to achieve its 2020 and 2050 GHG reduction goals, though success will require continued vigilance. The 13% below baseline reduction target assigned to this year was based on a 2005 analysis outlining an incremental step down towards the 2020 goal from 2004 onward. Given that we have exceeded original reduction targets over the past few years, the upcoming 2014/2015 G&O target has been adjusted to require a 29% reduction in GHG emissions from 2004 levels. Achieving next year's goal will essentially require maintaining current energy consumption levels, which may be challenging given rebounding economic growth and several anticipated new building developments.

Continuing to reduce emissions while the organization grows will be a significant challenge requiring continuous analysis, action and program deployment. As the COA approaches upcoming G&O targets and the long-term CO_2 reduction goals, the Canary Initiative will continue to engage and collaborate with City departments to ensure ongoing success.

Acknowledgments: Compiling GHG inventories requires contributions and inputs from numerous individuals. The Canary Initiative would like to thank the following individuals for their efforts in making this analysis possible:

- Fred Perrin and Jeremy Isenhart, Canary Initiative interns
- Marcie Aten, SourceGas (provided a monthly consumption analysis on COA accounts)
- Wayne Alderson, Holy Cross Energy (provided a monthly consumption analysis on COA accounts)
- Patrick Baird, Aspen Electric (provided a monthly consumption analysis on COA accounts)
- Linda Chi, City of Aspen Streets Department (provided monthly 'fleet' fuel consumption analysis, and 'department travel' data for Streets)
- Will Dolan, COA Renewable Energy Coordinator (provided narrative of changes in underlying fuel mix and 2004 through 2014 Aspen Electric carbon factors)
- Ryland French, COA EE Intern (provided narrative of 2013/14 energy efficiency projects)
- Scott Miller, Public Works Director (provided insights on facilities changes)
- Phil Overeynder, Special Projects Engineer (provided water production data)

- Debbie Pearce, City Finance Accountant (provided employee numbers data)
- Rebecca Hodgson, City Manager's Office (provided monthly 'department travel' data)
- Jeff Pendarvis, City Asset Management (provided monthly 'department travel' data)
- Tara Nelson, City Attorney's Office (provided monthly 'department travel' data)
- Angela Scorey, City Building Department, Planning (provided us with Figure 8., as well as monthly 'department travel' data)
- Linda Manning, City Clerk's/Courts Office (provided monthly 'department travel' data)
- Karen McConnell, Utilities – Electric and Water (provided monthly 'department travel' data)
- Shelby Holmes, City Engineering Department (provided monthly 'department travel' data)
- Stacy Keating, City Environmental Health Department (provided monthly 'department travel' data)
- Sheila Babbie, City Finance (provided monthly 'department travel' data)
- Steve Aitken, Golf (provided monthly 'department travel' data)
- Cindy Christensen, City/County Housing Authority (provided monthly 'department travel' data)
- Heather Becker, Human Resources (provided monthly 'department travel' data)
- Jim Considine, IT and GIS (provided monthly 'department travel' data)
- Shirley Ritter, Kids First (provided monthly 'department travel' data)
- Debbi Kirkwood, City Parking Department (provided monthly 'department travel' data)
- Teresa Hackbarth, Parks (provided monthly 'department travel' data)
- Kathy Tolle, City of Aspen Police (provided monthly 'department travel' data)
- Susan Arenella, Recreation Department (provided monthly 'department travel' data)
- Nancy Leslie, Special Events (provided monthly 'department travel' data)
- Jennifer Outwater, Transportation Department (provided monthly 'department travel' data)
- Amy Kaiser, Wheeler Opera House (provided monthly 'department travel' data

Appendix A – COA Energy Consumption, Carbon Factors and CO_2 Emissions, 2004-2014

City of Aspen - Energy Consumption, Carbon factor and CO2 Comparisons	The City's GHG Year Runs from October - Spetember									
	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014
Electricity (kWh)										
Aspen Electric kWh	4,503,904	4,540,335	4,779,715	4,710,644	4,357,486	4,564,009	4,621,878	4,640,150	4,832,443	4,938,228
Holy Cross kWh	4,384,777	4,670,182	4,553,883	4,645,440	4,390,413	4,273,707	4,345,980	2,899,421	2,019,902	2,048,349
Total kWh	8,888,681	9,210,517	9,333,598	9,356,084	8,747,899	8,837,716	8,967,858	7,539,571	6,852,345	6,986,577
Carbon Factors										
Aspen Electric (lbs CO2/MWh)	906	552	645	612	612	668	596	825	947	403
Holy Cross (lbs CO2/MWh)	1795	1795	1795	1570	1730	1770	1830	1810	1810	1810
CO2 emissions (tons)										
Aspen Electric (tons CO2)	2,202.1	1,455.1	1,485.0	1,460.0	1,333.4	1,490.0	1,422.1	1,785.8	2,213.3	1,354.8
Holy Cross (tons CO2)	3,935.3	4,191.5	3,698.7	3,932.6	3,863.8	3,879.6	3,943.4	2,624.0	1,923.1	1,882.9
All Electricity (tons CO2) UM	6,137.5	5,646.5	5,183.8	5,392.6	5,197.2	5,369.6	5,365.5	4,409.8	4,136.5	3,237.7
Source Gas - Natural gas (therms)	623,496	546,491	521,673	409,285	369,435	400,506	387,891	310,643	380,589	344,116
Carbon factor (lbs/kBtu)	0.1008	0.1008	0.1008	0.1008	0.1008	0.1102	0.1102	0.1179	0.1102	0.1102
Natural Gas (Tons CO2)	3,141.5	2,753.5	2,628.4	2,062.2	1,982.2	2,207.4	2,253.2	1,831.2	2,135.3	1,896.1
Fleet & Dept Travel - Gasoline (gallons)	56,831	58,167	57,741	59,544	54,197	53,957	49,358	56,371	55,053	49,820
Carbon factor (lbs/kBtu)	0.1567	0.1567	0.1567	0.1567	0.1567	0.1567	0.1567	0.1567	0.1567	0.1567
Gasonline (Tons CO2)	556.6	569.7	565.5	583.2	530.8	528.4	483.4	552.1	539.2	487.9
Fleet & Dept Travel - Diesel (gallons)	33,504.00	39,248.00	35,696.00	42,321.00	37,820.00	31,413.00	34,183.00	30,893.00	35,365.00	28,058.00
Carbon factor (lbs/kBtu)	0.1789	0.1789	0.1789	0.1789	0.1789	0.1789	0.1789	0.1789	0.1789	0.1789
Diesel (Tons CO2)	374.9	439.2	399.4	473.6	423.2	351.5	382.5	345.7	395.7	314.0
Dept Travel - Jet fuel (gallons)	2599.00	1661.00	3521.00	2488.00	2058.00	1541.00	0.00	1832.00	2673.00	2121.00
Carbon factor (lbs/kBtu)	0.1614	0.1614	0.1614	0.1614	0.1614	0.1614	0.1614	0.1614	0.1614	0.1614
Jet Fuel (Tons CO2)	27.1	17.3	36.8	26.0	21.5	16.1	0.0	19.1	27.9	22.2
Total COA Energy (Short Tons CO2)	**10,238**	**9,426**	**8,814**	**8,538**	**8,155**	**8,473**	**8,485**	**7,158**	**7,235**	**5,958**