Chapter 2
Inventory and Forecast of Alaska's GHG Emissions

Introduction

This chapter summarizes Alaska's greenhouse gas (GHG) emissions and sinks (carbon storage) from 1990 to 2025. Under an agreement with the Western Governors' Association, the Center for Climate Strategies (CCS) prepared a draft of Alaska's GHG emissions inventory and reference case projections for the Alaska Department of Environmental Conservation (DEC), which appears in Appendix D of this report. The draft inventory and reference case projections provided DEC with an initial, comprehensive understanding of current and possible future GHG emissions. The draft report was provided to the Alaska Climate Change Mitigation Advisory Group (MAG) and its Technical Work Groups (TWGs) to assist them in understanding past, current, and possible future GHG emissions in Alaska, and thereby inform the policy recommendation development process. The MAG and TWGs have reviewed, discussed, and evaluated the draft inventory and methodologies, as well as alternative data and approaches for improving the draft GHG inventory and forecast (I&F).[1] The I&F has since been revised to address the comments provided by the MAG. The information in this chapter reflects the information presented in the final *Alaska Greenhouse Gas Inventory and Reference Case Projections* report (hereafter referred to as the Inventory and Projections report).

Historical GHG emission estimates (1990–2005)[2] were developed using a set of generally accepted principles and guidelines for state GHG emission inventories, relying to the extent possible on Alaska-specific data and inputs. The reference case projections (2006–2025) are based on a compilation of various existing projections of electricity generation, fuel use, and other GHG-emitting activities, along with a set of simple, transparent assumptions described in the final Inventory and Projections report.

The Inventory and Projections report covers the six types of gases included in the U.S. GHG inventory: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). Emissions of these GHGs are presented using a common metric, CO_2 equivalence, which indicates the relative contribution of each gas, per unit mass, to global average radiative forcing on a global warming potential-weighted basis.[3]

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[1] Center for Climate Strategies. *Final Alaska Greenhouse Gas Inventory and Reference Case Projections: 1990–2025*. Prepared for the Alaska Climate Change Mitigation Advisory Group, July 2009, available at http://www.akclimatechange.us/Inventory_Forecast_Report.cfm.

[2] The last year of available historical data for each sector varies between 2000 and 2005.

[3] Changes in the atmospheric concentrations of GHGs can alter the balance of energy transfers between the atmosphere, space, land, and oceans. A gauge of these changes is called radiative forcing, which is a simple measure of changes in the energy available to the Earth–atmosphere system. Holding all else constant, increases in GHG concentrations in the atmosphere will produce positive radiative forcing (i.e., a net increase in the absorption of energy by the Earth). See: Boucher, O., et al. "Radiative Forcing of Climate Change." Chapter 6 in Climate Change 2001: The Scientific Basis. Contribution of Working Group 1 of the Intergovernmental Panel on Climate

It is important to note that the emission estimates reflect the GHG emissions associated with the electricity sources used to meet Alaska's demands, corresponding to a consumption-based approach to emissions accounting. Another way to look at electricity emissions is to consider the GHG emissions produced by electricity generation facilities in the state, a production-based method. The study covers both methods of accounting for emissions, but for consistency, all total results are reported as consumption-based. Because Alaska has very limited electricity imports or exports, the GHG emissions on a production basis are the same as GHG emissions from a consumption basis. In contrast, electricity imports and exports are an important issue in other states.

Alaska GHG Emissions: Sources and Trends

Table 2-1 provides a summary of GHG emissions estimated for Alaska by sector for 1990, 2000, 2005, 2010, 2020, and 2025. As shown in this table, Alaska is estimated to be a net source of GHG emissions (positive, or gross, emissions). Alaska's forests serve as sinks of GHG emissions (removal of emissions, or negative emissions). Alaska's net emissions subtract the equivalent GHG reduction from emission sinks from the gross GHG emission totals. The following sections discuss GHG emission sources and sinks, trends, projections, and uncertainties.

Historical Emissions

Overview

In 2005, on a gross emissions consumption basis (i.e., excluding carbon sinks), Alaska accounted for approximately 50.6 million metric tons of carbon dioxide equivalent (MMtCO2e) emissions, an amount equal to 0.7% of total U.S. gross GHG emissions. On a net emissions basis (i.e., including carbon sinks), Alaska residents accounted for approximately 49.2 MMtCO2e of emissions in 2005, an amount equal to 0.8% of total U.S. net GHG emissions.4 Alaska's GHG emissions are growing at a much faster pace than those of the nation as a whole. From 1990 to 2005, Alaska's gross GHG emissions increased by 30%, while national gross emissions rose by 16%.5

On a per-capita basis, Alaska residents emitted about 79 metric tons (t) of gross CO_2e in 2005, significantly higher the national average of 24 tCO_2e. Figure 2-1 illustrates the state's emissions per capita and per unit of economic output. Per-capita emissions have increased somewhat in Alaska through the 1995–2005 period, while national per-capita emissions have remained relatively constant over this period. The higher per capita emission rates and growth in Alaska are driven by emissions from the industrial and transportation sectors, which are much higher than the national average. In both Alaska and the nation as a whole, economic growth exceeded

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Change, Cambridge University Press, Cambridge, United Kingdom. Available at: http://www.grida.no/climate/ipcc_tar/wg1/212.htm.

[4] The national emissions used for these comparisons are based on 2008 emissions from U.S. Environmental Protection Agency, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2006, April 15, 2008, EPA 430-R-08-005. Available at: http://www.epa.gov/climatechange/emissions/usinventoryreport.html.

[5] The growth in Alaska's emissions from 1990 to 2005 is primarily associated with the transportation and the residential, commercial, and industrial (RCI) fuel consumption sectors.

emissions growth throughout the 1990–2005 period. From 1990 to 2005, emissions per unit of gross product dropped by 26% nationally, and by 17% in Alaska.[6]

Table 2-1. Alaska GHG emissions, historical and reference case projection, by sector*

Sector	1990	2000	2005	2010	2020	2025
	MMtCO₂e					
Energy (Consumption Based)	**38.6**	**45.3**	**49.6**	**52.5**	**58.8**	**60.9**
Electricity Use (Consumption)	**2.76**	**3.19**	**3.20**	**3.58**	**3.74**	**4.02**
Electricity Production (in-state)	2.76	3.19	3.20	3.58	3.74	4.02
Coal	*0.40*	*0.42*	*0.48*	*0.50*	*0.79*	*0.79*
Natural Gas	*2.00*	*2.29*	*2.14*	*2.22*	*2.36*	*2.36*
Oil	*0.37*	*0.48*	*0.57*	*0.86*	*0.58*	*0.86*
Imported/Exported Electricity	0.00	0.00	0.00	0.00	0.00	0.00
Residential/Commercial Fuel Use	**3.77**	**4.33**	**3.88**	**3.91**	**4.12**	**4.07**
Coal	*0.76*	*0.79*	*0.70*	*0.69*	*0.67*	*0.66*
Natural Gas	*1.79*	*2.22*	*1.87*	*1.91*	*2.09*	*2.13*
Petroleum	*1.21*	*1.30*	*1.29*	*1.29*	*1.34*	*1.26*
Wood (CH_4 and N_2O)	*0.012*	*0.013*	*0.023*	*0.023*	*0.023*	*0.023*
Industrial Fuel Use/Fossil Fuel Industry	**20.5**	**22.9**	**24.7**	**26.5**	**30.9**	**31.8**
Coal/Coal Mining	*0.009*	*0.010*	*0.009*	*0.009*	*0.009*	*0.010*
Natural Gas/Natural Gas Industry	*13.4*	*17.7*	*19.1*	*20.5*	*25.1*	*26.1*
Petroleum/Oil Industry	*7.10*	*5.18*	*5.57*	*5.98*	*5.78*	*5.60*
Wood (CH_4 and N_2O)	*0.012*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
Transportation	**11.5**	**14.9**	**17.8**	**18.5**	**20.1**	**21.1**
Aviation	*7.15*	*10.6*	*12.9*	*13.1*	*13.4*	*13.7*
Marine Vessels	*0.83*	*0.48*	*0.61*	*0.72*	*1.00*	*1.17*
On-road Vehicles	*3.41*	*3.71*	*4.19*	*4.55*	*5.57*	*6.20*
Rail and Other	*0.082*	*0.075*	*0.056*	*0.057*	*0.062*	*0.063*
Industrial Processes	**0.051**	**0.20**	**0.33**	**0.45**	**0.75**	**0.96**
Limestone and Dolomite Use (CO_2)	0.000	0.000	0.008	0.008	0.009	0.009
Soda Ash (CO_2)	0.006	0.006	0.006	0.006	0.007	0.007
ODS Substitutes (HFC, PFC)	0.001	0.17	0.30	0.42	0.72	0.94
Electric Power T&D (SF_6)	0.044	0.025	0.024	0.017	0.010	0.008
Waste Management	**0.32**	**0.53**	**0.63**	**0.52**	**0.73**	**0.86**
Solid Waste Management	0.26	0.46	0.56	0.45	0.65	0.78
Wastewater Management	0.057	0.067	0.068	0.071	0.076	0.079
Agriculture	**0.053**	**0.054**	**0.053**	**0.056**	**0.066**	**0.073**
Enteric Fermentation	0.013	0.015	0.020	0.023	0.029	0.034
Manure Management	0.001	0.002	0.004	0.005	0.009	0.012
Agricultural Soils	0.039	0.037	0.030	0.029	0.028	0.028
Gross Emissions (Consumption Basis)	**39.0**	**46.1**	**50.6**	**53.5**	**60.3**	**62.8**
Increase relative to 1990		*18%*	*30%*	*37%*	*55%*	*61%*
Emissions Sinks	**–0.3**	**–1.4**	**–1.4**	**–1.4**	**–1.4**	**–1.4**
Forestry and Land Use	–0.3	–1.4	–1.4	–1.4	–1.4	–1.4

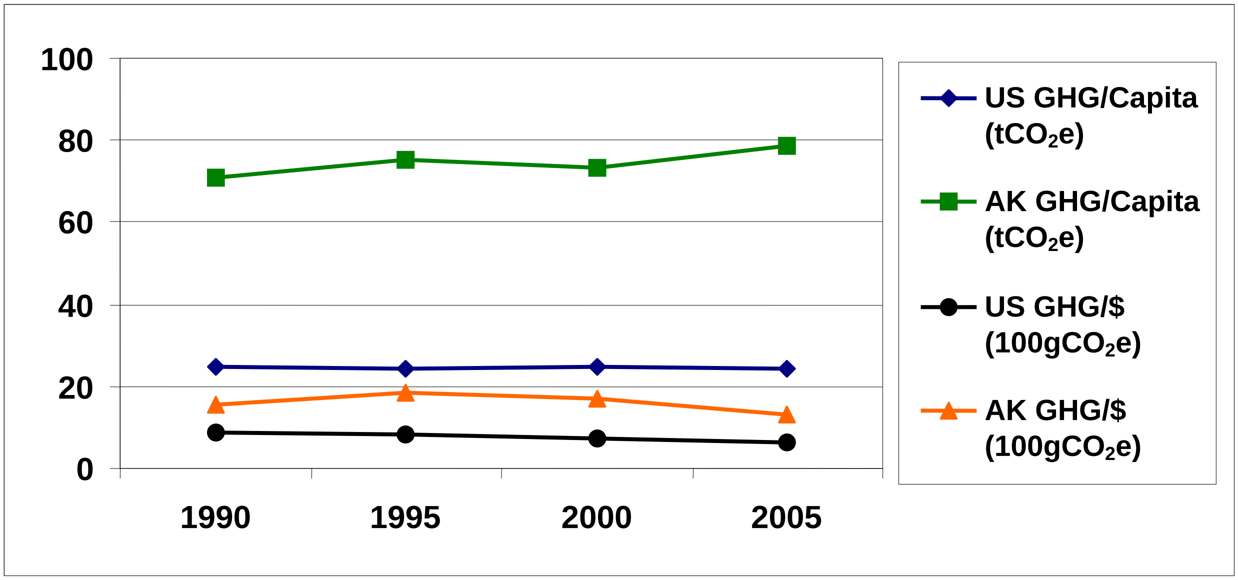
[6] Based on real gross domestic product (millions of chained 2000 dollars) that excludes the effects of inflation. U.S. Department of Commerce, Bureau of Economic Analysis. "Gross Domestic Product by State." Available at: http://www.bea.gov/regional/gsp/.

Net Emissions (Consumption Basis) (Including Forestry and Land Use Sinks)	**38.7**	**44.7**	**49.2**	**52.1**	**58.9**	**61.4**

$MMtCO_2e$ = million metric tons of carbon dioxide equivalent; CH_4 = methane; CO_2 = carbon dioxide; N_2O = nitrous oxide; ODS = ozone-depleting substance; HFC = hydrofluorocarbon; PFC = perfluorocarbon; SF_6 = sulfur hexafluoride; T&D = transmission and distribution.

* Totals may not equal exact sum of subtotals shown in this table due to independent rounding.

Figure 2-1. Alaska and U.S. gross GHG emissions, per-capita and per-unit gross product

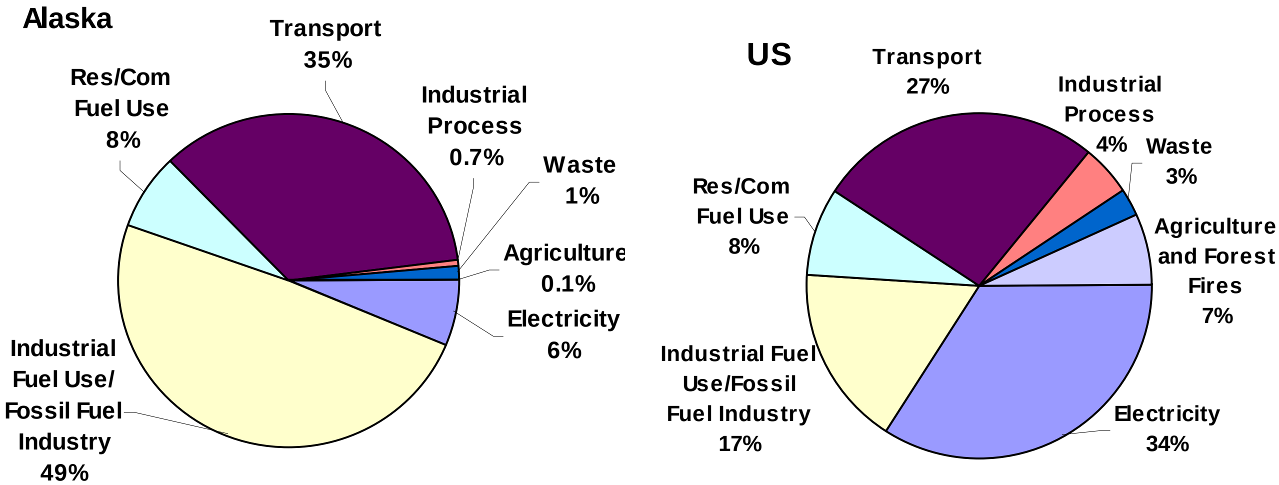


AK = Alaska; g = gram; GHG = greenhouse gas; tCO_2e = metric tons of carbon dioxide equivalent

The principal sources of Alaska's GHG emissions in 2005 are the industrial and transportation sectors, accounting for 49% and 35% of Alaska's gross GHG emissions, respectively (Figure 2-2). The industrial sector includes fossil fuel combustion at industrial sites as well as fossil fuel industry emissions associated with natural gas production, processing, transmission and distribution (T&D), flaring, and pipeline fuel use, as well as with oil production and refining and coal mining emission releases. The next-largest contributor is the combustion of fossil fuel by the residential and commercial sectors, accounting for 8% of gross GHG emissions in 2005. Electricity production accounted for 7% of gross GHG emissions in 2005. The remaining sectors—agriculture, landfills and wastewater management facilities, and industrial processes—accounted for about 2% of the state's emissions in 2005. Industrial process emissions comprised only 0.7% of state GHG emissions in 2005, but these emissions are rising due to the increasing use of HFCs as substitutes for ozone-depleting chlorofluorocarbons.[7] Other industrial process emissions result from CO_2 released during soda ash, limestone, and dolomite use. In addition, SF_6 is released due to the use of electric power T&D equipment.

[7] Chlorofluorocarbons are also potent GHGs. However, they are not included in GHG estimates because of concerns related to implementation of the Montreal Protocol on Substances That Deplete the Ozone Layer. See Appendix J in the Final Inventory and Projections report for Alaska, available at http://www.akclimatechange.us/Inventory_Forecast_Report.cfm.

Figure 2-2. Gross GHG emissions by sector, 2005: Alaska and U.S.



Notes: Res/Com = Residential and commercial fuel use sectors. Emissions for the residential and commercial fuel use sectors are associated with the direct use of fuels (natural gas, petroleum, coal, and wood) to provide space heating, water heating, process heating, cooking, and other energy end uses. The commercial sector accounts for emissions associated with the direct use of fuels by, for example, hospitals, schools, government buildings (local, county, and state), and other commercial establishments.

The industrial fuel use/fossil fuel industry sector accounts for direct fuel combustion in the industrial sector as well as fugitive methane that occurs from leaks and venting during the production, processing, transmission, and distribution of fossil fuels. The industrial processes sector accounts for emissions associated with manufacturing and excludes emissions included in the industrial fuel use/fossil fuel industry sector.

The transportation sector accounts for emissions associated with fuel consumption by all on-road and non-highway vehicles. Non-highway vehicles include jet aircraft, gasoline-fueled piston aircraft, railway locomotives, boats, and ships. Emissions from non-highway agricultural and construction equipment are included in the industrial sector.

Electricity = Electricity generation sector emissions on a consumption basis. In Alaska, the electricity consumed is assumed to be the same as the electricity produced in the state.

Forestry emissions refer to the net CO_2 flux[8] from forested lands in Alaska, which account for about 35% of the state's land area.[9] Alaska's forests are estimated to be net sinks of CO_2 emissions in the state, reducing net GHG emissions by 1.4 $MMtCO_2e$ in 2005.

Reference Case Projections

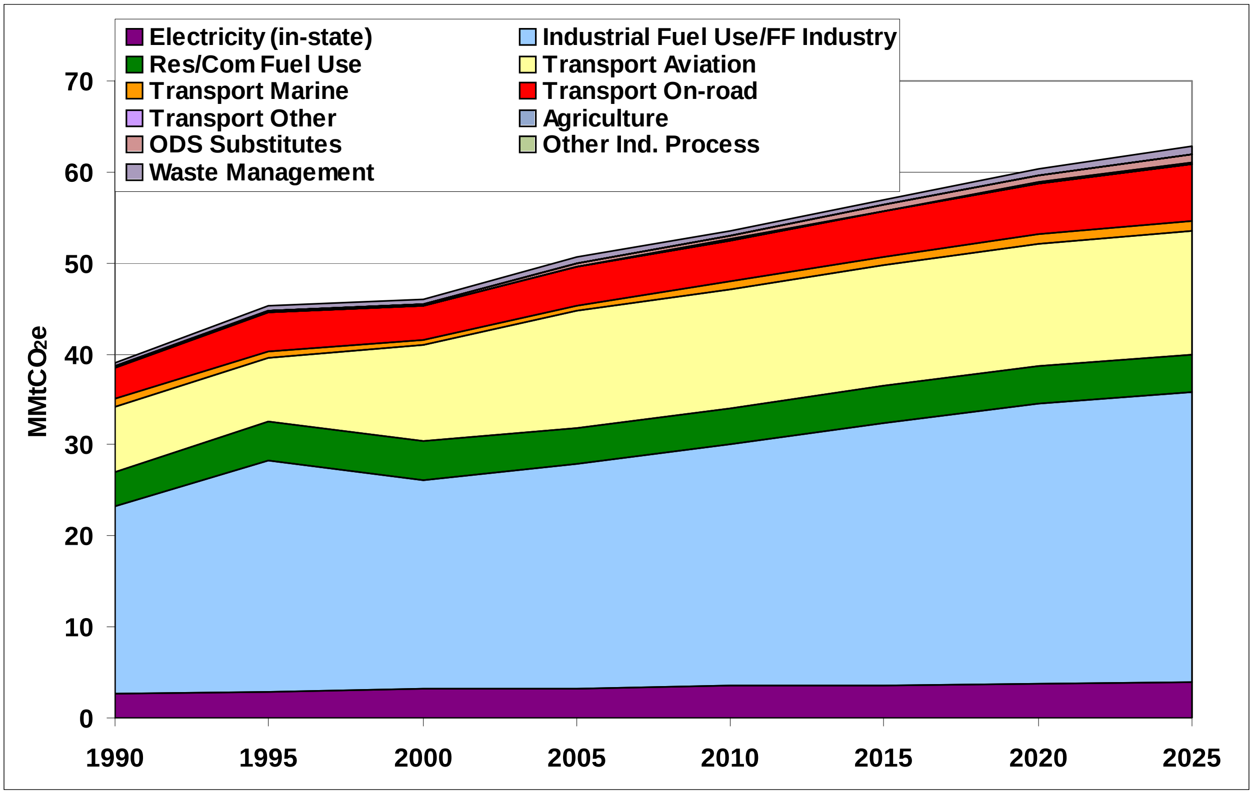
Relying on a variety of sources for projections, as noted in the Inventory and Projections report, a simple reference case projection of GHG emissions through 2025 was developed. As illustrated in Figure 2-3 and shown numerically in Table 2-1, under the reference case projections, Alaska's gross GHG emissions continue to grow steadily, climbing to about 62.8 $MMtCO_2e$ by 2025, or 61% above 1990 levels. This equates to a 1.4% annual rate of growth from 1990 to 2025. Relative to 2005, the share of emissions associated with industrial sector and industrial processes increases somewhat to 51% and 2%, respectively, by 2025. The shares of emissions from the transportation and residential and commercial fuel use sectors both decrease

[8] "Flux" refers to both emissions of CO_2 to the atmosphere and removal (sinks) of CO_2 from the atmosphere.

[9] Alaska Forest Association, http://www.akforest.org/facts.htm, reports 129 million acres of forested lands. The total land area in Alaska is 365 million acres (http://www.netstate.com/states/geography/ak_geography.htm).

slightly to 34% and 7%, respectively. The shares of emissions from the electricity, waste, and agriculture sectors remain the same in 2025 as in 2005.

Figure 2-3. Alaska gross GHG emissions by sector, 1990–2025: historical and projected

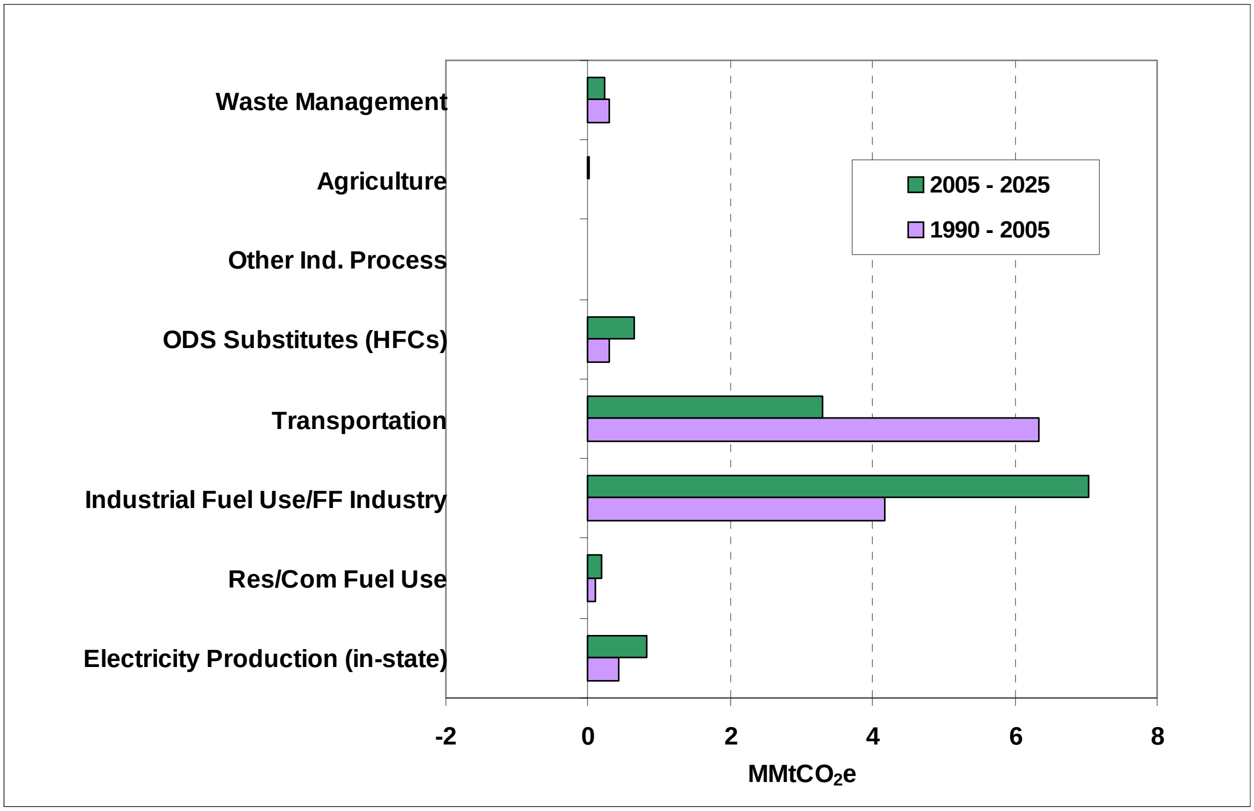


GHG = greenhouse gas; $MMtCO_2e$ = million metric tons of carbon dioxide equivalent; FF=fossil fuel; Res/Com = direct fuel use in the residential and commercial sectors; ODS = ozone-depleting substance; Ind. = industrial.

Note: The Industrial Fuel Use/FF Industry category accounts for direct fuel combustion in the industrial sector as well as fugitive methane that occurs from leaks and venting during the production, processing, transmission, and distribution of fossil fuels.

Emissions associated with the industrial sector are projected to be the largest contributor to future GHG emissions growth, with a total increase in GHG emissions from 2005 to 2025 of 7.0 $MMtCO_2e$, as shown in Figure 2-4. The next-largest source of emissions growth in this time period is the transportation sector, with an increase of 3.3 $MMtCO_2e$. Other sources of emissions growth include the electricity production, ozone-depleting substance substitutes, waste management, and agriculture sectors. Table 2-2 summarizes the growth rates that drive the growth in the Alaska reference case projections, as well as the sources of these data.

Figure 2-4. Sector contributions to gross emissions growth in Alaska, 1990–2025: reference case projections



$MMtCO_2e$ = million metric tons of carbon dioxide equivalent; Ind. = industrial; ODS = ozone-depleting substance; HFCs = hydrofluorocarbons; FF= fossil fuel; Res/Com = residential and commercial sectors.

Table 2-2. Key annual growth rates for Alaska, historical and projected

Annual Growth Rate	1990–2005	2005–2025	Sources
Population	1.0%	0.6%	Alaska Department of Labor and Workforce Development, 2004-2014.
Employment Goods Services	 2.1% 1.7%	 0.9% 1.1%	Alaska Department of Labor and Workforce Development, 2004-2014. Forecast trend assumed to continue through 2025.
Electricity Sales	2.2%	0.8%	Historic rates are from EIA data. Projections are CCS assumptions as described in Appendix A of the Inventory and Projections report.
Vehicle Miles Traveled	1.7%	1.3%	Alaska Department of Transportation and Public Facilities, Western Region Air Partnership Mobile Source Inventory.

* Population and employment projections for Alaska were used together with the U.S. Department of Energy's Energy Information Administration *Annual Energy Outlook 2006* projections of changes in fuel use per capita and per employee, as relevant for each sector (http://www.scag.ca.gov/rcp/pdf/publications/1_2006AnnualEnergyOutlook.pdf). For instance, growth in Alaska's residential natural gas use is calculated as the Alaska population growth times the change in per-capita natural gas use for the Pacific region.

EIA = Energy Information Administration; CCS = Center for Climate Strategies.

A Closer Look at the Two Major Sources: Industrial Sector and Transportation

As shown in Figure 2-2, the industrial sector, comprised of industrial fuel combustion as well as emissions associated with the production, processing, transmission, and distribution of fossil fuels, accounted for 49% of Alaska's gross GHG emissions in 2005 (about 25 $MMtCO_2e$), which was much higher than the national average share of emissions from the industrial sector (17%). Activities in the industrial[10] sector produce GHG emissions when fuels are combusted to provide space heating, process heating, and other applications. This sector also includes emissions released during the production, processing, transmission, and distribution of fossil fuels. Known as fugitive emissions, these are methane and carbon dioxide gases released via leakage and venting at coal mines, oil and gas fields, processing facilities, and pipelines. A majority of the industrial sector emissions resulted from the use of natural gas and the natural gas industry (19.1 $MMtCO_2e$). Industrial oil combustion and the oil industry together contributed 5.6 $MMtCO_2e$ of GHG emissions in 2005. An insignificant amount of the industrial sector emissions was contributed by coal use and coal mining. GHG emissions for the industrial sector (excluding those associated with electricity consumption) are expected to increase by 28% between 2005 and 2025, reaching 31.8 $MMtCO_2e$ by 2025.[11]

The transportation sector accounted for 35% (17.8 $MMtCO_2e$) of Alaska's gross GHG emissions in 2005. Emissions are projected to increase to 21.1 $MMtCO_2e$ (34% of gross GHG emissions) in 2025. Jet fuel consumption accounts for the largest share of transportation GHG emissions. Emissions from jet fuel consumption increased by about 84% from 1990 to 2005, accounting for 72% of total transportation emissions in 2005. Emissions from on-road gasoline grew by 15% between 1990 and 2005, and on-road diesel emissions grew by 37% during this period. In 2005, on-road gasoline and diesel accounted for 14% and 10% of total transportation emissions, respectively. GHG emissions from marine fuel consumption decreased by 26% from 1990 to 2005, and in 2005 accounted for 3% of GHG emissions from the transportation sector. Emissions from all other categories combined (aviation gasoline, locomotives, natural gas and liquefied petroleum gas, and oxidation of lubricants) contributed slightly over 0.3% of total transportation emissions in 2005.

From 2005 to 2025, emissions from transportation fuels are projected to rise by 0.85% per year. This leads to an increase of 3.3 $MMtCO_2e$ in transportation emissions during the period, for a total of 21.1 $MMtCO_2e$ in 2025. The largest percentage increase in emissions over this time period is seen in on-road diesel fuel consumption, which is projected to increase by 92% from 2005 to 2025.

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[10] The industrial sector includes emissions associated with agricultural energy use and fuel used by the fossil fuel production industry.

[11] See Appendix B of the Inventory and Reference Case Projections report for more details, available at http://www.akclimatechange.us/Inventory_Forecast_Report.cfm. Given the forecasted decline in non-combustion emissions for the fossil fuel industry, the increase in the industrial fossil fuel consumption seems odd; however, DEC contacts indicate that natural gas combustion is expected to increase significantly in future years, since more fuel is consumed to extract oil and gas as the production in existing fields declines. This is an area that should be investigated further during future work. The industrial fossil fuel consumption projections are based on the regional Energy Information Administration *Annual Energy Outlook 2006* forecast data for the Pacific Region (http://www.scag.ca.gov/rcp/pdf/publications/1_2006AnnualEnergyOutlook.pdf).

It is important to note that the jet fuel emissions include fuel that is purchased in Alaska but is not necessarily consumed within Alaska's airspace. This accounting issue is also present in the inventories of other states prepared by CCS, where international passenger and cargo transportation emissions are concerned. On the other hand, fuel purchased outside of the state for aircraft that enter the state are not included in the emission estimates presented in this report. The size of the contribution from the transportation aviation sector shown in Figure 2-3 reflects the importance of this industry in Alaska.

Mitigation Advisory Group Revisions

Following are the revisions that the MAG made to the inventory and reference case projections, thus explaining the differences between the final Inventory and Projections report and the initial assessment completed in July 2007:

All Sectors

The initial assessment included GHG emission projections to 2020. This was revised to extend the GHG projections to 2025 for all sectors.

Electric Supply

The Energy Supply and Demand TWG generated forecasts for RCI fuel and electricity consumption for the purposes of deriving sub-sector emission reductions from various policies. Historical RCI uses, growing at regional rates, were used to estimate future non-oil and gas use. Electricity-sector emissions were designed to be consistent with the current fuel mix in Alaska, as well as specific expected changes in the fuel mix based on expert opinion in the TWG. It is expected that, in absence of new infrastructure, new demand in the future would be met through petroleum combustion. The 60-megawatt Healy Clean Coal Project is expected to be brought on line in 2013 (displacing natural gas), and Fairbanks is expected to obtain natural gas delivery service by 2019 (displacing petroleum consumption), according to panel experts.

Transportation

The Transportation and Land Use TWG recommended that the marine emissions inventory exclude emissions from vessels that pass through Alaskan waters but do not call on Alaskan ports. This approach is consistent with the treatment of aviation emissions, which exclude emissions from aircraft that pass through Alaskan airspace but do not stop in Alaska. It was estimated that the offshore marine emissions previously calculated consisted largely of emissions from vessels that do not call on Alaska ports. Approximately 1%–2% of ships passing through Alaska's Exclusive Economic Zone, which extends 200 miles from the shore, actually stop at an Alaska port. In addition, some of those offshore emissions are already accounted for in the nearshore emissions component. As a result, the offshore emissions have been removed from the GHG I&F. Historical fuel consumption data and vehicle miles traveled through 2005 were added, where available. In addition, several minor errors were corrected, including the baseline on-road fuel economy values.

Waste Management

The Forestry, Agriculture, and Waste Management (FAW) TWG recommended that open-burning emissions be assumed to occur based on 50% of all waste received at Class III landfills.

In addition, open-burning emissions were removed from the controlled burning category. Controlled burning was then updated based on input from DEC. The 2005 and future year emission totals for the controlled burning category were also adjusted to account for the fact that Juneau no longer used controlled burning as a waste management practice. For municipal solid waste (MSW) landfills, the total tonnage disposed of in Class II and Class III landfills was adjusted based on the population of the areas served by those landfills and an assumed 5.9 pounds MSW/person/day. The initial I&F overestimated the number of Class III landfills by 78 and the number of Class II landfills by 36. The allocation of potential landfill gas emissions among uncontrolled, flared, and landfill-gas-to-energy (LFGTE) landfills was adjusted, based on TWG input that the Anchorage and Juneau landfills began flaring in 2006 and 2008, respectively, and the Anchorage Regional Landfill will begin an LFGTE project in 2015. All revised landfill data were provided by members of the FAW TWG.

Key Uncertainties

Some data gaps exist in this I&F, particularly in the reference case projections. Key tasks for future refinement of this I&F include review and revision of key drivers, such as the industrial and transportation fuel use growth rates that will be major determinants of Alaska's future GHG emissions (see Table 2-2 and Figure 2-4). These growth rates are driven by uncertain economic, demographic, and land-use trends (including growth patterns and transportation system impacts), all of which deserve closer review and discussion. Perhaps the variables with the most important implications for the state's GHG emissions are the assumptions regarding air travel and industrial sector growth, particularly the oil and gas industry.