Chapter 2
Inventory and Projections of GHG Emissions

Introduction

This chapter summarizes Arkansas' greenhouse gas (GHG) emissions and sinks (carbon storage) from 1990 to 2025. The Center for Climate Strategies (CCS) prepared a draft of Arkansas' GHG emissions inventory and reference case projections for the Arkansas Governor's Commission on Global Warming (GCGW). The draft inventory and reference case projections, completed in May 2008, provided the GCGW with an initial, comprehensive understanding of current and possible future GHG emissions. The draft report was provided to the GCGW and its Technical Work Groups (TWGs) to assist them in understanding past, current, and possible future GHG emissions in Arkansas, and thereby inform the policy recommendation development process. The GCGW 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. The inventory and forecast have since been revised to address the comments provided by the GCGW. The information in this chapter reflects the information presented in the final *Arkansas Greenhouse Gas Inventory and Reference Case Projections* report (hereafter referred to as the Inventory and Projections report).[1]

Historical GHG emission estimates (1990 through 2005)[2] were developed using a set of generally accepted principles and guidelines for state GHG emission inventories, relying to the extent possible on Arkansas-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 (CO_2e), 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 Arkansas Greenhouse Gas Inventory and Reference Case Projections: 1990–2025*. Prepared for the Arkansas Governor's Commission on Global Warming. October 2008.

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

It is important to note that the emission estimates reflect the GHG emissions associated with the electricity sources used to meet Arkansas' 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.

Arkansas GHG Emissions: Sources and Trends

Table 2-1 provides a summary of GHG emissions estimated for Arkansas by sector for 1990, 2000, 2005, 2010, 2015, 2020, and 2025. As shown in this table, Arkansas is estimated to be a net source of GHG emissions (positive, or gross, emissions). Arkansas' forests serve as sinks of GHG emissions (removal of emissions, or negative emissions). Arkansas' 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), Arkansas accounted for approximately 85 million metric tons (MMt) of CO_2e emissions, an amount equal to 1.2% of total U.S. gross GHG emissions. On a net emissions basis (i.e., including carbon sinks), Arkansans accounted for approximately 65 $MMtCO_2e$ of emissions in 2005, an amount equal to 1.0% of total U.S. net GHG emissions.[4] Arkansas' GHG emissions are rising faster than those of the nation as a whole. From 1990 to 2005, Arkansas' gross GHG emissions increased by 30%, while national gross emissions rose by 16%.[5]

On a per-capita basis, Arkansans emitted about 31 metric tons (t) of gross CO_2e in 2005, higher than the national average of about 24 tCO_2e. Figure 2-1 illustrates the state's emissions per capita and per unit of economic output. It also shows that while per-capita emissions have increased from 1990 to 2000 in Arkansas and then began to decrease from 2000 to 2005, per capita emissions for the nation as a whole remained fairly flat from 1990 to 2005. The higher per capita emission rates in Arkansas are driven by emissions growth in the electricity supply, transportation, and agricultural sectors (agricultural sector emissions are twice the national average). In both Arkansas and the nation as a whole, economic growth exceeded emissions growth throughout the 1990–2005 period. From 1990 to 2005, emissions per unit of gross product dropped by 26% nationally, and by 23% in Arkansas.[6]

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[4] The national emissions used for these comparisons are based on 2005 emissions from U.S. Environmental Protection Agency, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2006*, April 15, 2008, EPA430-R-08-005. Available at: http://www.epa.gov/climatechange/emissions/usinventoryreport.html.

[5] During this period, population grew by 18% in Arkansas and by 19% nationally. However, Arkansas' economy grew at a faster rate on a per capita basis (up 44% vs. 32% nationally).

[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/.

The principal sources of Arkansas' GHG emissions in 2005 are electricity consumption and transportation, accounting for 32% and 26% of Arkansas' gross GHG emissions, respectively, as shown in Figure 2-2. The direct use of fuels—natural gas, oil products, coal, and wood—in the residential, commercial, and industrial (RCI) sectors accounts for another 18% of the state's emissions in 2005.

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

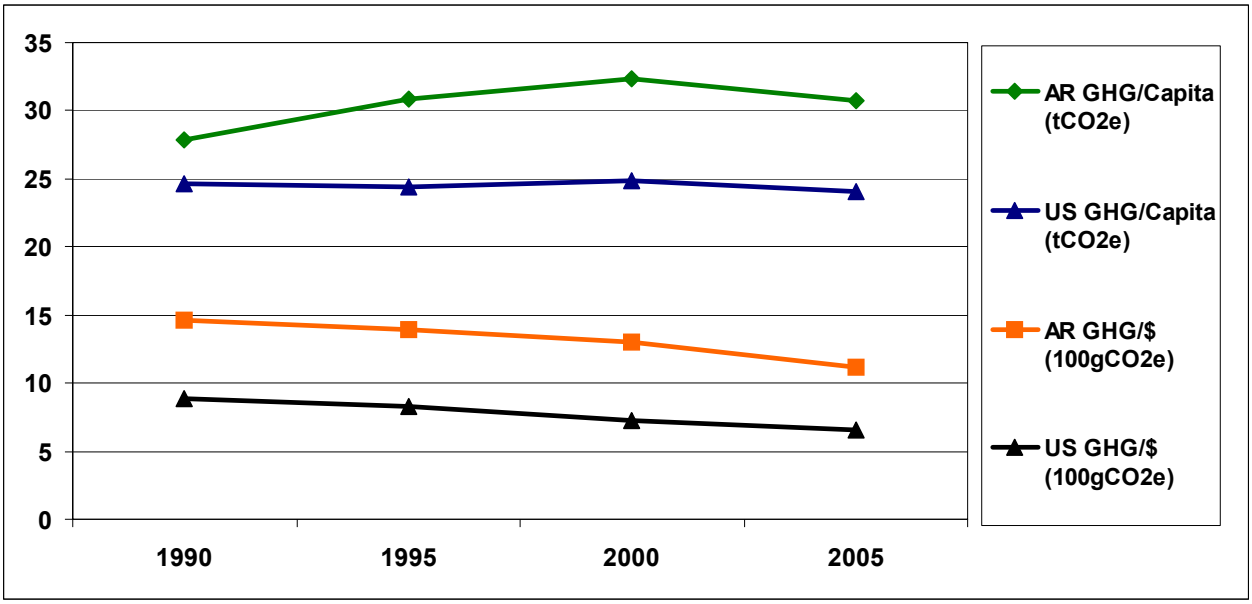
Million Metric Tons CO_2e	1990	2000	2005	2010	2015	2020	2025
Energy (Consumption Based)	**50.7**	**70.4**	**67.2**	**74.3**	**80.5**	**85.0**	**89.6**
Electricity Use (Consumption)	**17.4**	**28.0**	**27.2**	**30.7**	**34.1**	**35.7**	**37.4**
Electricity Production (in-state)	22.5	27.4	27.2	30.7		35.7	37.4
Coal	*19.7*	*24.8*	*23.1*	*27.1*	*30.5*	*30.5*	*30.5*
Natural Gas	*2.64*	*2.37*	*3.98*	*3.49*	*3.45*	*5.05*	*6.69*
Oil	*0.07*	*0.17*	*0.15*	*0.15*	*0.15*	*0.15*	*0.15*
MSW/Landfill Gas	*0.06*	*0.07*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Biomass	*0.008*	*0.010*	*0.009*	*0.009*	*0.009*	*0.009*	*0.009*
Other Wastes	*0.000*	*0.003*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
Pumped Storage	*0.03*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Imported/Exported Electricity	-5.03	0.56	0.00	0.00	0.00	0.00	0.00
Residential/Commercial/Industrial (RCI) Fuel Use	**13.7**	**17.1**	**15.1**	**16.7**	**17.0**	**17.5**	**18.1**
Coal	*0.55*	*0.90*	*0.87*	*0.90*	*0.89*	*0.89*	*0.90*
Natural Gas	*10.1*	*11.0*	*8.2*	*9.6*	*9.7*	*10.0*	*10.3*
Petroleum	*2.90*	*5.03*	*5.92*	*6.08*	*6.3*	*6.40*	*6.66*
Wood (CH_4 and N_2O)	*0.14*	*0.16*	*0.15*	*0.17*	*0.18*	*0.19*	*0.20*
Transportation	**16.9**	**22.4**	**22.0**	**23.9**	**26.2**	**28.6**	**31.1**
On-road Gasoline	*10.9*	*12.4*	*12.4*	*13.3*	*14.4*	*15.4*	*16.5*
On-road Diesel	*3.78*	*5.37*	*6.08*	*7.22*	*8.29*	*9.55*	*10.8*
Rail, Natural Gas, LPG, other	*0.57*	*0.87*	*1.10*	*1.11*	*1.12*	*1.13*	*1.14*
Marine Vessels	*0.93*	*1.79*	*1.84*	*1.73*	*1.86*	*1.98*	*2.11*
Jet Fuel and Aviation Gasoline	*0.72*	*2.01*	*0.53*	*0.50*	*0.51*	*0.52*	*0.53*
Fossil Fuel Industry	**2.72**	**2.88**	**2.82**	**2.97**	**3.18**	**3.11**	**3.04**
Natural Gas Industry	2.58	2.79	2.73	2.89	3.10	3.04	2.98
Oil Industry	0.13	0.09	0.10	0.09	0.08	0.07	0.06
Coal Mining	0.003	0.001	0.000	0.000	0.000	0.000	0.000
Industrial Processes	**2.23**	**3.41**	**4.03**	**4.92**	**5.67**	**6.46**	**7.45**
Cement Manufacture (CO_2)	0.31	0.65	0.68	0.74	0.79	0.86	0.92
Lime Manufacture (CO_2)	0.05	0.07	0.28	0.48	0.48	0.48	0.48
Limestone and Dolomite Use (CO_2)	0.07	0.06	0.07	0.07	0.07	0.08	0.08
Soda Ash (CO_2)	0.03	0.03	0.02	0.02	0.02	0.02	0.02
Ammonia and Urea (CO_2)	0.53	0.30	0.28	0.28	0.28	0.28	0.28
Iron & Steel (CO_2)	0.09	0.36	0.38	0.42	0.48	0.55	0.62
Nitric Acid (N_2O)	0.88	1.00	0.99	0.99	0.99	0.99	0.99
ODS Substitutes (HFC, PFC)	0.00	0.76	1.16	1.76	2.40	3.06	3.91
Electric Power T&D (SF_6)	0.27	0.18	0.17	0.15	0.15	0.14	0.14

Million Metric Tons CO_2e	1990	2000	2005	2010	2015	2020	2025
Waste Management	**2.01**	**2.05**	**2.40**	**2.89**	**3.49**	**4.24**	**5.17**
Landfills	1.45	1.49	1.81	2.26	2.82	3.53	4.41
Wastewater Management	0.48	0.56	0.59	0.63	0.67	0.72	0.77
Waste Combustion	0.07	0.00	0.00	0.00	0.00	0.00	0.00
Agriculture	**10.7**	**10.7**	**11.7**	**11.2**	**11.4**	**11.6**	**11.9**
Enteric Fermentation	2.02	2.05	2.08	2.10	2.17	2.24	2.30
Manure Management	1.68	1.45	1.31	1.37	1.43	1.49	1.55
Agricultural Soils	4.76	4.62	5.24	4.56	4.42	4.29	4.15
Rice Cultivation	2.14	2.52	2.92	3.06	3.27	3.49	3.70
Agricultural Burning	0.05	0.06	0.11	0.11	0.13	0.14	0.16
Forest Wildfires and Prescribed Burning	**0.17**	**0.18**	**0.18**	**0.18**	**0.18**	**0.18**	**0.18**
Gross Emissions (Consumption Basis)	**65.8**	**86.8**	**85.4**	**93.5**	**101.3**	**107.5**	**114.2**
Increase relative to 1990		*32%*	*30%*	*42%*	*54%*	*63%*	*74%*
Emissions Sinks	**–38.5**	**–20.8**	**–20.9**	**–20.9**	**–20.9**	**–20.9**	**–20.9**
Forestry and Land Use	**–36.7**	**–19.0**	**–19.1**	**–19.1**	**–19.1**	**–19.1**	**–19.1**
Forested Landscape	–34.2	–18.2	–18.2	–18.2	–18.2	–18.2	–18.2
Urban Forestry and Land Use	–2.43	–0.83	–0.91	–0.91	–0.91	–0.91	–0.91
Agricultural Soils (Cultivation Practices)	**–1.80**	**–1.80**	**–1.80**	**–1.80**	**–1.80**	**–1.80**	**–1.80**
Net Emissions (Consumption Basis) (including forestry and land use sinks)	**27.3**	**66.0**	**64.6**	**72.6**	**80.4**	**86.6**	**93.4**

$MMtCO_2e$ = million metric tons of carbon dioxide equivalent; CH_4 = methane; N_2O = nitrous oxide; MSW = municipal solid waste; LPG = liquefied petroleum gas; 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.

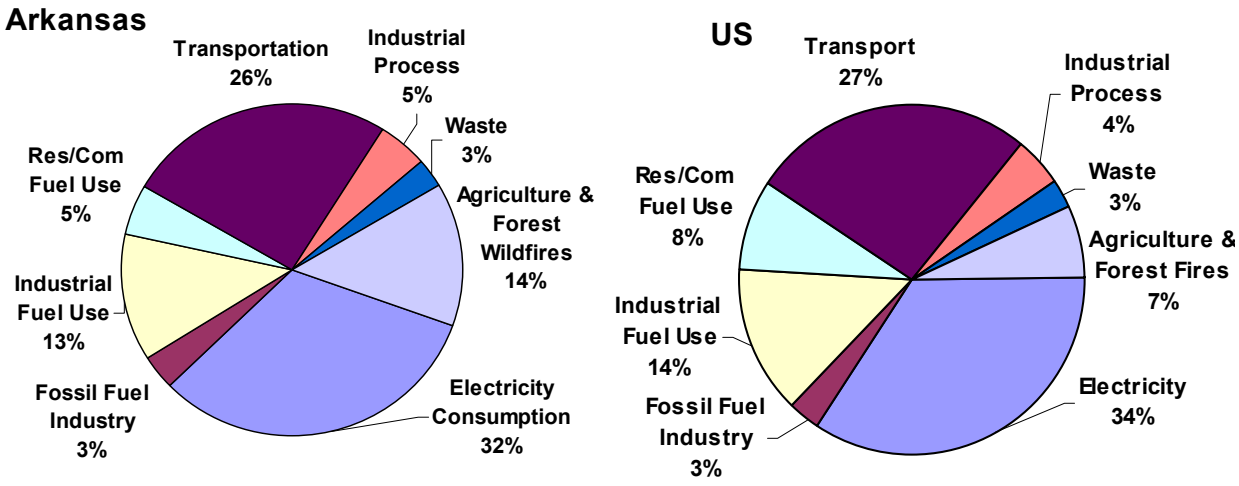
Figure 2-1. Arkansas and U.S. gross GHG emissions, per-capita and per-unit gross product



GHG = greenhouse gas; tCO_2e = metric tons of carbon dioxide equivalent.; g = grams.

Figure 2-2 shows the agricultural and forest wildfire (including prescribed burning) sectors together accounted for 14% of the gross GHG emissions in Arkansas in 2005. These CH_4 and N_2O emissions primarily come from agricultural soils, rice cultivation, enteric fermentation, and manure management. Industrial process emissions accounted for another 5% of the state's GHG emissions in 2005, and these emissions are rising due to the increasing use of HFCs and PFCs as substitutes for ozone-depleting chlorofluorocarbons.[7] Other industrial process emissions include CO_2 released by cement and lime manufacturing; CO_2 released during soda ash, limestone, and dolomite use; CO_2 released during ammonia, urea, and iron and steel production; N_2O released during nitric acid production; and SF_6 released from transformers used in electricity transmission and distribution systems. Also, landfills and wastewater management facilities produce CH_4 and N_2O emissions that accounted for 3% of total gross GHG emissions in Arkansas in 2005. Similarly, emissions associated with the production, processing, transmission, and distribution of fossil fuels accounted for 3% of the gross GHG emissions in 2005.

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



Forestry emissions refer to the net CO_2 flux[8] from forested lands in Arkansas, which account for about 56% of the state's land area.[9] Arkansas' forests are estimated to be net sinks of CO_2 emissions in the state, reducing net GHG emissions by 19 $MMtCO_2e$ in 2005. In addition, estimates of net carbon fluxes from agricultural soil cultivation practices are estimated to be net

[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 Affect the Ozone Layer. See Appendix I in the Final Inventory and Projections report for Arkansas (http://www.arclimatechange.us/Inventory_Forecast_Report.cfm).

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

[9] Total forested acreage in Arkansas is 18.8 million acres. For acreage by forest type, see: Richard A. Birdsey and George M. Lewis. "Carbon in United States Forests and Wood Products, 1987–1997: State-by-State Estimates." Arkansas Estimate for 1987–1997. Available from the U.S. Department of Agriculture, Forest Service, Northern Global Change Research Program, at: http://www.fs.fed.us/ne/global/pubs/books/epa/states/AR.htm. The total land area in Arkansas is 33.3 million acres (http://www.50states.com/arkansas.htm).

sinks of CO_2 emissions in Arkansas. However, the Inventory and Projections report does not consider above-ground carbon sequestration in agriculture because it is not considered to be sequestered.[10]

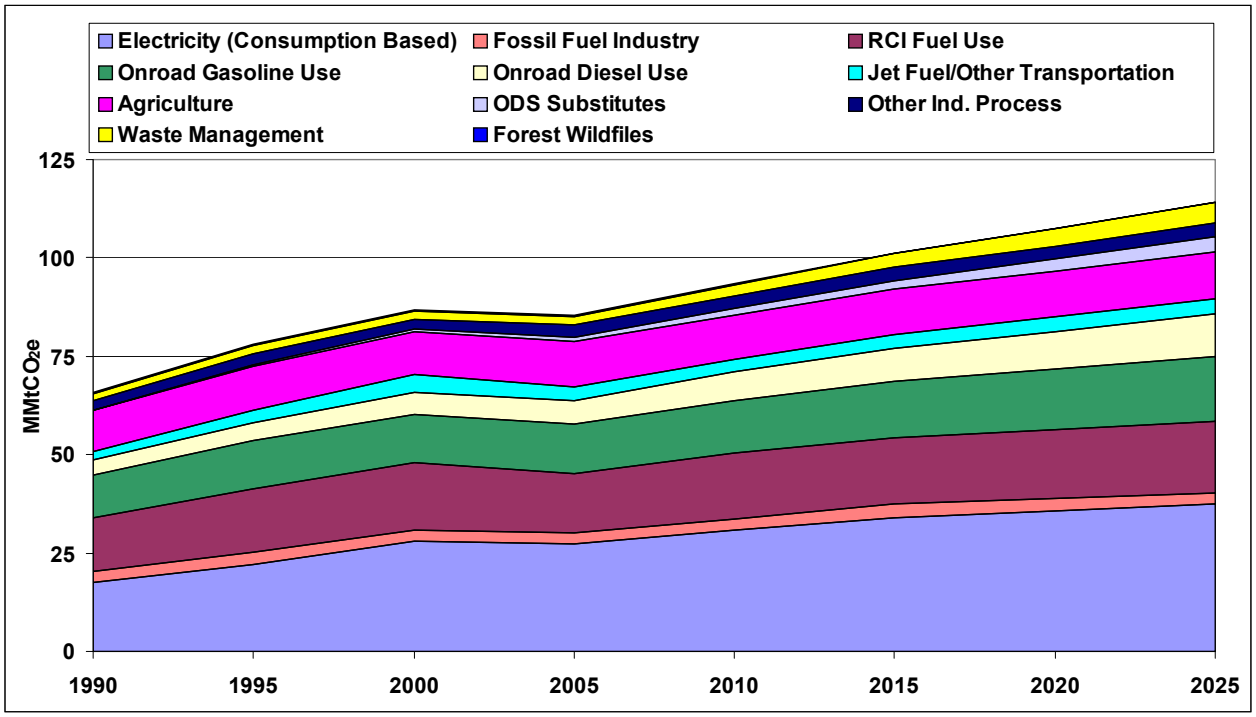
Reference Case Projections

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, Arkansas' gross GHG emissions continue to grow steadily, climbing to about 114 $MMtCO_2e$ by 2025, or 74% above 1990 levels. This equates to a 1.6% annual rate of growth from 1990 to 2025. By 2025, the share of emissions associated with electricity consumption and the transportation sector both increase slightly to 33% and 27%, respectively; emissions from the residential, commercial, and industrial (RCI) fuel use and agriculture sectors both decrease to 16% and 10%, respectively.

Emissions associated with electricity consumption are projected to be the largest contributor to future GHG emissions growth, followed by emissions associated with the transportation sector, as shown in Figure 2-4. Other sources of emissions growth include the increasing use of HFCs and PFCs as substitutes for ozone-depleting substances in refrigeration, air conditioning, and other applications, as well as the RCI fuel use sector. Table 2-2 summarizes the growth rates that drive the growth in the Arkansas reference case projections, as well as the sources of these data.

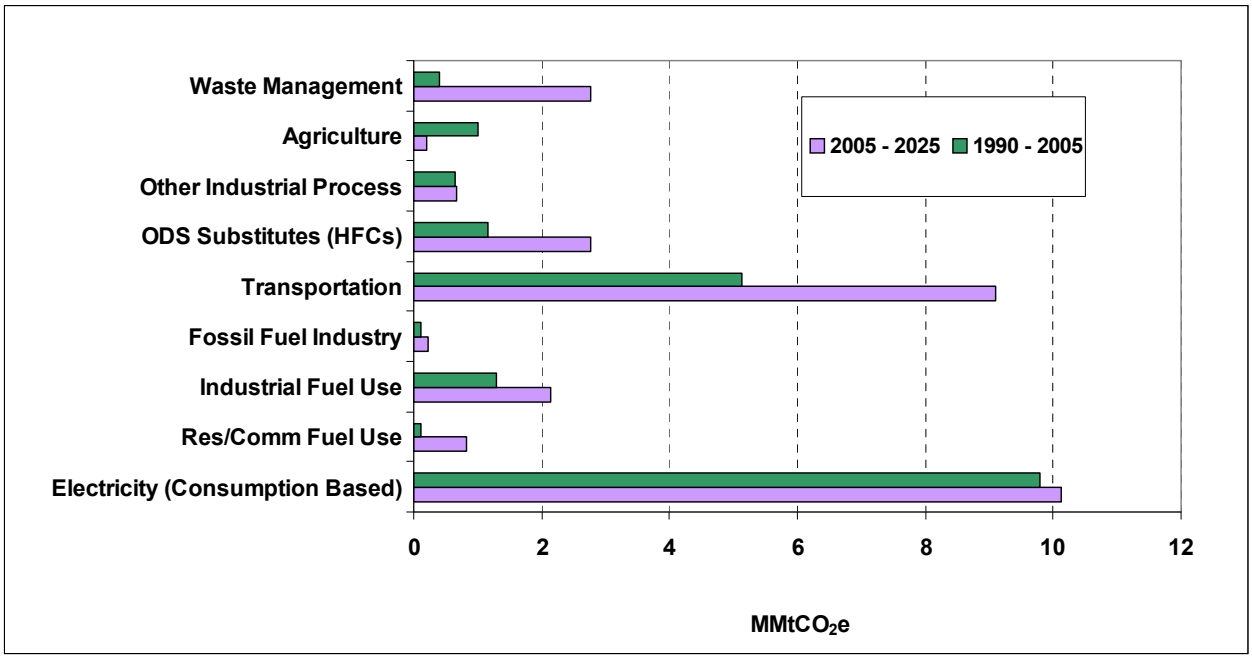
[10] Above-ground carbon re-enters the natural carbon cycle and is lost to the atmosphere through respiration or decomposition either directly or indirectly (e.g., used as energy as animal feed or by humans) over relatively short periods of time (months to years). Carbon sequestration in agriculture is below ground in the form of soil carbon (i.e., the result of the photosynthesis process), where carbon can be stored over long periods of time (potentially indefinitely). The U.S. Environmental Protection Agency (EPA) Web sites http://www.epa.gov/sequestration/ccyle.html and http://www.epa.gov/sequestration/local_scale.html have some useful information. For additional information on the potential for sequestration in agriculture, see EPA's *Greenhouse Gas Mitigation Potential in U.S. Forestry and Agriculture* (http://www.epa.gov/sequestration/pdf/greenhousegas2005.pdf).

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



$MMtCO_2e$ = million metric tons of carbon dioxide equivalent; RCI = direct fuel use in residential, commercial, and industrial sectors; ODS = ozone-depleting substance; Ind. = industrial.

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



$MMtCO_2e$ = million metric tons of carbon dioxide equivalent; ODS = ozone-depleting substance; HFCs = hydrofluorocarbons; Res/Comm = direct fuel use in the residential and commercial sectors.

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

	1990–2005	2005–2025	Sources
Population	1.10%	0.81%	1990–2004 from Historical Data from U.S. Census Bureau, Intercensal Population Estimates at: http://cber.uark.edu/data/population/Geographic_Regions.xls Arkansas County and State Population Projections: Time Series Extrapolations, 2005–2030 http://www.aiea.ualr.edu/research/demographic/population/default.html
Electricity Sales	3.55%	1.37%	For 1990–2005, annual growth rate in total electricity sales for all sectors combined in Arkansas calculated from EIA State Electricity Profiles (Table 8) and sales by Arkansas generators calculated from EIA State Electricity Profiles (Table 5) http://www.eia.doe.gov/cneaf/electricity/st_profiles/arkansas.html For 2005–2025, annual growth rates are based on average growth rates in the SERC and SPP regions in which Arkansas is located.
Vehicle Miles Traveled	2.7%	1.7%	Based on SIT default Federal Highway Administration VMT for 1990–1992; 1993–2005 VMT provided by Arkansas Highway and Transportation Department; VMT for 2006–2025 calculated by linear regression based on 1990–2005 VMT.

[a] Represents annual growth in total sales of electricity by generators in Arkansas to RCI sectors located within and outside of Arkansas.
[b] Represents annual growth in total sales of electricity by generators in Arkansas to RCI sectors located within Arkansas.
EIA = Energy Information Administration; SIT = State (GHG) Inventory Tool; VMT = vehicle miles traveled.

A Closer Look at the Two Major Sources: Electricity Supply and Transportation

As shown in Figure 2-2, electricity use in 2005 accounted for 32% of Arkansas' gross GHG emissions (about 27 $MMtCO_2e$), which was very similar to the national share of emissions from electricity generation (34%). On a per-capita basis, Arkansas' GHG emissions from electricity consumption are higher than the national average (in 2005, 9.8 tCO_2e per capita in Arkansas, versus 8.1 tCO_2e per capita nationally). Electricity generation in Arkansas is dominated by steam units, which are primarily powered by coal and nuclear fuel. In 2005, 45% of Arkansas' electricity generation was provided by coal-fired units, with another 27% of generation provided by nuclear units. The remaining in-state generation came from a mix of natural gas, hydroelectric, biomass, oil, and refuse-derived fuel facilities.[11]

As noted above, these electricity emission estimates reflect the GHG emissions associated with the electricity sources used to meet Arkansas' demand for electricity, corresponding to a consumption-based approach to emissions accounting. From 1990 to 1999 and from 2001 to 2004, Arkansas was a net exporter of electricity, meaning that Arkansas power plants have produced more electricity than is consumed in the state.[12] For 2000 and 2005, Arkansas was a

[11] Percentages are based on gross generation (including plant fuel use) associated with the electricity produced by facilities in Arkansas.

[12] Estimating the emissions associated with electricity use requires an understanding of the electricity sources (both in state and out of state) used by utilities to meet consumer demand. The current estimates reflect some very simple assumptions, as described in Appendix A of the Inventory and Projections report.

net importer of electricity. Based on the approval of the GCGW, the final reference case forecast assumes that Arkansas is self-sufficient in electricity production, and that there will be no net imports over the revised forecast period (2006–2025). For the purpose of estimating emissions, natural gas-fired generation is assumed to fill any gaps in the supply of electricity to meet Arkansas demand during the forecast period.

While estimates are provided for emissions from both electricity production and consumption, unless otherwise indicated, tables, figures, and totals in this report reflect electricity consumption emissions. The consumption-based approach can better reflect the emissions (and emission reductions) associated with activities occurring in the state, particularly with respect to electricity use (and efficiency improvements), and is particularly useful for decision making. Under this approach, emissions associated with electricity exported to other states would need to be covered in those states' inventories in order to avoid double counting or exclusions.

Like electricity emissions, GHG emissions from transportation fuel use have risen steadily from 1990 to 2005, at an average annual growth rate of 1.8%. In 2005, gasoline-powered on-road vehicles accounted for about 57% of transportation GHG emissions; on-road diesel vehicles for 28%; marine vessels for 8%; aviation fuels for 2%; and rail and other sources (natural gas- and liquefied petroleum gas-fueled vehicles used in transport applications) for the remaining 5%. As a result of Arkansas' population and economic growth and an increase in total vehicle miles traveled, emissions from on-road gasoline use grew at a rate of 0.91% annually between 1990 and 2005. Meanwhile, emissions from on-road diesel use rose by 3.2% per year from 1990 to 2005, suggesting an even more rapid growth in freight movement within or across the state. Emissions from on-road gasoline vehicles in 2025 are projected to increase by 1.4% annually from 2005 levels, and emissions from on-road diesel vehicles are projected to increase by 2.9% annually from 2005 to 2025, with total transportation emissions are expected to reach 31 $MMtCO_2e$ by 2025.

GCGW Revisions

The GCGW made the following revisions to the inventory and reference case projections, which explain the differences between the final Inventory and Projections report and the draft initial assessment completed during May 2008:

- *Energy Supply*:
    - *Gross coal-fired generation:* The GCGW approved including both the Plum Point and Hempstead County (Turk) coal plants in the reference case projections (both of these plants were included in the May 2008 draft forecast). The GCGW revised the start year for the plants, changing the on-line start date for Plum Point from 2009 to 2010 and for Hempstead County from 2011 to 2012. The GCGW also approved a faster ramp-up of output from the Plum Point and Hempstead plants relative to the draft forecast.
    - *Net imports:* Assume no net imports (or exports) during the forecast period (2006–2025). The draft forecast assumed Arkansas would be a net importer of electricity from 2005 to 2010 and a net exporter of electricity from 2011 to 2025.
    - *Gross natural gas-fired generation and primary energy use:* Include natural gas combined-cycle capacity to satisfy the criteria (1) that Arkansas be self-sufficient in

electricity production, and (2) that there are no net imports over the revised forecast period (2006–2025) (the earlier forecast did not include this assumption).
    - *Gross oil-fired generation and primary energy use:* About 20%–25% higher than the draft forecast for 2006–2025.
    - *Gross nuclear generation and primary energy use:* 36% less than the draft forecast in the 2020–2025 period.
    - *All other gross generation and primary energy use:* About 3% higher than the draft forecast for 2006–2025.

- *Agriculture*:
    - A preliminary estimate was made of the likely emissions coming from catfish farms in Arkansas. This emission estimate was relatively low and has been documented in Appendix F of the Inventory and Projections report. However, the GCGW determined that the uncertainty associated with this estimate was too great for these emissions to be included in the overall agricultural emission totals included in this section of the report.
    - Two additional tables have been added to Appendix F of the Inventory and Projections report that categorize manure management emissions by pollutant (N_2O and CH_4) and by animal (chicken, dairy, etc). This does not change the manure management emissions total.

- *Waste Management*:
    - Arkansas Department of Environmental Quality (ADEQ) provided 2002–2005 municipal solid waste (MSW) landfill disposal data, which were used in place of default EPA data.
    - ADEQ also provided a growth rate for MSW landfill disposal, which replaced the original growth rate that was based on historical data.

Key Uncertainties

Some data gaps exist in this inventory, and particularly in the reference case projections. Key tasks for future refinement of this inventory and forecast include review and revision of key drivers, such as the transportation, electricity demand, and RCI fuel use growth rates that will be major determinants of Arkansas' 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.