

4.3 Climate

4.3.1 Introduction

The primary issue in the ROS concerning climate is greenhouse gases, emissions that are thought to be associated with global warming (also referred to as greenhouse gas emissions). The link between emissions from thermal generation and climate change is disputed. Moreover, the influence of emissions from a region such as the TVA Power Service Area cannot be reliably determined based on changes in the climate of the same region because global warming is a global effect. Assuming the potential for impacts on climate from atmospheric emissions, this section describes the current climate in the TVA Power Service Area, existing emissions, and anticipated future trends.

Resource Issues
▶ Greenhouse gases

Some policy alternatives could result in a change in the mix of the generating resources TVA uses to meet its energy supply requirements to customers in its service area. TVA presently uses a mix of hydro, nuclear, and fossil-fueled generation and a small amount of renewable resources to meet its load. A change in the availability of hydropower could create an increase in the use of fossil-fired generation, resulting in corresponding increases in carbon dioxide (CO₂) emissions—a greenhouse gas. Similarly, an increase in the availability of hydropower generation could decrease TVA's use of fossil-fueled generation, reducing the emission of greenhouse gases. In addition, an alternative that increases or decreases barge traffic along the Tennessee River may shift CO₂ emissions from trucks to barges or from barges to trucks.

The timing of an increase or decrease in hydropower generation is of particular concern. If decreases occur in summer, when demand for electricity is at its peak, TVA would have less flexibility in reducing greenhouse emissions from replacement generation. Hydropower reductions in summer would most likely be replaced by fossil fuel generation, potentially increasing greenhouse emissions.

4.3.2 Regulatory Programs and TVA Management Activities

Regulatory Programs

No regulations currently limit emissions of CO₂, the primary greenhouse gas emitted by TVA plants. The Administration has called for a voluntary program, and several members of the U.S. Senate are proposing regulatory programs for these emissions.

TVA Management Activities

As a regional development agency and producer of public power, TVA was the first in the nation to participate in the "Climate Challenge," a voluntary greenhouse gas reduction program for electric utilities sponsored by the U.S. Department of Energy. Through this program, TVA has reduced, avoided (for example, by using nuclear power instead of fossil fuels and by using wind

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and solar power), or sequestered (removed from the atmosphere, for example by planting trees) a cumulative total of about 200 million tons of CO₂ over the past decade. The initial voluntary reporting commitment for reduction, avoidance, or sequestration of 27 million tons annually by 2000 was exceeded that year, when 30.3 million tons was actually reported.

TVA has identified additional voluntary actions to continue efforts to reduce, avoid, or sequester CO₂ emissions. Among these are increasing use of renewable energy sources (such as wind, solar, and methane gas), co-firing with waste materials, vehicle and energy efficiency measures, sequestration of CO₂ through reforestation efforts, power upgrading of Units 2 and 3 at Browns Ferry, restarting Browns Ferry Unit 1, and increasing generation at hydroelectric units by modernizing equipment.

4.3.3 Existing Conditions

Although no reliable analysis documents changes to the climate of the TVA Power Service Area due to global warming, temperature and precipitation records can be used to describe recent climate conditions.

Table 4.3-01 shows the average surface temperatures for the regions within the TVA Power Service Area. Table 4.3-01 compares the average temperatures from 1931 to 2000 with those from 1971 to 2000. These data show a generally declining pattern of temperatures throughout the region except for the North Carolina Mountains, which warmed slightly. There is also a discernable pattern of the southerly portion of the TVA Power Service Area cooling more than the northern portion. Thus, the TVA Power Service Area is generally cooling and not experiencing increasing temperatures that may be associated with global warming.

Precipitation is another measure of changing climate conditions. Figure 4.3-01 shows the precipitation departure from normal precipitation for three distinct areas in the Tennessee River basin from 1971 to 2000. Normal means the average precipitation for the three areas, as follows:

- Above Kentucky Dam, 51.01 inches per year;
- Below Chattanooga, 51.93 inches per year; and,
- Above Chattanooga, 50.20 inches per year.

Precipitation varied from 15 inches above normal to 15 inches below normal. The four wettest consecutive years in TVA history (1972 to 1975) occurred during this period, as well as the four driest (1985 to 1988) consecutive years. No distinct global warming pattern is associated with this precipitation.

Table 4.3-01 Average Temperatures and Departures for the TVA Power Service Area

National Weather Service Area		Temperature °F		
		1930 to 2000 Average	1971 to 2000 Average	Change
Kentucky	Western	57.1	57.2	+0.1
	Central	56.0	56.0	0.0
Virginia	Southwestern	52.5	52.1	-0.4
Tennessee	Western	59.5	59.2	-0.3
	Middle	58.2	57.8	-0.4
	Cumberland Plateau	56.4	56.3	-0.1
	Eastern	57.0	56.7	-0.3
North Carolina	Northern Mountains	52.7	52.9	+0.2
	Southern Mountains	55.1	55.2	+0.1
Mississippi	North Central	61.3	60.7	-0.6
	Northeast	61.1	60.6	-0.5
	East Central	63.0	62.5	-0.5
Alabama	Northern Valley	60.5	60.0	-0.5
	Appalachian	60.4	60.1	-0.3
Georgia	Northwest	60.2	59.7	-0.5
	North Central	59.6	59.3	-0.3

Source: National Climatic Data Center 2002.

4.3.4 Emissions of Greenhouse Gases

Emissions of greenhouse gases could potentially affect the global climate. The term greenhouse gases includes CO₂ (generally a product of combustion), methane (generally a product of natural gas and decomposition of organic material), nitrous oxide (a product of combustion), and chlorofluorocarbons (freons). These compounds do not contribute equally to global warming. For instance, pound for pound, methane is considered to contribute 21 times more to global warming as a greenhouse gas than CO₂. Because emissions of CO₂ from combustion represent the largest quantity of manmade greenhouse gas emissions, CO₂ often is used as a gauge of total greenhouse gas emissions. Often “CO₂ equivalents” are used, where the emissions of other greenhouse gases are converted to equivalents by comparing their equivalent effects to CO₂. Another important greenhouse gas is water vapor, primarily from natural sources.

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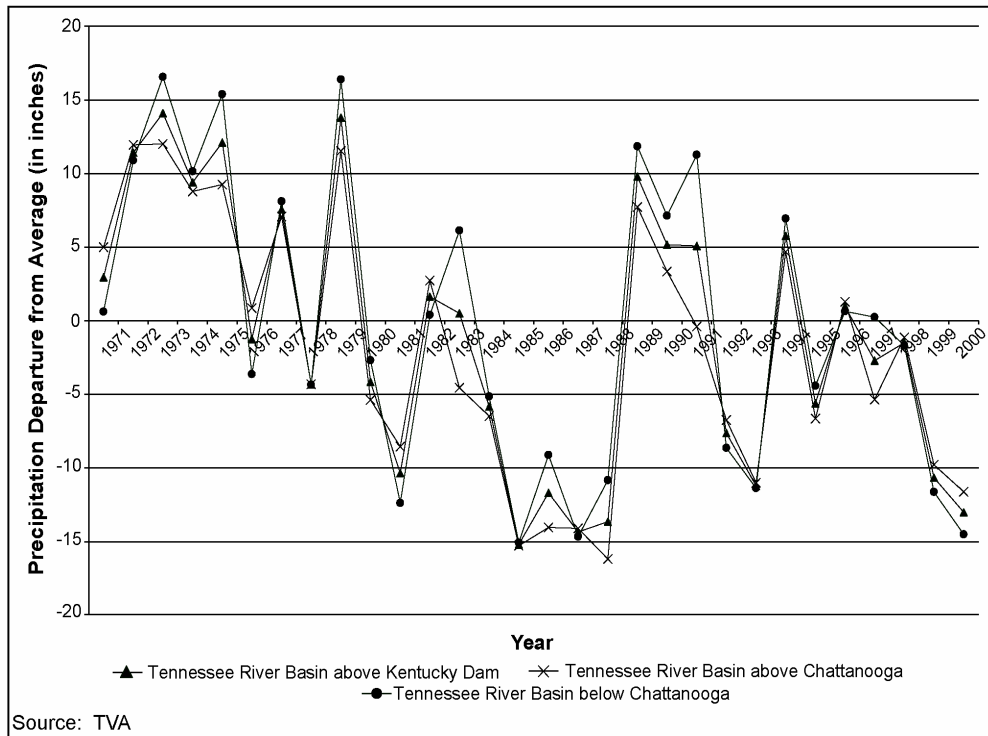


Figure 4.3-01 Precipitation Departure from the 1971 to 2000 Average in the Tennessee River Basin

Existing Conditions

Table 4.3-02 presents data on TVA emissions of CO₂ for the past 3 years. TVA's contribution to total CO₂ for the United States was 1.4 percent in 1999 and 2000 (USEPA 2002). The U.S. contribution to CO₂ equivalent emissions from the 21 highly developed industrialized nations that report was 53 percent in 1996 and 52 percent in 1990 (United Nations 1998). Total global emissions of manmade greenhouse gases are approximately double the amount reported by the 21 countries.

In the TVA Power Service Area, TVA's CO₂ emissions account for about 46 percent of the region's total CO₂ emissions and 41 percent of the region's total manmade greenhouse gas emissions (USEPA 2002). Thus, changes in TVA's CO₂ emissions may substantially affect these totals. Transportation sources account for about 32 percent of the CO₂ emissions in the TVA Power Service Area and 29 percent of total greenhouse gas emissions. Barge and truck traffic, however, represent only small percentages of the total transportation emissions for the TVA Power Service Area.

Table 4.3-02 Greenhouse Gas Emissions (millions of tons) (1990 to 2001)

Year	TVA ¹	United States ²		United Nations ³	
	CO ₂	CO ₂	Total	CO ₂	Total
2001	105.5			–	–
2000	108.3	6,424	7,749	–	–
1999	103.6	6,232	7,558	–	–
1996	--	6,032	7,416	11,299	13,889
1990	--	5,498	6,790	10,680	13,169

¹ TVA data from continuous emissions monitors on TVA power plants. Estimates of TVA emissions of other greenhouse gases are not available.

² USEPA “Greenhouse Gases and Global Warming Potential Values,” April 2002. Data are available only through 2000. The “Total” columns include other greenhouse gas emissions in carbon dioxide (CO₂) equivalents.

³ United Nations Framework Convention on Climate Change, “Summary Compilation of Annual Greenhouse Gas Emissions Inventory Data from Annex I Parties.” These totals are from only 21 individual nations, mostly in Europe and North America. Data are available only through 1996. There are no totals available for the world.

Future Trends

TVA’s CO₂ emissions depend primarily on the amount of electricity generated from fossil fuels. Changes in the emission generation source (from coal to natural gas and from fossil fuel to hydropower or nuclear power) result in reduced CO₂ emissions. The U.S. trend in greenhouse gas emissions has been an increase from 1990 to 2000 of 14 percent in CO₂ equivalents. The increase from 1990 to 1996 by the 21 highly developed countries that report CO₂ equivalents was 5.5 percent.

Energy demand is expected to continue to grow in the TVA Power Service Area over the next 30 years. At an average of 0.5 percent per year (a minimal rate), energy demand would grow 17 percent during the period.

This demand is likely to be met by a combination of increased hydropower, nuclear power, and fossil fuel generation. Four TVA projects have been completed to add more natural gas-fired generation to the TVA system. Increased reliance on hydropower, nuclear, and natural gas generation is expected to reduce greenhouse gas emissions from the TVA system on an output basis (greenhouse gas emissions/total generation).

Prospects for reductions in CO₂ equivalent emissions are primarily tied to international agreements. Fluorocarbons (freons) have been significantly reduced due to worldwide—especially U.S.—implementation of the Montreal Protocol of 1988, which banned worldwide production of these high CO₂ equivalent emissions. It is difficult to predict future trends in CO₂ equivalent emissions. If the Kyoto Protocol now being discussed is signed by many countries and implemented, some reductions may occur both in the United States and worldwide. The

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United States has not yet committed to participate in any worldwide program of reductions of emissions of greenhouse gases.