5.3 Climate

Because no direct link between greenhouse gas emissions and changes in regional climate has been demonstrated, impacts on regional climate cannot be estimated. Instead, changes in greenhouse gas emissions were used as a surrogate for potential impacts on the global climate. For the purposes of this analysis, TVA assumed that increases in greenhouse gas emissions would negatively affect climate. This could be untrue, however, especially for the Tennessee Valley region, which has been experiencing a cooling (not warming) trend.

5.3.1 Impact Assessment Methods

Because balancing among generation sources is both an economic decision (the marginal cost of power) and a physical decision (the availability of generation units to run), calculating the generation mix and related emissions is complex. TVA developed a computer model (PROSYM) that calculates the effect on fossil-fuel generation for each of the policy alternatives (see Appendix C-3). When hydropower is not available compared to existing operations (the Base Case), PROSYM identifies the most likely sources of replacement power. That portion of the replacement power provided by fossil-fired generation is then used to determine increases or decreases in CO_2 emissions.

The steps in the analysis methodology used to estimate changes in greenhouse gas emissions for the alternatives included:

- Determine the increase or decrease in the annual hydropower generation for the alternative being considered as compared to the Base Case. (Assumed to be 2005 consistent with the first full year for application of the policy alternatives).

- Determine the likely generation fuel (nuclear, coal, or gas) or mix of fuels to be used to satisfy the lost power or fuel to be reduced because of the gained hydropower. TVA has used a computer model, PROSYM, to make this analysis.

- Using PROSYM results, determine the number of MW hours of the increased or decreased non-hydropower requirement and the associated CO_2 emissions.

- Compare the increase or decrease in CO_2 emissions to the annual 2005 CO_2 emissions under the Base Case in order to arrive at a percentage change in TVA emissions. Extend the comparison to U.S. and global CO_2 emissions.

- Compare the increase or decrease in CO_2 emissions to expected reductions in CO_2 emissions over the study period, to 2030.

Figure 5.3-01 shows the changes in CO_2 annual emissions for each alternative. For this figure, the PROSYM model calculated impacts.

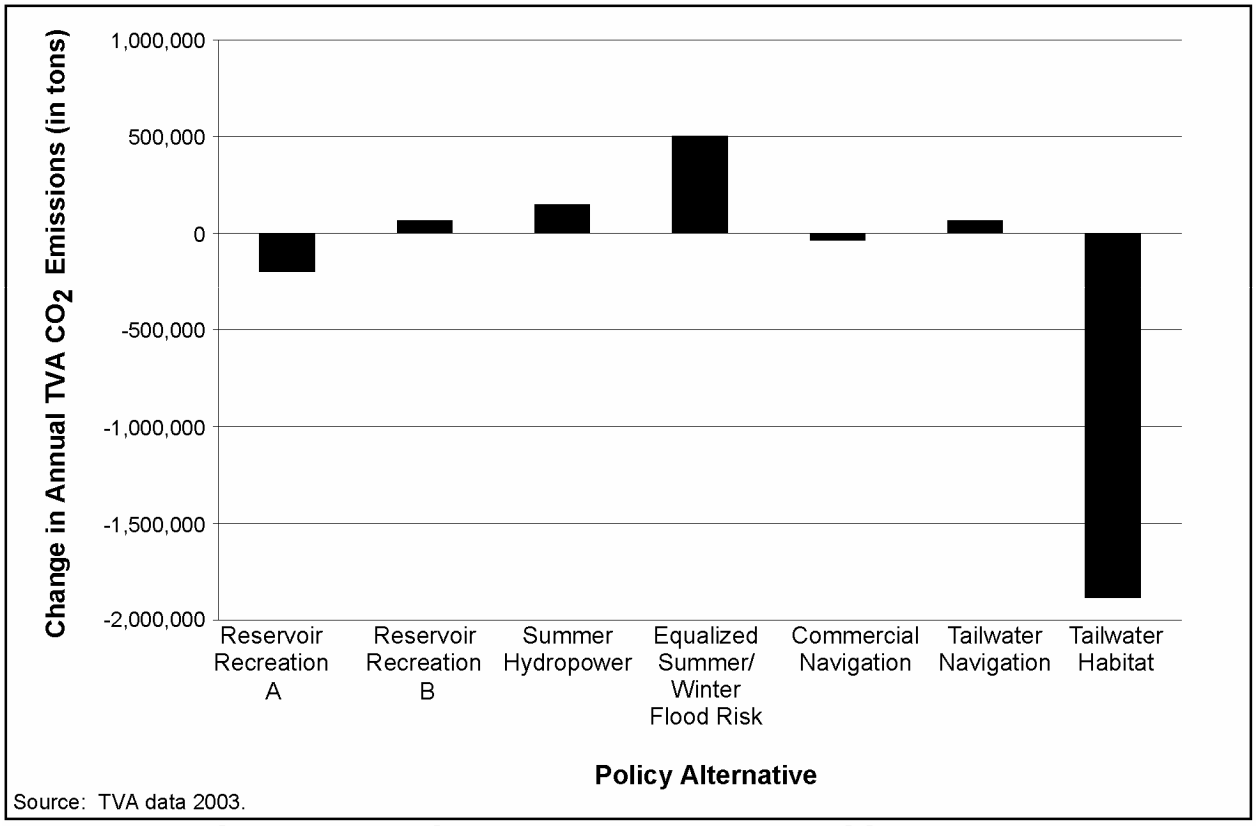

Figure 5.3-01 Comparison of Changes in Annual Total TVA CO_2 Emissions by Alternative

Table 5.3-01 contains numerical values for the increases and decreases in CO_2 emissions for each alternative. The table includes the change in MW hours; the change of CO_2 emissions (calculated by PROSYM); and the percentages of those changes compared to CO_2 emissions under the Base Case for TVA, 2000 emissions for the United States, and 1996 emissions for the 21 reporting countries.

5.3.2 Base Case

If TVA reservoir system operations are not changed, no consequent increases or decreases in CO_2 emissions would result. Increases and decreases in emissions would occur naturally due to annual variations of rainfall.

5.3.3 Reservoir Recreation Alternative A

Reservoir Recreation Alternative A would result in a minor increase in total annual hydropower production; thus, PROSYM calculates a minor decrease in CO_2 emissions (a decrease of 196,593 tons per year, or a reduction of approximately 0.18 percent). Of all the policy alternatives, Reservoir Recreation Alternative A would result in the second largest decrease in CO_2 emissions.

5.3.4 Reservoir Recreation Alternative B

Reservoir Recreation Alternative B would result in a decrease in hydropower production and therefore an increase in non-hydropower generation. Replacement of the lost hydropower generation was calculated by PROSYM to result in an average increase of 66,060 tons per year in CO_2 emissions. This amount represents an increase of approximately 0.06 percent of total annual TVA CO_2 emissions.

5.3.5 Summer Hydropower Alternative

While the Summer Hydropower Alternative would result in more hydropower generation in summer, hydropower generation for the entire year would decrease. The potential annual increase in CO_2 emissions calculated by PROSYM under the Summer Hydropower Alternative is 150,766 tons, representing approximately 0.14 percent of TVA CO_2 emissions.

5.3.6 Equalized Summer/Winter Flood Risk

The Equalized Summer/Winter Flood Risk Alternative would result in the largest decrease in hydropower production and increased CO_2 emissions of all the alternatives. Replacement of lost hydropower as calculated by PROSYM would result in an increase of 502,725 tons of CO_2 emissions. This amount represents an increase of approximately 0.47 percent.

5.3.7 Commercial Navigation Alternative

Because the Commercial Navigation Alternative would result in slightly increased hydropower production, there would be less need for fossil generation and thus corresponding potential decreases in emissions of CO_2. As calculated by PROSYM, the reduction would be 33,130 tons per year of CO_2 (or approximately 0.03 percent), representing a small positive benefit of the Commercial Navigation Alternative.

5.3.8 Tailwater Recreation Alternative

The Tailwater Recreation Alternative would result in a loss of hydropower production similar to that under Reservoir Recreation Alternative B and an increase in demand for fossil generation. PROSYM was not run specifically for this alternative because of its power production similarity to Reservoir Recreation Alternative B. As with Reservoir Recreation Alternative B, the annual increase in CO_2 emissions would be 66,060 tons (or 0.06 percent).

5.3.9 Tailwater Habitat Alternative

The PROSYM results for the Tailwater Habitat Alternative is a decrease of 1,884,347 tons per year of CO_2 emissions, representing an approximately 1.77-percent decrease. This alternative would result in the largest positive impact on climate resources.

5.3.10 Preferred Alternative

The Preferred Alternative would result in a minor decrease in total annual hydropower production. Thus, as for Reservoir Recreation Alternative A, a minor increase in CO_2 emissions is expected.

5.3.11 Summary of Impacts

Table 5.3-01 provides a summary of impacts on climate by policy alternative. Alternatives that would decrease hydropower generation could result in slightly adverse impacts on climate, but on a global scale the change at TVA in greenhouse gas emissions would have no noticeable effect. The severity of impacts associated with each alternative would depend on the amount of fossil-fuel generation used to replace lost hydropower. Implementation of the Equalized Summer/Winter Flood Risk Alternative could result in the largest potential adverse impact on climate. Reservoir Recreation Alternative B, the Summer Hydropower Alternative, and the Tailwater Recreation Alternative would result in lesser impacts on climate when compared to the Equalized Summer/Winter Flood Risk Alternative. The Preferred Alternative, Reservoir Recreation Alternative A, and the Commercial Navigation Alternative most likely would result in slightly beneficial impacts on climate, and the Tailwater Habitat Alternative would result in a beneficial impact on climate.

Table 5.3-01 Summary of Impacts on Climate by Policy Alternative

	Alternative								
	Base Case	**Reservoir Recreation A**	**Reservoir Recreation B**	**Summer Hydropower**	**Equalized Summer/Winter Flood Risk**	**Commercial Navigation**	**Tailwater Recreation[1]**	**Tailwater Habitat**	**Preferred[2]**
Increase/decrease in non-hydropower generation (MW hours)	No change	-89,310	+248,370	+157,850	+906,350	-90,930	+248,370	+298,810	The Preferred Alternative is similar to Reservoir Recreation Alternative A
Change in CO_2 emissions (tons)	No change	-196,593	+66,060	+150,766	+502,725	-33,130	+66,060	-1,884,347	
Percent of total annual TVA CO_2 emissions	100	-0.18	+0.06	+0.14	+0.47	–0.03	+0.06	-1.77	
Percent of total annual U.S. CO_2 emissions	1.64	-0.003	+0.001	+0.002	+0.008	-0.001	+0.001	-0.029	
Percent of total annual CO_2 emissions for 21 reporting countries	0.934	-0.002	+0.001	+0.001	+0.004	–0.0003	+0.001	-0.017	

[1] The Tailwater Recreation Alternative was assumed to be similar to the results of Reservoir Recreation Alternative B; no separate PROSYM run was made for the Tailwater Recreation Alternative.

[2] The Preferred Alternative was assumed to be similar to the results of Reservoir Recreation Alternative A; no separate PROSYM run was made for the Preferred Alternative.

Source: TVA PROSYM model runs for 2005.

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