Energy Vision

2020

1

Volume 2, Technical Document

Comprehensive Affected Environment

Summary

This document provides detailed information about the natural and socioeconomic resources in the region that may be influenced by TVA's Energy Vision 2020 decisions about future energy resources. It helps provide a baseline for assessing the potential environmental consequences of alternative energy strategies for the future.

The Energy Vision 2020 assessment is made at a macro, or regional, scale rather than at a micro, or site-specific, scale.

The primary study area for Energy Vision 2020 includes the TVA power service area and the Tennessee River watershed. This area contains 201 counties within a 58- million acre area. It also covers appropriate areas of the Green and Ohio Rivers in Kentucky and the Cumberland and Mississippi Rivers in Tennessee because they contain TVA coal-fired plants and, in the case of the Cumberland River, one hydro-electric power plant.

Similarly, there are potential effects on other resources outside the primary study area. As appropriate, the study contains information about them.

Volume 2, Technical Document 1

Comprehensive Affected Environment

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Comprehensive Affected Environment

SECTION 1: OVERVIEW

Energy Vision 2020 evaluates the affected environment to help provide a baseline for assessing the environmental consequences of alternative energy strategies. Because Energy Vision 2020 is also an environmental impact statement, special emphasis is being given to the environment. A regional perspective takes in both natural conditions and those resulting from human development. It considers socioeconomic, air, water, and land resources.

The Study Area

The primary study area for Energy Vision 2020, shown in the maps in *Figures T1-1* and *T1-2*, includes the TVA power service area and the Tennessee River watershed. This area contains 201 counties within a 58-million acre area. This study also covers appropriate areas of the Green and Ohio Rivers in Kentucky and the Cumberland and Mississippi Rivers in Tennessee because they contain TVA coal-fired plants and, in the case of the Cumberland River, one hydroelectric power plant. Similarly, there are potential effects on other resources outside the primary study area. As appropriate, the study contains information about them. For example, the assessment region for air quality is not limited to the TVA service area because of pollutant emissions originating outside the region, pollutants leaving the region, and because of some air pollution effects such as haze and ozone. These are recognized as regional issues.

Fuel Cycles

Fuel cycles have a wide range of impacts in the environment. They include mining, drilling, fuel transportation, power generation and waste assimilation or disposal impacts that involve air, land, and water resources. As a result, the affected environment also encompasses potentially impacted areas that may be remote from power plants. A fuel cycle consists of all the actions and outcomes of using any fuel for energy conversion, including both direct and indirect effects of the fuel cycle.

Figure T1-3 shows the relationships between fuel cycles and their resulting environmental impacts. Fuel energy choices, conversion technology, and environmental controls determine potential environmental impacts. For most impacts, site selection determines to what degree potential impacts are realized.

Environmental Quality and Trends

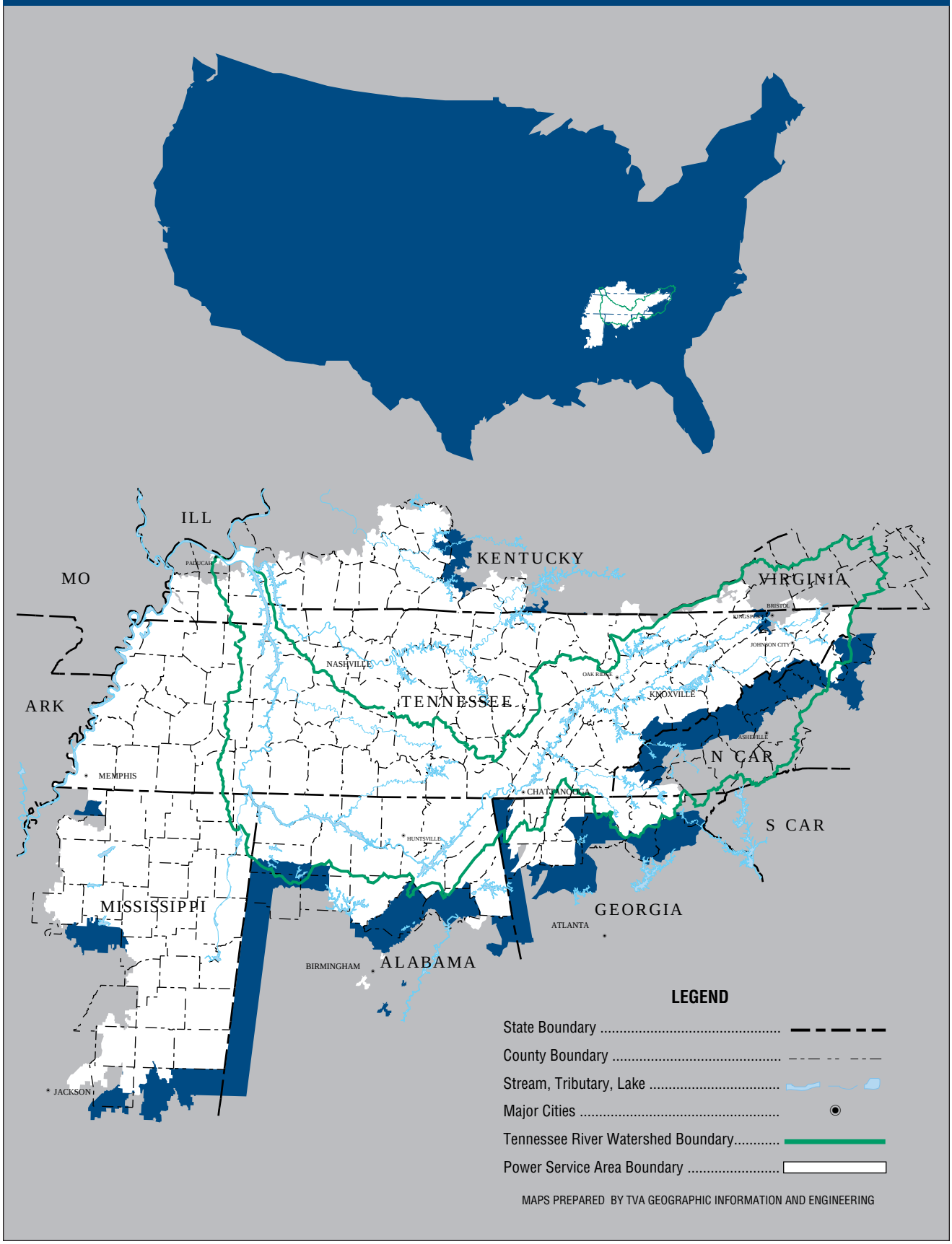
Natural resources include the air, water, and land resources of the region. This document, Technical Document 1, discusses the present quality of these resources, as well as recent and current trends in environmental quality. The socioeconomic environment, also discussed here, encompasses both the regional economy and the TVA power system.

Most direct land, water, and socioeconomic impacts are localized and depend on site selection. Proper environmental screening and selection can avoid many potentially significant impacts such as:

- Loss of wetlands, habitats, prime farmland, and cultural and historic resources
- Alteration of sensitive aquatic habitats due to heat releases, wastewater discharge, water withdrawal, or stream flow alteration
- Danger to threatened or endangered species
- Aesthetics and noise
- Socioeconomic implications

Although some air quality impacts are localized, such as plume impacts on elevated terrain, most are not. Air pollutant transport

FIGURE T1-1. **The Energy Vision 2020 Study Area is in the Southeastern United States**



and conversion processes are complex and depend greatly on meteorological conditions. TVA considers air quality impacts distant from the site when selecting plant locations. Considerations include the "down wind" spatial distribution of sensitive receptors (humans, natural resources), prevailing ambient air quality, dominant meteorological conditions, and characteristics of the air pollutant emissions. Some air quality conditions, however, are regional in scale, and some level of direct impacts may occur regardless of the location of emissions in the TVA region. Visibility impairment due to haze, ozone formation, and acid deposition are examples of potential regional effects.

Some indirect impacts, such as those from fuel sourcing and transportation, function independently of site selection. For example, coal mining impacts are generally unaffected by a power plant's location. Most potential land and water impacts depend on site selection. These are assessed in a general manner, with emphasis on the range of impacts that may be encountered. Some strategies are inherently more likely than others to result in significant environmental impacts because of an emphasis on a particular fuel or energy conversion technology. These inherent differences are discussed. Detailed environmental reviews will be conducted under National Environmental Policy Act guidelines as specific sites are selected.

SOCIOECONOMIC ENVIRONMENT

The socioeconomic environment is an integral portion of the region's total environment. Potential socioeconomic effects include impacts to social services and the local or regional economies. Energy Vision 2020 focuses on the region's economy and its components, since social services impacts are largely site-specific.

AIR RESOURCES

Air quality is important to the protection of human health and natural resources. Regional compliance with the Federal National Ambient Air Quality Standards (NAAQS) serves as a key indicator of how well human health is protected. This document presents trends in regional compliance and analyzes present air quality. Federal standards are reviewed periodically by the U.S. Environmental Protection Agency to determine if changes in standards are necessary to ensure continued adequate protection for human health and natural resources. Section 3, Air Resources, in this document examines the implications of stricter standards on compliance.

Natural resources such as soils, forests, crops, other vegetation, surface waters, aquatic ecosystems, and aquatic life may be sensitive to air quality impacts of acidic deposition (including acid rain), ozone exposure, and heavy metals deposition. Concerns in these areas are discussed in terms of present air quality and regional emissions, including those emissions contributed by TVA.

WATER RESOURCES

Water quality is critical to protecting, preserving, and restoring finite water resources. These resources include aquatic ecosystems and aquatic life, recreation, and domestic and industrial water supplies. Section 4, Water Resources, in this document discusses in detail the water quality necessary to support these uses. The sources and reasons for impaired water quality are presented, including TVA operations.

LAND RESOURCES

A broad range of land uses takes in management of the natural ecosystem, agriculture, forestry, urban and industrial use, and recreational use. Factors such as soils, groundwater, wildlife, sensitive or threatened ecosystems, threatened and endangered species, cultural resources, and terrestrial environments, such as wetlands and forests, are critically important in supporting and preserving these uses.

TVA affects land resources through site selection for power plants, reservoirs, and transmission lines; fuel procurement; air emissions; radioactive waste management; and solid waste management. Most land resource impacts are site-specific in nature and thus are not addressed in detail in this document because Energy Vision 2020 is intended to serve as a broader program-level review. Appropriate National Environmental Policy Act environmental reviews will evaluate site-specific effects associated with the actual deployment of future energy resource options.

FIGURE T1-2. **The Energy Vision 2020 Study Area Includes the TVA Service Area and the Tennessee River Watershed**

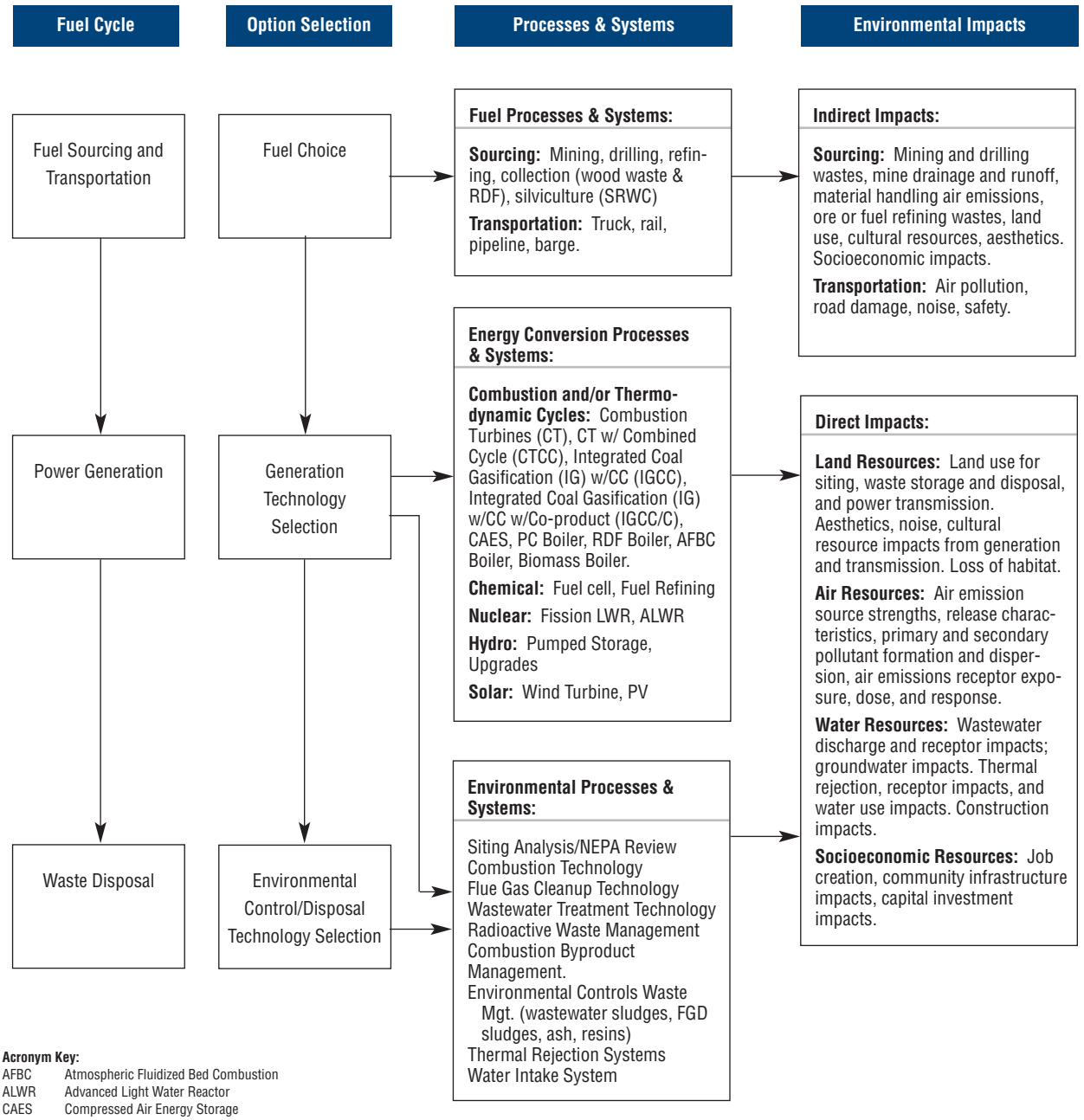
LEGEND

Tennessee Watershed Boundary

Power Service Boundary

MAPS PREPARED BY TVA GEOGRAPHIC INFORMATION AND ENGINEERING

FIGURE T1-3. **Relationships Between Fuel Cycles and Their Resultant Environmental Impacts**



Acronym Key:

AFBC	Atmospheric Fluidized Bed Combustion
ALWR	Advanced Light Water Reactor
CAES	Compressed Air Energy Storage
CT	Combustion Turbine
FGD	Flue Gas Desulfurization
IG	Integrated Gasification
IGCC	Integrated Gasification Combined Cycle
LWR	Light Water Reactor
NEPA	National Environmental Policy Act
RDF	Refuse Derived Fuel
PV	Photovoltiacs
SRWC	Short Rotation Woody Crops

SECTION 2: SOCIOECONOMIC ENVIRONMENT

Introduction

The TVA region consists of the 170 counties in which TVA provides electric power. It also includes 31 additional counties that are within the Tennessee River watershed, most of Tennessee, and parts of the surrounding states of Alabama, Georgia, Kentucky, Mississippi, North Carolina, and Virginia, to comprise a 201-county area. In terms of economic development impacts, the study area is the power service area, since this is the area that is directly affected by TVA plant locations, electric rates, and bills. In 1994, the power service area had an economy of $146 billion in total personal income, 3.6 million people in total non-farm payroll employment, and $175 billion in gross product. The population was 7.7 million in 1994. Per capita income in the power service area was about $19 thousand the same year, or about 86 percent of the national average.

The 201-county area constitutes an economy that is about 13 percent larger than the power service area. In 1994, the 201-county region had an economy of $165 billion in total personal income and 4 million non-farm jobs. (Gross product is not available for this area.) The population was 8.7 million, and per capita income was about the same as for the power service area. The general economic situation and trends are identical for the power service area and the 201-county region.

The region is considerably more rural and the economy depends much more on manufacturing than the nation as a whole. Close to half of the region's population lives in non-metropolitan counties, compared to less than one-fourth in the nation. In 1994, about 26 percent of total non-farm payroll employment in the region was in manufacturing. This compares to 16 percent for the entire United States Manufacturing's predominance in the region is due to several advantages that have previously benefited the area and should continue to do so in the future. They include:

- A location in the South, with good access to the markets of the Northeast, the Midwest, the Southwest, and Florida
- Good transportation for shipping commodities via interstate highway, rail, and barge
- A low-wage (for the U.S.) workforce with good work habits
- Abundant, relatively low-cost resources including water, electricity, and land.

Economy

A large manufacturing base has helped this area outperform the U.S. economy and is expected to continue to do so. Strong manufacturing gains since 1985, as evidenced in manufacturing employment shown in *Figure T1-4*, have stimulated the region's growth. Three critical factors hampered manufacturing in the early to mid-1980s: exceptionally high oil and energy prices, high interest rates, and high foreign exchange rates. These have returned to relatively lower levels and are expected to remain there, setting up favorable conditions for growth in the region's manufacturing.

FIGURE T1-4. **Manufacturing Employment**

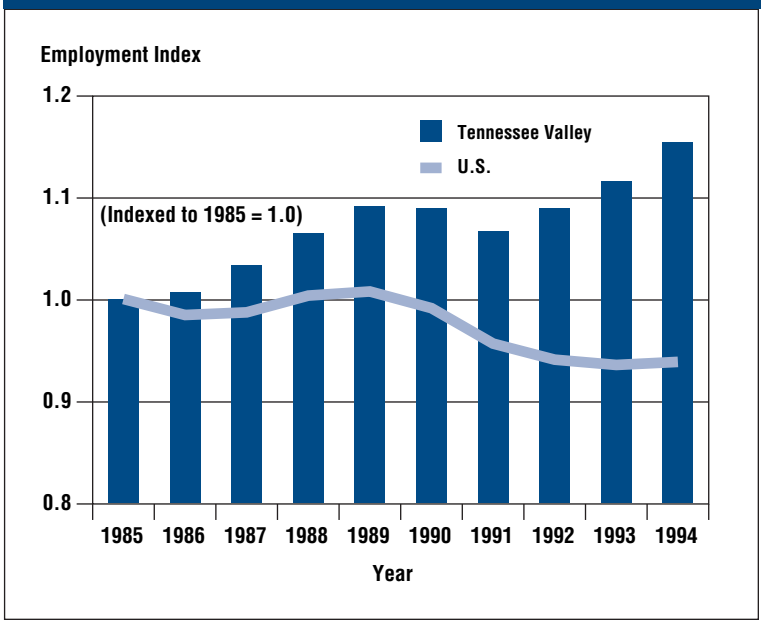


FIGURE T1-5. **Earnings, Employment, and Product in the Tennessee Valley**

	AVERAGE ANNUAL GROWTH RATES	
Earnings (1994 dollars)	**1979-1985**	**1985-1994**
Total	1.0%	3.4%
Manufacturing	0.3%	2.5%
Durables	1.1%	3.0%
Non-Durables	-0.6%	2.0%
Service Sector	2.5%	4.4%
Employment		
Total	0.9%	3.0%
Manufacturing	-0.4%	1.6%
Durables	0.1%	2.2%
Non-Durables	-0.9%	1.1%
Service Sector	2.8%	4.2%
Product (1987 dollars)		
Total	2.1%	3.9%
Manufacturing	2.4%	5.3%
Durables	3.4%	6.5%
Non-Durables	1.7%	4.2%
Service Sector	3.1%	4.0%

The cost of electricity significantly affects production costs for many of the region's manufacturing industries. Manufacturing has been helped by relatively low, stable TVA electric rates since 1988. In the future, TVA rates are expected to become even more competitive with the U.S. average. This will aid the region in maintaining manufacturing's competitive edge.

The region's manufacturing industry mix has been changing. The manufacture of durable goods, those which generally last three or more years, has expanded rapidly in the region. This has been due to newer durables industries, such as motor vehicles, coming to the region. At the same time, non-durable goods industries, such as textiles and apparel, have been losing jobs to foreign markets despite outperforming the national market.

Although manufacturing is the core of the region's economic base, non-manufacturing industries accounted for some two-thirds of total regional product in 1994. The service sector, which makes up the bulk of the non-manufacturing side of the economy, has provided, and is expected to continue to provide, the great majority of all new jobs created in the region. This follows the national trend. However, the region does not have particular comparative advantages in the service sector, as it does in manufacturing. Thus, compared with the national service sector, the service sector in the Energy Vision 2020 study area remains highly dependent on the income generated in manufacturing.

Figure T1-5 shows these historical trends for earnings, employment, and product in the manufacturing and service sectors of the TVA power service area.

Future Trends

For the balance of the decade, the region's performance is expected to continue the trend of the 1985 to 1994 period. Relatively favorable national conditions and TVA's favorable electric rates for regional manufacturing are both expected to continue. TVA expects the region's newer manufacturing industries to continue further expansion. However, worldwide economic competition is likely to become more intense as some trade barriers are removed and regions of the world favor trading blocs. For this reason, businesses will continue to hold down labor costs as much as possible; downsizing and relatively slow wage growth in the TVA region will persist. Overall, manufacturing growth in the region is expected to exceed the national rate significantly. The strength in the region's service sector is expected to continue, following the growth in manufacturing.

After the year 2000, Energy Vision 2020 expects the region's growth will slow considerably as the area's newer manufacturing industries reach maturity. Nevertheless, manufacturing's intensiveness is expected to continue to provide enough impetus for the region to expand somewhat faster than the national rate. The region's service sector is expected to remain somewhat underdeveloped relative to the nation's. Thus, with the slowing of manufacturing growth, the whole regional economy is expected to proceed at a slower tempo.

The TVA region is not a uniform economic area, however. Manufacturing accounts for about twice the share of non-farm employment in the region's non-metropolitan areas compared to the metropolitan areas (42 percent compared to only 20 percent). Further, the region's non-metropolitan areas have shown faster growth in manufacturing during expansionary periods than its metropolitan areas. Thus, the non-metropolitan areas have been, and are more likely to continue to be, more affected by the fortunes of manufacturing.

Additional information on the economic forecast is available in Volume 2, Technical Document 5, "Load Forecast." Detailed information on the regional economic situation and trends is available from TVA in a report titled "Economic Outlook" (TVA 1994).

The Agricultural Sector

Agriculture directly represents a very small percentage of the Valley's economy. The terms "agriculture" and "agricultural" refer to industries grouped in Division A of the Office of Management and Budget's (OMB) Standard Industrial Classification of Establishments. Division A industries include those involved in crop and livestock production, agricultural services, forestry, fishing, hunting, and trapping.

In 1989, only 2.7 percent of the area's population lived on farms. These farms generated only 1.8 percent of the region's total earnings, produced only 1.6 percent of its total product, and employed only 5.1 percent of its labor force. These small percentages belie the importance of agriculture to the area, however, since they do not account for the strong linkages between the agricultural sector and most other Valley industrial sectors. Once the economy's most important sector, agriculture has been declining in importance in terms of earnings, product, and employment, as shown in *Figure T1-6*. It is expected to continue to wane in the future.

The table in *Figure T1-6* shows that the Valley's farm population in 1969 was almost three times larger than in 1989. Earnings, employment, and production also fell steeply over the period, both absolutely and relative to regional totals. By 2020, the Valley's agricultural sector is expected to account for only 0.5 percent of regional earnings, 0.9 percent of regional product, and 3.1 percent of regional employment.

FIGURE T1-6. **Population, Earnings, Employment, and Product in the Agricultural Sector in 1969, 1979, and 1989**

	1969	1979	1989
Farm Population	636,090	337,008	219,503
Earnings (millions of 1994 dollars)	$2,675	$2,176	$1,656
Employment	250,876	224,901	201,401
Product (millions of 1987 dollars)	$1,936	$1,769	$1,865
SHARE OF REGIONAL TOTAL:			
Farm Population	9.5%	4.3%	2.7%
Earnings	5.0%	2.9%	1.8%
Employment	9.7%	6.8%	5.1%
Product	3.3%	2.1%	1.6%

[1] Population for the 201-County Valley Region from the 1970, 1980, and 1990 U.S. Censuses of Population.

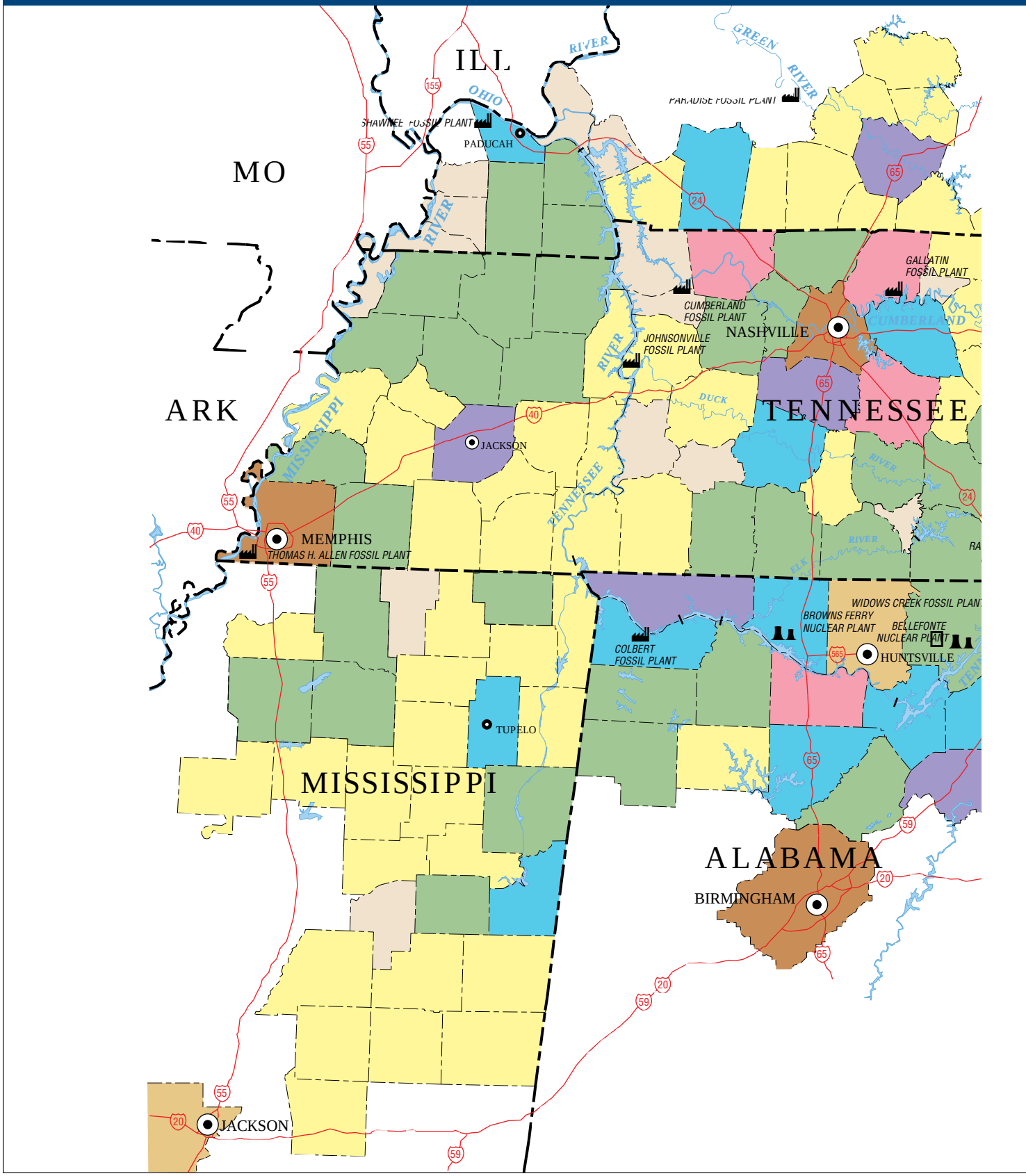
[2] Earnings, employment, and product data are for the 170-County Power Service Area.

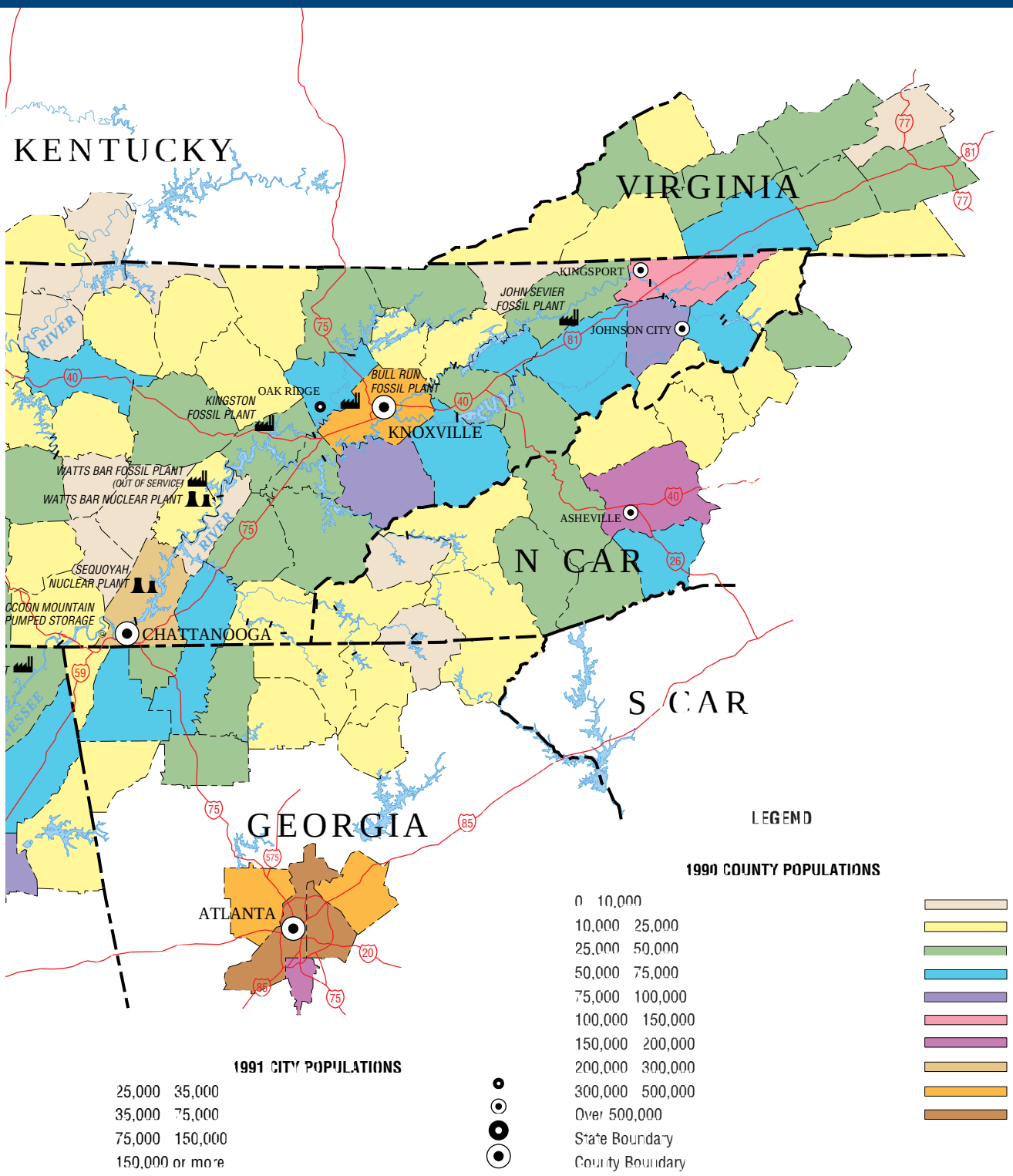
Population

About 8.7 million people live in the 201-county TVA region (about 7.7 million of these within the TVA power service area), with almost half residing in the major metropolitan areas of Nashville, Memphis, Knoxville, Chattanooga, and Tri-Cities, Tennessee, and Huntsville, Alabama. These metropolitan areas are all mid-sized, without any one large dominating area in the region, and are distributed fairly evenly throughout the region. Surrounding these metropolitan areas are a few smaller metropolitan areas and numerous satellite cities, along with the surrounding rural communities connected by both economic and transportation links. *Figure T1-7* shows the distribution of population in the TVA region. Thus, the region, while largely rural, is generally well served by centers of commerce and government, and the workforce is evenly distributed across the region, rather than focused in any particular central area.

Although only about 15 percent of the population is non-white, the distribution of the non-white population is very uneven across the region. There are greater concentrations in the central counties of metropolitan areas and in an area including most of the region's Mississippi counties, Memphis, and the counties north and east of Memphis. The region's African American households had a median income of $15,705 in 1990, about two-thirds of the region's median. Most of the region's non-metropolitan counties also had low median income levels. Similarly, regional poverty rates are generally much higher among the non-white population and in both rural and inner city areas. (Poverty rates are 34 percent for African American persons compared with 16 percent of the total population.)

FIGURE T1-7. **Population Distribution for Counties and Selected Cities**




KENTUCKY
VIRGINIA
N CAR
S CAR
GEORGIA
KINGSPORT
JOHN SEVIER FOSSIL PLANT
JOHNSON CITY
OAK RIDGE
BULL RUN FOSSIL PLANT
KNOXVILLE
KINGSTON FOSSIL PLANT
WATTS BAR FOSSIL PLANT (OUT OF SERVICE)
WATTS BAR NUCLEAR PLANT
ASHEVILLE
SEQUOYAH NUCLEAR PLANT
CCOON MOUNTAIN PUMPED STORAGE
CHATTANOOGA
ATLANTA
RIVER
LEGEND
1990 COUNTY POPULATIONS
0 10,000
10,000 25,000
25,000 50,000
50,000 75,000
75,000 100,000
100,000 150,000
150,000 200,000
200,000 300,000
300,000 500,000
Over 500,000
State Boundary
County Boundary
1991 CITY POPULATIONS
25,000 35,000
35,000 75,000
75,000 150,000
150,000 or more
MAPS PREPARED BY TVA GEOGRAPHIC INFORMATION AND ENGINEERING