

CHAPTER 1

1.0 INTRODUCTION

1.1 Introduction

The Tennessee Valley Authority (TVA) is conducting a comprehensive study of alternatives for meeting the future electrical energy needs of the Tennessee Valley. The purpose of this study, the Integrated Resource Plan (IRP), *TVA's Environmental and Energy Future*, is to develop a plan that TVA can enact to achieve a sustainable future and meet the electricity needs of its customers over the next 20 years. TVA has undertaken this study in response to recent and anticipated changes in the utility industry and recommendations from individuals and stakeholder groups.

TVA has prepared this Final Programmatic Environmental Impact Statement (DEIS) in accordance with the National Environmental Policy Act (NEPA) 42 USC §§ 4321 et seq., Council on Environmental Quality (CEQ) regulations for implementing NEPA 40 C.F.R. Parts 1500-1508, and TVA's procedures for implementing NEPA.

1.2 The Tennessee Valley Authority

The Tennessee Valley Authority was established by an act of Congress in 1933. As stated in the TVA Act, TVA is to “improve the navigability and to provide for the flood control of the Tennessee River; to provide for reforestation and the proper use of marginal lands in the Tennessee Valley; to provide for agricultural and industrial development of said valley; [and] to provide for the national defense....” Fundamental to this mission was the construction of a series of hydroelectric dams, other generating resources, and electrical transmission system which brought abundant and inexpensive electricity to the TVA region. This electrical system has grown to serve 9 million people in a seven-state, 80,000 square mile region that includes most of Tennessee and parts of Alabama, Georgia, Kentucky, Mississippi, North Carolina, and Virginia (Figure 1-1).

TVA is the largest public power producer in the United States. Dependable generating capacity on the TVA power system is about 37,200 megawatts. TVA generates most of this with 3 nuclear plants, 11 coal-fired plants, 9 combustion-turbine plants, 3 combined cycle plants, 29 hydroelectric dams, two diesel generator plants, a pumped-storage plant, a windfarm, a methane-gas cofiring facility, and several small photovoltaic facilities. A portion of delivered power is provided through long-term power purchase agreements. Electricity is transmitted to 155 local distributors and 56 large industrial and federal installations through a network consisting of approximately 16,000 miles of transmission line; 498 substations, switchyards and switching stations; and 1,240 individual customer connection points. Chapter 3 presents a more detailed description of the TVA power system. The TVA Act requires the TVA power system to be self-supporting and operated on a nonprofit basis and directs TVA to sell power at rates as low as are feasible. TVA receives no funding from taxpayers. Amendments to the TVA Act in 2004 changed the structure of the TVA Board of Directors from three full-time members to nine part-time members with the responsibility to “affirm support for the objectives and missions of [TVA], including being a national leader in

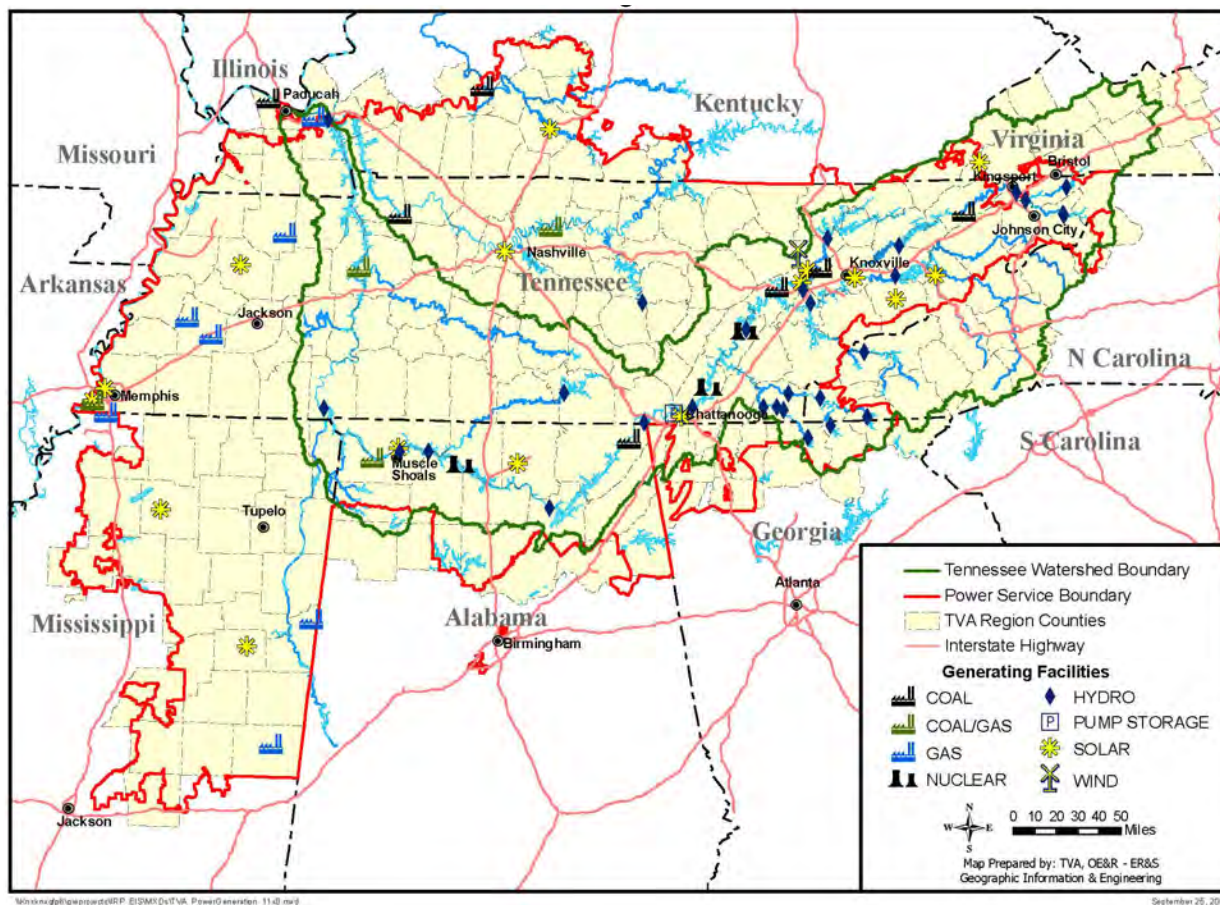


Figure 1-1. The TVA region.

technological innovation, low-cost power, and environmental stewardship.” The amendments also created a full-time Chief Executive Officer. Directors are nominated by the President and confirmed by the U.S. Senate to serve five-year terms.

1.3 History of the TVA Power System

At the time of TVA’s establishment in 1933, the Tennessee Valley region was suffering from the Great Depression, flooding along the Tennessee River, and erosion of the region’s natural resources. From its beginning, TVA was charged with the integrated development of the region with emphasis on flood control, navigation, and power production. Consistent with these purposes, TVA was also to provide a range of other public benefits including the proper use of reservoir lands, the conservation and development of the natural resources of the region, and the enhancement of the economic and social well-being of residents. As described by President Franklin Roosevelt, TVA was created as “a corporation clothed with the power of government but possessed of the flexibility of a private enterprise” (Roosevelt 1933).

To meet its objectives of flood control, navigation, and power production, the newly formed TVA took over the operation of Wilson Dam and began constructing a series of hydroelectric dams on the Tennessee River and its tributaries. The first new TVA dam to be completed was Norris Dam in 1936; by that time four other dams were under

construction. Simultaneous with this was the construction of a network of transmission lines to make electricity available across the region. Early transmission system developments included the construction of TVA's first long-distance high-voltage line, the Wilson-Wheeler-Norris line, the construction of lines connecting to the newly completed hydroelectric plants, and the integration of numerous existing transmission lines purchased by TVA. By 1939, this transmission system included about 4,200 miles of transmission lines; a large proportion of these lines were 44-kV. These lines connected to a network of local electrical distributors, who constructed and operated low-voltage lines serving end users. TVA also directly supplied a few large industrial end users. This early generation, transmission, and distribution system provided abundant and inexpensive electricity, a major tool for improving the quality of life in the region. Electric lights and modern appliances made life easier and farms more productive. Electricity also drew industries into the region, providing desperately needed jobs.

The construction of hydroelectric dams greatly accelerated during World War II in order to provide power for critical war industries. At its peak in 1942, 12 hydroelectric projects and the coal-fired Watts Bar Steam Plant were under construction and design and construction employment reached a total of 28,000. Over 1,800 miles of new transmission line were constructed during this period, and a large proportion of them were 154- and 161-kV lines.

By the late 1940s, the rapid growth in the demand for electricity was about to exceed the capacity of TVA's dams, Watts Bar Steam Plant, and a few small steam plants acquired by TVA. TVA began planning several large coal-fired steam plants and started constructing the first of these in 1949. The newest of these 11 large steam plants, Cumberland, was completed in 1973. The steam plants incorporated several technology advancements, including the largest, first-of-a-kind, coal-fired units in the world. Early in this period, TVA faced increasing difficulty in securing federal appropriations to build these single-purpose plants. In 1959, Congress passed legislation to make the TVA power system self-financing, a situation which continues to this day. This legislation also established a statutory "fence" which prohibited TVA from selling power beyond its service area with the exception of those neighboring electric companies with which TVA already had power exchange agreements. This fence was modified by the Energy Policy Act of 1992 by prohibiting the Federal Energy Regulatory Commission from requiring TVA to transmit electricity from suppliers outside the fence to customers inside the fence; this modification limits the ability of other utilities to serve TVA customers.

TVA became the largest power producer in the US during the 1950s. The TVA transmission system also greatly expanded during this period, due in large part to the need to transmit electricity from the new steam plants. Over 4,300 miles of new transmission line were constructed, mostly 154- and 161-kV lines. The 154-kV lines were soon routinely operated at 161-kV. During the 1950s, TVA installed its first microwave communication systems and began using electronic data processing equipment to manage system operations.

The 1960s were years of unprecedented economic growth in the Tennessee Valley and TVA power rates were among the lowest in the country. To meet the need for more power, TVA expanded its generating resources through an ambitious program of nuclear plant construction. This program originally called for a total of 17 nuclear units at 7 plant sites. Construction of the first TVA nuclear plant, Browns Ferry, began in 1967 and its three units began commercial operation between 1974 and 1977. The two-unit Sequoyah Nuclear Plant was completed in 1982.

The great increase in generating capacity led to the construction of a network of extra-high voltage 500-kV lines to economically and reliably transmit large amounts of power within the TVA service area and to exchange power with neighboring utilities. TVA built an experimental 6-mile 460-kV line in 1959 in order to gain experience with construction methods and costs. TVA then completed the world's first 500-kV line, a 155-mile line from Johnsonville Fossil Plant to an interconnection with Arkansas Power and Light near Memphis, in 1965. In the spring of 1966, a new 500-161-kV substation was energized at Cordova, just east of Memphis, and the 500-kV line was looped into Cordova, thus creating two lines. Over the next 2 decades TVA built several other high voltage transmission lines to better serve the region.

The 1970s brought significant changes in the economy and the demand for electricity. These started with the international oil embargo in 1973 and continued with rapidly rising fuel costs later in the decade. The average cost of electricity in the Tennessee Valley increased fivefold from the early 1970s to the early 1980s. With energy demand dropping and construction costs rising, TVA canceled the four-unit Hartsville Nuclear Plant and the two-unit Phipps Bend and Yellow Creek Nuclear Plant. Completion of the two-unit Watts Bar and Bellefonte Nuclear Plants was deferred. The passage of several major environmental laws during this period also affected TVA and the rest of the utility industry.

During 1970s and 1980s, TVA constructed or participated in several innovative and/or experimental plants. The Raccoon Mountain Pumped-Storage Plant near Chattanooga was completed in 1978. This facility works like a large storage battery by pumping water from Nickajack Reservoir to a mountaintop reservoir during periods of low demand and reversing the water flow to generate electricity during periods of high demand. After operating an experimental 20-MW atmospheric fluidized bed combustion (AFBC) pilot unit at Shawnee Fossil Plant in the early 1980s, TVA completed a 160-MW AFBC unit at Shawnee in 1989, the first commercial scale unit of its kind. TVA was a partner with the Department of Energy and Commonwealth Edison in the development and construction of the Clinch River Breeder Reactor near Oak Ridge, Tennessee; this project was canceled in 1983. In 1981 TVA began work on the Murphy Hill Coal Gasification Plant in northeast Alabama with funding from the Synthetic Fuels Corporation. This plant, designed to convert coal into liquid fuels, was canceled after Congress stopped funding the Synthetic Fuels Corporation.

As energy costs across the nation continued to climb in the 1970s and early 1980s, TVA introduced programs to encourage customers to reduce their electricity use. These programs focused on energy conservation and peak load reduction, and helped TVA's existing generating resources meet energy demands for several years. To become more competitive, TVA began aggressively improving the efficiency and productivity of its operations while cutting costs. In the late 1980s, TVA began a period of rate stability that would last for the next decade. It also halted several of its energy conservation programs. During this time period, TVA's seasonal electrical load peak changed from winter to summer.

In 1985, the Browns Ferry and Sequoyah Nuclear Plants were shut down due to safety concerns. The two Sequoyah units were restarted in 1988. After extensive modifications, Browns Ferry Units 2 and 3 were restarted in 1991 and 1995, respectively, and Unit 1 was restarted in 2007. Following a long period of deferred construction, Watts Bar Nuclear Plant Unit 1 was completed and began generating electricity in 1996. TVA resumed work on Watts Bar Unit 2 in 2007 and plans to begin operating it in 2013.

As the electric-utility industry moved toward restructuring in the 1990s, TVA began preparing for competition. It further cut operating costs, reduced its workforce, and increased the generating capacity of some of its plants. TVA began a program to modernize its hydroelectric plants by automating their operation and replacing aging equipment, resulting in an increase in their generating capacity. In the mid-1990s, TVA completed the Energy Vision 2020 Integrated Resource Plan and adopted short- and long-term action plans to serve the energy needs of the Tennessee Valley region and be competitive in a deregulated market. Since then, TVA has increased its natural gas-fueled generating capacity and implemented a clean-air strategy to greatly reduce emissions from its coal-fired plants. It has also continued to build an annual average of about 150 miles of new transmission lines and many new customer delivery points. In 2008, TVA completed its first major 500-kV transmission line since the 1980s.

1.4 Purpose and Need for Integrated Resource Planning

Like other utilities, TVA develops power supply plans. This planning process includes forecasting the demand for power and developing capacity resource plans. In the mid-1990s, TVA developed a comprehensive integrated resource plan with extensive public involvement. This process was completed with issuance of the Energy Vision 2020 IRP/Final EIS (EV2020) in 1995 (TVA 1995) and the associated Record of Decision in 1996. Based on the extensive evaluation, TVA decided to adopt a flexible portfolio of supply- and demand-side energy resource options to meet the growing demand for electricity in the region, prepare for industry deregulation, and achieve the goals of the TVA Act and other congressional directives. The adopted portfolio has subsequently been amended by Records of Decision for various implementing actions. When completed, the new IRP and EIS will replace EV2020.

The purpose of this study is to evaluate TVA's current portfolio and alternative future portfolios of energy resource options in order to meet the future electrical energy needs of the TVA region and achieve a sustainable future. Energy resource options include the means by which TVA generates or purchases electricity, transmits that electricity to customers, and influences the end use of that electricity through energy efficiency and demand response programs. As part of the integrated resource planning process, TVA has evaluated the future demand for electricity by its customers, characterized potential supply- and demand-side options for meeting future demand, and assembled these options into planning strategies and portfolios. TVA then evaluated the strategies for several criteria including capital and fuel costs, risk, reliability, compliance with existing and anticipated future regulations, environmental impacts, and flexibility in adapting to changing future conditions. Following the public review of the Draft IRP and EIS, TVA conducted further evaluations, including the development of a new strategy, addressed the public comments, and has issued this Final EIS and the Final IRP. These reports identify TVA's preferred alternative strategy, which will be submitted to the TVA Board of Directors for approval.

1.5 The Integrated Resource Planning Process

The basic integrated resource planning process consists of the six steps summarized below.

1. Scoping - Through interaction with the public and expert TVA staff, identify important issues to be considered in the planning process. The results of the public scoping are described in more detail below in Section 1.8.
2. Develop Modeling Inputs and Framework - Much of the IRP analysis involves sophisticated computer modeling. In this step, model inputs for topics mostly out of

TVA's control, such as the forecasted need for power, fuel prices, environmental and other legislation, and construction and materials costs, are determined. These inputs are organized into various scenarios which portray possible future "worlds" that TVA may find itself in. Another phase of this step is the development of various strategies in which TVA varies attributes under its control, such as the size of energy conservation and demand reduction programs, the amount of renewable energy to be used, how much nuclear generation will be added, whether and when to idle existing plants, and how much energy will be bought from other producers. These scenarios and strategies are described in more detail in Chapter 2.

3. Analyze and Evaluate - Once the model inputs and framework are developed, a two-phase modeling process produces least cost energy resource plans and associated plan costs. A unique resource plans is produced for each combination of a scenario and a strategy. The results of this modeling are described in Chapter 6.
4. Issue Draft Plan - The Draft IRP incorporating the results of the modeling and the associated Draft EIS are issued for review by the public.
5. Incorporate Public Comment and Conduct Modeling - After the close of the public comment period, TVA reviews all comments. TVA also conducts any necessary additional modeling in response to public and internal feedback as well as updated modeling inputs.
6. Identify Preferred Strategy and Issue Final Plan - Based on the public comments and results of any additional analyses, TVA identifies a preferred strategy. This is documented in the Final IRP and associated Final EIS. The Final EIS also contain responses to the public comments. The TVA Board will subsequently select the strategy to be implemented.

1.6 The TVA Strategic Plan and Vision

The TVA Strategic Plan (TVA 2007a) reiterates the TVA mission of improving the quality of life in the TVA region through its work in the three key areas of energy, the environment, and economic development as follows:

1. Energy: TVA supplies reliable, affordable electricity to the Tennessee Valley region. It strives to meet the changing needs of power distributor customers and directly served industrial customers for electricity and related products and services in a dynamic marketplace.
2. Environment: To fulfill its environmental stewardship mission, TVA manages the natural resources of the Valley for the benefit of the region and the nation. It manages the Tennessee River system and associated public lands to reduce flood damage, maintain navigation, support power production and recreational uses, improve water quality and supply, and protect shoreline resources.
3. Economic Development: TVA works with its power distributor customers; state, regional, and local economic development organizations; and other federal agencies to build partnerships that help bring jobs to the Tennessee Valley and make the economy stronger to benefit the people of the region.

Key components of the TVA business structure, in addition to the continued focus on the three-part mission of energy, environment, and economic development, include the following:

- All aspects of the business area will continue to be funded from power revenues and financings.

- Generation and transmission services will continue to be provided as part of a “bundled” package.
- Demand for power will be met through a careful balance of self-reliance and partnership with others, limiting dependence on the market to keep costs competitive and reduce risk associated with short-term market volatility.
- Financing obligations will be appropriate to the value of the assets.

The plan identifies the following five broad strategic objectives and corresponding critical success factors:

1. Customer: Maintain power reliability, provide competitive rates, and build trust with TVA’s customers
 - Strengthen relationships and trust by being responsive to stakeholder needs
 - Develop a portfolio of product and pricing structures that more accurately reflect the costs of serving load at different times and levels of use.
 - Partner with distributors and directly served customers to encourage conservation, promote energy efficiency, and reduce peak demand
 - Partner with customers to limit volatility in rates and participate in power supply through shared generation ownership
 - Assist states, communities, and distributors in sustaining economic development programs
2. People: Build pride in TVA’s performance and reputation
 - Safeguard the health and safety of employees and the public
 - Strengthen workforce knowledge and skills and management processes to motivate performance and successfully implement the strategic objectives
 - Treat employees, customers, and other stakeholders with integrity and respect
 - Communicate clearly and consistently
3. Financial: Adhere to a set of sound guiding financial principles to improve TVA’s fiscal performance
 - Apply sound economic and financing practices to new investments
 - Pay financing obligations before assets are fully depreciated
 - Strengthen TVA’s balance sheet by improving the ratio of financing obligations to total assets
 - Improve TVA’s cash return on total assets in order to service debt, preserve existing assets, reinvest in new assets, and improve environmental performance
 - Achieve top-quartile performance in non-fuel operation and maintenance expenses and then hold increases to be less than unit sales growth (kilowatt-hours)
4. Assets: Use TVA’s assets to meet market demand and deliver public value
 - Balance TVA’s production capabilities and load by adding assets (buy, build or through long-term contracts) and encouraging the use of energy in ways that reduce the need for new generation

- Preserve, maintain, repower or retire existing assets where appropriate and cost-effective
 - Manage land and water resources to provide multiple benefits to the Valley
 - Reduce fuel supply risk with a diverse portfolio of generation assets
5. Operations: Improve performance to be recognized as an industry leader
- Deliver reliable electric power generation and transmissions products and services
 - Benchmark the industry's best performers to develop metrics for top-quartile performance
 - Make nuclear safety the overriding priority for each nuclear facility and for each individual associated with it
 - Continue to reduce the impacts of TVA's operations on the environment
 - Serve as a responsible steward of the Tennessee River system
 - Apply science and technological innovation to improve operational performance

In August 2010, TVA announced a renewed vision (TVA 2010d) to become one of the nation's leading providers of low-cost and cleaner energy by 2020. This will be done by:

- Leading the nation in improving air quality
- Leading the nation in increased nuclear production
- Leading the Southeast in increased energy efficiency.

1.7 The TVA Environmental Policy

The TVA Environmental Policy (TVA 2008) was issued to align with TVA's mission of energy, environment, and economic development and to accent and integrate environmental leadership into all aspects of this mission. The policy is organized into six environmental areas and establishes an objective and critical success factors for each. The six areas and their objectives are listed below. The climate change mitigation, air quality improvement, and waste minimization areas are most relevant to the IRP.

1. Climate Change Mitigation: TVA will stop the growth in volume of emissions and reduce the rate of carbon emissions by 2020 by supporting a full slate of reliable, affordable, lower-carbon-dioxide (CO₂) energy-supply opportunities and energy efficiency.
2. Air Quality Improvement: TVA will continue efforts to reduce sulfur-dioxide, nitrogen-oxide, mercury, and particulate emissions and engage regional and national stakeholders to develop better ways to understand, monitor, and improve regional air quality, including all regulated air emissions.
3. Water Resource Protection and Improvement: TVA will improve reservoir and stream-water quality, reduce the impact of its operations, and leverage alliances with local and regional stakeholders to promote water conservation.
4. Waste Minimization: TVA will drive increased sustainability in existing compliance programs and waste management practices by focusing on waste avoidance, minimizing waste generation, and increasing recycling to reduce environmental impacts.

5. Sustainable Land Use: TVA will strive to maintain the lands under its management in good environmental health, balancing their multiple uses, and will improve its land transaction processes to support sustainable development.
6. Natural Resource Management: TVA will be a leader in natural resource management through the implementation of sustainable practices in dispersed recreation while balancing the protection of cultural, heritage, and ecological resources.

1.8 Scoping and Public Involvement

NEPA regulations require an early and open process for deciding what should be discussed in an EIS. This scoping process involves requesting and using comments from the public and interested agencies to help identify the issues and alternatives that should be addressed in the EIS, as well as the temporal and geographic coverage of the analyses.

1.8.1 Scoping

TVA initiated the public scoping process for the IRP and associated EIS with the publication of the Notice of Intent in the *Federal Register* on June 15, 2009. TVA simultaneously issued news releases, posted notice on the project website <http://www.tva.com/environment/reports/irp/index.htm>, and sent letters about the project to numerous state and federal agency offices and Indian tribal representatives. This began a 60-day scoping period.

TVA solicited scoping comments by mail, e-mail, a comment form and questionnaire on the project website, and at public meetings. TVA held seven public meetings between July 20 and August 6 (Table 1-1). About 180 people attended these meetings; attendees included members of the general public, representatives from state agencies and local governments, distributors of TVA power, non-governmental organizations, and other special interest groups. Exhibits, fact sheets, and other materials were available at each public meeting to provide information about the study and the EIS. TVA personnel introduced the project and answered questions about the planning process, the EIS, the TVA power system, supply- and demand-side options, and environmental issues.

Table 1-1. IRP 2009 Public Scoping Meetings.

Date	Location
July 20	Nashville, TN
July 21	Chattanooga, TN
July 23	Knoxville, TN
July 28	Huntsville, AL
July 30	Hopkinsville, KY
August 4	Starkville, MS
August 6	Memphis, TN

TVA received over 1,000 individual comments during the public scoping. About 40 attendees submitted oral or written comments during the public meetings. Sixty-five email comments were received from individuals and organizations and an additional 50 comments were submitted through the TVA website. Eight hundred forty-five people completed at least part of the scoping questionnaire, and almost 640 of these respondents answered the write-in questions as well as the multiple-choice questions. Responses were

received from nine offices of four federal agencies and from 20 state agencies representing six of the seven TVA region states. Some of these agency responses included specific comments; others stated they had no comments at this time but would like to review the draft IRP/EIS. Scoping comments were received from six of the seven TVA region states and about four percent of the comments were from outside the TVA region. Three-fourths of the comments were from Tennessee residents. The geographic origin of three percent of the comments was not identified.

Some comments from agencies, organizations, and individuals were specific to TVA's natural and cultural resource stewardship activities and are not included in this summary of scoping results. At the time scoping was initiated, TVA anticipated that the IRP would also address many of these stewardship activities. TVA subsequently established a separate planning process for these stewardship activities, the Natural Resource Plan. Information on this planning process is available at <http://www.tva.com/environment/reports/nrp/index.htm>. The comments on stewardship activities received during the IRP scoping are being addressed in the Natural Resource Plan and associated EIS.

Scoping comments addressed a wide range of issues, including the integrated resource planning process, preferences for various types of power generation, support for increased energy efficiency and demand response efforts, and the environmental impacts of TVA's power generation, fuel acquisition, and power transmission operations. Comments on these issues are briefly summarized below; a more detailed discussion of the scoping comments is available in the IRP EIS Scoping Report issued in October, 2009 (TVA 2009).

The most frequently mentioned issue in the scoping comments was the cost of electricity. While a large number of commenters were opposed to any future price increases, a majority of those completing the questionnaire expressed willingness to pay more for electricity generated from non-greenhouse gas emitting sources. Reliability and the ability to meet future demand were also among the most frequently mentioned issues. A large number of commenters also expressed concern about and/or dissatisfaction with TVA leadership, TVA facility maintenance, and TVA's ability to adapt to future conditions. A majority of those completing the questionnaire also expressed willingness to take various measures to reduce their energy use; the willingness to undertake some measures increased with the availability of financial incentives.

The Integrated Resource Planning Process

Several commenters addressed the integrated resource planning process. Their comments recommended that TVA: follow industry standard practices; enter the process without preconceptions about the adequacy of various resource options; be open and transparent throughout the planning process; treat energy efficiency and renewable energy as priority resources, and address the total societal costs and benefits, including externalities.

Recommended Energy Resource Options

Many scoping comments included general recommendations about TVA's future supply-side and demand-side resource options. Common themes throughout a large number of the comments were that TVA's future resource portfolio avoid or minimize rate increases, minimize or reduce pollution and other environmental impacts, and be reliable. The most frequently mentioned generalized resources included increased renewable generation (including wind, solar, locally sourced biomass and low-impact hydro), decreased coal-fueled generation, and increased nuclear generation. Somewhat less frequently mentioned

were decreased nuclear generation, increased energy efficiency and demand response programs, reliance on a diversity of fuel sources, avoidance of uneconomical renewable generation, and the need for a modernized or “smart” transmission system. A few commenters recommended specific goals such as 15 to 20 percent renewable generation capacity by 2020, 60 to 70 percent nuclear generation capacity by 2029, and a 1 percent annual increase in energy efficiency savings through 2020. Many commenters recommended that TVA take a leadership role (or reestablish its former leadership role) in researching and developing a wide range of supply-side and demand-side options.

Environmental Impacts of Power System Operations

A majority of the commenters expressed concerns about the environmental impacts of the TVA power system. General concerns about pollution were the second most frequently mentioned issue, and over half of questionnaire respondents ranked the issues of air pollutants, greenhouse gas emissions/climate change, spent nuclear fuel, and coal combustion byproducts as of high importance. The Kingston Fossil Plant coal ash spill in December 2008 was also frequently mentioned. Many written comments encouraged TVA to decrease its emissions of greenhouse gases while others questioned the human influence on climate change. Several commenters also raised the issue of the impacts of buying coal from surface mines, particularly mountaintop removal mines, and recommended that TVA stop this practice.

Options to Be Evaluated

Scoping participants recommended a large number of traditional and non-traditional demand- and supply-side resource options. TVA has evaluated an extensive list of options, including the options currently used by TVA, options mentioned during public scoping, and options identified by TVA staff. Each option has been characterized by a suite of factors and initially screened by various feasibility criteria. The feasible resource options were then grouped into portfolios consisting of specific combinations of demand- and supply-side options.

Issues to Be Addressed

The various resource options are screened and then combined into possible 20-year planning strategies. The strategies are evaluated against a long list of criteria or issues. This list has been developed from standard industry practices, public scoping comments, and TVA staff input. In both the options screening and strategy evaluations, TVA considers numerous criteria including technological maturity and availability; operational criteria such as duty cycle, capacity, reliability, and fuel requirements; transmission requirements; environmental criteria such as air pollutants, greenhouse gas emissions, water requirements and thermal discharges, solid waste generation, and land requirements; financial criteria such as construction/implementation costs, operating costs, and decommissioning costs; risk; and workforce requirements. Some of these criteria are quantitatively evaluated in industry-standard models; others are evaluated qualitatively. These criteria address many of the environmental objectives and critical success factors listed in TVA's Environmental Policy.

The strategies are evaluated against a set of scenarios that address uncertainties in predicting economic conditions, power demand and load shape, environmental regulations including reductions in greenhouse gas emissions, renewable energy standards, commodity prices, cost of financing, cost of purchased power, construction cost escalation, and risks associated with licensing, permitting, and the schedule for new generating and transmission facilities. The ranges of forecasts associated with these key uncertainties

have been aggregated into the scenarios described in Section 2.3. The results of the evaluation of each of the planning strategies against the criteria in this range of scenarios will be a key factor in selecting the preferred strategy and associated short- and long-term action plans.

Because this is a programmatic EIS, site specific issues associated with constructing and operating power facilities are not addressed. Before implementing a specific resource option, a resource-specific environmental review will be conducted as appropriate.

Alternatives to Be Evaluated

TVA's current power supply planning strategy represents the No Action Alternative. The Action Alternatives consist of the final short list of strategies and associated portfolios which are evaluated against the range of scenarios.

1.8.2 Public Briefings

In addition to the public scoping meetings described above, TVA held quarterly public briefings on November 16, 2009, February 17, 2010, and May 13, 2010. Participants could attend in person or by web conference. Videos of the briefings and presentation materials were posted on the project website. Topics discussed at the public briefings included an introduction to the resource planning process, load forecasts, resource options, development of scenarios and strategies, and evaluation metrics.

1.8.3 Stakeholder Review Group

Following the public scoping efforts, TVA established a Stakeholder Review Group to more actively engage stakeholders throughout the IRP development process. The 16-member review group is composed of representatives of state agencies, the Department of Energy, distributors of TVA power, industrial groups, academia, and non-governmental organizations. These members are expected to represent their constituency and report to them on the IRP process, as well as give input to TVA on the process. Review group meetings have been held throughout the study. Additional information about the review group, including a list of members and meeting materials, is available at <http://www.tva.gov/environment/reports/irp/stakeholder.htm>.

1.8.4 Public Review of the Draft IRP and EIS

The Draft IRP and EIS were issued to the public on September 15, 2010 and the notice of their availability was published in the *Federal Register* on September 24, 2010. This initiated a 45-day public comment period. The comment period was later extended to 52 days and closed on November 15, 2010.

The Draft IRP and EIS were posted on the project website. Printed copies and/or CDs containing electronic files of the documents were mailed to state and federal agencies and to others upon request. Others on the project contact list were mailed or e-mailed notifications of the availability of the documents and instructions on how to submit comments.

TVA accepted comments submitted through an electronic comment form on the project website, and by mail and email. During the comment period, TVA held five public meetings (Table 1-2) to describe the project and to accept comments on the Draft IRP and EIS. TVA staff presented an overview of the planning process and draft results. Attendees then had the opportunity to make oral comments and ask questions about the project. A panel of

TVA staff responded to the questions. Stakeholders could also participate in the meetings via webinar and TVA responded to comments and questions submitted by webinar participants in the same manner as those from in-person attendees. About 125 people attended these public meetings in person and 43 attended by webinar.

Table 1-2. Public Meetings Held in 2010 Following Release of Draft IRP and EIS.

Date	Location
October 5	Bowling Green, KY
October 6	Nashville, TN
October 7	Olive Branch, MS
October 13	Knoxville, TN
October 14	Huntsville, AL

TVA received 501 comment submissions, which included letters, form letters, emails, oral statements, and submissions through the project website. These were carefully reviewed and synthesized into about 370 individual comments. These comments and TVA's responses to them are provided in Volume 2 of this Final EIS. As a result of the comments, TVA made several changes to the Final IRP and EIS. TVA also considered the comments during the development of Recommended Planning Direction alternative that has been added to the Final IRP and EIS.

1.9 Statutory Overview

Several federal laws and executive orders are relevant to TVA's integrated resource planning. Those that are specific to the natural, cultural, and socioeconomic resources potentially affected by the TVA power system are described below. This section begins with a detailed description of the National Environmental Policy Act and then lists other potentially applicable laws and executive orders. Compliance with these laws and orders may affect the environmental consequences of an alternative or measures needed during its implementation. Chapter 4, Existing Environment, describes the regulatory setting for each resource in more detail. Chapter 7, Environmental Consequences, discusses applicable laws and their relevance to this analysis.

National Environmental Policy Act

This EIS has been prepared by TVA, in compliance with the National Environmental Policy Act (NEPA) of 1969 (42 United States Code [U.S.C] §§ 4321 et seq.), regulations implementing NEPA promulgated by the Council on Environmental Quality (40 Code of Federal Regulations [C.F.R] Parts 1500 to 1508), and TVA NEPA procedures. TVA will use this EIS, as well as the analyses in the IRP, to select the resource plan to be implemented.

NEPA requires federal agencies to consider the impact of their proposed actions on the environment before making any decisions. Actions, in this context, include new and continuing activities conducted, financed, assisted, regulated or approved by federal agencies, as well as new or revised agencies rules, regulations, plans, policies, or procedures. For major federal actions, NEPA requires that an EIS be prepared. This process must include public involvement and analysis of a reasonable range of alternatives.

According to CEQ regulations, a programmatic EIS is appropriate when a decision involves a policy or program, or a series of related actions by an agency over a broad geographic area. Due to the nature of the IRP, this EIS is programmatic. The environmental impacts of the alternative actions are therefore addressed at a regional level with some extending to

a national or global level. The more site-specific effects of specific actions proposed to implement the IRP will be addressed in later tiered environmental reviews.

The Draft EIS was distributed to interested individuals, groups, and federal, state, and local agencies for their review and comment. Following the close of this public comment period, TVA has compiled and responded to the substantive comments received on the DEIS and incorporate any required changes into the Final EIS. The completed Final EIS will be sent to those who received the DEIS or submitted comments on the Draft EIS. It will also be transmitted to the Environmental Protection Agency which will publish a notice of its availability in the *Federal Register*. The TVA Board will be asked to approve an energy resource strategy no sooner than 30 days after the publication of this notice of availability. TVA will then issue a Record of Decision which will include (1) what the decision was; (2) the rationale for the decision; (3) what alternatives were considered; (4) which alternative was considered environmentally preferable; and (5) any associated mitigation measures and monitoring, and enforcement requirements.

Other Laws and Executive Orders

Several other laws and executive orders are relevant to the effects of power system planning, construction, and operation on natural, cultural, and socioeconomic resources (Table 1-3). Compliance with these laws and orders may affect the environmental consequences of an alternative or measures needed during its implementation. Most of these laws also have associated implementing regulations. Chapter 3, *Affected Environment*, describes the regulatory setting for each resource in more detail. Chapter 7, *Environmental Consequences*, discusses applicable laws and their relevance to this analysis.

1.10 Relationship with Other NEPA Reviews

Energy Vision 2020 - Integrated Resource Plan and Environmental Impact Statement

TVA completed this comprehensive IRP and Final EIS (TVA 1995) in December 1995. Based on the extensive evaluation, TVA adopted a flexible portfolio of supply- and demand-side energy resource options to meet the growing demand for electricity in the region, prepare for industry deregulation, and achieve the goals of the TVA Act and other congressional directives. The adopted portfolio has subsequently been amended by Records of Decision for various implementing actions. The new IRP and EIS update EV2020 and when completed will replace it.

Table 1-3. Laws and executive orders relevant to the environmental effects of power system planning, construction, and operation.

Environmental Resource Area	Law / Executive Order
Water Quality	Clean Water Act
Groundwater	Safe Drinking Water Act
Air Quality	Clean Air Act
Wetlands	Clean Water Act Executive Order 11990 – Protection of Wetlands
Floodplains	Executive Order 11988 – Floodplain Management
Endangered and Threatened Species	Endangered Species Act
Cultural Resources	National Historic Preservation Act Archaeological Resource Protection Act Native American Graves Protection and Repatriation Act
Environmental Justice	Executive Order 12898 – Federal Actions to Address Environmental Justice in Minority and Low-Income Populations
Land Use	Farmland Protection Policy Act
Coal Mining	Surface Mining Control and Reclamation Act
Waste Management	Resource Conservation and Recovery Act Comprehensive Environmental Response, Compensation, and Liability Act Toxic Substances Control Act

River Operations Study Final Environmental Impact Statement

Published in 2004, this EIS (TVA 2004) evaluated potential changes in TVA's policy for operating its reservoir system. The new operating policy adopted by TVA established a balance of reservoir system operating objectives to produce a mix of benefits that is more responsive to the values expressed by the public. The changes include enhancing recreational opportunities while avoiding unacceptable effects on flood risk, water quality, and TVA electric power system costs. This EIS contains a detailed description of TVA's hydroelectric generating facilities and is incorporated by reference.

Adoption of PURPA Standards for Energy Conservation and Efficiency Environmental Assessment

This 2007 environmental assessment (TVA 2007b) evaluates TVA's proposed adoption of standards established by the Public Utilities Regulatory Policies Act of 1978, as modified by the Energy Policy Act of 2005, for Smart Metering, Net Metering, Fuel Diversity, Fossil Fuel Generation Efficiency, and Interconnection. TVA determined that it would adopt the first three standards without changing its operations and it would adopt modified versions of the last two standards. These standards are relevant to the integrated resource planning process.

Environmental Impact Statements and Environmental Assessments for Generating Facilities and Transmission Lines

Since the early 1970s, TVA has issued numerous EISs and environmental assessments describing the anticipated impacts of the construction and operation of new generating

facilities, major upgrades to generating facilities, and new transmission lines and substations. Most of these issued since 2002 are available at <http://www.tva.com/environment/reports/index.htm>. Several of these were used as sources of information for the impact analyses in Chapter 6. The following are examples of these reports:

- The 2000 EIS for the Lagoon Creek combustion turbine generating plant in Haywood County, Tennessee (TVA 2000)
- The 2001 EIS for a combined cycle generating plant in Franklin County, Tennessee (TVA 2001)
- The 2005 environmental assessment of the modernization of turbines at Wilson Hydro Plant (TVA 2005a)
- The 2005 EIS for a 500-kV transmission line and substation in middle Tennessee (TVA 2005b)
- The 2006 environmental assessment of the flue gas desulfurization system at Kingston Fossil Plant (TVA 2006)
- The 2007 EIS on the completion of Watts Bar Nuclear Plant unit 2 (TVA 2007c)

1.11 EIS Overview

This Final EIS consists of two volumes. The contents of each volume are outlined below.

Volume 1

Chapter 1: Introduction—describes the purpose and need for the IRP EIS, the decision to be made, history of the TVA power system, an overview of integrated resource planning, and the scoping process and public involvement.

Chapter 2: TVA's Resource Planning Process—describes the integrated resource planning process, evaluation metrics, the power needs assessment, and scenario and strategy development.

Chapter 3: Existing Power System—describes TVA customers, sales, and power exchanges; TVA-owned generating facilities; purchased power; energy efficiency and demand response programs, and the transmission system.

Chapter 4: Existing Environment—describes aspects of the natural, cultural, and socioeconomic environment potentially affected by the alternative actions.

Chapter 5: Energy Resource Options—describes supply-side (e.g., generating facilities) and demand-side (e.g., energy efficiency and demand response programs) options potentially comprising the power portfolios.

Chapter 6: Alternatives/Strategies—describes the alternative/strategy development process, the alternatives/strategies assessed in this EIS, and a comparison of the alternatives/strategies.

Chapter 7: Environmental Consequences—describes the anticipated environmental impacts of each of the options used in the final alternatives/strategies, as well as the environmental impacts of each alternative/strategy over the 20-year planning period.

Chapters 8-10—contain lists of the literature cited, preparers, and EIS recipients. It is followed by the glossary and index.

Volume 2

Chapter 1: Introduction and Overview

Chapter 2: Responses to Public Comments

Chapter 3: Listing of Commenters and Affiliations

Chapter 4: Agency Comment Letters