

# Energy Vision 2020

EXECUTIVE SUMMARY

## Integrated Resource Plan Environmental Impact Statement





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## Executive Summary, Energy Vision 2020 Integrated Resource Plan/Environmental Impact Statement

### **TVA Leadership**

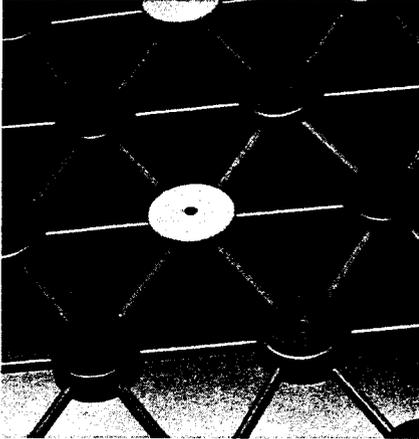
#### **Board of Directors**

Craven Crowell, Chairman

William H. Kennoy, Director

Johnny H. Hayes, Director

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*In presenting the action plans of Energy Vision 2020, TVA is again demonstrating that best business practices can be compatible with environmental responsibility—that economic growth and improvements in the quality of life are compatible—and that innovation and creativity are integral to remaining successful in a competitive market.*

## **Introduction to Energy Vision 2020**

Energy Vision 2020 is TVA's roadmap for meeting the energy needs of its customers during the next 25 years with economical and environmentally sound energy choices. These are important challenges for TVA, which is the largest single producer of electricity in the United States. With a generating capacity of 28,000 megawatts, TVA provides wholesale power to 160 distributors and directly serves 60 large industrial and federal customers. In partnership with the distributors, the TVA power system serves 7.7 million people in an 80,000-square-mile area that covers parts of seven southeastern states.

TVA is expecting important changes in the relationships between utilities and their customers. Consumer, legislative, and utility actions across the nation are changing the electric utility industry from a regulated monopoly to a competitive marketplace. TVA is at the forefront of this change and welcomes the opportunity for growth and improved service and responsiveness to the needs of its current and new customers. By identifying the best energy choices for current and future consumers, Energy Vision 2020 will guide TVA as it enters this competitive marketplace.

Moreover, Energy Vision 2020 goes beyond the issue of how TVA can provide competitively priced power. The plan also considers economic development and the environment as part of TVA's mandate to be a leader in total resource development. Innovative approaches to meeting the demand for energy through new technologies and business arrangements are the means by which TVA can provide competitively priced power, opportunities for economic growth, and a quality environment rich in natural resources.

The TVA Board has already taken several strategic actions in part based on information and analyses performed in conjunction with Energy Vision 2020.

These are:

- Reversed TVA policy on nuclear plant construction.
- Placed an internal limit on new capital debt and announced a debt-reduction program.
- Kept TVA's electric rates steady for a ninth consecutive year.
- Introduced TVA to the global energy market through international bond offerings.
- Commissioned a major study to identify strategic actions that will strengthen TVA's position in an open marketplace.

The result of these efforts is that TVA's self-supporting power system is financially strong. TVA's electric power production and operating costs are competitive with utilities in the regional market. The same is true for the electric prices paid by consumers in the TVA service area.

Energy Vision 2020 provides the TVA Board with a flexible energy supply plan that will help guide the strategic actions necessary for TVA to serve its customers efficiently, and to compete and succeed in the electric utility marketplace of the future.

Launched in the winter of 1994, Energy Vision 2020 includes an unprecedented effort by TVA to involve the public in TVA's energy planning process. Environmental, consumer, and energy industry representatives were appointed to a citizen group to provide input on the formulation of the plan, and public meetings were held throughout the TVA service area to gather public comments and suggestions. Interviews were also conducted with elected officials and opinion leaders. The open process produced a stronger partnership with the more than 7.7 million people who use the electricity produced by TVA.

Energy Vision 2020 identified a viable mix of conservation programs and options for power plant operations that will be used to responsibly and economically provide energy for sustainable economic growth. For all resource options, the environmental consequences and economic impacts were considered as part of TVA's effort to encourage sustainable economic growth in the region. Strong public support for various options, such as demand-side management, also was considered.

Overall the key recommendations of Energy Vision 2020 are:

- Invest in up to 3,000 megawatts of flexible purchases of power
- Convert Bellefonte to an alternative fuel source such as natural gas or coal
- Implement up to 1,450 megawatts of energy efficiency and load management
- Research and develop renewable energy resources - wind, biomass, solar photovoltaics

Additional recommendations, which the TVA Board of Directors has asked the staff to include, are:

- Begin additional flexible demand-side management programs with a potential of 750 megawatts
- Investigate the development of a flexible wind project, a biomass refinery, and a combined garbage and biomass energy facility

Because TVA has a unique mission to supply electric power and encourage sustainable economic development in its service region, Energy Vision 2020 has the flexibility to shift priorities as the marketplace evolves and changes influence the viability of power supply options. When changes in energy options are necessary, TVA will remain focused on making economical and environmentally sound energy choices.

## Energy Vision 2020: The Report

Energy Vision 2020 is the culmination of more than 24 months of work and research by TVA staff and leading national experts in power planning and the integrated resource planning process. The final plan offers a portfolio of resource options that have met the evaluation criteria established by TVA and TVA's customers and stakeholders.

Resource options identified in Energy Vision 2020 will guide TVA in meeting the demand for energy through the next 25 years.

A draft resource plan, Energy Vision 2020, was issued for public review and comment on July 26, 1995. The public comment period closed on October 15, 1995. Following this public review period, TVA produced a final plan and will begin implementing short-term actions that will enable TVA to meet the demand for energy for the near future. These short-term actions will also establish the groundwork for a Long-Term Plan that will serve TVA and the consumers of TVA power through the year 2020.

The Energy Vision 2020 report is a three-volume publication. Volume 1 provides a comprehensive overview of TVA's resource plan and provides information about the issues on which recommendations were based. Volume 2 contains technical documents that provide in-depth information on specific areas of interest. Volume 3 contains TVA's responses to the public comments it received during the draft plan review period.

*The recommendations in Energy Vision 2020 are the result of an extensive process to identify and consider all factors necessary to ensure a sound future for TVA and the Tennessee Valley region.*





*Resource options identified in Energy Vision 2020 will guide TVA in meeting the demand for energy through the next 25 years.*

Those interested in receiving a copy of any of these publications may do so by calling (615) 751-6172 or writing Kathy Heck, Tennessee Valley Authority, MR 3H, 1101 Market Street, Chattanooga, Tennessee 37402.

To better understand the issues involved in the planning process for Energy Vision 2020, one must first be aware of TVA's current situation and existing resources and the proposed changes in the utility industry.

## An Overview of TVA Today

TVA is one of the largest producers of electricity in the United States, generating 4 to 5 percent of all the electricity in the nation. Some 7.7 million people in a 7-state region depend on the power provided by TVA.

TVA's power system includes 5 nuclear generating units, 11 coal-fired plants, 29 hydroelectric dams, 48 combustion turbine units, and 1 pumped-storage facility. The system is linked by approximately 16,000 miles of transmission lines throughout the 7-state region. TVA's electric system is self-financed, as are other electric utilities, and receives no subsidies from the federal government.

With its low average utility rates, TVA ranks 30th in a comparison of 130 utilities in the nation. TVA's rates have remained constant since 1987 because of improved productivity and efficiency.

Operating revenues were \$5.4 billion for fiscal year 1994, with net income for 1994 of \$151 million. Total energy generated was 134 billion kilowatt-hours for 1994, an increase of 3.4 percent over 1993.

The size of TVA's power system and its influence on the Tennessee Valley's economy make integrated resource planning especially important. The decisions TVA makes today will have a significant impact on tomorrow's quality of life for millions of residents of the Valley, as well as on the competitive success of area business and industry.

*TVA's power system serves about 8 million people in a 7-state region encompassing some 80,000 square miles.*

**FIGURE 1. TVA's Power System**



*TVA's low average utility rates rank it 30th in a comparison of 130 utilities in the nation. TVA's rates have remained constant since 1987 because of improved productivity and efficiency. The size of TVA's power system and its influence on the Tennessee Valley's economy make integrated resource planning especially important. The decisions TVA makes today will have a significant impact on tomorrow's quality of life for millions of Valley residents, as well as on the competitive success of area business and industry.*

## Changes in the Utility Industry

A second factor affecting the development of Energy Vision 2020 is the tremendous amount of change occurring in the utility industry. Historically, TVA and regulated electric utilities have had well-defined, protected markets or service areas.

Utilities have controlled their transmission systems, choosing whose power they purchase for resale, whose power they will transport or "wheel" through their service areas, and how much they will charge for wheeling. All that is changing.

### OPEN ACCESS

The National Energy Policy Act of 1992 and related Federal Energy Regulatory Commission regulations introduced the concept of open access, a dramatic change for the industry. Open access provides wholesale customers and suppliers access to virtually all of the nation's transmission systems. With open access, competing utilities can better use existing generating facilities, bring more cost-effective options to the market, and provide electric utilities and their customers with more competitive choices.

### THE FENCE

The potential impact of open access on TVA is heavily influenced by the "fence" surrounding TVA's power service area. In 1959, Congress amended the TVA Act to allow TVA to use power revenues to finance future expansion of generation and transmission facilities. Although the amendment passed, investor-owned electric utilities feared competition from TVA. To allay those fears, Congress limited TVA's market to its current service area. This border around TVA's market is called the "fence."

The "fence" essentially restricts the area in which TVA can sell power, but permits TVA to sell power to utilities with which it was interconnected in 1957.

Because TVA is prevented by this one-way fence from generally selling power outside its existing service area, open access could enable other utilities to come into TVA's area to serve customers, but prohibit TVA from offering service to their customers.

### **TVA'S POSITION IN A COMPETITIVE ENVIRONMENT**

TVA realizes that many of its customers may want the choice of shopping for energy services in a competitive marketplace. To examine this situation, TVA commissioned a study of its competitive condition, called "The Ties That Bind: TVA in a Competitive Electric Market." This study recommends eliminating the "fence" to allow TVA to enter the emerging competitive environment on an equal footing with other suppliers.



### **Resource Integration Process**

The recommendations in Energy Vision 2020 are the result of an extensive process to identify and consider all factors necessary to ensure a sound future for TVA and the Tennessee Valley region.

TVA, unlike almost any other electric utility in the nation, has a broad mission that includes the continued development of the TVA region. Providing a reliable and economical supply of energy is certainly primary to this development, but other considerations also come into play. The strong bond between TVA

and its customers and stakeholders means that TVA carefully considers any effects that its actions may have on the environment, the economy, and the quality of life for the millions of people who make their home in the Tennessee Valley.

With these considerations in mind, TVA developed a five-step process:

1. Public involvement to identify stakeholder issues and concerns
2. Development of evaluation criteria and related measurements to ensure that these issues and concerns were considered
3. Identification of all possible resource options to meet consumer energy needs
4. Evaluation of key uncertainties about future conditions that could influence the use of various energy resource options
5. Design of numerous strategies for ultimate evaluation

*TVA, unlike almost any other electric utility in the nation, has a broad mission that includes the continued development of the TVA region.*

A complete description of the integrated resource planning process is given in Energy Vision 2020, Volume 1.



The public participation process used in the development of Energy Vision 2020 was of special importance to TVA because of TVA's commitment to be customer focused and sensitive to the needs and values of its stakeholders. TVA sought to incorporate a broad base of public input in the planning process.



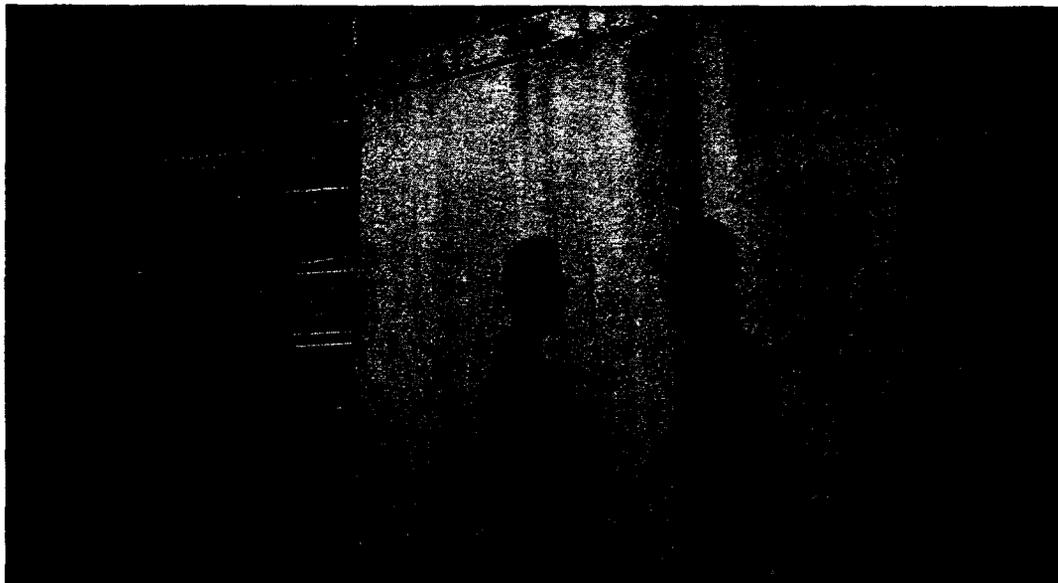
## **PUBLIC PARTICIPATION**

During the first phase of public participation, TVA used four techniques to gain broad public input: interviews with opinion leaders, a series of 12 public meetings throughout the TVA region, a stakeholders' review group, and opportunities for the public to submit written comments. In each case, the goal was the same: to encourage people to share their views on issues they believe should be important to TVA as it plans for future energy needs.

Of special interest was the stakeholders' review group. The Energy Vision 2020 Review Group was formed to provide TVA with in-depth, ongoing input as the plan progressed. Group participants represented business and industry, distributors of TVA power, minority businesses, environmental organizations, state agencies, academia, and civic organizations.

As a result of this initial public participation process, about 600 written comments were received, for a total of more than 1,300 oral and written comments from approximately 375 individuals and organizations. These comments were used by TVA to better define the full scope of its plan. Major issues identified through the first phase included concerns about TVA's debt, the nuclear program, the ability to remain competitive, and the privatization of TVA. Other

*TVA is well positioned to enter the competitive market, and Energy Vision 2020 will guide TVA in making business decisions to meet the long-term energy needs of our customers.*



*The strong bond between TVA and its customers and stakeholders means that TVA carefully considers any effects that its actions may have on the environment, the economy, and the quality of life for the millions of people who make their homes in the Tennessee Valley.*

comments focused on the use of specific energy resource options such as renewable energy sources.

The second phase provided an opportunity for the public to comment on the draft resource plan, Energy Vision 2020, which was issued on July 26, 1995. In addition to accepting written comments, TVA held nine public meetings throughout the Tennessee Valley, so that the public could present their views on the draft plan. Over 250 people or organizations made 2,000 comments. The public comments and TVA's responses are in Volume 3 of Energy Vision 2020.

### **PUBLIC INPUT GUIDED TVA**

TVA developed 42 evaluation criteria, or measurements, to reflect the values of the public expressed during the first phase, as well as TVA's goals and objectives.

Potential resource options were measured against these criteria, which included impact on rates, TVA's debt, the environment, and other concerns voiced by the public. The resource options determined to best meet these evaluation criteria were included in a portfolio of resource options.

These resource options were also analyzed to determine how well they would perform under a variety of uncertainties that could occur in the future. For example, low load growth, significant increases in the price of natural gas (a fuel source for several resource options), or more stringent environmental regulations, would make particular resource options more or less attractive.

Because of these uncertainties, options recommended in TVA's Long-Term Plan had to be proven to be

robust, meaning that they would work well under a variety of possible future situations; or flexible, to allow TVA to easily and economically modify its resource mix as necessary.

From information gained during the initial review and analysis of various resource options, TVA identified workable strategies to guide its future energy resource choices.

The public's comments on the draft plan were generally spread over a number of different issues. A number of the commenters concentrated on three issues: the viability of Watts Bar Nuclear Plant Unit 1 as a current and future resource choice; the need for implementing more demand-side management options; and the need for a stronger commitment to developing renewable resources, (e.g., solar, biomass).

When appropriate, Energy Vision 2020 was changed, and TVA's responses to these issues and other public comments are provided in Volume 3 of Energy Vision 2020.



FIGURE 2. Long-Term Plan

Develop a preferred portfolio of resource options for the long term from key strategies. Objectives of the portfolio are:

1. Balance costs, rates, environment, debt, and economic development.
2. Provide a robust set of resource options or flexibility to adapt to uncertain load growth, future market prices, changes in environmental regulations, and changes in market regulations to manage risk.

Strategies	Options	1996 -2005	2006 -2020
<ul style="list-style-type: none"> <li>● J – Bellefonte Coproduct, Renewables, IPPs</li> <li>● M – Combined DSM and Off-System Sales</li> <li>● O – Bellefonte Coproduct, More DSM, More Off-System Sales</li> <li>● Q – Flexible Strategy with External Options</li> <li>● R – Flexible Strategy with Internal Options</li> <li>● S – Low Cost, Low Rates, Improved Environment</li> <li>● T – Low-Cost Renewables, Low-Price DSM, Repowering, Bellefonte Coproduct Partnership</li> </ul>	<b>Supply Peaking</b>	<ul style="list-style-type: none"> <li>● Combustion turbines, purchases of peak power, and call options on peaking power</li> </ul>	<ul style="list-style-type: none"> <li>● Compressed air energy storage (CAES)</li> </ul>
	<b>Base Load</b>	<ul style="list-style-type: none"> <li>● Call options on base-load power</li> <li>● Improvements to existing hydro system</li> <li>● Combined cycle with pre-siting and engineering</li> <li>● Purchases from independent power producers with and without cogeneration</li> <li>● Combined cycle repowering of coal-fired plants</li> <li>● Renewables—landfill methane and refuse-derived fuel</li> <li>● Coalbed methane</li> <li>● Bellefonte coal gasification and coproducts with partners</li> <li>● Additional coal unit at Shawnee</li> <li>● Improvements in existing system</li> <li>● Nuclear partnership</li> </ul>	<ul style="list-style-type: none"> <li>● Wind turbines</li> <li>● Coal refinery</li> <li>● Cascaded humidified advanced turbine (CHAT)</li> <li>● Integrated gasification combined cycle (IGCC)</li> <li>● Integrated gasification with CHAT (IGCHAT)</li> </ul>
	<b>Customer Service</b>	<ul style="list-style-type: none"> <li>● DSM—low price and cost (examples of programs)</li> <li>● Beneficial Electrification (examples of programs)</li> <li>● Flexible DSM and Beneficial Electrification</li> </ul>	<ul style="list-style-type: none"> <li>● Residential new construction</li> <li>● Commercial and industrial comprehensive finance</li> <li>● Industrial motors</li> <li>● Residential heating, air conditioning, and water heating</li> <li>● Commercial cooking</li> <li>● Industrial electrotechnologies</li> </ul>
	<b>Environmental</b>	<ul style="list-style-type: none"> <li>● Pursue a flexible strategy of fuel switches, scrubbers</li> <li>● Global climate challenge—improvements to existing system, biomass cofiring</li> </ul>	

Uncertainty	Options
● Load Growth	<ul style="list-style-type: none"> <li>● Call options on purchases from external suppliers</li> <li>● Flexible internal supply options</li> <li>● Small modular options—landfill methane, coalbed methane, and distributed resource alternatives</li> <li>● Flexible DSM options</li> </ul>
● Natural Gas Prices/Coproduct Prices	<ul style="list-style-type: none"> <li>● Integrated gasification combined cycle (IGCC)</li> <li>● Integrated gasification cascaded humidified advanced turbine (IGCHAT)</li> <li>● Bellefonte coal gasification with a chemical coproduct</li> </ul>
● Environmental Regulation—Air, Water, CO <sub>2</sub> Regulation	<ul style="list-style-type: none"> <li>● Renewables—wind, landfill methane, biomass</li> <li>● Coalbed methane</li> <li>● Aggressive DSM and beneficial electrification</li> <li>● Natural gas-based resource alternatives</li> </ul>

## Long-Term Plan

For the long term, TVA will use a portfolio of resource options that were derived from the best strategies identified during the evaluation process. This portfolio will give TVA the flexibility it needs to respond to the uncertainties of the future. The options have been determined to meet customer needs by balancing cost, rates, reliability, debt, environmental concerns, equity among rate classes, and economic development, while also managing risk.

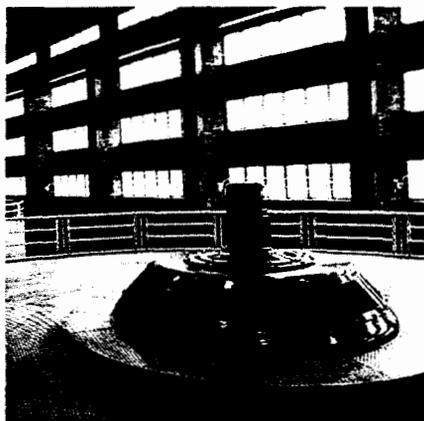
TVA will need approximately 10,000 megawatts of additional power supply by the year 2010 to meet the Valley's needs. Resource options that may be added to TVA's existing power supply system include:

- Supply-Side Options, which could include exercising call options (the right to purchase power at a set price at some time in the future); purchases of power from independent power producers; looking at new and innovative approaches such as renewable power sources; and partnering to convert the unfinished Bellefonte Nuclear Plant into a coal gasification plant with coproducts that could be sold to supplement power revenues
- Customer Service Options, including demand-side management and beneficial electrification could provide up to 2,200 megawatts, or 22 percent of additional capacity by 2010
- Environmental Controls, including fuel switching and the use of scrubbers at TVA's coal-fired plants to further reduce the emission of sulfur and other pollutants

In addition, other supply-side options are projected to be viable for TVA for the years 2006 to 2020. These include a coal refinery, wind turbines, and advanced coal technologies such as coal gasification.



*The Long-Term Plan meets customer needs by balancing costs, rates, debt, environmental concerns, and economic development, and also manages risk.*



*The Short-Term Plan emphasizes those resource options that minimize risk.*

## Short-Term Actions

The Short-Term Plan is based on the Long-Term Plan and describes the specific actions TVA will undertake to meet customer needs through the year 2002. TVA estimates it will need an additional 3,500 megawatts of capacity to meet the Valley's energy needs during that period. The Short-Term Plan emphasizes those resource options which minimize the risk associated with uncertain load growth and other key uncertainties.

One of the key recommendations in the short-term action plan is that TVA will not, by itself, complete Bellefonte Nuclear Plant Units 1 and 2, Watts Bar Nuclear Plant Unit 2, or restore Browns Ferry Nuclear Plant Unit 1 as nuclear plants. By eliminating the large capital outlays on nuclear plants, TVA will be able to better manage its debt and be more competitive.

For the foreseeable future, Browns Ferry Unit 1 and Watts Bar Unit 2 would continue in an inoperative or deferred status. TVA will keep open alternatives such as completing the units as nuclear through partnering arrangements, converting the units to another technology, or replacing the units with different types of supply and demand-side resource options.

For the Bellefonte Nuclear Plant, converting the unfinished plant to a combined cycle plant that uses either natural gas or gasified coal as the primary fuel has been identified as one of the most viable alternatives. (A coal gasification plant converts coal into a gas that can be used to generate power and make chemical products, such as methanol.) An effort is underway to demonstrate integrated gasification combined cycle technology at Bellefonte through the use of Department of Energy funding under the Clean Coal Technology program. TVA will work with a team of outside, independent experts to develop the Bellefonte conversion plan over the next 18 to 24 months. TVA will continue to be recep-

tive should outside entities propose an acceptable financial arrangement to complete these units as nuclear facilities in partnership with TVA.

Other short-term actions in the plan include:

- Buying call options—options for TVA to buy power from a seller at a given price at some specified time in the future—that would permit TVA to purchase up to 3,000 megawatts of power from outside sources to meet base-load and peak demand between 1998 and 2002. (This option permits TVA to plan for uncertain load growth. TVA would buy the power only if it is cost effective)
- Investment in siting and pre-engineering work for combustion turbines or other facilities using different technologies
- Continued modernization of TVA's hydro plants, which would add about 100 megawatts to the existing capacity
- Implementation of cost-effective biomass cofiring (using two types of fuel at a generating plant simultaneously such as a combination of coal and wood waste products, commonly sawdust)
- Implementing three types of customer-service options—demand-side management, beneficial electrification, and the sale of power to utilities and others currently outside the TVA power system



*Demand-Side Management is a key element of Energy Vision 2020.*

FIGURE 3. Short-Term Action Plan

Short-Term Actions—Supply-Side	Milestones
<b>Purchase Call Options</b>	
• Base-Load Coverage - 2001–2002	Implement up to 3,000 MW
• Winter and Summer Peaking Coverage - 1998–2002	
<b>Hydro Modernization Projects</b>	
• Invest in hydro modernization projects between 1996–2007	Achieve 150 MW
<b>Bellefonte Nuclear Plant Conversion to Combined Cycle Plant</b>	
<ul style="list-style-type: none"> <li>• Converting the Bellefonte Nuclear Plant to a combined cycle plant utilizing natural gas or gasified coal as the primary fuel has been identified as one of the most viable alternatives. Such an alternative provides the opportunity to utilize a substantial portion of the Bellefonte non-nuclear plant equipment. However, there is a degree of uncertainty and market risk associated with this alternative which requires further in-depth engineering and financial examination. Accordingly, TVA will use an outside, independent team of technical and financial experts to assess and develop the Bellefonte conversion strategy more fully over the next 18 to 24 months. During the course of the study, TVA will also pursue the evaluation and development of a demonstration gasification plant with the Department of Energy. In the meantime, the Bellefonte plant and Watts Bar Nuclear Plant Unit 2 will continue in a deferred status. TVA will continue to be receptive should outside entities propose an acceptable financial arrangement to complete these units as nuclear facilities in partnership with TVA.</li> <li>• Browns Ferry Nuclear Plant Unit 1 will continue in its inoperative status.</li> </ul>	18–24 month study
<b>Renewables</b>	
• Implement cost-effective biomass cofiring	
- Cofiring precommercial demonstration runs at existing TVA coal-fired plants	1996
- Initiate first commercial wood waste cofiring project operation	1997
• Investigate biomass energy facilities	1996–97
• Implement a flexible wind project	1996–97
• Determine coalbed methane resources feasibility	1996–97
• Inventory sites suitable for landfill methane	1996
• Initiate 25-kW landfill methane fuel cells pilot	1997–98
<b>Additional Capacity Development</b>	
• Acquire three sites and develop preliminary engineering modules suitable for coproduction, combined cycle, combustion turbines, cascaded humidified advanced turbines, and compressed air energy storage	1996–1998
• Investigate cogeneration and other unique energy supply arrangements	1996
<b>Implement a Flexible Phase II Acid Rain Strategy</b>	
• Strategy/Plan Definition	1996
• Initiate early implementation options	1996–97

FIGURE 3. Short-Term Action Plan CONTINUED

Short-Term Actions—Customer Services	Milestones
<b>DEMAND-SIDE SAVINGS</b>	Up to 650 MW - 2002, Up to 2,200 MW - 2010
<b>Residential</b>	
<i>Full Scale Programs</i>	Revisions in Place
• Heat Pump Leasing / Financing	1996–97
• Ground Source Heat Pump Leasing	1996–97
• New Homes Program	1996–97
• Manufactured Housing - New Construction	1996–97
• Residential Self-Audit	Launch 1996–97
• Load Management	Revisions in Place
- Air Conditioners	1996–97
- Water Heaters	1996–97
<i>Flexible Residential Demand-Side Programs for Selected Market Segments</i>	Launch Phase 1
• Efficiency Products Catalog - Mail Order	1997
• Lighting Products Retail Component	1997
• Low Income Program - Site Visit	1997
• Student Self-Audit - Schools Environmental	1997
• Heat Pump Water Heater Initiative	1997
<b>Commercial and Industrial</b>	
<i>Full Scale Programs</i>	Launch 1996–97
• Commercial and Industrial Energy Services	1996–97
- Comprehensive Measures Financing	1996–97
- Commercial New Construction	1996–97
- Commercial Lighting	1996–97
- Commercial Appliances	1996–97
- Industrial Process Energy Efficiency	1996–97
- Industrial High Efficiency Motors	1996–97
• Commercial Cool Storage	1996–97
<i>Flexible Commercial and Industrial Programs</i>	Launch Phase 1
• Commercial Group Load Curtailment	1997
• Commercial Rooftop Cool Storage Program	1997
<b>BENEFICIAL ELECTRIFICATION</b>	
<b>Residential</b>	
• HVAC and Water Heating applications to improve consumer value	1996–97
• Initiate Flexible Security Lighting and Lawn Mower Programs	Launch 1997
<b>Commercial and Industrial</b>	
• Commercial Space Conditioning and Water Heating	Launch 1996–97
• Commercial Cooking and Security Lighting	Launch 1996–97
• Industrial Electrification Programs for Processing Heating, Food Processing, and Environmental Technologies	Launch 1996–97
• Flexible Industrial Electrification Options for Curing & Drying applications and Textile processes	Launch Phase 1 - 1997
<b>General Research and Development</b>	
• Develop telecommunication supported demand-side management programs	Launch 1996
• End-use renewables, market transformation, load management new technologies, targeted distributed generation, photovoltaics, electric vehicles	Launch 1996–97



*New technologies provide the means to maintain competitive rates, improve the environment, and increase economic development.*

commercial customers such as cool storage, a technology that allows a cooling source, such as ice, to be produced and stored for space cooling, and financing programs to assist customers in making energy-efficiency improvements. TVA will also begin several flexible demand-side management programs. These programs will include a low income program, heat pump water heater program, and several programs in the commercial sector.

Beneficial electrification options offer customers opportunities to improve energy efficiency and to reduce energy costs. In the short term, TVA will consider programs such as residential and commercial heating and air conditioning (primarily the use of various types of electric heat pumps) and industrial electrotechnologies (providing technical assistance and financing programs that would allow industrial customers the opportunity to improve productivity and efficiency through the use of improved or new electric processing equipment).

TVA plans to continue to sell power off-system when market conditions make such sales beneficial to TVA and its existing customers.

Demand-side management options would add up to 650 megawatts by 2002 and potentially 2,200 megawatts by 2010. This would include for immediate implementation the expansion of some of TVA's current programs, such as the *energy right* heat pump program and the *energy right* new homes and manufactured homes programs. It would also include new programs for

Implementation of the short-term actions would begin in 1996, enabling TVA to meet the demand for energy in the near future while laying the groundwork for TVA's Long-Term Plan.

Concurrent with the short-term actions outlined above, TVA also proposes that research and development programs be put into place to evaluate emerging new technologies that show promise for the future. Such projects would include:

1. Developing new capacity using such technologies as cascaded humidified advanced turbines, distributed generation, and fuel cells. An explanation of these technologies is given below.

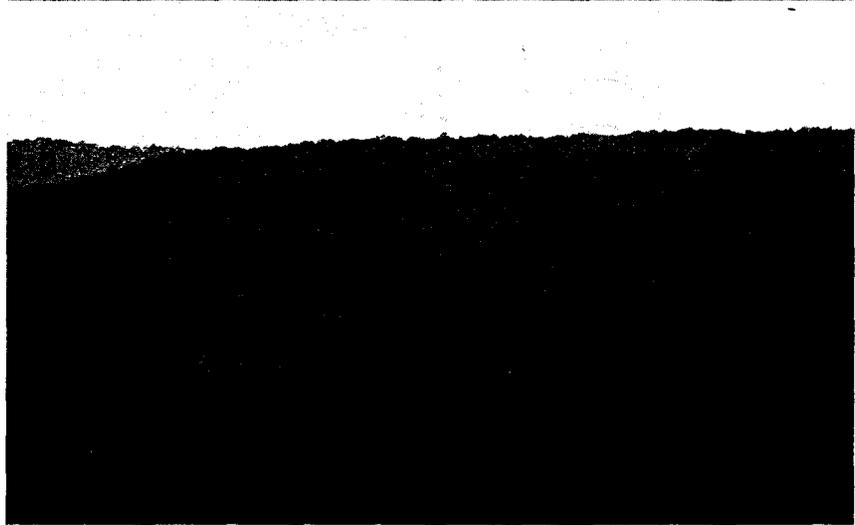
- A cascaded humidified advanced turbine is a gas turbine with a unique configuration that allows the unit to have efficiencies similar to a conventional combined cycle plant (a type of plant that generates electricity first from the heat produced by burning gas and then again from heat extracted from exhaust steam), but without the addition of a steam turbine and associated equipment. The cascaded humidified advanced turbine should have a capital cost somewhat less than for a combined cycle installation of similar generating capacity.
- Distributed generation refers to the location of smaller-scale power generating units near the power consumer. Examples would be gas turbines or diesel generators located in power transmission substations or installed adjacent to large industrial or commercial power consumers. The close proximity of the power generator to the power user significantly reduces the losses associated with the transmission of power.
- Fuel cells are devices similar to batteries, except they are capable of generating power rather than simply storing power. A fuel and a form of air or oxygen are consumed in the cell by a chemical reaction that creates electricity.

2. Developing renewable energy options to include investigations and research into the possibility of using wind resources, landfill methane, coalbed methane, and biomass energy projects.
  - Large wind turbines (windmills) have the potential to be a viable generation source, subject to the availability of wind at speeds and durations capable of supporting this type of generating equipment. Short-term actions by TVA will include a flexible wind project at a selected site in the TVA service area. The first phase will determine the potential for this technology.
  - Methane (gas) from sanitary landfills offers another possible option as an innovative fuel source. Landfills are filled with organic waste material and sealed (covered) in such a way that air cannot gain admittance to the material. As the material decomposes, methane is produced. The methane can be collected by a series of wells drilled into the waste layers. Once collected, the methane can be used as a fuel by conventional power generation equipment such as internal combustion engines, gas turbines, or fuel cells.

*Renewable energy resources include wind turbines, photovoltaics, and landfill methane.*



- Coalbed methane is produced in the same way as methane from a landfill. As the organic material in the coalbed decomposes to form coal, methane is produced as a byproduct. The methane can be collected from the coalbed prior to opening the coal seam for mining by a series of wells drilled into the seam. Like landfill methane, this gas can be used as a fuel in conventional power generation equipment.
  - The biomass energy facilities include a biorefinery that uses refuse-derived fuel, wood waste, and energy crops, and a combined garbage and biomass energy plant.
3. Conduct research and development for demand-side management and beneficial electrification. Some examples include research and development efforts to explore new load management technologies, the use of photovoltaics (to collect solar energy), and the use of electric vehicles. Photovoltaics is a technology that converts solar energy into electricity. TVA will investigate the use of photovoltaics for end-use applications at remote sites where electricity is not readily available.
  4. Investigate cogeneration and other unique energy supply arrangements.



*TVA will pilot several demand-side management programs such as new load management technologies, energy-efficient products, and the use of electric vehicles.*

## Summary

Throughout its 62-year history, TVA has conducted its business in a unique way—demonstrating flexibility and initiative similar to that of private enterprise and protecting the environment and natural resources as would a gov-



ernment body. TVA has accomplished these objectives through innovative approaches in meeting the demand for energy and exploring and testing new technologies that provide environmental benefits to the region and the nation.

In presenting the action plans of *Energy Vision 2020*, TVA is again demonstrating that best business practices can be compatible with environmental responsibility—that economic growth and improvements in the quality of life are compatible—and that innovation and creativity are integral to remaining successful in a competitive market.