Contents

Overview

The Tennessee Valley Authority's (TVA) Integrated Resource Plan (IRP), entitled TVA's Environmental and Energy Future, serves as a roadmap for identifying the resources that are acceptable and available to meet the energy needs of the Tennessee Valley region over the next 20 years. It addresses the demand for power in the region, the options available for meeting that demand and the potential environmental, economic and operating impacts of each.

This endeavor aligns with TVA's Environmental Policy and will serve as a guide for TVA to fulfill its renewed vision—to become one of the nation's leading providers of low-cost and cleaner energy by 2020. TVA is committed to lead the nation in improved air quality and increased nuclear production and to lead the Southeast in increased energy efficiency. This vision will be accomplished as TVA continues to carry out the mission established by Congress in 1933.

The current planning environment that confronts TVA is one of the most challenging in TVA's history. Therefore, TVA must ensure that its strategy is robust, regardless of future conditions, and enables TVA to navigate through these challenges in a way that best supports its multiple responsibilities. This IRP establishes a strategic direction for TVA and provides it with the flexibility to make the best decisions in a dynamic, ever-changing regulatory and economic environment.

Public Participation

Public participation was a significant component of the IRP process. In an effort to develop the plan in a transparent manner, TVA offered multiple opportunities for the public to contribute to and influence the development of this IRP. These opportunities included two series of public meetings, written comments, webinars, briefings, a web-based questionnaire, and a phone survey. The goal for all public participation opportunities was to encourage others to share their views on issues they believe TVA should focus on as it plans for the region's future energy needs.

In addition to public participation, TVA also formed a Stakeholder Review Group (SRG). This group consisted of 16 individuals representing a wide range of interests. Members of the group were asked to provide TVA with their viewpoints on the IRP process, assumptions, analyses and results. TVA met approximately every month with the SRG throughout the IRP process to discuss strategic findings.

Need for Power Analysis

As a part of the IRP analysis, TVA developed a forecast of the need for power, referred to in the electric utility industry as "demand." To develop this forecast, the following four basic steps were taken:

1. Demand for electricity (peak demand and energy sales) was forecasted for a 20-year planning horizon (Figure 1)
2. Firm requirements were calculated to determine generation capacity required by adding forecasted demand to a planning contingency. The planning contingency allowed for unforeseen events, inaccuracies or unplanned unit outages and other resource limitations
3. Existing generation resources available to meet the forecasted demand were identified
4. The need for power was calculated by comparing the firm requirements to the existing viable generation resources. The difference between the two defines the need for additional resources over the planning period. This is referred to as "the capacity gap" (Figure 2)

TVA expects the need for power to continue to grow due to economic recovery, population growth and other factors. However, this growth is expected to occur at a lower rate than historical average.

Figure 1 shows the Reference Case: Spring 2010 forecast of peak demand over the 20-year planning horizon. The figure also illustrates the range of load forecasts considered within this IRP, with the highest and lowest forecasts representing the upper and lower bounds.

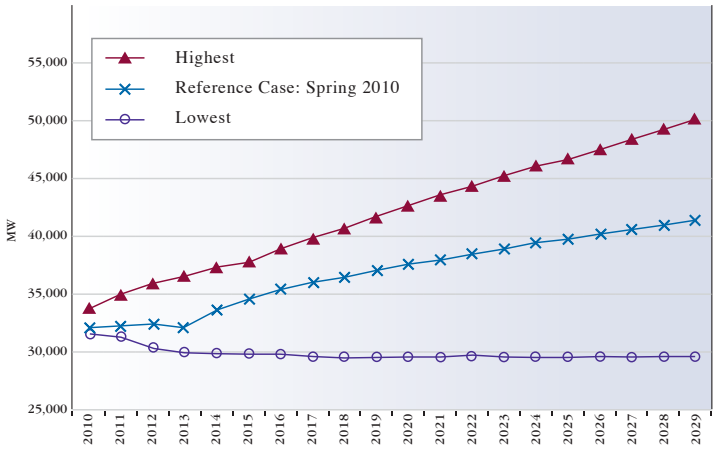

Figure 1 – Peak Load Forecast

Figure 2 shows the capacity gap for the Reference Case: Spring 2010 forecast over the 20-year planning horizon. The figure also illustrates the capacity gap based on the range of peak loads considered in this IRP. The capacity gaps were developed by adding a planning reserve margin to the peak load forecast and subtracting existing resources. Additional detail on the need for power analysis is included in Chapter 4 – Need for Power Analysis.

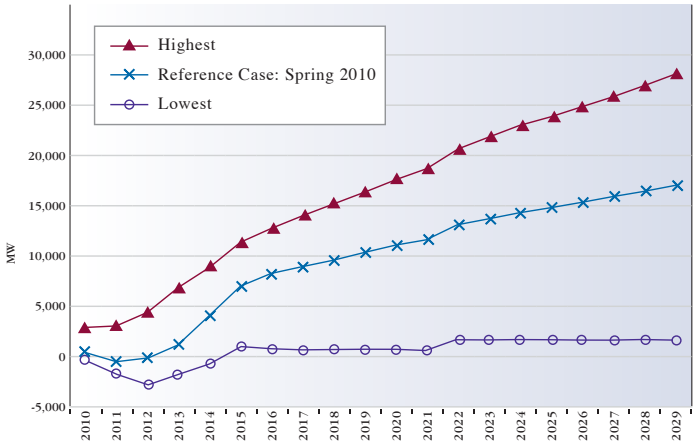

Figure 2 – Capacity Gap

Approach

Scenario Planning

A scenario planning approach was utilized for the development of this IRP. TVA carried out its analysis in a "no-regrets" framework. This framework defined a process in which all relevant and available information was analyzed in a careful and considered fashion, with significant attention paid to what would happen if the future unfolds in an unexpected way.

In other words, strategic options were analyzed not only from the perspective of what was expected to occur in the future, but also from the perspective of what was possible to occur in the future. Using this framework, decisions made today and in the near future are not overly dependent on the future unfolding exactly as expected. Therefore, this IRP should provide benefit and value to stakeholders even if the future turns out to be different than predicted.

Scenarios and planning strategies form the basic building blocks of the IRP analysis. Scenarios do not predict the future, but rather portray the range of possible "worlds" that TVA may encounter in the future based on a number of uncertainties outside of TVA's control. Scenarios were also used to test resource selection and reflect key stakeholder interests.

Factors that differed between scenarios included economic growth, inflation, fuel prices, demand growth and regulatory environments. Uncertainties varied among scenarios to highlight how decisions would change under different conditions.

Six unique scenarios were developed for this IRP along with two iterations of a reference forecast. Scenario 7 – Reference Case: Spring 2010 was used in the Draft IRP analysis and was refreshed with Scenario 8 – Reference Case: Great Recession Impacts Recovery between the Draft and final IRP. The following eight scenarios were used:

- Scenario 1 – Economy Recovers Dramatically
- Scenario 2 – Environmental Focus is National Priority
- Scenario 3 – Prolonged Economic Malaise
- Scenario 4 – Game-Changing Technology
- Scenario 5 – Energy Independence
- Scenario 6 – Carbon Regulation Creates Economic Downturn

- Scenario 7 – Reference Case: Spring 2010
- Scenario 8 – Reference Case: Great Recession Impacts Recovery

Additional details on the scenarios are included in Chapter 6 – Resource Plan Development and Analysis.

Recommended Planning Direction Development

The Draft IRP evaluated five specific planning strategies. These planning strategies described a broad range of business options that TVA could adopt and were built upon key decisions within TVA's control. Components such as renewable generation additions, nuclear expansion and market purchases varied among planning strategies. The following planning strategies were considered in the Draft IRP:

- Strategy A – Limited Change in Current Resource Portfolio
- Strategy B – Baseline Plan Resource Portfolio
- Strategy C – Diversity Focused Resource Portfolio
- Strategy D – Nuclear Focused Resource Portfolio
- Strategy E – EEDR and Renewables Focused Resource Portfolio

Each planning strategy was evaluated across the first seven scenarios. The results were summarized using a scorecard designed to identify financial, risk and strategic factors to consider when selecting a Recommended Planning Direction.

Based on the preliminary results, TVA focused on the top three ranked planning strategies (Strategies B, C and E) for further evaluation. Additional detail on the Draft IRP results is included in Chapter 7 – Draft Study Results.

A high-level summary of the process used for developing the final IRP is shown in Figure 3.

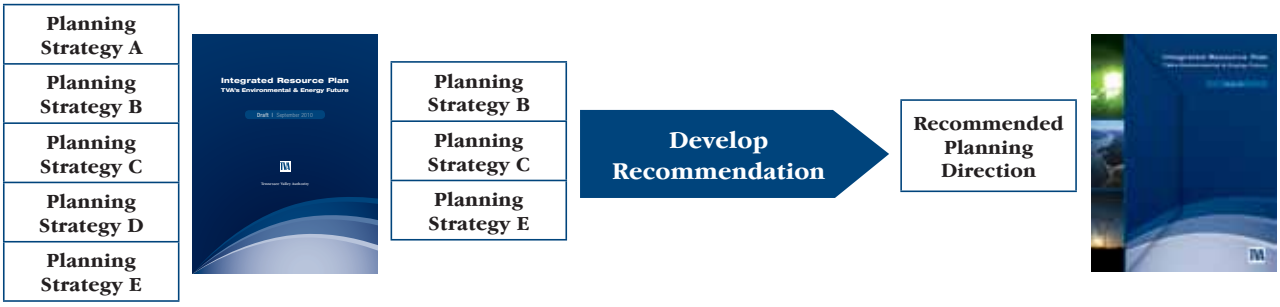

Figure 3 – Final IRP Development

A key objective in transitioning from the Draft to the final IRP was to identify a Recommended Planning Direction. The preliminary results and findings of the Draft IRP were used to establish boundaries for evaluating new combinations of planning strategy components through an optimization framework. In addition, input received during the public comment period was reviewed in detail and appropriately incorporated into the analysis. This approach produced more comprehensive results by allowing unique combinations of resources to be tested in addition to those directly considered in the Draft IRP. A summary of the options considered for the final IRP is shown in Figure 4.

Components	Range of Options Tested				
EEDR	2,100 MW & 5,900 annual GWh reductions by 2020		3,600 MW & 11,400 annual GWh reductions by 2020		5,100 MW & 14,400 annual GWh reductions by 2020
Renewable additions	1,500 MW competitive resources or PPAs by 2020	2,500 MW competitive resources or PPAs by 2020	2,500 MW competitive resources or PPAs by 2029	3,500 MW competitive resources or PPAs by 2020	3,500 MW competitive resources or PPAs by 2029
Coal-fired capacity idled	2,400 MW total fleet reductions by 2017	3,200 MW total fleet reductions by 2017	4,000 MW total fleet reductions by 2017	4,700 MW total fleet reductions by 2017	

Figure 4 – Optimization Framework for the final IRP Analysis

The Recommended Planning Direction was evaluated in all eight scenarios. The results were used to build a fully populated scorecard with ranking and strategic metrics. The completed scorecard was compared with the Draft IRP results to evaluate improvements between previously considered planning strategies. Additional detail on the Recommended Planning Direction results is included in Chapter 8 – Final Study Results and Recommended Planning Direction.

Strategic Findings

The following strategic findings emerged from the IRP analysis:

- Expanded EEDR portfolios perform well; the mid level portfolio provided the best balance of cost and implementation risk
- Renewable generation above existing wind contracts played a role in future resource portfolios, assuming certain costs
- Some increased idling of coal-fired capacity was favorable compared to adding environmental controls to the existing fleet
- Coal-fired capacity was only added in scenarios with high load growth
- Pumped-storage added needed operational flexibility
- Nuclear expansion was selected in most cases, except scenarios with no load growth
- Natural gas-fired capacity was selected in most cases after 2020, except when needed earlier to meet high load growth or to provide grid reliability

Recommended Planning Direction

This IRP provides TVA with a strategic direction and the flexibility to make sound choices in a dynamic, ever-changing regulatory and economic environment. The Recommended Planning Direction is the most balanced in terms of cost, financial risk and other strategic considerations and provides direction by articulating a 20-year roadmap.

Components of the Recommended Planning Direction are based upon extensive modeling, in-depth stakeholder input and the assessment of quantified and non-quantified risks. They also allow for flexibility to adapt to future conditions by providing guideline ranges and timeframes for each component of the planning strategy. A summary of the Recommended Planning Direction is shown in Figure 5.

Component	Guideline MW Range	Window of Time	Recommendations
EEDR	3,600-5,100 (11,400-14,400 GWh)	By 2020[1]	Expand contribution of EEDR in the portfolio
Renewable additions	1,500-2,500[2]	By 2020[1]	Pursue cost effective renewable energy
Coal-fired capacity idled	2,400-4,700[3]	By 2017	Consider increasing amount of coal-fired capacity idled
Energy storage	850[4]	2020-2024	Add pumped-storage capacity
Nuclear additions	1,150-5,900[5]	2013-2029	Increase contribution of nuclear generation
Coal additions	0-900[6]	2025-2029	Preserve option of generation with carbon capture
Natural gas additions	900-9,300[7]	2012-2029	Utilize natural gas as an intermediate supply source

1 – This range includes EEDR savings achieved through 2010. The 2020 range for EEDR and renewable energy does not preclude further investment in these resources during the following decade

2 – TVA's existing wind contracts that total more than 1,600 MW are included in this range. Values are nameplate capacity. Net dependable capacity would be lower

3 – TVA has previously announced plans to idle 1,000 MW of coal-fired capacity, which is included in this range. MW values based on maximum net dependable capacity

4 – This is the expected size of a new pumped-storage hydro facility

5 – The completion of Watts Bar Unit 2 represents the lower end of this range

6 – Up to 900 MW of new coal-fired capacity is recommended between 2025 and 2029

7 – The completion of John Sevier combined cycle plant represents the lower end of this range

Figure 5 – The Recommended Planning Direction