2024 IRP Working Group

Meeting 1: July 17-18, 2023 Franklin, TN



Welcome and Safety Moment

Brian Child; Vice President, Enterprise Planning Melanie Farrell; Vice President, External Strategy and Regulatory Oversight Jo Anne Lavender; IRP Facilitator



TVA's Integrated Resource Plan

The IRP is a study of how TVA could meet customer demand for electricity between now and 2050 across a variety of future environments.

A programmatic Environmental Impact Statement (EIS) accompanies the IRP to address its environmental effects.

An updated IRP is needed in order to:

- Proactively establish a strong planning foundation for the 2030s and beyond
- Inform TVA's next long-range financial plan

The IRP provides strategic direction on how TVA will continue to provide low-cost, reliable, and increasingly cleaner electricity to the 10 million residents of the Tennessee Valley.

2019 Integrated **Resource Plan VOLUME I - FINAL RESOURCE PLAN** NNESSEE VALLEY AUTHOR



IRP Working Group (IRP-WG)

A key engagement mechanism for TVA and diverse stakeholders.

Members represent a diverse group of stakeholders, including local power companies (LPCs), industrial customers, customer associations, state government, environmental NGOs, academia and research associations, special interest groups, and community stakeholders.

Provide in-depth ongoing discussion and feedback on the IRP process, approach and assumptions.

Validate the assumptions behind the analysis and the recommendations.

Real time stakeholder input results in greater efficiency.

Seeking input from and listening to our customers and stakeholders is foundational to our mission – serving the people of the Tennessee Valley



Customer and Stakeholder Engagement

Engagement	Purpose	FY22	FY23	FY24
Valley Vision 2035	Leveraging the strengths of the public power model to lead innovation and transformation in the energy industry	♦	•	
Valley Pathways Study	Understanding what economic sectors might do throughout the Valley to reduce carbon emissions and grow the economy			••••
Utility of the Future Information Exchange (UFIX)	Providing input for consideration on the Integrated Resource Plan and helping TVA become the utility of the future	.	•	
Integrated Resource Plan	Guiding TVA to meet future electricity demands with affordable, reliable, resilient, and clean energy generation		.	•



Overarching Objective of the IRP-WG

To provide stakeholder input to the framing and evaluation included in TVA's next IRP, which establishes TVA's resource strategy in developing the energy system of the future.



TVA Staff Introductions

Name

Organization

Role in the IRP





Agenda – July 17, 2023

Торіс	Time (CT)	Presenter(s)	Notes
Lunch, including executive welcome, agenda review	11:00-12:35	Brian Child; Melanie Farrell; Jo Anne Lavender	Welcome, safety moment, and TVA staff introduction
IRP-WG introductions and orientation	12:35-1:45	Jo Anne Lavender	Including roles and responsibilities and IRP-WG objectives
Break	1:45-2:00		
TVA 101	2:00-2:30	Brian Child	TVA introduction, overview of current resource portfolio
IRP and resource planning overview	2:30-3:45	Clifton Lowry; Candy Kelly	IRP 101, resource planning 101, and 2019 IRP results overview
Break	3:45-4:00		
2024 IRP schedule and key considerations	4:00-4:25	Candy Kelly	
Non-disclosure agreement (NDA)	4:25-4:40	Jarom Smartt	NDA review
Wrap-up and day two preview	4:40-5:00	Jo Anne Lavender	
Gather for transport to dinner	5:50		
Off-site dinner	6:30-8:00		



Safety Moment

EMERGENCY EXITS

- In case of Building Emergency
- In case of Severe Weather



IRP-WG Introductions and Orientation

Jo Anne Lavender, IRP Facilitator



IRP-WG Member Introductions

Name

Organization and Role

Interest in the Energy Sector

What interests you most about being a member the IRP Working Group?





IRP-WG Meeting Ground Rules

To make a comment or ask a question, turn on your lightbulb. The presenter will call on you. Turn off your lightbulb when you are called upon.

One person speak at a time; be respectful of others; refrain from interrupting while someone is speaking.

Be succinct so that everyone has the opportunity to speak.

Try to offer alternatives that accommodate your interests and the interests of others.

Members reserve the right to disagree with any position.

ELMO (Enough Let's Move On).



IRP-WG Meeting Protocols

TVA will prepare each meeting agenda and logistics.

Meeting materials will be sent to IRP-WG members ahead of time using a Microsoft Teams site.

TVA will maintain meeting notes and running action items and responses.

Meeting location is expected to primarily be Franklin, TN, with some limited exceptions (e.g., August 2023).

The IRP-WG is expected to meet most months for one-to-two days in-person, with some months including a mid-month, two-hour virtual session.

Only the member or a pre-selected alternate may attend IRP-WG meetings.





Break

and the second s

TVA Overview

Brian Child; Vice President, Enterprise Planning



TVA Region



TVA Created to Make Life Better



May 18, 1933, the TVA Act was signed.

TENNESSEE VALLEY AUTHORITY ACT

AN ACT

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 the agricultural and industrial development of said valley; to provide for the national defense by the creation of a corporation for the operation of Government properties at and near Muscle Sheals in the State of Alabara, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That for the purpose of maintaining and operating the properties now owned by the United States in the vicinity of Muscle Shoals, Alabama, in the interest of the national defense and for agricultural and industrial development, and to improve navigation in the Tennessee River and to control the destructive flood water in the Tennessee River and Mississippi River Basins, there is hereby created a body corporate by the name of the "Tennessee Valley Authority" (hereinafter referred to as the "Corporation"). The Board of Directors first appointed shall be deemed the incorporator, and the incorporation shall be held to have been effected from the date of the first meeting of the Board. This Act may be cited as the "Tennessee Valley Authority Act of 1933." [48 Stat. 58-59, 16 U.S.C. sec. 831]¹

Sec. 2. MEMBERSHIP, OPERATION, AND DUTIES OF THE BOARD OF DIRECTORS.

(a) MEMBERSHIP .--

(1) APPOINTMENT.--The Board of Directors of the Corporation (referred to in this Act as the "Board") shall be composed of 9 members appointed by the President by and with the advice and consent of the Senate, at least 7 of whom shall be a legal resident of the service area of the Corporation.

(2) CHAIRMAN.--The members of the Board shall select 1 of the members to act as chairman of the Board.

(b) QUALIFICATIONS.--To be eligible to be appointed as a member of the Board, an individual--

shall be a citizen of the United States;

(2) shall have management expertise relative to a large for-profit or nonprofit corporate, government, or academic structure;

(3) shall not be an employee of the Corporation;

(4) shall make full disclosure to Congress of any investment or other financial interest that the individual holds in the energy industry; and

(5) shall affirm support for the objectives and missions, of the Corporation, including being a national leader in technological innovation, low-cost power, and environmental stewardship.

¹ For the purpose of identifying the sections that appeared in the original Act of 1933 and those that have been brought into the Act by amendment, references have been placed at the end of the sections. For example, the reference at the end of section 1, 48 Stat. 58-59, indicates that this section will be found in volume 48 of the Statutes at Large on pages 38 and 59.



Our Mission

To serve the people of the Tennessee Valley to make life better.

Delivering on Our Mission to You

Energy | Environment | Economic Development



Provide affordable, reliable power.



Steward the Valley's natural resources.



Partner for economic growth.



Partnering to Serve You & Your Community

Partnering with 153 Local Power Companies

To serve 10 Million People 700,000 Businesses in Parts of 7 States 58 Large Industries & Federal Installations



The Value of Public Power

People are first – Accountable to stakeholders, not stockholders

Rates are set to recover costs and reinvest in facilities – Not maximize profits

Low-cost, reliable service are the focus – Not shareholders

Collaborative regulatory process with a clear focus on serving energy consumers





The TVA Power System



Today's Resource Portfolio

FY22 Capacity 39,553 MW



Capacity aligns to FY22 10-K Net Summer Capability, adjusted to include demand response programs. Planning capacity is lower, as it accounts for Hydro and Renewable expected generation at peak, fuel blend derates, and other factors.

FY22 Energy 165 TWh



In addition to power supply sources included here, TVA offers energy efficiency programs that effectively reduced 2022 energy needs by about 2,200 GWh or 1.3% (Net Cumulative Realized at System basis, 2007 base year).



Providing Flood Control

49 Dams Hydroelectric & non-power

Flood damage averted \$9.7 Billion Since 1936 \$300 Million Annually



Partnering to Manage Our Resources

Water source for over **5 Million People**

10 Billion Gallons of Water are used in the valley every day

95.6% is Recycled

and returned to the river

Our 14 locks move 50 million tons **Saving \$500 Million Per Year** in shipping costs



Bringing Businesses & Jobs to the Valley

Fiscal year 2022 Attracted | Retained 66,500 Jobs \$10.2 Billion Invested

17th year **Top 10 Utility**



Engage



Attract



Serve



Investing in the Valley

Entirely self-funded since 1999

Tax-equivalent payments **\$500 Million**

Integrated Management of Natural Resources Partner for Economic Growth



TVA Governance

Corporate Agency of the United States, receives no tax dollars and is self financing

Nine-member, part-time Board of Directors, nominated by the President, confirmed by the Senate

CEO, appointed by the TVA Board

Regional Energy Resource Council (RERC) provides advice to the TVA Board







IRP and Resource Planning Overview

Clifton Lowry; Director, Resource Planning & Strategy Candy Kelly; Sr. Manager, Resource Strategy

IRP Overview

Clifton Lowry; Director, Resource Planning & Strategy



TVA's Integrated Resource Planning

Collaboration with stakeholders to envision the generation needs of the future.

Based on a least-cost planning framework.

Provides foundation for developing long-range financial plans.

Considers a number of potential futures to help predict changes in the marketplace.



The IRP functions like a compass, not a GPS



Planning is Grounded in Least-Cost Principles

In resource planning, TVA applies fundamental least-cost planning principles*:



Resource Planning Is About Solving Puzzles



By asking a lot of questions, like ...

How much energy will our customers use in the future?

What alternatives do we have to meet our resource needs?

Are there strategic considerations that will limit the alternatives we can consider?

How do we properly evaluate these resource alternatives?

How do we find the best solution?

Which plan (portfolio) do we select?



Resource Planning Addresses Future Capacity Needs

Resource planning is about optimizing the mix of future capacity.

Projections of capacity needed are filled by the most cost-effective resources that meet system needs.

MW





The TVA Resource Planning Process

Resource Planning is a common practice in the utility industry to identify the least cost solution to meet customer demand and system operational requirements over a long horizon (typically 20-30 years)





A Maze of Future Possible Paths

- Our industry is facing rapid, difficult to predict change, driven by:
 - Uncertainty in growth rates
 - Evolving regulatory future
 - Maturity of new, low-carbon, generation technologies
 - Fluctuating fuel costs
 - Uncertainty over nuclear extensions
 - Growth of distributed energy resources
- Drivers interact and new drivers may emerge that can change the future path
- Considering only the most likely path is risky
- Commitment to a single forecast could discourage strategic thinking and ignore significant business risks



Adopting this single path forward could be the right choice, but if the future evolves along one of the other paths, we will be locked in with few alternatives




How the Integrated Resource Planning Process Works



Stakeholder feedback is a key component in the development of all model inputs



Scenarios and Strategies Establish a Framework

Scenarios Outside TVA's Control

- Describe potential outcomes of factors (uncertainties) outside of TVA's control
- Represent possible conditions and are not predictions of the future
- Include uncertainties that could significantly impact operations, such as:
 - Load forecasts
 - Commodity prices
 - Environmental regulations
- Lends insight to riskiness of portfolio choices

Strategies Within TVA's Control

- Test various business options within TVA's control
- Defined by a combination of resource assumptions, such as:
 - DER portfolio
 - Nuclear expansion
 - Energy storage
- Consider multiple viewpoints
 - Public scoping period comments
 - Assumptions that would have the greatest impact on TVA long-term

A well-designed strategy will perform well in many possible scenarios



Portfolio Metrics and Tradeoffs Inform Recommendation





Results from multiple case runs are scored using metrics that capture multiple aspects of TVA's mission.

Preferred resource plans can then be identified based on trade-off analysis across metrics categories and stakeholder input.



Plan Assessment

What TVA's IRP Does

The IRP will:

- Use least-cost planning criteria
- Incorporate resource capital, operating, fuel, and environmental compliance costs
- Include Valley economics as key criteria to evaluate strategies
- Evaluate socioeconomic and climate impacts of alternative strategies in the associated EIS

The IRP will not:

- Establish wholesale or retail electricity rates
- Identify specific sites for new resources
- Be a Distribution Integrated Resource Plan (DIRP)



Overview of the 2019 IRP

Clifton Lowry; Director, Resource Planning & Strategy



Evolution of TVA IRPs

2019 IRP Focus Areas:

- Distributed Energy Resources
- System Flexibility
- Portfolio Diversity





2019 IRP Utilized a Rigorous Analytical Process



Stakeholder and public comments informed additional sensitivity analyses to test the impact of changes in key assumptions



2019 IRP Results



All portfolios point to a TVA power system that will be LOW-COST, RELIABLE, and CLEAN



In addition to providing the strategic direction for TVA's future energy supply, the 2019 IRP recommended near-term actions that have been integrated into TVA's asset strategy.



2019 IRP Near-Term Actions

Renewables & Flexibility



- Add solar based on economics and to meet customer demand
- Enhance system flexibility to integrate renewables and distributed resources
- Evaluate demonstration battery storage to gain operational experience

Existing Fleet



- Pursue option for license renewal for TVA's nuclear fleet
- Evaluate engineering end-of-life dates for aging fossil units to inform longterm planning





- Conduct market potential study for energy efficiency and demand response
- Collaborate with states and local stakeholders to address low-income energy efficiency
- Collaboratively deploy initiatives to stimulate the local electric vehicle market

Distribution Planning



 Support development of Distribution Resource Planning for integration into TVA's planning process



2019 IRP Key Signposts



AUTHORITY

2019 IRP - TVA Board Action and Direction*

Approved the planning direction in the 2019 IRP.

Directed TVA staff to monitor signposts to appropriately consider possible adjustments to the planning direction:

- Changing market conditions
- More stringent regulations
- Technology advancements

Directed TVA staff to initiate the next IRP no later than 2024.



Asset Strategy

TVA's asset strategy was developed based on 2019 IRP strategic direction, near-term actions, and key signposts, grounded in least-cost planning, and includes the following initiatives:



AUTHORITY

Continued Carbon Reduction





Aspiration by 2050

Projected CO2 emissions rate is based on the FY23 Budget with stochastic range. Represents TVA system level emissions (owned and purchased generation), on an asdelivered basis, including but not limited to directly served customers and local power companies, with an associated RECs immediately retired.

All reductions are based on a Calendar Year 2005 baseline



Resource Planning 101

Candy Kelly; Sr. Manager, Resource Strategy



Planning Horizons and Uncertainty





Resource Planning Continuum



Planning is an iterative process, evolving with tactical experience and evolving signposts



Definitions of Capacity and Energy

Capacity is the maximum electric output an electricity generator can produce under specific conditions

Energy (or generation) is the amount of electricity a generator produces over a specific period of time



Variations

Nameplate Capacity – Manufacturer-defined output under standard conditions

Summer Net Dependable Capacity (NDC) – Expected unit output during specific summer conditions (e.g., temperature)



Variations

Capacity Factor – Energy produced divided by total theoretical output for a given time period (tells you what percentage of hours it ran)



Winter and Summer Have Distinct Profiles





Expansion Resource Technologies

Earliest Deployment Year for Additional Resources

2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036 +	
		Technol	ogies De	ployable	e by 203	0			Techı	nologies	Deploya	able after	[.] 2030	
		Ener Efficie	gy	Natural Gas				Pumped Storage						
		and Demand Response		Solar Wind				Advanced Storage				Emorging		
	Programs		ams					Carbon Capture technology Combined Cycle timelines have						
				Lithium-Ion Battery Storage				Small Modular Reactors				more uncertainty		



Resource Types and Load







Daily Load Shape and Resource Dispatch

Summer Day Load Shape





Load Dispatch on Typical Summer Day





58

TVA Carries Reserves to Ensure Reliability

TVA carries reserves for unplanned events related to weather, load forecast error, and system performance, targeting an industry best-practice of one loss of load event (LOLE) in 10 years or 0.1 LOLE per year.



Weather-driven variability

- Temperatures / Load
- Hydrology
- Solar and wind patterns
- Cold weather impact on unit performance



Non-weather variability

- Economic cycles
- Customer mix
- Consumer behavior





System performance

- Planned outages
- Forced outages
- Renewable generation
- Import capability





Break

and the second s

2024 IRP Schedule and Key Considerations

Candy Kelly; Sr. Manager, Resource Strategy



Key IRP Dates

The 2024 IRP study approach is intended to enable stakeholder involvement and ensure transparency

Spring '23 – Publication of Notice of Intent (NOI) and public scoping initiation

Summer '23 – IRP Working Group commences

Fall '23 – Public scoping report published

Fall/Winter '23 – Modeling and environmental study

Spring '24 – Publish Draft IRP and EIS, public comment period begins

Spring/Summer '24 – Respond to Draft comments and develop Final documents

Summer '24 – Publication and TVA Board adoption of Final IRP and EIS



What is Public Scoping?

As TVA updates its power generation strategy, the first step is to understand the environment we're planning in, which is referred to as scoping.

We ask the general public, our customers, and our partners and regulators about their ideas regarding the generation needs of the future.

With this information, we develop key assumptions to study which are transformed into candidate resource plans to be evaluated for viability and environmental impact.

We also ask the public to comment on potential environmental issues and concerns that should be addressed in the EIS.



2024 IRP Key Considerations

Reliability, affordability, and resiliency

Dispatchability

Electrification and load growth

Carbon reductions and net zero

Renewables and storage

Climate impacts

Environmental justice

Other Risks



Wrap-Up and Day 2 Preview

Jo Anne Lavender; IRP Facilitator



Agenda – July 18, 2023

Торіс	Time (CT)	Presenter(s)	Notes
Breakfast	8:00-8:30		
Agenda and welcome	8:30-8:40	Jo Anne Lavender	
Prior IRP-WG member reflections	8:40-9:00	Jo Anne Lavender	Allow former WG members a chance to speak about the WG experience
Introduction to scenarios & strategies	9:00-9:15	Candy Kelly	Scenario and strategy overview
Scenarios deep-dive, breakout, and discussion (break included)	9:15-11:45	Daniel Woolley; Jo Anne Lavender	Scenario development, potential 2024 scenarios, and breakout groups
Lunch, including environmental review overview	11:45-12:45	Kelly Baxter	NEPA team review of EIS analysis for the IRP
Strategies deep-dive, breakout, and discussion (break included)	12:45-3:10	Daniel Woolley; Jo Anne Lavender	Strategy development, potential 2024 strategies, and breakout groups
Stakeholder Engagement Strategy	3:10-3:40	Amy Edge	External relations engagement strategy
Wrap-up	3:40-4:00	Jo Anne Lavender	



Prior IRP-WG Member Reflections

Jo Anne Lavender; IRP Facilitator



Introduction to Scenarios and Strategies

Candy Kelly; Sr. Manager, Resource Strategy



TVA's Integrated Resource Plan (IRP)

TVA conducts a least-cost planning program consistent with the Energy Policy Act of 1992.

The IRP is a risk-informed study of future needs and how TVA could meet customer demands.

The IRP is:

- A collaborative, stakeholder-focused effort
- Based on least-cost planning principles
- A risk-informed study that assesses a wide range of potential futures
- The basis for TVA's asset strategy

The TVA board approves the strategic planning direction set forth in the IRP.

To meet regulatory requirements, an Environmental Impact Statement (EIS) accompanies the IRP to analyze the impacts to the Valley.



The IRP functions like a compass, not a GPS



Planning is Grounded in Least-Cost Principles

In resource planning, TVA applies fundamental least-cost planning principles*:



*In alignment with the Energy Policy Act of 1992

The IRP Utilizes Rigorous Analytical Process



The 2019 IRP evaluated 6 Scenarios (Likely Futures) and 5 Strategies (How TVA Responds) for a total of 30 core portfolios, as well as multiple sensitivity cases, all informed by internal and external stakeholders



Scenarios and Strategies Establish a Framework

Scenarios Outside TVA's Control

- Describe potential outcomes of factors (uncertainties) outside of TVA's control
- Represent possible conditions and are not predictions of the future
- Include uncertainties that could significantly impact operations, such as:
 - Load forecasts
 - Commodity prices
 - Environmental regulations
- Lends insight to riskiness of portfolio choices

Strategies Within TVA's Control

- Test various business options within TVA's control
- Defined by a combination of resource assumptions, such as:
 - DER portfolio
 - Nuclear expansion
 - Energy storage
- Consider multiple viewpoints
 - Public scoping period comments
 - Assumptions that would have the greatest impact on TVA long-term

A well-designed strategy will perform well in many possible scenarios


How the Resource Planning Process Works





Scenarios Breakout and Discussion

Daniel Woolley; Sr. Specialist, Resource Strategy Jo Anne Lavender; IRP Facilitator





Lunch

Environmental Review Overview

Kelly Baxter NEPA Project Manager



IRP Environmental Impact Statement (EIS) Purpose and Approach

Required per the National Environmental Policy Act (NEPA)

NEPA is part of the planning process

Decision-makers informed of environmental impacts

Public involvement

System-wide study of environmental impacts

Programmatic EIS





EIS Process and Milestones

The NEPA review of a proposed action must consider all aspects of the proposed action and all of the individual steps necessary to implement the proposed action.



*Opportunity for public feedback



EIS Analyzes Key Environmental Factors

The EIS will assess broad region-wide impacts of the next IRP on environmental factors such as:

- Air quality and climate impacts
- Water resources
- Fuel requirements

- Waste production
- Land requirements
- Socioeconomics and Environmental Justice





Example IRP EIS Analysis

Table 5-4: Average CO₂ emissions and emissions rates, percent emissions changes, and percent emission rate changes by alternative strategy and the Target Power Supply Mix.

	Alternative Strategy						
	A – No Action	В	С	D	E	Target Power Supply Mix	
						Current Outlook Range	Extended Range
Total CO ₂ emissions 2019- 2038, million tons	772	766	758	758	759	847 - 865	588 - 996
Annual CO ₂ emissions, thousand tons	38,610	38,316	37,915	37,931	37,945	42,328 - 43,230	29,392 - 49,805
Percent CO ₂ emissions change, 2019-2038	-21.4	-22.4	-24.4	-24.8	-24.1	-7.6 to -9.5	+6.4 to -37.2
CO2 emissions rate, lbs/MWh	488	485	479	480	480	532 - 543	409 - 543
Percent CO ₂ change reduction, 2019-2038	-26.2	-27.0	-29.4	-29.0	-28.4	-8.3 to -10.0	-8.3 to -31.0



Figure 5-7: Trends in emissions of CO₂ by alternative strategy based on averages of the six scenarios.



Strategies Breakout and Discussion

Daniel Woolley; Sr. Specialist, Resource Strategy Jo Anne Lavender; IRP Facilitator



Stakeholder Engagement Strategy

Amy Edge; Director, External Relations



TVA Customer & Stakeholder Engagement

- Seeking input from and listening to our customers and stakeholders is foundational to our mission serving the people of the Tennessee Valley to make life better
- TVA seeks customer and stakeholder input and feedback on an ongoing basis through forums such as:
 - Federal Advisory Committees Regional Energy Resource Council (RERC) and Regional Resource Stewardship Council (RRSC)
 - Quarterly TVA Board Listening Sessions
 - Powerful Partnership and Voice of the Customer Surveys
 - Environmental Impact Studies (EIS) public comments and public meetings
 - Regional Field Teams
- A key element of TVA's IRP process is to ensure active public involvement and direct engagement with a diverse group of stakeholders





Stakeholder Engagement and the IRP

- The 2024 IRP process will leverage both past effective engagement venues as well as input from several additional avenues:
 - IRP Working Group (IRPWG)
 - Regional Energy Resource Council (RERC)
 - Public Scoping Meetings / Public Meetings on Draft IRP Report
 - Periodic Informational Webinars
 - Dedicated IRP Public Website
- Enhanced stakeholder engagement mechanisms:
 - Valley Vision 2035, Valley Pathways Study, Utility of the Future Information Exchange outputs leveraged to inform the IRP process
 - Regional Field Teams
 - Environmental Justice focus applied to all engagements with the objective of advancing improvements in reaching and involving environmental justice populations





Meeting Wrap-Up

Jo Anne Lavender; IRP Facilitator

