About Today’s Meeting

• This a Webinar Meeting.

• **Attendees** are in listen-only mode.

• Questions **will be accepted during the webinar**; please use the question box to submit your questions.

• This session is being recorded and will be available on the TVA 2019 IRP website.

• 2019 IRP website:  [www.tva.com/irp](http://www.tva.com/irp)
Webinar Agenda

• Welcome and Meeting Purpose

• Overview of the 2019 Integrated Resource Plan and current status
  • Scenarios and Strategies being considered in the IRP
  • About Resource Technologies

• Update on the NEPA process

• How to stay up to date on the 2019 IRP

• Clarifying Questions from Audience
Welcome & Meeting Purpose

Laura Campbell
Vice President, Enterprise Planning
TVA’s Integrated Resource Plan

The IRP is a comprehensive study that provides direction on how to best meet future electricity demand.

A programmatic Environmental Impact Statement (EIS) accompanies the IRP to analyze the impacts associated with an updated IRP to the Valley.
About the 2019 IRP and Project Update

Hunter Hydas
Enterprise Planning
Integrated Resource Planning

- Collaborate with stakeholders to envision the power generation needs of the future
- Determine how TVA can continue to provide low-cost, reliable electricity; support environmental stewardship; and spur economic development
- Inform the company’s next long range financial plan

The IRP functions like a compass, not a GPS
2019 IRP Focus Areas

- System flexibility
- Distributed Energy Resources
- Portfolio diversity
Flexibility
Goals for an Optimal Resource Plan

- Low Cost
- Risk Informed
- Environmentally Responsible
- Reliable
- Diverse
- Flexible
2019 IRP Schedule: Schedule & Milestones

The 2019 IRP Study Approach is intended to ensure transparency & enable stakeholder involvement.

Key Tasks/Milestones in this study timeline include:

- Establish stakeholder group and hold first meeting (Feb 2018)
- Initial modeling (June 2018)
- Publish draft EIS and IRP (Feb 2019)
- Complete public meetings (April 2019)
- Board approval and final publication of EIS and IRP (expected Summer 2019)
Integrated Resource Planning Process

Scenarios

Modeling Assumptions

Model

Strategies

Portfolios

Candidate Technologies

Analyze Portfolios

Select Preferred Portfolio

INTEGRATED Resource Plan 2019
Planned Scenarios & Strategies

**Scenarios**
1. Current Outlook
2. Economic Turndown
3. Valley Load Growth
4. Decarbonization
5. Rapid DER Adoption
6. No Nuclear Extensions

**Strategies**
A. Base Case
B. Promote DER
C. Promote Resiliency
D. Promote Efficient Energy Usage
E. Promote Renewables
IRP Comparison

2015 IRP Energy (TWh)

- 1 Current Outlook
- 2 Stagnant Economy
- 3 Growth Economy
- 4 De-carbonized Future
- 5 Distributed Marketplace

In the 2015 IRP, all of the scenarios had increasing energy escalation within a tight band.

2019 IRP Energy (TWh)

- 1 Current
- 2 Downturn
- 3 Growth
- 4 Decarb
- 5 DER

The 2019 IRP has a wider spread of potential load scenarios.
Framework Informs Portfolio Optimization

Scenarios

Modeling Assumptions

Model

Strategies

Portfolios

Candidate Technologies

Analyze Portfolios

Select Preferred Portfolio
Planning for an Evolving System

Winter Peaking Demand
Updated reserve margins support reliability in both winter and summer and with more renewables on the system.

More Renewable Resources
Integration cost recognizes the costs driven by integrating intermittent resources onto the system.

Increasing Need for Flexibility
Flexibility benefit recognizes the benefits driven by integrating flexible resources onto the system.
Resource Options Are Offered for Selection

Scenarios

Strategies

Modeling Assumptions

Model

Candidate Technologies

Portfolios

Analyze Portfolios

Select Preferred Portfolio

Resource Plan 2019
Resource Planning for Future Capacity Needs

Capacity Gap Chart

A projection of customer demand increased by a reserve margin – known as firm requirements.

Portfolio Options
- Retired Nuclear
- Retired Coal
- Retired Gas
- Nuclear
- Coal
- Gas
- Hydro
- Renewables
- Storage
- EE/DR
- Distributed Resources
- Market Purchases

Recommended path provides a low-cost, reliable, diverse and flexible system.
Wide Variety of Resource Options to Consider

Conventional Power Plants

Renewable Resources

Distributed Energy Resources

Resource options are screened based on multiple criteria:
- Technological viability and maturity
- Economic (based on levelized cost)
Resources Have Different Characteristics

Summer Day Load Shape

Peaking Resources
- Highest operating costs
- Designed for use only when loads are highest and other resources already committed

Intermediate Resources
- Moderate operating costs
- Ability to "swing" with changes in load

Base Load Resources
- Lowest overall operating costs
- Designed to remain online virtually around the clock

Total Available Capacity > Peak Load (reflects required reserve margin)

Represents surplus capacity (used for pumping or off-system sales)
### MATURE

- **Baseload**
  - Coal: Pulverized Coal
  - Nuclear: BWR, PWR
- **Intermediate**
  - Renewable: Landfill Gas
  - Gas: Combined Cycle
  - Combined Heat & Power (CHP)
- **Peaking**
  - Storage: Pumped Hydro
  - Gas: Reciprocating Engine
  - Energy Efficiency & Demand Response
  - Gas: Combustion Turbine
- **Variable**
  - Renewable: Wind
  - Renewable: Solar Photovoltaic
  - Renewable: Solar Thermal

### EMERGING

- **Baseload**
  - Nuclear: AP1000
  - Coal: IGCC with CCS
- **Intermediate**
  - Renewable: Geothermal
  - Renewable: Biomass
  - Storage: Batteries (Lithium-ion)
  - Storage: Fuel Cells
  - Storage: Batteries (advanced chemistry)
  - Storage: Advanced Energy Storage Options
  - Gas: Combined Cycle w/CCS
- **Peaking**
  - Advanced Rankine Steam Cycles
- **Variable**
  - Storage: Compressed Air Energy Storage
  - Electronic Vehicles (Vehicle to Grid)

### DEVELOPMENTAL

- **Baseload**
  - Nuclear: Small Modular Reactors
- **Intermediate**
  - Gas: Allam Cycle
- **Peaking**
  - Advanced Reactor Options
- **Variable**
  - SMRs will be modeled to enable sensitivity in Nuclear scenario

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Tabulation of resources by duty cycle and maturity
Retirement Options

Total costs can be reduced in low load scenarios or when replacement resources are more economic than the ongoing costs of existing resources. It is important that accurate ongoing costs, demolition/closure costs, and transmission upgrades required to retire resources are considered against the cost of new resources.

Window of Retirement Options

- Gas
- Shawnee 2, 3, 5-9 (uncontrolled)
- Paradise 3
- Bull Run
- Other Coal
- Browns Ferry Nuclear 1-3

2018 2020 2022 2024 2026 2028 2030 2032 2034 2036 2038
Update on the NEPA Process

Ashley Pilakowski, NEPA Specialist
IRP Environmental Impact Statement - Purpose and Approach

- Determine environmental impacts system-wide
- Inform decision makers of potential impacts
- Provide public involvement
EIS Process

(** indicates timing of Valley-wide public meetings)
2019 IRP Public Scoping Report

Scoping period: 2/15/2018 to 04/16/2018

2019 Integrated Resource Plan

TVA has begun work on the 2019 Integrated Resource Plan (IRP)—a comprehensive study that provides direction on how to best meet future electricity demand. Building upon the work done in prior plans, TVA has started the 2019 IRP to proactively address the changing utility market. The 2014 IRP explored various scenarios related to expansion of Distributed Energy Resources (DER) in the Tennessee Valley. We will also seek to improve TVA’s understanding of the impact and benefit of system flexibility with increasing renewable and distributed resources. The IRP will consider many views of the future to determine how TVA can continue to provide low-cost, reliable electricity, support environmental stewardship, and spur economic development in the Valley.

TVA Publishes 2019 IRP Scoping Report

On Aug. 1, 2018, TVA published the 2019 Integrated Resource Plan (IRP) Scoping Report that includes public comments related to TVA’s work on the IRP and related Environmental Impact Statement (EIS). The scoping report includes information about how the IRP and EIS are being developed, and captures public comments TVA received online, by mail and at public meetings during the 60-day scoping period that ran from Feb. 14 to Apr. 16, 2018. Click here to read the full report.

2019 IRP SCOPING REPORT NOW AVAILABLE AT www.tva.com/irp

INTEGRATED Resource Plan 2019
Major Themes: Scope of EIS

- Cumulative effects of generating facilities on wildlife, listed species, and water resources
- Call for special attention to environmental justice/affected environment analyses on impacts to limited income households
- General comments on best practices for future evaluations of site specific actions
- General input on air quality and greenhouse gas emissions/climate change
Upcoming IRP Public Outreach

**Spring 2018**
- Video about IRP process
  - Monthly: Social media updates
  - Quarterly webinar: May 15, 2018

**FAQs** posted on website

**Monthly:**
- Social media updates

**Spring 2018**
- Video of preferred portfolio

**Summer 2018**
- Interactive report of Final IRP

**Fall/Winter 2018**
- Draft EIS public comment period begins
  - Feb 2019

**Monthly:**
- Social media updates

**Quarterly webinar:**
- Sept 10, 2018

**Spring 2019**
- Videos about portfolio options
  - Public meeting series
  - Launch of online public meeting

**Monthly:**
- Social media updates

**Quarterly webinar:**
- Dec 2018
- March 2019

**Summer 2019**
- Interactive report of Final IRP

**Monthly:**
- Social media updates

**Quarterly webinar:**
- July 2019

**Note:** Dates Subject to Change
Question and Answer Session
Clarifying Questions

• Use the ‘Question’ area of the webinar toolbar to ask clarifying questions
Wrap Up

Hunter Hydas
Enterprise Planning
Upcoming IRP Public Outreach

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- Monthly: Social media updates
- Quarterly webinar: July 2019

**Summer 2019**

- Video of preferred portfolio

**Note: Dates Subject to Change**
How You Can Stay Up to Date

• Visit www.tva.com/irp for current information and content.

• While there, sign up for the email list to receive updates.