Regional Energy Resource Council

June 26-27, 2019
Chattanooga, Tennessee
### Term 3 RERC Members

<table>
<thead>
<tr>
<th>Name</th>
<th>Title/Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Michael Butler</td>
<td>Tennessee Wildlife Federation</td>
</tr>
<tr>
<td>Wayne Davis*</td>
<td>University of Tennessee</td>
</tr>
<tr>
<td>Rodney Goodman</td>
<td>Habitat for Humanity</td>
</tr>
<tr>
<td>Dan Ionel</td>
<td>University of Kentucky</td>
</tr>
<tr>
<td>Wes Kelley</td>
<td>Huntsville Utilities</td>
</tr>
<tr>
<td>Doug Lawyer</td>
<td>Knoxville Chamber</td>
</tr>
<tr>
<td>Peter J. Mattheis</td>
<td>Tennessee Valley Industrial Committee</td>
</tr>
<tr>
<td>Shari Meghrebian</td>
<td>State of Tennessee (retired)</td>
</tr>
<tr>
<td>Jennifer Mundt</td>
<td>State of North Carolina</td>
</tr>
<tr>
<td>Jeremy Nails</td>
<td>Morgan County Economic Development Association</td>
</tr>
<tr>
<td>Alice Perry**</td>
<td>State of Mississippi</td>
</tr>
<tr>
<td>Doug Peters</td>
<td>Tennessee Valley Public Power Association</td>
</tr>
<tr>
<td>Derwin Sisnett</td>
<td>Gestalt Community Schools</td>
</tr>
<tr>
<td>Stephen Smith</td>
<td>Southern Alliance for Clean Energy</td>
</tr>
<tr>
<td>Charles Snavely</td>
<td>Commonwealth of Kentucky</td>
</tr>
<tr>
<td>John Warren</td>
<td>Commonwealth of Virginia</td>
</tr>
<tr>
<td>Lloyd Webb</td>
<td>Olin Chlor Alkali</td>
</tr>
<tr>
<td>Susan R. Williams</td>
<td>SRW &amp; Associates</td>
</tr>
</tbody>
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* RERC Chair  
** Retired from the RERC June, 2018
Special Guests -- TVA Board Members

- Skip Thompson, TVA Board Chair
- Kenny Allen
- A.D. Frazier
- Richard Howorth
- Gina Lodge
- John Ryder
Introductions

• Name
• Organization and Role
Safety Moment

Building Emergency Plan
Agenda and Meeting Protocols
<table>
<thead>
<tr>
<th>Time</th>
<th>Agenda Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>12:45</td>
<td>Welcome and Introductions and Safety Moment</td>
</tr>
<tr>
<td>1:00</td>
<td>RERC Overview and Meeting Protocols</td>
</tr>
<tr>
<td>1:05</td>
<td>Today’s Meeting Purpose</td>
</tr>
<tr>
<td>1:20</td>
<td>2019 IRP Overview and Development Process</td>
</tr>
<tr>
<td></td>
<td>2019 IRP Stakeholder Process</td>
</tr>
<tr>
<td>2:00</td>
<td>Break</td>
</tr>
<tr>
<td>2:15</td>
<td>Developing the IRP Recommendation.</td>
</tr>
<tr>
<td></td>
<td>The IRP Recommendation</td>
</tr>
<tr>
<td>3:15</td>
<td>Break</td>
</tr>
<tr>
<td>3:30</td>
<td>Panel - Challenges and Opportunities that the 2019 IRP points out for TVA</td>
</tr>
<tr>
<td>4:45</td>
<td>Break and prepare for Public Listening Session</td>
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<tr>
<td>5:00</td>
<td>Public Listening Session (sign up ahead at the door)</td>
</tr>
<tr>
<td>6:00</td>
<td>Wrap Up, Conclude Session, thank all attendees</td>
</tr>
</tbody>
</table>
## Agenda – June 27, 2019

<table>
<thead>
<tr>
<th>Time</th>
<th>Session Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:30</td>
<td>Welcome and Recap Day 1</td>
</tr>
<tr>
<td></td>
<td>Summarize meeting and Board session, panels, public comments</td>
</tr>
<tr>
<td>9:00</td>
<td>RERC Observations from Day 1</td>
</tr>
<tr>
<td>9:45</td>
<td>Break</td>
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<tr>
<td>10:00</td>
<td>The IRP Recommendation</td>
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<tr>
<td>11:00</td>
<td>RERC Discussion Questions</td>
</tr>
<tr>
<td>12:00</td>
<td>Lunch</td>
</tr>
<tr>
<td>1:00</td>
<td>Form RERC Advisory Statement</td>
</tr>
<tr>
<td>2:00</td>
<td>Next Steps</td>
</tr>
<tr>
<td>2:30</td>
<td>Wrap Up and Adjourn</td>
</tr>
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</table>
RERC Meeting Protocols

**Agenda**
- Prepared and approved by the Designated Federal Officer (DFO) in consultation with Council Chair
- Distributed to Council and published in the Federal Register prior to each meeting
- Topics may be submitted to the DFO by any member of the Council, or non-members, including members of the public

**Meeting Minutes**
- DFO will ensure that minutes are prepared for each meeting, approved by the Chair, and made available to Council members

**Voting**
- Any member of the Council may make a motion for a vote
- Recommendations to TVA Board shall require an affirmative vote of at least a simple majority of the total Council members present on that date
- Council members may include minority or dissenting views

**Discussion**
- DFO (or his designee) will facilitate and ensure good order during all open discussions
- Only one speaker or attendee is permitted to comment at a time
- To be recognized by the Chair (or meeting facilitator) in order to provide comment, please turn your name card on its side
Today's Meeting Purpose

Joe Hoagland, Designated Federal Officer
Recap Term 3 Meetings

- 8 Meetings held so far in Term 3
- 6 focused on the 2019 IRP development process:
  - June 14, 2018, IRP Focus Areas and Public Engagement
  - September 5, 2018, IRP Scenarios and Strategies
  - December 18, 2018, Metrics and Scorecards; Considerations as TVA applies these metrics
  - April 17-18, 2019: Moving from Draft IRP to Final
  - June 10, 2019: Webinar on Public Comments/Responses, and Sensitivities
Today’s Meeting Purpose

• **Provide an overview on the 2019 Integrated Resource Plan**
  - Development of the IRP, including final IRP /EIS
  - Review public engagement along the way
  - Present the Recommendation
  - Host a panel of experts to gain broad understanding of challenges related to the 2019 IRP
  - Review key themes heard from public and stakeholders and how TVA addressed them

• **Host a Public Listening Session**

• **Hear RERC views:**
  - On the 2019 IRP Development Process
  - On the Scope of the Analysis
  - On the Opportunities or Focus Areas for TVA going forward
April 17-18, 2019 Meeting – Recap

Moving to the Final IRP
- Sensitivities
- Forming a Recommendation
- Finalizing the IRP and EIS

Accelerated Solar

- Accelerating solar additions primarily has the effect of bringing the economic solar additions forward, resulting in an additional ~800MW of solar by 2036 which is less than the total accelerated amounts.
- Total nameplate MW of solar is below 10,000 MW in both cases.
TVA’s Mission

Energy
Provide affordable electric power throughout the Tennessee Valley

Environment
Act as a steward of the Valley’s natural resources

Economic Development
Serve as a catalyst for sustainable economic development
TVA’s Integrated Resource Plan and Environmental Impact Statement

The Integrated Resource Plan (IRP) is a study of how TVA could meet customer demands across a variety of future environments.

A programmatic Environmental Impact Statement (EIS) accompanies the IRP to analyze the impacts associated with an updated IRP to the Valley.
Why Are We Updating the IRP Now?

1. Consumer behaviors and preferences are changing
2. Companies are committing to renewables
3. Distributed energy resources introduce fundamental change

An updated Integrated Resource Plan is needed to:

- Proactively plan for the future
- Inform next long-range financial plan
- Shape how TVA can continue to achieve the Mission
Focus Areas:
- Distributed Energy Resources
- System Flexibility
- Portfolio Diversity
TVA’s IRP Planning Process

1. SCOPING
   WINTER/SPRING 2018
2. DEVELOP INPUTS & FRAMEWORK
   SPRING 2018
3. ANALYZE & EVALUATE
   SUMMER/FALL 2018
4. PRESENT DRAFT IRP FOR PUBLIC COMMENT
   WINTER/SPRING 2019
5. IDENTIFY OPTIMAL RESOURCE PLAN
   SPRING/SUMMER 2019
6. INCORPORATE INPUT
   SPRING/SUMMER 2019
7. PRESENT RECOMMENDATION
   SUMMER 2019

We are Here
How the Resource Planning Process Works

- Scenarios
- Strategies
- Modeling Assumptions
- Candidate Technologies
- Model
- Portfolios
- Analyze Portfolios
- Select Preferred Portfolio
Stakeholder Engagement

Amy Henry and Matthew Higdon
Stakeholder Engagement is a Cornerstone of TVA’s IRP Process

- TVA’s Integrated Resource Planning is unique
- More informed decision-making
- Better outcomes
- Incorporating TVA’s responsibilities under the National Environmental Policy Act (NEPA) - enhanced environmental analysis and public outreach
Stakeholder Input for the 2019 IRP

2018

- EIS Scoping
- IRP Email box
- IRP Working Group Meetings
- TVA Board Public Listening Sessions

2019

- Draft IRP/EIS Comment Period
- IRP Public Webinars
- RERC Meetings

LEGEND

- Launch Date
- Run Time
2019 IRP Stakeholder Engagement

- IRP Working Group
- Regional Energy Resource Council
- General Public
General Public Outreach

- Website
- Interactive Report
- Educational Videos
- Webinars
- Social Media
- Emails to mailing list subscribers
- Public Scoping and Comment Periods
- Environmental Justice Outreach / Spanish Language version
Social Media

- Facebook
- LinkedIn
- Twitter
- Instagram
- YouTube
2019 IRP Working Group

• 20 representatives
  - diverse, Valley-wide perspectives

• 14 meetings

• Input on:
  - Scenarios, strategies, resource technologies, metrics, sensitivities, signposts of change and implementation
Draft IRP and EIS Public Comment Period

• Draft IRP/EIS released February 2019 for Public Comment Period
• 400+ people attended 7 public meetings and a webinar
• Interactive report online
• About 1,200+ people and organizations submitted comments

Most Frequent Comments:
• Increase the use of renewable energy
• More aggressively reduce carbon emissions
• Increase energy efficiency
• Support for and caution about coal plant retirements
Sample of the Diversity of Commenters

Tennessee Wildlife Federation
Tennessee Department of Environment and Conservation
Tennessee Solar Energy Association
Center for Biological Diversity
City of Oak Ridge
The Climate Reality Project
Tennessee Citizens for Wilderness Planning
Tennessee Interfaith Power and Light
Tennessee Valley Industrial Committee
Tennessee Valley Public Power Association
Alabama Solar Association
Senator Rand Paul
U.S. Department of the Interior

U.S. Environmental Protection Agency
Kentucky State Clearinghouse
Mississippi Department of Archives and History
Tennessee Historical Commission
Virginia Department of Historic Resources
Southern Alliance for Clean Energy
Southern Environmental Law Center
Sierra Club (includes a petition)
Southern Renewable Energy Association
Citizen’s Climate Lobby, Knoxville Chapter
American Petroleum Institute
Sunrise Movement, Knoxville
NAACP
Energy Alabama
Sample of Draft IRP and EIS Comment Topics

**IRP Process**
- Cost of Implementing a Strategy
- Data Inputs and Assumptions
- Scenarios
- Sensitivity Testing
- Strategies
- Strategy Evaluation Metrics

**Energy Resource Options**
- Clean Energy
- Coal
- Distributed Energy Resources (DER)
- Energy Efficiency
- Facility Siting
- Natural Gas
- Nuclear Energy
- Renewable Energy
- Solar Energy
- Storage
- Wind Energy

**Environmental Impacts**
- Air Quality
- Endangered and Threatened Species
- Greenhouse Gas Emissions and Climate Change
- Historic Properties
- Land Use
- Life Cycle Impacts
- Parks, Managed Areas and Ecologically Significant Sites
- Socioeconomics
- Solid and Hazardous Waste
- Water Resources
Impact of Public Comments

- Informed sensitivity analysis
- Considered in development of the IRP recommendation
- Revised IRP and EIS reports
- Comments and responses will be appended to Final IRP / EIS
TVA Used Input Received

RERC, IRP Working Group and Public Input received informed:

- Scenarios and strategies evaluated
- Resource options considered
- Metrics utilized
- Sensitivity analyses run
- Signposts to watch
Developing the IRP Recommendation

Hunter Hydas and Jane Elliott
Integrated Resource Planning Process

- Scenarios (Possible Futures)
- Strategies (TVA Approach to Scenarios)
- Modeling Assumptions
- Model
- Candidate Technologies
- Portfolios
- Analyze Portfolios
- Select Preferred Portfolio
2019 IRP Scenarios and Strategies

Scenarios
1. Current Outlook
2. Economic Downturn
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 Load Shape
E. Promote Renewables
### Scenario Forecasts: Load Outlook

**Peak**

- **Current Downturn Growth Decarb DER Nuclear**
  - CAGR: 0.3% -0.2% 1.7% -0.4% -0.7% 0.3%

**Energy**

- **Current Downturn Growth Decarb DER Nuclear**
  - CAGR: 0.0% -0.5% 2.0% -1.1% -1.5% 0.0%

*Note: Forecast for Scenario 6 Nuclear same as Scenario 1 Current Outlook*
Scenario Forecasts: Behind the Meter Impacts

### Electric Vehicles

- Current CAGR: 27%
- Downturn Growth: 29%
- Decarb: 43%
- DER: 37%
- Nuclear: 34%
- CAGR: 27%

### Energy Efficiency

- Current CAGR: N/A
- Downturn Growth: 44%
- Decarb: -47%
- DER: -66%
- Nuclear: -60%
- CAGR: N/A

### Renewable Energy (GWh)

- Current CAGR: -14%
- Downturn Growth: -14%
- Decarb: -15%
- DER: -25%
- Nuclear: -32%
- CAGR: -14%

### Combined Heat & Power

- Current CAGR: -14%
- Downturn Growth: -9%
- Decarb: -19%
- DER: -14%
- Nuclear: -27%
- CAGR: -14%

Note: Scenarios shown as delta from the Current Outlook
Scenario Forecasts: Gas and Carbon Prices

Henry Hub Gas Prices

<table>
<thead>
<tr>
<th>Year</th>
<th>2018</th>
<th>2020</th>
<th>2022</th>
<th>2024</th>
<th>2026</th>
<th>2028</th>
<th>2030</th>
<th>2032</th>
<th>2034</th>
<th>2036</th>
<th>2038</th>
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<tbody>
<tr>
<td>Costs ($/MMBtu)</td>
<td>$2.00</td>
<td>$2.50</td>
<td>$3.00</td>
<td>$3.50</td>
<td>$4.00</td>
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<td>$5.00</td>
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<td>$6.00</td>
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CO₂ Cost

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<th>Year</th>
<th>2018</th>
<th>2020</th>
<th>2022</th>
<th>2024</th>
<th>2026</th>
<th>2028</th>
<th>2030</th>
<th>2032</th>
<th>2034</th>
<th>2036</th>
<th>2038</th>
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</thead>
<tbody>
<tr>
<td>Costs ($/Ton)</td>
<td>$0.00</td>
<td>$1.00</td>
<td>$2.00</td>
<td>$3.00</td>
<td>$4.00</td>
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<td>$6.00</td>
<td>$7.00</td>
<td>$8.00</td>
<td>$9.00</td>
<td>$10.00</td>
</tr>
</tbody>
</table>

Note: Forecast for Scenarios 2 Downturn, 5 DER and 6 Nuclear same as Scenario 1 Current Outlook.
Planned Reductions in Firm Capacity

- **2020:** Paradise 3 retire
- **2021:** Enernoc contract
- **2022:** Caledonia lease, Diesel PPAs
- **2023:** DEC PPA, Buffalo Mountain Wind, Diesel PPAs
- **2024:** Bull Run retire (end of 2023)
- **2024:** Diesel PPAs
- **2026:** MEC contract expiration
- **2031:** Pioneer Prairie, Lost Lakes, White Oak, Caney River Wind
- **2032:** Red Hills contract, Bishop Hill, California Ridge, Cimarron Wind
- **2034:** SHF 2,3,5-9 retire (projected)
- **2036:** NextEra River Bend Solar
- **2038:** Millington Solar

<table>
<thead>
<tr>
<th>Year</th>
<th>Project/Description</th>
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<tr>
<td>2019</td>
<td>Enermoc, Paradise 3, Caledonia, Diesels PPAs, DEC PPA, Buff Mtn Wind, Diesel PPA, Bull Run, DEC PPA, MEC PPA, Wind PPA, Red Hills, Wind PPA, SHF 2,3,5-9, Next Era, Millington Solar</td>
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</tbody>
</table>
Colored bars reflect benchmark ranges and black outlines represent TVA assumptions. TVA assumptions outside of benchmark ranges are based on actual costs of TVA projects or vendor quotes. Navigant provided a third-party review of assumptions for generating resources.
Escalation Assumptions

While most resource costs will escalate with inflation, costs for resources that are still rapidly evolving may escalate differently, and escalation rates can vary by scenario.

**Solar Overnight Capital Costs**

**Lithium-Ion Battery Overnight Capital Costs**
Programmatic DER Options & Cost Assumptions

BE = Beneficial Electrification
EE = Energy Efficiency
DR = Demand Response
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.
Strategies Promote Resources Using Incentives

Strategies provide incentives to promote adoption of certain resources, with consideration of potential, adoption curve, and reserve margin.

- **Base Level Adoption**
  - No Additional Incentive
  - Incentive aligned to base case

- **Moderate Adoption**
  - Moderate Incentive
  - 50% of marginal cost

- **High Adoption**
  - High Incentive
  - 100% of marginal cost
<table>
<thead>
<tr>
<th>Strategy</th>
<th>Distributed Solar</th>
<th>Distributed Storage</th>
<th>Combined Heat &amp; Power</th>
<th>Energy Efficiency</th>
<th>Demand Response</th>
<th>Beneficial Electrification</th>
<th>Solar</th>
<th>Wind</th>
<th>Biomass &amp; Biogas</th>
<th>Storage</th>
<th>Aero CTs &amp; Recip Engines</th>
<th>Small Modular Reactors</th>
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</thead>
<tbody>
<tr>
<td>Base Case</td>
<td>Base</td>
<td>Base</td>
<td>Base</td>
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<tr>
<td>Promote DER</td>
<td>High</td>
<td>Moderate</td>
<td>High</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Base</td>
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<tr>
<td>Promote Resiliency</td>
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<td>High</td>
<td>Moderate</td>
<td>Base</td>
<td>Moderate</td>
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<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
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<tr>
<td>Promote Efficient Load Shape</td>
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<td>Moderate</td>
<td>Base</td>
<td>High</td>
<td>High</td>
<td>Moderate</td>
<td>Base</td>
<td>Base</td>
<td>Base</td>
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<td>Promote Renewables</td>
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</table>

Low Income Energy Efficiency is promoted in the following manner across the strategies:

- Pilot continuation (Base, Resiliency, Renewables)
- Pilot expanded valley-wide (DER)
- Pilot expanded valley-wide and incentives increased (Efficient Load Shape)
Robust Set of Portfolios Evaluated in the IRP

Additional sensitivity analysis was also performed to test the impact of changes in key assumptions, creating about 15 additional portfolios.
Updated Base Case

- All portfolios were updated to reflect the February 2019 TVA Board decision to retire Paradise Unit 3 and Bull Run fossil plants.

- There was little to no change in capacity expansion plans for scenarios that had flat or declining electricity demand.

- In the Valley Load Growth and No Nuclear Extensions scenarios, additional solar and gas capacity expansion occurred.

- Overall, the updated base case portfolios resulted in similar costs but better environmental performance than the original cases.
Incremental Capacity by 2038

The figure above illustrates the incremental capacity by 2038 under various strategies. Each strategy is color-coded and labeled:

- **Strategy A:** Base Case
- **Strategy B:** Promote DER
- **Strategy C:** Promote Resiliency
- **Strategy D:** Promote Efficient Load Shape
- **Strategy E:** Promote Renewables

The strategies are distinguished by different types of energy sources, including DR 2038, EE 2038, Storage 2038, Renewables 2038, Gas CT 2038, Gas CC 2038, Coal 2038, Hydro, and Nuclear 2038.

The vertical axis represents MW, SND, and the horizontal axis represents different scenarios labeled as:

- 1: Current Outlook
- 2: Economic Downturn
- 3: Utility Load Growth
- 4: Rapid DER Adoption
- 5: No Nuclear Extensions
- 6: No Nuclear Extensions

The chart visually compares the projected capacity for each scenario under the five strategies, highlighting the impact of different energy integration and adoption strategies on future energy needs and capacity.
Total Energy in 2038

Energy in 2038

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>50</td>
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</table>
## Strategy Performance

<table>
<thead>
<tr>
<th>COST</th>
<th>RISK</th>
<th>ENVIRONMENTAL STEWARDSHIP</th>
<th>OPERATIONAL FLEXIBILITY</th>
<th>VALLEY ECONOMICS</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>CO₂, Water, Waste</strong></td>
<td><strong>Land Use</strong></td>
<td></td>
</tr>
<tr>
<td>STRATEGY A: BASE CASE</td>
<td>$</td>
<td>![Warning Icon]</td>
<td>![Green Icon]</td>
<td>![Footprint Icon]</td>
</tr>
<tr>
<td>STRATEGY B: PROMOTE DER</td>
<td>$</td>
<td>![Warning Icon]</td>
<td>![Green Icon]</td>
<td>![Footprint Icon]</td>
</tr>
<tr>
<td>STRATEGY C: PROMOTE RESILIENCY</td>
<td>$</td>
<td>![Warning Icon]</td>
<td>![Green Icon]</td>
<td>![Footprint Icon]</td>
</tr>
<tr>
<td>STRATEGY D: PROMOTE EFFICIENT LOAD SHAPE</td>
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<td>![Warning Icon]</td>
<td>![Green Icon]</td>
<td>![Footprint Icon]</td>
</tr>
<tr>
<td>STRATEGY E: PROMOTE RENEWABLES</td>
<td>$</td>
<td>![Warning Icon]</td>
<td>![Green Icon]</td>
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</table>

All strategies have similar impacts on the Valley economy as measured by per capita income and employment.
## Summary of 2019 IRP Sensitivities

**SENSITIVITY CASE**

*Base Case comparison is the Current Outlook unless otherwise noted*

**CAPACITY EXPANSION IMPACTS BY 2038**

*GREEN indicates increase and RED indicates decrease in resource type*

<table>
<thead>
<tr>
<th>SENSITIVITY CASE</th>
<th>Nuclear</th>
<th>Coal</th>
<th>Gas</th>
<th>Hydro</th>
<th>Solar Nameplate</th>
<th>Wind Nameplate</th>
<th>EEDR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Higher Natural Gas Prices</td>
<td></td>
<td></td>
<td></td>
<td>+55 MW</td>
<td>+2,050 MW</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower Natural Gas Prices</td>
<td></td>
<td></td>
<td>2,000 MW CT replaced by CC</td>
<td></td>
<td>-5,900 MW</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower Wind Costs</td>
<td></td>
<td></td>
<td>-1,100 MW</td>
<td></td>
<td>-3,100 MW</td>
<td>+4,200 MW</td>
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<tr>
<td>Greater EE and DR Market Depth</td>
<td></td>
<td></td>
<td>-2,000 MW</td>
<td></td>
<td>-2,200 MW</td>
<td></td>
<td>+2,100 MW</td>
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<tr>
<td>Integration Cost &amp; Flexibility Benefit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Minor timing differences</td>
<td>Minor timing differences</td>
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<tr>
<td>Pace &amp; Magnitude of Solar Additions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>+1,100 MW</td>
<td></td>
<td></td>
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<tr>
<td>Magnitude of Solar Additions (Valley Load Growth)</td>
<td></td>
<td></td>
<td>1,000 MW CC replaced by CT</td>
<td></td>
<td>+6,000 MW</td>
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<tr>
<td>Higher Operating Costs for Coal Plants</td>
<td></td>
<td></td>
<td>-2,200 MW</td>
<td></td>
<td>+1,500 MW</td>
<td></td>
<td></td>
</tr>
<tr>
<td>More Stringent Carbon Constraints (Decarbonization)</td>
<td></td>
<td></td>
<td>-2,200 MW accelerated</td>
<td>CC expansion accelerated</td>
<td>+175 MW</td>
<td></td>
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<tr>
<td>Variation in Climate</td>
<td>Summer derates</td>
<td>Summer derates</td>
<td>CT expansion accelerated</td>
<td></td>
<td>+2,100 MW</td>
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</table>
2019 IRP Results Indicate:

Over the next 20 years, up to 14 GW solar additions (nameplate), and up to 5 GW storage additions. All portfolios point to a TVA power system that will be LOW COST, RELIABLE, and CLEAN.

Evaluation of additional coal and gas retirements and projected 70% reduction in CO₂ Intensity (lbs/MWh).
2019 IRP Key Findings

• There is a need for new capacity in all scenarios to replace expiring or retiring capacity
• Solar expansion plays a substantial role in all futures
• Gas, storage, and demand response additions provide reliability and/or flexibility
• No baseload resources (designed to operate around the clock) are added, highlighting the need for operational flexibility in the resource portfolio
• Additional coal retirements occur in certain futures
• Energy Efficiency levels depend on market depth and cost-competitiveness
• Wind could play a role if it becomes cost-competitive
• In all cases, TVA will continue to provide for economic growth in the Tennessee Valley
2019 IRP Proposed Recommendation

Range of MW Additions and Subtractions by 2028 and 2038

- MWs are incremental changes from 2019 forward. Baseline case represents expiring and retiring capacity assumed for all cases.
- Browns Ferry Nuclear Plant license is not extended in the No Nuclear Extensions Scenario (outside of TVA control).
- Upper bounds of potential natural gas and solar additions are driven by the Valley Load Growth Scenario.
- Solar and wind are shown in nameplate capacity.
- Solar, gas, and storage ranges include utility-scale and distributed additions (where promoted in a strategy).

Baseline Case
- Expiring or Retiring Capacity

IRP Recommendation
- Baseline Acceleration
- Current Outlook
- Range of IRP Scenarios and Sensitivities
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 long-term planning

Energy Usage
- 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
Signposts to Guide Long-Term Actions

Portfolio shifts will be driven by changing market conditions, more stringent regulations, and technology advancements.

- Demand for electricity
- Natural gas prices
- Customer expectations
- Regulatory requirements
- Operating costs for existing units
- Solar and wind costs
- Emerging and developmental technologies
Meeting will reconvene at 3:30 PM EDT
Panel Discussion

Joe Hoagland, Moderator
Panelists:

- **Al Armandariz**, Sierra Club
- **Cyrus Bhedwar**, SEEEA (Southeast Energy Efficiency Alliance)
- **Stacy Cantrell**, Huntsville Utilities
- **Gil Hough**, TenneSEIA (Tennessee Solar Industries Association)
- **Pete Mattheis**, Tennessee Valley Industrial Committee
- **Brian Solsbee**, Tennessee Municipal Electric Power Association
Meeting will reconvene at 5:00 PM EDT
Public Listening Session

• Public participation is appreciated

• This is a listening session; responses are typically not provided

• Remarks will be time limited to allow as many to speak as possible
Thank you and Travel Safely

The RERC will reconvene here tomorrow at 8:30 AM
Regional Energy Resource Council

June 26-27, 2019
Chattanooga, Tennessee
welcome
# Agenda – June 27, 2019

<table>
<thead>
<tr>
<th>Time</th>
<th>Session Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:30</td>
<td>Welcome and Recap Day 1</td>
</tr>
<tr>
<td></td>
<td>Summarize meeting and Board session, panels, public comments</td>
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<tr>
<td>9:00</td>
<td>RERC Observations from Day 1</td>
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<tr>
<td>9:45</td>
<td>Break</td>
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<tr>
<td>10:00</td>
<td>The IRP Recommendation</td>
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<tr>
<td>11:00</td>
<td>RERC Group Discussion Questions</td>
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<tr>
<td>12:00</td>
<td>Lunch</td>
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<tr>
<td>1:00</td>
<td>Form RERC Advisory Statement</td>
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<tr>
<td>2:00</td>
<td>Next Steps</td>
</tr>
<tr>
<td>2:30</td>
<td>Wrap Up and Adjourn</td>
</tr>
</tbody>
</table>
RERC Meeting Recap – Day 1
RERC Observations from Day 1
Break
The IRP Recommendation

Hunter Hydas and Jane Elliott
2019 IRP Results Indicate:

Over the next **20** years

Up to **14** GW solar additions (nameplate)

Up to **5** GW storage additions

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

**2** to **17** GW Natural Gas Additions

Evaluation of additional coal and gas retirements

Projected **70%** reduction in CO₂ Intensity

Average results from 2005 baseline (lbs/MWh)
2019 IRP Key Findings

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- Solar and wind costs
- Emerging and developmental technologies
RERC Discussion Questions

1. What are your thoughts on the process?
   
   Was the stakeholder and public engagement extensive enough to gain sufficient input?

1. Did the boundaries of 2019 IRP analysis cover what we might need to be prepared for in the future?

2. What do you see as challenges and opportunities for TVA going forward, given the near term actions identified?
Break for Lunch
Meeting will reconvene at 1:00 PM EDT
RERC Discussion (cont’d)
RERC Discussion Questions

1. What are your thoughts on the process?

   Was the stakeholder and public engagement extensive enough to gain sufficient input?

1. Did the boundaries of 2019 IRP analysis cover what we might need to be prepared for in the future?

2. What do you see as challenges and opportunities for TVA going forward, given the near term actions identified?
Wrap Up and Adjourn
Term 3 RERC

Thank you for your Service!
Thank you and please travel safely!