2015 Integrated Resource Plan

IRPWG Meeting
Session 2
December 5th, 2013
<table>
<thead>
<tr>
<th>Time</th>
<th>Topic</th>
<th>Presenter</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:30</td>
<td>Welcome</td>
<td>Randy McAdams</td>
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<tr>
<td>9:45</td>
<td>IRPWG Administration</td>
<td>Randy McAdams</td>
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<tr>
<td>10:15</td>
<td>TVA Strategic Framework</td>
<td>Joe Hoagland</td>
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<td>10:45</td>
<td>Break</td>
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<td>11:00</td>
<td>Scenario Development Process</td>
<td>Gary Brinkworth</td>
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<td>12:00</td>
<td>Lunch</td>
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<td>12:45</td>
<td>Overview of Candidate Scenarios</td>
<td>Gary Brinkworth</td>
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<td>1:45</td>
<td>Scenarios and Critical Uncertainties</td>
<td>Gary Brinkworth</td>
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<td>2:30</td>
<td>Break</td>
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<td>2:45</td>
<td>Scenarios and Critical Uncertainties (Cont.)</td>
<td>Gary Brinkworth</td>
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<td>3:30</td>
<td>Homework/Ranking of Scenarios</td>
<td>Randy McAdams</td>
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<td>3:45</td>
<td>Wrap-up</td>
<td>Randy McAdams</td>
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<td>4:00</td>
<td>Adjourn</td>
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Key Announcements:

- TVA plans to continue to operate the Paradise coal-fired plant in Kentucky until a new gas-fired combined-cycle plant is complete; at that point, Units 1-2 will be shut down (Unit 3 will continue to operate).

- In Alabama, five coal-powered units at the Colbert plant and one unit at the Widow’s Creek plant will be shut down as part of the long-term plan to reshape TVA’s generation fleet.

- The decision is driven by stringent environmental regulations and flat power demand.

- The objective is to achieve a balanced resource portfolio based on a mix of nuclear, coal, gas, hydro and other renewables.
**TVA’s Coal Fleet: Current Status**

**Continue to Operate**
- Bull Run 1
- Cumberland 1-2
- Paradise 3
- Gallatin 1-4
- Kingston 1-9

**Retire / Idle**
- Colbert 1-5
- John Sevier 1-4
- Johnsonville 1-10
- Paradise 1-2
- Widows Creek 1-6; 8
- Shawnee 10

**Evaluate**
- Allen 1-3
- Shawnee 1-9
- Widows Creek 7

- TVA plans to retain 17 coal units at 5 plant sites (6,678 MW) for long-term operation
- TVA plans to retire/idle about 5,579 MW of coal capacity by 2024, or 29 units at 6 plants
- TVA is evaluating about 2,420 MW of coal capacity, or 13 units at 3 plants

*Note: MW reflect summer net capability consistent with TVA’s 10k*
During today’s meeting we will be covering the following action items from the November session:

- IRP Sessions Calendar and Agenda
- TVA’s Strategic Goals
- Scenario Assumptions

After this meeting we will put on the IRP file sharing site the first version of the template, please review the action items and provide feedback by the next session.
The 2015 IRP is intended to ensure transparency and enable stakeholder involvement.

Key tasks/milestones in this study timeline include:

- Establish stakeholder group and hold first meeting (Nov 2013)
- Complete first modeling runs (June 2014)
- Publish draft Supplemental Environmental Impact Statement (SEIS) and IRP (Nov 2014)
- Complete public meetings (Jan 2015)
- Final publication of SEIS and IRP and Board approval (exp. Spring 2015)
Meeting Objectives for IRPWG thru Spring 2014

December 2013
• Review candidate scenarios
• Scenarios ranked by WG

January 2014
• Short list of scenarios
• Intro to strategies
• Resource options framework

February 2014
• Review candidate strategies
• Resource options & planning assumptions
• Strategies ranked by WG

March 2014
• Short list of strategies
• Study methods
• Modeling constraints
• Resource options

◆ Overview of TVA’s strategic framework
◆ Overview of the scenario design process
◆ Present the scenarios and assumptions currently under review by TVA
◆ WG individually ranks scenarios and selects top 5 for next session

◆ Discuss scenarios proposed by the WG
◆ Discuss the “consensus” top 5 scenarios
◆ Introduce planning strategy concepts
◆ Introduce resource options data & modeling framework
◆ RERC receives briefing on scenarios

◆ Introduce the strategies currently under review by TVA
◆ Continue review of resource options
◆ Begin discussion of planning assumptions
◆ WG individually ranks strategies and selects top 5 for next session
◆ TVA Board receives briefing on scenarios and strategies

◆ Discuss any strategies proposed by the WG
◆ Identify “consensus” top 5 strategies
◆ Overview of study methods & modeling constraints
◆ Complete the discussion of planning assumptions and resource options
The IRP will use the scenario and strategy framework, with enhanced modeling techniques to capture possible impacts from renewables (solar), distributed generation alternatives, energy efficiency programs, and optimized transmission investments.

Modeling, stakeholder input, and other strategic considerations all serve as inputs for TVA to consider when selecting the final resource plan.
TVA Mission and Vision

**Mission**

- Provide low-cost power
- Improve navigation and provide for flood control
- Provide for reforestation and the proper use of marginal lands
- Provide for agricultural and industrial development
- Provide for the national defense
- Technological innovation
- Environmental stewardship

**Vision**

One of the nation’s leading providers of low-cost and cleaner energy by 2020
**TVA Strategic Imperatives**

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**Key Imperatives**

- **Rates:** we must maintain low rates that encourage regional economic development, encourage energy efficiency and accommodate changing paradigms (e.g., distributed generation, etc.) in our region.

- **Debt:** we must live within our means.

- **Asset Portfolio:** we must optimize the value of the resource portfolio for the valley.

- **Stewardship:** we must be responsible stewards for the environment/economic resources entrusted to our care.
Imperative 1: Living within Our Means
Consistent with Financial Guiding Principles

Current Debt Information

- Statutory debt = $24.5 billion with a cap of $30 billion
- Total financial obligations = $27 billion

Key Principles

- Debt may only be used for new assets or asset improvements
- Principal and interest must be repaid when a project goes into service
- All other activities must be paid through current rates
- Board can authorize regulatory exceptions (e.g.: Kingston, $1 billion pension contribution)

Statutory Debt: traditional debt instruments (TVA bonds and notes) subject to the $30B debt ceiling
Total Financing Obligations: includes statutory debt (bonds and notes), lease-leaseback and lease-purchase obligations, and energy prepayment obligations.
Imperative 2: Optimize the Resource Portfolio

TVA’s Resource Portfolio Plan: A Balanced Approach

TVA performs a periodic revision of its generation portfolio adapting it to changing market conditions.

The objective is to maximize customer's value while maintaining a balanced approach that minimizes risks.

The results of the work of the IRPWG will help define the plan for the next 20 years.

TVA to close 8 coal-powered units in Ala., Ky.

Board Meeting Nov. 2013
**Imperative 3: Stewardship of Resources**

**Key Aspect of TVA’s Mission**

- **Mission**
  - Provide low-cost power
  - Improve navigation and provide for flood control
  - Provide for reforestation and the proper use of marginal lands
  - Provide for agricultural and industrial development
  - Provide for national defense
  - Technological innovation
  - Environmental stewardship

- **Stewardship of Resources**
  - River System Stewardship
    - Operating river system
    - Management of lands and reservoirs for public benefit
  - Natural Resource Management
    - Biological and cultural resources
    - Water resource management
    - Reservoir lands planning
  - Technology Innovation
    - Research and development
    - Work with partners on new energy technologies
  - Economic Development
    - Work to recruit and retain economic development prospects
    - Assist communities in being prepared for economic growth through training, capacity building, and technical services
Imperative 4: Low Rates that Encourage Development

National Rate Comparison

12-month Average Industrial Rate (¢ / kwh) of the Top 100 U.S. Utilities

- Top Quartile = 5.90
- Median = 6.50
- Bottom Quartile = 8.10

TVA 26th out of 100
Effective Rate: 5.91¢ / kWh without USEC

Source: EIA-826 & ESS
Addressing the Key Strategic Imperatives in the IRP Process

- **Rates**: rates and the impact on economic development are assessed indirectly in the IRP study through scorecard metrics.

- **Debt**: the debt limit is explicitly considered in the financial modeling for each planning strategy.

- **Asset Portfolio**: the optimization of asset choices is the central task of the IRP.

- **Stewardship**: the consideration of environmental impacts and stewardship obligations are included both directly in the system modeling and through scorecard metrics.
Our industry is subject to rapid and unpredictable change, driven by a multitude of challenges including:

- Uncertain growth rates
- A highly volatile regulatory future
- Maturity of new generation technologies
- Fuel costs
- Uncertainty over nuclear generation
- Growth of demand-side resources

These drivers interact with each other and with still unknown drivers that will emerge in coming years. The result is a business environment that could evolve along any number of different paths.

In the face of complexity and uncertainty, the temptation can sometimes be to gravitate around the path that seems the most likely.

This approach is fraught with risks, since commitment to a single forecast could serve as a straitjacket for strategic thinking and significant business risks could be ignored.
The Value of the Scenario Planning Approach for TVA

The electric utility industry is very capital intensive with significant investments recovered over long horizons, exposing plans to numerous uncertainties.

- Scenarios allow us to put boundaries around key uncertainties to create a wide range of possible future outcomes.

- Scenario analysis looks at a set of “plausible futures”. They do not cover the universe of unpredictable possibilities and are not intended to predict the future.

- Plans developed in these “futures” show how the value of near-term and future decisions could change under different conditions, giving an idea of robustness.

- Basic assumption is that a “good” strategy is one that performs well in most possible futures. High potential for regret if decisions are not robust to multiple possible futures (stranded costs).

- Scenario planning leads to better understanding of risks and potential opportunities. Commonality across scenarios concerning near-term decisions give some comfort that decisions are less “risky” and less leveraged to specific futures.
“Scenarios and Strategies” Establish the Planning Framework

Scenarios

- Describe potential outcomes of factors (uncertainties) outside of TVA’s control

- Represent possible conditions and are not predictions of the future

- Include uncertainties that are volatile and could significantly impact operations such as:
  - Commodity prices
  - Environmental regulations

Planning Strategies

- Test various business options within TVA’s control

- Defined by a combination of resource assumptions such as:
  - EEDR 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 and robust set of scenarios is one of the most fundamental components for a successful planning process

Focus of the working group
December session

2015 Integrated Resource Plan
The Value of Scenario Thinking

“Scenario thinking is both a process and a posture.

It is the process through which scenarios are developed and then used to inform decision-making.

After that process itself is internalized, scenario thinking becomes, for many, a posture towards the world – a way of thinking about and managing change, a way of exploring the future so that they might meet it better prepared.

At its most basic, scenarios help people and organizations order and frame their thinking about the long-term while providing them with the tools and confidence to take action soon.

At its most powerful, scenarios help people and organizations find strength of purpose and strategic direction in the face of daunting, chaotic, and even frightening circumstances.”

– Heinrich Vogel, Why Scenarios?
TVA’s Process for Building Scenarios

- TVA identified trends and factors with an unknown outcome – “uncertainties” that could potentially affect its business environment
- Selected the ones that will have the biggest impact on TVA’s business
- This list of uncertainties become a set of building blocks to help TVA think about plausible futures

- The next step was to imagine different futures
- TVA used the building blocks to help frame what it is about these futures that matters to TVA

- Developed stories that describe the plausible futures
- Gave each one a name: these are what we call scenarios
- Defined the list of scenarios and grouped them by common “themes”

- Discuss the draft scenarios and refine description narratives
- Analyze the proposed scenarios and define selection criteria (i.e. probability of occurrence, potential impact on the business, etc.)
- Collect stakeholders input

- Finally, TVA selects a short list of scenarios that covers the range of the most critical uncertainties (i.e. booming economy, slow economic growth)
In Reality the Process Is Not as Linear

Creating scenarios and defining critical uncertainties is an iterative process.

The TVA team started brainstorming and producing numerous but vague possible futures and uncertainties.

As TVA went deeper into the understanding of the possible scenarios, it identified the drivers of change as well as common themes that allowed the team to group the scenarios and consolidate overlapping possibilities.

At times, the analysis of consistency of the possible scenarios identified new drivers or the need for new scenarios.

Scenario building is an iterative process of creating/consolidating different possibilities.

Candidate scenarios are being assessed for diversity and robustness to determine if they are internally consistent and that the variation of each key uncertainty across all the scenarios makes sense.
Sampling of Initial Scenario Brainstorming

Great Recession II
Looking Great
The Heat is On
CO2 Makes Us Blue
Game Changing Tech Increases Electricity Use
Abandoned City
Mandatory Coal Retirement
Stagnation Based Environmental Regulations
Diminishing loads
Environmental-driven Economy
Fukushima Effect
Strong Valley Economy
Technology Snowball (DG Takes Off)
Green Energy is a National Priority
Strong Global Economy, Weak US economy
Economic Boom

Doldrums
Competitive Threats
Limited Water
Reliability > Cost
Safety Violations
Push Toward Energy Independence (driven by global unrest)
Continued economic slowdown
Increasing distributed resources
Regulatory constraint on natural gas production or availability
Customer-Driven Transition (Bottom-up approach)
Climate-Driven Legislation (Top-down approach)
No backing for “fracking”
Evolving Energy mix
## Initial Scenarios Reflect 5 Themes

<table>
<thead>
<tr>
<th>Declining Economics</th>
<th>Strong Economics</th>
<th>Stringent Environmental</th>
<th>Changing Paradigm</th>
<th>Other Futures</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Final Straw</td>
<td>Strong Valley Economy</td>
<td>Mandatory Coal Retirement</td>
<td>Reliability &gt; Cost</td>
<td>No backing for “fracking”</td>
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<tr>
<td>Great Recession II</td>
<td>Economic Boom</td>
<td>Energy mix</td>
<td>Competitive Threats</td>
<td>Fukushima Effect</td>
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<tr>
<td>Abandoned City</td>
<td>Looking Great</td>
<td>The Heat is On</td>
<td>Technology Snowball (DG Takes Off)</td>
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<tr>
<td>Strong Global Economy, Weak US economy</td>
<td>TVA Off-fence</td>
<td>CO2 Makes Us Blue</td>
<td>Energy demand</td>
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<td>Doldrums</td>
<td>Game Changing Tech Increases Electricity Use</td>
<td>Safety Violations</td>
<td>Customer-Driven Transition (Bottom-up approach)</td>
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<tr>
<td>Stagnation Based Environmental Regulations</td>
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<td>Green Energy is a National Priority</td>
<td>Increasing distributed resources</td>
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<tr>
<td>Diminishing loads</td>
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<td>Environmental-driven Economy</td>
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<tr>
<td>Push Toward Energy Independence (driven by global unrest)</td>
<td></td>
<td>Regulatory constraint on natural gas production or availability</td>
<td>Aggressive Greener &amp; DG</td>
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<tr>
<td>Continued economic slowdown</td>
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<td>Climate-Driven Legislation (Top-down approach)</td>
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<td>Limited Water</td>
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### Critical Uncertainties

<table>
<thead>
<tr>
<th>Energy Markets</th>
<th>Financial</th>
<th>Regulatory</th>
<th>Technology</th>
<th>Climate</th>
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<tbody>
<tr>
<td>Adoption of Electric Vehicles</td>
<td>Cost of capital</td>
<td>GHG legislation</td>
<td>Industrial CHP</td>
<td>Weather</td>
</tr>
<tr>
<td>Implementation of Smart Grid</td>
<td>Inflation/Deflation</td>
<td>Nuclear licensing risks</td>
<td>Smart Grid</td>
<td>Water availability and temperature</td>
</tr>
<tr>
<td>Public support for renewables and clean energy</td>
<td>Monetary policy</td>
<td>Nuclear fuel storage</td>
<td>Home generators</td>
<td>Demand for power</td>
</tr>
<tr>
<td>Adoption of EE/DR and DG</td>
<td>Geo-political issues</td>
<td>Nuclear regulations due to new accidents</td>
<td>Improved DG technologies and EE costs</td>
<td>Load shape</td>
</tr>
<tr>
<td>Level of LPC participation</td>
<td>Access to capital markets</td>
<td>Availability and permitting of new sites</td>
<td>3rd party aggregators of DG resources (Solar City)</td>
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</tr>
<tr>
<td>Population growth</td>
<td>Construction costs</td>
<td>Renewable energy credits</td>
<td>Penetration of customer installed solar</td>
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<tr>
<td>Level of energy utilization (household)</td>
<td>Tax incentives for renewables</td>
<td>Renewable energy standards</td>
<td>Feed-in tariff structures</td>
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<tr>
<td>Appliance mix</td>
<td>Rate structure</td>
<td>Construction codes and standards</td>
<td>Cost of utility level renewables</td>
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<tr>
<td>Demand for power</td>
<td>Commodity prices</td>
<td>Air quality regulation</td>
<td></td>
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<tr>
<td>Load shape</td>
<td>Electricity prices</td>
<td>Fracking regulation</td>
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### Example of Uncertainties Identified During Brainstorming Sessions

Critical uncertainties were selected based on their variability (range of unknown outcome) and the level of potential impact to TVA’s business.
## Description of the Critical Uncertainties

<table>
<thead>
<tr>
<th>Uncertainty</th>
<th>Description</th>
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<tbody>
<tr>
<td>TVA Sales</td>
<td>The customer energy requirements (GWh) for the TVA service territory including losses; it represents the load to be served by TVA</td>
</tr>
<tr>
<td>Natural Gas Prices</td>
<td>The price ($/MMBtu) of the commodity including transportation</td>
</tr>
<tr>
<td>Electricity Prices into TVA</td>
<td>The hourly price of energy ($/MWh) at the TVA boundary; used as a proxy for market price of power</td>
</tr>
<tr>
<td>Coal Prices</td>
<td>The price ($/MMBtu) of the commodity including transportation</td>
</tr>
<tr>
<td>Regulations</td>
<td>All regulatory and legislative actions, including applicable codes and standards, that impact the operation of electric utilities excluding CO2 regulations</td>
</tr>
<tr>
<td>CO2 Regulation/Price</td>
<td>The cost of compliance with possible CO2 related regulation and/or the price of cap-and-trade legislation, represented as a $/Ton value</td>
</tr>
<tr>
<td>Distributed Generation Penetration</td>
<td>National trending of distributed generation resources and potential regional activity by customers or third party developers (not TVA)</td>
</tr>
<tr>
<td>Nat'l Energy Efficiency Adoption</td>
<td>An estimate of the adoption of energy efficiency measures by customers nationally; a measure of interest/commitment of customers in general to adopt EE initiatives</td>
</tr>
<tr>
<td>Economic Outlook (National/Regional)</td>
<td>All aspects of the regional and national economy including general inflation, financing considerations, population growth, GDP and other factors that drive the overall economy</td>
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## The Critical Uncertainties: Other Utilities

<table>
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<tbody>
<tr>
<td>Electric Load</td>
<td>Electric Load</td>
<td>TVA Sales</td>
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<tr>
<td>Fuel Prices</td>
<td>Fuel Prices</td>
<td>Natural Gas Prices</td>
</tr>
<tr>
<td>Energy Efficiency and Demand Management Adoption</td>
<td>Greenhouse Legislation</td>
<td>Electricity Prices into TVA</td>
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<tr>
<td>Renewable Energy Requirements</td>
<td>Economic Environment Regional/National</td>
<td>Coal Prices</td>
</tr>
<tr>
<td>Environmental Legislation</td>
<td>Demand Side Programs</td>
<td>Regulations</td>
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</table>

Sources: Duke Energy Carolinas 2013 Annual IRP  
Georgia Power 2013 IRP  
TVA - 2015  

- CO2 Regulation/Price  
- Distributed Generation Penetration  
- Nat'l Energy Efficiency Adoption  
- Economic Outlook (National/Regional)
The Critical Uncertainties: 2011 IRP vs. 2015

**TVA - 2011**

- Greenhouse gas requirements
- Total load
- Change in load shape
- Commodity prices
- Renewable electricity standards
- Environmental outlook
- Capital expansion viability
- Financing
- Construction cost
- Purchased power

**TVA - 2015**

- TVA Sales
- Natural Gas Prices
- Electricity Prices into TVA
- Coal Prices
- Regulations
- CO2 Regulation/Price
- Distributed Generation Penetration
- Nat'I Energy Efficiency Adoption
- Economic Outlook (National/Regional)
Feedback from the Working Group

- Your thoughts about the proposed uncertainties?
- Any other critical uncertainties that TVA should take into consideration?
- Other comments?
TVA is Considering 9 Scenarios Grouped Around 5 Themes

- **A Declining Economy**
  - Major Industry Leaves the Valley (DE1)
  - Prolonged Stagnant National Economy (DE2)
  - Stringent Environmental Regulations Lead to Weak Energy Sales (DE3)

- **Economic Growth**
  - Economic Boom (EG1)
  - Game-Changing Technology Increased Load (EG2)

- **Stringent Environmental Requirements**
  - De-carbonized Energy Future (SE1)
  - Southeast Hot & Dry (SE2)

- **Changing Paradigm**
  - Customer-Driven Competitive Resources (CP1)

- **Other Possible Futures**
  - Existing Coal Exploited (OF1)

- Initial brainstorming work by TVA identified over 30 plausible futures grouped into 5 broad categories.
- From this initial list, TVA is considering 9 candidate scenarios for further consideration and refinement.
Scenario Group 1: A Declining Economy

**DE1 Major Industry Leaves the Valley**

**Scenario Narrative**
- A major valley industry becomes obsolete or moves overseas (e.g. paper or chemical industries)
- Sales are reduced, but the national economy is largely unaffected
- TVA revenues are impacted, while commodity prices and GDP increase as planned
- Decreased capacity need leads to delayed expansion for new generation

**DE2 Prolonged Stagnant National Economy**

**Scenario Narrative**
- Prolonged, stagnant economy results in low to negative growth and delayed expansion of new generation
- Stringent environmental regulations are delayed due to concerns of adding further pressure to the economy
- Cost of capital is decreased, inflation increases

**DE3 Stringent Environmental Regulations Lead to Weak Energy Sales**

**Scenario Narrative**
- Stringent environmental regulations are passed and implemented quickly. Increased federal subsidies for DG
- High cost of production, due to fracking and environmental legislation for gas and CO2 allowances, increase electricity prices significantly
- Federal renewable portfolio standards are implemented with new, more stringent MATS regulations
- U.S. based industry is non-competitive in global markets which leads to economic downturn
**Scenario Group 2: Economic Growth**

**EG1 Economic Boom**

**Scenario Narrative**
- Rapid economic growth translates into higher than forecasted energy sales and energy expansion
- Increasingly positive public attitude toward adoption of energy efficiency programs and new technology
- Advances in electric vehicles make it cheaper to buy electric than gas cars
- Tightened environmental legislation with increased focus on cost-efficient energy efficiency choices and pressure for retirement of existing coal assets
- Ambient and water temperatures remain normal. Gas, oil, and coal are more costly due to regulations

**EG2 Game-Changing Technology Increased Load**

**Scenario Narrative**
- Technology driven growth: more plug-in's, flatter load shape enabled by storage, end-use technology, electric vehicle, renewables generation storage, smart-meters/appliances
- Moderately higher economic growth during and after the tech shift; expected growth in first 10 years
- Advances in electric vehicles make it cheaper to buy electric instead than gas
- Renewable generation technology cost becomes more competitive due to innovation in storage technology
- A neutral or tightened position on greenhouse gases but other regulations remain neutral
Scenario Group 3: Stringent Environmental Requirements

**SE1 De-carbonized Energy Future**

*Scenario Narrative*

- Increasing climate-driven effects create strong federal push to curb GHG emissions: new legislation caps and penalizes CO2 emissions from the utility industry and incentivizes non-emitting technologies.
- Compliance with new rules increases energy prices and US based industry becomes less competitive; later in the decade, the US economy begins another downward turn and loads begin to decline.
- Fracking regulations never materialize but gas contends with the CO2-adder.
- New expansion units are necessary to replace existing CO2-emitting fleet and not to meet load growth.

**SE2 Southeast Hot & Dry**

*Scenario Narrative*

- Persistent drought conditions develop over the next decade, reducing output from TVA’s hydro resources and the availability of water for cooling fossil and nuclear units.
- Steady load growth persists due to higher temperatures, with more constrained options to meet it.
- TVA electric prices increase causing greater penetration of distributed energy resources.
Scenario Group 4: Changing Paradigm

Customer-Driven Competitive Resources

Scenario Narrative

- Customers’ awareness of growing competitive energy markets and the rapid advance in energy technologies produce unexpected high penetration rates in distributed generation (DG) and energy efficiency (EE)
- Utilities are no longer the only source of generation and multiple options are available to customers (solar, wind, hydro, Wal-Mart, Distributed Generation, First Solar, Solar City, Google…etc.), causing load to diminish
- Growing implementation of DG and EE resources by customers lead to a continual decrease in supply-side generation sources and an increased need for transmission infrastructure and utilization planning.
Scenario Group 5: Other Possible Futures

**Scenario Narrative**

- Due to environmental issues and increased regulatory restrictions, fracking becomes increasingly costly and drilling is restricted. Supply diminishes and costs increase.
- Nuclear option requires increasing capital costs (e.g., storage issues, safety requirements) and permitting timeframes become excessive.
- CO2 regulations take a backseat to natural gas fracking and nuclear safety and storage regulations making existing coal the most viable and economic option.

**OF1 Existing Coal Exploited**
Feedback from the Working Group

- Your thoughts about the proposed scenarios?
- Any suggestions from the group about other futures?
- Other comments?
Scenarios are described using the critical uncertainties when describing the scenarios, the critical uncertainties are expressed relative to the current view of the future: very low, low, same, high or very high.
**Slow Load Growth Continues**

Near-term peak growth remains relatively unchanged, with a compound annual growth rate of less than 1% for 2014-2024. Energy growth also remains below 1% as slow economic growth persists and energy efficiency programs (e.g., DOE efficiency standards) continue to reduce average energy usage.

**Less Stringent Environmental Regulation Persist**

Environmental requirements unchanged from previous projections; final MATS less stringent than draft, and reduced GHG penalties still expected (TVA penalty for carbon emissions cut in half from the FY13 Budget forecast).

**Low Natural Gas Prices**

Gas price forecast relatively unchanged compared to previous forecast. Seasonal patterns for gas seen in the past not expected in the current forecast. Long term gas prices grow faster than GDP deflator 2018-2033, reflecting the expectation that higher cost production will be required to meet future demand.

**EEDR Contribution and Costs**

Program growth scaled back to reflect expectations of reduced funding. Summer capacity benefit levels off around FY2020. Energy savings (GWh) continues to increase, albeit at a slower rate.

**Bellefonte**

BLN not included in the current base planning assumptions. Site spending will proceed (at a reduced rate) to maintain the expansion option. Analysis will continue, and the 2015 IRP will help determine the least cost approach to meet future demand.
### Scenario Group 1: A Declining Economy

**Major Industry Leaves the Valley**

#### Scenario Narrative

- A major valley industry becomes obsolete or moves overseas (e.g. paper or chemical industries)
- Sales are reduced, but the national economy is largely unaffected
- TVA revenues are impacted, while commodity prices and GDP increase as planned
- Decreased capacity need leads to delayed expansion for new generation

#### Uncertainty Table

<table>
<thead>
<tr>
<th>Uncertainty</th>
<th>Level Of Impact (*)</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>TVA Sales</td>
<td>Low</td>
<td>A major valley industry becomes obsolete or moves overseas, leading to lower TVA sales.</td>
</tr>
<tr>
<td>Natural Gas Prices</td>
<td>Same</td>
<td>Commodity prices and GDP increase as planned</td>
</tr>
<tr>
<td>Electricity Prices into TVA</td>
<td>Same</td>
<td>It will likely have an impact on the amount of electricity purchased by TVA but not on the price</td>
</tr>
<tr>
<td>Coal Prices</td>
<td>Same</td>
<td>Commodity prices and GDP increase as planned</td>
</tr>
<tr>
<td>Regulations</td>
<td>Same</td>
<td>Regulations evolve as planned</td>
</tr>
<tr>
<td>CO2 Regulation/Price</td>
<td>Same</td>
<td>Greenhouse regulation and CO2 prices evolve as planned</td>
</tr>
<tr>
<td>Distributed Generation Penetration</td>
<td>Same</td>
<td>No impact at national level and very limited (if any) at a regional level</td>
</tr>
<tr>
<td>Nat'l Energy Efficiency Adoption</td>
<td>Same</td>
<td>No impact at national level and very limited (if any) at a regional level</td>
</tr>
<tr>
<td>Economic Outlook (National/Regional)</td>
<td>Same/Lower</td>
<td>Regional economic outlook is lower due to loss of industry sector.</td>
</tr>
</tbody>
</table>

(*) Note: Compared to current view of the future
Scenario Group 1: A Declining Economy
Prolonged Stagnant National Economy

Scenario Narrative

- Prolonged, stagnant economy results in low to negative growth and delayed expansion of new generation
- Stringent environmental regulations are delayed due to concerns of adding further pressure to the economy
- Cost of capital is decreased, inflation increases

Uncertainty | Level Of Impact (*) | Rationale
--- | --- | ---
TVA Sales | Very Low | Very low sales due to stagnant economy
Natural Gas Prices | Lower | Low natural gas prices due to low demand and less stringent environmental legislation
Electricity Prices into TVA | Lower | Lower demand creates lower commodity prices
Coal Prices | Lower | Low coal prices due to low demand and less stringent environmental legislation
Regulations | Lower | Economic downturn and decreased energy demand lead to less stringent environmental regulations
CO2 Regulation/Price | None | Economic downturn and decreased energy demand lead to delay of CO2 legislation beyond the forecast horizon
Distributed Generation Penetration | Lower | Traditional generation over-capacity decreases the interest of investing in these technologies
Nat'l Energy Efficiency Adoption | Low | Energy efficiency is not a priority due to sluggish economy and energy sales
Economic Outlook (National/Regional) | Very Low | Stagnant national and regional economy

(*) Note: Compared to current view of the future
**Scenario Group 1: A Declining Economy**

**Stringent Environmental Regulations Lead to Weak Energy Sales**

**Scenario Narrative**
- Stringent environmental regulations are passed and implemented quickly. Increased federal subsidies DG
- High cost of production, due to fracking and environmental legislation for gas and CO2 allowances, increase electricity prices significantly
- Federal renewable portfolio standards are implemented with new, more stringent MATS regulations
- U.S. based industry is non-competitive in global markets and leads to economic downturn

<table>
<thead>
<tr>
<th>Uncertainty</th>
<th>Level Of Impact (*)</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>TVA Sales</td>
<td>Low</td>
<td>Lower sales due to higher energy prices</td>
</tr>
<tr>
<td>Natural Gas Prices</td>
<td>High</td>
<td>Stringent fracking legislation leads to higher gas prices</td>
</tr>
<tr>
<td>Electricity Prices into TVA</td>
<td>High</td>
<td>Higher due to high commodity prices</td>
</tr>
<tr>
<td>Coal Prices</td>
<td>High</td>
<td>Higher due to stringent environmental legislation</td>
</tr>
<tr>
<td>Regulations</td>
<td>High</td>
<td>New, more stringent MATS regulations are passed</td>
</tr>
<tr>
<td>CO2 Regulation/Price</td>
<td>Very High</td>
<td>Very stringent CO2 legislation</td>
</tr>
<tr>
<td>Distributed Generation Penetration</td>
<td>High</td>
<td>Federal subsidies for solar distributed generation and increased energy costs result in higher penetration</td>
</tr>
<tr>
<td>Nat'l Energy Efficiency Adoption</td>
<td>High</td>
<td>Energy efficiency standards are increased</td>
</tr>
<tr>
<td>Economic Outlook (National/Regional)</td>
<td>Same</td>
<td>Higher inflation pressure due to higher energy costs is neutralized by lower energy demand</td>
</tr>
</tbody>
</table>

(*) Note: Compared to current view of the future
### Scenario Group 2: Economic Growth

**The Economic Boom**

#### Scenario Narrative
- Rapid economic growth translates into higher than forecasted energy sales and energy expansion
- Increasingly positive public attitude toward adoption of energy efficiency programs and new technology
- Advances in electric vehicles make it cheaper to buy electric than gas cars
- Tightened environmental legislation with increased focus on cost-efficient energy efficiency choices and pressure for retirement of existing coal assets
- Ambient and water temperatures remain normal. Gas, oil, and coal are more costly due to regulations

<table>
<thead>
<tr>
<th>Uncertainty</th>
<th>Level Of Impact (*)</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>TVA Sales</td>
<td>High</td>
<td>Higher due to overall economic growth; similar to TVA experience in the 1990s</td>
</tr>
<tr>
<td>Natural Gas Prices</td>
<td>High</td>
<td>Higher due to increased demand and regulations</td>
</tr>
<tr>
<td>Electricity Prices into TVA</td>
<td>High</td>
<td>Electricity driven by NG prices and higher demand</td>
</tr>
<tr>
<td>Coal Prices</td>
<td>High</td>
<td>Higher regulations, but they do not overcome coal utilization in coal / gas tradeoff</td>
</tr>
<tr>
<td>Regulations</td>
<td>High</td>
<td>Prosperity as a regulatory driver…</td>
</tr>
<tr>
<td>CO2 Regulation/Price</td>
<td>High</td>
<td>Prosperity drives more stringent and earlier CO2 goals</td>
</tr>
<tr>
<td>Distributed Generation Penetration</td>
<td>High</td>
<td>This scenario focuses in the economic impact and the feedback of higher prices more than adoption of DG</td>
</tr>
<tr>
<td>Nat'l Energy Efficiency Adoption</td>
<td>High</td>
<td>Higher prices mitigated by greater energy efficiency (prices drive response)</td>
</tr>
<tr>
<td>Economic Outlook (National/Regional)</td>
<td>High</td>
<td>Overall economic growth is higher on both a TVA level and a National level similar to 1990s</td>
</tr>
</tbody>
</table>

(*) Note: Compared to current view of the future
**Scenario Group 2: Economic Growth**

Game-changing technology increases load

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**Scenario Narrative**

- Technology driven growth-more plug-in’s; flatter load shape enabled by storage, end-use technology, Hybrid/EV, renewables generation storage, smart-meters/appliances
- Moderately higher economic growth during and after the tech shift; expected growth in first 10 years
- Advances in electric vehicles make it cheaper to buy electric than gas
- Renewable generation technology cost becomes more competitive due to innovation in storage technology
- A neutral or tightened position on greenhouse gases but other regulations remain neutral

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<table>
<thead>
<tr>
<th>Uncertainty</th>
<th>Level Of Impact (*)</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>TVA Sales</td>
<td>Very High</td>
<td>Energy use increases as central station efficiency and load shape improves</td>
</tr>
<tr>
<td>Natural Gas Prices</td>
<td>Low</td>
<td>Storage technology and renewable competitiveness drives down demand</td>
</tr>
<tr>
<td>Electricity Prices into TVA</td>
<td>Same</td>
<td>Flatter load shape, higher cost and NG gas cost lead to neutral electricity prices</td>
</tr>
<tr>
<td>Coal Prices</td>
<td>Same</td>
<td>Regulations do not overcome coal utilization in coal / gas tradeoff</td>
</tr>
<tr>
<td>Regulations</td>
<td>Low</td>
<td>The presence of lower emissions through renewables and storage technology diminishes the impetus for more regulations</td>
</tr>
<tr>
<td>CO2 Regulation/Price</td>
<td>Very High</td>
<td>Prosperity is a driver but CO2 becomes a proxy replacement for other fossil fuel based regulations.</td>
</tr>
<tr>
<td>Distributed Generation Penetration</td>
<td>Same</td>
<td>Large scale storage technology improves; it is not effectively scaled and is part of the driving force behind the improved load shape</td>
</tr>
<tr>
<td>Nat'l Energy Efficiency Adoption</td>
<td>Higher</td>
<td>Awareness and acceptance is high driven by technology breakthroughs, such as smart meters</td>
</tr>
<tr>
<td>Economic Outlook (National/Regional)</td>
<td>High</td>
<td>Economic growth is higher, but it is the technology growth that is the engine behind the sales growth</td>
</tr>
</tbody>
</table>

(*) Note: Compared to current view of the future
### Scenario Group 3: Stringent Environmental Requirements

**De-carbonized Energy Future**

#### Scenario Narrative
- Increasing climate-driven effects create strong federal push to curb GHG emissions: new legislation caps and penalizes CO2 emissions from the utility industry and incentivizes non-emitting technologies
- Compliance with new rules increases energy prices and US based industry becomes less competitive; later in the decade, the US economy begins another downward turn and loads begin to decline
- Fracking regulations never materialize but gas contends with the CO2-adder
- New expansion units are necessary to replace existing CO2-emitting fleet and not to meet load growth

<table>
<thead>
<tr>
<th>Uncertainty</th>
<th>Level Of Impact (*)</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>TVA Sales</td>
<td>Low</td>
<td>CO2 penalties drive industry to non-emitting technologies; raising prices and leading to economic decline later in the decade</td>
</tr>
<tr>
<td>Natural Gas Prices</td>
<td>High</td>
<td>Demand for gas increases spiking prices</td>
</tr>
<tr>
<td>Electricity Prices into TVA</td>
<td>High</td>
<td>Rush to switch to lower-emitting/non-emitting technologies results in increase in energy prices</td>
</tr>
<tr>
<td>Coal Prices</td>
<td>Same</td>
<td>Demand decreases and keeps prices in current forecasted range</td>
</tr>
<tr>
<td>Regulations</td>
<td>Same</td>
<td>No additional coal requirements/controls</td>
</tr>
<tr>
<td>CO2 Regulation/Price</td>
<td>High</td>
<td>Stringent federal CO2 penalties</td>
</tr>
<tr>
<td>Distributed Generation Penetration</td>
<td>High</td>
<td>DG resources increase due to higher energy prices and CO2 penalties</td>
</tr>
<tr>
<td>Nat'l Energy Efficiency Adoption</td>
<td>High</td>
<td>Higher energy prices drive EE</td>
</tr>
<tr>
<td>Economic Outlook (National/Regional)</td>
<td>Low</td>
<td>Higher energy prices make US less competitive and economy downturns</td>
</tr>
</tbody>
</table>

(*) Note: Compared to current view of the future
**Scenario Group 3: Stringent Environmental Requirements**

**Southeast Hot & Dry**

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**Scenario Narrative**

- Persistent drought conditions develop over the next decade, reducing output from TVA’s hydro resources and the availability of water for cooling fossil and nuclear units.
- Steady load growth persists due to higher temperatures, with more constrained options to meet it.
- TVA electric prices increase causing greater penetration of distributed energy resources.

<table>
<thead>
<tr>
<th>Uncertainty</th>
<th>Level Of Impact (*)</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>TVA Sales</td>
<td>Same</td>
<td>Steady load growth due to higher temperature</td>
</tr>
<tr>
<td>Natural Gas Prices</td>
<td>Same</td>
<td>Abundant gas supply continues</td>
</tr>
<tr>
<td>Electricity Prices into TVA</td>
<td>High</td>
<td>Dryer weather leads to less hydro and more derates on coal and nuclear generation. Prices increase as less economic assets are utilized and more energy is purchased.</td>
</tr>
<tr>
<td>Coal Prices</td>
<td>Same</td>
<td>Current forecasted trends continue. TVA's demand similar, may even decrease but barge transport limited</td>
</tr>
<tr>
<td>Regulations</td>
<td>High</td>
<td>Closed cycle cooling required on all new coal and nuclear and existing units on temperature sensitive rivers</td>
</tr>
<tr>
<td>CO2 Regulation/Price</td>
<td>Same</td>
<td>Current forecasted trends continue</td>
</tr>
<tr>
<td>Distributed Generation Penetration</td>
<td>High</td>
<td>Higher electricity prices drive development of DG</td>
</tr>
<tr>
<td>Nat'l Energy Efficiency Adoption</td>
<td>High</td>
<td>Higher electricity prices lead to increased customer EE</td>
</tr>
<tr>
<td>Economic Outlook (National/Regional)</td>
<td>Same</td>
<td>While electricity cost is higher in the Valley, cost from dryer weather nationally is not great enough to drive economic decline</td>
</tr>
</tbody>
</table>

(*) Note: Compared to current view of the future
## Scenario Group 4: Changing Paradigm

**Customer Driven Competitive Resources**

### Scenario Narrative
- Customers’ awareness of growing competitive energy markets and the rapid advance in energy technologies produce unexpected high penetration rates in distributed generation (DG) and energy efficiency (EE).
- Utilities are no longer the only source of generation and multiple options are available to customers (solar, wind, hydro, Wal-Mart, Distributed Generation, First Solar, Solar City, Google…etc.), causing the load to diminish.
- Growing implementation of DG and EE resources by customers lead to a continual decrease in supply-side generation sources and an increased need for transmission infrastructure and utilization planning.

### Uncertainty Summary

<table>
<thead>
<tr>
<th>Uncertainty</th>
<th>Level Of Impact (*)</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>TVA Sales</td>
<td>Low</td>
<td>End use customers continue to find ways to control their energy demands and look to the utility to fill in the gaps.</td>
</tr>
<tr>
<td>Natural Gas Prices</td>
<td>Low</td>
<td>Reduced energy demand lessens the dependency on CT/CC’s.</td>
</tr>
<tr>
<td>Electricity Prices into TVA</td>
<td>Low</td>
<td>Utilities are long on capacity.</td>
</tr>
<tr>
<td>Coal Prices</td>
<td>Low</td>
<td>Nuclear and DG has coal only filling in the gaps when needed.</td>
</tr>
<tr>
<td>Regulations</td>
<td>Same</td>
<td>Codes and standards for EE and renewables drive emissions lower, diminishing the impetus for more regulation.</td>
</tr>
<tr>
<td>CO2 Regulation/Price</td>
<td>Same</td>
<td>CO2 goals are being met with the increased EE and DG.</td>
</tr>
<tr>
<td>Distributed Generation Penetration</td>
<td>Very High</td>
<td>DG becomes an integral part of customers’ energy supply.</td>
</tr>
<tr>
<td>Nat'l Energy Efficiency Adoption</td>
<td>Very High</td>
<td>Codes and standards increases the adoption of EE.</td>
</tr>
<tr>
<td>Economic Outlook (National/Regional)</td>
<td>Same</td>
<td>The economy continues to grow but, businesses will continue to work on process efficiencies to gain more market share.</td>
</tr>
</tbody>
</table>

(*) Note: Compared to current view of the future.
## Scenario Group 3: Other Possible Futures
### Existing Coal Exploited

#### Scenario Narrative
- Due to environmental issues and increased regulatory restrictions, fracking becomes increasingly costly and drilling is restricted. Supply diminishes and costs increase.
- Nuclear option requires increasing capital costs (e.g., storage issues, safety requirements) and permitting timeframes become excessive.
- CO2 regulations take a backseat to natural gas fracking and nuclear safety and storage regulations making existing coal the most viable and economic option.

<table>
<thead>
<tr>
<th>Uncertainty</th>
<th>Level Of Impact (*)</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>TVA Sales</td>
<td>Same</td>
<td>Demand follows expected growth in the TVA region as electricity prices remain low compared to other areas</td>
</tr>
<tr>
<td>Natural Gas Prices</td>
<td>High</td>
<td>Fracking regulations decrease supply and increase NG prices</td>
</tr>
<tr>
<td>Electricity Prices into TVA</td>
<td>Low</td>
<td>TVA through existing coal assets keeps prices low Coal on margin</td>
</tr>
<tr>
<td>Coal Prices</td>
<td>Same</td>
<td>Coal demand doesn't increase national enough to drastically change price</td>
</tr>
<tr>
<td>Regulations</td>
<td>High</td>
<td>Fracking regulation increase and nuclear storage issues cause increased permitting timelines and higher capital costs</td>
</tr>
<tr>
<td>CO2 Regulation/Price</td>
<td>Low</td>
<td>CO2 regulations take a back seat to fracking regulations</td>
</tr>
<tr>
<td>Distributed Generation Penetration</td>
<td>Same</td>
<td>Forecasted trends continue</td>
</tr>
<tr>
<td>Nat'I Energy Efficiency Adoption</td>
<td>Same</td>
<td>Forecasted trends continue</td>
</tr>
<tr>
<td>Economic Outlook (National/Regional)</td>
<td>Same</td>
<td>Higher electricity prices cause economic slump nationally, but the Valley is able to fend off the effects</td>
</tr>
</tbody>
</table>

(*) Note: Compared to current view of the future
To assess the adequacy of the candidate scenarios for use in the IRP study, TVA is performing different analyses to gauge the robustness and diversity of scenarios.

The objective is to ensure that, among the different scenarios, there is both an internal consistency within each plausible future (uncertainties are appropriately correlated) and sufficient diversity in the uncertainties values across scenarios.

As a gauge of robustness, the scenario design team reviewed the variation of 3 uncertainties considered most likely to influence the resource plan: TVA sales (load), natural gas prices, and the cost of CO2 compliance.

- A graphical “metric” was developed based on an x-y plot of gas price vs. TVA sales with CO2 price as a correlated variable.
- A second x-y plot was also developed to compare level of EE/DG penetration vs. TVA sales.

As a measure of diversity, the qualitative values for each of the uncertainties were converted to numerical values using a 5-point scale. A chart was developed that displayed for each of the 9 key uncertainties the % of futures that designated that uncertainty very high, high, same, low or very low.

Further work on evaluating the breadth of the scenarios is underway and those results will be shared with the working group at the January meeting.
Ensuring the Breadth of Scenarios Scenario Analysis

**Example of Scenario Analysis Performed: Scenario X-Y Plots**

The Scenario Matrix is constructed by juxtaposing the two axes of uncertainty that reflect the most important uncertainties, offer the most insight or provide the most intriguing glimpse of the future.
**Example of Scenario Analysis Performed: Diversity of Uncertainties**

The key uncertainties are expressed in relation to the current view of the future (very low, low, same, high, very high). This table summarizes the distribution of the uncertainties across the 9 candidate scenarios by counting the number of occurrences of each ranking value:

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Very Low</td>
<td>Low</td>
<td>Same</td>
<td>High</td>
<td>Very High</td>
</tr>
<tr>
<td>TVA Sales</td>
<td>1</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Natural Gas Prices</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Electricity Prices into TVA</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Coal Prices</td>
<td>0</td>
<td>1</td>
<td>6</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Regulations</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>CO2 Regulation/Price</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Distributed Generation Penetration</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Nat'l Energy Efficiency Adoption</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Economic Outlook (National/Regional)</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

For example, 56% of scenarios (5 of 9) assume lower TVA sales; coal prices are assumed to be the same as currently forecasted in 67% of scenarios (6 of 9)
## Summary of the Selected Scenarios and Uncertainties

### Potential Scenarios

<table>
<thead>
<tr>
<th>Major Industry Leaves the Valley (DE1)</th>
<th>Prolonged Stagnant National Economy (DE2)</th>
<th>Stringent Environmental Regulations Lead to Weak Energy Sales (DE3)</th>
<th>Economic Boom (EG1)</th>
<th>Game-changing Technology Increases Load (EG2)</th>
<th>De-carbonized Energy Future (SE1)</th>
<th>Southeast Hot &amp; Dry (SE2)</th>
<th>Customer Driven Competitive Resources (CP1)</th>
<th>Existing Coal Exploited (OF1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TVA Sales</td>
<td>Low</td>
<td>Very Low</td>
<td>Low</td>
<td>High</td>
<td>Very High</td>
<td>Low</td>
<td>Same</td>
<td>Low</td>
</tr>
<tr>
<td>Natural Gas Prices</td>
<td>Same</td>
<td>Low</td>
<td>High</td>
<td>High</td>
<td>Low</td>
<td>High</td>
<td>Same</td>
<td>Low</td>
</tr>
<tr>
<td>Electricity Prices into TVA</td>
<td>Same</td>
<td>Low</td>
<td>High</td>
<td>High</td>
<td>Same</td>
<td>High</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Coal Prices</td>
<td>Same</td>
<td>Low</td>
<td>High</td>
<td>High</td>
<td>Same</td>
<td>Same</td>
<td>Same</td>
<td>Same</td>
</tr>
<tr>
<td>Regulations</td>
<td>Same</td>
<td>Low</td>
<td>High</td>
<td>High</td>
<td>Low</td>
<td>Same</td>
<td>High</td>
<td>Same</td>
</tr>
<tr>
<td>CO2 Regulation/Price</td>
<td>Same</td>
<td>Very Low</td>
<td>Very High</td>
<td>High</td>
<td>Very High</td>
<td>High</td>
<td>Same</td>
<td>Same</td>
</tr>
<tr>
<td>Distributed Generation Penetration</td>
<td>Same</td>
<td>Low</td>
<td>High</td>
<td>High</td>
<td>Same</td>
<td>High</td>
<td>Very High</td>
<td>Same</td>
</tr>
<tr>
<td>Nat’l Energy Efficiency Adoption</td>
<td>Same</td>
<td>Low</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>Very High</td>
<td>Same</td>
</tr>
<tr>
<td>Economic Outlook (National/Regional)</td>
<td>Same</td>
<td>Very Low</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
<td>Same</td>
<td>Same</td>
<td>Same</td>
</tr>
</tbody>
</table>

### Key Points

- The selected scenarios represent a ample breadth of possible futures
- The scenarios cover a wide range of values for the critical uncertainties
Feedback from the Working Group

- Your thoughts or questions about the proposed scenarios and their impacts on critical uncertainties?
- Other comments?
We ask the working group to individually select their 5 top scenarios (1st being their top selection) to be analyzed during the rest of IRP process.

The working group needs to post their selection in the file site before the January session:
- We will put a ranking sheet template in the file sharing site
- Please download that template, enter your rankings, and then email to us

Ranking criteria could include:
- Potential impact of the scenario on TVA business
- Intriguing future that should be analyzed by TVA

The members of the working group can propose new scenarios as part of their selection if they believe the proposed set does not reflect an important aspect that should be explored.
Wrap-up
Pending items for next meetings

- We are proposing the next meeting on January 13th in the Nashville area
- February and March meetings may be two-day sessions
Happy Holidays – See You in January!

Thanks