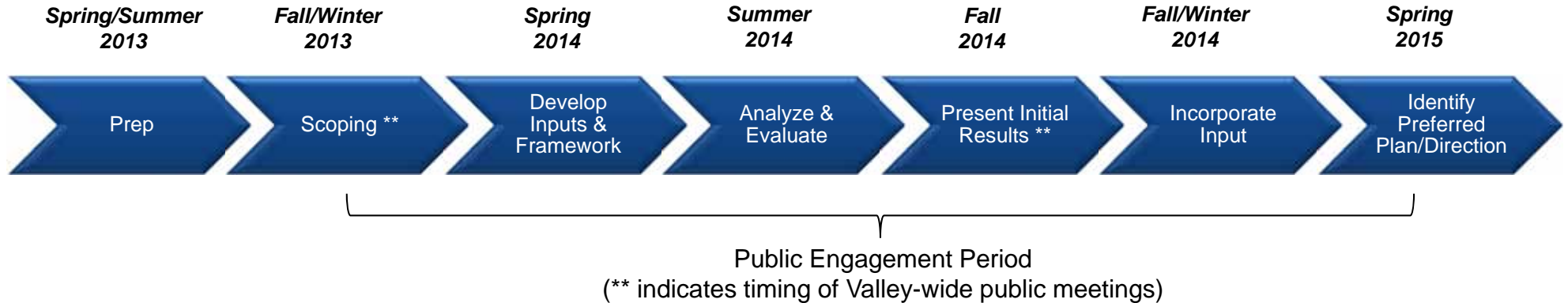


2015 IRP Schedule: Major Project Phases and Milestones

The 2015 IRP process is intended to ensure transparency and enable stakeholder involvement.

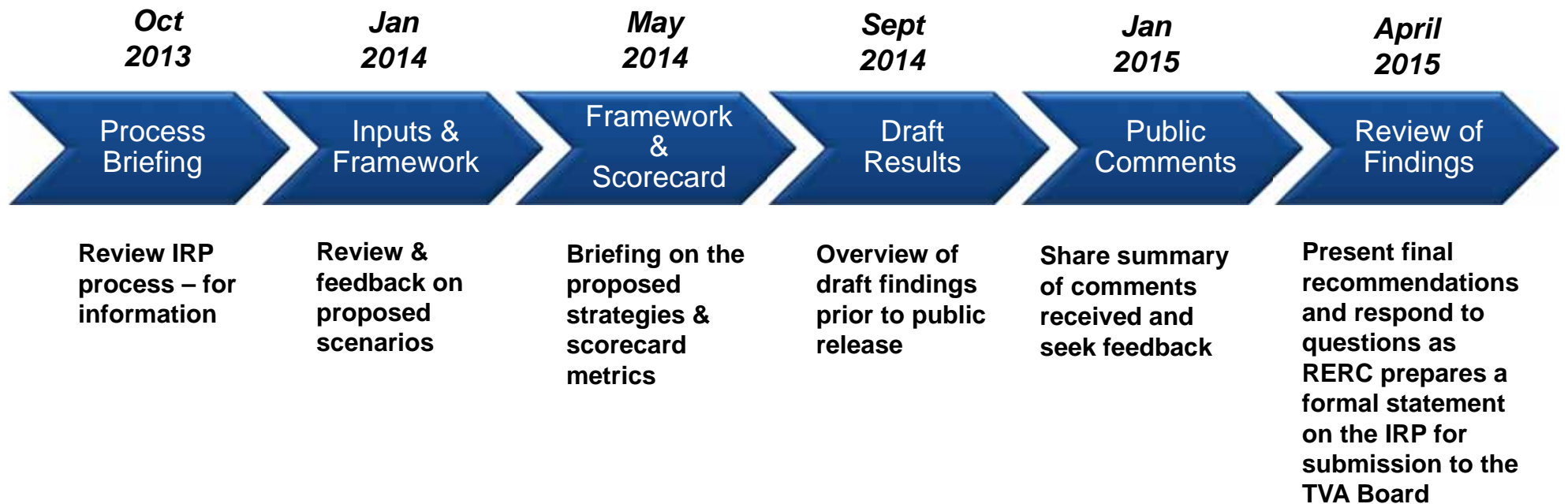


Key tasks/milestones in this study timeline include:

- ◆ 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)



RERC Proposed Engagement: 2015 IRP





Scenarios and Strategies Establish the Planning Framework

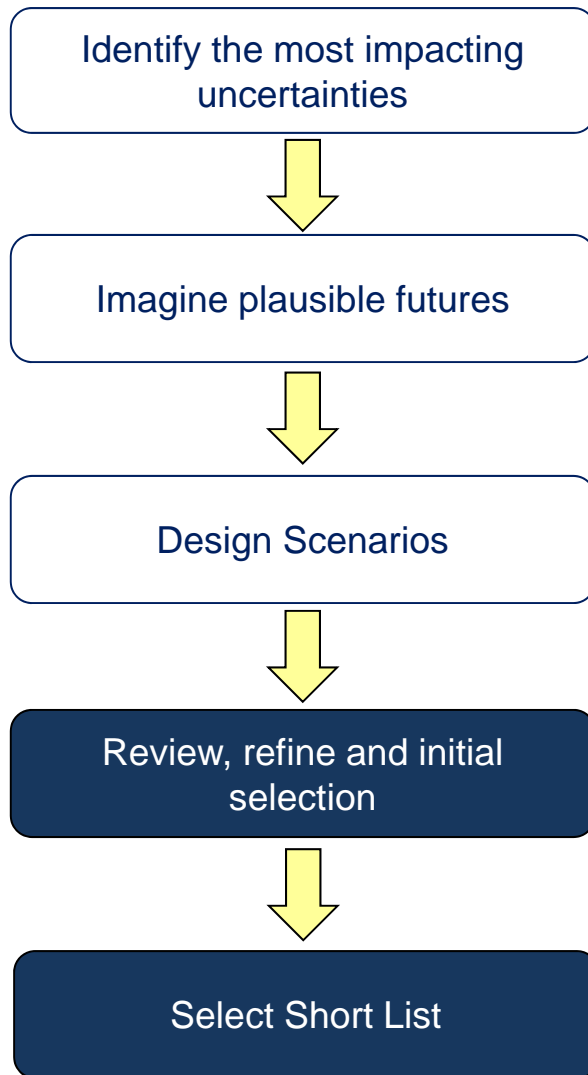
Scenarios

- ◆ 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

TVA's Process for Building Scenarios



- ◆ Uncertainties: trends and factors that could potentially affect its business environment
- ◆ Selected ones with the biggest impact on TVA's business
- ◆ Use uncertainties to frame potential future conditions that matter to TVA
- ◆ Scenario: story that describe the plausible futures
- ◆ Defined the list of scenarios and grouped them by common "themes"
- ◆ Evaluate scenarios to ensure they consider a wide range of possible futures
- ◆ Obtain input from internal and external stakeholders
- ◆ Select scenarios that cover a wide range of possible futures and critical uncertainties

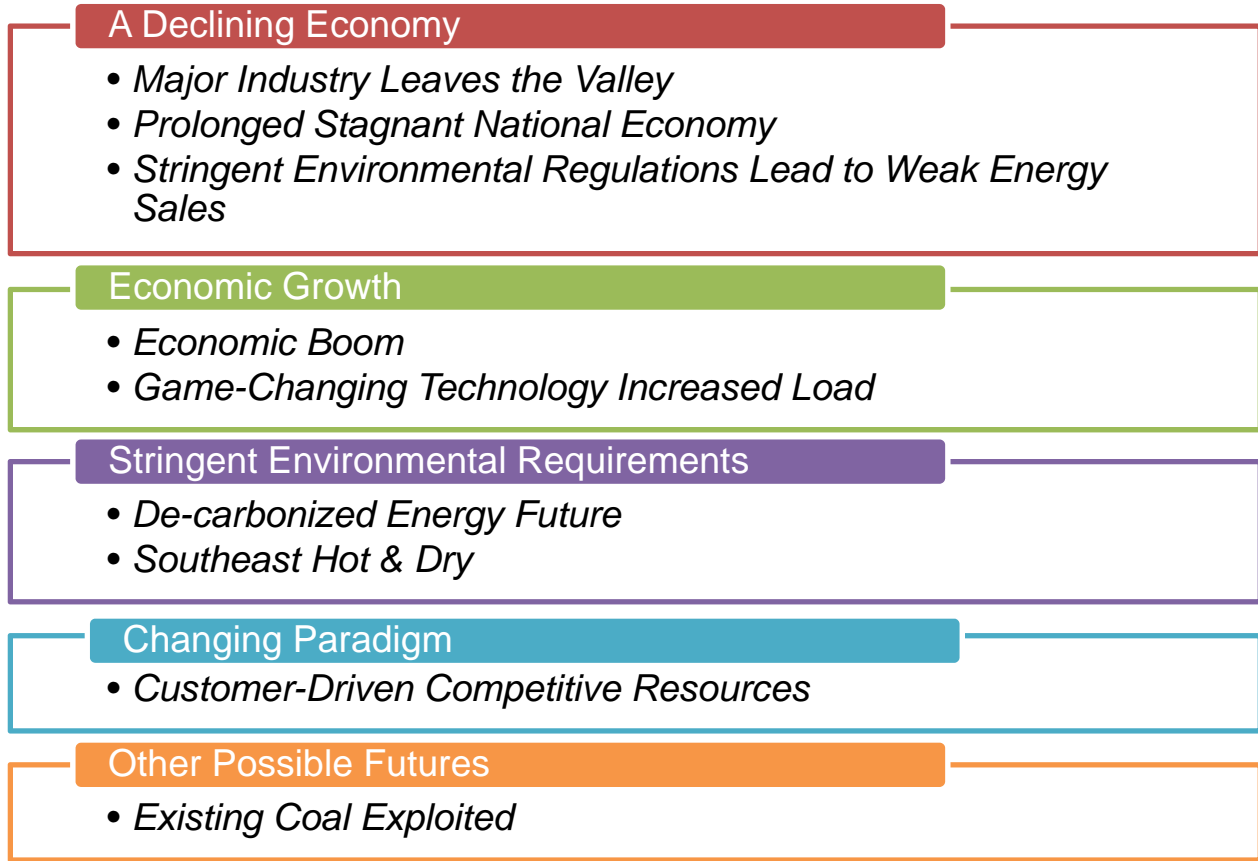


Description of Critical Uncertainties

Uncertainty	Description
TVA Sales	◆ The customer energy requirements (GWh) for the TVA service territory including losses; it represents the load to be served by TVA
Natural Gas Prices	◆ The price (\$/MMBtu) of the commodity including transportation
Wholesale Electricity Prices for TVA	◆ The hourly price of energy (\$/MWh) at the TVA boundary; used as a proxy for market price of power
Coal Prices	◆ The price (\$/MMBtu) of the commodity including transportation
Regulations	◆ All regulatory and legislative actions, including applicable codes and standards, that impact the operation of electric utilities excluding CO2 regulations
CO2 Regulation/Price	◆ The cost of compliance with possible CO2 related regulation and/or the price of cap-and-trade legislation, represented as a \$/Ton value
Distributed Generation Penetration	◆ National trending of distributed generation resources and potential regional activity by customers or third party developers (not TVA)
Nat'l Energy Efficiency Adoption	◆ 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, recognizing the impacts of both technology affordability and electricity price on willingness to adopt efficiency measures
Economic Outlook (National/Regional)	◆ All aspects of the regional and national economy including general inflation, financing considerations, population growth, GDP and other factors that drive the overall economy



TVA is Considering 9 Scenarios Grouped Around 5 Themes



Critical Uncertainties

TVA Sales
Natural Gas Prices
Wholesale Electricity Prices into TVA
Coal Prices
Regulations (non CO2)
CO2 Regulations/Price
Distributed Generation
National Energy Efficiency
Economic Outlook (National/Regional)



Scenario Descriptions

Scenario*	Description	
Major Industry Leaves the Valley	<ul style="list-style-type: none"> ◆ 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 	✓
Prolonged Stagnant National Economy	<ul style="list-style-type: none"> ◆ 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 	✓
Stringent Environmental Regulations Lead to Weak Energy Sales	<ul style="list-style-type: none"> ◆ Stringent environmental regulations are passed and implemented quickly. Increased federal subsidies of distributed generation (DG) ◆ High cost of production, due to fracking and environmental legislation for gas and CO2 allowances, increases electricity prices significantly ◆ Federal renewable portfolio standards are implemented with new, more stringent MATS regulations ◆ US based industry is non-competitive in global markets and leads to economic downturn 	✓
The Economic Boom	<ul style="list-style-type: none"> ◆ 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 	✓
Game Changing Technology Increases Load	<ul style="list-style-type: none"> ◆ Technology driven growth-more plug-ins; 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 green house gases but other regulations remain neutral 	

✓ Indicates preferred scenarios based on current stakeholder feedback

TVA Scenario Descriptions (Cont'd)

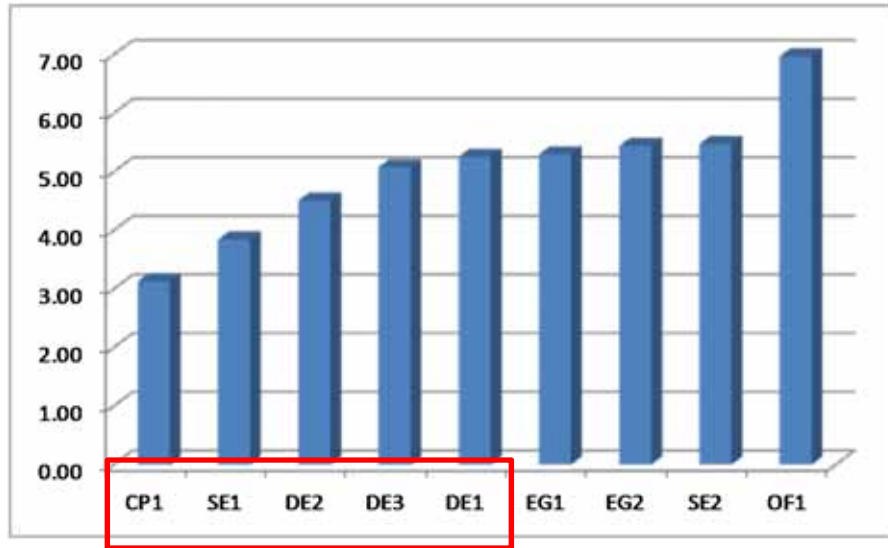
Scenario*	Description
De-carbonized Energy Future	<ul style="list-style-type: none"> ◆ Increasing climate-driven effects create strong federal push to curb GHG emissions: new legislation caps and penalizes CO2 emissions from the utility industry and incentivizes non-emitting technologies ◆ Compliance 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
Southeast Hot & Dry	<ul style="list-style-type: none"> ◆ 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
Customer Driven Competitive Resources	<ul style="list-style-type: none"> ◆ Customers' awareness of growing competitive energy markets and the rapid advance in energy technologies produce unexpected high penetration rates in 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
Existing Coal Exploited	<ul style="list-style-type: none"> ◆ 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



✓ Indicates preferred scenarios based on current stakeholder feedback

TVA Scenario Ranking Shows Clear Preferences

Composite Weighted Average Ranking



TVA Sales/NG\$ with CO2 indicator



- ◆ The preferred scenarios based on the composite ranking are:
 - *Customer-Driven Competitive Resources (CP1)*
 - *De-carbonized Energy Future (SE1)*
 - *Prolonged Stagnant National Economy (DE2)*
 - *Stringent Environmental Regulations Lead to Weak Energy Sales (DE3)*
 - *Major Industry Leaves the Valley (DE1)*
- ◆ Composite results show a bias for scenarios with lower sales, even though both IRPWG-only and TVA-only rankings included at least one scenario with higher sales

Composite weighted average results are based on a 50/50 weighting of scores from 17 stakeholders and 8 TVA executives.

TVA Scenario Design Example: 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

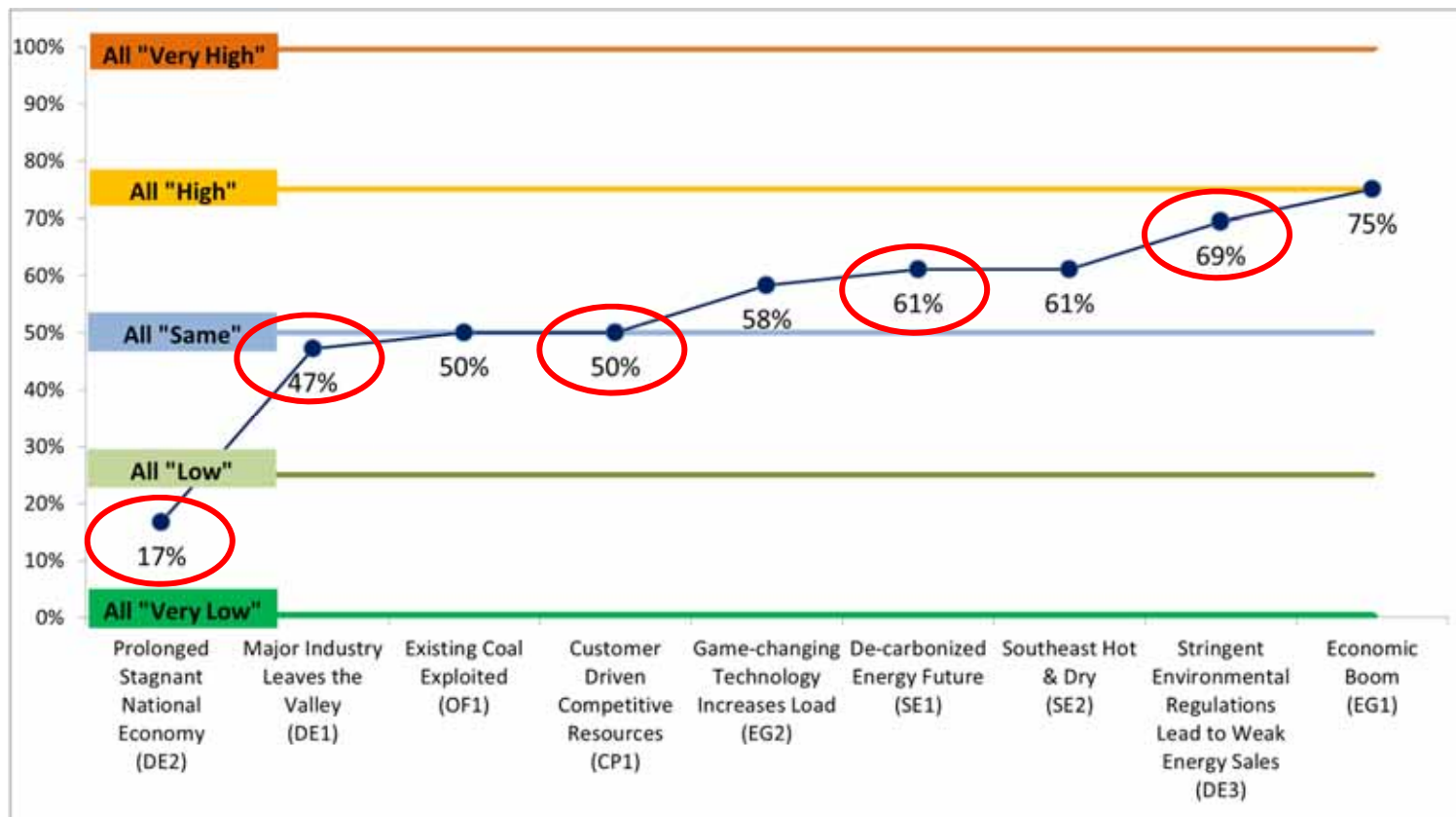
Uncertainty	Level Of Impact (*)	Rationale
TVA Sales	Low	CO2 penalties drive industry to non-emitting technologies; raising prices and leading to economic decline later in the decade
Natural Gas Prices	High	Demand for gas increases spiking prices
Whole Sale Electricity Prices for TVA	High	Rush to switch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

(*) Note: Compared to current view of the future

TVA Preferred Scenarios Demonstrate Adequate Diversity

- ◆ The Diversity Range value for a particular scenario is calculated as the total sum of the value of the uncertainties (Very Low = 1, Very High = 5) compared with the maximum (45) and minimum (9) potential values; the result is expressed as a percentage
- ◆ The results show that there is a good dispersion of values in the composite ranking results

Scenarios Diversity Range



* Note: The IRPWG results are based on 17 of 18 members participating. The TVA results are based on all 8 members participating.

Comments or observations
about the current scenario
designs?



What's Next for the Project

- ◆ Scenarios will be refined based on feedback from the stakeholders at the January 13th meeting
 - Some scenarios may be merged
 - An economic growth scenario will be considered for inclusion in the short list

- ◆ The focus will then shift to development of the proposed set of planning strategies
 - IRP stakeholders will rank preferred strategies using a similar method to the ranking of scenarios (February)

- ◆ Modeling inputs will be reviewed with the IRP stakeholders in March & April, including scorecard metrics

- ◆ The forecasts for key drivers (the scenario uncertainties) will be presented in May

- ◆ Actual case runs should begin in June



RERC Proposed Engagement – 2015 IRP

