

Tennessee Valley Authority

Regional Energy Resource Council

Nashville, Tennessee

May 13, 2014



Welcoming Comments



Agenda

8:30 Continental Breakfast

**9:00 Welcome - Introductions & New
Member Recognition**

Dus Rogers, Council Chair

Agenda Review

Jo Anne Lavender, Facilitator

9:15 Meeting Purpose

**Joe Hoagland,
Designated Federal Officer**

9:30 IRP Update: Strategies

**Gary Brinkworth,
Senior Program Manager, IRP**

10:30 Break

10:45 Public Comment Period

11:45 Lunch

12:45 IRP Update: Scorecard

Brinkworth

2:00 Break

2:15 Council Discussion

Lavender

3:00 Wrap up & Adjourn

Hoagland/Rogers

Agenda

- ◆ Agenda prepared and approved by the Designated Federal Officer (DFO) in consultation with Council Chair
- ◆ Agenda 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

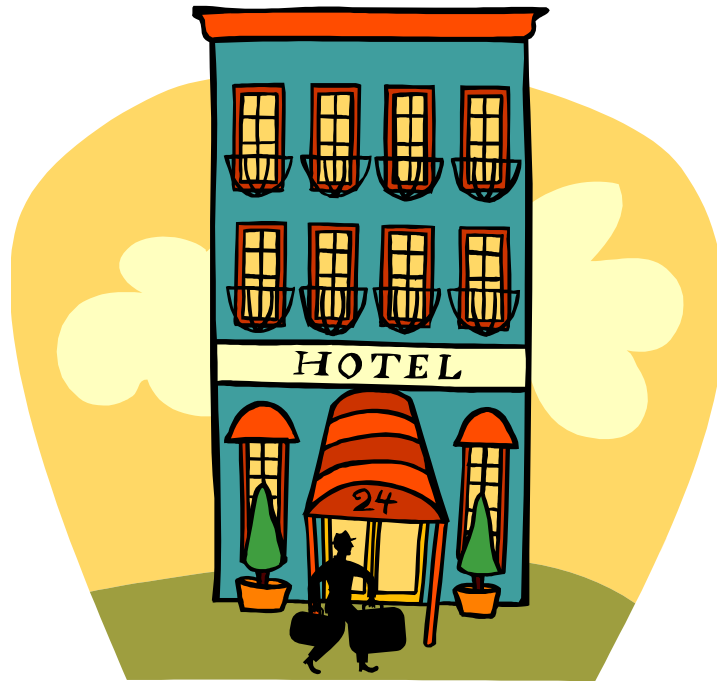
- ◆ DFO will ensure that minutes are prepared for each meeting, approved by the Chair, and made available to Council members

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



Meeting Purpose

Most RERC meetings include discussion and formation of advice for TVA. However, this meeting is primarily informational:

- Update the RERC on progress of the IRP
- Gain your input on the strategies
- Gain ideas for the structure and content of the scorecard

	Candidate Planning Strategies
A	"Traditional" Least Cost Planning
B	Meet an Emission Target
C	Lean on the Market
D	Do Gas Only
E	Doing More EEDR
F	Promoting Renewables
G	Energy-Water Nexus
H	No Nuclear

Scenario Analysis

		Scenarios						
		#1	#2	#3	#4	#5	#6	#7
Strategies	A							
	B							
	C							
	D							
	E							

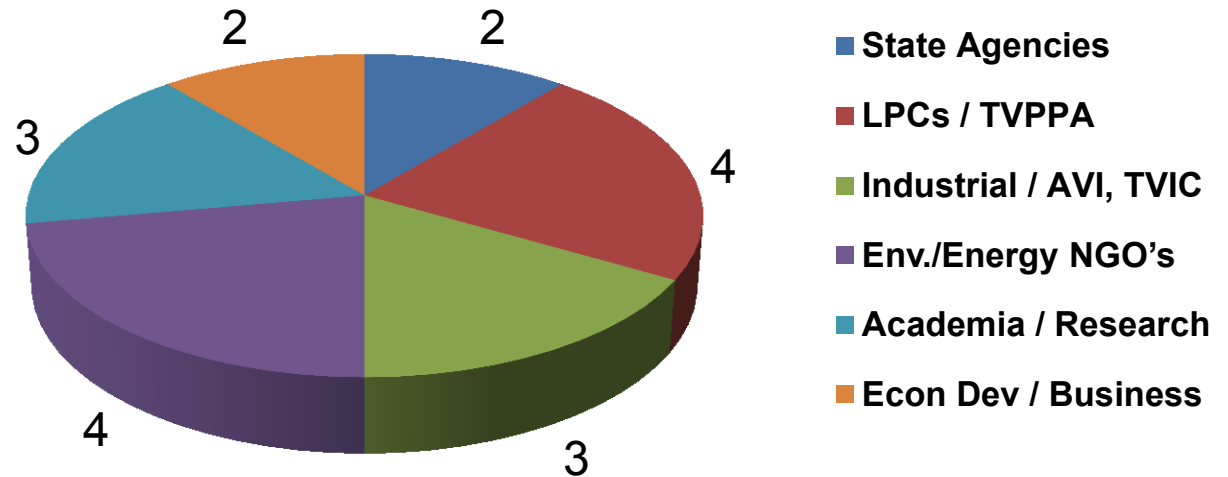
Scorecards evaluate the performance of a strategy across many different scenarios

◆ 18 Members

◆ Meets ~ Monthly

◆ Engaged in details of the IRP

◆ Encourages dialogue between stakeholders and diverse opinions to TVA



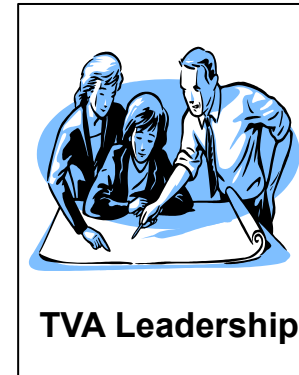
LPC= Local Power Companies
TVPPA = Tennessee Valley Public Power Association
AVI= Associated Valley Industries
TVIC= Tennessee Valley Industrial Committee
NGO = Non-governmental Organization

TVA Energy Resource Decisions

		Scenarios					
		Current Situation	#1	#2	#3	#4	#5
Planning Strategy	Planning Strategy A						
	Planning Strategy B						
	Planning Strategy C						
	Planning Strategy D						
	Planning Strategy E						

Other Strategic Considerations

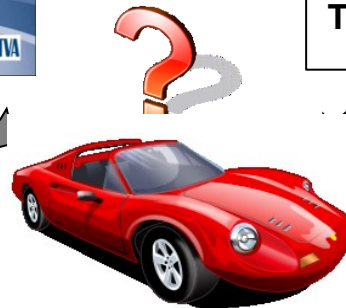
Internal/External Stakeholder Input



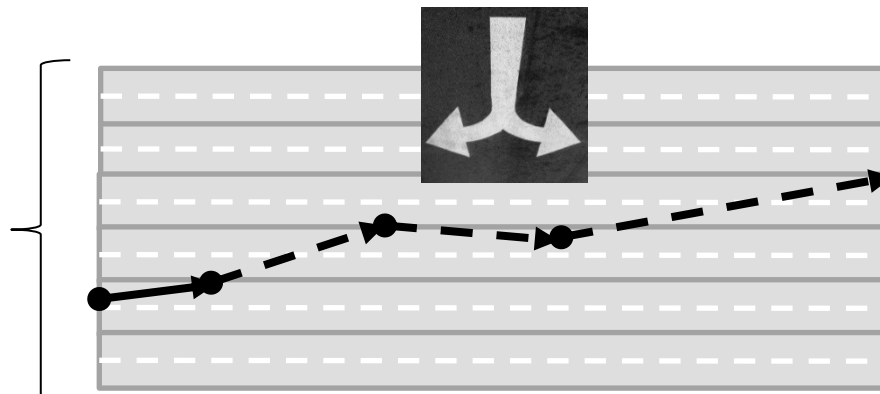
Financial Health Rates

Reliability Resiliency

Environmental Stewardship



IRP establishes direction for 'The Highway'



Specific 'Lane' decided by TVA Leadership with Business Considerations

Resource Planning: *The application of economic and engineering analyses to the resource adequacy problem, specifically, making investment decisions to minimize fixed and variable costs, while maintaining appropriate resource adequacy.*

'Resource adequacy' is typically achieved by maintaining an amount of capacity in excess of forecasted peak demand.

- This "reserve margin" ensures that customer demand for power can be met, with fluctuations in actual demand (weather) and unexpected outages of generating assets.
- The optimum level of reserves balances the cost with the risk of power being unavailable.

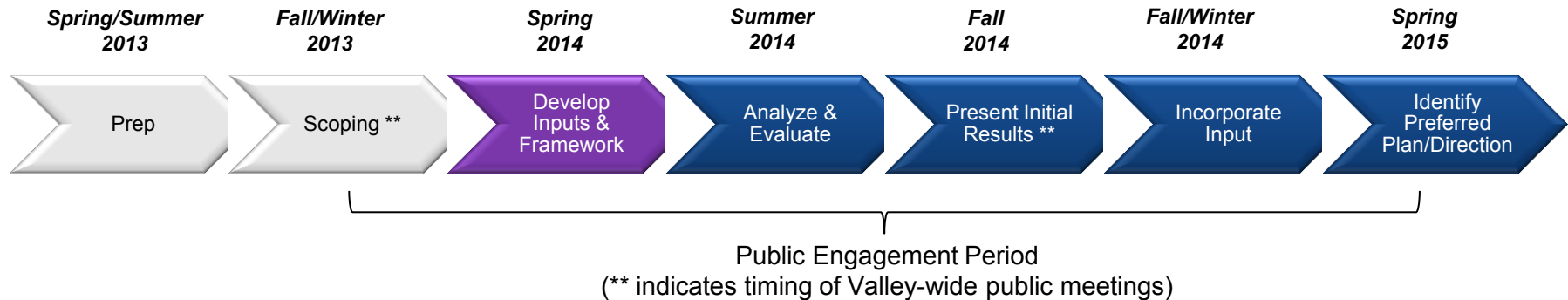




- ◆ The Integrated Resource Planning (IRP) process at TVA follows a least-regret planning approach that considers a broad range of supply-side and customer service options, using multiple evaluation criteria, involving the public, and considering uncertainty associated with future events
- ◆ The outcome of the IRP is a kind of road map for TVA that will guide decision-makers and support our overall mission of:
 - Low cost reliable power
 - Environmental stewardship
 - Economic development
- ◆ This road map outlines changes that, if implemented, will impact the cost and the environmental effects of producing that power

2015 IRP/SEIS Schedule: Major Phases and Milestones

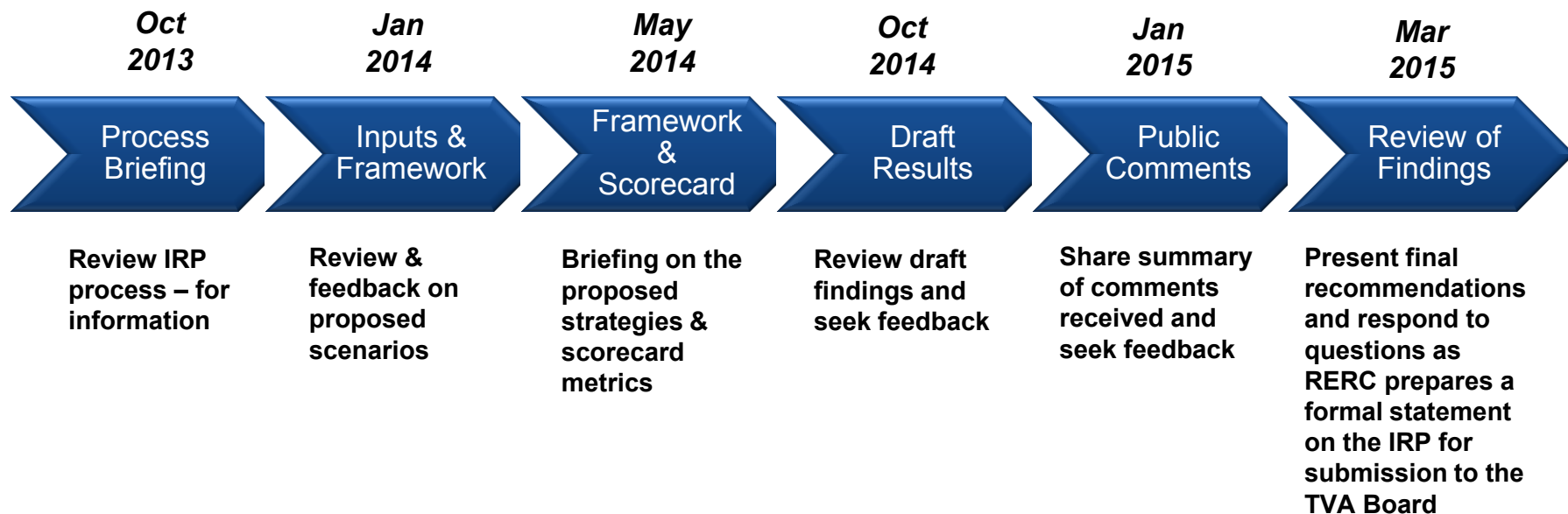
The 2015 IRP is intended to ensure transparency and enable stakeholder involvement.



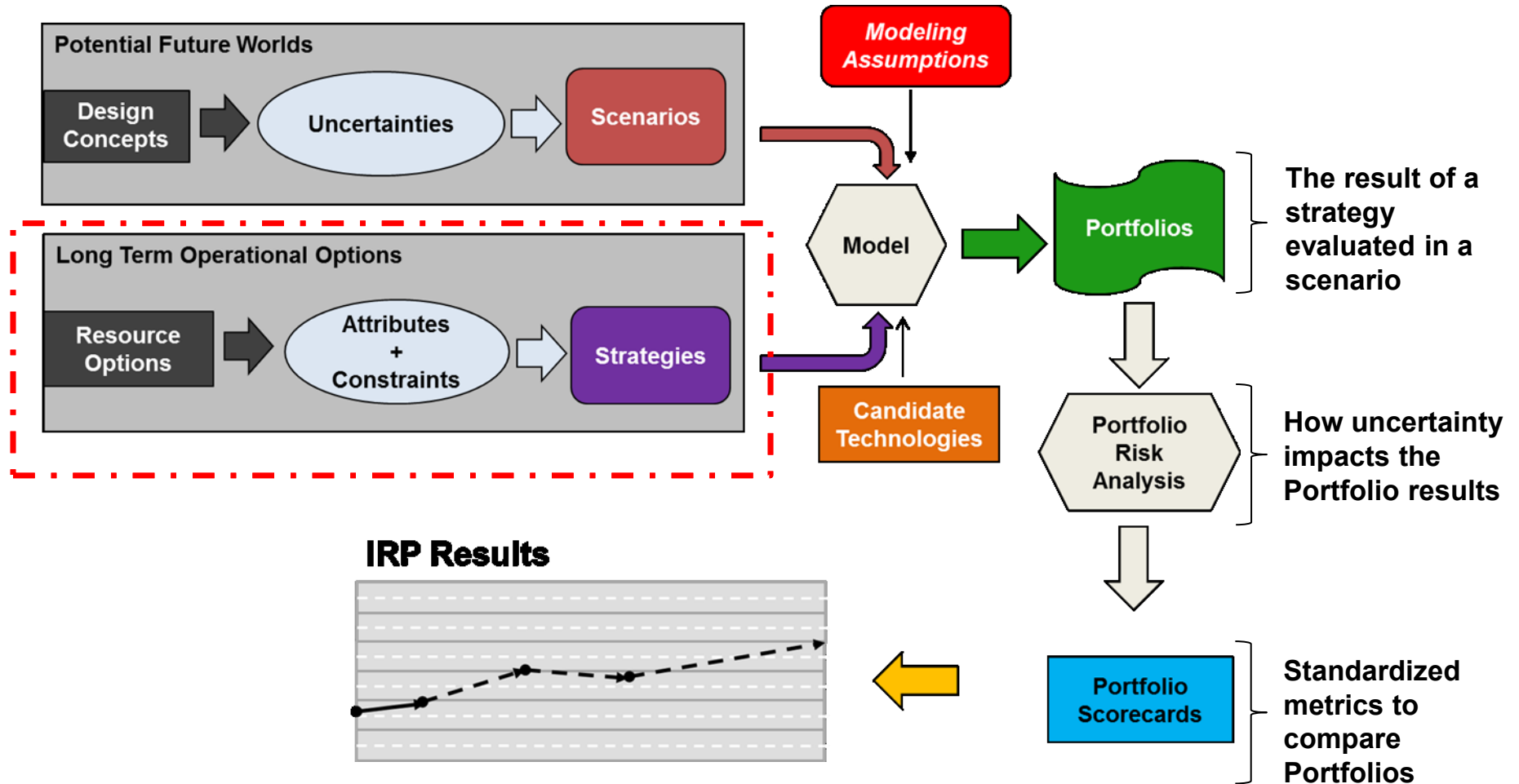
Key tasks/milestones in this study timeline include:

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

RERC Proposed Engagement: 2015 IRP



How the Resource Planning Model Works



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

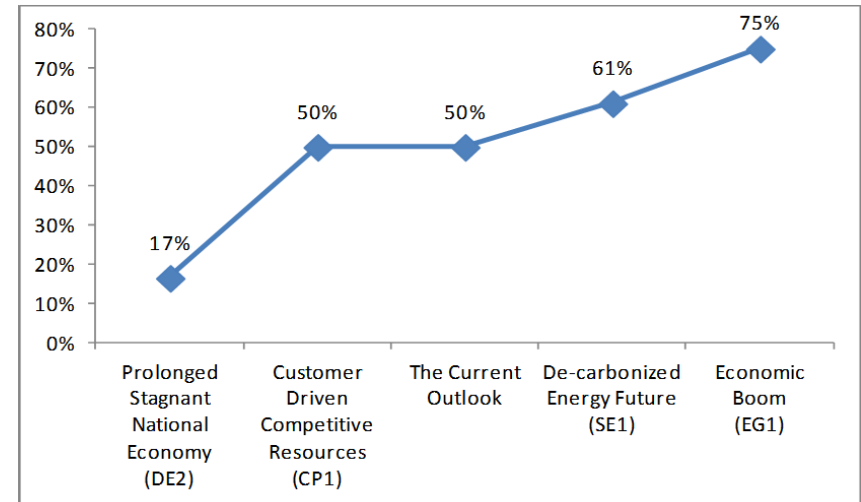
Planning Strategies

- ◆ Test various business options within TVA’s control
- ◆ Defined by a combination of resource assumptions such as:
 - EEDR portfolio
 - Nuclear expansion
 - Gas CT/CC units
- ◆ Consider multiple viewpoints
 - Public scoping period comments
 - Assumptions that would have the greatest impact on TVA long-term

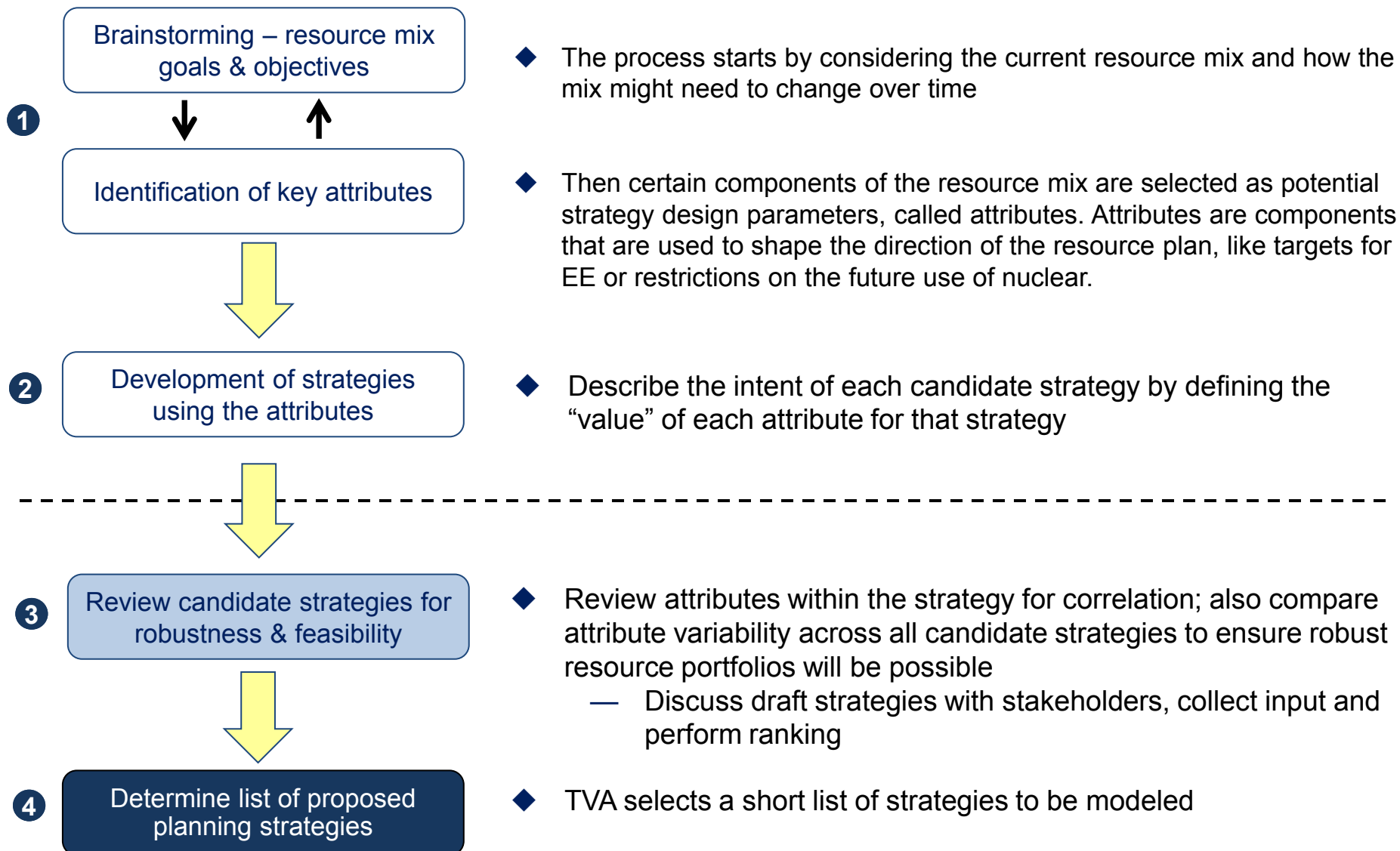
A well-designed and robust set of scenarios is one of the most fundamental components for a successful planning process

TVA Recap: Scenarios Create Diverse Planning Futures

	Scenario Design Focus
Current Outlook	Captures the current outlook for the future TVA is using for resource planning studies
Prolonged Stagnant National Economy	Stagnant economy results in flat to negative growth, delaying the need for new generation
Economic Boom	Rapid economic growth translates into higher than forecasted energy sales and resource expansion
De-Carbonized Energy Future	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
Customer-Driven Competitive Resources	Customers' awareness of growing competitive energy markets and the rapid advance in energy technologies produce unexpected high penetration rates in distributed generation and energy efficiency



- ◆ The line graph shown here provides an indication of overall scenario diversity by plotting a numerical scenario “score” based on the expected ranges for the key uncertainties that define each scenario
- ◆ This set of scenarios provides an adequate diversity of “futures” for the IRP study



Resource Mix & Strategy Attribute List

1	Transmission Grid Improvements	Power Resource Stack
	Seasonal Market Power	
2	Purchased Power Agreements (PPA)	
3	Distributed Generation (DG) Options	
4	New Renewables (utility scale)	
	Existing Renewables (wind PPA, solar)	
	Existing Power Contracts	
5	Energy Efficiency & Demand Response (EEDR)	
6	New Gas Units	
	Existing Gas Units	
	Conv. Hydro & Pumped Storage Hydro	
7	New Coal Units	
8	Existing Coal	
9	Nuclear Additions	
10	Existing Nuclear	

- ◆ This list includes resources currently in TVA's portfolio as well as components that could be part of the future power supply mix
- ◆ The highlighted entries are the design parameters (or attributes) for the planning strategies being considered for the IRP
- ◆ In addition to these resource options, transmission grid improvements are also being used as a design parameter for the planning strategies

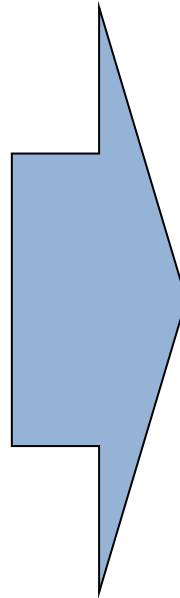
Ten Design Parameters for Strategies

Attributes	Description
Existing Nuclear	Constraints related to the existing nuclear fleet; EPU's are considered part of existing nuclear
Nuclear Additions	Limitations on technologies and timing related to the addition of new nuclear capacity; Watts Bar 2, SMRs, A/P 1000s and BLN are considered in this category
Existing Coal	Constraints related to the existing coal fleet; the current schedule plan of coal unit idling is considered as an input
New Coal	Limitations on technology and timing on new coal-fired plants; includes CCS on conventional coal plus IGCC technology
Gas Additions	Limitations on technologies and timing related to the expansion options fueled by natural gas (CT, CC)
EEDR	Considers energy efficiency and demand response programs that are incentivized by TVA and/or LPCs (excludes impacts from naturally occurring efficiency/conservation)
Renewables (Utility Scale)	Limitations on technologies and timing of renewable resources; considers options that would be pursued by TVA or in collaboration with LPC's
Purchased Power Agreements (PPA)	Level of market reliance allowed in each strategy; no limitation on the type of energy source (conventional or renewable)
DG/DER	Includes customer-driven resource options or third party projects that are distributed in nature
Transmission	Type and level of transmission infrastructure required to support resource options in each strategy

Developing Planning Strategies

Design Guide: Planning Strategies

- ◆ The strategies are designed to test various business options on how to address capacity needs over the study period
- ◆ Planning strategies are defined by a combination of resource assumptions and constraints (attributes) such as:
 - Existing Nuclear
 - Nuclear Additions
 - Existing Coal
 - New Coal
 - Gas Additions
 - EEDR
 - Renewables (utility scale)
 - Purchased Power Agreements (PPA)
 - Distributed Generation (DG)
 - Transmission Infrastructure & Grid Conversion



Candidate Planning Strategies	
A	“Traditional” Least Cost Planning
B	Meet an Emission Target
C	Lean on the Market
D	Do Gas Only
E	Doing More EEDR
F	Promoting Renewables
G	Energy-Water Nexus
H	No Nuclear

These strategies have been discussed extensively with the IRP working group

Strategy Classification into Categories

The proposed strategies can be classified in three categories according to the approach in the use of some of the candidate resources:

- ◆ “Promoting” Strategy (P): Contains attributes that incentivize the use of a particular resource/s
- ◆ “Constraining” Strategy (C): Contains attributes that limit the use of a particular resource/s
- ◆ “Excluding” Strategy (E): One or more of the resources can not be used for expanding capacity

STRATEGY	Type	Comment
A - “Traditional” Least Cost Planning	C	No preference for any resource; the constraint is the aim of “minimum cost”
B - Meet an Emission Target	C	Promotes the use on no/lower CO2 emitting new resources by constraining the total emission of the generation portfolio
C - Lean on the Market	C	Preference for new generation capacity not built by TVA
D - Do Gas Only	E	Excludes all options not fueled by NG for new capacity
E - Doing More EEDR	P	Promotes more EEDR by setting targets
F - Embracing Renewables	P	Promotes renewable resources through targets and cost trends of key technologies
G - Energy-Water Nexus	C	Promotes the use of no/low water new resources by constraining the consumption of the generation portfolio
H - No Nuclear	E	Excludes any nuclear, including the current fleet

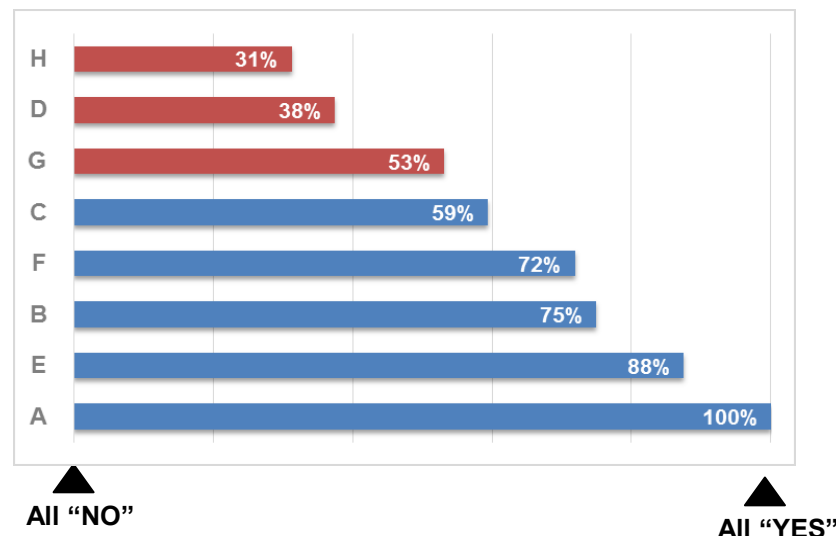
Seeking a Preferred Set of Planning Strategies

- ◆ Stakeholders were given the option to express their preference on the proposed strategies in terms of “Yes, No or Maybe” instead or ranking them in an order of preference
- ◆ The following graphs display the composite results of 16 respondents (11 IRPWG and 5 TVA)

Histogram Map – Sum of Occurrences

	Candidate Planning Strategies	Y	N	MYBE
A	“Traditional” Least Cost Planning	16	0	0
B	Meet an Emission Target	10	2	4
C	Lean on the Market	8	5	3
D	Do Gas Only	4	8	4
E	Doing More EEDR	13	1	2
F	Promoting Renewables	9	2	5
G	Energy-Water Nexus	5	4	7
H	No Nuclear	4	8	3

Ranking “Yes or No”



- ◆ There seems to be consensus around the top 5 ranking strategies:

- A - “Traditional” Least Cost Planning
- B - Meet an Emission Target
- C - Lean on the Market
- E - Doing More EEDR
- F - Promoting Renewables

IRP 2015 Selected Strategies

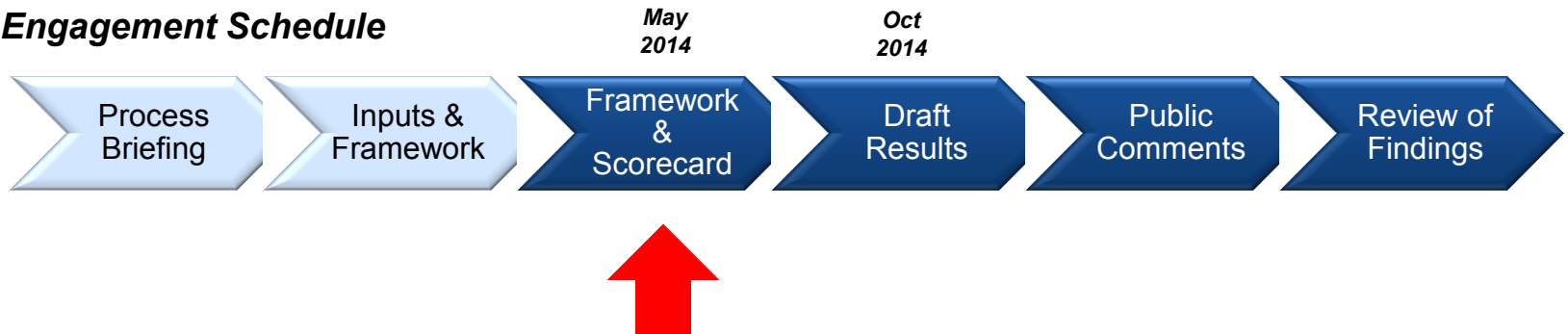
STRATEGY	DESCRIPTION
A - “Traditional” Least Cost Planning	<ul style="list-style-type: none"> All resource options available for selection; traditional utility “least cost optimization” case
B- Meet an Emission Target	<ul style="list-style-type: none"> Resources selected to create lower emitting portfolio instead of focusing only on a traditional least cost approach This lower emissions plan will be based on an emission rate target or level using CO2 as the emissions metric (the target will be set as a reduction from current emissions forecast) Additional existing unit retirements may be included in the plan.
C - Lean on the Market	<ul style="list-style-type: none"> Most new capacity needs are met using market resources and/or third-party assets acquired through PPA or other bilateral arrangements TVA makes a minimal investment in owned assets (deployment of EEDR to meet resource needs will continue)
E - Doing More EEDR	<ul style="list-style-type: none"> In order to establish TVA as a regional energy efficiency leader, a majority of capacity needs are met by setting an annual energy target for EEDR (e.g., minimum contribution of 1% of sales) Renewable energy and gas are secondary options with no coal or nuclear additions permitted
F – Embracing Renewables	<ul style="list-style-type: none"> In order to establish TVA as a regional renewable leader, a majority of new capacity needs are met by setting immediate and long-term renewable energy targets (e.g., 20% by 2020 and 35% by 2040), including hydroelectric energy A utility-scale approach is targeted initially with growing transition to distributed generation as the dominant renewable resource type by 2024 EEDR and gas are secondary options with no coal or nuclear additions permitted

TVA Next Steps: Ongoing RERC IRP Engagement

The 2015 IRP Schedule (major phases)



RERC Engagement Schedule



Break

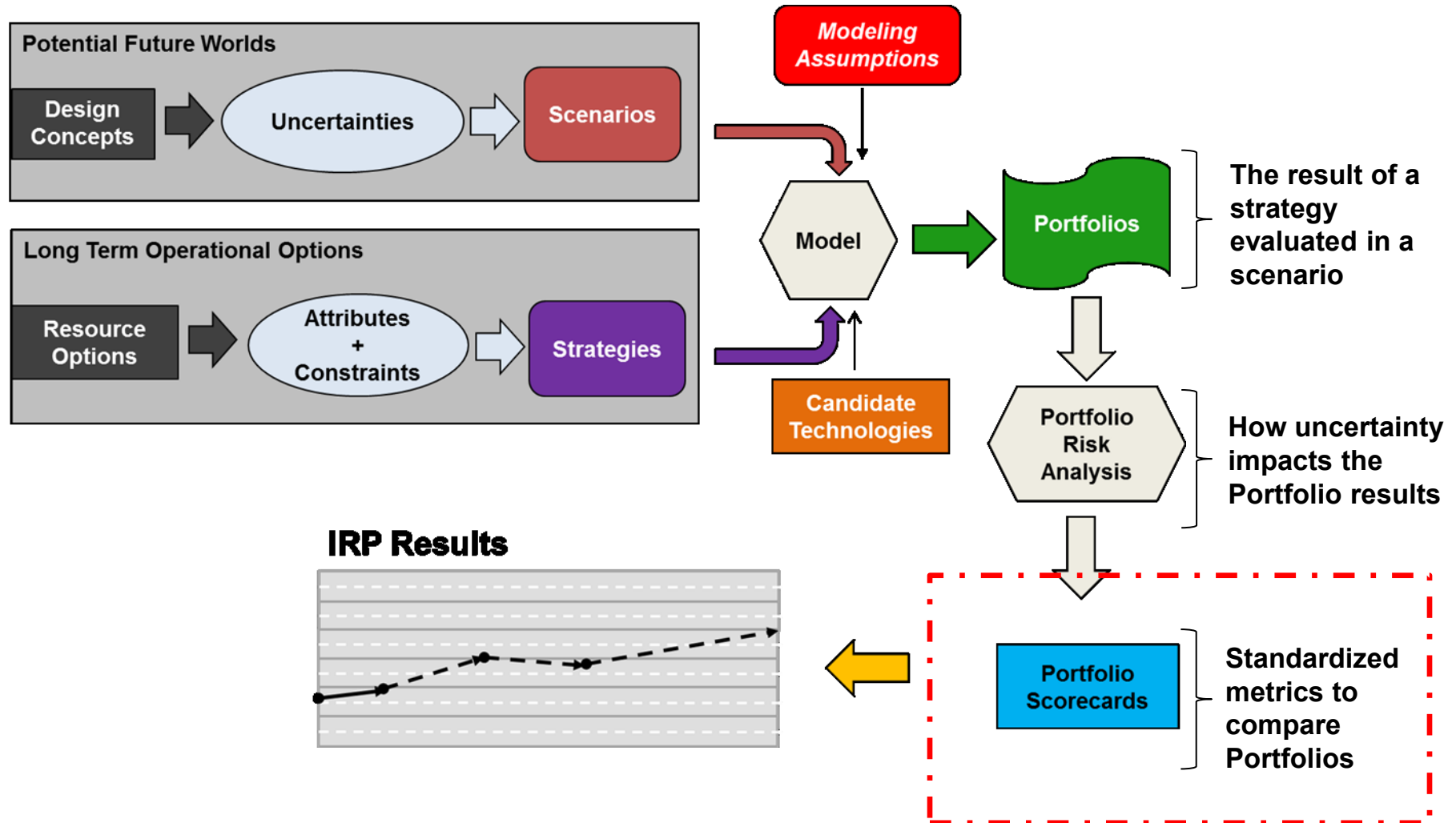
- Public participation is appreciated
- This is a listening session; responses are typically not provided
- Members of the public have a set number of minutes for their comments



Public Comment Period

Lunch

How the Resource Planning Model Works



TVA Good, Better, Best: Choosing the Right Resource Plan

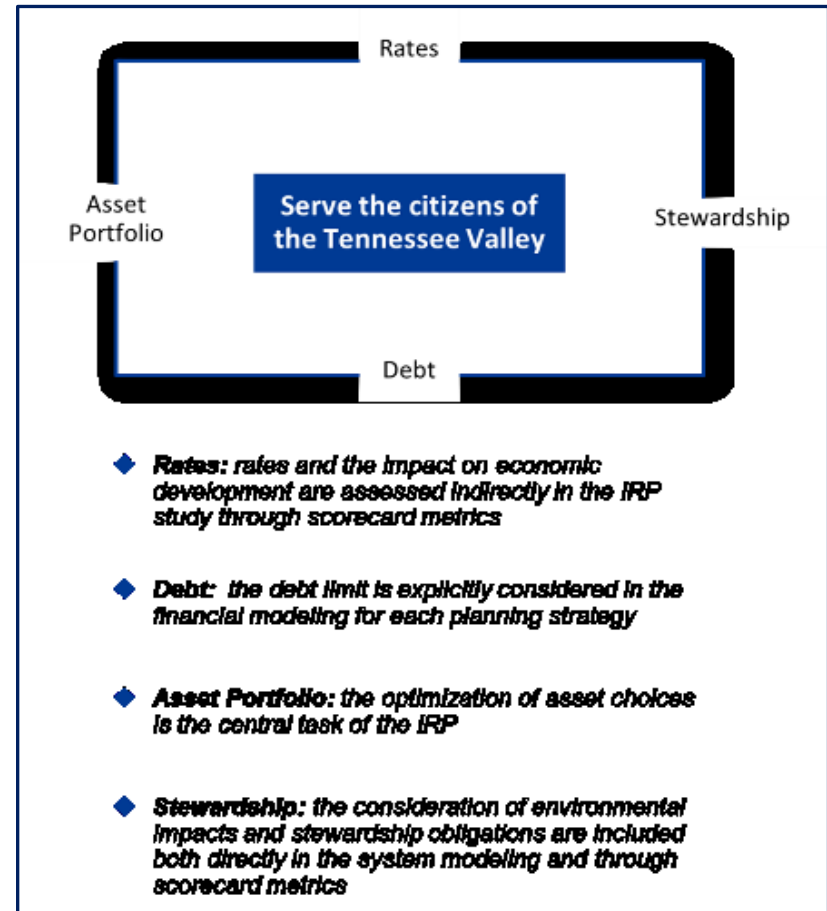
- ◆ The challenge is not insufficient data, but rather sorting through all the results to identify the preferred resource plan
- ◆ So how do you know when the plan is “good”? When is it “best” or “preferred”?
- ◆ And who decides that? Are the decision-makers well-grounded in the fundamentals of resource planning? In the assumptions and uncertainties around input data? Will stakeholder opinions be considered in the final selection of a resource plan?
- ◆ The solution to this dilemma is – METRICS!



Metrics Facilitate Selecting a Plan Consistent with Goals

- ◆ Metrics help focus the evaluation of plan results, if done correctly
- ◆ Metrics need to reflect the utility and stakeholder goals and priorities
 - TVA's broader mission requires the use of metrics that go beyond typical resource planning values to include stewardship and economic development factors.
- ◆ Metrics need to be clear and easy for stakeholders and decision-makers to understand, which implies that metric design needs to consider these groups
 - Internal teams at TVA developed candidate metrics
 - Stakeholders make other suggestions and help to shape the final set of evaluation metrics
- ◆ How metrics are described and presented makes a big difference in how effective they are.

TVA Strategic Imperatives



IRP Metrics Used by Peers

The table below provides a comparison of the IRP evaluation criteria used by each of the utilities.

- ◆ On average, utilities consider three to four criteria when evaluating potential IRP portfolios
- ◆ All utilities include some measure of cost in the evaluation (PVRR at a minimum)
- ◆ Most utilities include reliability metrics and environmental metrics as well
- ◆ The most common measure of environmental impact is emission levels
- ◆ APS is the only company to specifically consider water use in the evaluation

Company
Duke Energy Carolinas (DEC)
Florida Power & Light (FPL)
Georgia Power Company (GPC)
PacifiCorp (PCQ)
Progress Energy Carolinas (PEC)
Dominion (DOM)
Entergy (ETR)
Arizona Public Service (APS)

Evaluation Criteria	DEC 2013	FPL 2013	GPC 2012	PCQ 2013	PEC 2012	DOM 2013	ETR 2012	APS 2012
Financial Measures								
Present Value of Revenue Requirement (PVRR)	✓	✓	✓	✓	✓	✓	✓	✓
Cummulative CapEx								✓
Levelized Cost of Power (fixed & variable costs)							✓	
Price Growth					✓			
Shareholder Value			✓					
Risk Measures								
Risk			✓	✓				
Fuel Price Volatility					✓			
Fuel Diversity	✓	✓						
Reliability			✓	✓				
Flexibility	✓		✓					
Long-term Viability			✓					
Load/Generation Capacity Balance		✓						
Environmental Impact Measures								
Environmental Footprint	✓							
Emission Levels		✓		✓	✓			✓
Environmental Compliance			✓					
Water Use								✓

To Be Effective, Metrics Need a Scorecard

- ◆ Metrics facilitate discussion/debate about trade-offs that lead to the selection of the preferred resource plan
- ◆ At TVA, we use a scorecard approach to packaging the metrics, so that stakeholders and decision-makers can be fully engaged in the identification of what makes a resource plan “preferred”
- ◆ For the 2011 IRP, scorecards were developed to reflect components of TVA’s mission and strategic principles
 - Cost and risk metrics evaluated quantitative values that reflect traditional utility measures
 - Environmental and economic metrics considered possible impacts of both quantitative and qualitative assessments
- ◆ A similar approach is being considered for the 2015 IRP

Scenario Analysis

		Scenarios						
		#1	#2	#3	#4	#5	#6	#7
Strategies	A							
	B							
	C							
	D							
	E							

Scorecards evaluate the performance of a strategy across many different scenarios

A Scorecard Enables Consideration of Several Metrics

Ranking Metrics						Strategic Metrics				
Energy Supply						Environmental Stewardship			Economic Impact	
Scenarios	PVRR	Short-Term Rate Impact	PVRR Risk/Benefit	PVRR Risk	Total Plan Score	CO ₂ Footprint	Water	Waste	Total Employment	Growth in Personal Income
1	99.00	95.13	100.00	99.53	98.36				0.9%	0.7%
2	100.00	95.58	99.40	95.30	97.85					
3	100.00	100.00	99.81	89.37	97.56					
4	100.00	97.40	100.00	95.37	98.36					
5	100.00	96.43	100.00	100.00	99.19					
6	100.00	100.00	100.00	86.69	96.97				0.2%	0.1%
7	100.00	97.24	100.00	97.03	98.70					
8	99.84	96.66	98.35	97.93	98.50					
Total Ranking Metric Score					785.49					

Legend	
	Better

Legend	
	Better

- ◆ The scorecard facilitates discussion about trade-offs and identified the strengths & weaknesses of various resource planning strategies
- ◆ Using this type of scorecard allows stakeholders and decision-makers who are not technical experts to participate more fully in the debate around selecting a preferred resource plan

Scorecards Make Dialogue & Engagement Possible

Recommended Planning Strategy

Scenarios	Ranking Metrics					Strategic Metrics		
	Energy Supply					Environmental Stewardship		
	PVRR	Short-Term Rate Impact	PVRR Risk/Benefit	PVRR Risk	Total Plan Score	CO ₂ Footprint	Water	Waste
1	99.00	95.13	100.00	99.53	98.36			
2	100.00	95.58	99.40	95.30	97.85			
3	100.00	100.00	99.81	89.37	97.56			
4	100.00	97.40	100.00	95.37	98.36			
5	100.00	96.43	100.00	100.00	99.19			
6	100.00	100.00	100.00	86.69	96.97			
7	100.00	97.24	100.00	97.03	98.70			
8	99.84	96.66	98.35	97.93	98.50			
Total Ranking Metric Score					785.49			

Former Planning Strategy C

Scenarios	Ranking Metrics					Strategic Metrics		
	Energy Supply					Environmental Stewardship		
	PVRR	Short-Term Rate Impact	PVRR Risk/Benefit	PVRR Risk	Total Plan Score	CO ₂ Footprint	Water	Waste
1	99.22	94.09	97.68	100.00	98.04			
2	96.35	100.00	96.46	95.85	97.08			
3	95.56	94.68	100.00	100.00	96.91			
4	97.39	98.37	98.19	100.00	98.30			
5	98.90	100.00	97.49	99.17	99.04			
6	95.03	94.41	97.83	93.22	94.82			
7	98.88	98.94	99.45	100.00	99.22			
8	99.56	99.63	99.03	99.31	99.45			
Total Ranking Metric Score					782.87			

Former Planning Strategy E

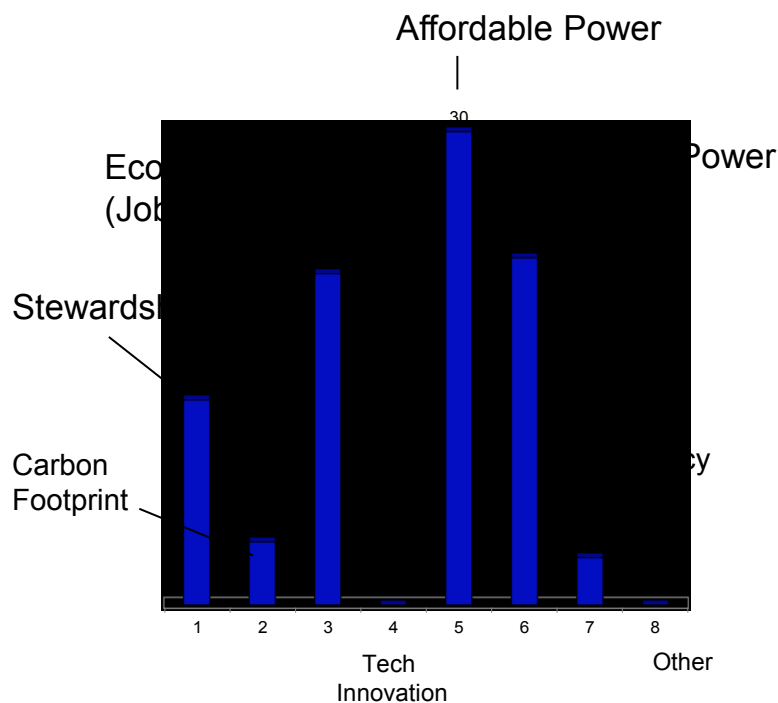
Scenarios	Ranking Metrics					Strategic Metrics		
	Energy Supply					Environmental Stewardship		
	PVRR	Short-Term Rate Impact	PVRR Risk/Benefit	PVRR Risk	Total Plan Score	CO ₂ Footprint	Water	Waste
1	100.00	100.00	96.78	95.46	98.57			
2	97.74	98.20	99.96	98.54	98.30			
3	94.67	93.55	95.91	97.73	95.26			
4	96.83	100.00	93.42	89.57	95.48			
5	98.72	99.50	96.33	98.64	98.59			
6	95.62	93.91	99.65	100.00	96.72			
7	98.56	100.00	98.42	98.96	98.96			
8	100.00	100.00	100.00	100.00	100.00			
Total Ranking Metric Score					781.88			

Former Planning Strategy B

Scenarios	Ranking Metrics					Strategic Metrics		
	Energy Supply					Environmental Stewardship		
	PVRR	Short-Term Rate Impact	PVRR Risk/Benefit	PVRR Risk	Total Plan Score	CO ₂ Footprint	Water	Waste
1	96.93	95.47	96.26	97.26	96.59			
2	94.34	96.12	100.00	100.00	96.72			
3	95.15	96.29	91.37	83.79	92.36			
4	95.73	98.53	96.41	93.79	96.01			
5	97.32	98.14	96.07	98.10	97.53			
6	92.92	95.29	88.18	78.46	89.59			
7	96.87	99.24	95.93	94.26	96.70			
8	98.42	96.26	94.88	94.74	96.65			
Total Ranking Metric Score					762.16			

Proposed Scorecard Categories

- ◆ Polling of the RERC in January 2014 in response to a general question about energy policy priorities for TVA customers gives some insight into priorities that might be used in evaluating the study results from the IRP
- ◆ These informal results show good alignment with scorecard categories used in the 2011 IRP



IRP Evaluation Categories

Costs - both long term and short term metrics based on plan costs

Environmental Stewardship – CO2 footprint, water (thermal), waste disposal

Risk – both upside exposure & risk/benefit balance

Economic Impacts – total employment & growth in personal income

Flexibility – measures that evaluate the confidence in resource and grid margin under uncertainty

2011 IRP Scorecard Categories

Summary - Candidate Metrics by Category

Category	Description of Proposed Scorecard Metrics
Cost	A combination of total plan cost (revenue requirements) over the study period and average system costs (\$/MWh) over the nearer term
Risk	A composite of measures that reflects the uncertainty around the cost of the resource plan caused by variations in key inputs (tested using stochastic methods)
Environmental Stewardship	Individual metrics in this category capture CO2 emissions, thermal loading & water consumptive use, spent nuclear fuel and coal combustion byproducts
Economic Impacts	Measures to indicate the macro-economic impacts attributed to a power supply plan (per capita income) expressed as a change from a reference case
Flexibility	Metrics in this category provide an indication of performance uncertainty or dispatch constraints related to different resource portfolios

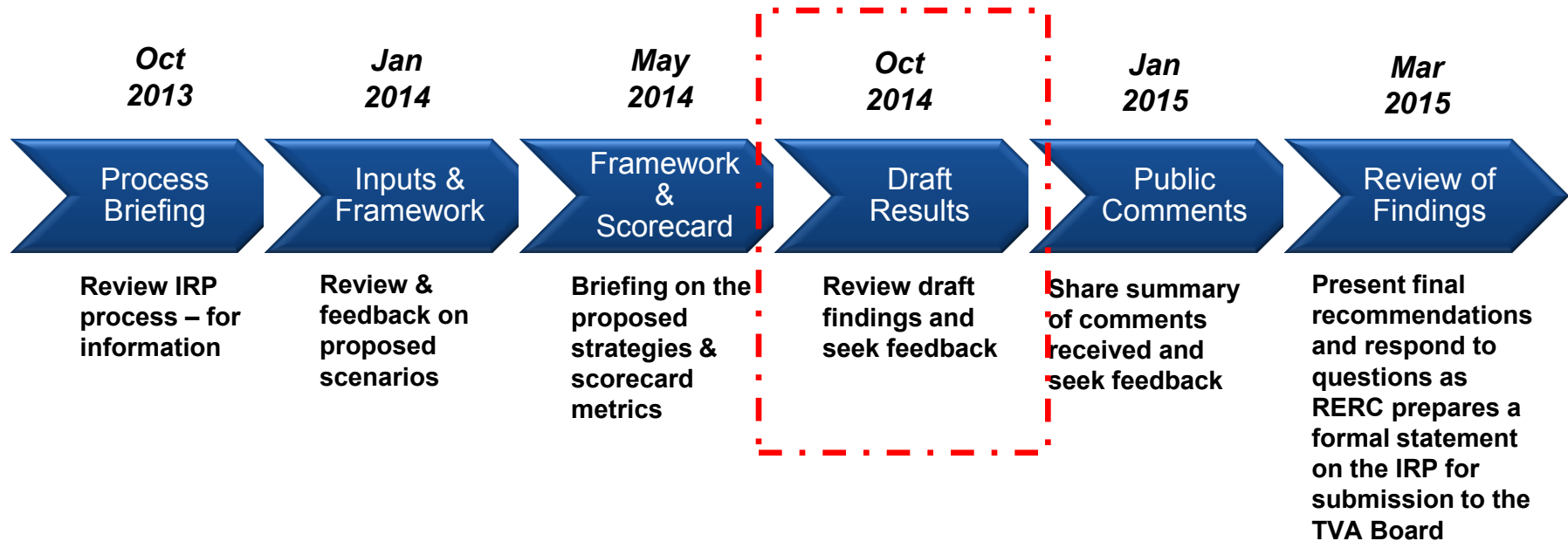
A list of candidate metrics is still being evaluated by TVA (a preliminary list has been shared with the IRP stakeholder working group). Not all of the metrics under consideration will become part of the evaluation scorecard.

TVA Good Metrics + Clear Scorecards = A Successful IRP

- ◆ Policy objectives and goals frame the IRP study. That framework has to be understood and sanctioned by both stakeholders and decision-makers in order for the outcome of the IRP analysis to be credible
- ◆ Stakeholder engagement is the key to a successful IRP – at the end of the day, stakeholders may not agree with all the aspects of the recommendation but they must support the integrity of the process
- ◆ Scorecards are the most effective method for stimulating stakeholder engagement and facilitating dialogue about priorities and trade-offs that go into selection of the preferred resource plan



RERC Proposed Engagement: 2015 IRP



Break

Council Discussion

Wrap Up & Adjourn

Next Steps: Upcoming Meetings

- **Fall Meeting:** Oct 15 and 16, 2014 (*new dates*)

Location: Knoxville

Topic: Draft IRP review and feedback

- **Winter Meeting:** January 2015

Location: TBD

Topic: Draft IRP public comments review and feedback

- **Spring Meeting:** March 2015

Location: TBD

Topic: Final IRP review and statement to TVA Board