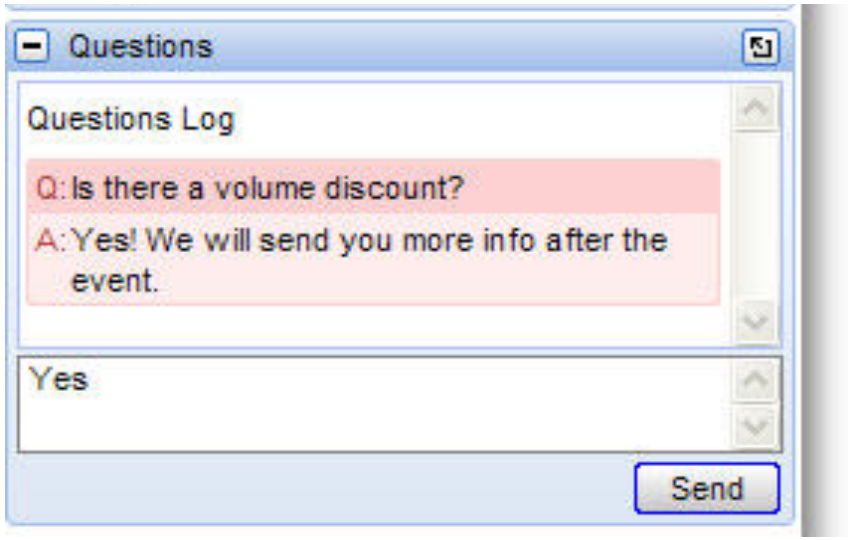
2015 Integrated Resource Plan
Project Quarterly Update
June 18, 2014

About Tonight's Meeting

- This is both a live meeting, and a Webinar.
- Webinar attendees attending by phone are muted.

To ask questions:

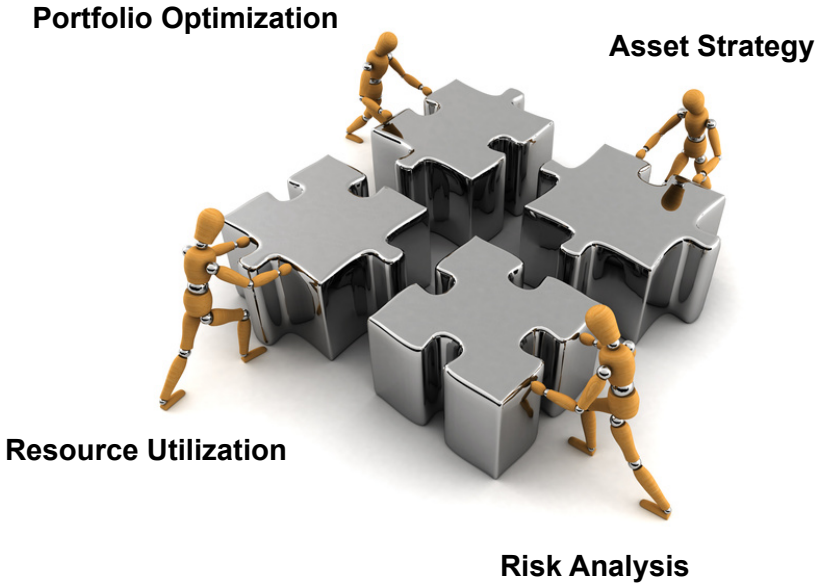
- Live meeting attendees can ask questions by coming to the podium at the front of the room.
- Webinar attendees can submit Questions using the Question tool on the Webinar toolbar



Quarterly Update Session - Agenda

- Welcome
- IRP/SEIS Schedule Review
- IRP Status Update
  - Recap of the scenarios
  - Review of the Planning Strategies
  - Summary of Resource Options
  - A Look at Metrics & Scorecard Design
  - Next Steps
- Questions
- Closing Remarks

The IRP Is About Solving A Puzzle



The Integrated Resource Plan (IRP) is a special form of resource planning study that attempts to balance the mix of resources to ensure TVA is successful over a broad range of possible future conditions; this is sometimes called “least regrets” planning.

The outcome of the IRP is a kind of road map for TVA that will guide decision-makers and support our overall mission:

- 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.

So it’s important for customers to be aware of the direction we are headed and the current thinking about how we plan to get there.

Objectives for the Preferred Resource Plan

In addition to balancing the objectives of TVA's overall mission, resource planning must explicitly address these key characteristics when recommending a preferred plan:

Low Cost

Fundamental Focus of TVA's Resource Planning Studies

Reliability

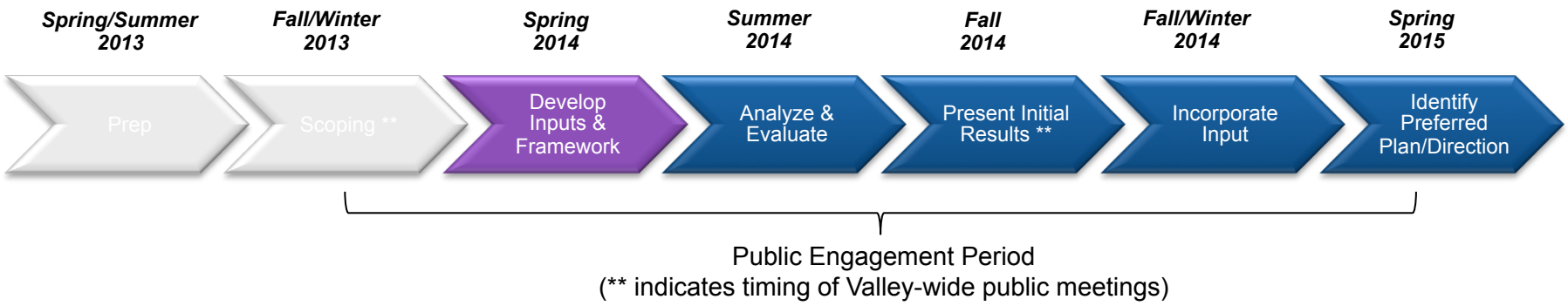
Maintain Power Delivery & System Resiliency; Ensure Resource Adequacy in the changing utility paradigm

Portfolio Mix

Seeking a balanced portfolio that minimizes risk and diversifies resources (supply & demand side)

2015 IRP/SEIS Schedule: Major Phases and Milestones

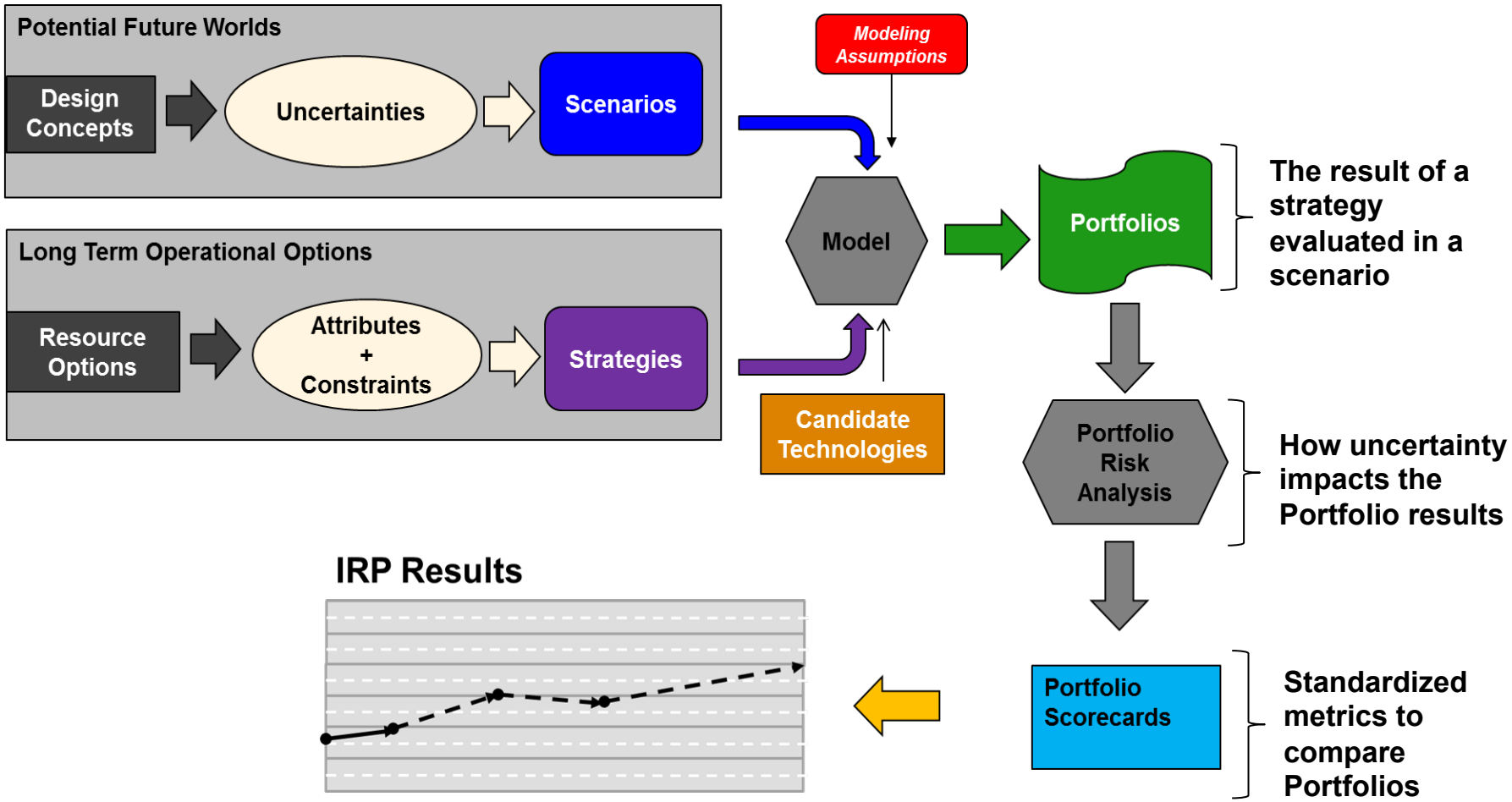
The 2015 IRP is intended to ensure transparency and enable stakeholder involvement.



Key tasks/milestones in this study timeline include:

- Establish stakeholder group and hold first meeting (Nov 2013)
- Complete 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)

How the Resource Planning Model Works

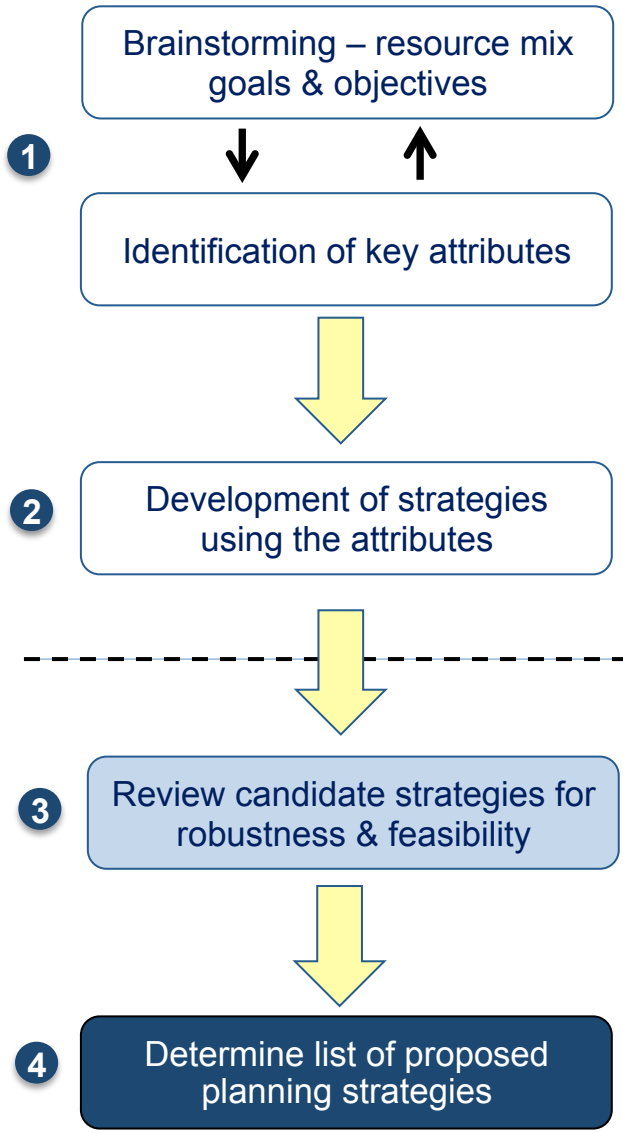


Scenarios Create Diverse Planning Futures

	Scenario Design Focus
Current Outlook	Captures the current outlook for the future TVA is using for resource planning studies
Stagnant Economy	Stagnant economy results in flat to negative growth, delaying the need for new generation
Growth Economy	Rapid economic growth translates into higher than forecasted energy sales and resource expansion
De-Carbonized 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
Distributed Marketplace	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

- This set of scenarios provides an adequate diversity of "futures" for the IRP study
- Work is nearly complete to translate the concepts outlined in each scenario (the scenario narrative) into forecasts of the key drivers, like power demand, commodity prices, environmental constraints, etc
  - Some additional refinement of these scenario forecasts was requested by the stakeholder working group
- The framework for the 5 scenarios should be final by the end of June.

TVA's Process for Building Strategies

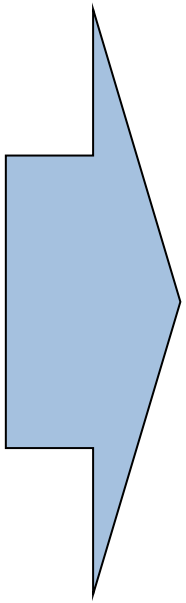


- The process starts by considering the current resource mix and how the mix might need to change over time
- Then certain components of the resource mix are selected as potential strategy design parameters, called attributes. Attributes are components that are used to shape the direction of the resource plan, like targets for EE or restrictions on the future use of nuclear.
- Describe the intent of each candidate strategy by defining the "value" of each attribute for that strategy
- Review attributes within the strategy for correlation; also compare attribute variability across all candidate strategies to ensure robust resource portfolios will be possible
  - Discuss draft strategies with stakeholders, collect input and perform ranking
- TVA selects a short list of strategies to be modeled

Developing the 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



	Proposed Strategies
A	The Reference Plan
B	Meet an Emission Target
C	Lean on the Market
D	Doing More EE
E	Focusing on Renewables

IRP 2015 Selected Strategies

STRATEGY	DESCRIPTION
A – The Reference Plan	• All resource options available for selection; traditional utility "least cost optimization" case
B- Meet an Emission Target	• 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
C - Lean on the Market	• 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
D - Doing More EE	• 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 EE (e.g., minimum contribution of 1% of sales)
E – Focusing on Renewables	• 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

Power Resource Options in the IRP

NATURAL GAS FIRED
- Simple cycle combustion turbine (CT3x)
- Simple cycle combustion turbine (CT4x)
- Combined cycle two on one (CC2x1)
- Combined cycle three on one (CC3x1)

COAL FIRED
- Integrated Gas Combined Cycle (IGCC)
- Pulverized Coal 1x8 (PC1x8)
- Pulverized Coal 2x8 (PC2x8)
- Integrated Gas Combined Cycle with Carbon Capture and Sequestration (IGCC CCS)
- Pulverized Coal 1x8 with Carbon Capture and Sequestration (PC1x8 CCS)
- Pulverized Coal 2x8 with Carbon Capture and Sequestration (PC2x8 CCS)

NUCLEAR
- Pressurized water reactor (PWR)
- Advanced pressurized water reactor (APWR)
- Small Modular Reactor (SMR)

HYDRO
- Hydro dam expansion project: Spill addition
- Hydro dam expansion project: Space addition
- Run of river

UTILITY-SCALE STORAGE
- Pumped-hydro storage
- Compressed air energy storage (CAES)

BIOMASS
- New direct combustion
- Repowering

SOLAR
- Utility-scale one-axis tracking photovoltaic
- Utility-scale fixed-axis photovoltaic
- Commercial-scale large photovoltaic
- Commercial-scale small photovoltaic

WIND
- Midcontinent Independent System Operator (MISO)
- Southwest Power Pool (SPP)
- In valley
- High Voltage Direct Current (HVDC)

Key Resource Specifications

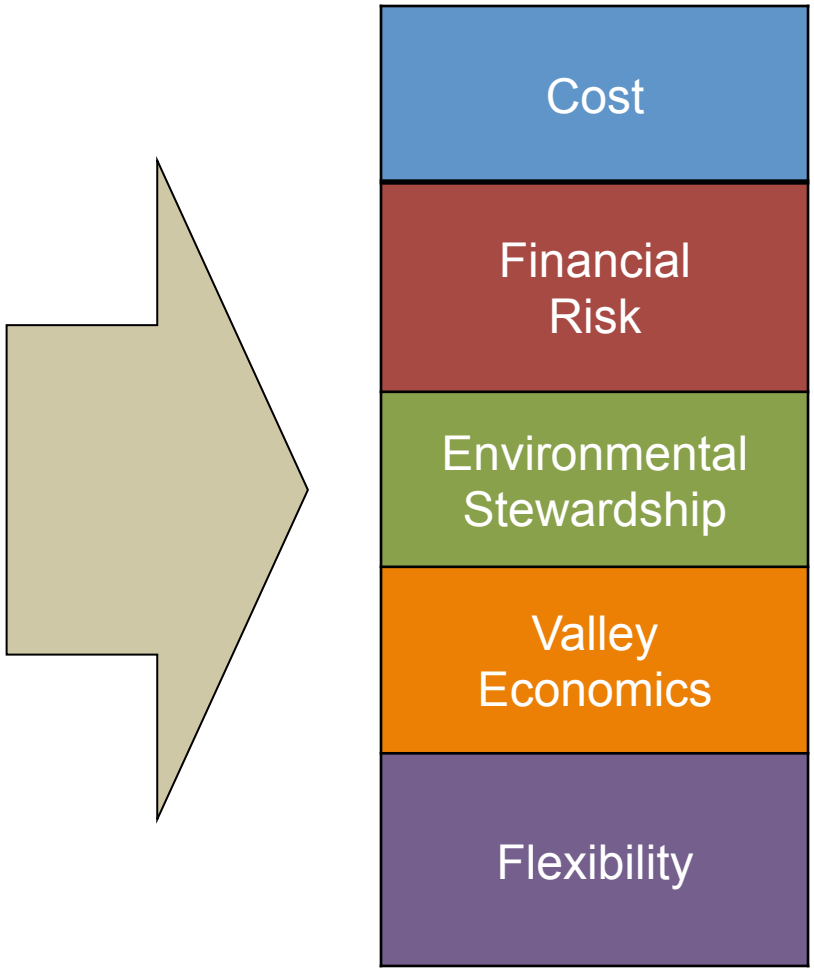
	Description	Form
Unit Characteristics		
Capacity	Nameplate capacity	MW
Heat Rate	Summer full-load heat rate	Btu/kWh
Unit Availability	First year available	Year
Outage Rate	Forced and planned outage rate	Annual %
Cost Characteristics (2013$)		
Capital Costs	Total overnight capital cost	Millions of $
	Transmission costs	Millions of $
	Total overnight capital plus transmission costs per unit	$/kW
Variable Costs	Non-fuel variable O&M rate	$/MWh
Fixed Costs	Variable fixed O&M rate plus fixed fuel transportation costs	$/kW-yr
Book life	Number of years a resource is expected to be in service	Yrs

Good, Better, Best: Choosing the Right Resource Plan

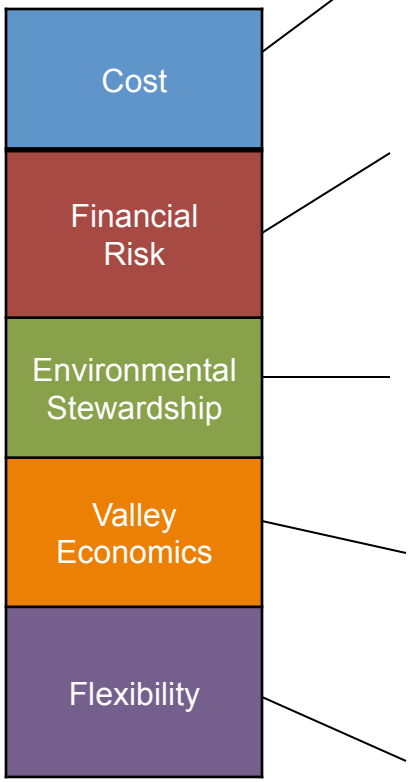
- The challenge is not insufficient data, but rather sorting through all the results to identify the preferred resource plan
- So how do you know when the plan is “good”? When is it “best” or “preferred”?
- And who decides that? Are the decision-makers well-grounded in the fundamentals of resource planning? 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!
- But those metrics need to be organized in a way that facilitates decision-making

Organizing IRP Study Metrics

- The least-regrets planning at TVA uses scenario analysis methods combined with a robust assessment of uncertainty to identify alternative resource plans
- These plans need to be evaluated using a broad set of criteria in order to determine the plan that best positions the utility for success in multiple future conditions
- TVA uses a scorecard designed to capture the key aspects of our mission as the mechanism to help decision-makers select the preferred resource plan
- It's unlikely any one single resource plan will score high in all criteria; variation in scores stimulate the trade-off discussion that leads to the choice of the preferred plan



Populating the Scorecard Categories



Cost includes both the long-range cost of the resource plan (present value of customer costs) as well as a look at short term average system cost (an indicator of possible rate pressure)

Financial Risk measures the variation (uncertainty) around the cost of the resource plan by assessing a risk/benefit ratio and computing the likely amount of cost at risk; both of these indicators use data from probability modeling

Stewardship captures multiple measures related to the environmental "footprint" of the resource plans, like air emissions and thermal loading impacts

Valley Economics computes the macro-economic effects of the resource plans by measuring the change in per capita income compared to a reference case

Flexibility is a measure of how responsive the generation portfolio of each resource plan is by evaluating the type/quantity of resources and the extent to which this mix can easily follow load swings

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)

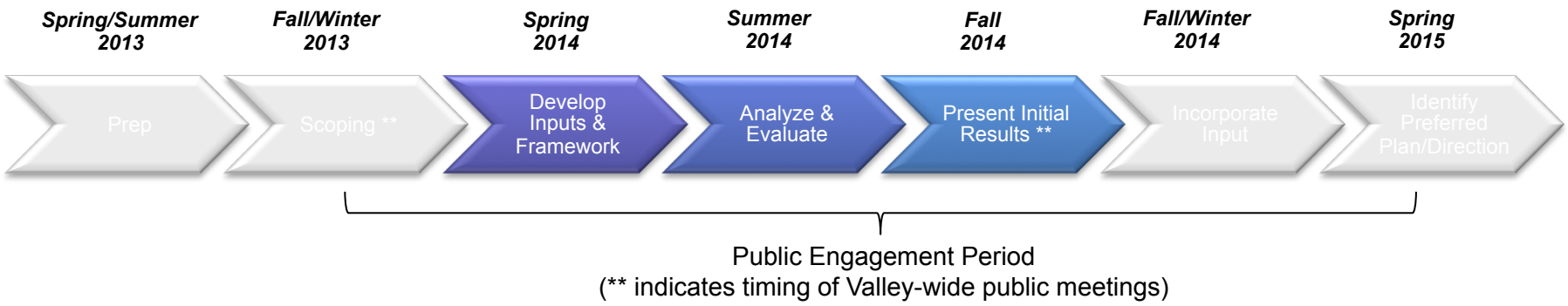
Evaluation Criteria	DEC 2013	FPL 2013	GPC 2012	PCQ 2013	PEC 2012	DOM 2013	ETR 2012	APS 2012
Financial Measures								
Present Value of Revenue Requirement (PVRR)	✓	✓	✓	✓	✓	✓	✓	✓
Cummulative CapEx								✓
Levelized Cost of Power (fixed & variable costs)							✓	
Price Growth					✓			
Shareholder Value			✓					
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								✓

Scorecard Design Concepts

- A scorecard is a visualization mechanism that facilitates decision making
- It should not be treated as an algorithm with a mechanical calculation
- It should strike a balance between summarizing and segregating information that facilitates the understanding & interpretation of the underlying analysis without requiring decision-makers to be familiar with all the details

- The scorecard design should make communication of the key information clear and understandable to stakeholders and the general public
- The structure of the scorecard can take several forms
  - Numerical
  - Visual/relational
  - A combination that can be weighted or un-weighted

IRP Next Steps



Key upcoming milestones include:

- Finalize the scorecard design and the ranking metrics
- Complete the modeling runs
- Publish draft Supplemental Environmental Impact Statement (SEIS) and IRP
- Set public meetings to discuss the draft findings

The next quarterly update is scheduled for September 2014

Thank you for attending today's session

For information about the 2015 IRP, or to submit comments, go to www.tva.gov/irp