



2015 INTEGRATED RESOURCE PLAN

Integrated Resource Plan

Working Group

November 5, 2013



Agenda

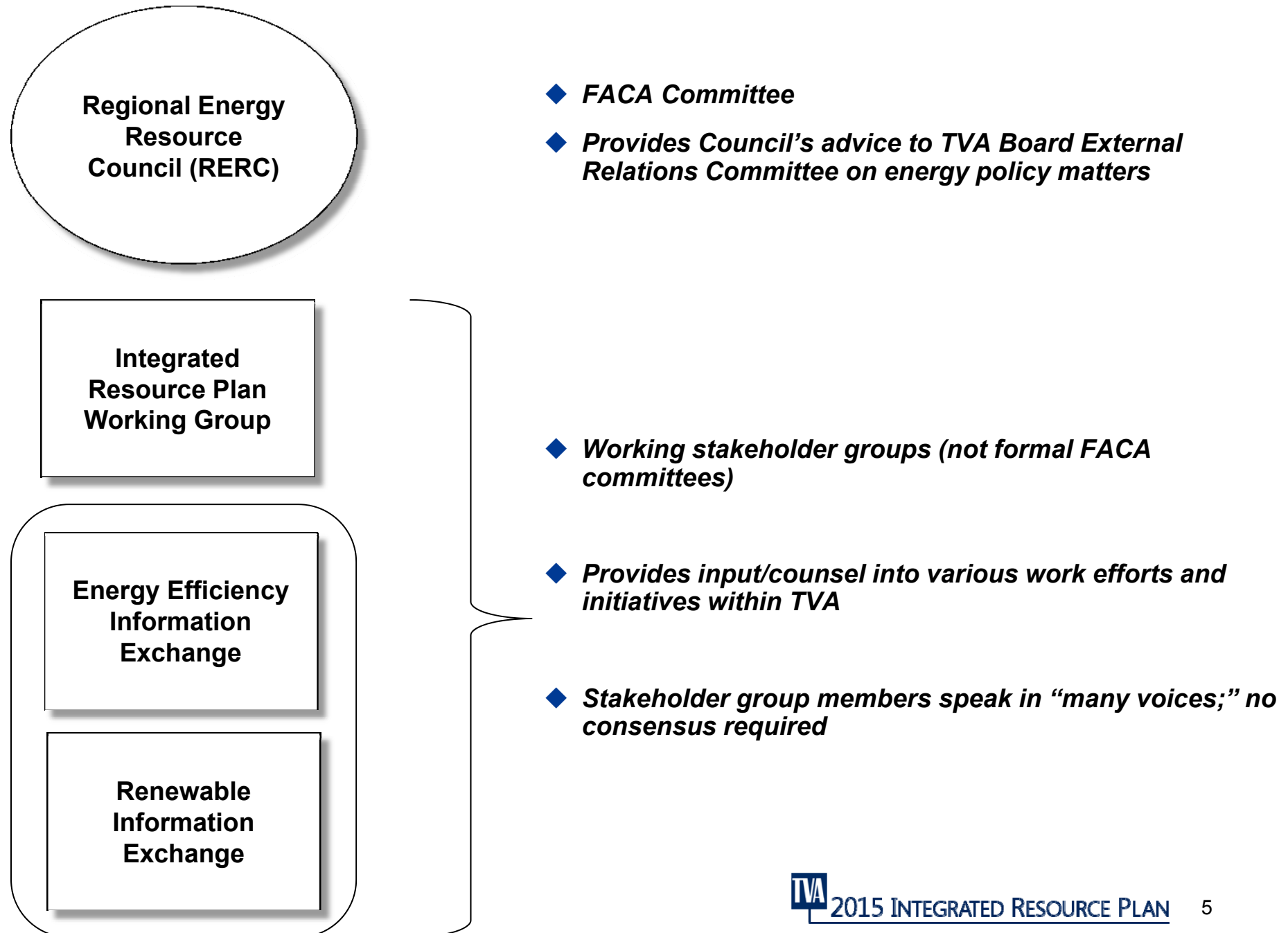
9:30-9:45am.	Welcome and Introduction	Randy McAdams
9:45-10:00am	Purpose of the IRPWG	Joe Hoagland
10:00-10:30am	IRPWD Protocols and Logistics	Randy McAdams
10:30-10:45 am	Information Sharing Protocol	Randy McAdams
10:45-11:00am	Break	
11:15-12:15am	What is Resource Planning?	Gary Brinkworth
12:15-1:00pm	Lunch	
1:00-2:00pm	Overview of the 2011 Integrated Resource Plan	Gary Brinkworth
2:00-2:15pm	Break	
2:15-3:15pm	2015 IRP Process and Schedule	Gary Brinkworth
3:15-3:45pm	Open Discussion/Review of Action Items	Randy McAdams

Purpose of the IRP Working Group (IRPWG)

- ◆ The IRP Working Group (IRPWG) is the main coordination mechanism between TVA and the different stakeholders throughout the whole planning process
- ◆ Members are expected to provide TVA with in-depth ongoing discussion and feedback on the IRP process, approach and assumptions
- ◆ Validates the assumptions behind the analysis and the recommendations
- ◆ Build efficiency into the planning process through real-time stakeholder's input



IRPWG Relationship to Other Stakeholder Groups



IRPWG vs. RERC: Roles and Responsibilities

	RERC	IRPWG
Purpose:	<i>Provide direction and advice on energy related items</i>	<i>Validate analysis behind resource planning recommendations</i>
Example Topics for Discussion:	<ul style="list-style-type: none"> ◆ Should TVA subsidize solar? ◆ Should the cost of Energy Efficiency be spread across all customer classes? ◆ What factors should TVA consider when evaluating nuclear options? ◆ Should TVA consider natural gas a primary generation option in the future? ◆ To bridge its future gap in capacity, should TVA focus on reducing load with EE/DR or building additional generation resources? 	<ul style="list-style-type: none"> ◆ How do we value solar for modeling purposes? ◆ How does Energy Efficiency affect future load growth? ◆ How does the cost of nuclear compare to the cost of installing controls on coal units? ◆ At what price point does natural gas generation become less favorable to coal? ◆ What is the load forecast and what factors are driving it?
Nature of Advice/Counsel:	<ul style="list-style-type: none"> — Is a FACA group, subject to FACA rules — Provides advice to the External Relations Committee of the Board — Speaks in one voice (develops consensus points of advice) 	<ul style="list-style-type: none"> — Comprised of many, individual voices — Members provide advice to the IRP team on methodology and assumptions regarding the IRP

Stakeholder & Public Involvement Similar to the 2011 IRP

Forum for Public Input

- ◆ Public Scoping Meetings
- ◆ IRP Working Group (and other stakeholder groups)
- ◆ Quarterly Public Briefings
- ◆ Draft IRP Public Comment Period
- ◆ External Web Page



Fall 2013

*Input will be
incorporated
throughout the
process*

Spring 2015

Expanded Stakeholder Engagement will be Employed

Team	Description / Interaction with IRP
<i>Regional Energy Resource Council (RERC)</i>	<ul style="list-style-type: none"> ◆ Provides high-level stakeholder input to TVA on strategic and environmental issues ◆ Will likely require regular briefings on the IRP
<i>Tennessee Valley Renewable Information Exchange (TVRIX)</i>	<ul style="list-style-type: none"> ◆ Discusses and provides TVA input on renewable options in the Valley ◆ Will develop data options for renewables by early 2014 and provide to the IRP team to include in modeling
<i>Energy Efficiency Information Exchange (EEIX)</i>	<ul style="list-style-type: none"> ◆ Helps TVA identify “best practices” in energy efficiency ◆ EEDR staff will take the best practices and create program blocks (load shapes, market penetration studies, etc.) to be used in IRP modeling
<i>IRP Working Group (IRPWG)</i>	<ul style="list-style-type: none"> ◆ Stakeholder group format similar to that used during 2011 IRP ◆ Consists of diverse stakeholders representing balanced interests ◆ Will meet regularly and serve as the working group for stakeholder input

Ground rules during the IRPWG meetings:

- ◆ Wait for your turn to speak, be respectful of others and refrain from interrupting while someone is speaking
- ◆ Express your own views
- ◆ Be succinct so that everyone has the opportunity to speak
- ◆ Try to offer alternatives that accommodates your interests and the interests of others. Members reserve the right to disagree with any position
- ◆ If you cannot attend a specific meeting, make an effort to send an informed alternate representative. If a member fails to attend three meetings in a row, TVA may seek a replacement

Agenda and Meeting Materials

- ◆ TVA will prepare each meeting agenda and logistics
- ◆ Meeting materials will be sent to all group members ahead of the meeting date using an external file sharing site

Third-Party Facilitator

- ◆ TVA shall engage a third-party facilitator to moderate all IRPWG meetings and workshops

IRPWG Protocols and Logistics (Cont'd)

Meeting Minutes and Action Items

- ◆ TVA shall appoint a reporter for each meeting, charged with capturing the discussion at a high level and any action items that result from the conversation
- ◆ Draft meeting summary and action items will be circulated prior to the next meeting

Frequency and Location of Meetings

- ◆ Meeting locations will likely rotate, with sites chosen in consultation with the IRPWG
- ◆ The IRPWG is expected to meet every 4 to 6 weeks.

Confidential Information

- ◆ TVA may desire, from time to time, to share confidential information relevant to the discussions with the IRPWG
- ◆ Such information shall be provided under a Confidentiality Agreement (*to be discussed later today*)

Public Involvement

- ◆ Meetings and working sessions of the IRPWG will not be open to the general public
- ◆ The general public will have an opportunity to make comments about the IRP during the public comment period of the IRP environmental review process
- ◆ In addition, members of the general public can submit written comments to the IRPWG
 - TVA will provide an address (both post and email) on its IRP website providing a place for such comments to be received
 - TVA will forward copies of all comments directed to the IRPWG to all members of the group

IRPWG Meeting Types

- ◆ *Working Sessions* – regular meetings that are not open to the general public
- ◆ *Workshops* – the IRPWG by majority vote, can request TVA hold additional “workshops” to provide more in-depth information on specific topics to those members who are interested in attending



Proposed Information Sharing Policy

- ◆ TVA is committed to share information required for the IRPWG to fulfill its objectives
- ◆ TVA will evaluate all requests in accordance with the IRPWG's purpose, sensitivity of the information, and time to assemble to determine an appropriate response
- ◆ A general guideline of information that will be shared is shown below

Type	General Definition	Treatment
Public Information	<ul style="list-style-type: none"> Information that is deemed suitable for public release or is already publicly available 	<ul style="list-style-type: none"> Will be provided
Confidential Information	<ul style="list-style-type: none"> Information that if released could reasonably be expected to have an adverse effect on TVA operations, assets or individuals 	<ul style="list-style-type: none"> Will be provided under a confidentiality agreement
Sensitive / Restricted Information	<ul style="list-style-type: none"> Information that if released could reasonably be expected to cause serious risk of harm to TVA operations, assets or individuals. Primarily, this is either: <ul style="list-style-type: none"> — Commercially proprietary information that could put TVA at a serious disadvantage in the marketplace — Information that would risk safety and security of assets or individuals 	<ul style="list-style-type: none"> Will not be provided



Non-Disclosure Agreement

Purpose

- ◆ Facilitate IRP deliberations by providing access to sensitive information regarding TVA's operations or assets
- ◆ Helps TVA maintain confidentiality of the sensitive information
- ◆ Written information
 - marked "IRP Workgroup Confidential"
- ◆ Oral information
 - stated by TVA to be confidential

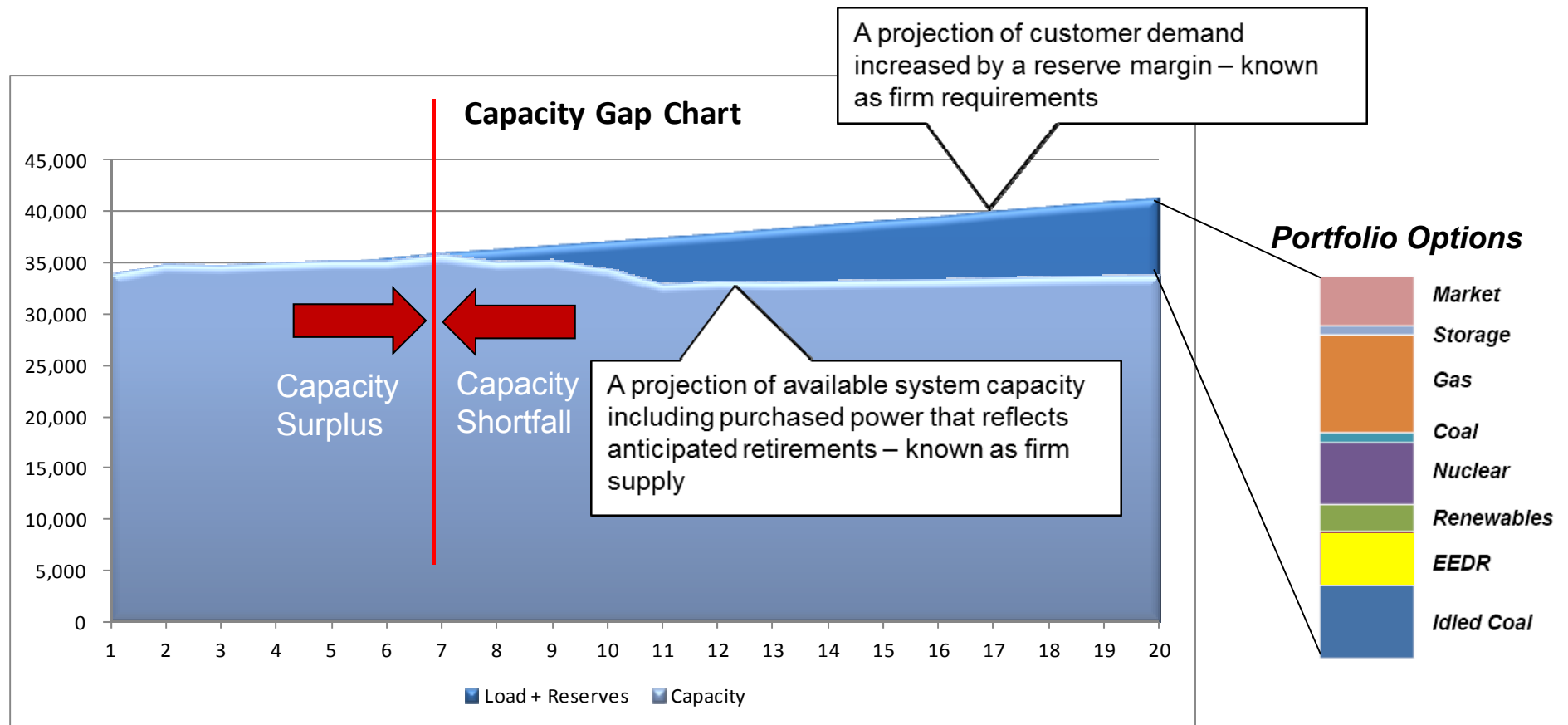
IRPWG Member Obligations

- ◆ Keep information confidential
- ◆ Safeguard information
- ◆ Upon request, return information to TVA
- ◆ If not requested by TVA, destroy information after its use in IRP deliberations
- ◆ Member may share information with its representatives only for purpose of evaluating IRP
- ◆ Return signed copies (with signatures of member and its representatives) at next IRP Workgroup meeting

Proposed NDA can be found in your notebooks (and on the file sharing site)

Resource Planning Addresses Future Capacity Needs

Resource planning is about optimizing the capacity mix



Projections of capacity needed are filled by the most cost-effective resource.

Recommended path provides low cost, diversity and flexibility

Why This Is Important to Customers

- ◆ Planners are essentially developing a road map for TVA. This road map will guide decision makers and support TVA's overall mission:
 - Low cost reliable power
 - Environmental stewardship
 - Economic development
- ◆ This road map outlines changes that, if implemented, will impact the cost to produce the power and the net 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



Resource Planners Solve Puzzles

In order to elaborate the plan, multiple analyses and assumptions need to be considered:



- ◆ How much energy will our customers use in the future?
- ◆ What alternatives do we have to meet our resource needs?
- ◆ Are there strategic considerations that will limit the alternatives we can consider?
- ◆ How do we properly evaluate these resource alternatives?
- ◆ How do we find the best solution? Which plan (portfolio) do we select?

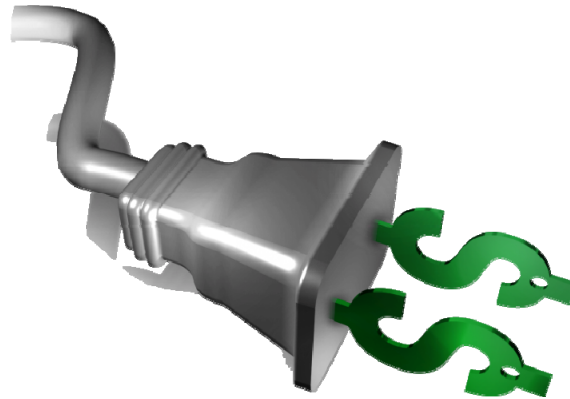
Finding the Least Cost (Optimum) Resource Plan

Using the reliability limit as a constraint, we optimize by minimizing the customer's delivered cost of power

The Planning Objective Function:
Minimize Exp (PV (Revenue Requirements))
or Min E (PV (RR))

Components

- ◆ Optimization
- ◆ Uncertainty
- ◆ Time value of money

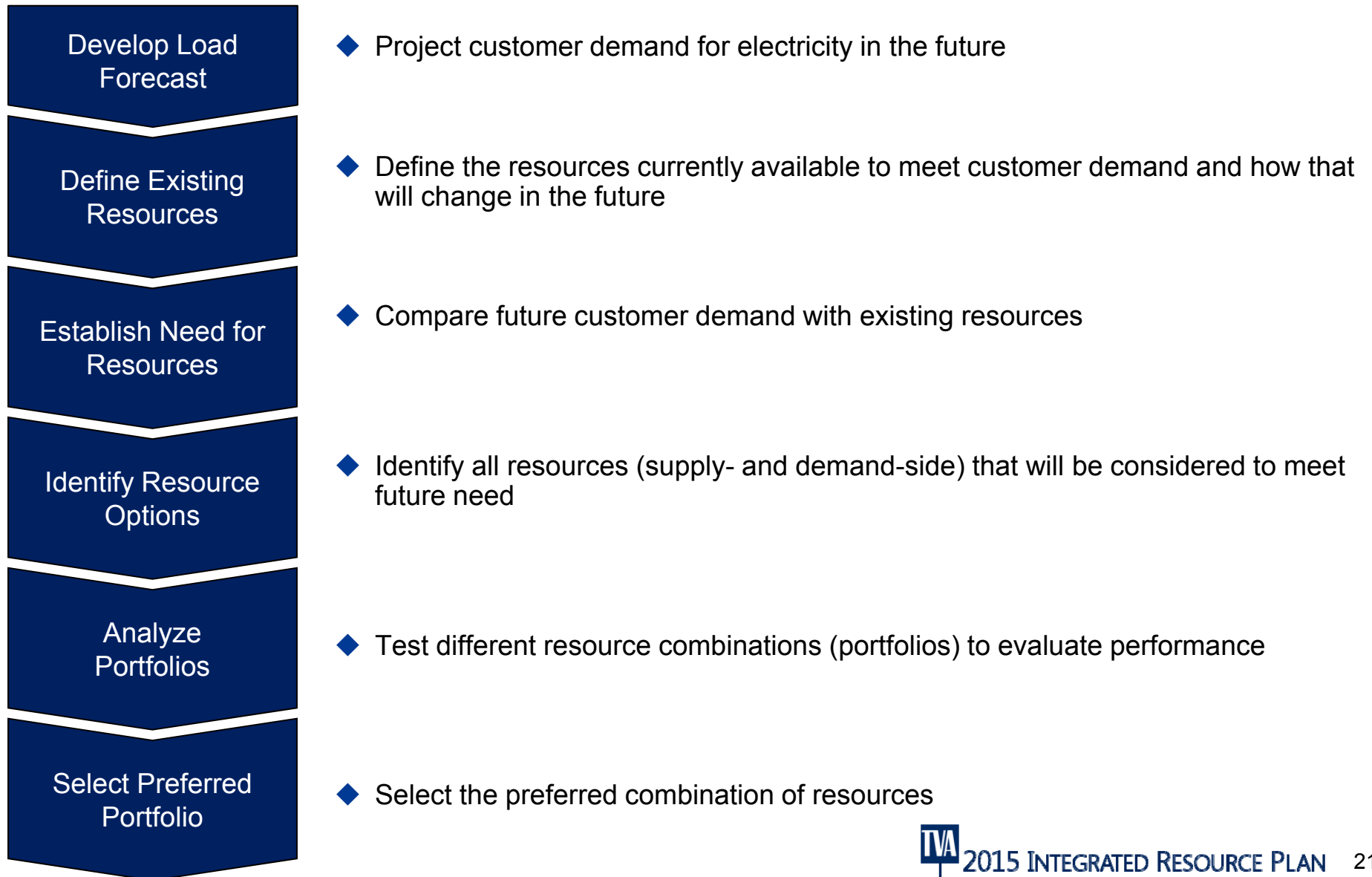


- ◆ Revenue requirements
 - Operating expenses
 - Return *of* and *on* capital
- ◆ Constraints
 - Planning reserve

The objective is to find the capacity mix that will produce the minimum cost over the planning horizon

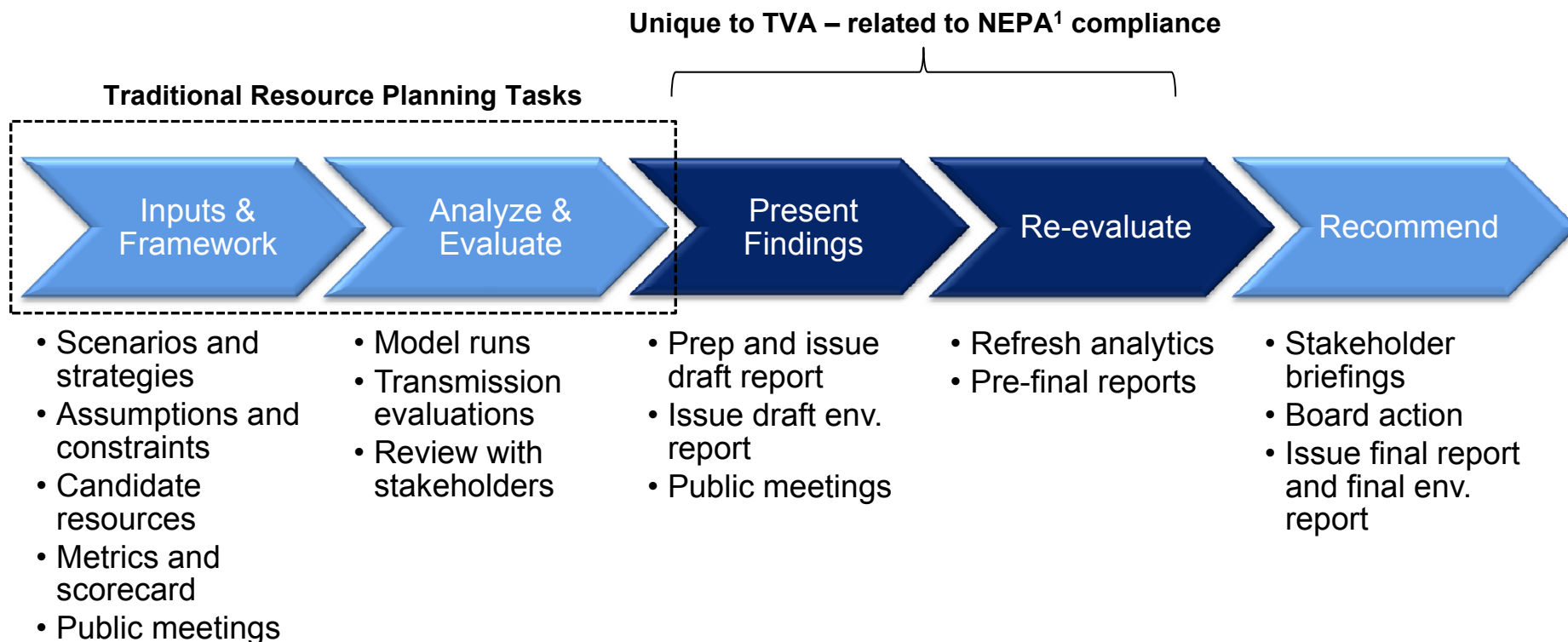
The Resource Planning Process

Resource Planning is a common tool in the utility industry to identify the least cost solution to meet customer demand over a long horizon (usually 20 years).



IRP Process Flowchart at TVA

An IRP is a special form of resource planning that seeks to optimize supply-side and demand-side contributions to make up a least cost plan. TVA's process for conducting an IRP differs slightly from what's typical in the industry.



Least regrets planning requires selecting scenarios based on a range of plausible futures rather than the most likely case used in traditional least cost planning.

1 – National Environmental Policy Act

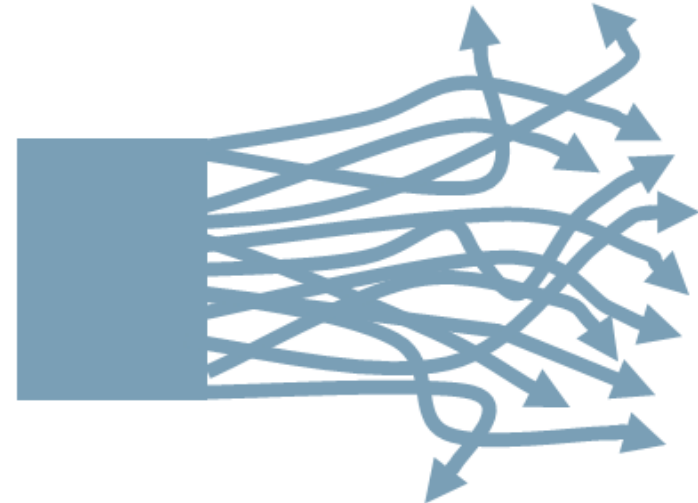
A Maze of Future Possible Paths

- ◆ 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

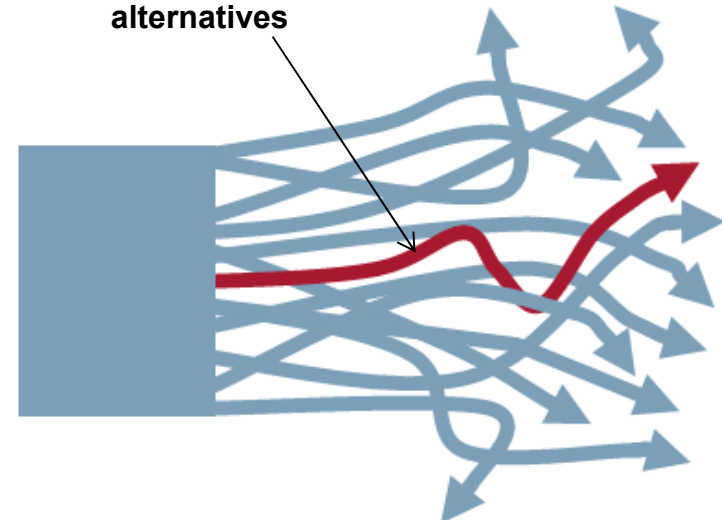
- ◆ These drivers interact with each other and with still unknown drivers that will emerge in coming years. The result is a business environment that could evolve along any number of different paths

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

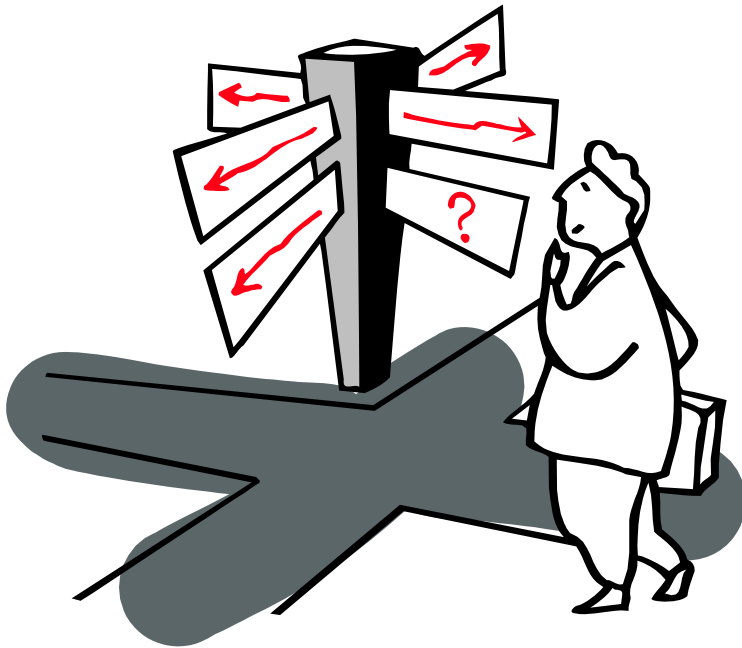
- ◆ This approach is fraught with risks, since commitment to a single forecast could serve as a straitjacket for strategic thinking and significant business risks could be ignored



Adopting this single path forward could be the right choice, but if the future evolves along one of the other paths, we will be locked in with few alternatives



The Scenario Planning Approach



- ◆ Scenarios allow us to bound 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
- ◆ Commonality across scenarios concerning near-term decisions give some comfort that decisions are less “*risky*” and less leveraged to specific futures

“Scenarios are stories. They are works of art, rather than scientific analyses. The reliability of (their content) is less important than the types of conversations and decisions they spark...”

- Arie de Geus, The Living Company

“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

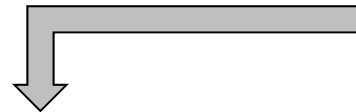
A well-designed strategy will perform well in many possible scenarios

Findings Presented Using Scorecard Metrics

- ◆ Modeling results facilitate a discussion/debate about trade-offs that lead to the selection of the preferred resource plan. Key metrics are used to enable this trade-off discussion
- ◆ 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”
- ◆ IRP scorecards are developed to reflect components of TVA’s mission and strategic principles

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

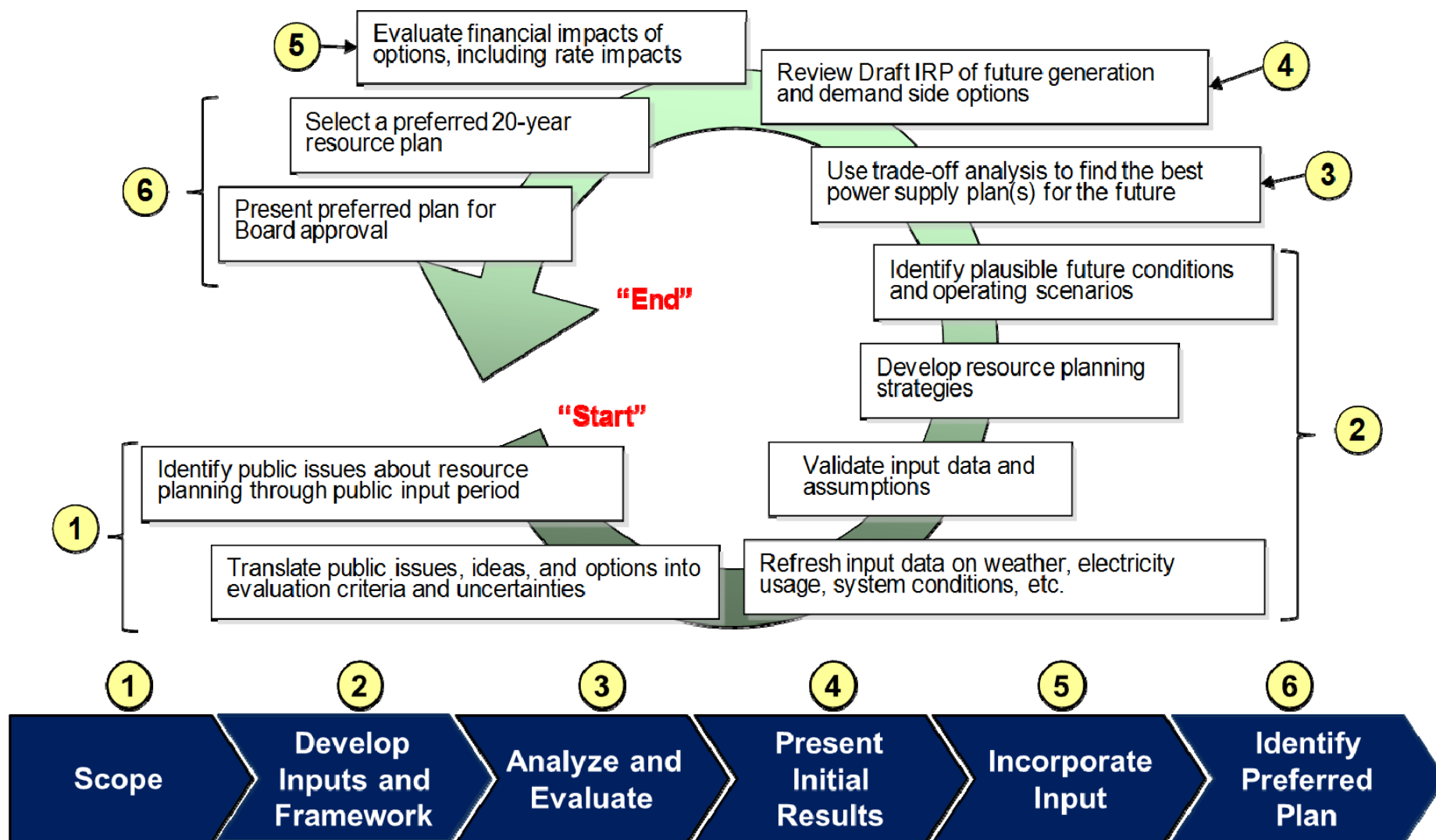
Scorecards evaluate the performance of a strategy across many different scenarios



Example Scenario Scorecard

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			

2011 IRP Study Process



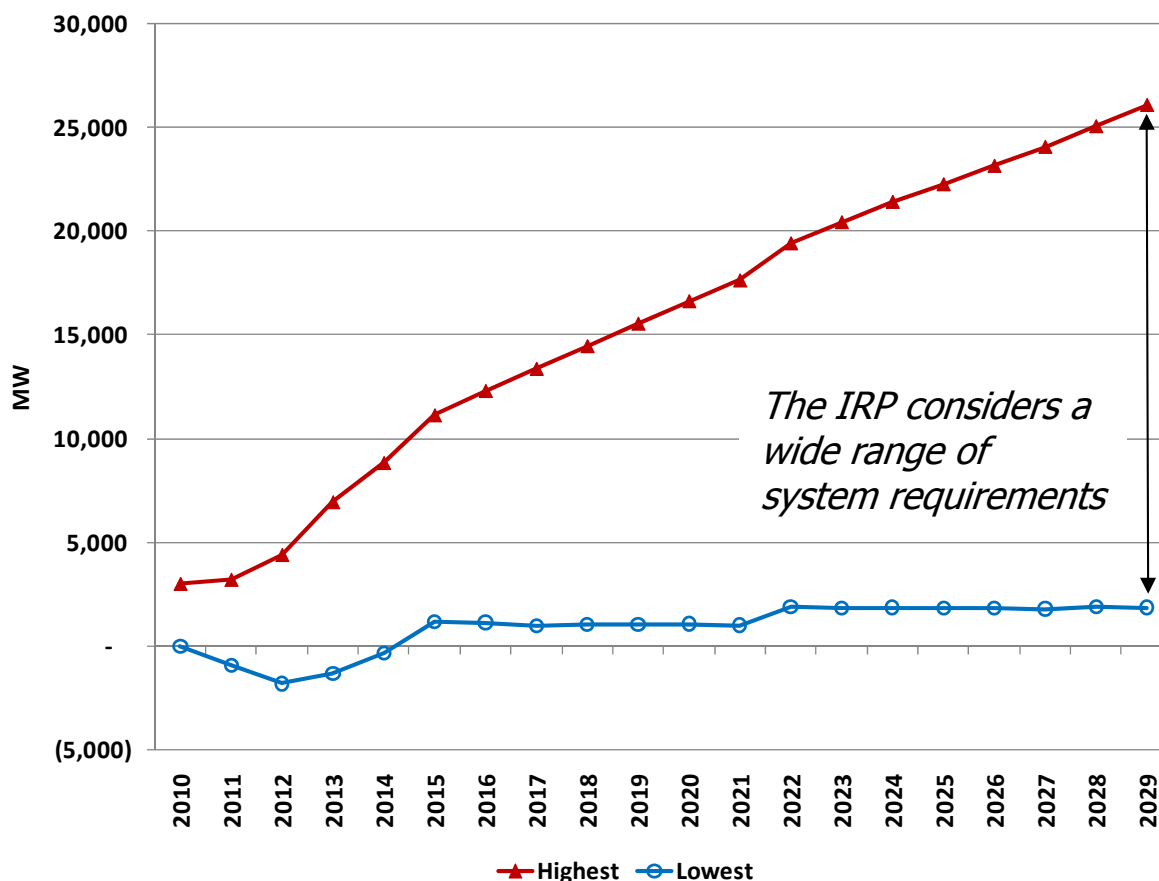


The 2011 IRP Considered Wide-Ranging Demand Scenarios

Scenarios

- 1 – Economy Recovers Dramatically
- 2 – Environmental Focus is a National Priority
- 3 – Prolonged Economic Malaise
- 4 – Game-Changing Technology
- 5 – Energy Independence
- 6 – Carbon Regulation Creates Economic Downturn

Range of Capacity Need



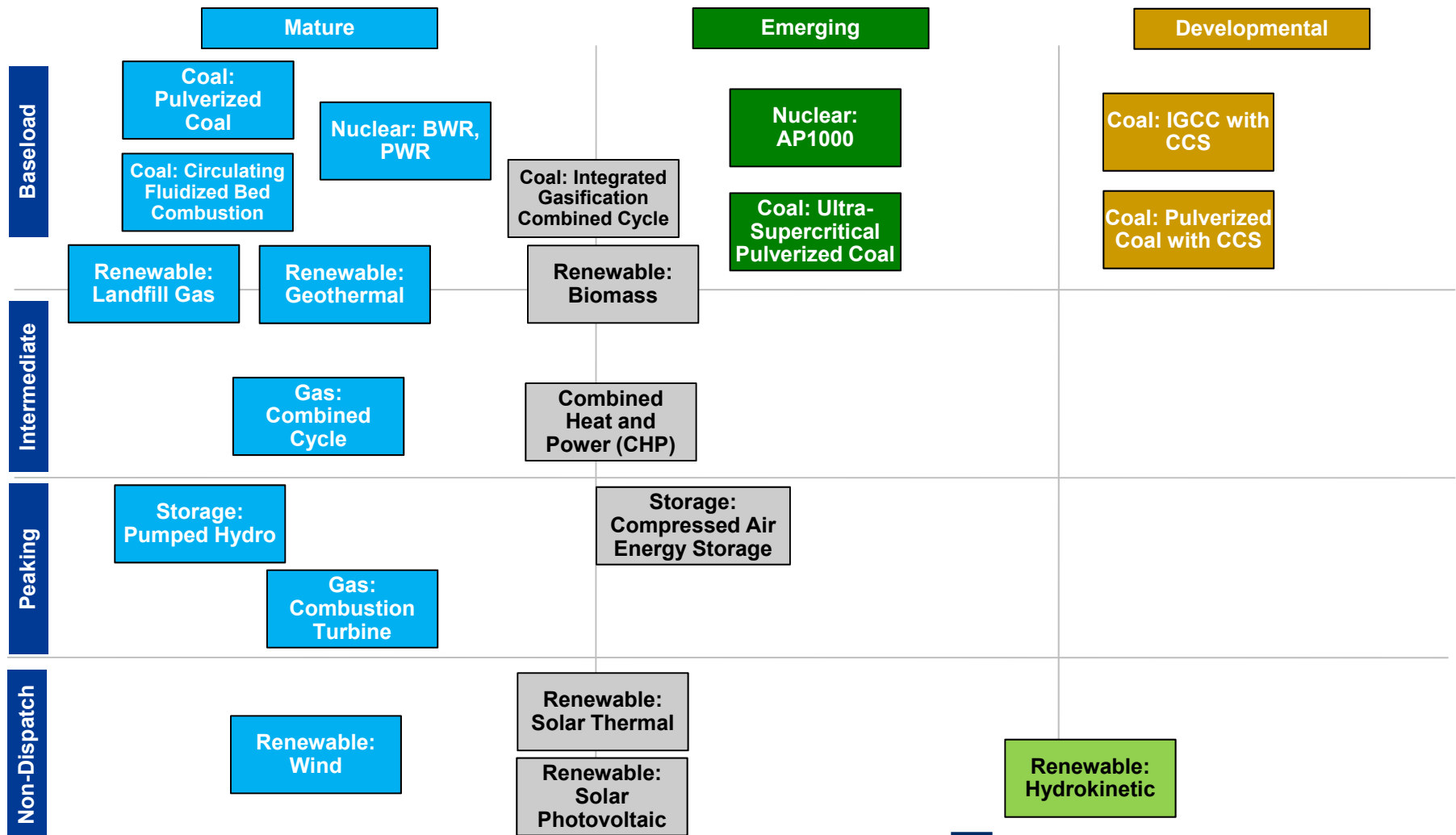
Scenarios consider a broad range of possible futures that include everything from strong economic growth to negative growth



A Wide Variety of Resource Options Were Evaluated As Well

Capacity resources included traditional generation, renewables as well as demand-side options.

Example of Resources Options Used during the 2011 IRP



Diverse Planning Strategies Were Tested

Planning Strategies

A – Limited Change in Current Resource Portfolio

B – Baseline Plan Resource Portfolio

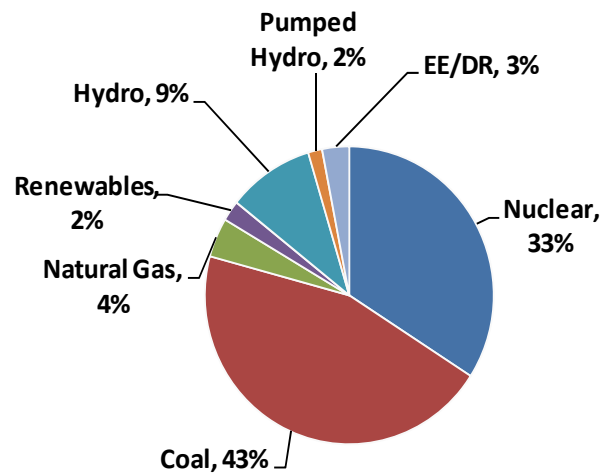
C – Diversity Focused Resource Portfolio

D – Nuclear Focused Resource Portfolio

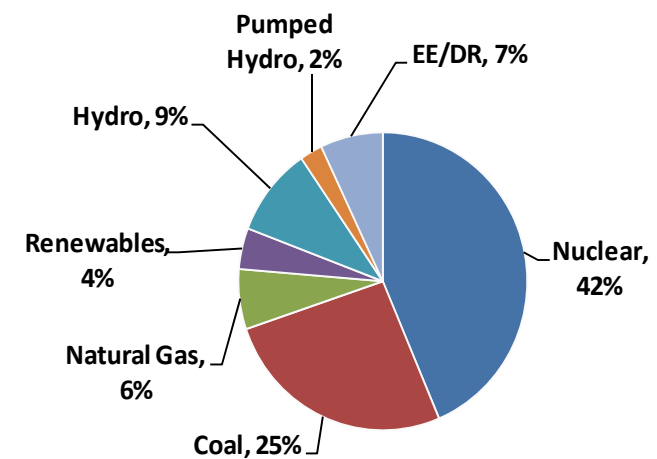
E – EEDR and Renewables Focused Resource Portfolio

Potential Energy Mix in 2025

Limited Change Example¹



Significant Change Example¹



Planning strategies are diverse and consider business options that range from limited to significant changes in current resource mix

¹Percentages do not include contribution of power purchases

2011 Recommended Planning Direction

Component	Guideline MW Range	Window of Time	Recommendations
Energy Efficiency/ Demand Response	3,600-5,100 (11,400-14,400 GWh)	By 2020	◆ Expand contribution of energy efficiency/demand response in the portfolio
Renewable additions	1,500-2,500	By 2020	◆ Pursue cost effective renewable energy
Coal capacity idled	2,400-4,700	By 2017	◆ Consider Increasing amount of coal capacity idled
Energy storage	850	2020-2024	◆ Add pumped storage hydro capacity
Nuclear additions	1,150-5,900	2013-2029	◆ Increase contribution of nuclear generation
Coal additions	0-900	2025-2029	◆ Preserve option of generation with carbon capture
Natural gas additions	900-9,300	2012-2029	◆ Utilize natural gas as an intermediate supply source
Market purchases	1,300-4,700	2013-2029	◆ Utilize cost effective market purchases to supplement TVA owned supply

**Additional details about Recommended Planning Direction components are included in the 2011 IRP*

What TVA Did with the 2011 IRP Recommendations

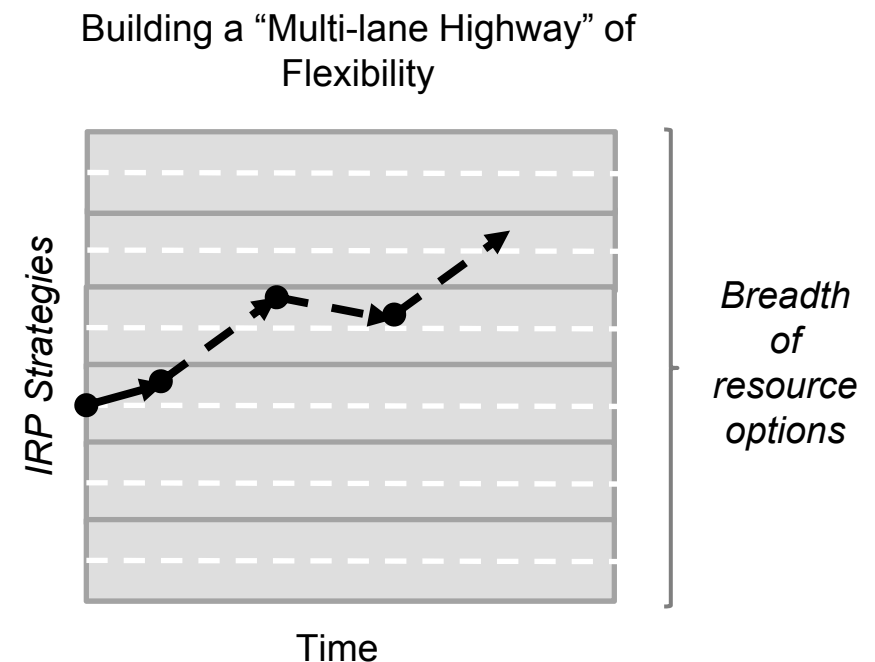
Component	Recommendations
Energy Efficiency/ Demand Response	◆ Expand contribution of energy efficiency/demand response in the portfolio
Renewable additions	◆ Pursue cost effective renewable energy
Coal capacity idled	◆ Consider Increasing amount of coal capacity idled
Energy storage	◆ Add pumped storage hydro capacity
Nuclear additions	◆ Increase contribution of nuclear generation
Natural gas additions	◆ Utilize natural gas as an intermediate supply source
Market purchases	◆ Utilize cost effective market purchases to supplement TVA owned supply



TVA's current resource mix and long-term resource plan reflect adoption of the recommendations outlined in the last IRP

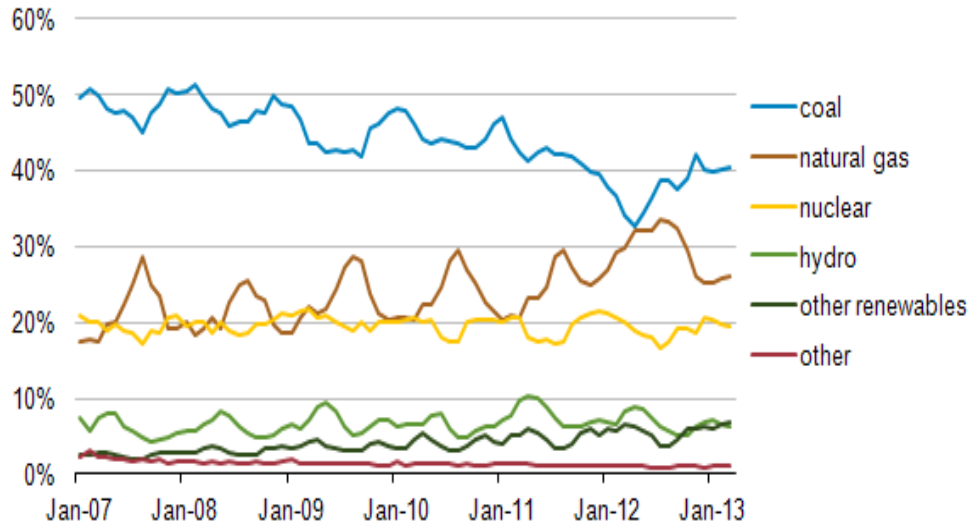
Significant Changes in the Electric Industry Drive the Need to Refresh the 2011 IRP

- ◆ While the recommendations from the 2011 IRP study remain valid, significant changes occurred that motivated TVA to refresh the study now:
 - Abundant supplies of natural gas from shale deposits
 - A decline in electricity demand growth industry-wide and in the Tennessee Valley region,
 - A new schedule for completing Watts Bar Nuclear Unit 2
 - TVA's clean-air commitments to retire some less-efficient coal capacity by 2019
- ◆ Structural trends in the electrical sector such as distributed generation, demand response and energy efficiency program are evolving rapidly, reshaping the equation between supply and demand
- ◆ More stringent environmental regulations continue to be implemented while there is increasing pressure on maintaining competitive rates
- ◆ TVA elected to refresh the IRP analysis about a year ahead of schedule to better position the utility to respond to future events

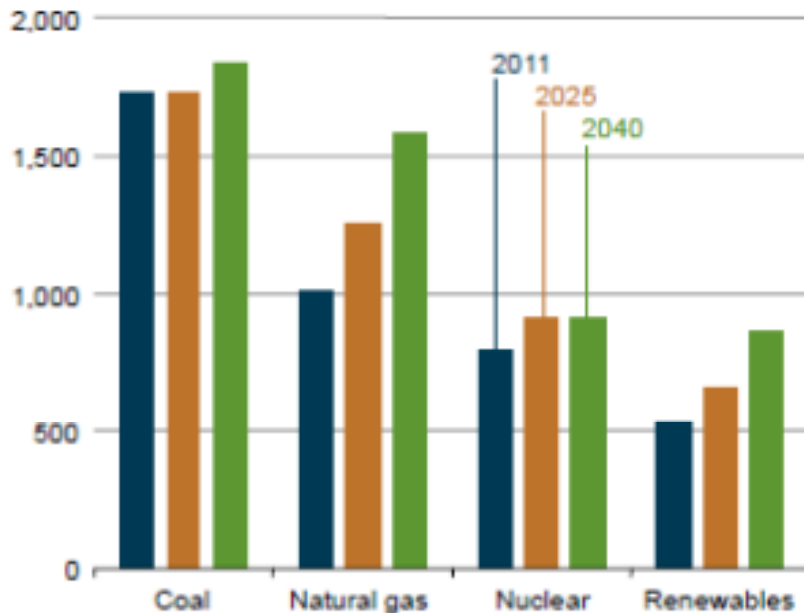


TVA Natural Gas Will Increase Its Share of Power Generation over the Next Two Decades

U.S. monthly net electric power generation, January 2007 - March 2013
percent share



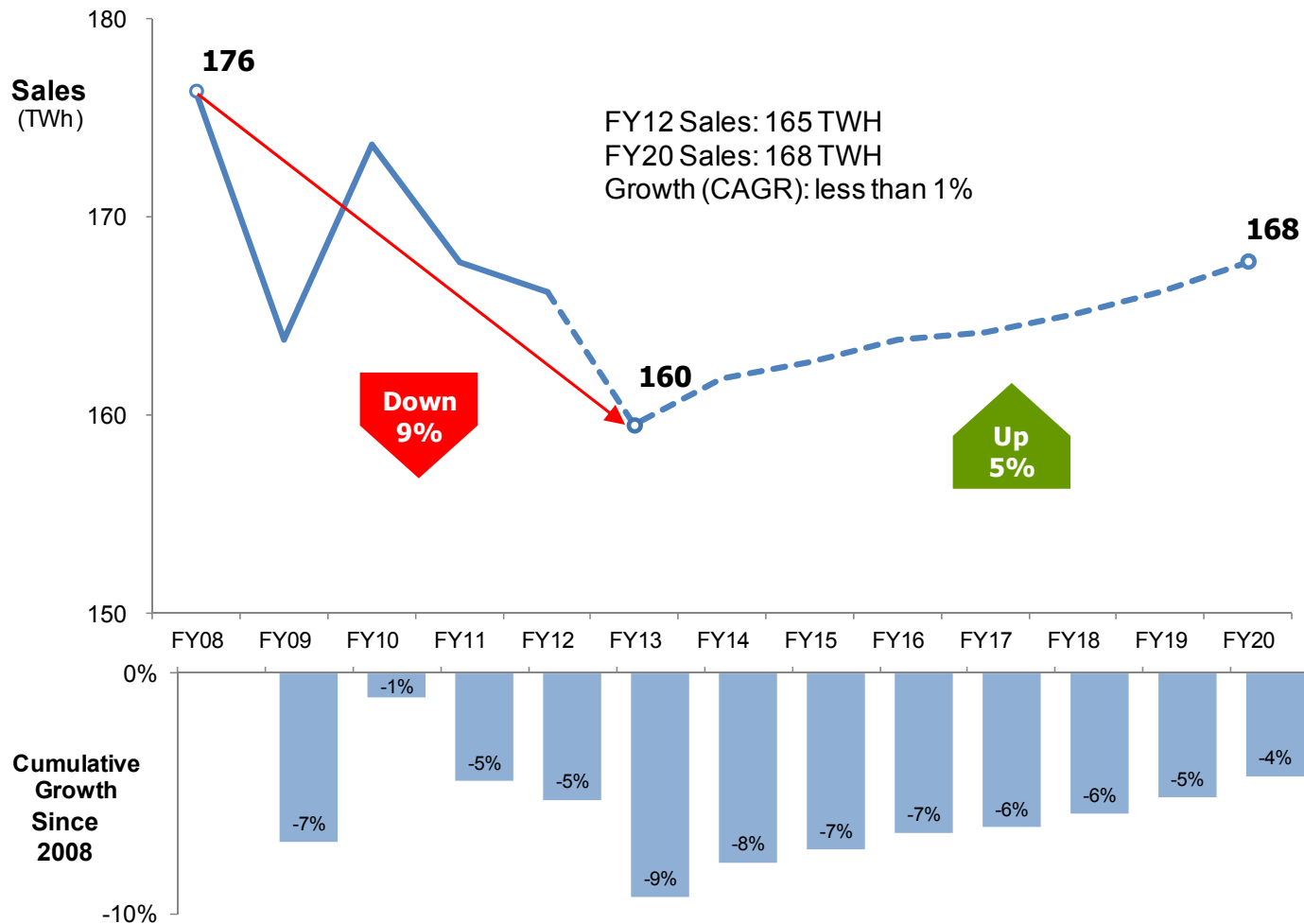
Electricity Generation by fuel: 2011,2025,2040 (BWh)



- ◆ In the first half of 2012 the abundance of gas and record low prices produced the highest level of electricity production generated from gas (33%)
- ◆ Since then, a combination of higher prices for natural gas and increased demand for electricity during the summer months led electric systems across much of the country to increase their use of coal-fired units
- ◆ According to American Electric Power Co., utilities start to switch back to coal once natural gas prices are between \$3 and \$3.25 per MMBtu
- ◆ On the other hand, new environmental regulations are putting a lot of pressure on coal. Roughly 4,335 megawatts (MW) of coal-fired power generation is slated for retirement over the next two years. This capacity will be offset by new gas-based generation capacity
- ◆ Analysts predict this to be a sustained trend in the long term. EIA in its recent 2013 Energy Outlook estimates that generation from natural gas increases by an average of 1.6 percent per year from 2011 to 2040

The Economic Environment Points to a Slow Recovery

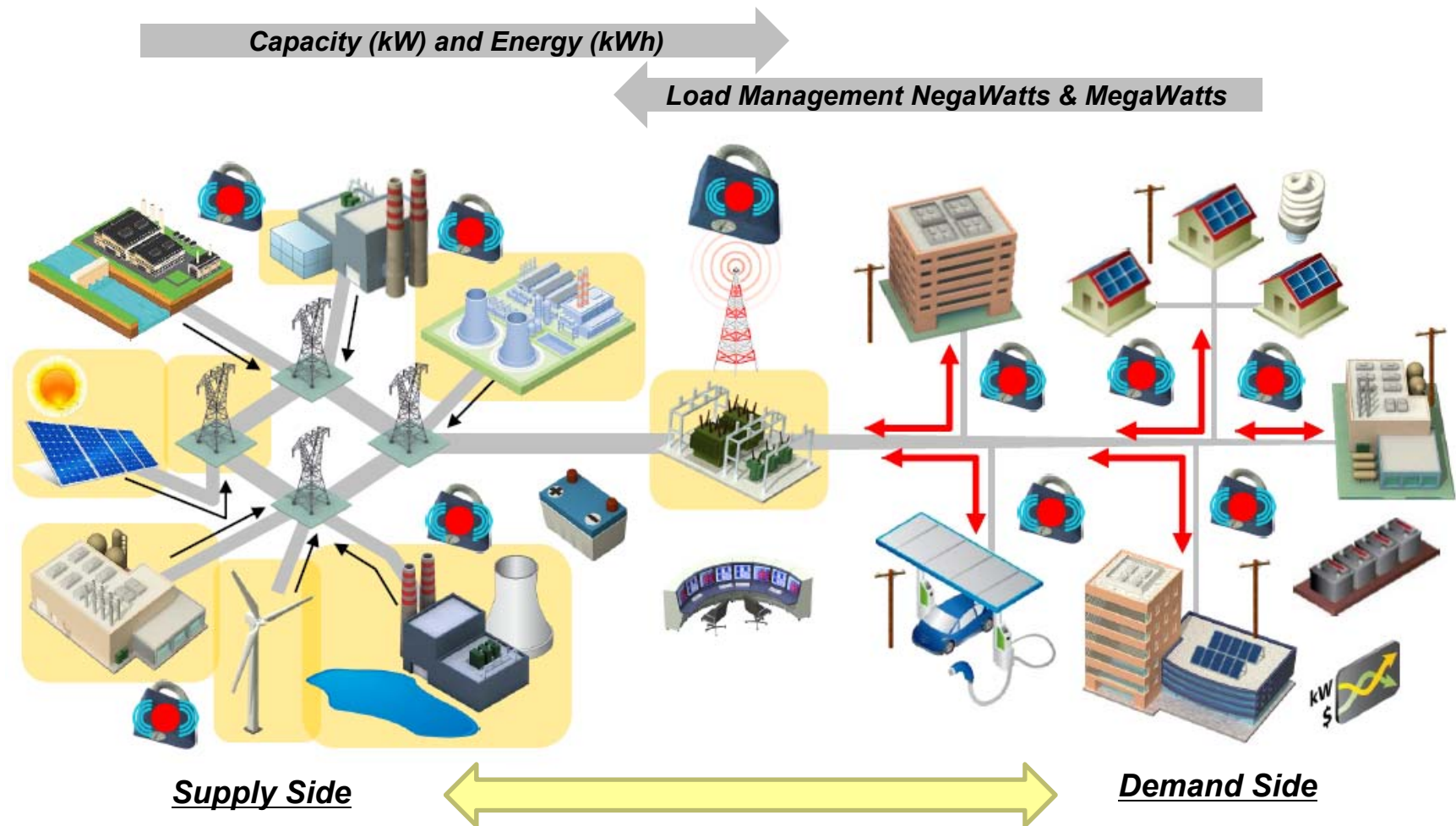
Challenge: Slow economic recovery and lower sales



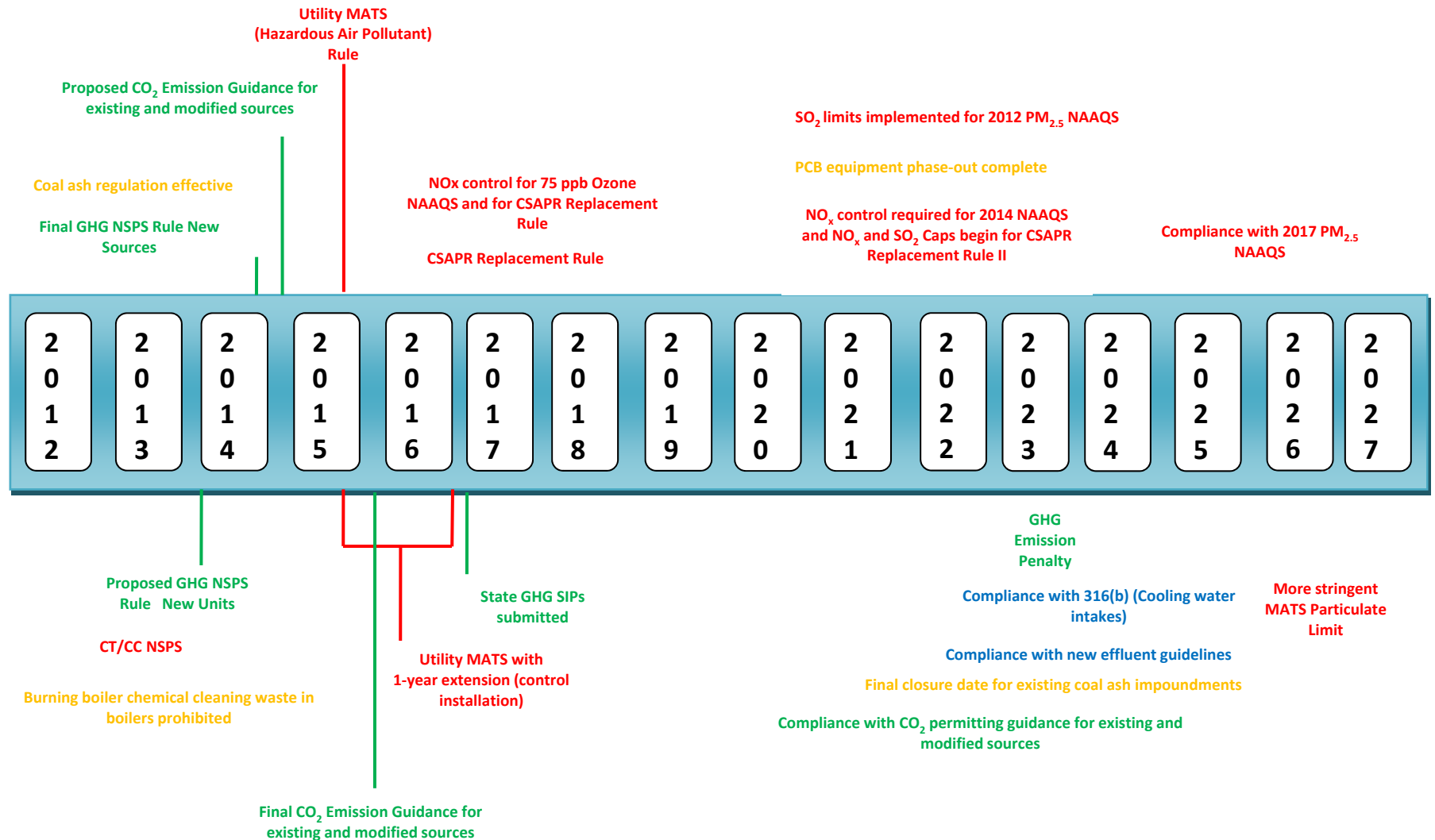
Sales do not return to FY08 levels until beyond 2020

A Multidirectional Electric System Is an Evolving Reality

TVA is operating in an environment in which renewables, energy efficiency (EE), distributed generation, demand response (DR) are managed by multiple entities



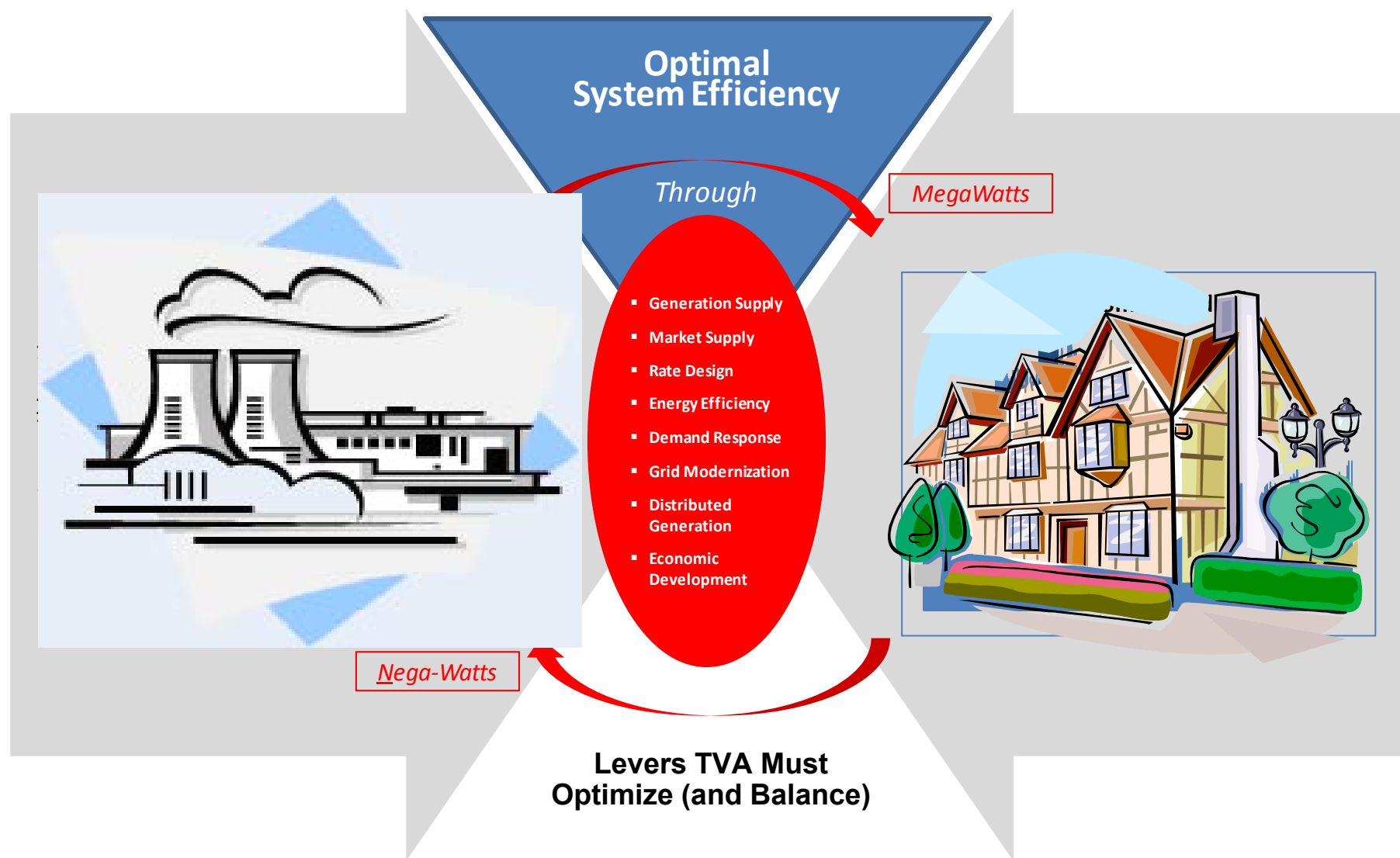
The Plan Needs to Keep Addressing Emerging Environmental Regulations



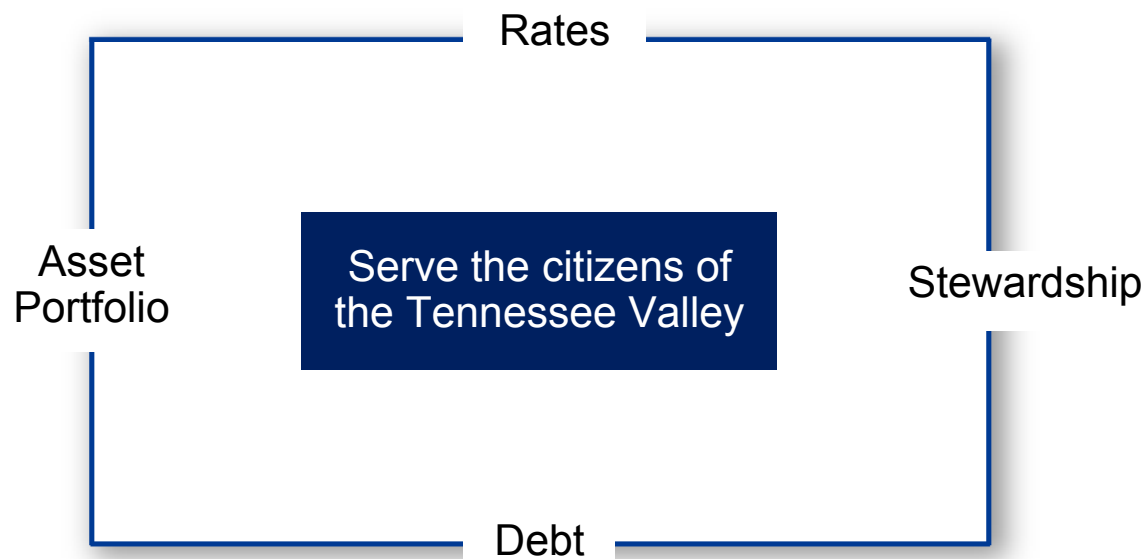
Legend	
■	Air
■	Water
■	Waste
■	Climate

- Future rules are hard to predict
- Costly and difficult to comply
- Introduce uncertainty and risk into planning and future operations

This Environment Requires Optimizing Multiple Levers in Order to Balance Supply and Demand-side Resources



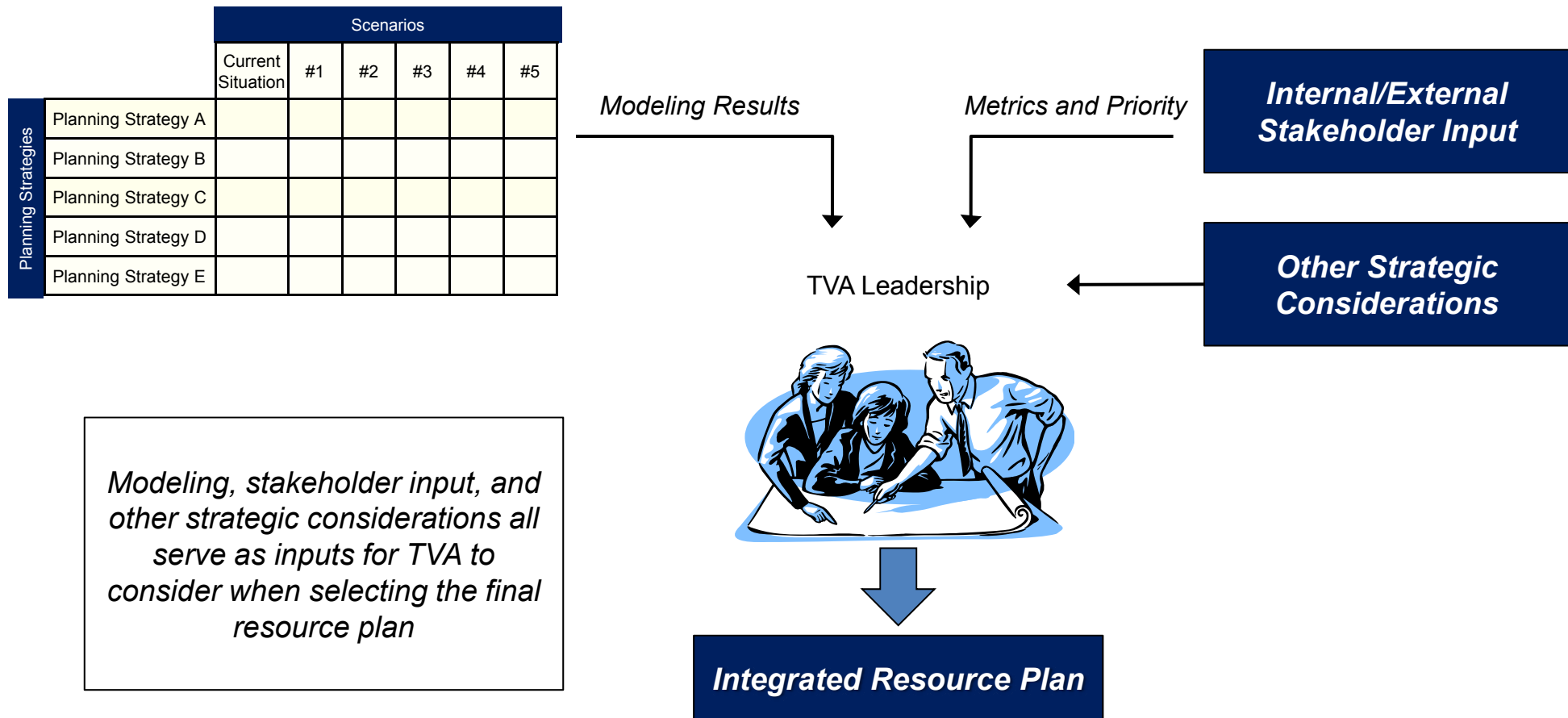
The 2015 IRP Must Be Consistent with TVA's Key Strategic Imperatives



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

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



Developing Scenarios and Strategies for the 2015 IRP

About Scenarios

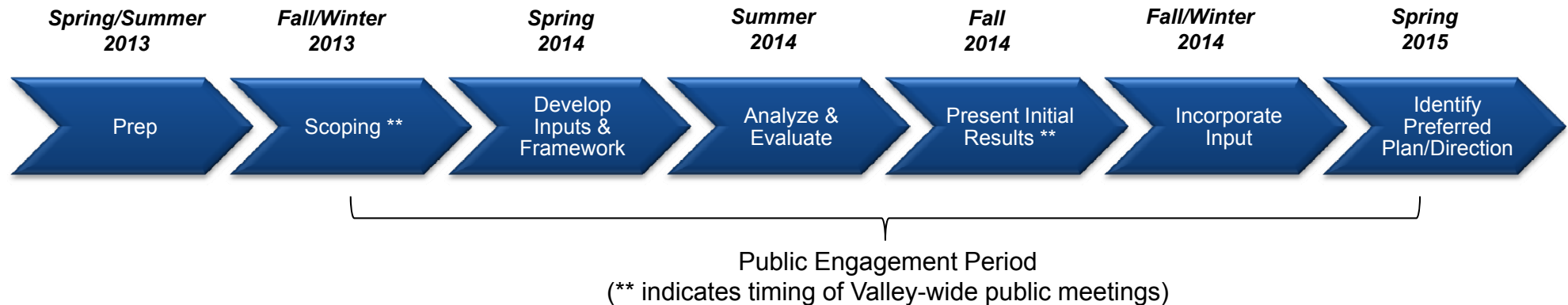
- ◆ Scenario design is underway
- ◆ Objective is to develop a set of plausible futures that are distinct enough from each other that substantively different plans will result
- ◆ Work plan is targeting the selection of no more than 5 scenarios for use in the IRP study
- ◆ IRPWG will get a basic orientation to the candidate list of scenarios and in a follow up meeting will be asked to identify their top 5

About Strategies

- ◆ Strategy development is in the initial stages
- ◆ Cross-functional team is debating key attributes that should be tested thru strategy design
- ◆ Work plan is targeting the selection of no more than 5 strategies for use in the IRP study
- ◆ IRPWG will get a basic orientation to the candidate list of strategies and in a follow up meeting will be asked to identify their top 5

2015 IRP Schedule: Major Project Phases and Milestones

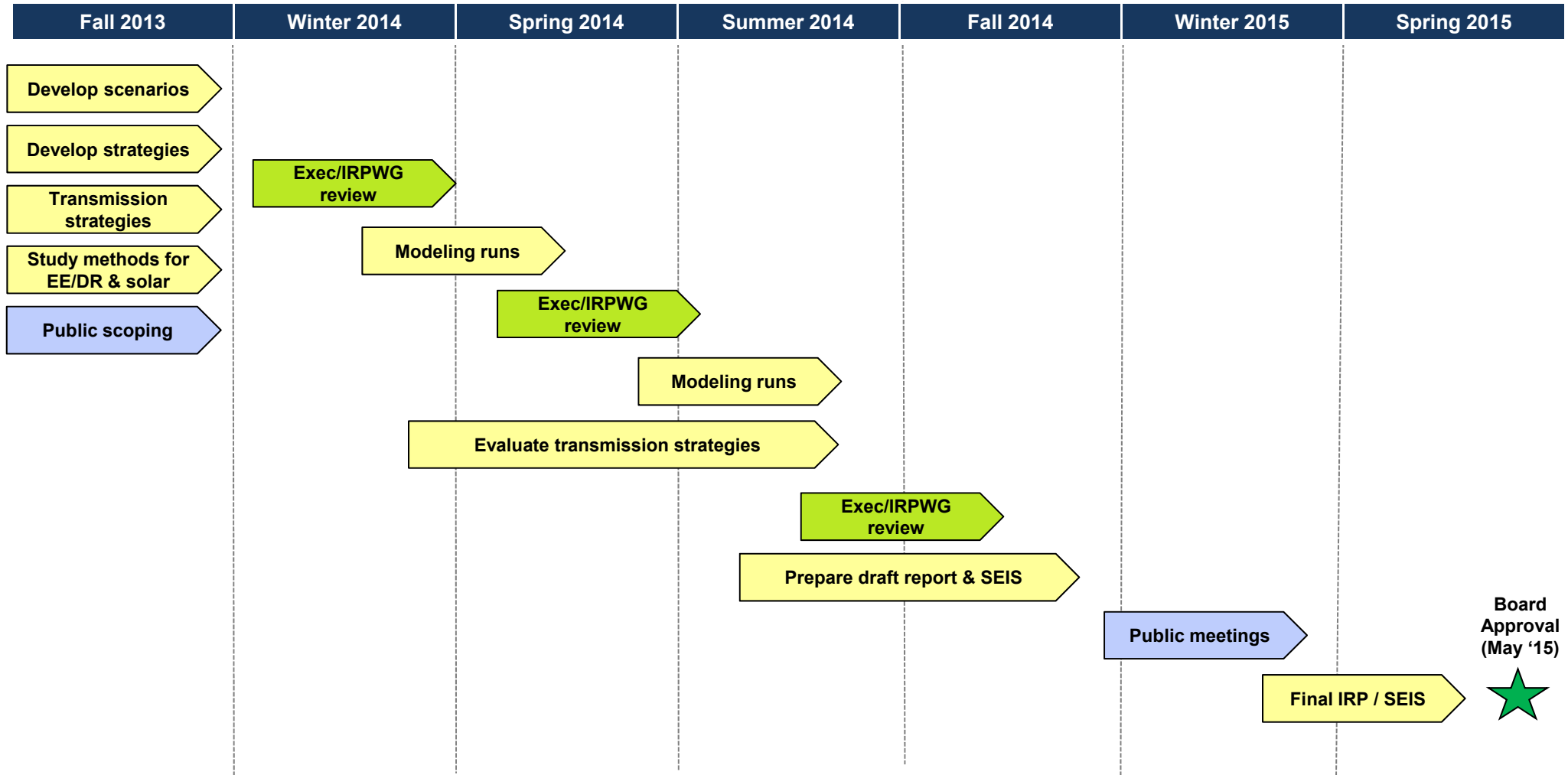
The 2015 IRP is intended to ensure transparency and enable stakeholder involvement.



Key tasks/milestones in this study timeline include:

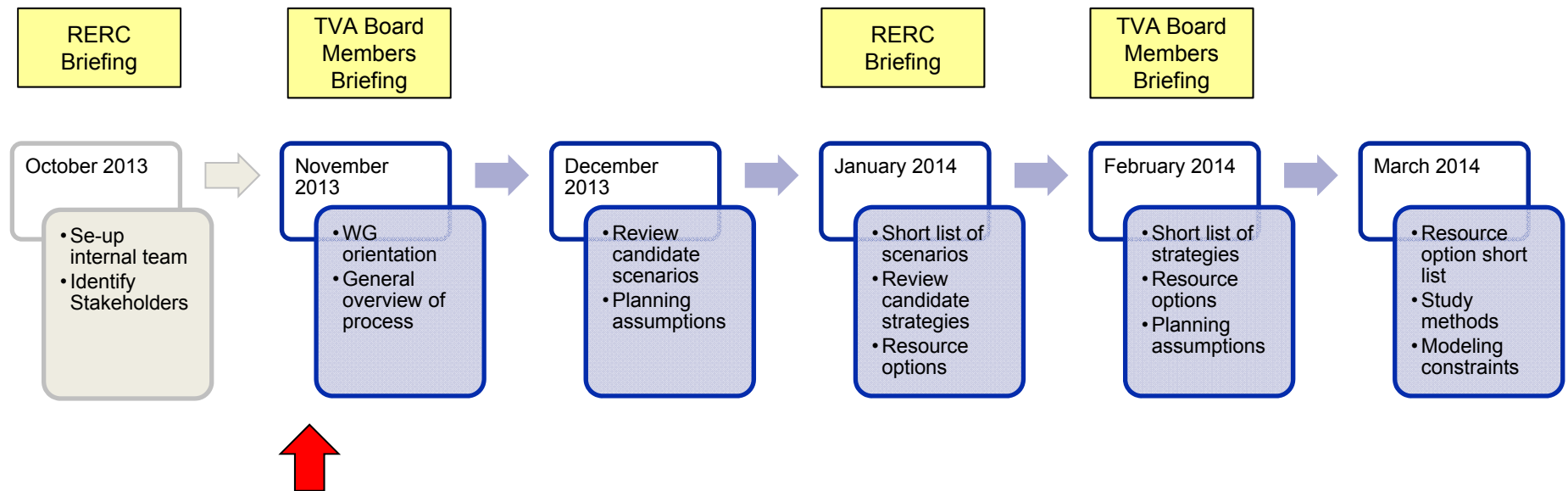
- ◆ Establish stakeholder group and hold first meeting (Nov 2013)
- ◆ Complete first modeling runs (June 2014)
- ◆ Publish draft Supplemental Environmental Impact Statement (SEIS) and IRP (Nov 2014)
- ◆ Complete public meetings (Jan 2015)
- ◆ Final publication of SEIS and IRP and Board approval (exp.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

2015 IRP Schedule: Major Tasks



Stakeholder input will be instrumental throughout the process

Meeting Objectives for IRPWG thru Spring 2014



- ◆ The IRPWG feedback over the next 5 months will provide valuable guidance to TVA during the Inputs & Framework phase of the IRP
- ◆ Examples of the questions this stakeholder group will be asked to provide input upon include:
 - Are the scenarios and strategies TVA has developed reasonable? Has a key plausible future or likely business approach/option been overlooked?
 - Have all reasonable resource options (supply-side and demand-side) been considered and included if applicable?
 - Has the modeling approach been selected to ensure that special types of resources (like intermittent wind or solar) are fairly and accurately considered?

Open Discussion/Review of Action Items

Issues, Challenges, and Key Topics in the 2015 IRP

- ◆ *Integrated Resource Planning in an Age of Uncertainty* (a workshop in Raleigh for state regulatory staff hosted by Duke University) identified several broad challenges that confront utilities as they do resource planning in the current industry landscape
- ◆ TVA has some challenges in common with most electric utilities, including
 - Capacity planning under a declining demand future
 - The challenge of balancing investment in maintaining existing assets vs. commitment to new assets or funding demand-side alternatives
 - Increasing penetration of distributed generation options and the impact on the business paradigm of electric utilities
- ◆ And we also have some challenges that are unique to TVA
 - Collaboration with local power companies to effectively plan for future resources and deploy energy efficiency
 - Respecting the debt cap when considering the preferred resource plan

Are there other areas that the IRPWG members have identified?



Proposed Meeting Dates

- ◆ For Next Month: December 3 or 5
 - Location: Knoxville

- ◆ For January 2014: January 15-16?
 - Location: TBD

- ◆ Target dates for February and March 2014 are pending

Thank you
