Integrated Resource Plan

TVA'S ENVIRONMENTAL AND ENERGY FUTURE

Public Briefings

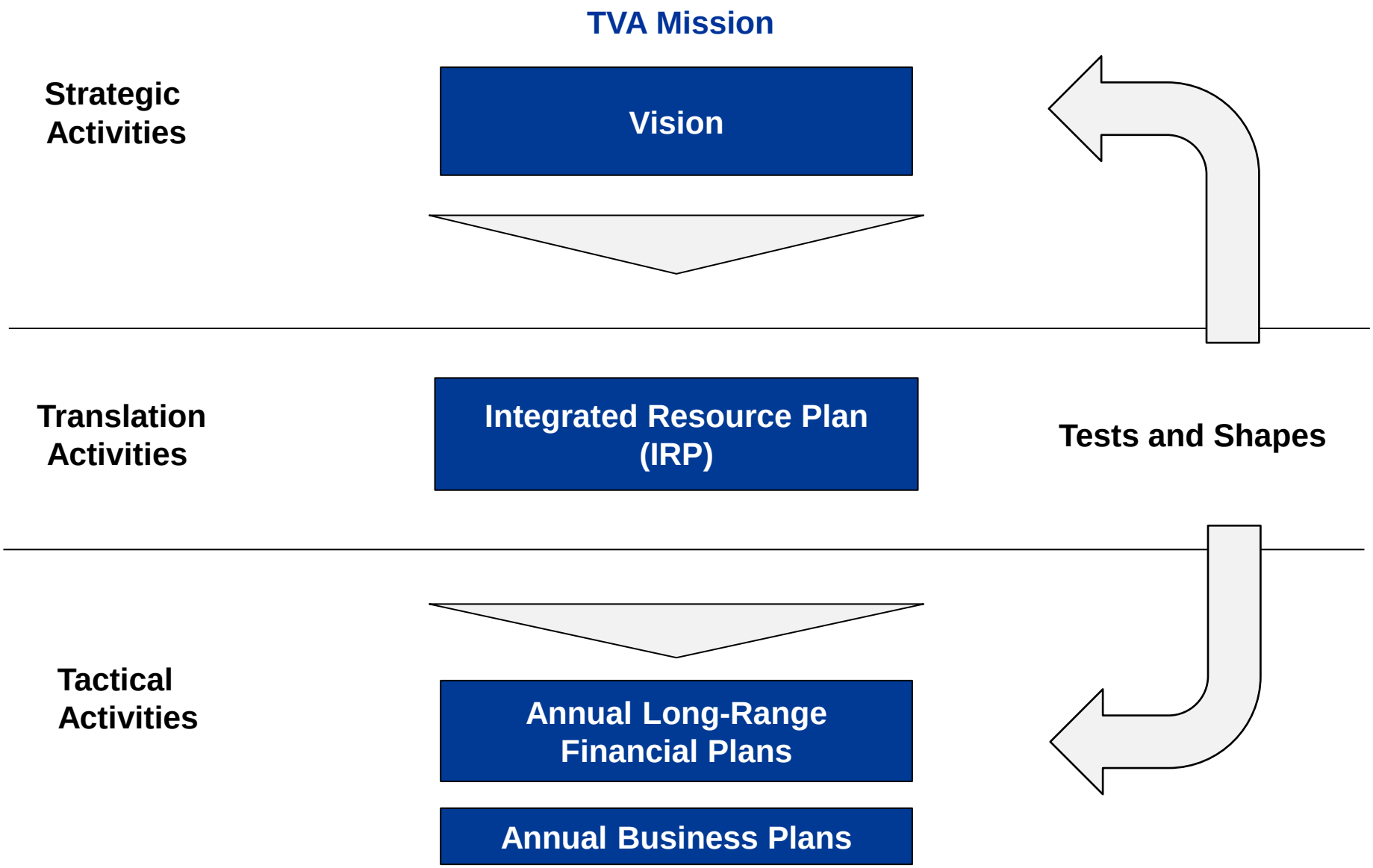
What is an Integrated Resource Plan (IRP)?

- An IRP is a 20-year look ahead that evaluates reliable, cost-effective resource options (supply- and demand-side) for meeting future demand for electricity

- IRPs are a common planning tool employed throughout the utility industry
  - TVA's last IRP was completed in 1995 (Energy Vision 2020) and has provided guidance for decisions over the last 15 years
  - Most utilities develop an IRP every 3-5 years

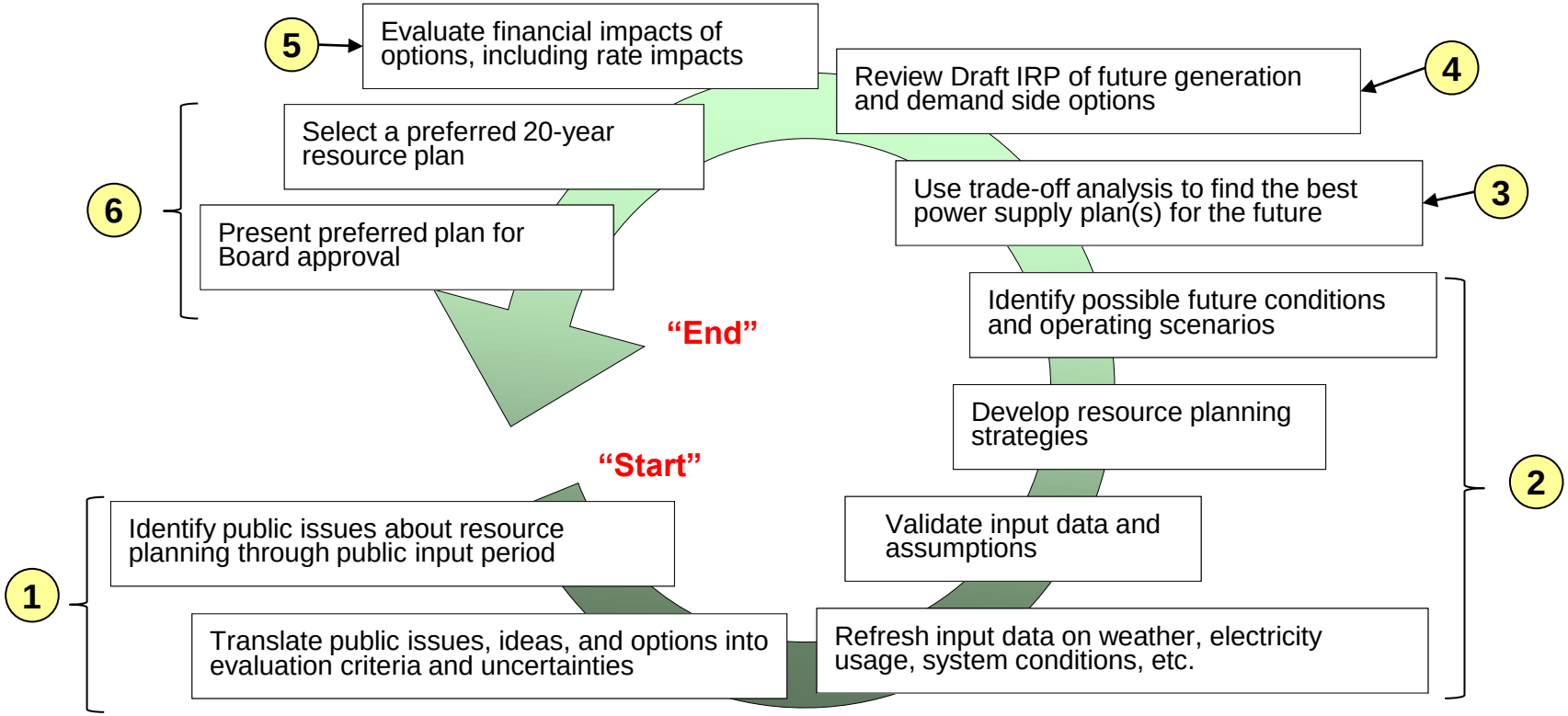
- IRPs strive to do the following:
  - Evaluate all options in a fair and consistent manner
  - Minimize costs to all stakeholders (and not just costs to the utility)
  - Create a flexible plan that allows for uncertainty and permits adjustment in response to changed circumstances
  - Minimize environmental impact of electric supply

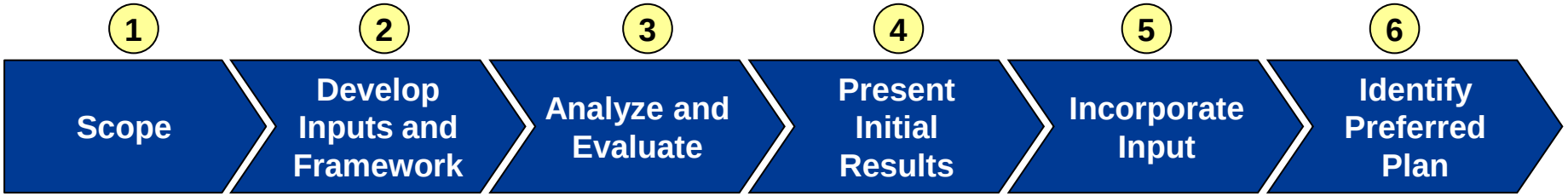
Role of the IRP



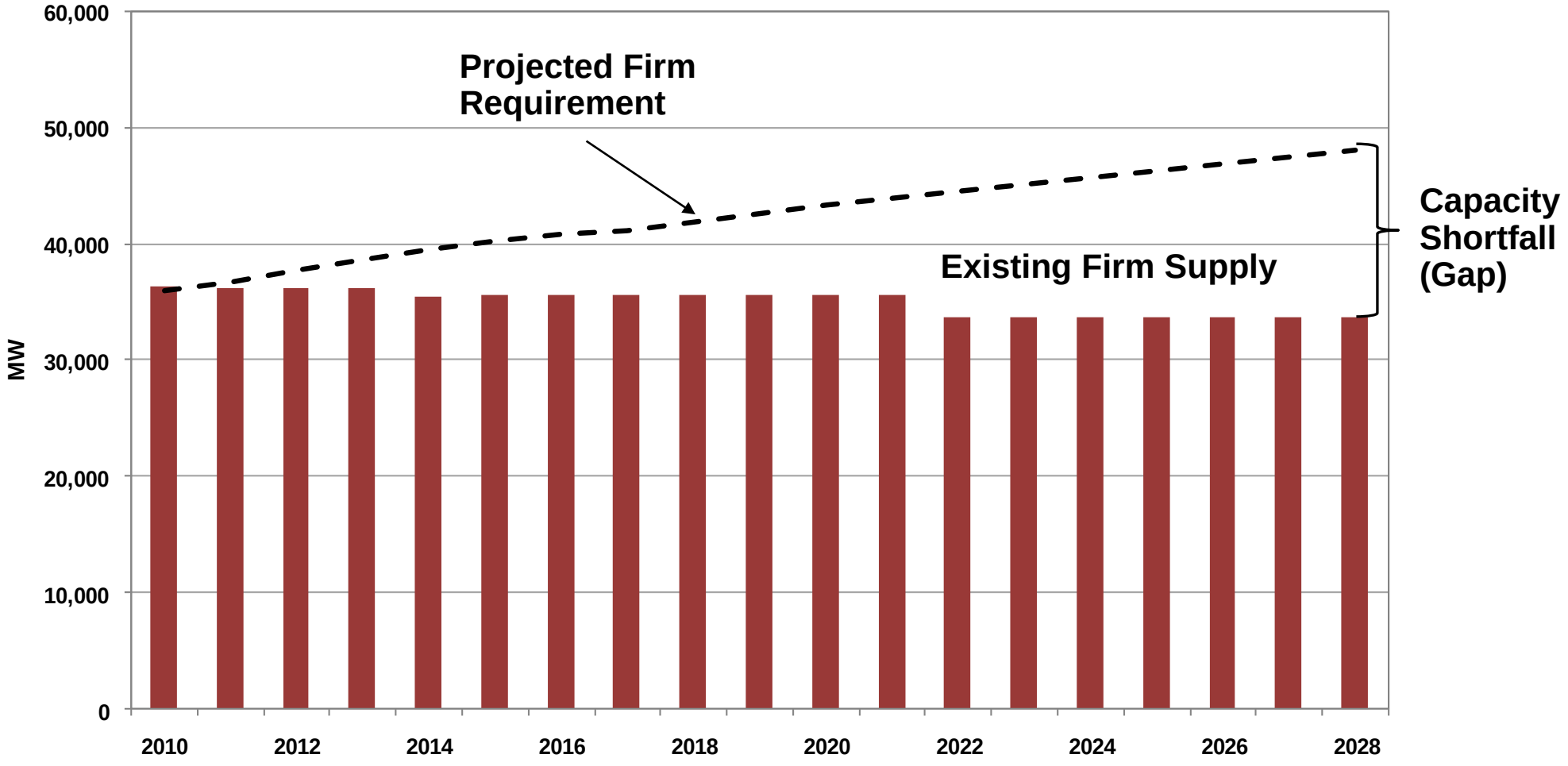
TVA's IRP Process

The IRP process can be summarized into six high-level steps





Closing the Capacity Shortfall



Objective: Identify the optimum resource combination to close the gap between existing firm supply and projected firm requirement

Stakeholders are Involved

Forum for Public Input	Comments
◆ Public Scoping Meetings	— Conducted seven public scoping meetings between July 20th and August 6th, 2009 — Gave participants an opportunity to provide input to IRP scope
◆ Stakeholder Review Group (SRG)	— Established in July 2009 to obtain input from different stakeholder viewpoints throughout IRP development — Conducted ten meetings with the SRG to date
◆ Quarterly Public Briefings	— Held three quarterly public briefings to provide update on IRP development and to answer questions — Invited the public to participate in person or by webinar
◆ Phone Survey	— Conducted a phone survey of 1,000 end-use customers across the Valley in the summer of 2010
◆ Draft IRP Public Comment Period	— Hosting five public meetings across the Tennessee Valley beginning in October 2010 — Plan to present an overview of the Draft IRP followed by a moderated Q&A session
◆ External Web Page *(www.tva.gov/irp)*	— Updated as new content is available

Stakeholders are Involved (Cont'd)

Stakeholder Review Group (SRG) Represented Organizations

- Commonwealth of Kentucky
- Howard Baker Center for Public Policy
- Joe Wheeler EMC
- Oak Ridge National Labs
- Partnership for Affordable Clean Energy
- Sierra Club
- Southern Alliance for Clean Energy
- State of Mississippi
- State of Tennessee
- Tennessee Chamber of Commerce and Industry
- Tennessee Paper Council
- Tennessee Valley Industrial Committee
- Tennessee Valley Public Power Association
- Tennessee Wildlife Resource Agency
- University of Tennessee Knoxville

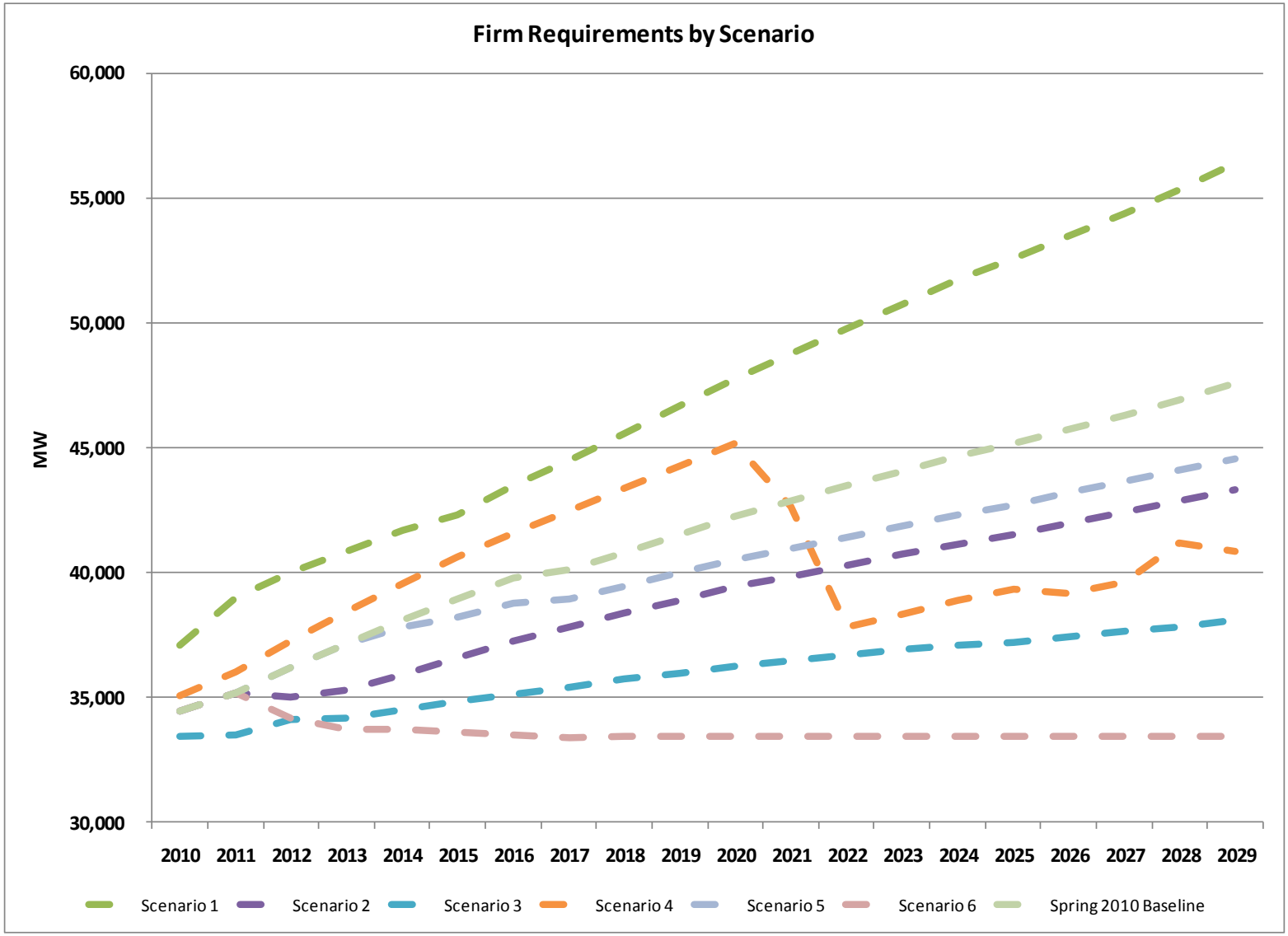
Scenario Planning is Being Employed

- Scenario planning provides an understanding of how near-term and future decisions would change under different conditions
  - Similar near-term decisions across different scenarios may imply that these decisions are less "risky" while major differences may imply possibility of future regret
- Scenarios and planning strategies set the boundaries for analysis
- Scenarios include a number of factors (uncertainties) that are outside of TVA's control
  - Uncertainties vary from scenario to scenario to highlight how decisions would change under different conditions
  - Scenarios stress resource selection and reflect key stakeholder interests
- Planning strategies describe business options that TVA might consider
  - Business options are described by attributes that vary from planning strategy to planning strategy
  - The attributes include: level of EE/DR, renewable additions, nuclear schedule, fossil asset strategy, energy storage, and market purchases
- A portfolio is created by applying a planning strategy in a scenario
  - A total of 35 portfolios are created (7 scenarios x 5 planning strategies)

IRP Scenario Summaries

Scenario	Key Characteristics
1 – Economy Recovers Dramatically	— Economy recovers stronger than expected and creates high demand for electricity — Carbon legislation and renewable electricity standard are passed — Demand for commodity and construction resources increases — Electricity prices are moderated by increased gas supply
2 – Environmental Focus is a National Priority	— Mitigation of climate change effects and development of a "green economy" is a priority — The cost of CO_2 allowances, gas, and electricity increase significantly — Industry focus turns to nuclear, renewables, conservation, and gas to meet demand
3 – Prolonged Economic Malaise	— Prolonged, stagnant economy results in low to negative load growth and delayed expansion of new generation — Federal climate change legislation is delayed due to concerns of adding further pressure to the economy
4 – Game-Changing Technology	— Strong economy with high demand for electricity and commodities — High price levels and concerns about the environment incentivize conservation — Game-changing technology results in an abrupt decrease in load after strong growth
5 – Energy Independence	— The U.S. focuses on reducing its dependence on non-North American fuel sources — Supply of natural gas is constrained and prices for gas and electricity rise — Energy efficiency and renewable energy move to the forefront as an objective of achieving energy independence
6 – Carbon Regulation Creates Economic Downturn	— Federal climate change legislation is passed and implemented quickly — High prices for gas and CO_2 allowances increase electricity prices significantly — U.S. based energy-intensive industry is non-competitive in global markets and leads to an economic downturn
Current Situation	— Based on the most recent planning assumptions

Scenarios Provide a Broad Range of Power Requirements



Firm requirements (load forecast – interruptible load + reserve margin)

IRP Planning Strategy Summaries

Planning Strategy	Key Characteristics
A – Limited Change in Current Resource Portfolio	— Retain and maintain existing generating fleet (no additions beyond Watts Bar 2) — Rely on the market to meet future resource needs
B – Baseline Plan Resource Portfolio	— Allows for nuclear expansion after 2018 and new gas-fired capacity as needed — Assumes idling of 2,000 MW of coal capacity — Includes EE/DR portfolios and wind PPA's
C – Diversity Focused Resource Portfolio	— Allows for nuclear expansion after 2018 and new gas-fired capacity as needed — Increases the contribution from EE/DR portfolio and new renewables — Adds a pumped storage hydro unit — Assumes idling of 3,000 MW of coal capacity
D – Nuclear Focused Resource Portfolio	— Allows for nuclear expansion after 2018 and new gas-fired capacity as needed — Includes an increased EE/DR portfolio compared to other strategies — Assumes idling of 7,000 MW of coal capacity — Includes new renewables (same as planning strategy C) — Includes a pumped storage hydro unit
E – EE/DR and Renewables Focused Resource Portfolio	— Assumes greatest reliance on EE/DR portfolio of any strategy and includes largest new renewable portfolio — Assumes idling of 5,000 MW of coal capacity — Delays nuclear expansion until 2022

Key Findings Emerge in the Draft IRP

- Nuclear expansion is present in the majority of portfolios
- Some fossil layups are favorable compared to maintaining the existing fleet
- Planned Energy Efficiency and Demand Response (EE/DR) play an increasing role in future resource portfolios
- The addition of renewable generation above existing wind contracts plays a role in future resource portfolios
- The option to expand with natural gas capacity is retained, while new coal units only appear very late in the study
- The intensity of CO_2 emissions decreases in all portfolios

Scorecard Approach is Utilized

The IRP Scorecard will be applied to inform selection of a preferred 20-year resource plan

Step 1

- Planning strategies are prioritized by their ranking metric scores
  - Ranking metrics are financial measures of cost and risk

Step 2

- Strategic metrics are constructed and paired with the ranking metrics
- Preferred planning strategy alternatives to be included in the Draft IRP are selected

★ ***We are here***

Step 3

- Sensitivity analysis will evaluate attributes from the planning strategies retained in the Draft IRP and incorporate input (as appropriate) from the public comment period
- Ranking and strategic metrics will be refreshed and re-scored to evaluate new attribute combinations identified in sensitivity analysis
- A short list of planning strategies is presented for consideration in the Final IRP

Scorecard Approach is Utilized (Cont'd)

The IRP scorecard was developed to reflect components of TVA's mission

	Ranking Metrics					Strategic Metrics				
	Energy Supply					Environmental Stewardship			Economic Impact	
Scenarios	Plan Cost	Short-Term Rate Impacts	Risk / Benefit	Risk Exposure	Total Plan Score	Carbon Footprint	Water Impact	Waste Impact	Total Employment	Growth in Personal Income
Total Ranking Metric Score										

Each row of the scorecard corresponds to a scenario (7 rows)
A scorecard is produced for each planning strategy (5 total scorecards)

- Ranking metrics are based on quantitative values of cost and risk and are used to select planning strategies for further analysis
- Ranking metrics reflect traditional utility measures
- Strategic metrics are based upon both quantitative and qualitative assessment of environmental and economic impact
- TVA's strategic metrics are far less common in the utility industry

Ranking Metrics Summary

Strategy C – Diversity Focused

	Ranking Metrics				
	Energy Supply				
Scenarios	Plan Cost	Short-Term Rate Impacts	Risk / Benefit	Risk Exposure	Total Plan Score
1	100.00	97.48	100.00	100.00	99.43
2	99.58	100.00	96.20	96.17	98.49
3	100.00	97.13	100.00	100.00	99.35
4	100.00	97.94	100.00	100.00	99.53
5	100.00	100.00	100.00	100.00	100.00
6	98.59	96.09	98.19	93.22	96.75
Baseline	100.00	98.71	100.00	100.00	99.71
				Total Ranking Metric Score	**693.25**

Strategy E – EE/DR and Renewables Focused

	Ranking Metrics				
	Energy Supply				
Scenarios	Plan Cost	Short-Term Rate Impacts	Risk / Benefit	Risk Exposure	Total Plan Score
1	99.43	99.21	97.82	96.78	98.58
2	100.00	99.22	99.79	100.00	99.80
3	99.15	96.03	95.91	97.73	97.72
4	99.45	99.58	95.32	89.57	96.73
5	99.83	99.50	98.87	99.47	99.56
6	99.16	95.61	100.00	100.00	98.64
Baseline	99.68	99.77	98.98	98.96	99.45
				Total Ranking Metric Score	**690.47**

Strategy B – Baseline Plan

	Ranking Metrics				
	Energy Supply				
Scenarios	Plan Cost	Short-Term Rate Impacts	Risk / Benefit	Risk Exposure	Total Plan Score
1	97.71	97.59	98.40	97.34	97.68
2	97.76	98.85	100.00	99.98	98.79
3	99.61	98.70	91.37	83.79	94.79
4	98.38	98.11	98.25	93.79	97.26
5	98.44	98.14	98.61	98.94	98.51
6	96.55	96.96	88.56	78.46	91.55
Baseline	98.01	99.01	96.50	94.26	97.20
				Total Ranking Metric Score	**675.78**

Strategy D – Nuclear Focused

	Ranking Metrics				
	Energy Supply				
Scenarios	Plan Cost	Short-Term Rate Impacts	Risk / Benefit	Risk Exposure	Total Plan Score
1	97.40	97.54	96.41	96.81	97.18
2	97.90	98.51	99.04	98.90	98.40
3	99.41	100.00	81.31	69.12	90.43
4	97.40	97.97	90.14	92.05	95.42
5	97.86	98.47	96.57	92.60	96.64
6	100.00	100.00	89.16	78.46	93.77
Baseline	98.56	99.79	92.15	91.33	96.41
				Total Ranking Metric Score	**668.26**

Legend	
	Better

Strategy A – Limited Change in Current Portfolio

	Ranking Metrics				
	Energy Supply				
Scenarios	Plan Cost	Short-Term Rate Impacts	Risk / Benefit	Risk Exposure	Total Plan Score
1	93.87	100.00	95.07	91.26	94.82
2	95.76	99.25	90.32	85.74	93.61
3	98.28	95.78	98.39	94.38	96.84
4	97.49	100.00	88.75	77.41	92.42
5	97.09	99.85	91.73	87.21	94.81
6	94.14	93.66	90.08	80.82	90.51
Baseline	96.74	100.00	90.59	85.43	94.15
				Total Ranking Metric Score	**657.15**

Completed IRP Scorecards

Strategy C – Diversity Focused

	Ranking Metrics				
	Energy Supply				
Scenarios	Plan Cost	Short-Term Rate Impacts	Risk / Benefit	Risk Exposure	Total Plan Score
1	100.00	97.48	100.00	100.00	99.43
2	99.58	100.00	96.20	96.17	98.49
3	100.00	97.13	100.00	100.00	99.35
4	100.00	97.94	100.00	100.00	99.53
5	100.00	100.00	100.00	100.00	100.00
6	98.59	96.09	98.19	93.22	96.75
Baseline	100.00	98.71	100.00	100.00	99.71
				Total Ranking Metric Score	693.25

Strategic Metrics				
Environmental Stewardship			Economic Impact	
CO_2 Footprint	Water	Waste	Total Employment	Growth in Personal Income
◑	◔	◔	0.9%	0.6%
◑	◑	◑		
◑	◑	◑		
◕	◑	◔		
◑	◑	◑		
◑	◑	◑	0.2%	0.1%
◑	◑	◔		

Strategy E – EE/DR and Renewables Focused

	Ranking Metrics				
	Energy Supply				
Scenarios	Plan Cost	Short-Term Rate Impacts	Risk / Benefit	Risk Exposure	Total Plan Score
1	99.43	99.21	97.82	96.78	98.58
2	100.00	99.22	99.79	100.00	99.80
3	99.15	96.03	95.91	97.73	97.72
4	99.45	99.58	95.32	89.57	96.73
5	99.83	99.50	98.87	99.47	99.56
6	99.16	95.61	100.00	100.00	98.64
Baseline	99.68	99.77	98.98	98.96	99.45
				Total Ranking Metric Score	690.47

Strategic Metrics				
Environmental Stewardship			Economic Impact	
CO_2 Footprint	Water	Waste	Total Employment	Growth in Personal Income
◕	●	◕	0.8%	0.6%
◕	●	◕		
◕	◕	◕		
◑	●	◕		
◕	◕	◕		
●	◕	◕	0.3%	0.2%
◕	◕	◕		

Strategy B – Baseline Plan

	Ranking Metrics				
	Energy Supply				
Scenarios	Plan Cost	Short-Term Rate Impacts	Risk / Benefit	Risk Exposure	Total Plan Score
1	97.71	97.59	98.40	97.34	97.68
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Baseline	98.01	99.01	96.50	94.26	97.20
				Total Ranking Metric Score	675.78

Strategic Metrics				
Environmental Stewardship			Economic Impact	
CO_2 Footprint	Water	Waste	Total Employment	Growth in Personal Income
◔	○	○	1.0%	0.8%
◔	○	○		
◔	◔	◔		
◔	○	○		
◔	○	○		
◔	◔	○	-0.3%	-0.3%
◔	○	○		

Legend	
	↓
	Better

Legend	
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●	*Better*

Technology Innovation

- Innovations that enable the utilization of key technologies in the planning strategies have been identified and summarized in the table below

Technology Innovation	Description	A	B	C	D	E
Smart Grid Technologies	Advancements in this area are necessary to fully realize the EE/DR benefits included in certain planning strategies		X	X	X	X
Transmission Design and Infrastructure	Improvements in transmission system devices to manage power flows and advancement in DC line technologies will be needed to facilitate power transfers and the import of additional wind-sourced power			X	X	X
Advanced Energy Storage	More research is needed to improve the design of pumped-storage hydro (PSH) and identify new storage technologies that might offer advantages similar to PSH			X	X	X
Small Modular Nuclear Reactors	This technology may offer some flexibility for siting and operating nuclear capacity in those strategies that include a reliance on new nuclear capacity later in the planning period		X	X	X	
Advanced Emissions Controls for Coal-Fired Units	To enable full use of coal-fired resources, advances in emission controls (especially carbon capture and sequestration) are needed to achieve a more balanced long-term generation portfolio	X	X	X	X	

Other Considerations of Risk

- Other risks should be considered when evaluating the merits of alternative strategies
  - The financial risk measures included in the ranking metrics may indirectly account for part of these risks, but not all

- Examples of these broader risk considerations include but are not limited to:

Other Risk Considerations	Potential Implications
— The ability of EEDR programs to stimulate distributor/customer participation and deliver forecasted energy savings and demand reductions	— Planning strategies with higher EEDR targets will have a greater exposure to this risk.
— The availability and deliverability of natural gas due to finite capacity in the existing infrastructure	— Risks of being limited by deliverability and availability will likely increase as natural gas generation capacity is increased
— The ability to achieve schedule targets for licensing/permitting, developing and constructing new generation capacity	— Risks of meeting schedule targets will likely increase as the number and complexity of construction projects increase — Projects with more extensive licensing/permitting requirements may have greater exposure to schedule risk
— The timely build-out of transmission infrastructure to support future resources	— Risks will likely increase as the amount of construction required increases and if that construction is undertaken by entities other than TVA

Implications of Preliminary Results

Rank	Planning Strategy	Key Characteristics
1	C – Diversity Focused Resource Portfolio	— Allows for nuclear expansion after 2018 and new gas-fired capacity as needed — Increases the contribution from EE/DR portfolio and new renewables — Adds a pumped storage hydro unit — Assumes idling of 3,000 MW of coal capacity
2	E – EE/DR and Renewables Focused Resource Portfolio	— Assumes greatest reliance on EE/DR portfolio of any strategy and includes largest new renewable portfolio — Assumes idling of 5,000 MW of coal capacity — Delays nuclear expansion until 2022
3	B – Baseline Plan Resource Portfolio	— Allows for nuclear expansion after 2018 and new gas-fired capacity as needed — Assumes idling of 2,000 MW of coal capacity — Includes EE/DR portfolios and wind PPA's

- Planning strategies C and E are the best overall performers
  - Planning strategy C has better relative performance on the ranking metrics
  - Planning strategy E has better relative performance on strategic metrics
- Planning strategy B may also be a viable candidate and will be retained in the Draft since it represents a "business as usual" approach and will be used as a reference in the Environmental Impact Statement
- Planning strategies A and D are the worst performers and will be removed from further consideration

The Top Three Planning Strategies are Diverse

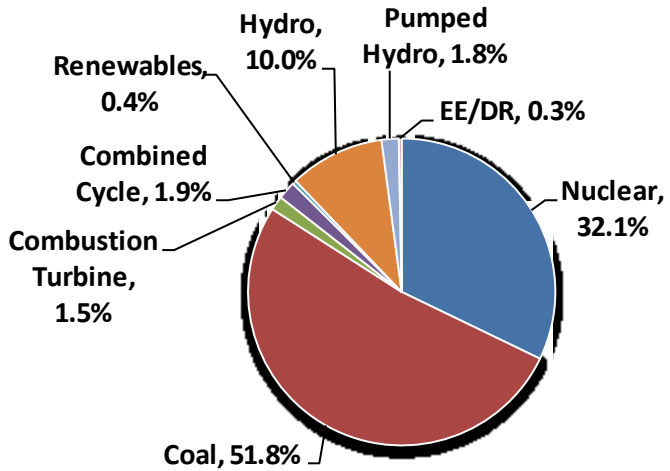
Range of Capacity Additions (MW)[1,2,3]

Type	Existing System	Minimum	Maximum
Nuclear	7,800	0	4,800
Combustion Turbine[4]	5,300	0	7,500
Combined Cycle[4]	2,200	0	5,700
IGCC[5]	0	0	500
Avoided Capacity (EE/DR)	346	1,400	6,000
Renewables	150	150	1,200
Pumped Storage	1,600	0	850
Coal Units Idled	0	2,400	4,700
Conventional Coal	13,300	0	0

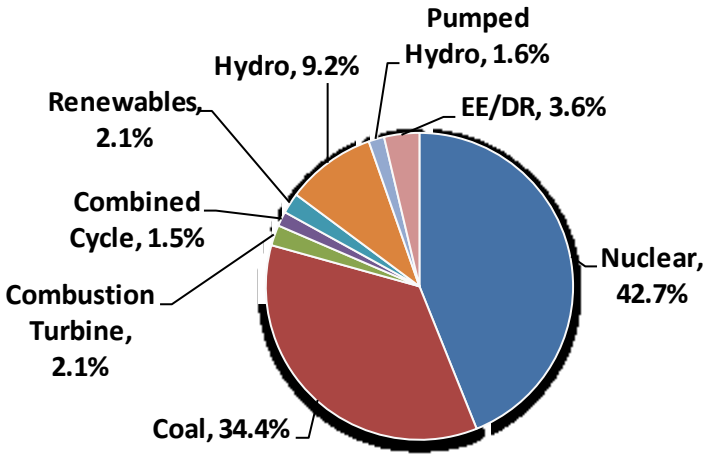
1 – Capacity values are expressed in terms of summer dependable capacity
2 – Ranges represent the maximum and minimum values for each type and are not from a single portfolio
3 – Excludes capacity and energy additions from approved projects (Watts Bar Nuclear Unit 2, John Sevier Combined Cycle, and Lagoon Creek Combined Cycle)
4 – Natural gas technologies
5 – Integrated Gasification Combined Cycle: an advanced coal technology

Example Change in Generation Mix

2010 Existing System



2025 – Strategy B in Current Situation



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IRP High-Level Schedule and Next Steps

Scope	Develop Inputs and Framework	Analyze and Evaluate	Present Initial Results	Incorporate Input	Identify Preferred Alternative
Summer 2009	*Fall 2009 – Winter 2010*	*Spring 2010*	***Current (Fall 2010)***	*Fall 2010 – Winter 2011*	*Winter - Spring 2011*

Next Steps

- Continue analysis between Draft and Final IRP and EIS
- End the public comment period on Draft IRP and EIS
- Incorporate input and conduct additional public briefings
- Transmit Final IRP and EIS to Environmental Protection Agency
- Present for Board approval