Integrated Resource Plan

TVA'S ENVIRONMENTAL AND ENERGY FUTURE

Stakeholder Review Group
Working Session

October 28, 2010
Knoxville, TN 2010

Agenda

10:00-10:15	Introduction	Randy McAdams
10:15-10:30	Update on Public Comments	Chuck Nicholson
10:30-11:00	Open Discussion on Draft IRP	
11:00-11:30	Summary of IRP Phone Survey Results	Randy Johnson
11:30-12:00	Lunch	
12:00-12:30	Transmission System and Potential Future Impacts	David Marler
12:30-1:30	Update on Ongoing Analysis	Gary Brinkworth
1:30-2:30	Open Discussion	
2:30-2:45	Break	
2:45-3:00	Next Steps	Gary Brinkworth
3:00-3:15	Wrap-Up	Randy McAdams

Introduction

SRG Purpose

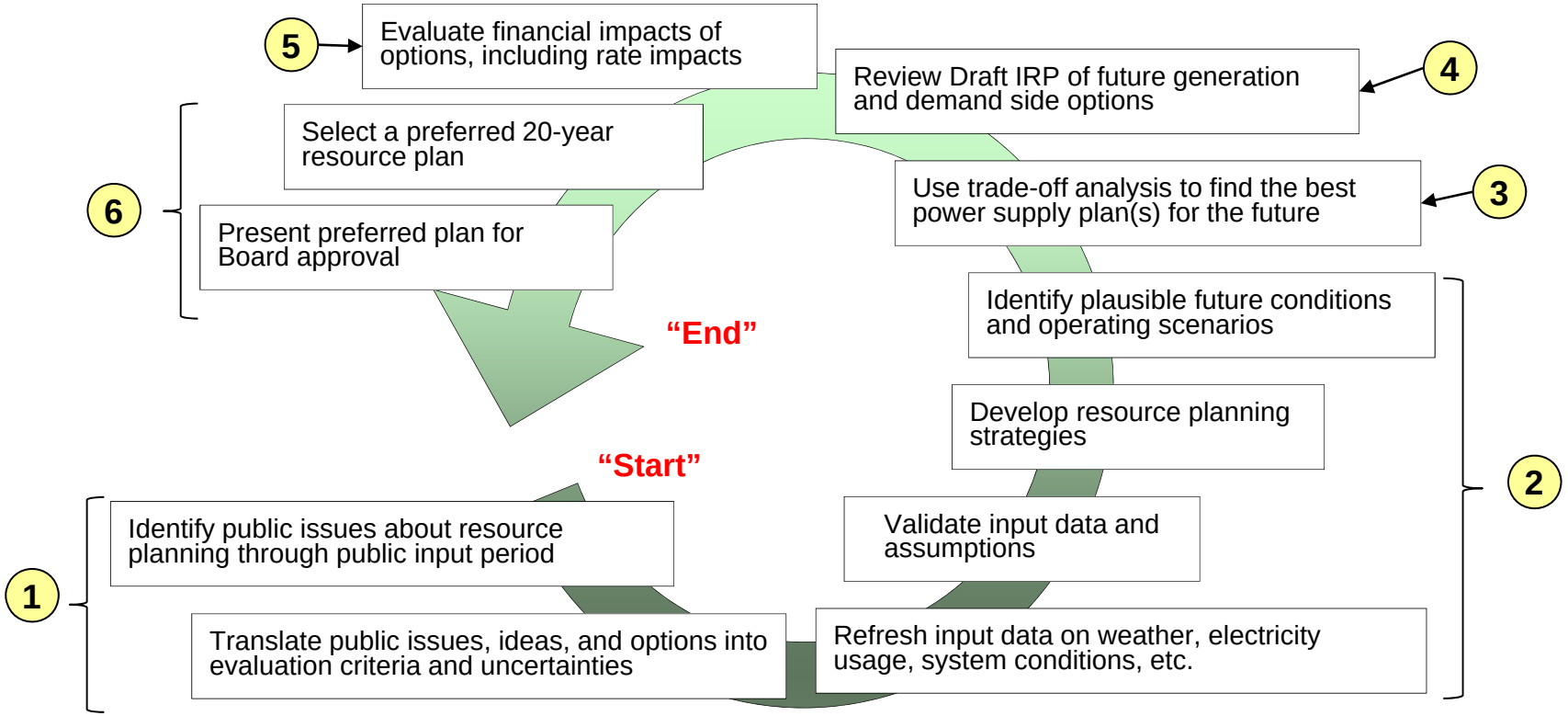
- Provide TVA with in-depth ongoing discussion and input from different stakeholder viewpoints
- Serve as a source of information, a coordination mechanism, and a professional review group
- Build efficiency into the study process by providing real-time public input to IRP issues and processes
- Validate the various steps in the IRP process

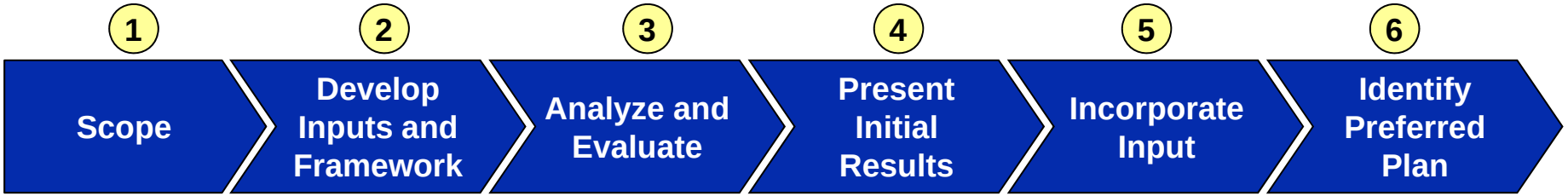
SRG Meeting Types

- *Working Sessions* – regular meetings that are not open to the general public
- *Workshops* – the SRG, 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
- *Public Comment Sessions* – by majority vote, the SRG may host a public comment session to receive input on specific topics

IRP Process Review

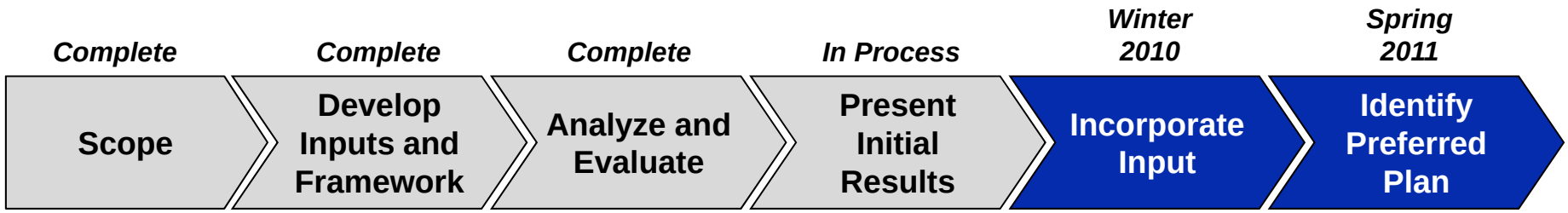
The IRP process that has been previously shared can be summarized into six high-level steps





IRP Process Review (Cont'd)

The SRG has reviewed and provided input on the following topics:



- Planning process
- Key uncertainties
- Updated scenario/worlds
- Demand-side resource options
- Supply-side resource options
- Busbar screening results for supply-side resource options
- Load forecast
- Environmental outlook
- Commodity price forecasts
- Financial parameters
- Energy efficiency and demand response
- Planning strategies
- IRP scorecard and evaluation metrics
- Preliminary model results

Complete or In Process
Not Started

IRP Public Briefings

- There were five public meetings held during the public comment period
  - October 5, Bowling Green, KY
  - October 6, Nashville, TN
  - October 7, Olive Branch, MS
  - October 13, Knoxville, TN
  - October 14, Huntsville, AL

- Meetings were held in the evenings from 6 to 8 pm
  - Interested persons could either attend in person or participate via webinar

- Over 130 people attended the public meetings and over 50 participated via webinar

Location	Number in Attendance	Number on Webinar
Bowling Green, KY	20	10
Nashville, TN	23	11
Olive Branch, MS	24	8
Knoxville, TN	40	12
Huntsville, AL	22	10

Public Comments Received

- A total of 138 people have provided comments on the Draft IRP to date

Method of Comment	Number Received
E-mail	5
Online comment form	16
Webinar comment/question from IRP Briefings	16
Oral comment/question from IRP Briefings	40
Letters	5
Form letters (pre-printed post cards)[A,B]	56
Total	138

Note: The public comment period is scheduled to end on November 8th

A – TVA received 56 post cards with pre-printed comments. Senders signed their name, but did not provide any additional comments beyond the standard text
B – One of four unique comments is included on each postcard:
1) Maximize economic development of the Valley through creation of clean energy jobs by developing EE and renewable energy resources
2) Minimize TVA's impact on climate change, particularly be developing the Valley's EE and renewable energy resources
3) Make TVA a national leader in EE with at least 1% per year reductions in energy demand and a serious commitment to developing the Valley's solar, wind, and bioenergy resources
4) Minimizes the amount of nuclear power used to meet future energy demand

Public Comments Received (Cont'd)

Common themes emerged from the comments received

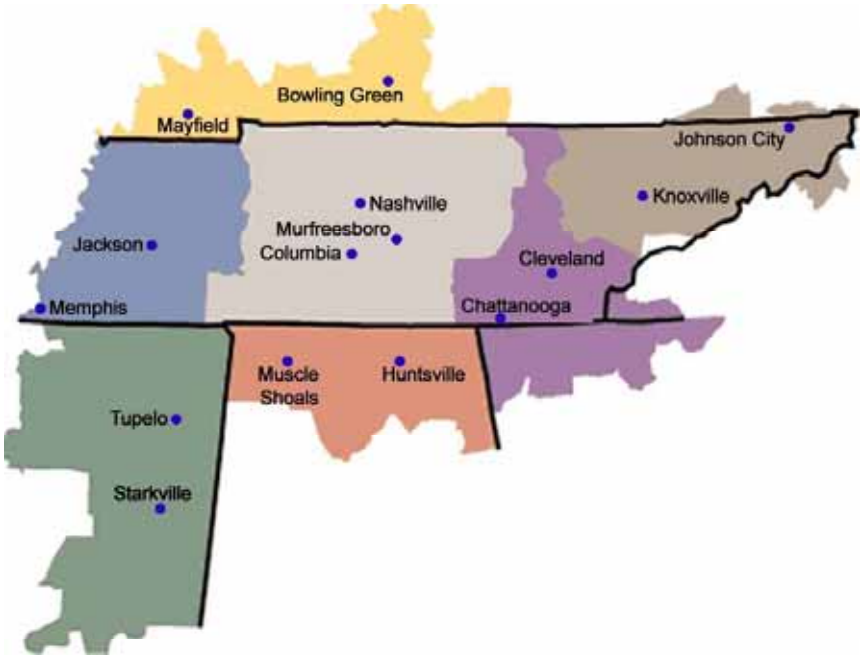
Topic	Comments
Fossil layup strategy	– People commended TVA on the fossil layup strategy – Some public briefing attendees felt that larger quantities of layups should be considered
Renewable additions	– Some people were pleased with the renewable recognition in the Draft IRP as long as costs were competitive – Others expressed support for greater in-valley options (particularly solar)
Nuclear additions	– Some comments were pleased with the nuclear additions and applauded TVA for adding nuclear in a cost effective, responsible way – Others expressed concerns over rising costs and nuclear waste issues related to additions to the nuclear portfolio
Energy efficiency and demand response	– Some comments wanted to see greater incentives and more focus on EE/DR in the IRP – Others were pleased with the contribution of EE/DR in the planning strategies retained in the Draft IRP
Energy storage	– Several comments suggested that energy storage capability should be increased
Natural gas	– Comments expressed support for additional natural gas-fired generation

Open Discussion on Public Comments

IRP Phone Survey
Methodology

- Survey was developed and conducted by Harris Interactive
- Ratepayers were randomly sampled in June and July, 2010
- Conducted with adults age 25 or older, with survey averaging 18 minutes in length
- A total of 1,001 surveys were completed across the seven TVA Customer Service districts as shown below:

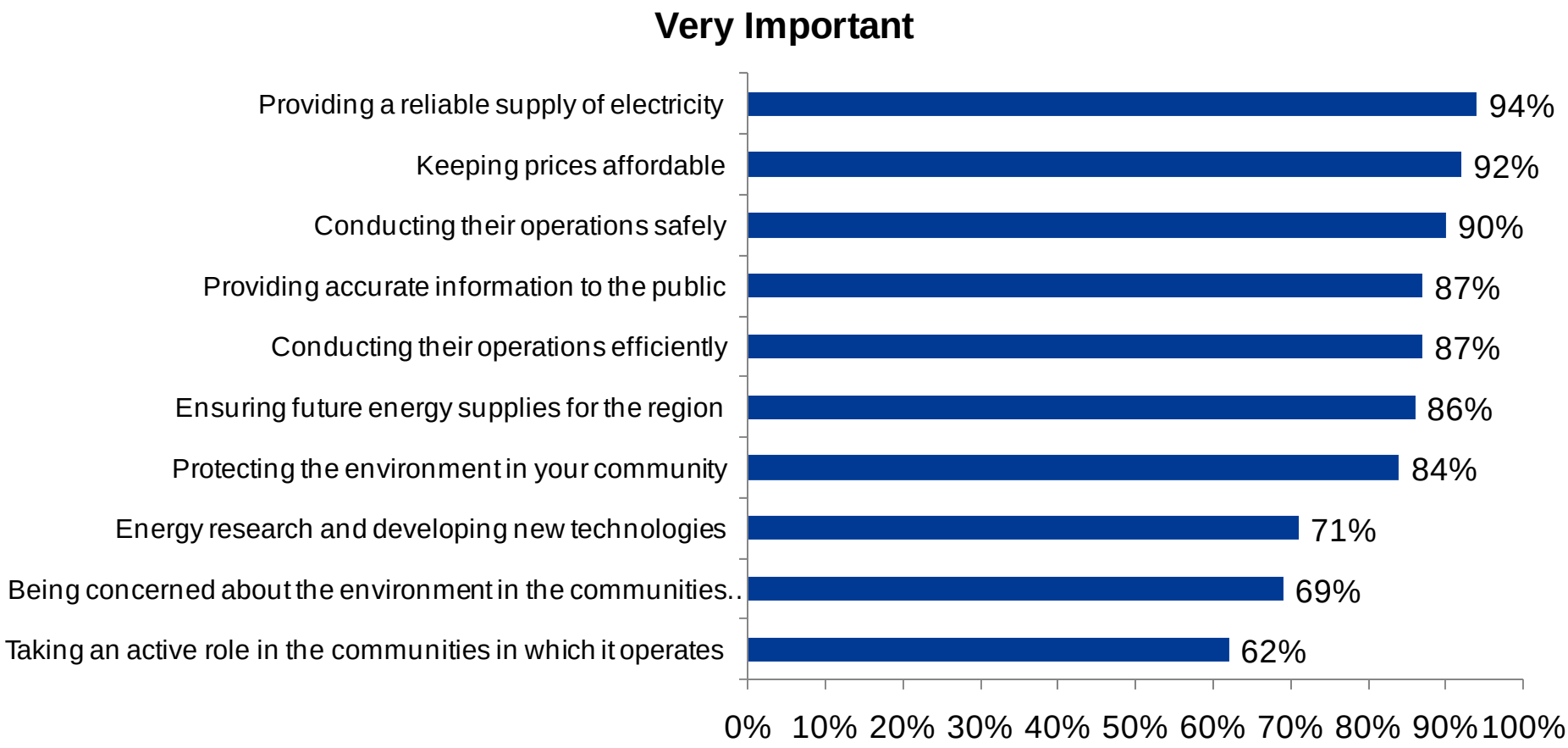
Customer Service Districts



Alabama	Kentucky	Mississippi	Northeast	Southeast	Middle TN	West TN
143	143	143	143	143	143	143

Importance of TVA Attributes

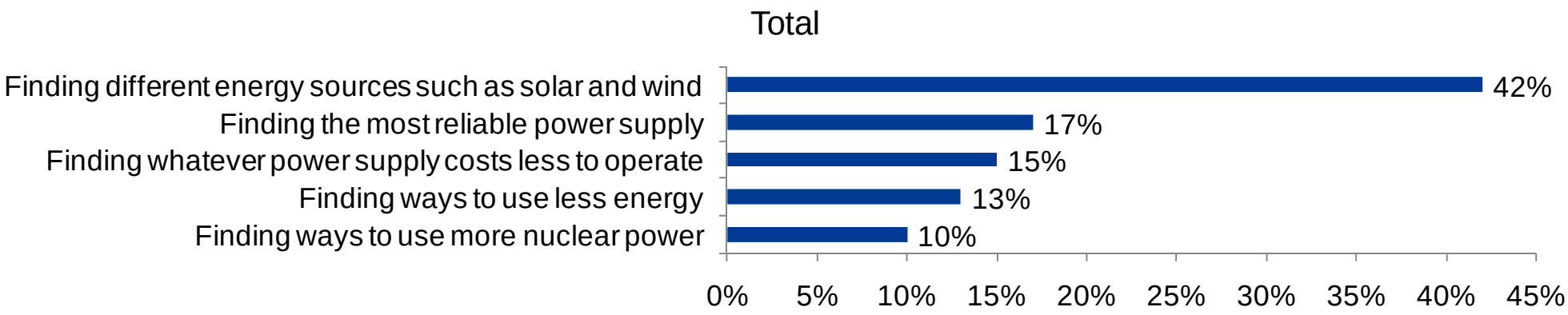
- Almost all Valley residents (94%) agreed that providing a reliable supply of electricity is very important in assessing TVA's quality of service
  - Also among the most important attributes were keeping prices affordable and conducting operations safely



Base: Qualified Respondents (Total n=1,001)

Focus for Meeting Future Energy Needs

- To meet future energy needs, 42% Valley residents believe finding different energy sources (solar, wind) should be emphasized most

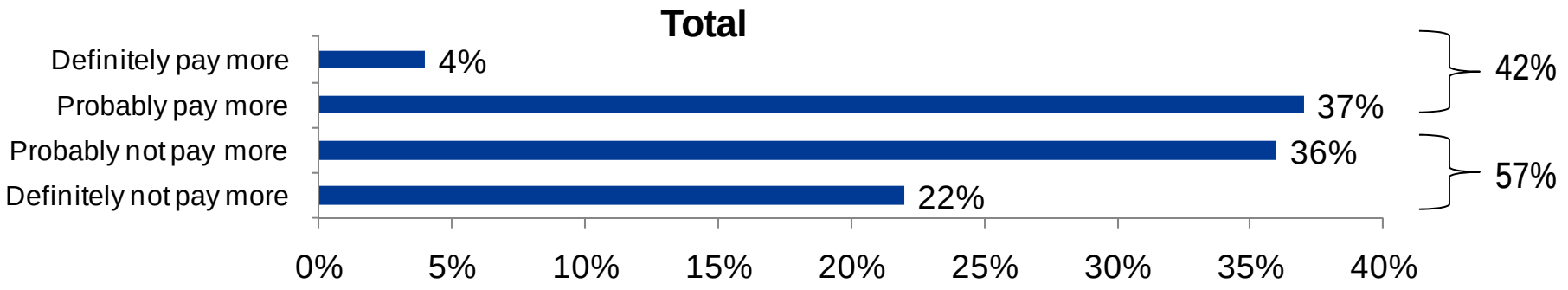


	Alabama (n=143)	Kentucky (n=143)	Mississippi (n=143)	Northeast (n=143)	Southeast (n=143)	Middle TN (n=143)	West TN (n=143)
Finding different energy sources such as solar and wind	44%	40%	37%	33%	47%	46%	47%
Finding the most reliable power supply	17%	17%	16%	26%	14%	13%	19%
Finding whatever power supply costs less to operate	16%	16%	18%	19%	13%	13%	12%
Finding ways to use less energy	12%	19%	18%	8%	12%	9%	13%
Finding ways to use more nuclear power	7%	8%	10%	8%	11%	17%	7%

Base: Qualified Respondents (Total n=1,001)

Willingness to Pay More for Renewable Electricity

- 42% of Valley residents indicated they would definitely or probably pay more for renewable energy
- When likelihood is weighted by normative proportions of purchase intent, actual likelihood is estimated at 15%* who would definitely or probably pay more



	Alabama (n=85)	Kentucky (n=86)	Mississippi (n=90)	Northeast (n=76)	Southeast (n=88)	Middle TN (n=86)	West TN (n=91)
Definitely pay more	*	3%	3%	8%	7%	5%	4%
Probably pay more	35%	29%	39%	55%	34%	44%	32%
Probably not pay more	47%	48%	31%	28%	36%	30%	30%
Definitely not pay more	17%	19%	26%	6%	23%	21%	33%

*data is weighted down to represent normative proportions of purchase intent (Definitely=0.498; Probably=0.342)
Base: Would Like to Purchase Renewable Energy (Total n=602)

Amount Respondents Would Pay for Renewable Electricity

- Valley residents indicating they would definitely pay more, would will pay an average of $12.60 per month to ensure that 10% of their energy comes from renewable sources
- This same group would pay an average of $26.91 more per month to ensure that all of their energy is renewable

Average $ to Ensure 10% Comes from Renewable Energy Sources

Means	Total* (n=472)	Alabama* (n=72)	Kentucky* (n=52)	Mississippi* (n=84)	Northeast* (n=51)	Southeast* (n=96)	Middle TN* (n=59)	West TN* (n=62)
Definitely pay more	$12.60	-	$31.13	$19.92	$6.08	$7.75	$12.78	$29.05
Probably pay more	$9.30	$11.07	$8.49	$5.37	$12.09	$7.45	$12.55	$9.14
Probably not pay more	$1.43	$1.14	$1.54	$1.32	$2.02	$1.75	$1.18	$1.09

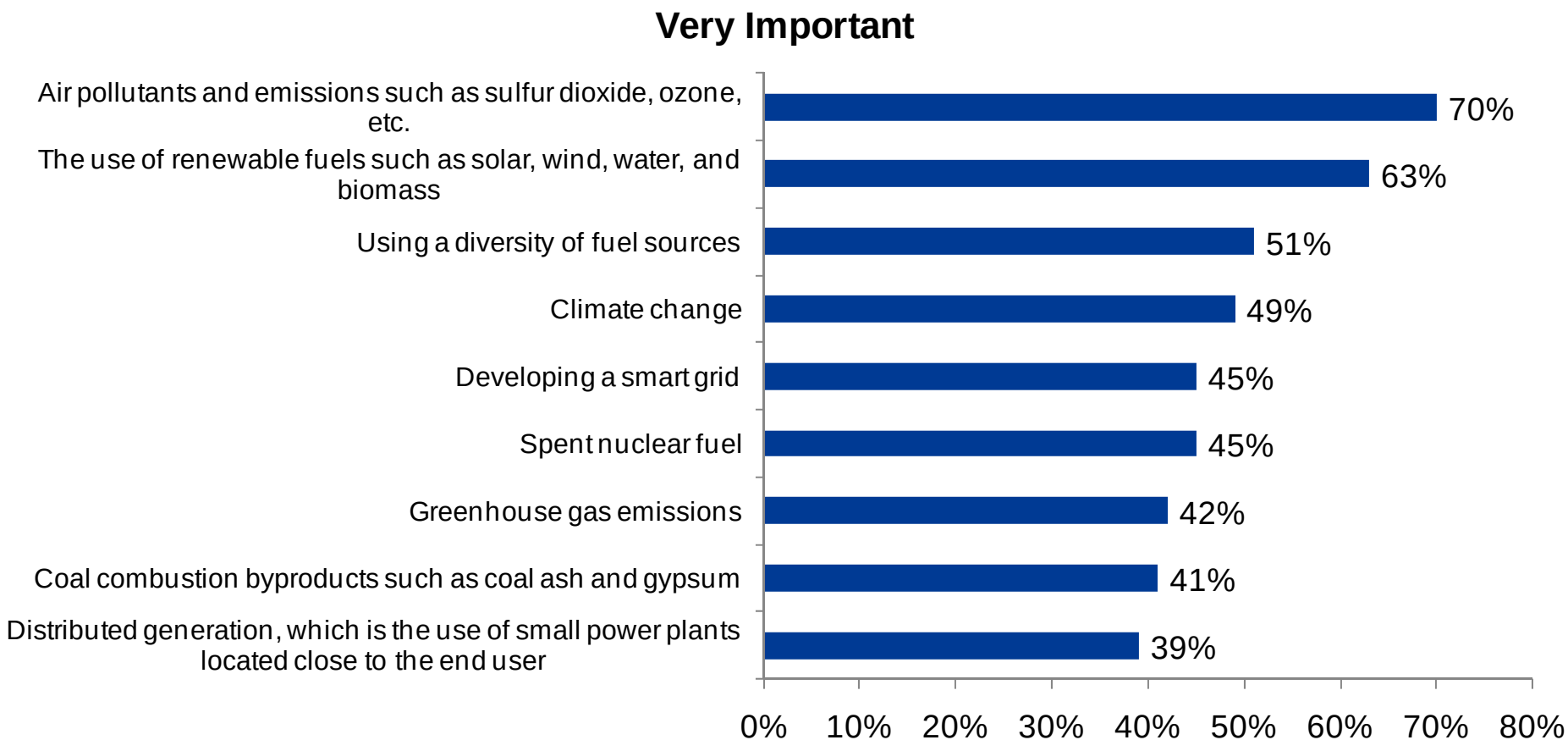
Average $ to Ensure ALL Comes from Renewable Energy Sources

Means	Total* (n=403)	Alabama* (n=57)	Kentucky* (n=40)	Mississippi* (n=69)	Northeast* (n=45)	Southeast* (n=82)	Middle TN* (n=53)	West TN* (n=52)
Definitely pay more	$26.91	-	$37.35	$38.18	$19.92	$23.48	$21.17	$49.80
Probably pay more	$16.18	$20.96	$15.65	$9.89	$23.42	$15.06	$17.00	$13.92
Probably not pay more	$2.84	$1.73	$2.82	$3.32	$3.96	$3.91	$1.41	$2.25

*all data is weighted down to represent normative proportions of purchase intent (Definitely=0.498; Probably=0.342)
Base: Would Pay More (Total n=471)
Base: Would Pay Something (Total n=402)

Importance of TVA Addressing Issues

- Over 50% of Valley residents agreed that it is very important for TVA to address air pollutants, the use of renewable fuels and using a diversity of fuel sources



Base: Qualified Respondents (Total n=1,001)

Biggest Concern Related to TVA's Energy Production

- Respondents were asked, "What is your biggest concern related to TVA's production of electricity?"
- Percentages below reflect all mentions within the category, comparing the customer phone survey to the scoping questionnaire:

Area of Concern	IRP Phone Survey (Summer 2010) N=1,001	IRP Scoping Questionnaire (Summer 2009) n=798
Cost/Billing	42%	19%
Environmental Impact	27%	32%
Reliability	20%	21%
Need for Alternative Energy Sources	10%	28%

Summary of Key Points

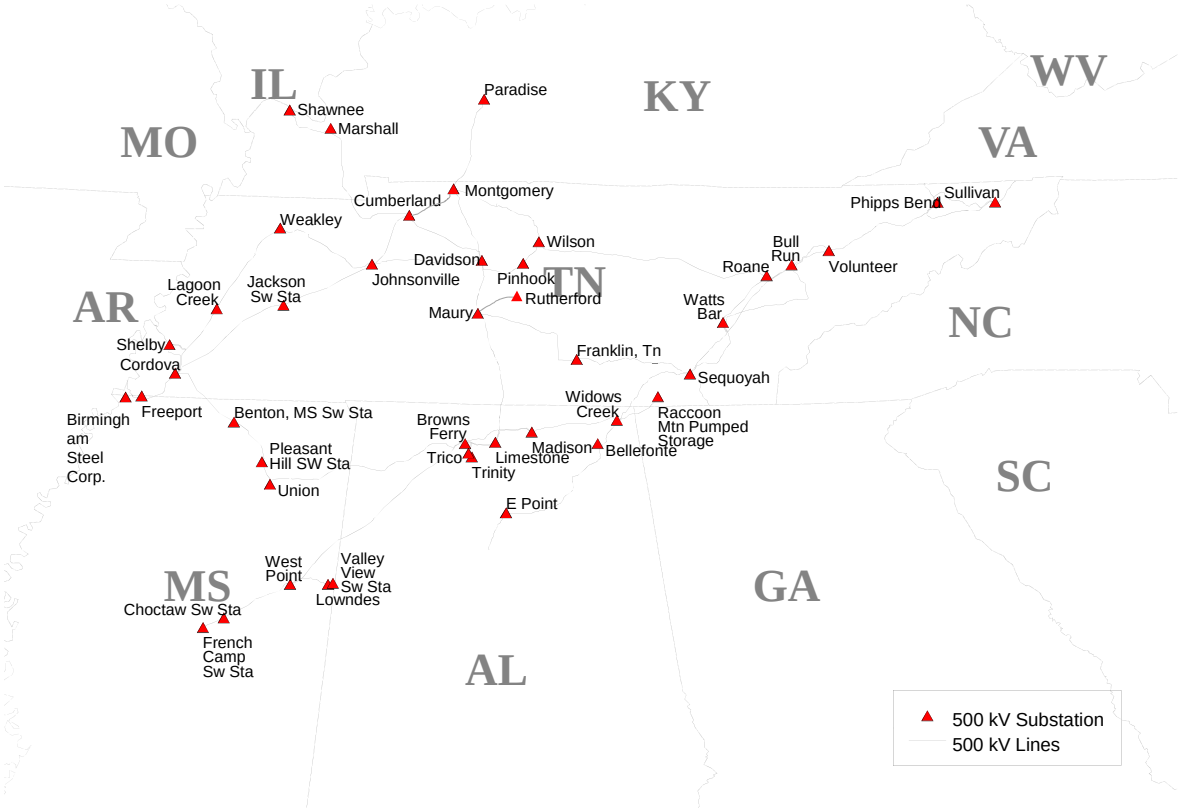
- The most important factors in evaluating TVA were:
  - Reliability
  - Affordable prices
  - Safe operation
- 42% of Valley residents said they believe that finding different energy sources such as solar and wind should be emphasized
  - Those interested in renewable energy were fairly split on whether they would pay more for it, though just under one-half indicated they would
- Valley residents find it very important for TVA to address the following:
  - Air pollutants and emissions such as sulfur dioxide, ozone, etc.
  - Use of renewable fuels such as solar, wind, water, and biomass
- The Valley residents that indicated they would pay more to reduce carbon emissions, were most willing to pay $11-$20 per month
- Residents' biggest concerns related to TVA's production of electricity were:
  - Cost
  - Environment impact
  - Reliability

Open Discussion on IRP Phone Survey

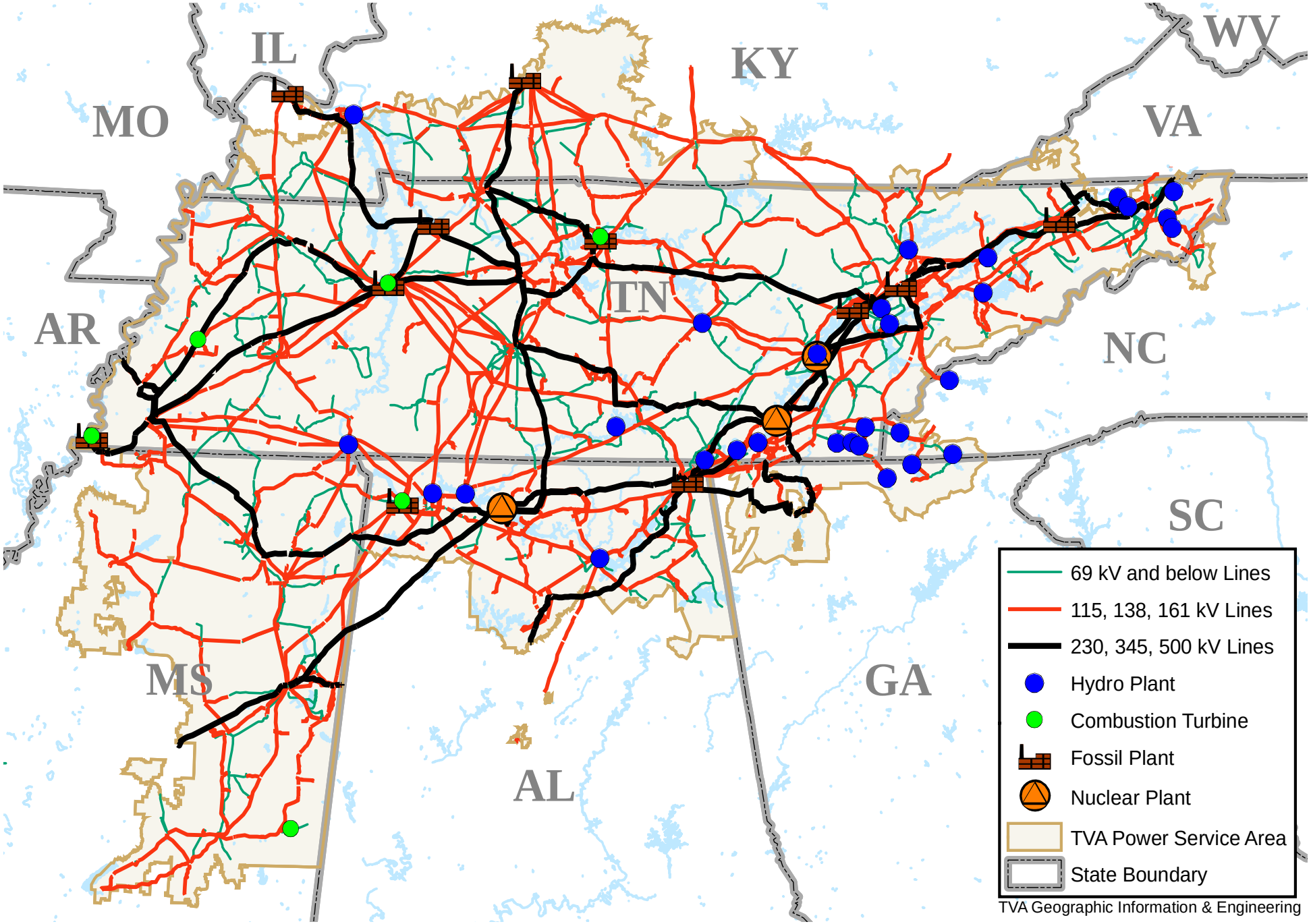
What We Have Today

- Designed to deliver internal TVA generation to TVA native load
- Total of 16,000* miles of transmission lines covering 80,000 square miles
  - 11,500* miles of 161-kV
  - 2,500* miles of 500-kV
  - 2,000* miles of 69 and 46-kV
  - 498 substations, switchyards and switching stations

  *values are approximate
- Supplies 155 distributors, 58 direct customers, 63 interconnections with neighboring utilities
- 53 generating plants
  - 3 nuclear, 29 hydro, 11 fossil, 9 gas, 2 combined cycle, and 1 pumped storage
- $200+ million invested annually in transmission
- Over a decade of 99.999% reliability



TVA's Existing Power System (Cont'd)



Transmission System Impacts – EE/DR

Positives

- Saves a total of 10% from Transmission (2%) & Distribution (8%) losses
- Creates potential to delay transmission expansion projects

Concerns

- Location, location, location
  - Must identify affected delivery point location before use in transmission expansion plan
  - Should be located in areas of transmission congestion to benefit transmission system
- Limited quantity
  - Limited quantity translates to limited impact to transmission system

Transmission System Impacts – Fossil Layups

- TVA's transmission system is designed around TVA's base load generation plants (fossil and nuclear) which serve local load and provide voltage support to the transmission system

- Impact of fossil layups on the transmission system vary based on location and unit size and typically include
  - Deficiencies in voltage support
  - Overloaded transmission lines

- Major schedule issues can also be created
  - Transmission upgrades can take 3-10 years to complete
  - When fossil units have an aggressive shutdown schedule, sometimes the only transmission solution is to replace the lost MWs with onsite generation

Transmission System Impacts – Renewables

- TVA's transmission system is designed to deliver internal TVA generation to TVA native load
  - In order to import substantial renewables (e.g., wind), the system must be re-designed

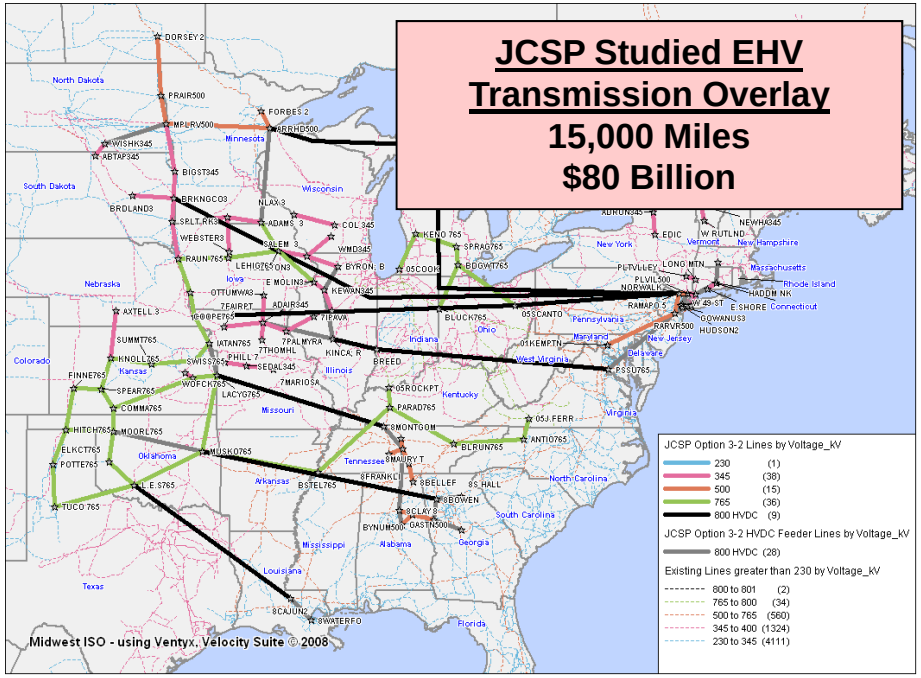
- TVA is an industry leader in pursing long-term renewable energy contracts and firm transmission paths to import this energy

- HVDC interconnection requests to deliver wind from the West are on the rise in the Southeast
  - Typically these requests are to deliver large quantities of power (3,000+ MWs)
  - Typically require major transmission upgrades to reliably deliver this power to the load

Transmission System Impacts – Renewables (Cont'd)

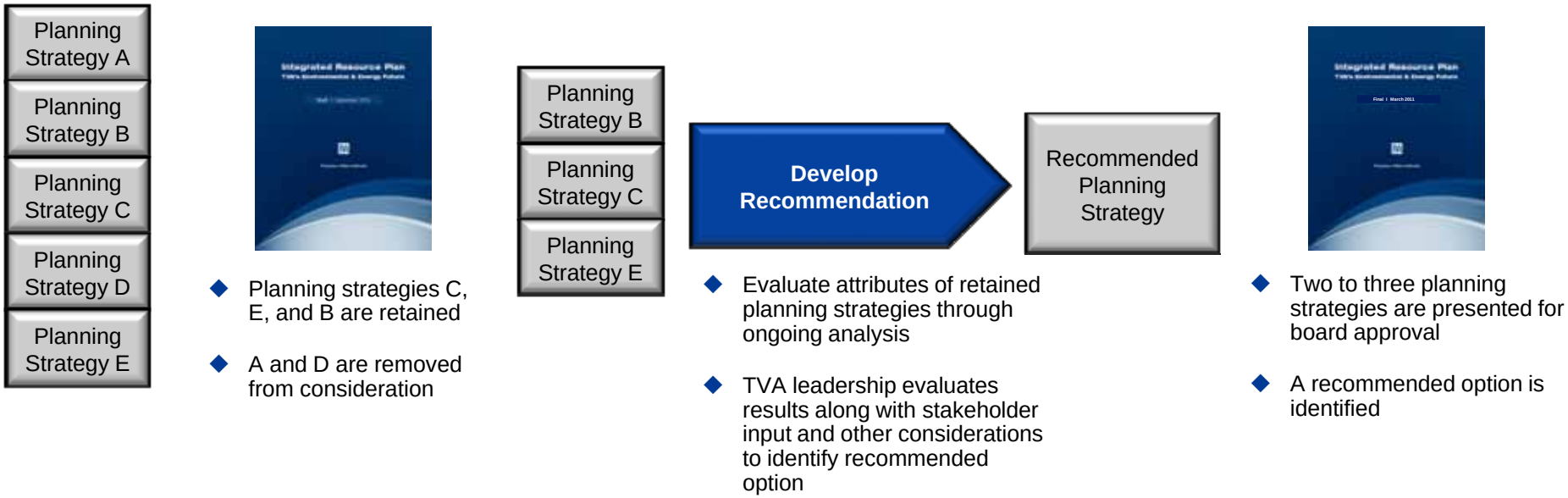
Joint-Coordinated System Plan (JCSP) Wind Study

- Study was performed in 2007 and led by PJM
- Deliver 20% renewable energy to the East
  - 240,000 MW
- Transmission impacts included
  - 15,000 miles of new Extra High-Voltage (EHV) transmission lines
  - Cost $80 billion for EHV network only
  - Cost for underlying transmission system could be another $80 billion



Developing the Recommended Planning Strategy

- The Draft IRP established a broad range of alternatives by presenting multiple planning strategies
- Between the Draft and Final IRP, a recommended planning strategy will be developed
  - The recommended planning strategy along with one to two alternatives will be included in the Final IRP
- Ongoing analysis will evaluate attributes from the top three planning strategies retained in the Draft IRP
  - The range of attributes in the retained strategies define the upper and lower bounds for the analysis



Analysis Approach

- The analysis approach has been modified to incorporate SRG input and increase productivity
  - The revised approach reduces defined model inputs and provides a more comprehensive result
  - A few “one-offs” will still be required to test additional factors
- Portfolios for renewable additions and EE/DR will be optimized in the analysis and not applied as defined model inputs
  - The model will select the best renewable and EE/DR portfolio from the options provided as a part of optimizing all other resource alternatives
- Fossil asset layups cannot be optimally selected and will require iterations to test all the levels
  - The optimum renewable and EE/DR portfolios will be selected for each level of fossil layups
- The following table summarizes options that will be evaluated

Attributes	Various Options for Developing the Recommended Planning Strategy				
EE/DR	– 2,100 MW & 5,900 annual GWh reductions by 2020	– 3,600 MW & 11,400 annual GWh reductions by 2020	– 4,000 MW & 8,900 annual GWh reductions by 2020	– 5,900 MW & 14,400 annual GWh reductions by 2020	
Renewable Additions	– 1,300 MW & 4,600 GWh competitive renewable resources or PPAs by 2020	– 2,000 MW competitive renewable resources or PPAs by 2020	– 2,500 MW and 8,600 GWh competitive renewable resources or PPAs by 2020	– 3,000 MW competitive renewable resources or PPAs by 2020	– 3,500 MW & 12,000 GWh competitive renewable resources or PPAs by 2020
Fossil Asset Layup	– 2,400 MW total fleet reductions by 2017	– 3,200 MW total fleet reductions by 2017	– 4,000 MW total fleet reductions by 2017	– 4,700 MW total fleet reductions by 2017	

Analysis Approach (Cont'd)

- The recommended planning strategy will be subject to constraints as defined by the planning strategies retained in the Draft IRP
  - These constraints are summarized below

Attributes	Constraints
EE/DR	– The EE/DR portfolio will be no less than 2,100 MW & 5,900 annual GWh reductions by 2020 (former planning strategy B)
Renewable Additions	– Renewable additions will be no less than the existing wind contracts (former planning strategy B)
Fossil Asset Layup	– Fossil layups will be between 2,400 MW (former planning strategy B) and 4,700 MW (former planning strategy E)
Energy Storage	– The pumped storage hydro unit (850 MW) will be included in all cases
Nuclear	– Nuclear units cannot be added any earlier than 2018 and must be a minimum of two years apart
Coal	– New units cannot be added prior to 2025 and must be equipped with carbon capture and sequestration
Market Purchases and Transmission	– If more than 900 MW are purchased beyond current contracts and extensions, potential transmission costs come into play
Transmission	– Transmission upgrades will be made to support new supply resources and maintain system reliability

Analysis Approach (Cont'd)

Previously identified sensitivity cases will be addressed as described below

Sensitivity Description	Method for Addressing
Evaluate increment/decrement of renewable additions for planning strategy C	– The range of renewable addition retained in the Draft IRP (along with additional increments) will be provided to the optimization tool as a selectable resource
Evaluate alternate fossil layup values for planning strategy C	– The range of fossil layups retained in the Draft IRP will be evaluated with all other resources optimized
Evaluate increment/decrement of EE/DR impacts for planning strategy C	– The range of EE/DR portfolios retained in the Draft IRP will be provided to the optimization tool as a selectable resource
Test "gas-only" expansion in planning strategy C	– "Gas-only" expansion will not allow nuclear additions – To be tested with 3,000 MW of fossil layups – All other factors will be optimized
Evaluate an aggressive EE/DR portfolio that targets 50% of the capacity gap beginning in 2015	– The 50% target will be based upon the capacity gap in the new baseline (Scenario 8) with 3,000 MW of fossil layups – All other factors will be optimized
Test deferral of nuclear expansion in planning strategy C until 2020	– Schedule of nuclear additions will be optimally selected based on the options and constraints described previously

Scenario Approach

- Analysis will follow an approach that uses a subset of the scenarios in the Draft IRP for interim evaluation

- Three scenarios will be used to efficiently test the full range of possible futures
  - Scenario 1 represents the upper bound
  - Scenario 3 is the lower bound and does not include climate change regulation
  - Scenario 8 is the current baseline and replaces the spring 2010 baseline

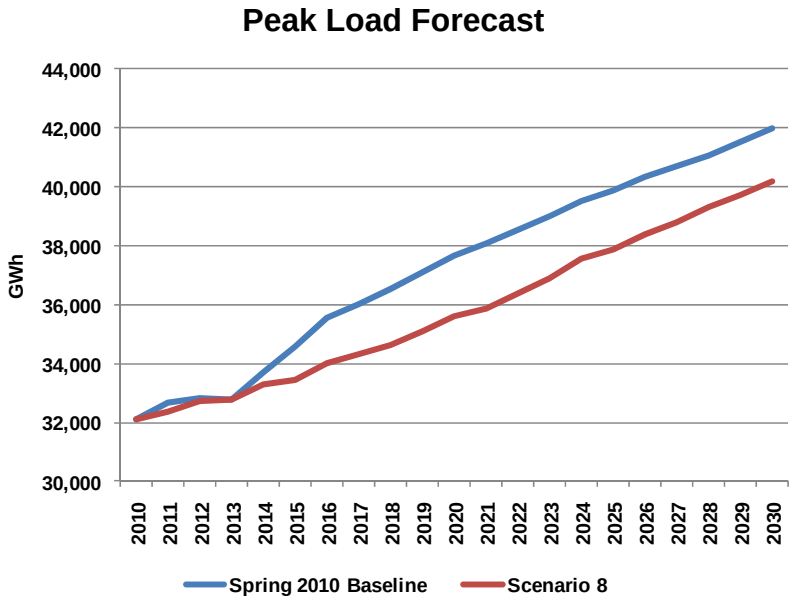
- Interim results will be evaluated on a pared down scorecard
  - The scorecard will use the same evaluation metrics and will be calculated in the same way as the Draft IRP
  - Former planning strategy C was the highest scoring in the Draft IRP and will be used as a reference line in the scorecard
  - A fully populated scorecard will be completed for the two to three planning strategies included in the Final IRP

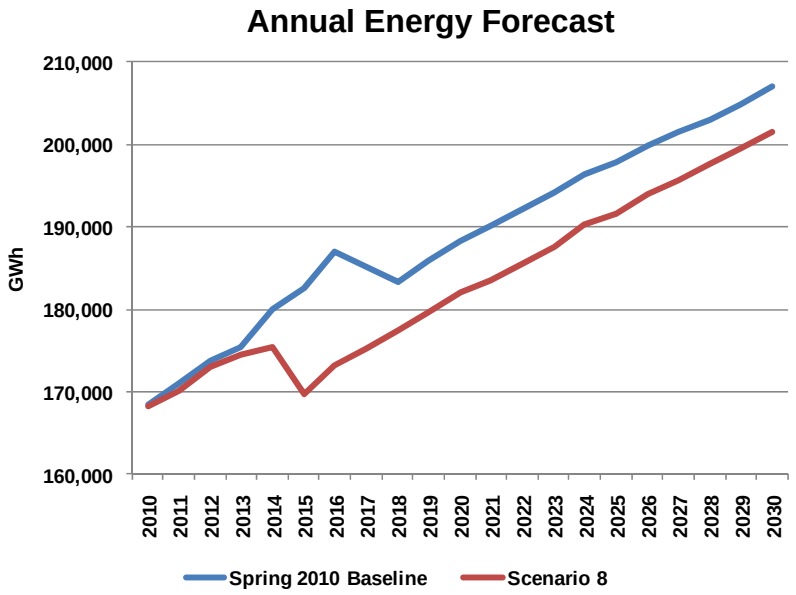
- The scenario approach significantly reduces model run time and increases the efficiency of the analysis

Additional information on Scenario 8 is included on the following slides

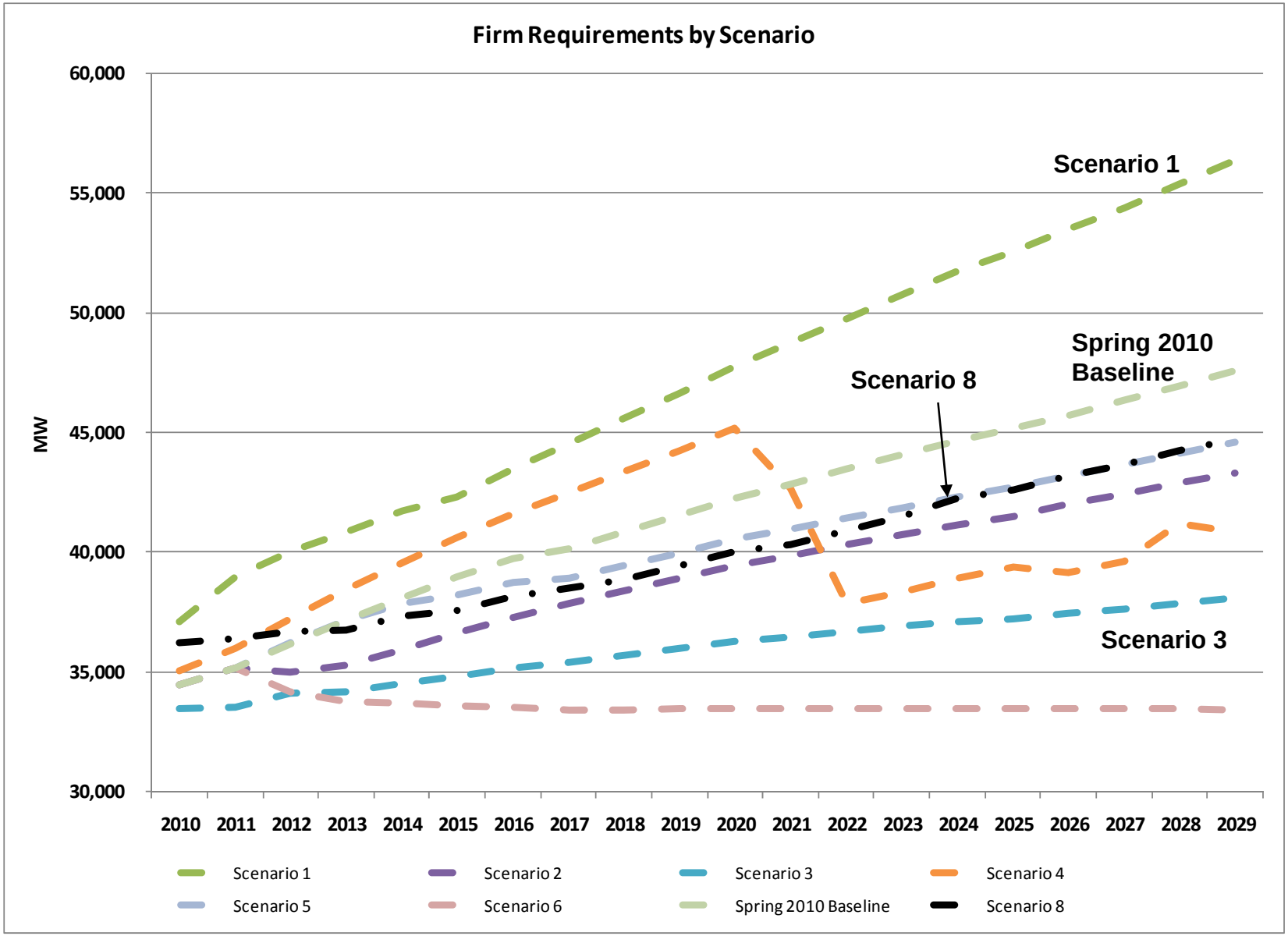
Comparison of Scenario 8 to Spring 2010 Baseline

- The most significant difference in the Spring 2010 Baseline and scenario 8 is a revised load forecast
- The figures to the right illustrate the peak load and annual energy forecasts for scenario 8 and the Spring 2010 Baseline
- The peak load forecast for scenario 8 is about 2,000 MW less than the Spring 2010 Baseline
  - Scenario 8 has an annual growth rate of 1.0% percent from 2011-2021
  - The annual growth rate for the Spring 2010 Baseline in the same period was 1.2%
- The annual energy forecast for scenario 8 is 5,000 GWh lower than the Spring 2010 Baseline
  - Scenario 8 has an annual growth rate of 0.8% percent from 2011-2021
  - The annual growth rate for the Spring 2010 Baseline in the same period was 1.1%



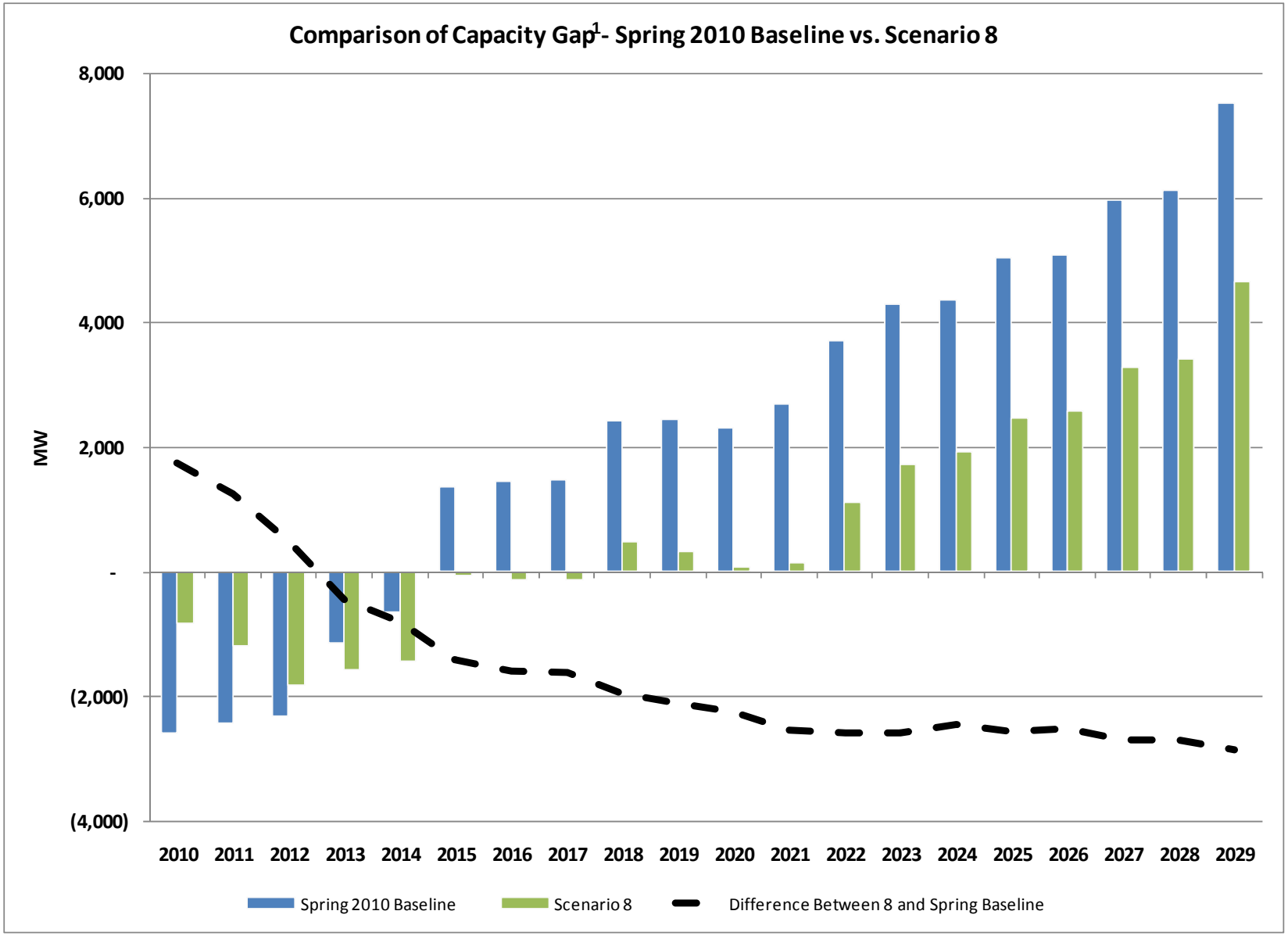


Scenarios Provide a Broad Range of Power Requirements



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

Comparison of Capacity Gaps



Scenario 8 will require fewer resources than the Spring 2010 Baseline to close the capacity gap

1 – Capacity gap shown based on 3,600 MW EE/DR by 2020, 2,500 MW of renewable additions by 2020, and 3,000 MW of fossil layups

Review of Key Inputs and Assumptions

- Key assumptions and inputs to the analysis are being reviewed as a part of the development of the recommended planning strategy

- The following characteristics have been modified
  - Load forecast: reduced from Spring 2010 Baseline
  - Natural gas price: increased expected 10 year average price of natural gas by 4%
  - Coal price: increased expected 10 year average composite price of coal by 1%
  - Coal operating characteristics: reduced Expected Forced Outage Rate (EFOR) by 0.4%

- Other relevant factors that are still under review are:
  - EE/DR portfolio assumptions
  - Capital cost estimates
  - Renewable portfolio assumptions
  - Regulatory outlook

Other Considerations of Risk

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

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

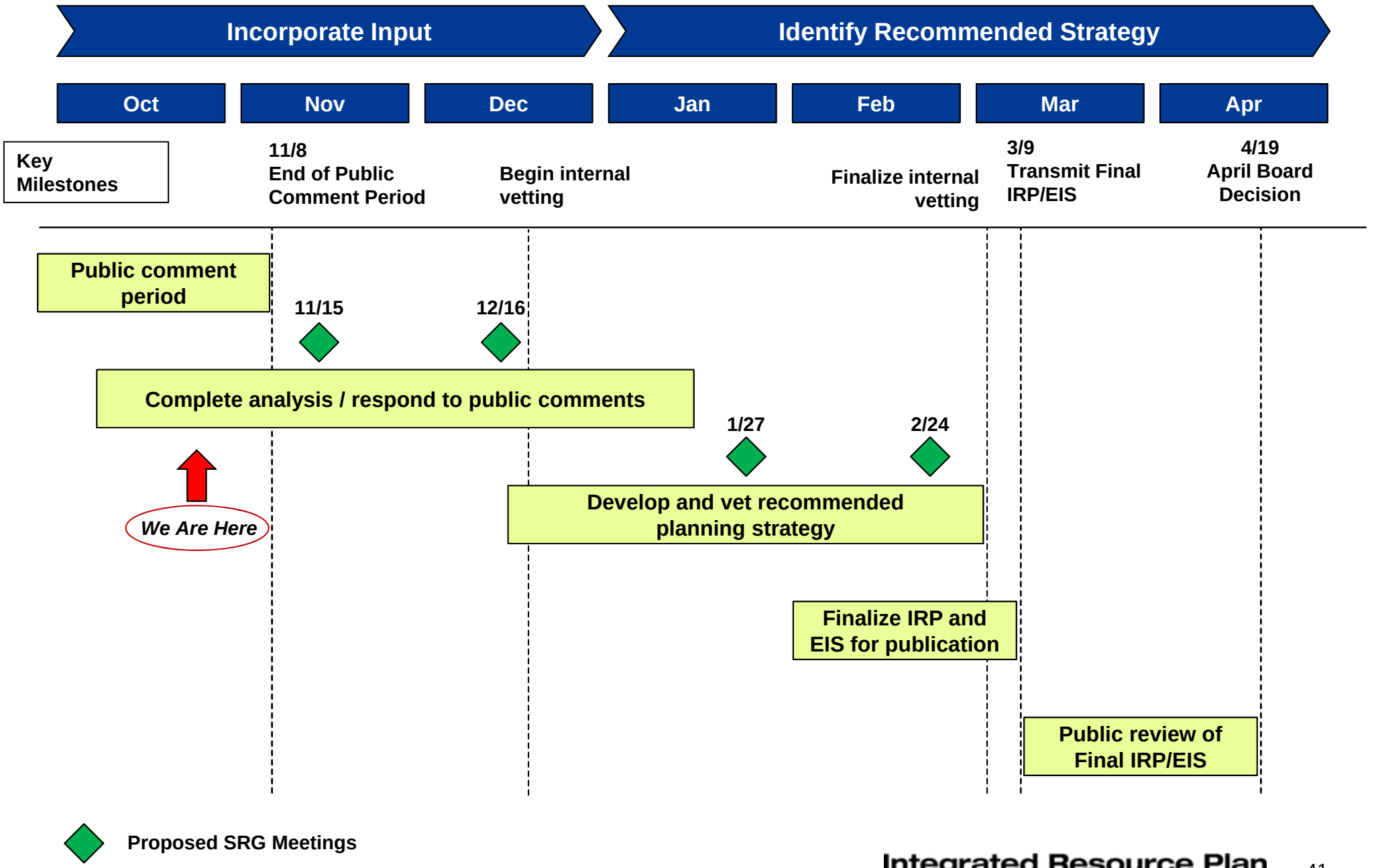
Other Risk Considerations	Potential Implications
— The ability of EEDR programs to stimulate distributor/customer participation and deliver forecasted energy savings and demand reductions	— Planning strategies with higher EEDR targets will have a greater exposure to this risk.
— The availability and 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
— The ability to maintain appropriate operational flexibility after significant changes in resource mix	— Risks of limiting operational flexibility increase as the magnitude of changes in baseload, dispatchable, and non-dispatchable resources change

Preliminary Insights

- A few preliminary insights were gleaned from the development of Scenario 8
- The lower load forecast in Scenario 8 will produce different unit addition schedules than the Spring 2010 Baseline
- While different, the expansion plans produced in Scenario 8 will still fall within the range of possible futures considered in the analysis

Detailed results will be reviewed in detail with the SRG once the analysis is complete and vetted with TVA leadership

High-Level IRP Project Schedule



Future SRG Meetings

Four additional meetings are planned for the SRG

Meeting Type	Topics	Proposed Date
Webinar	◆ Summary of input from public comment period ◆ Preliminary responses to input received ◆ Status of ongoing analysis	November 15, 2010
Working Session	◆ Discuss preliminary analysis results ◆ Input on potential implications of results	December 15, 2010
Working Session	◆ Discussion of potential recommendations in Final IRP	January 27, 2011
Working Session	◆ Preview of Final IRP	February 24, 2011