



2019 IRP Working Group

Meeting 8: October 25, 2018



Safety Moment



Building Emergency Plan

Introductions



- Name
- Organization and Role

Agenda – October 25

9:00	Welcome and Introductions and Safety Moment	Jo Anne Lavender
9:10	7 Re-Cap – key things covered Overview for today's session TVA Update: Financial Outlook	Brian Child
9:40	Recap where we are in the larger IRP process	Hunter Hydas
9:50	Round table: Individual Reflections of Input and process so far	Lavender and Group
10:10	Recap of Current Engagement Activities	Amy Henry
10:20	Break	
10:35	Recap on Metrics and Scorecards Overview of EIS Metrics: Land use and Lifecycle	Hunter Hydas Ashley Pilakowski
11:05	Outreach Plan for EJ Communities	Blair Wade
11:45	Lunch	
12:30	Review Confidential Protocols	Khurshid Mehta
12:35	Reminder of how the Model Works Review Reference Case	Jane Elliott and Team
2:00	Next Steps in Modeling Discuss Considerations and Sensitivities Planned	Jane Elliott
2:45	Wrap up and Adjourn	

Highlighted sections contain confidential information



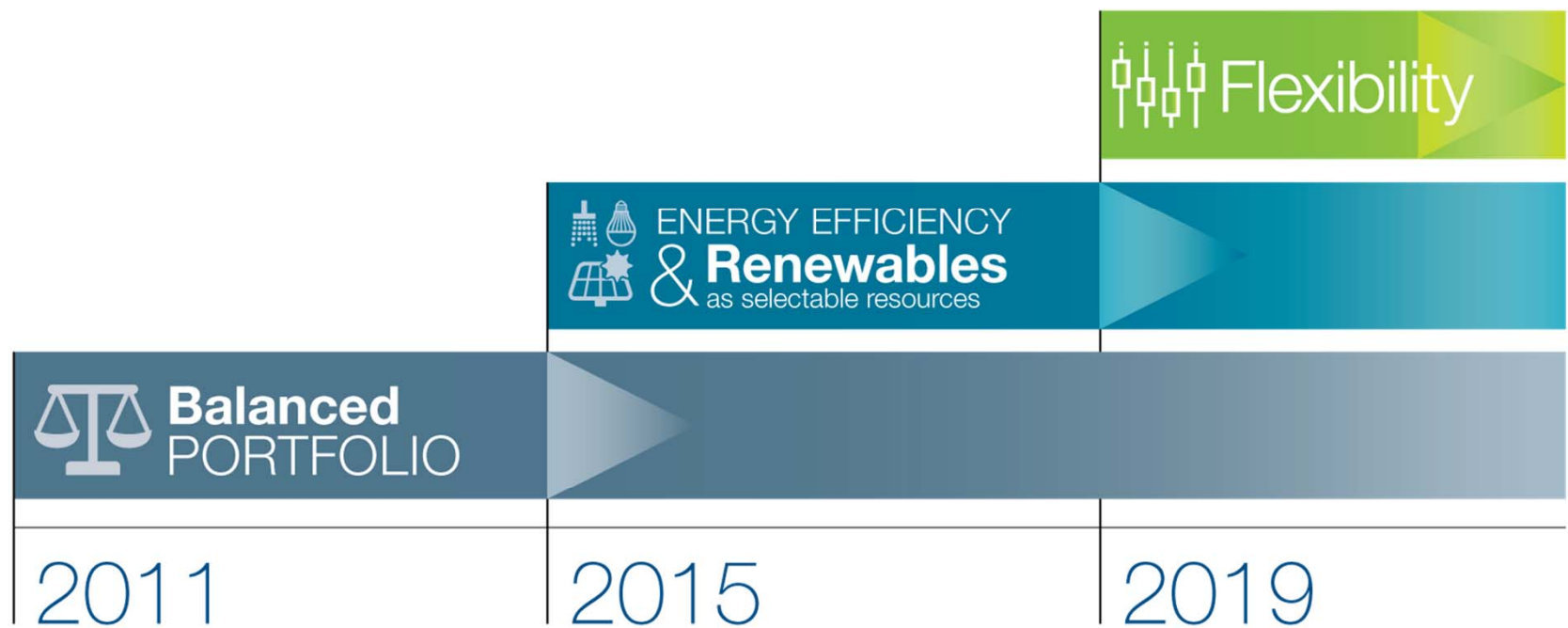
IRPWG Meeting 7 Recap

Brian Child

September Meeting Highlights

- IRP Metrics & Scorecards
- EIS Outline and Environmental Justice discussion
- Recap on Modeling and Strategy Development
- Energy Efficiency, Demand Response, and Distributed Generation Overviews
- Finalized Strategies

INTEGRATED Resource Plan 2019



2019 IRP Focus Areas

- System flexibility
- Distributed Energy Resources
- Portfolio diversity

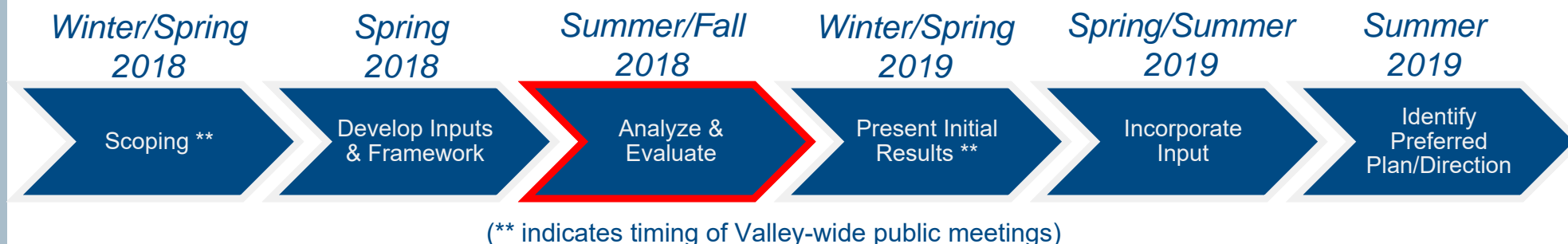


Flexibility



2019 IRP Schedule: Schedule & Milestones

The 2019 IRP Study Approach is intended to ensure transparency & enable stakeholder involvement



Key Tasks/Milestones in this study timeline include:

- Establish stakeholder group and hold first meeting (Feb 2018)
- System modeling (June – December, 2018)
- Publish draft EIS and IRP (Feb 2019)
- Complete public meetings (March 2019)
- Board approval and final publication of EIS and IRP (expected Summer 2019)

IRP Working Group Meeting Objectives

September 26 th -27 th	October 25 th	December 19 th -20 th	January 30 th -31 st , 2019
<ul style="list-style-type: none">• Strategy design (final)• Scorecard development (final)• Scorecard design• Environmental Impact Statement (EIS) outline	<ul style="list-style-type: none">• Finalize Metrics• Follow up on Environmental Impact Statement• Review Reference Case	<ul style="list-style-type: none">• Review Near Final Results for Draft Documents	<ul style="list-style-type: none">• Review Final Results for Draft Documents



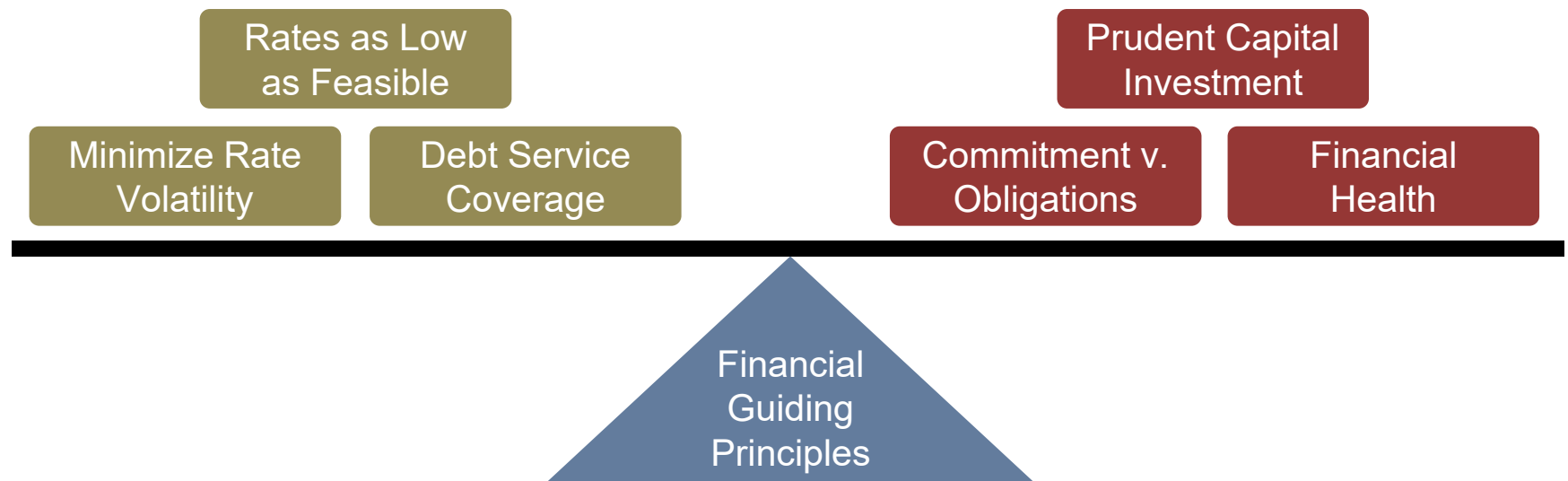
Financial Outlook

Brian M. Child

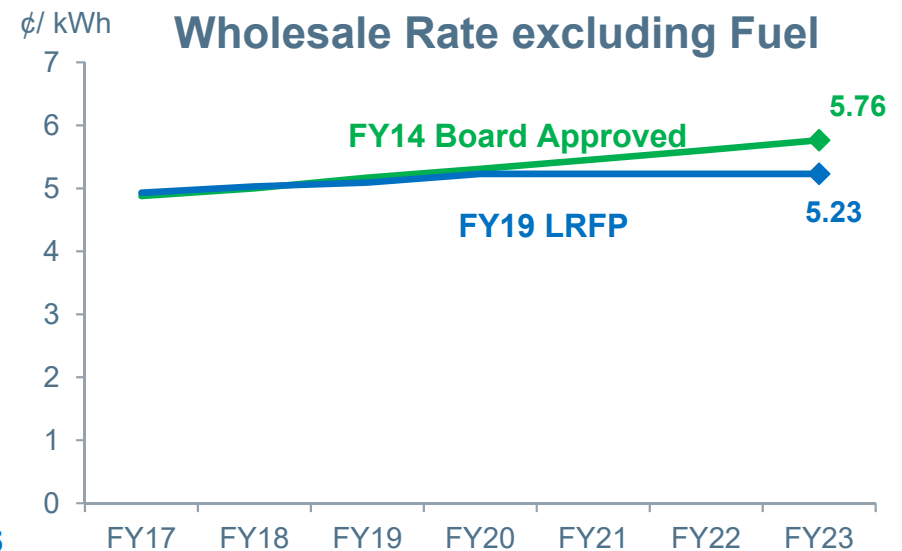
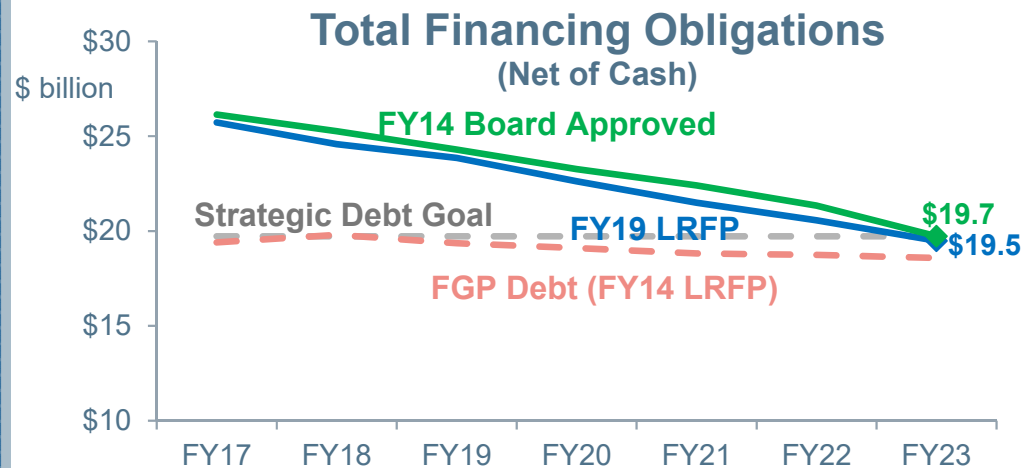
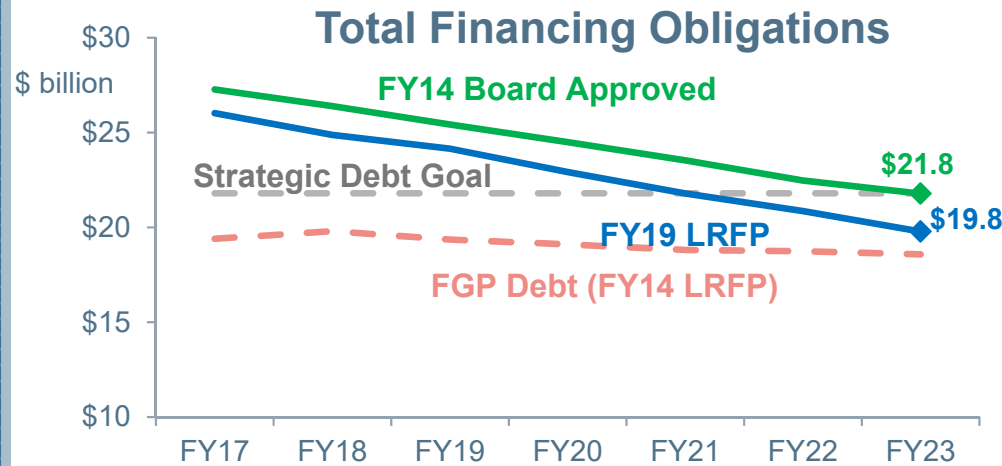
TVA Long-Range Financial Plan

- 2014 President's Budget – divest TVA due to inability to control debt (among other things)
- TVA/Lazard Study – TVA model is best for the Valley if TVA executes plan
- TVA commitment to OMB – reduce debt to \$21.8 billion by 2023
- TVA plan to reduce debt:
 - 1.5 percent annual base rate increases as long as rates remain competitive
 - Offset rate increases by reducing O&M (\$800M), reducing fuel costs (\$1 billion) and improving operations of assets and people
 - Reducing fuel costs required fleet modernization and large capital program (\$15 billion)
 - Achieved with slight overall reduction in debt and capital program substantially reduced
- Reporting progress to OMB routinely; audited by GAO

Financial Strategy Tradeoffs

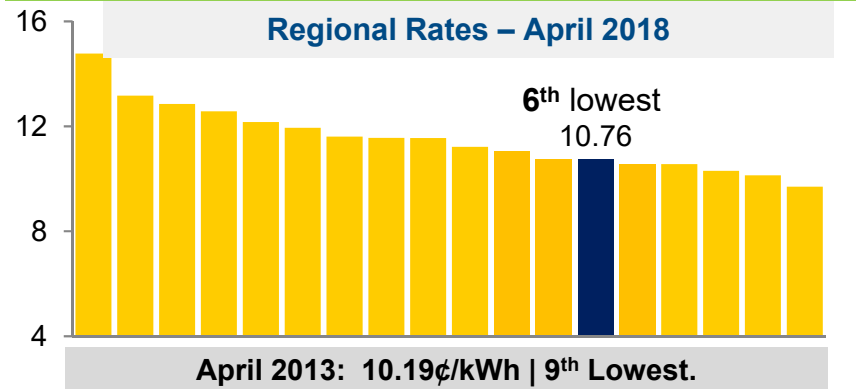


Balancing Rates and Debt – FY19 LRFP

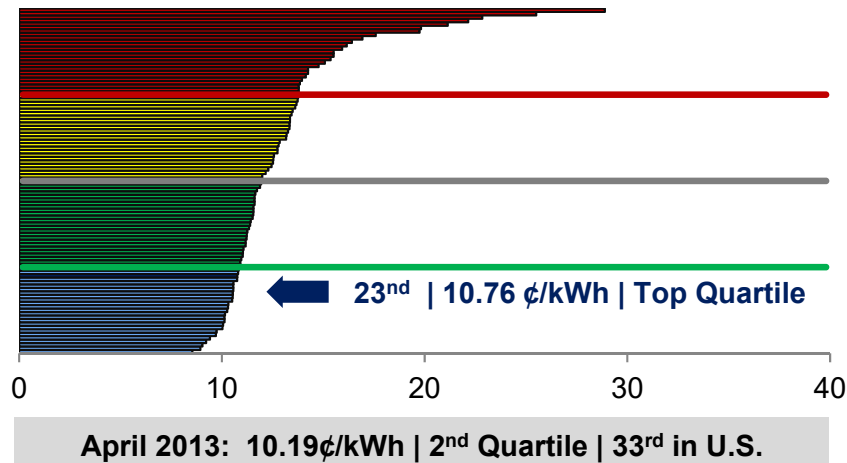


Tennessee Valley Rate Competitiveness

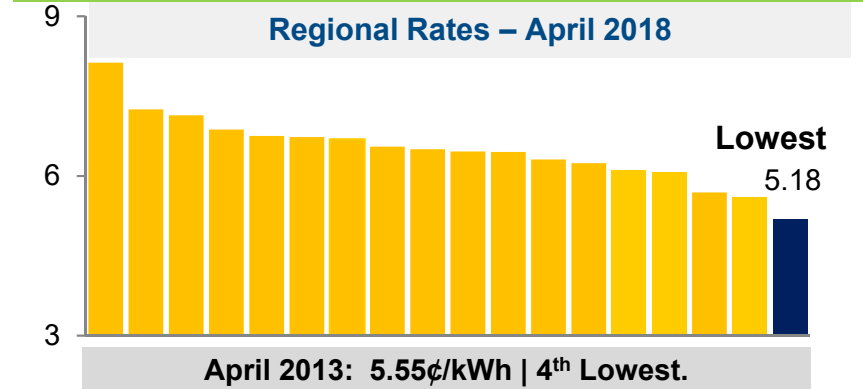
RESIDENTIAL



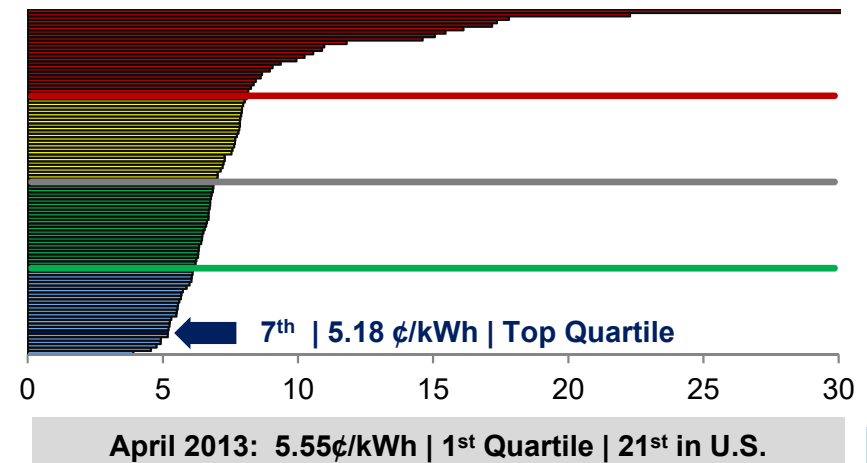
Top 100 Utilities – April 2018



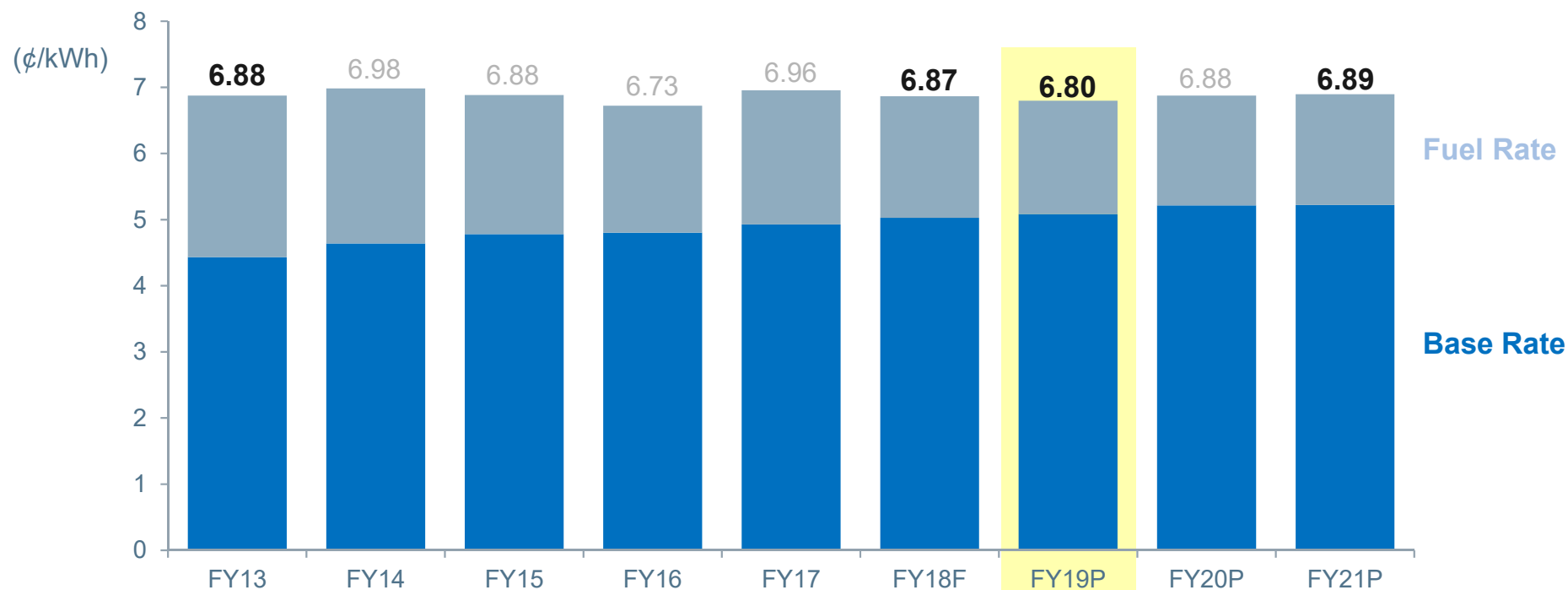
INDUSTRIAL



Top 100 Utilities – April 2018

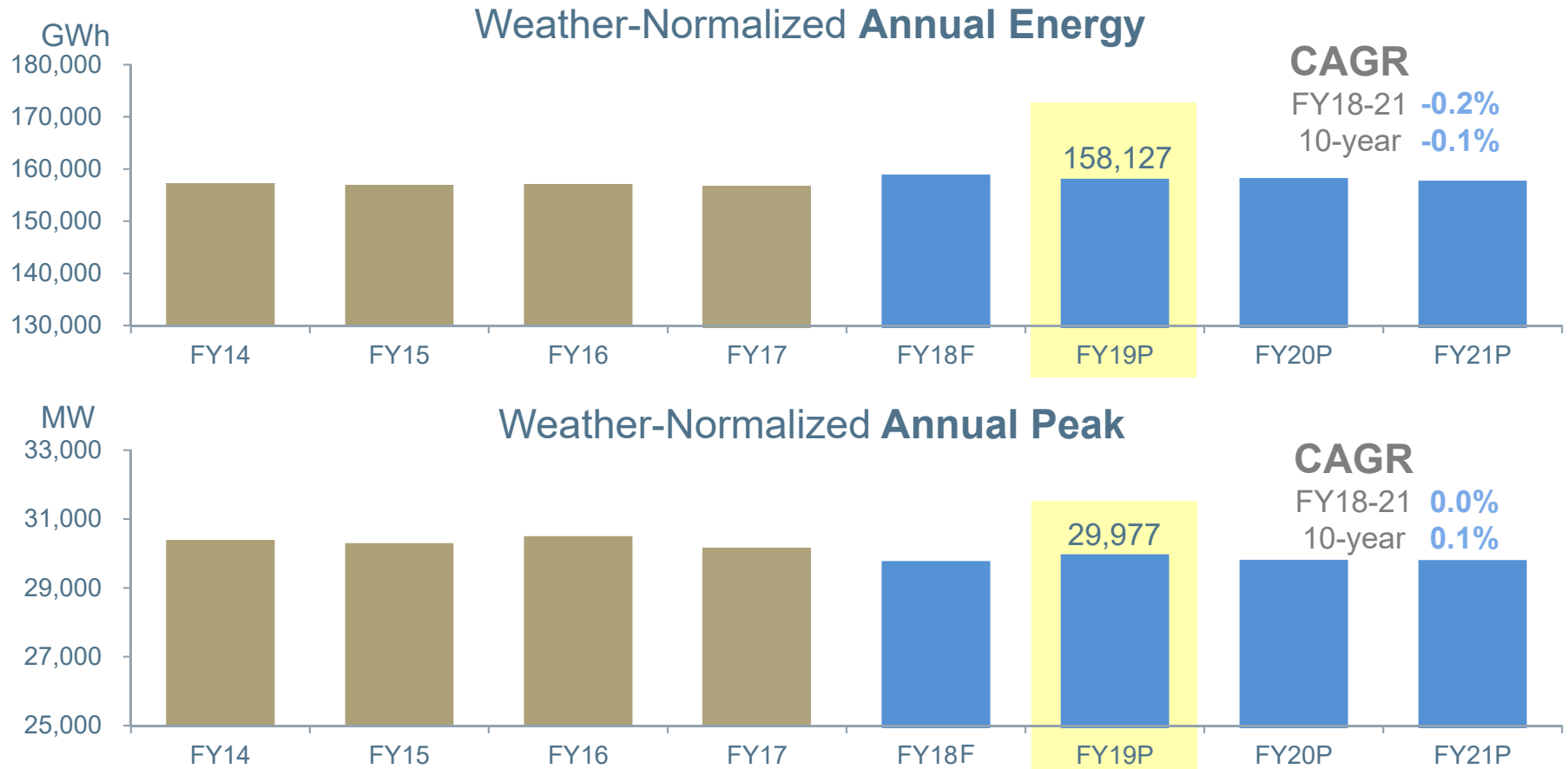


Flat Effective Wholesale Rate

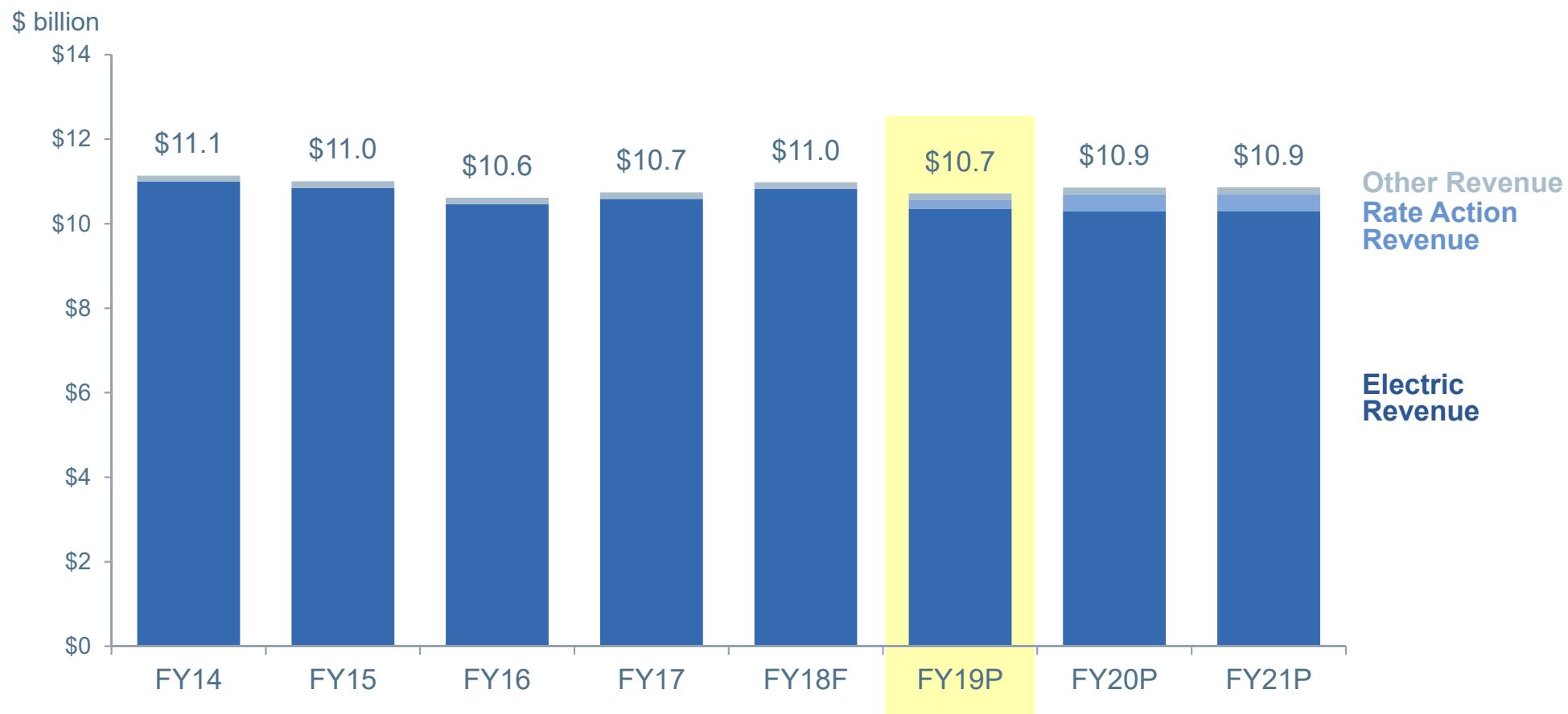


	FY13	FY14	FY15	FY16	FY17	FY18F	FY19P	FY20P	FY21P
Base Rate	4.44	4.64	4.78	4.81	4.93	5.03	5.09	5.22	5.22
Fuel Rate	2.44	2.34	2.10	1.92	2.03	1.84	1.71	1.66	1.67
Total Wholesale Rate	6.88	6.98	6.88	6.73	6.96	6.87	6.80	6.88	6.89

Energy and Peak

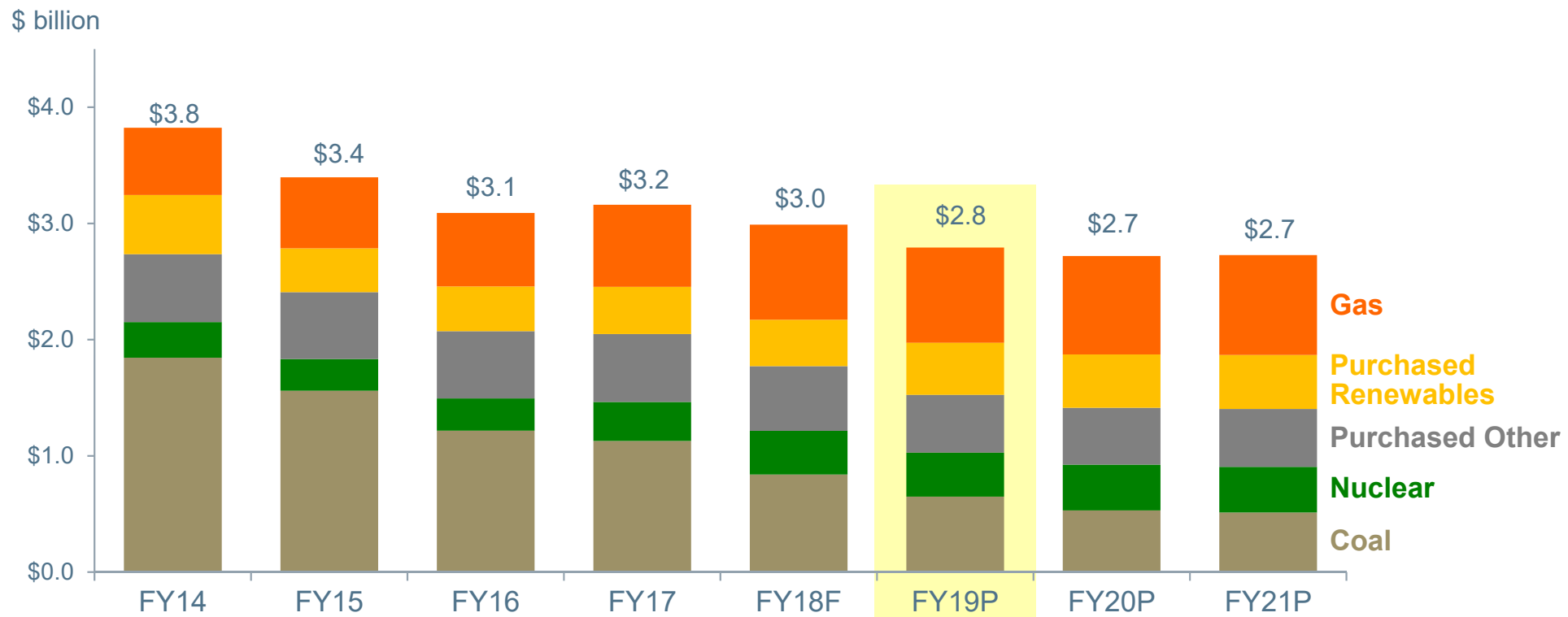


Operating Revenue

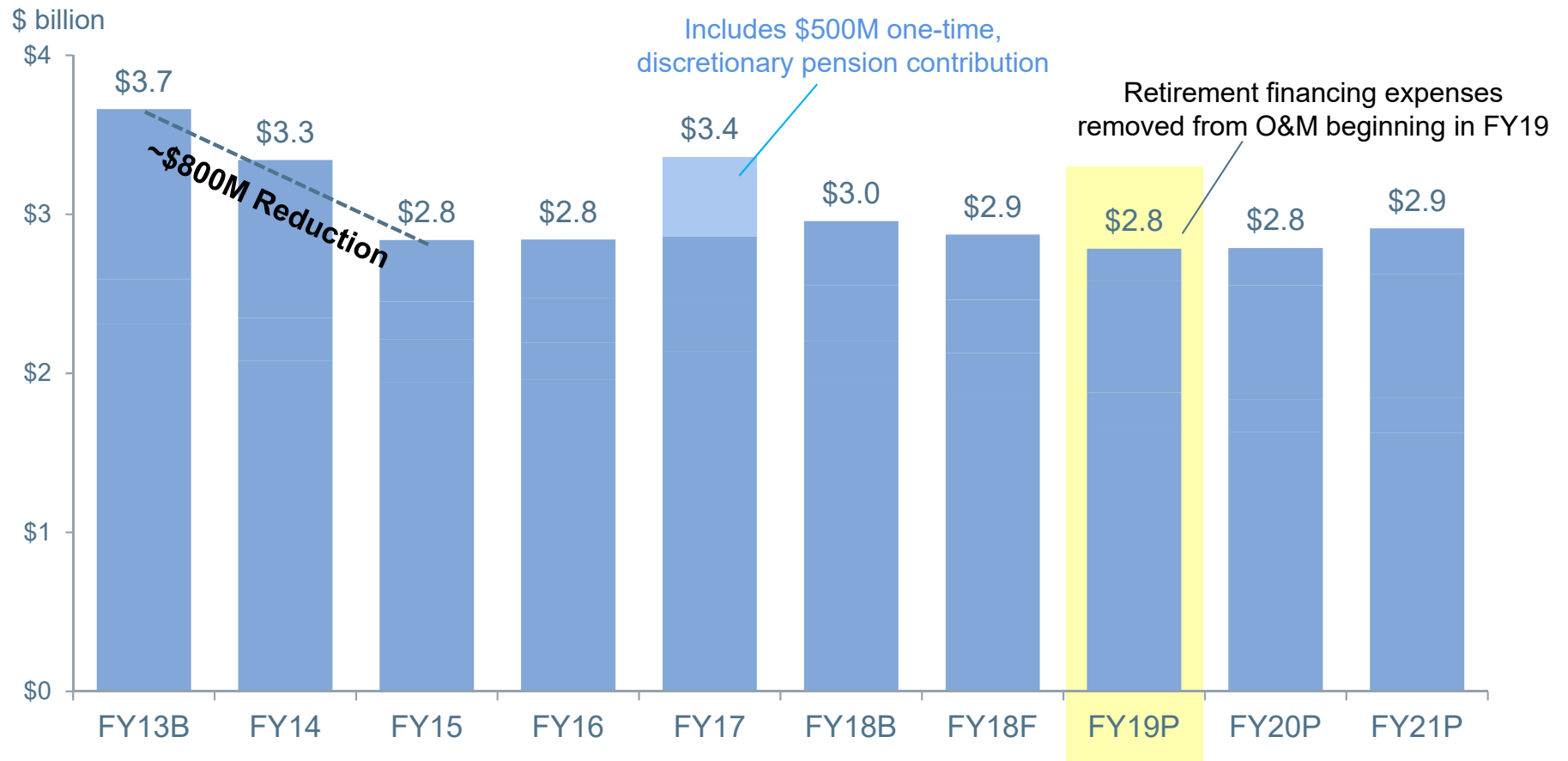


Fuel and Purchased Power

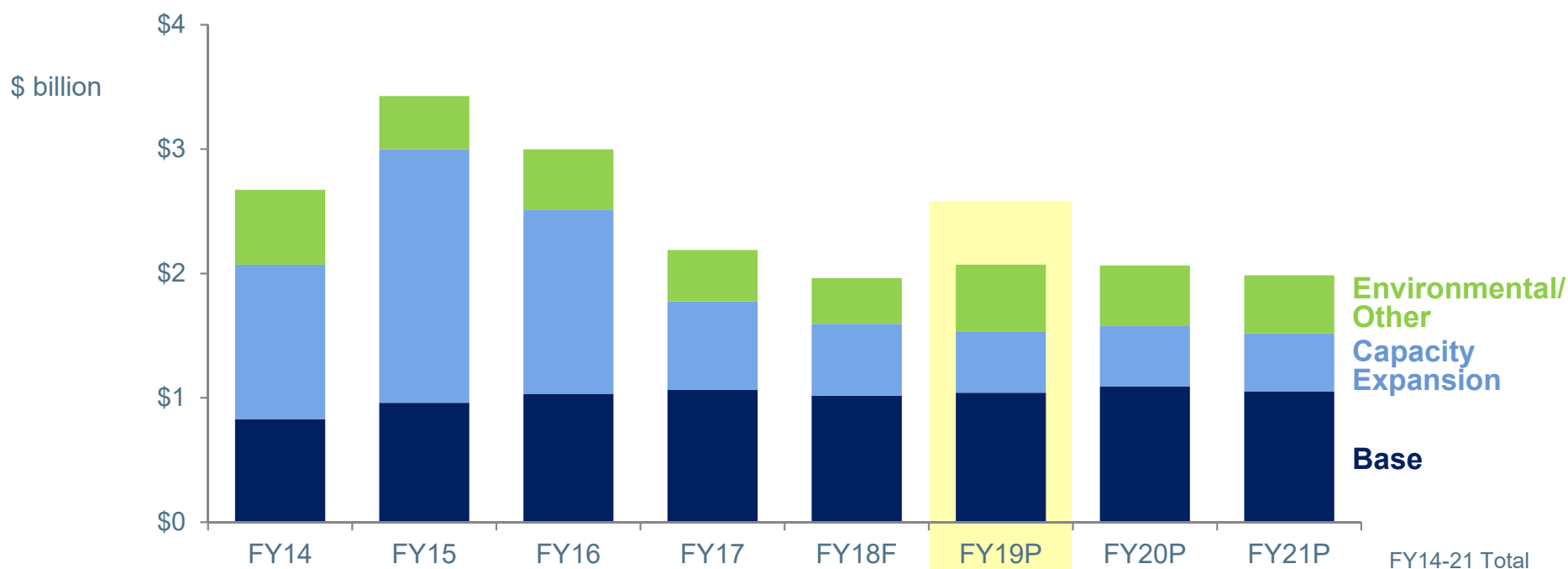
Benefits of a balanced portfolio



O&M Expense



Capital Expenditures

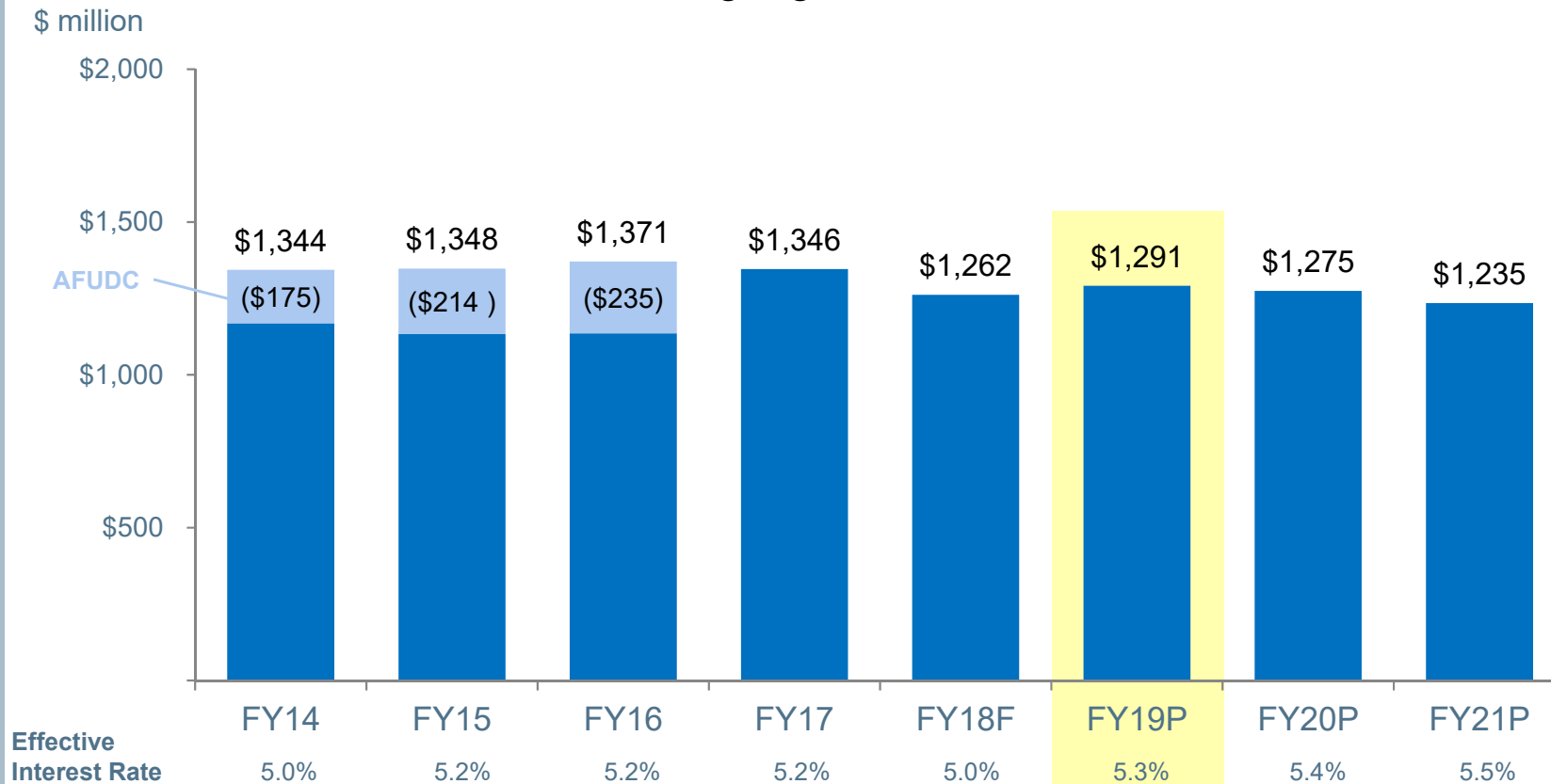


	FY14	FY15	FY16	FY17	FY18F	FY19P	FY20P	FY21P	FY14-21 Total
Base	\$ 0.8	\$ 1.0	\$ 1.0	\$ 1.1	\$ 1.0	\$ 1.0	\$ 1.1	\$ 1.0	\$ 8.0
Capacity Expansion	1.3	2.0	1.5	0.7	0.6	0.5	0.5	0.5	7.6
Environmental/Other	0.6	0.4	0.5	0.4	0.4	0.5	0.5	0.5	3.8
Total Capital Expenditures	\$ 2.7	\$ 3.4	\$ 3.0	\$ 2.2	\$ 2.0	\$ 2.0	\$ 2.1	\$ 2.0	\$ 19.4

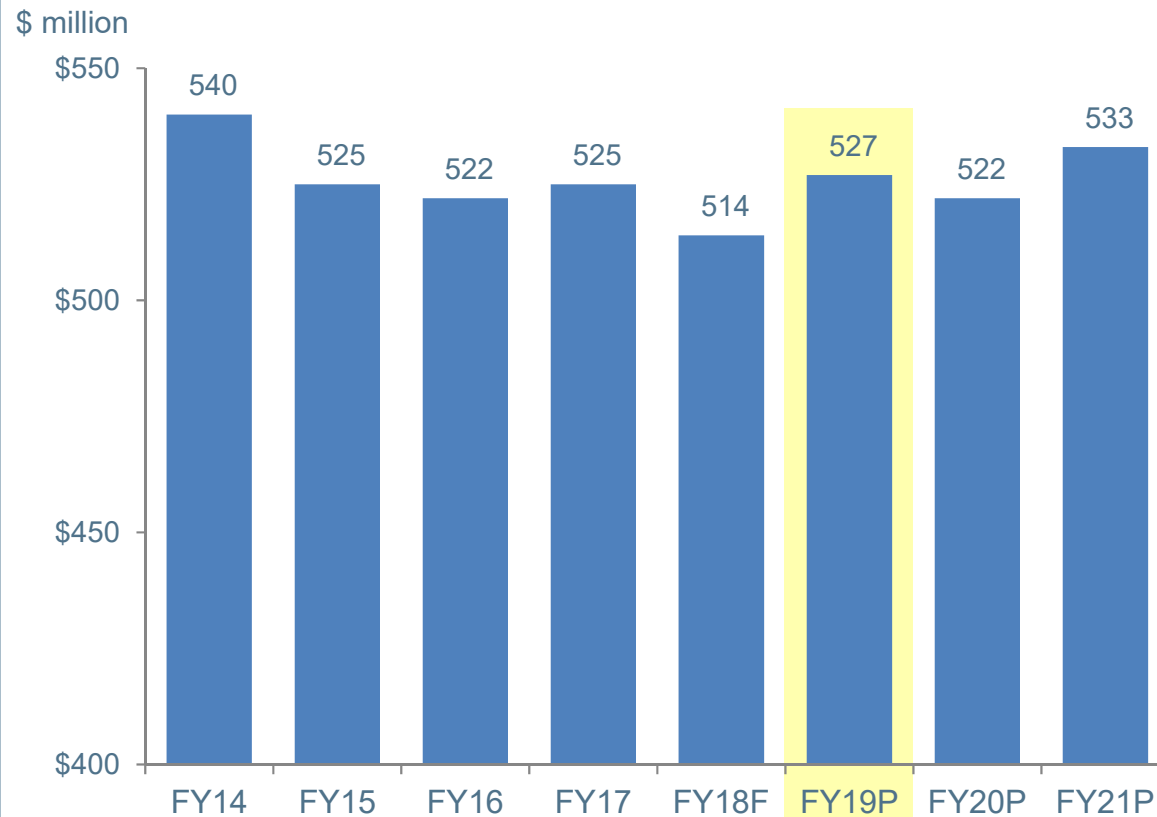
Capital Expenditures include AFUDC, ARO/Decommissioning, Kingston Ash Cleanup and Bellefonte Regulatory Asset spend

Interest Expense

Debt reduction offsetting higher effective interest rates



Tax Equivalents



Tax Equivalent Payments by State

\$ million	FY17 Final	FY18 Final	Delta
Tennessee	\$ 344	\$ 347	\$ 3
Alabama	87	88	1
Mississippi	39	40	1
Kentucky	34	36	2
Georgia	8	8	-
North Carolina	3	3	-
Virginia	1	1	-
Illinois	1	1	-
Total Payments	\$ 517	\$ 524	\$ 7
FCA Adjustment	8	(10)	(18)
Total Expense	\$ 525	\$ 514	\$ (11)

Risks to the Plan: \$Billion+

Loss of Load and/or Customers

Environmental Remediation Cost

Litigation

Financial Risk/Economy

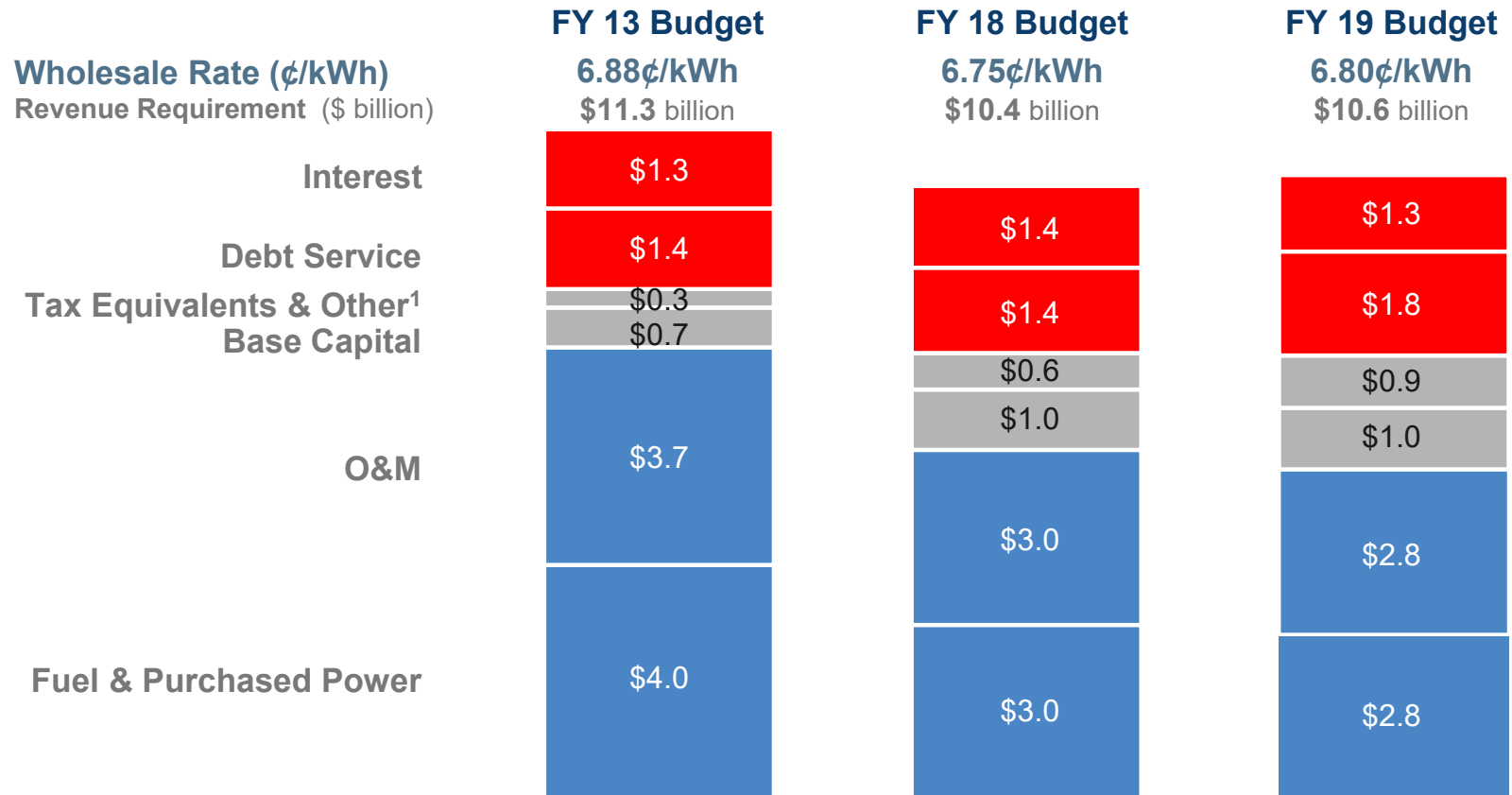
Pension Liability

Aging Infrastructure

Industry Issue

New Regulation/Compliance

Debt Reduction



¹Tax Equivalents & Other for FY13 excludes adjustment for pension expense

Revenue Requirements

\$ million	FY18B	FY18F	FY19P	FY20P	FY21P
<u>Revenue Forecast</u>					
Fuel	2,953	2,990	2,792	2,720	2,728
O&M	2,958	2,872	2,790	2,795	2,918
Base Capital	1,020	1,018	1,041	1,090	1,050
Interest	1,382	1,262	1,291	1,275	1,235
Tax Equivalents	510	514	527	522	533
Debt Paydown	1,439	2,086	1,759	2,208	2,067
Other	110	86	356	85	171
Total TVA Revenue Requirements	\$ 10,372	\$ 10,828	\$ 10,556	\$ 10,695	\$ 10,702
 Base Revenues	 7,349	 7,932	 7,699	 7,711	 7,704
Fuel Revenues	2,828	2,896	2,658	2,582	2,596
Rate Action Revenues	195	-	199	402	402
Total Electric Revenues	\$ 10,372	\$ 10,828	\$ 10,556	\$ 10,695	\$ 10,702
 Surplus / (Shortfall)	 -	 -	 -	 -	 -
 Strategic Capital	 1,112	 947	 1,030	 975	 936
Cash on Hand	-	-	-	-	-
Debt Paydown	(1,439)	(2,086)	(1,759)	(2,208)	(2,067)
Change in TFO	\$ (327)	\$ (1,139)	\$ (729)	\$ (1,233)	\$ (1,131)

TVA Financial Plan

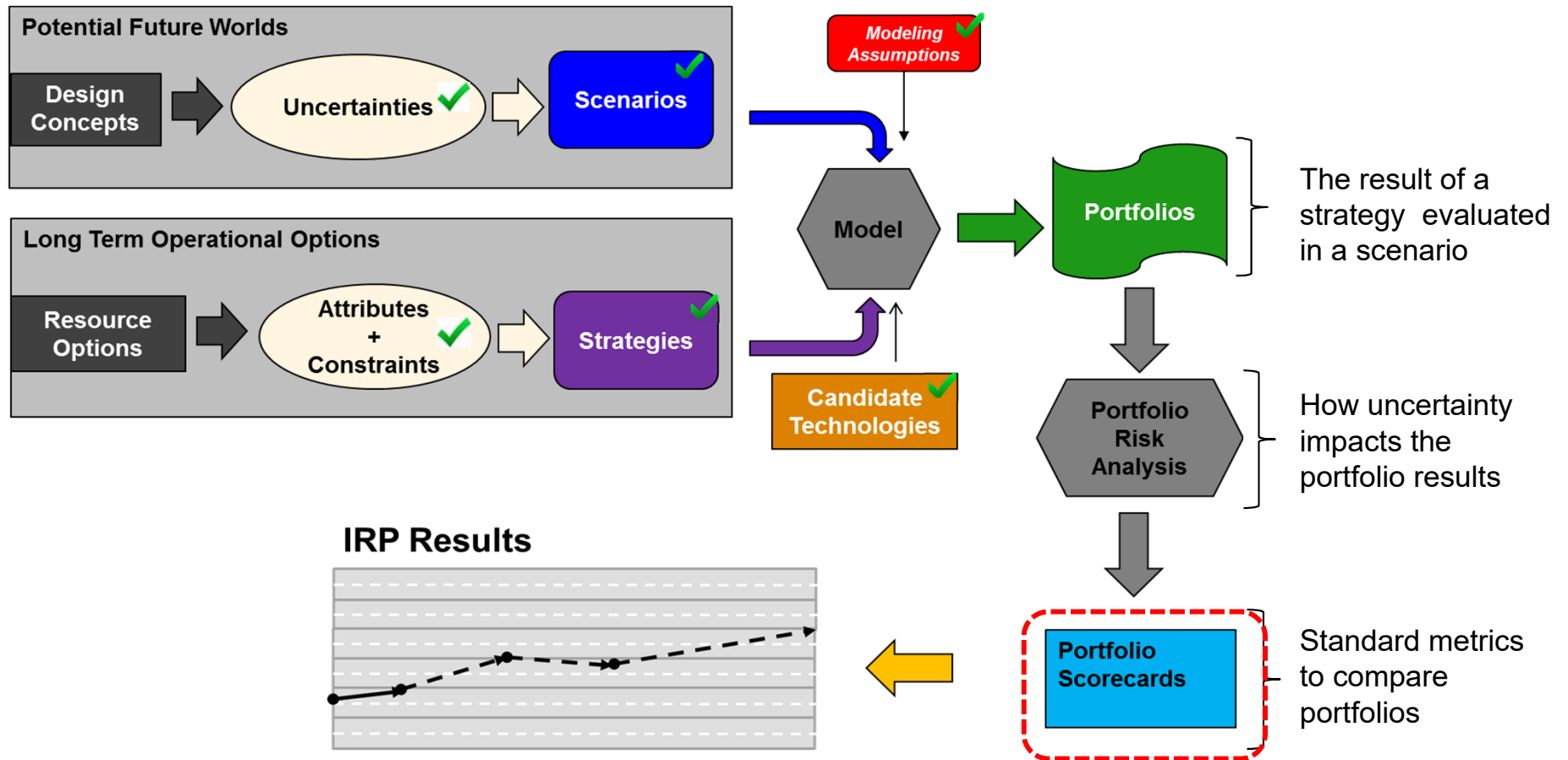
- Improved rate competitiveness in the Valley
 - Effective rates flat for 8 years
 - \$1 billion in fuel savings
 - \$800 million O&M reduction
- \$15 billion in capital expenditures
- \$3 billion of debt reduction
- TVA commitment to OMB
 - Debt \$21.8 billion by 2023
 - Debt \$19.7 billion net of cash



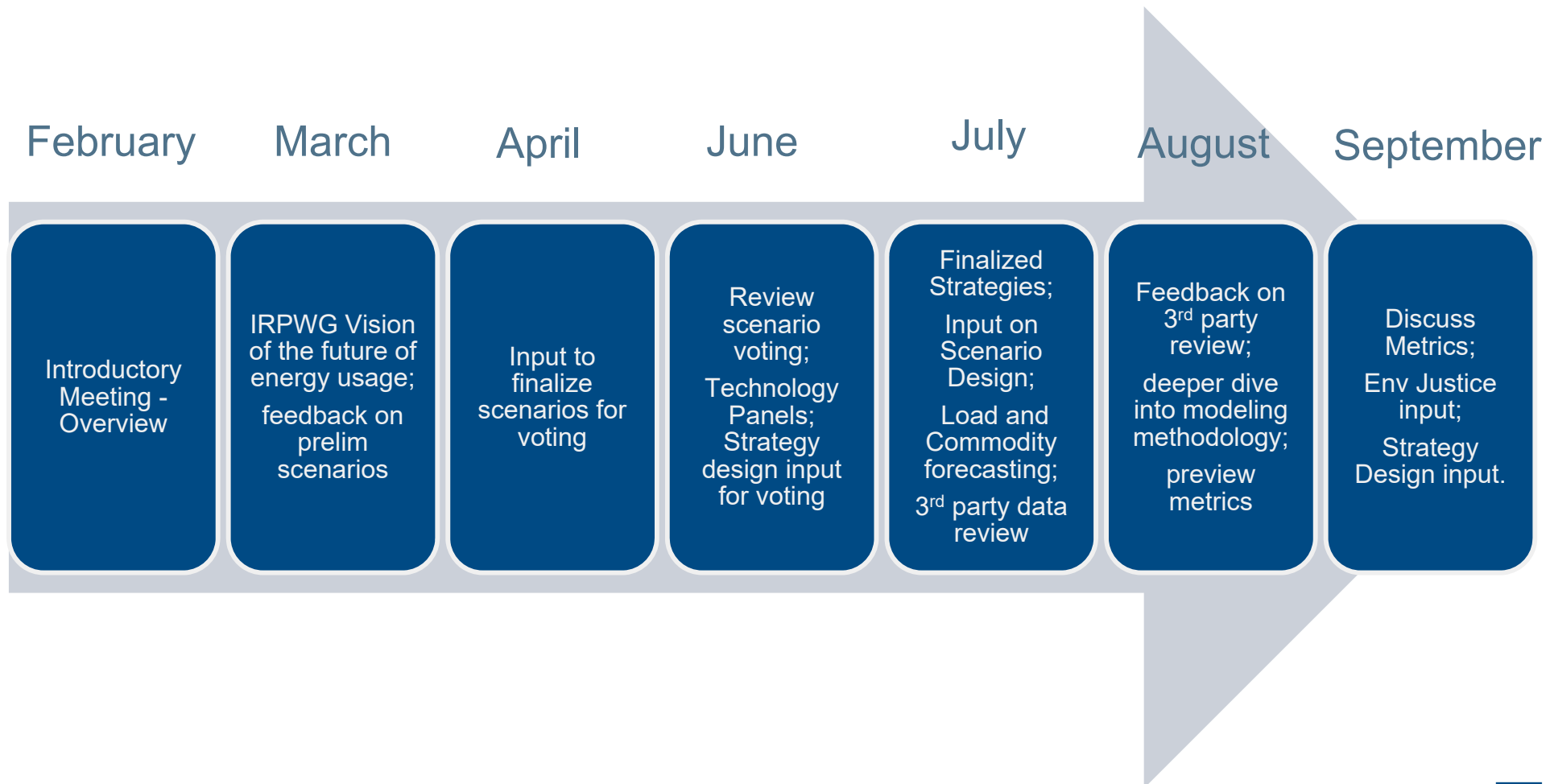
IRP Progress Check-In

Hunter Hydas

Integrated Resource Planning Process



IRPWG Input to date -- Shaping the Process





Individual Reflections on the Process

Jo Anne Lavender and IRPWG Members

What are your thoughts and feedback on the process of developing the IRP so far?



IRP Public Outreach Update

Amy Henry

TVA – 2019 IRP Website



www.tva.com/irp

- Nearly 8,000 views
- Average 2.5 minutes per visit

Upcoming Videos

October 2018	December 2019	February 2019	August 2019
“A Better Future for IRP-Y”	IRP Modeling	Draft IRP/ EIS Video	Overview of Final IRP & preferred alternative
<ul style="list-style-type: none"> • General education on IRP • Targeted for Gen Z/ Millennial for early education on value of TVA as this demographic comes into being rate payers 	<ul style="list-style-type: none"> • Basic education on IRP modeling – strategies, scenarios, constraints 	<ul style="list-style-type: none"> • Increase direct engagement w/ members of public • Encourage attendance at public meetings 	<ul style="list-style-type: none"> • Overview of final IRP & public input • Present preferred alternative





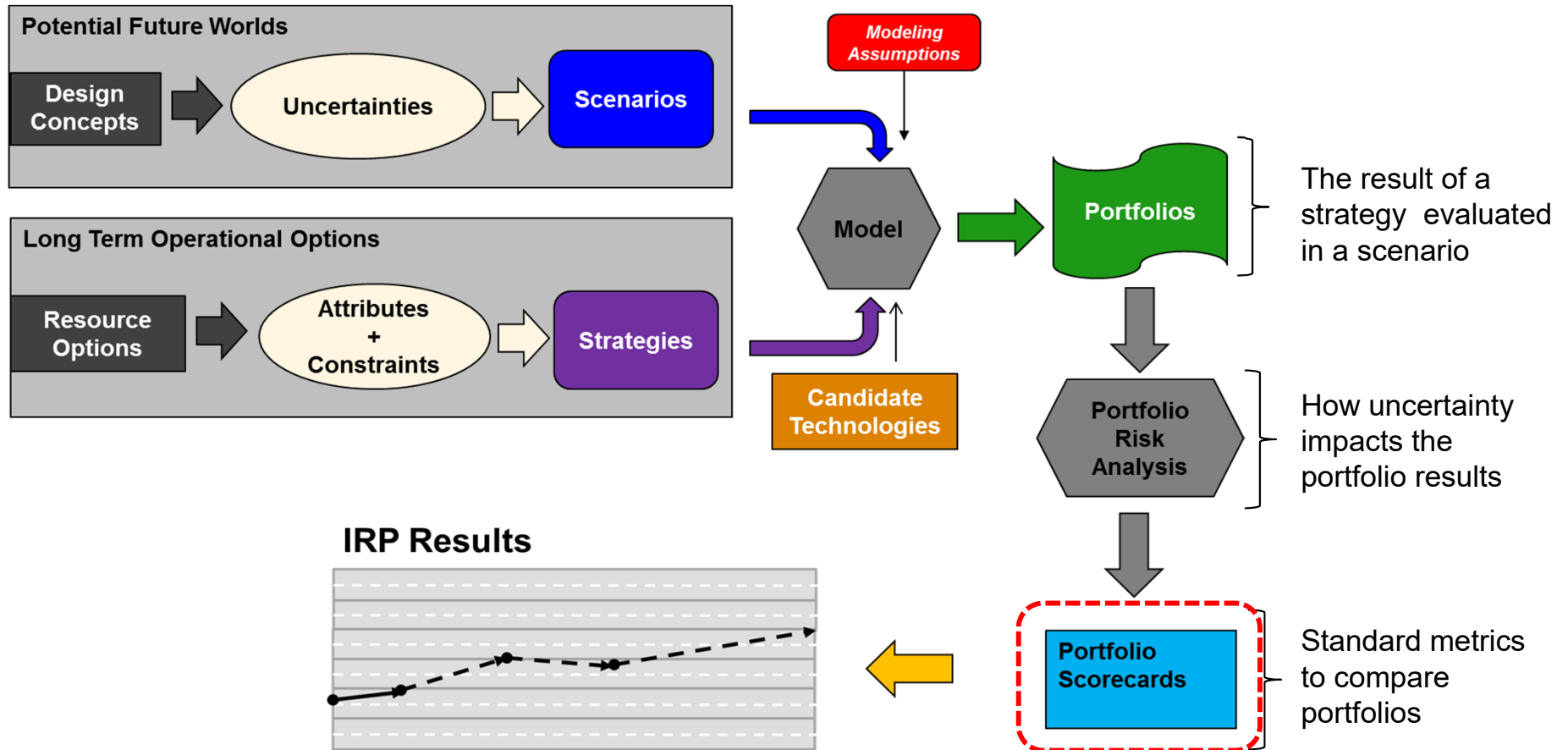
BREAK



Recap Metrics Overview of EIS Metrics

Hunter Hydas, Ashley Pilakowski and Blair Wade

Integrated Resource Planning Process



Types of Metrics

Metrics serve two different purposes in the IRP Process depending upon:

- Definition
- Calculation
- Insights provided

PRIMARY

- Well understood characteristics
- Industry standard measures
- Supports numerical comparison

SECONDARY

- Optional/advanced measures
- Developmental
- Informative/Supplemental



2019 IRP Primary Metrics

Category	Scoring Metric	Formula
Cost	PVRR (\$Bn)	Present Value of Revenue Requirements over Planning Horizon
	System Average Cost Years 1-10 (\$/MWh)	$\frac{\text{NPV Rev Reqs (2019-2028)}}{\text{NPV Sales (2019-2028)}}$
	Total Resource Cost (\$Bn)**	PVRR + Participant cost net of savings (bill savings, tax credits)
Risk	Risk/Benefit Ratio	$\frac{95^{\text{th}}_{(\text{PVRR})} - \text{Expected}_{(\text{PVRR})}}{\text{Expected}_{(\text{PVRR})} - 5^{\text{th}}_{(\text{PVRR})}}$
	Risk Exposure (\$/Bn)	95th Percentile $_{(\text{PVRR})}$
Environmental Stewardship	CO2 (MMTons)	Average Annual Tons of CO2 Emitted During Planning Period
	Water Consumption (MMGallons)	Average Annual Gallons of Water Consumed During Planning Period
	Waste (MMTons)	Average Annual Tons of Coal Ash and Scrubber Residue During Planning Period
	Land Use (Acres)**	Acreage Needed for Expansion Units in Each Portfolio (2038)
Flexibility	Flexible Resource Coverage Ratio**	$\frac{\text{Flexible Capacity Available for 3-Hour Ramp in each Strategy (2038)}}{\text{Capacity Required for Maximum 3-Hour Ramp in each Scenario (2038)}}$
Valley Economics	Percent Difference in Per Capita Income	Percent Difference in Per Capita Personal Income Compared to the Base Case (for each scenario)



** New metric for 2019

2019 IRP Secondary Metrics

Category	Reporting Metric	Formula
Cost	System Average Cost Years 11-20 (\$/MWh)	$\frac{\text{NPV Rev Reqs (2029-2038)}}{\text{NPV Sales (2029-2038)}}$
Risk	Cost Uncertainty	95th Percentile _(PVRR) - 5th Percentile _(PVRR)
	Risk Ratio	$\frac{95\text{th}_{(PVRR)} - \text{Expected}_{(PVRR)}}{\text{Expected}_{(PVRR)}}$
Environmental Stewardship	CO2 Intensity (lbs/MWh)	$\frac{\text{Pounds CO2 (2019-2038)}}{\text{MWh Generated \& Purchased (2019-2038)}}$
	Net CO2 Emissions**	Change in CO2 Emissions Compared to the Base Case in each Scenario
	Water Consumption by Basin**	Average Annual Gallons of Water Consumed During Planning Period by Basin
	Spent Nuclear Fuel Index (Tons)	Expected Spent Fuel Generated During Planning Period
Flexibility	Flexibility Turn Down Factor	$\frac{\text{"Must Run" + "Non-Dispatchable" (2038)}}{\text{Sales (2038)}}$
Valley Economics	Employment	Difference in the Change in Employment Compared to the Base Case



** New metric for 2019

Removed Land Use Intensity metric based on IRPWG feedback

2019 IRP Scorecard

- Results for each IRP Strategy are presented on a scorecard developed by TVA and the IRP Working Group
- They are not intended to provide an overall ranking but are a tool for evaluating tradeoffs



Scenarios	Cost			Risk		Environmental Stewardship				Flexibility	Valley Economics
	PVRR (\$Bn)	System Avg Cost Years 1-10 (\$/MWh)	Total Resource Cost (\$Bn)	Risk/Benefit Ratio	Risk Exposure (\$/Bn)	CO2 (MMTons)	Water (MM Gallons)	Waste (MMTons)	Land Use (Acres)	Flexible Resource Coverage Ratio	Percent Difference in Per Capita Income
1. Current Outlook											
2. Economic Downturn											
3. Valley Load Growth											
4. Decarbonization											
5. Rapid DER Adoption											
6. No Nuclear Extensions											



2019 INTEGRATED RESOURCE PLAN

Land Use Metrics and Life Cycle Analysis

Ashley Pilakowski

October 25, 2018

2019 IRP Primary Metrics

Category	Scoring Metric	Formula
Cost	PVRR (\$Bn)	Present Value of Revenue Requirements over Planning Horizon
	System Average Cost Years 1-10 (\$/MWh)	$\frac{\text{NPV Rev Reqs (2019-2028)}}{\text{NPV Sales (2019-2028)}}$
	Total Resource Cost (\$Bn)**	PVRR + Participant cost net of savings (bill savings, tax credits)
Risk	Risk/Benefit Ratio	$\frac{95^{\text{th}}_{(\text{PVRR})} - \text{Expected}_{(\text{PVRR})}}{\text{Expected}_{(\text{PVRR})} - 5^{\text{th}}_{(\text{PVRR})}}$
	Risk Exposure (\$/Bn)	95th Percentile _(PVRR)
Environmental Stewardship	CO2 (MMTons)	Average Annual Tons of CO2 Emitted During Planning Period
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Valley Economics	Percent Difference in Per Capita Income	Percent Difference in Per Capita Personal Income Compared to the Base Case (for each scenario)



** New metric for 2019

Land Use

Utility Tracking Solar

7.3 acres/MW

RENEWABLE

In-Valley Wind

1.0/
Turbine

New Direct
Combustion Biomass

.87

TRADITIONAL

0.88

Pumped Storage

.69

Coal

.62

SMR

.40

Nuclear (AP1000)

.11

Combined Cycle with Carbon
Capture and Storage

.09

Combustion Turbine

Portfolios

Portfolio
Risk
Analysis

Portfolio
Scorecards

Environmental Impacts Quantified in EIS

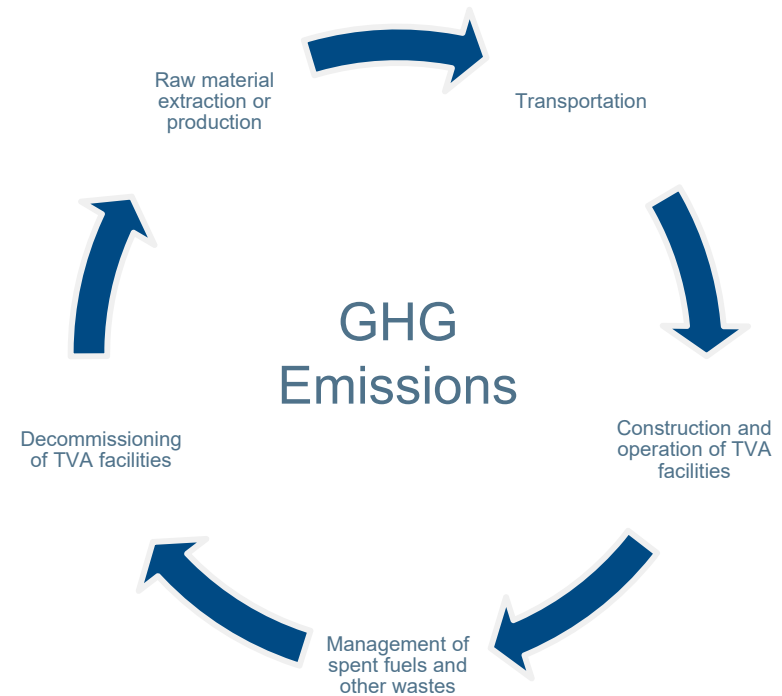
- CO2 total emissions
- CO2 intensity
- **net CO2 emissions**
- SO2 emissions
- NOx emissions
- total water use
- total water consumption
- **water use by basin and source (surface, groundwater)**
- **water consumption by basin and source**
- CCR production
- coal consumption
- natural gas consumption
- uranium consumption
- spent nuclear fuel production
- land use – facility land requirements
- life cycle land requirements for nuclear and fossil-fueled generation
- change in per-capita income (REMI results)
- change in employment (REMI results)

What is Lifecycle Analysis?

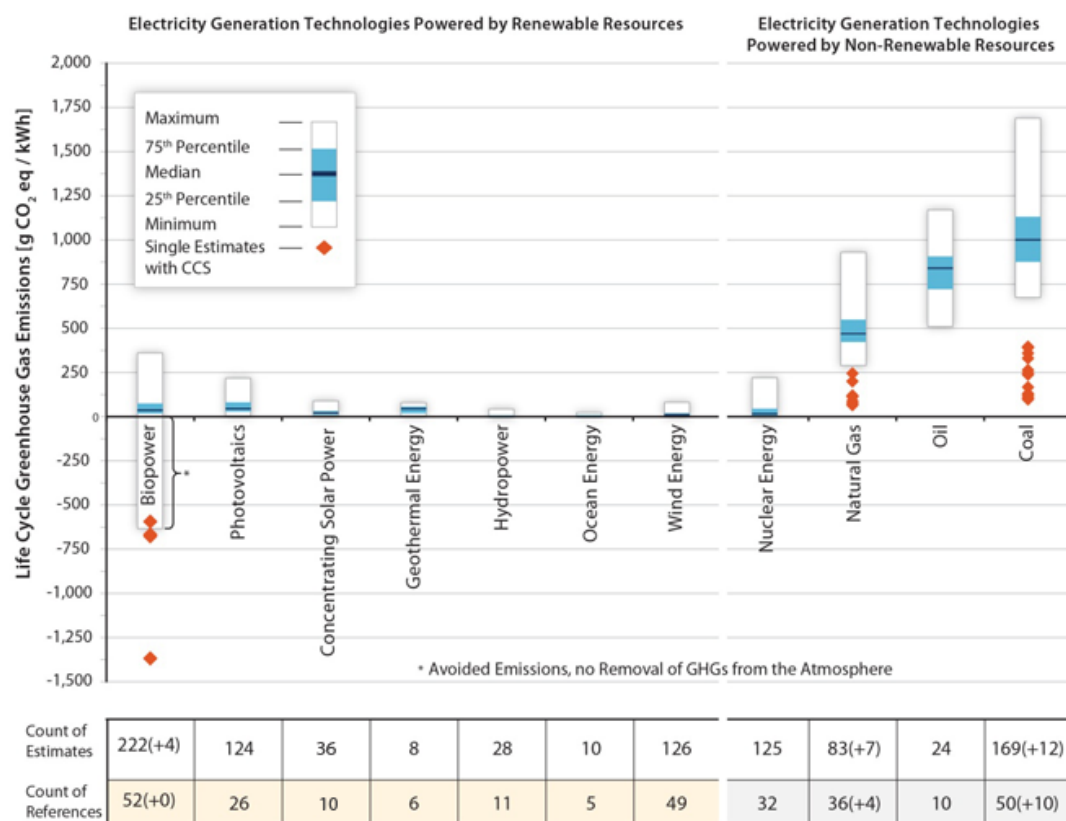
Analysis of environmental impacts associated with all the stages of a product's life from raw material extraction through materials processing, manufacture, distribution, use, repair and maintenance, and disposal or recycling.

Lifecycle GHG Emissions

- Emissions from the construction, operation, and decommissioning of generating facilities
- Extraction or production, processing and transportation of fuels
- Management of spent fuels and other wastes.



Lifecycle GHG Analysis Harmonization



- Effort to compare LCAs of electricity generation techniques
- Adjusted estimates to a consistent methodology and assumptions
- Harmonized data showed that lifecycle GHG emissions from solar, wind, and nuclear are lower and less variable than emissions from natural gas and coal.

Lifecycle Land Requirements

- A measure of the land area transformed during the life cycle of a generating facility, expressed in terms of units of area per amount of electricity generated.
- Includes:
 - facility site
 - adjacent buffer areas
 - lands used for fuel extraction or production, processing, and transportation
 - land used for managing spent fuels and other wastes



2019 INTEGRATED RESOURCE PLAN

Preliminary Engagement Plan for EJ Communities

Blair Wade

October 25, 2018

Executive Order 12898 - Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations

- Issued February 11, 1994
- “...each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations...”

What Is Environmental Justice?

The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation and enforcement of environmental laws, regulations and policies.

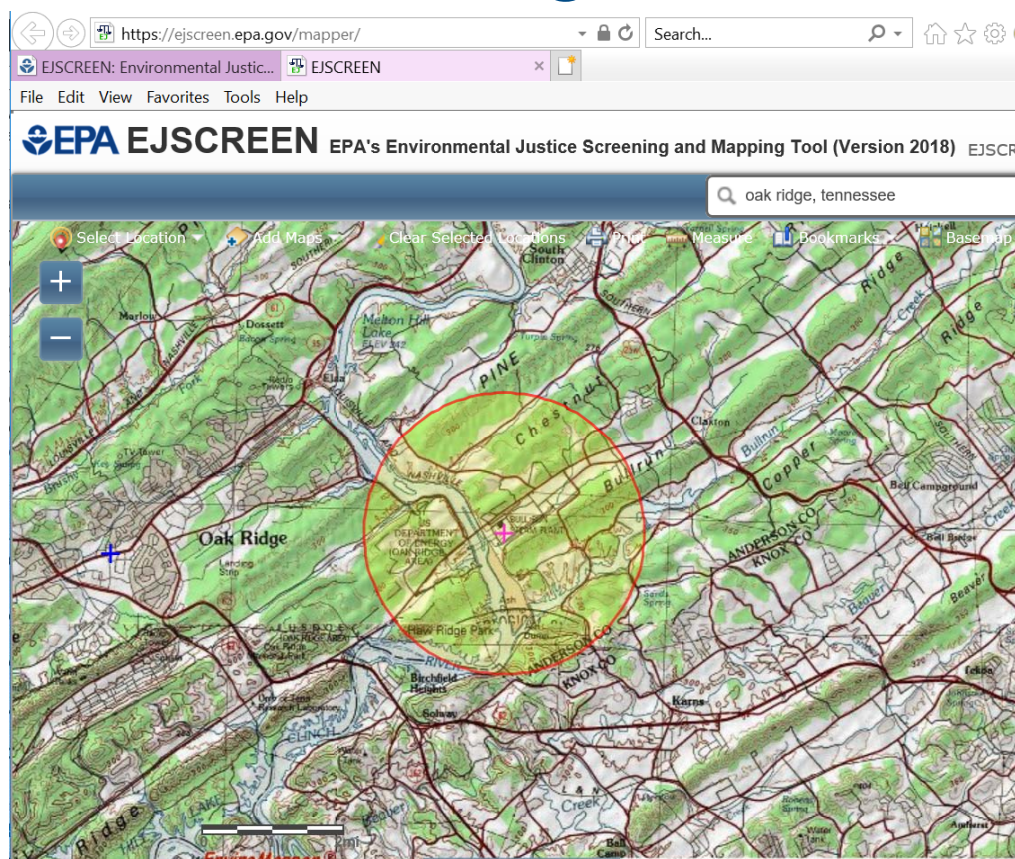
More Definitions

- Fair Treatment: no group of people should bear a disproportionate share of the negative environmental consequences resulting from industrial, governmental and commercial operations or policies.
- Meaningful Involvement:
 - People have opportunity to participate in decisions affecting their environment and/or health
 - Community concerns are considered in the decision-making process
 - Decision makers seek out and facilitate the involvement of those potentially affected

TVA's IRP EJ Analysis Approach

1. TVA valley-wide socioeconomic metrics (in EIS)
2. EJ communities adjacent to major TVA generating facilities (in EIS)
3. Identify EJ communities for targeted outreach during public comment period of Draft IRP and EIS

EJ Analysis Process on Major TVA Generating Facilities



EJ Screen 3-mi buffer around major generating facilities:

- Coal plants
- Nuclear plants
- Combined cycle plants

Types of information:

- Minority populations
- Low-income populations
- Limited English Proficiency
- Population age

Environmental Justice Population Definitions for TVA IRP

- *Valley-wide EJ Populations as Identified in the IRP EIS*
 - Minority population – areas having a greater percentage of minorities than the TVA PSA average of 21.3 percent
 - Low-income population – areas with poverty rates above the TVA PSA average rate of 19.7 percent
- *EJ Outreach Approach:*

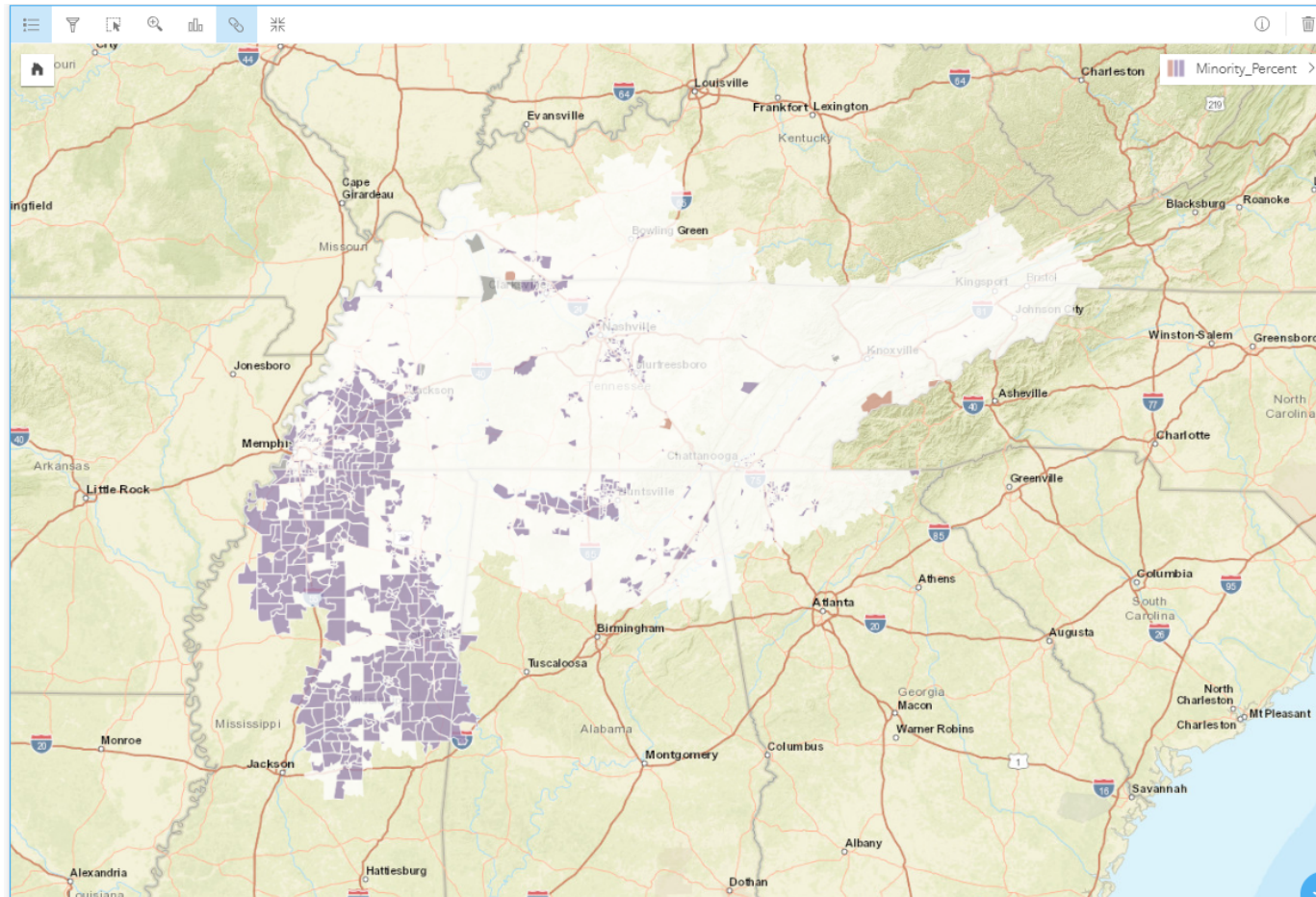
Combine census variables to identify most vulnerable areas

 - Poverty rate
 - Minority percentage
 - Limited English Proficiency
 - Low owner-occupied housing
 - Other relevant census variables

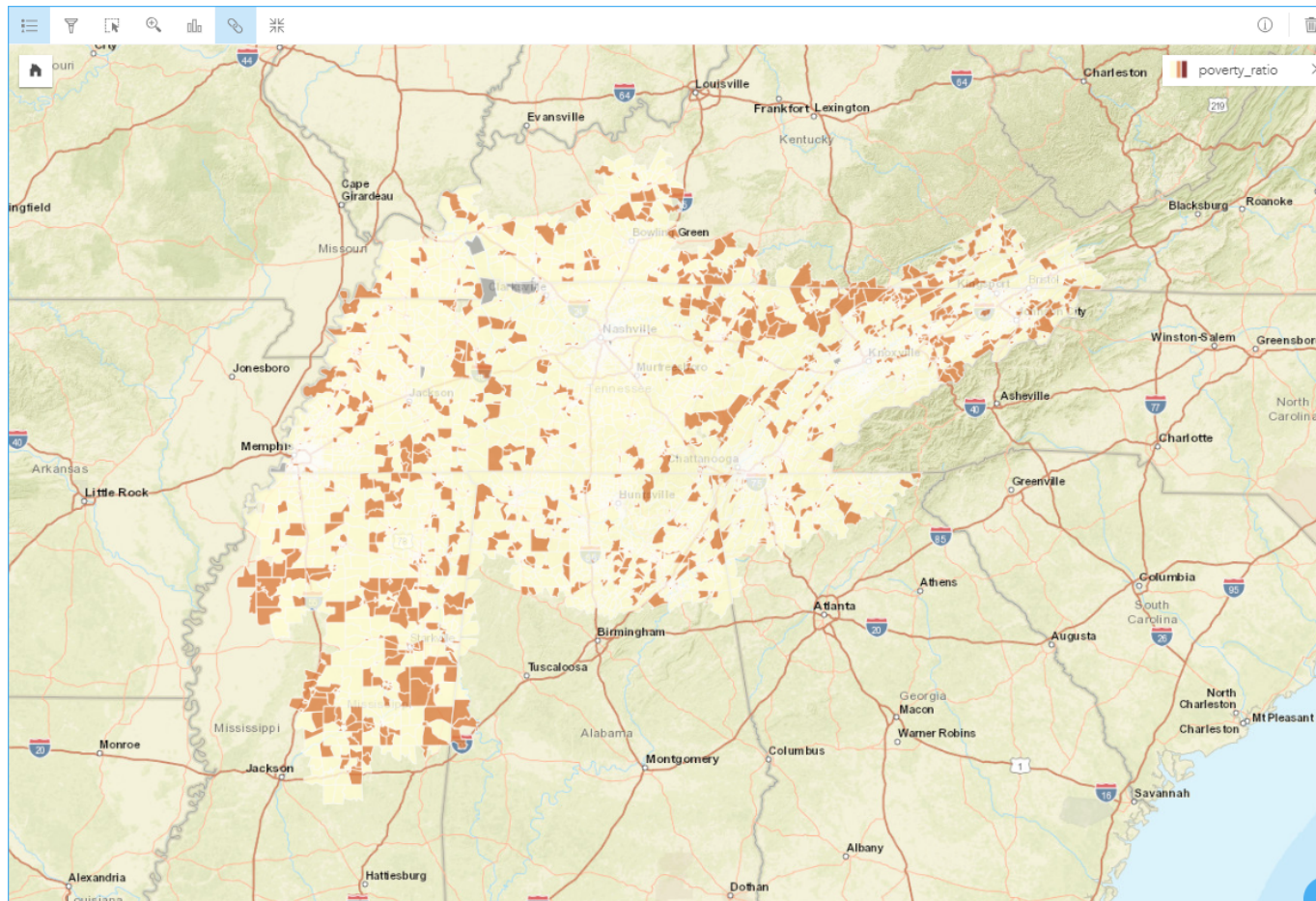
Environmental Justice Population Identification

- Varying Levels of Analysis
 - County/Independent City/Tribe
 - Census Tract
 - Block Group
- GIS Tools to Assist
 - Insights – import relevant census variables for entire TVA PSA
 - ESRI ArcMap – show multiple variables to identify most vulnerable areas
 - ESRI Community Analyst – help identify best means to communicate, whether online, in person, through events, etc.

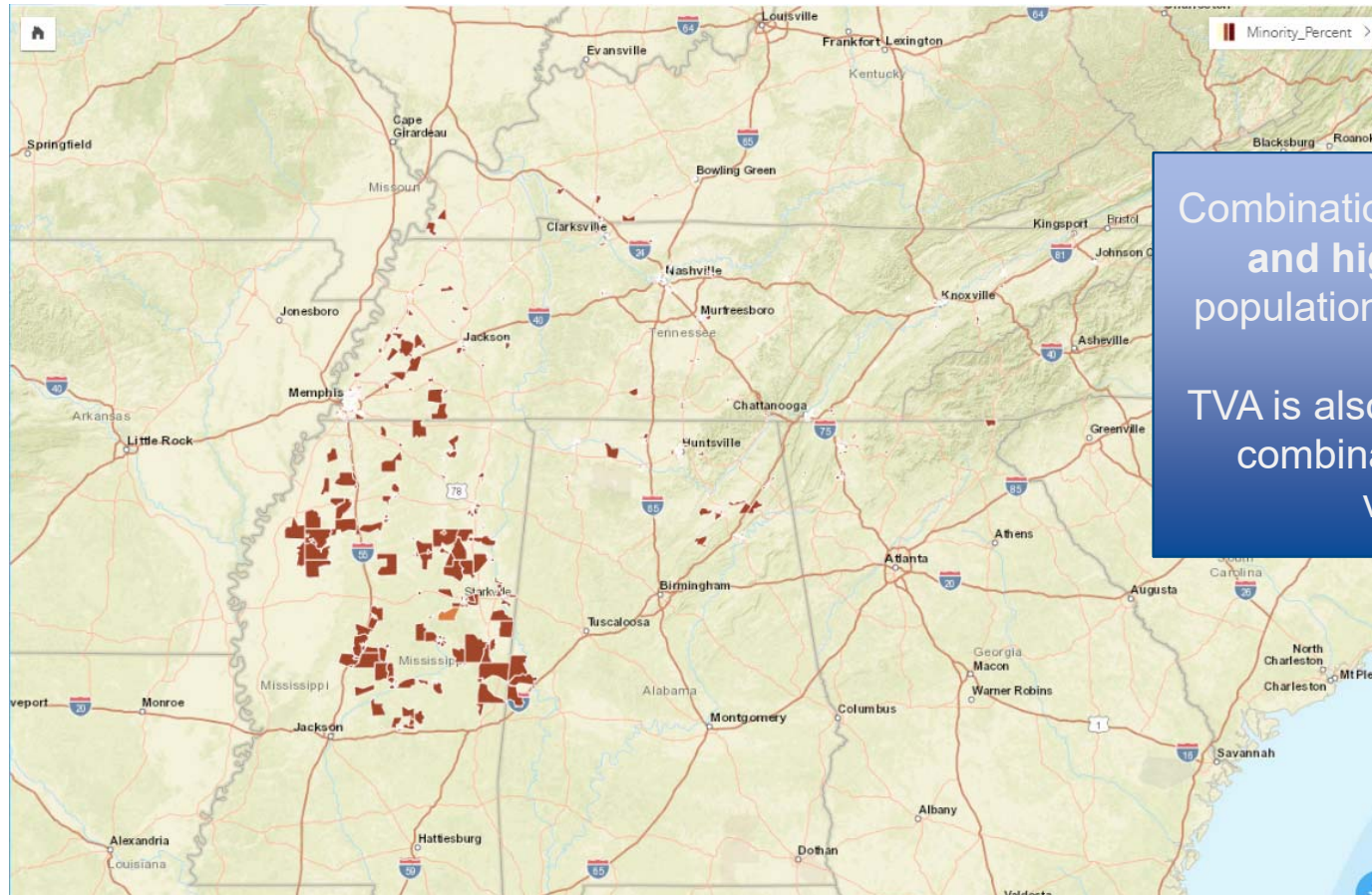
Minority Populations (>21.3%) at Block Group Level



Low-Income Populations (>19.7%) at Block Group Level



EJ Outreach-Qualifying Populations at Block Group Level



Combination of high minority
and high low-income
populations within the Valley

TVA is also considering other
combinations of census
variables.

Example of Community Analyst Output:

Internet Market Potential within EJ Outreach-Qualifying Block Group



Electronics and Internet Market Potential

471570067.002

471570067.002 (471570067002)

Geography: Block Group

Prepared by Esri

Demographic Summary		2018	2023
Population		1,009	971
Population 18+		767	745
Households		398	382
Median Household Income		\$20,096	\$21,496
Product/Consumer Behavior	Expected Number of Adults/HHs	Percent	MPI
Own any tablet	234	30.5%	67
Own any e-reader	14	1.8%	25
Own e-reader/tablet: iPad	106	13.8%	52
Own e-reader/tablet: Amazon Kindle	53	6.9%	53
Own any portable MP3 player	76	9.9%	46
Own portable MP3 player: Apple iPod	51	6.6%	39
Own wearable tech: wristband fitness tracker	18	2.3%	27
Own wearable tech: smartwatch	17	2.2%	73
Own any camera/camcorder	24	3.1%	34
Own digital point & shoot camera/camcorder	43	5.6%	48
Own digital SLR camera/camcorder	28	3.7%	47
Own 35mm camera/camcorder	25	3.3%	54
Own telephoto/zoom lens	14	1.8%	43
Own wideangle lens	13	1.7%	53
Printed digital photos in last 12 months	39	5.1%	22
Use a computer at work	147	19.2%	46
Use desktop computer at work	98	12.8%	55
Use laptop/notebook at work	31	4.0%	24
HH owns a computer	147	36.9%	50
Purchased home computer in last 12 months	13	3.3%	29
HH owns desktop computer	71	17.8%	47
HH owns laptop/notebook	103	25.9%	46
Child (under 18 yrs) uses home computer	37	9.3%	67
HH owns any Apple/Mac brand computer	13	3.3%	18
HH owns any PC/non-Apple brand computer	137	34.4%	55

Types of Outreach Considered

- Utilize existing relationships with groups such as NAACP in Memphis, SEED, Alliance House, Green Spaces, Energy Efficiency Information Exchange, Minority Universities
- Utilize existing relationships established through LPCs, TVPPA membership
- Targeted pop-up events (farmer's markets, festivals, grocery stores, libraries)
- Targeted social media / social media / online ads
- Listening sessions (community centers, libraries, places of worship)
- Speaker's bureaus
- Neighborhood/community meetings, HOA meetings
- Focus groups
- Media outreach (press release, news release, website)
- Elected officials (letter, email)
- Community fliers

Support multiple languages when required.

Next steps

Oct	Nov	Dec	Jan	Feb	March
<ul style="list-style-type: none">• Define goals and parameters• Gather data	<ul style="list-style-type: none">• Submit plan	<ul style="list-style-type: none">• Finalize plan• Begin content production	<ul style="list-style-type: none">• Finalize materials	<ul style="list-style-type: none">• Implement	<ul style="list-style-type: none">• Implement







Confidentiality Agreement

Khurshid Mehta
TVA Office of the General Counsel

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 and after instructing representatives of the restrictions

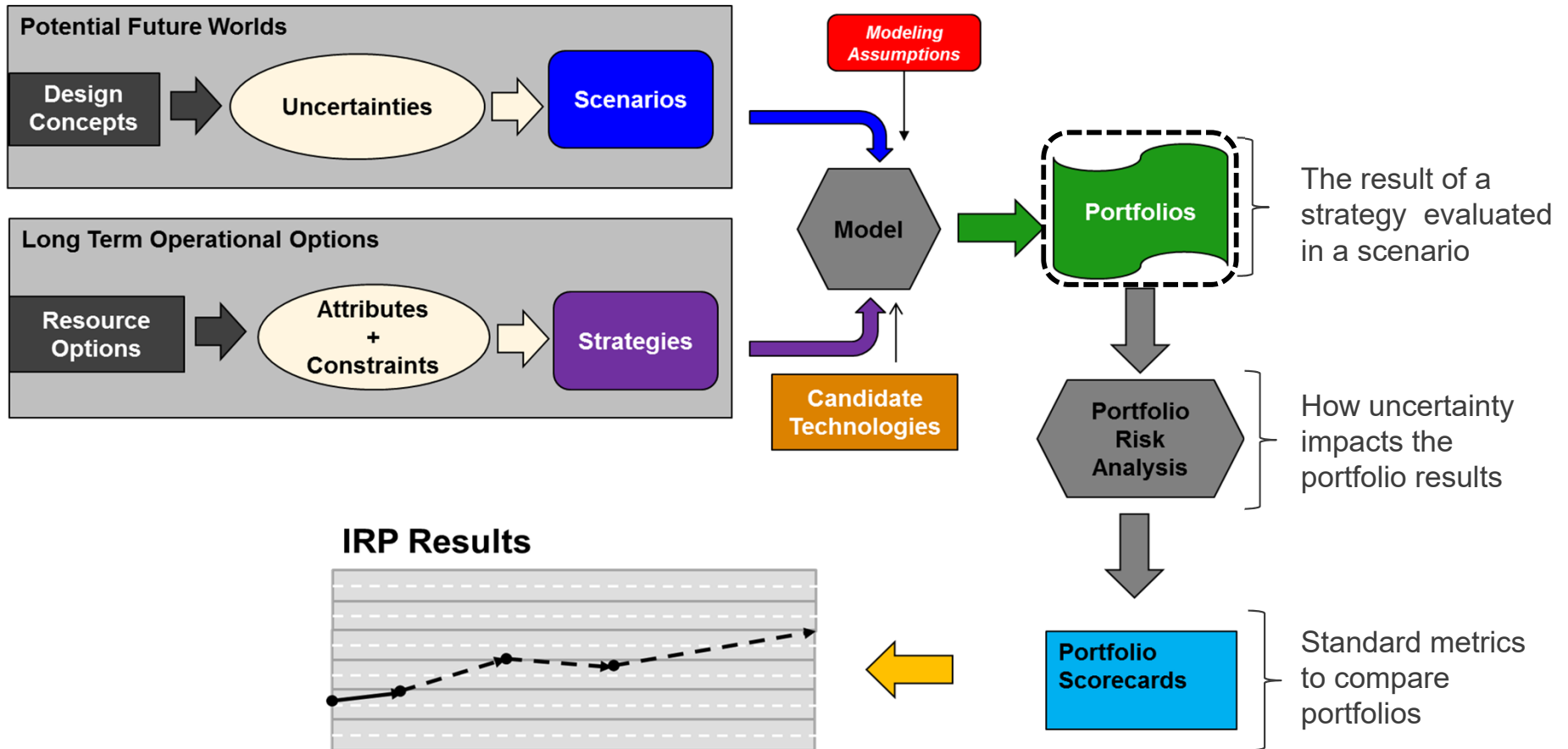
Most IRPWG members have already signed a Confidentiality Agreement with TVA



Reference Case Review

Jane Elliott, Senior Manager
Scott Jones, Senior Program Manager
Roger Pierce, Program Manager
TVA Resource Strategy Group

Strategy Evaluated in a Scenario → Portfolio



Today's Focus is the Reference Case (1A)

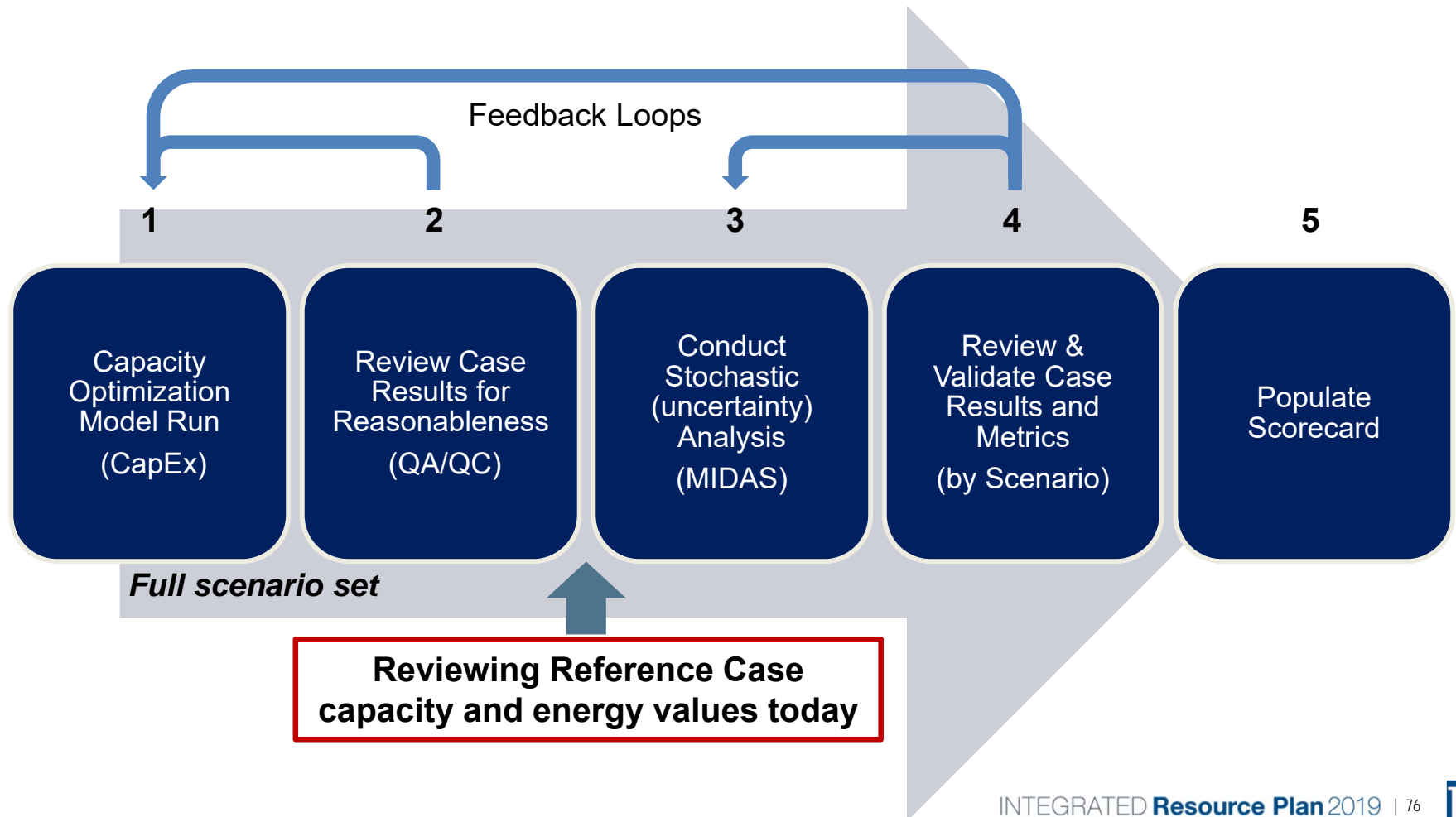
Scenarios

1. *Current Outlook*
2. *Economic Downturn*
3. *Valley Load Growth*
4. *Decarbonization*
5. *Rapid DER Adoption*
6. *No Nuclear Extensions*

Strategies

- A. *Base Case*
- B. *Promote DER*
- C. *Promote Resiliency*
- D. *Promote Efficient Energy Usage*
- E. *Promote Renewables*

The Modeling Process Involves Five Steps



Planning for an Evolving System



Winter Peaking Demand

Updated reserve margins support reliability in both winter and summer and with more renewables expected on the system



More Renewable Resources

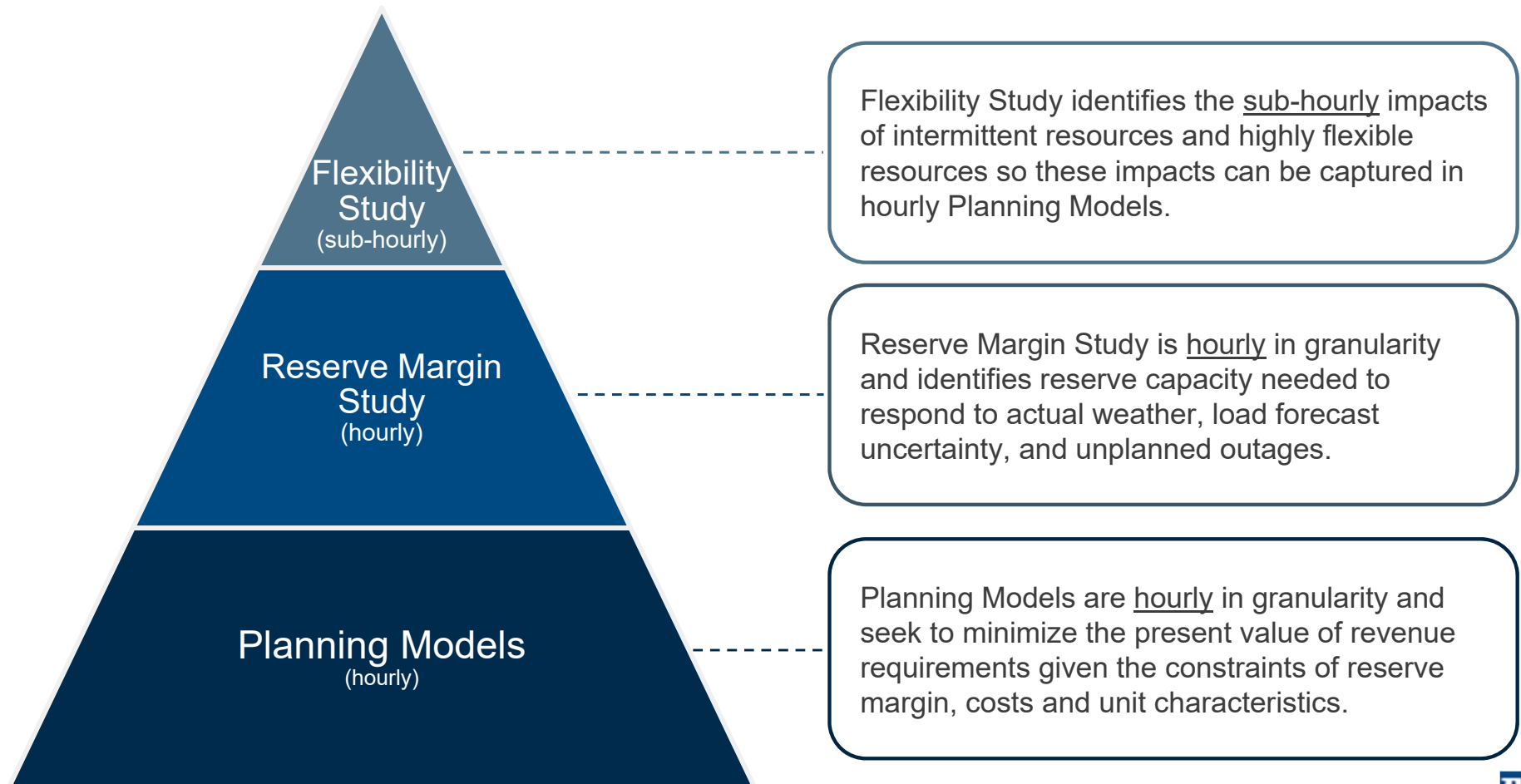
Integration cost recognizes the sub-hourly costs driven by integrating intermittent resources onto the system



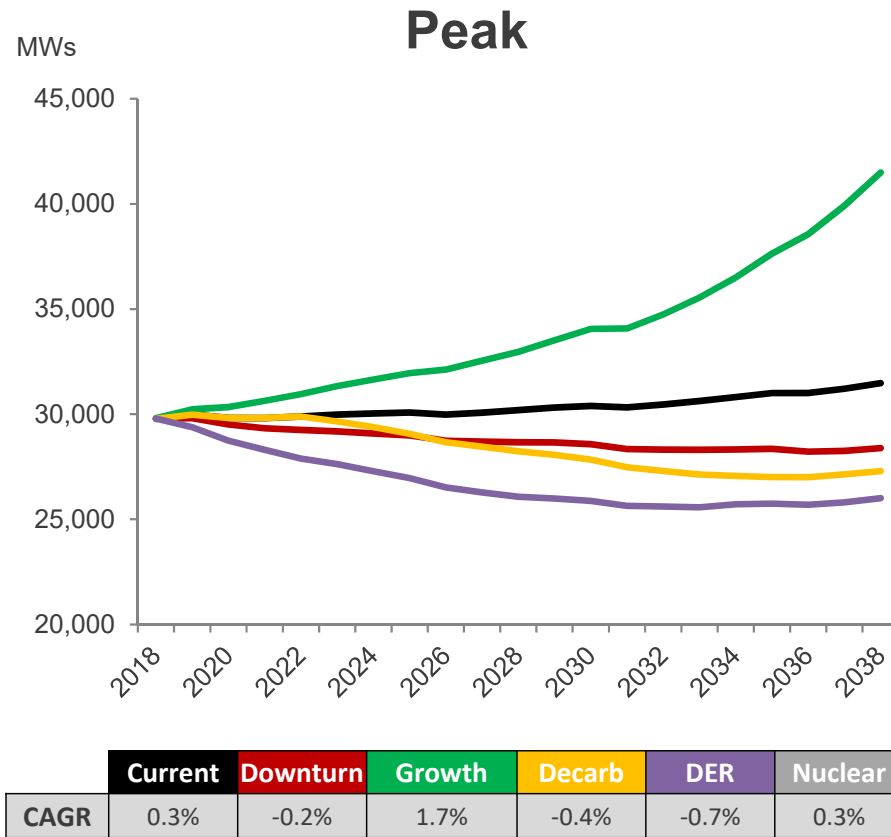
Increasing Need for Flexibility

Flexibility benefit recognizes the sub-hourly benefits driven by integrating highly flexible resources onto the system

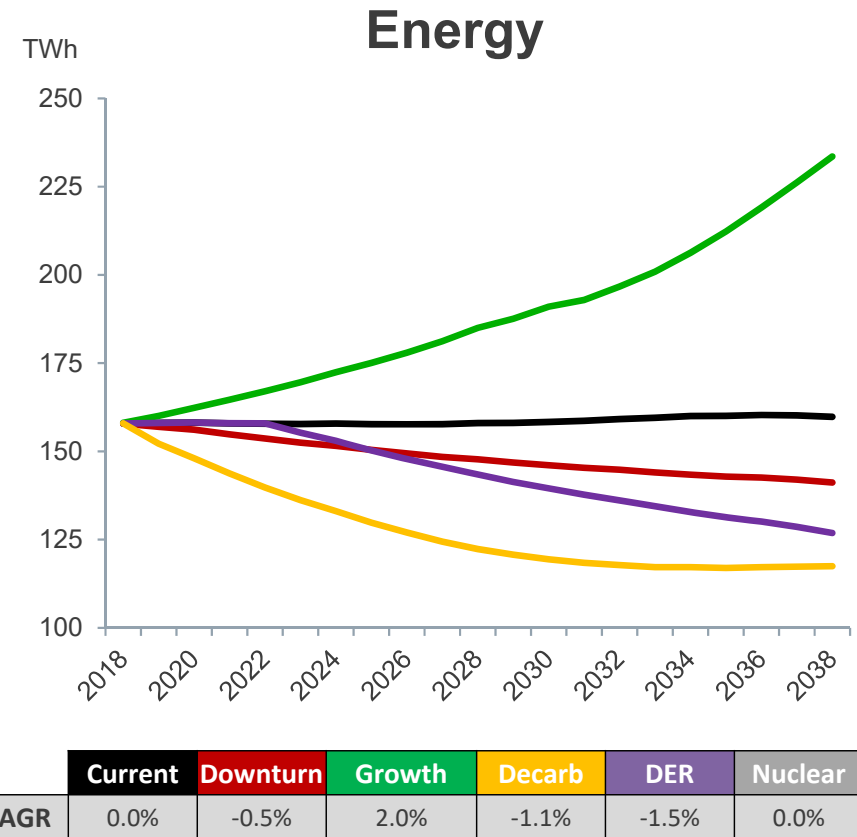
Key Elements of the Modeling Framework



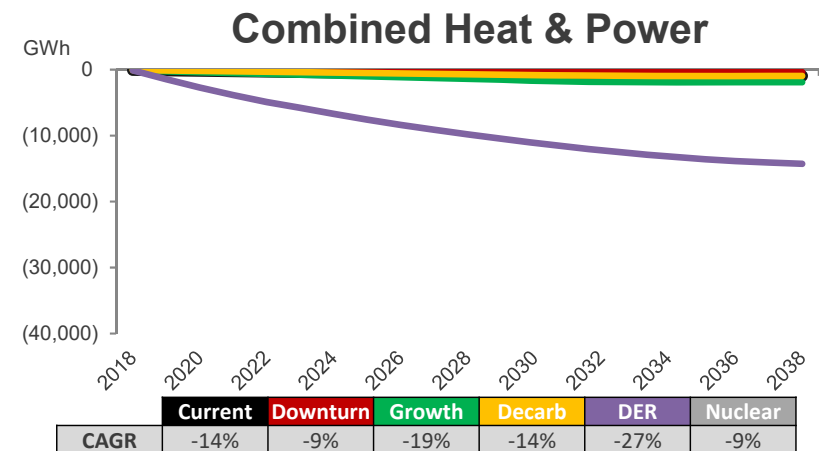
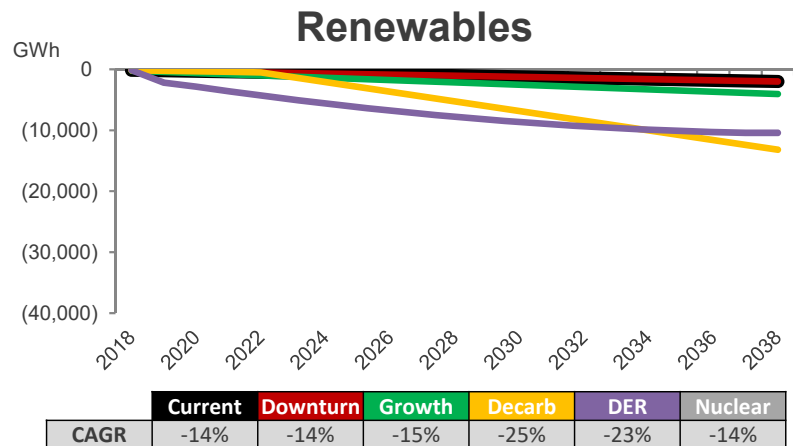
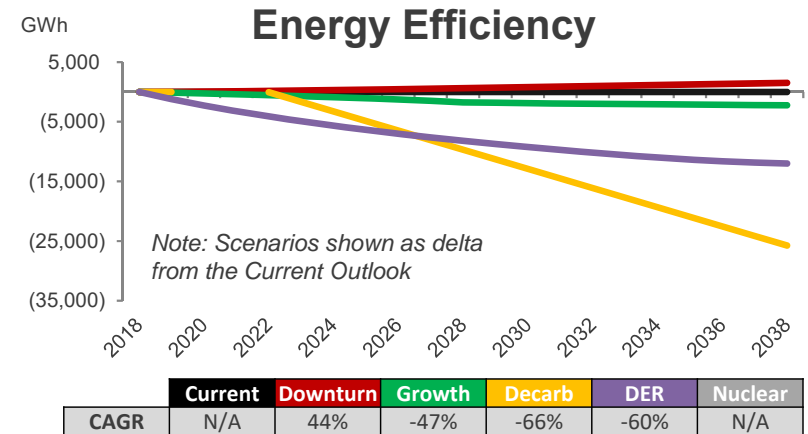
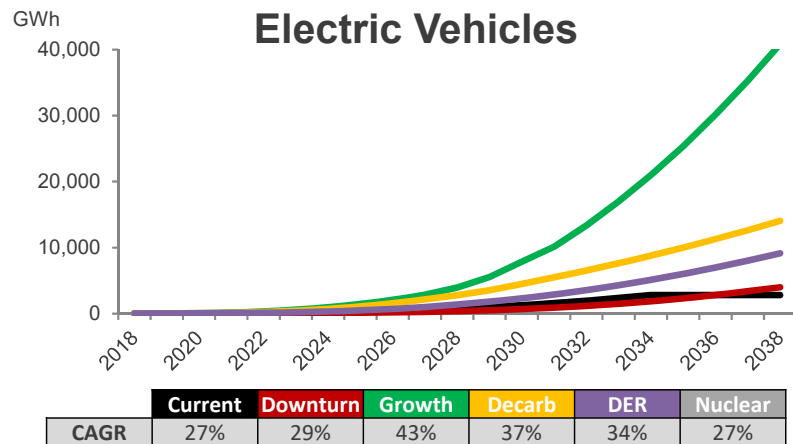
Scenario Forecasts: Load Outlook



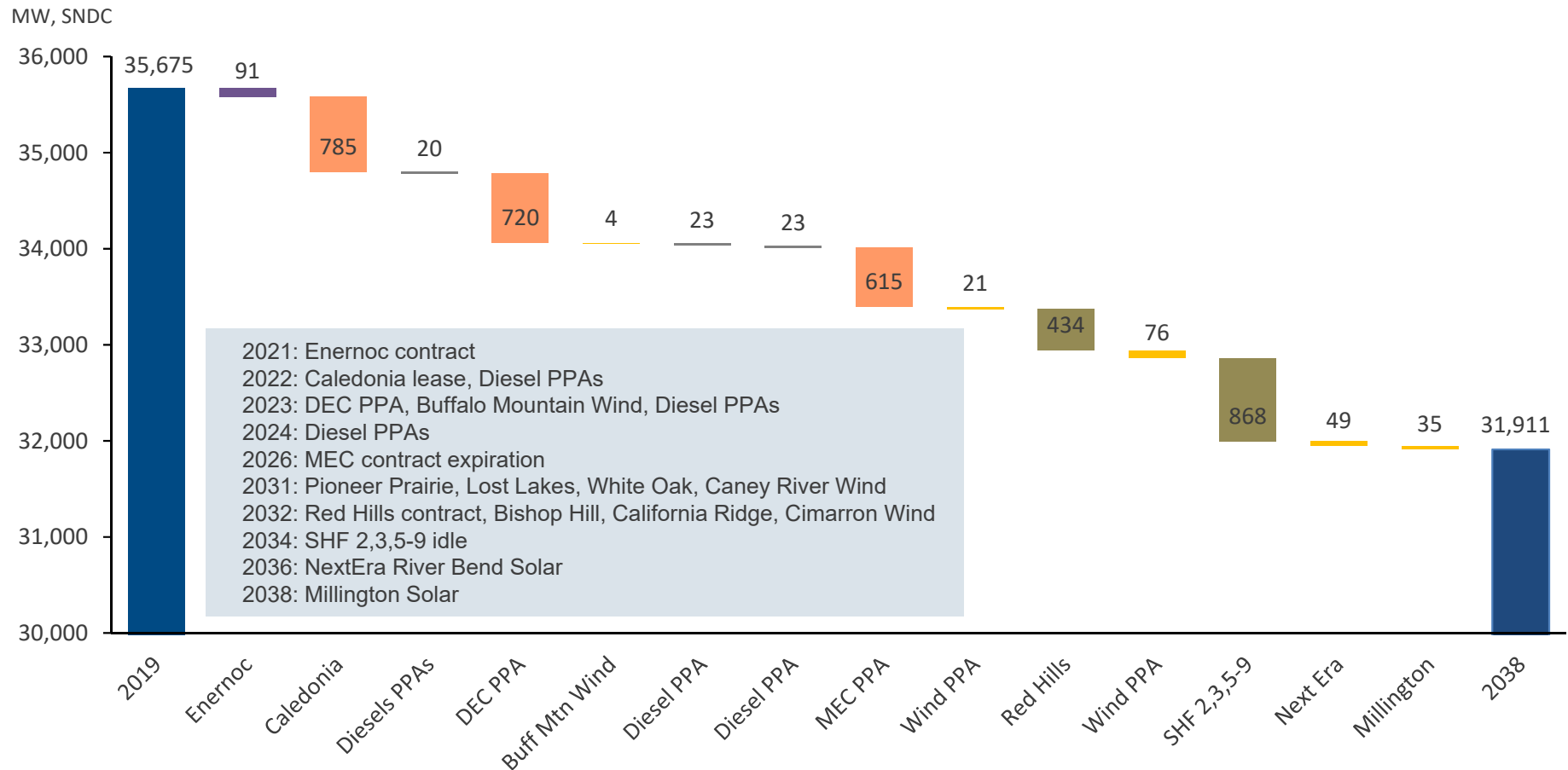
Note: Forecast for Scenario 6 Nuclear same as Scenario 1 Current Outlook



Scenario Forecasts: Behind the Meter Impacts

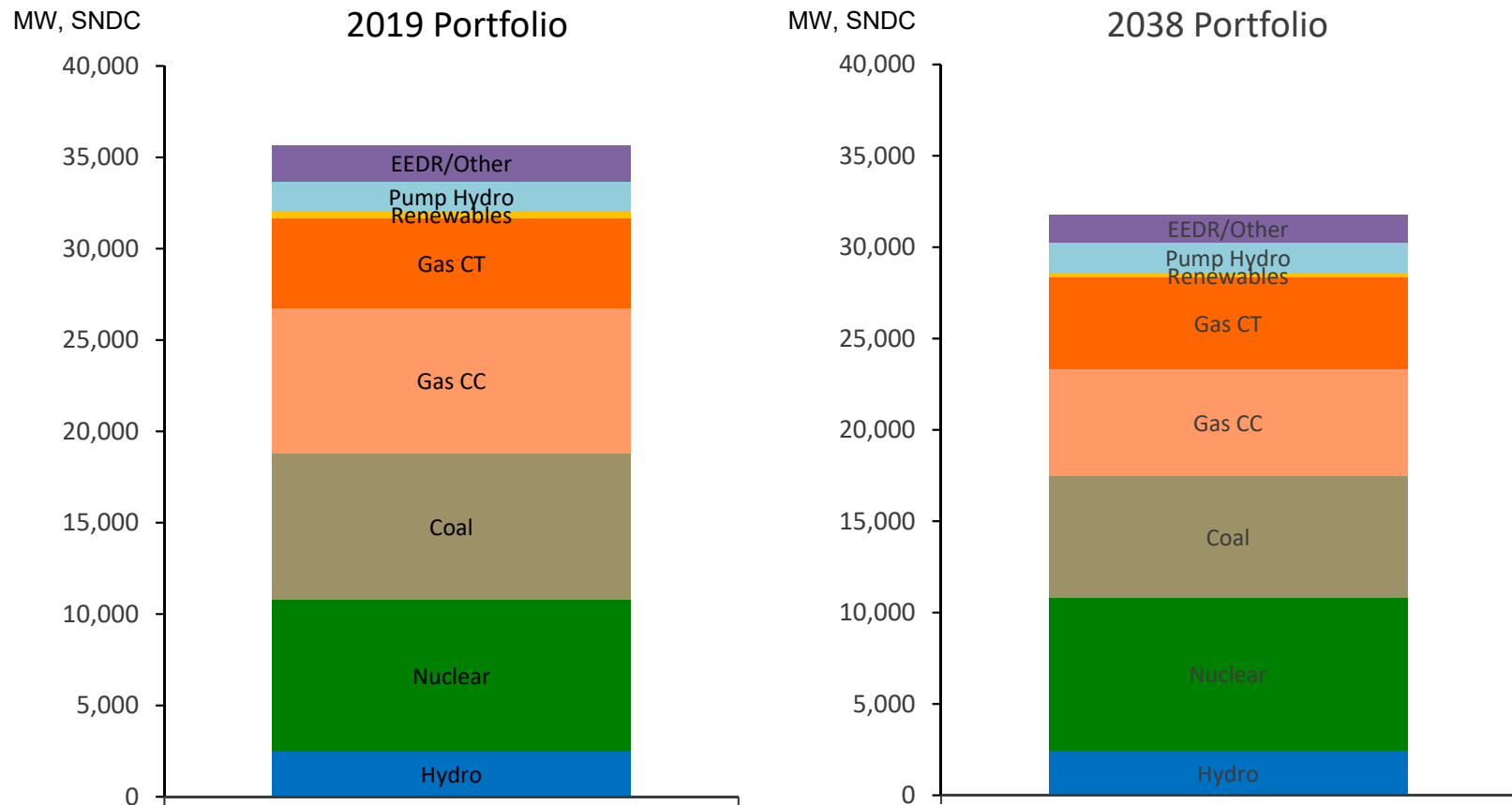


Firm Capacity Forecast: Reductions by Driver



Note: Planned reductions in firm capacity are consistent with FY19 Budget assumptions

Firm Capacity Forecast: Cumulative Reductions



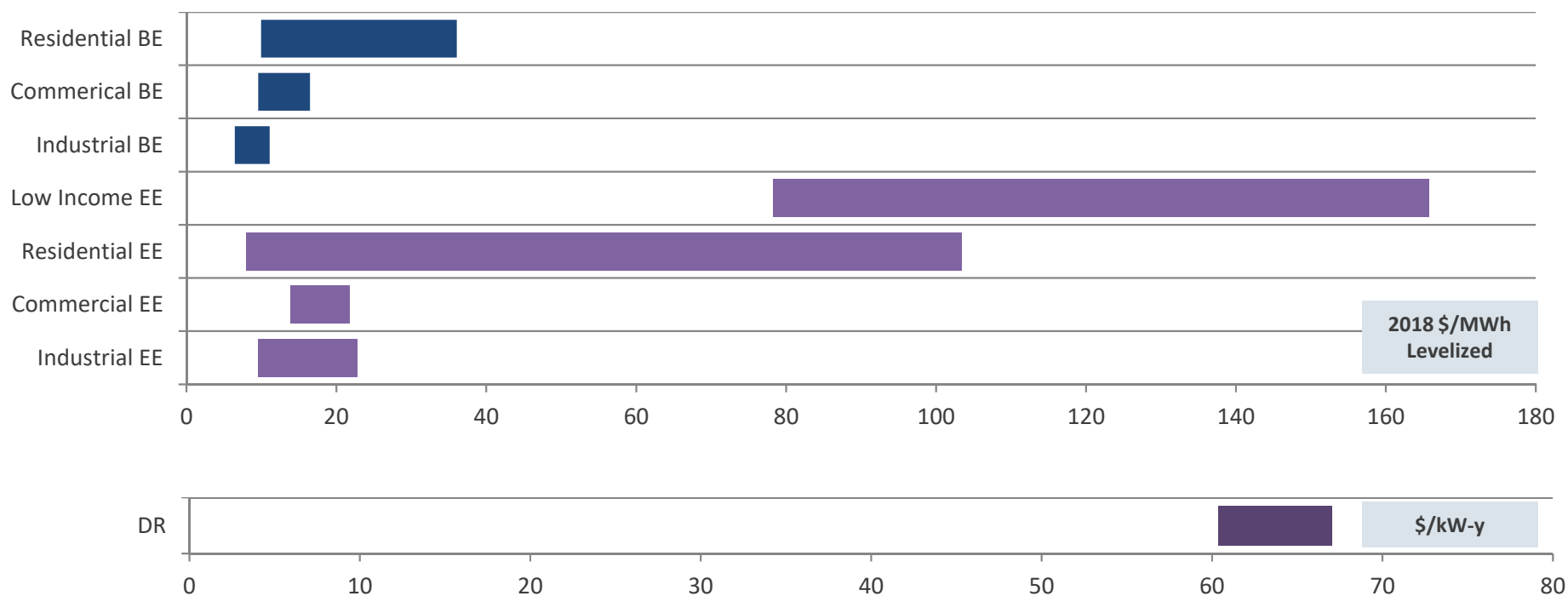
Note: Planned reductions in firm capacity are consistent with FY19 Budget assumptions

Resource Options and Cost (\$/kW)



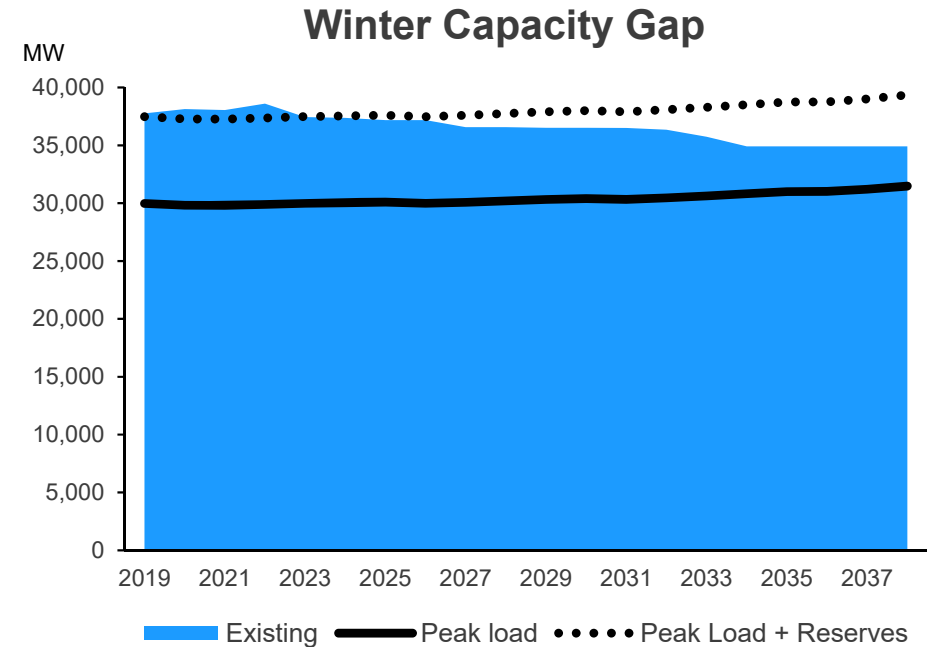
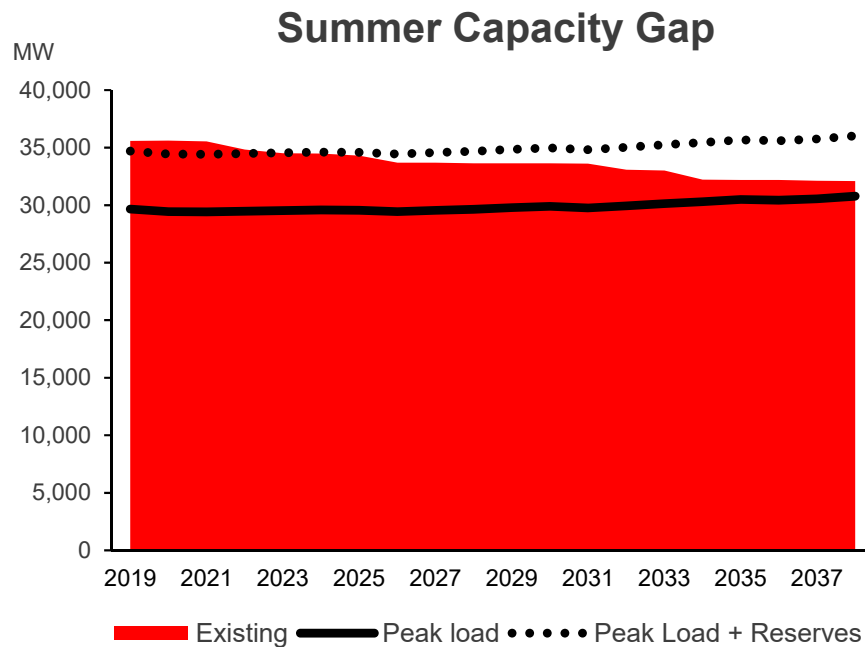
Colored bars reflect benchmark ranges and black outlines represent TVA assumptions;
TVA assumptions outside of benchmark ranges are based on actual costs of TVA projects or vendor quotes.

EE/DR/BE Program Options and Cost



Reference Case Uses Scenario 1: Current Outlook

The capacity gap is the difference between existing resource capacity and the required capacity needed to ensure reliability (peak load plus reserves). In the Current Outlook, an increasing peak forecast along with contract expirations and existing unit retirements contribute to the capacity gap.



Reference Case Uses Strategy A: Base Case

Strategy	Distributed Resources & Electrification						Utility Scale Resources					
	Distributed Solar	Distributed Storage	Combined Heat & Power	Energy Efficiency	Demand Response	Beneficial Electrification	Solar	Wind	Biomass & Biogas	Storage	Aero CTs & Recip Engines	Small Modular Reactors
Base Case	Base	Base	Base	Base	Base	Base	Base	Base	Base	Base	Base	Base
Promote DER	High	Moderate	High	Moderate	Moderate	Base	Base	Base	Base	Base	Base	Base
Promote Resiliency	Moderate	High	Moderate	Base	Moderate	Base	Base	Base	Base	Moderate	Moderate	Moderate
Promote Efficient Load Shape	Base	Moderate	Base	High	High	Moderate	Base	Base	Base	High	Base	Base
Promote Renewables	Moderate	Moderate	Base	Base	Base	Base	Moderate	Moderate	Moderate	Moderate	Base	Base

- No additional contract terminations or retirements beyond the FY19 Budget case
- EE/DR/BE selectable after 2019

Transition to Confidential Slide Section



Next Steps in Modeling

30 Portfolios to be Modeled

Scenarios

1. *Current Outlook*
2. *Economic Downturn*
3. *Valley Load Growth*
4. *Decarbonization*
5. *Rapid DER Adoption*
6. *No Nuclear Extensions*

Strategies

- A. *Base Case*
- B. *Promote DER*
- C. *Promote Resiliency*
- D. *Promote Efficient Energy Usage*
- E. *Promote Renewables*

Relative Incentive Levels by Strategy

Resources will be promoted to various levels across the strategies, with consideration of potential, adoption curve, and reserve margin.

Strategy	Distributed Resources & Electrification						Utility Scale Resources					
	Distributed Solar	Distributed Storage	Combined Heat & Power	Energy Efficiency	Demand Response	Beneficial Electrification	Solar	Wind	Biomass & Biogas	Storage	Aero CTs & Recip Engines	Small Modular Reactors
Base Case	Base	Base	Base	Base	Base	Base	Base	Base	Base	Base	Base	Base
Promote DER	High	Moderate	High	Moderate	Moderate	Base	Base	Base	Base	Base	Base	Base
Promote Resiliency	Moderate	High	Moderate	Base	Moderate	Base	Base	Base	Base	Moderate	Moderate	Moderate
Promote Efficient Load Shape	Base	Moderate	Base	High	High	Moderate	Base	Base	Base	High	Base	Base
Promote Renewables	Moderate	Moderate	Base	Base	Base	Base	Moderate	Moderate	Moderate	Moderate	Base	Base

Modeling Next Steps

- Finalize reference case processing through MIDAS
- Run optimization for all other portfolio combinations
- Complete scorecards for all strategies
- Review near-final results at December IRPWG meeting
- Identify and evaluate sensitivities

Initial List of Planned Sensitivities

Current Outlook & Valley Growth / Base Case

- Retire Paradise 3 (2020) and Bull Run (2023)

Reference Case:

- Enforce promoted resources individually at moderate and high levels *
- Enforce distributed scale solar at same penetration as utility scale solar
- Remove integration cost and flexibility benefit *

Current Outlook / Promote DER:

- Promote utility scale storage to moderate and high levels *
- Promote distributed storage to high level *

Current Outlook / Promote Renewables:

- Promote utility scale storage to high level *

** Included based on IRPWG feedback*



Group Discussion:

**What are your thoughts about
the initial list of sensitivities?
Is there anything you would add?**



Wrap Up

Tentative Meeting Dates / Locations



#4 June 6 and 7, 2018

Nashville, TN Music City Sheraton



#5 July 23-24, 2018

Middle Tennessee



#6 August 29 – 30, 2018

Memphis, TN / Memphis Chamber of Commerce



#7 September 26-27, 2018

Franklin, TN, Marriott



#8 October 25, 2018

Huntsville, Alabama

#9 December 19-20, 2018

Knoxville, Tennessee

#10 Jan 30-31, 2019

Oxford, Mississippi

Future Tentative Sessions:

#11: Feb 28 – March 1, 2019

#12: March 27-28, 2019

#13: April 30 – May 1, 2019

#14: June 19-20, 2019

#15: July 24-25, 2019

