



Regional Energy Resource Council

December 18, 2018
Knoxville, Tennessee



Safety Moment



Building Emergency Plan

Term 3 RERC Members

Michael Butler

Tennessee Wildlife Federation

Wayne Davis*

University of Tennessee

Rodney Goodman

Habitat for Humanity

Dan Ionel

University of Kentucky

Wes Kelley

Huntsville Utilities

Doug Lawyer

Knoxville Chamber

Peter J. Mattheis

Tennessee Valley Industrial Committee

Shari Meghreblian

State of Tennessee

Jennifer Mundt

State of North Carolina

Jeremy Nails

Morgan County Economic Development
Association

Alice Perry**

State of Mississippi

Doug Peters

Tennessee Valley Public Power
Association

Derwin Sisnett

Gestalt Community Schools

Stephen Smith

Southern Alliance for Clean Energy

Charles Snavelly

Commonwealth of Kentucky

John Warren

Commonwealth of Virginia

Lloyd Webb

Olin Chlor Alkali

Susan R. Williams

SRW & Associates

*RERC Chair

** Retired from the RERC June, 2018

Introductions



- Name
- Organization and Role
- Your most (or least) favorite part of the Holidays



Agenda and Meeting Protocols

Agenda – December 18, 2018

9:00	Welcome, Safety Moment, Building Emergency Plan TVA Updates	Joe Hoagland, Designated Federal Officer; Dr. Wayne Davis, Chair; Jo Anne Lavender, Facilitator
9:10	Meeting Purpose & Recap of Sept 5, 2018, Meeting	Hoagland
9:25	IRP Update	Brian Child Amy Henry
9:45	Break and prepare for Public Comment Period	
10:00	Public Comment Period	
11:00	Break	
11:15	IRP Update: Modeling, Metrics and Scorecards for the IRP	Jane Elliott / Hunter Hydas
12:15	Lunch	
1:15	IRP/EIS Update	Ashley Pilakowski
1:45	Council Discussion	Lavender and RERC
2:45	Break	
3:00	Form Advice Statement	Lavender and RER
4:00	Wrap up & Adjourn	Henry/Davis

Advisory Questions

- Our primary objectives in developing metrics and scorecards are to distinguish individual portfolio outcomes to evaluate differences and to clearly communicate results. How well do you feel that the metrics identified and scorecard designed accomplishes these objectives?
- What should TVA consider as we apply these metrics and scorecards in the IRP and EIS?

RERC Meeting Protocols

Agenda

- ◆ Agenda prepared and approved by the Designated Federal Officer (DFO) in consultation with Council Chair
- ◆ Agenda distributed to Council and published in the Federal Register prior to each meeting
- ◆ Topics may be submitted to the DFO by any member of the Council, or non-members, including members of the public

Meeting Minutes

- ◆ DFO will ensure that minutes are prepared for each meeting, approved by the Chair, and made available to Council members

Voting

- ◆ Any member of the Council may make a motion for a vote
- ◆ Recommendations to TVA Board shall require an affirmative vote of at least a simple majority of the total Council members present on that date
- ◆ Council members may include minority or dissenting views

Discussion

- ◆ DFO (or his designee) will facilitate and ensure good order during all open discussions
- ◆ Only one speaker or attendee is permitted to comment at a time
- ◆ To be recognized by the Chair (or meeting facilitator) in order to provide comment, please turn your name card on its side



TVA Update

Meeting Purpose and Recap

Joe Hoagland, Designated Federal Officer

TVA / DFO Update

Recap Term 3 Meetings

- 4 Meetings held for Term 3
 - November 29 and 30, 2017
 - December 22, 2017 (Webinar), Advice provided (principles that TVA should consider when designing wholesale rate changes and mechanisms to use to engage Valley stakeholders when making those changes)
 - June 14, 2018, Advice provided on focus areas and public engagement for the 2019 Integrated Resource Plan
 - September 5, 2018, Sentiments provided around the 2019 IRP Scenarios and Strategies

Sept 5 2018 Meeting - Recap

Planned Scenarios & Strategies

Scenarios

1. *Current Outlook*
2. *Economic Turndown*
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*

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Relative Incentive Levels by Strategy

PRELIMINARY

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

Strategy	Distributed Resources						Utility Scale Resources				
	Distributed Solar	Distributed Storage	Combined Heat & Power	Energy Efficiency	Demand Response	Beneficial Electrification	Solar	Wind	Storage	Aeros & Turbo Engines	Small Modular Reactors
Base Plan	Base	Base	Base	Base	Base	Base	Base	Base	Base	Base	Base
Promote DER	High	High	High	Moderate	Moderate	Base	Base	Base	Base	Base	Base
Promote Resiliency	Moderate	Moderate	Moderate	Base	Moderate	Base	Base	Base	Moderate	Moderate	Moderate
Promote Efficient Energy Usage	Moderate	Moderate	Moderate	High	High	Moderate	Base	Base	High	Base	Moderate
Promote Renewables	High	Moderate	Base	Base	Base	Base	High	High	Moderate	Base	Base

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Sept 5 2018 Sentiment Statement

How well do you think the 2019 IRP future scenarios achieve the study objective of pushing the boundaries of future plausible conditions?

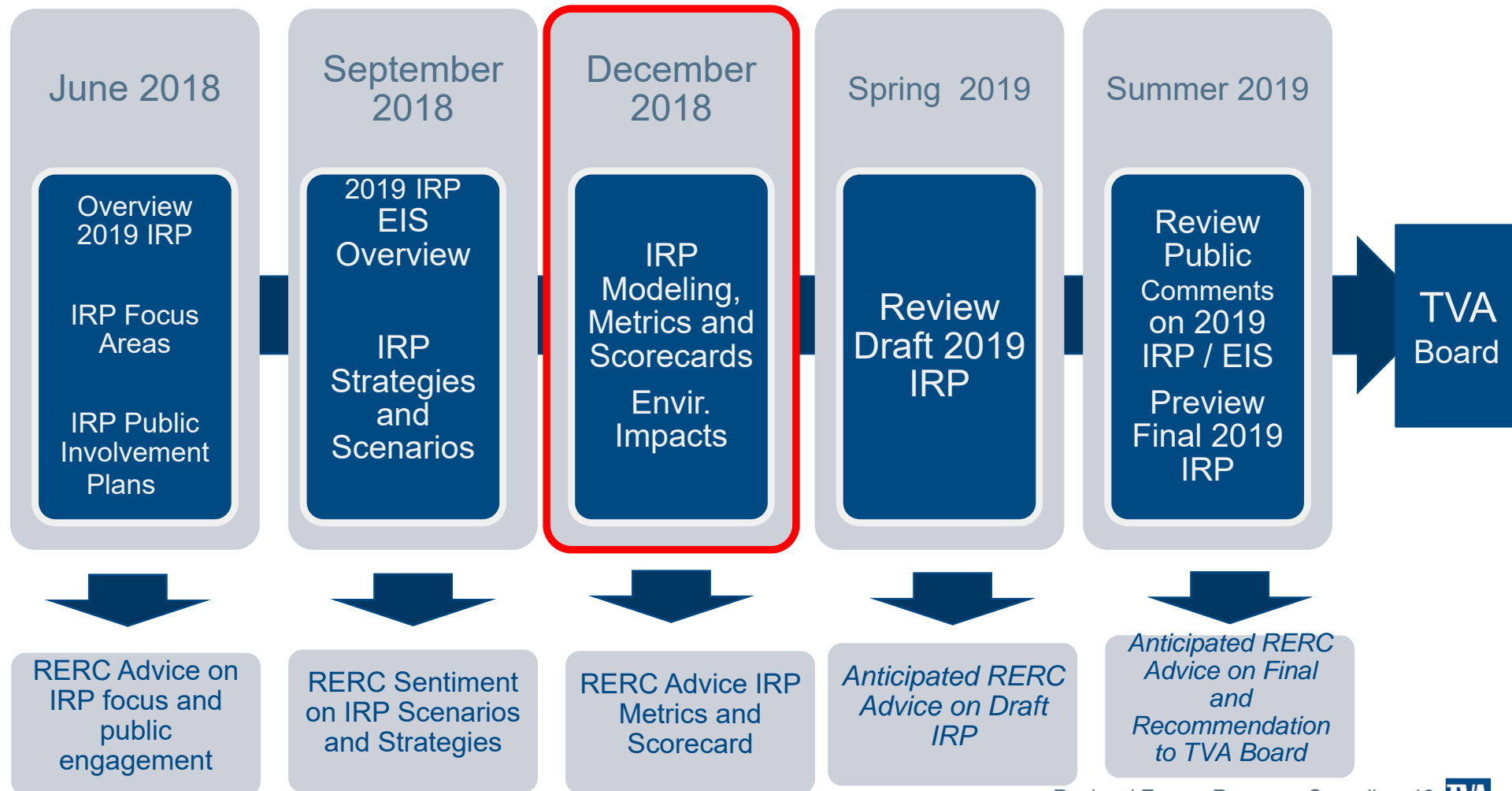
The RERC has reviewed the 2019 IRP Scenarios and their characteristics. In terms of the breadth of coverage of plausible future conditions, the RERC feels that the Scenarios generally do push the boundaries of future plausible conditions based on what we know today. We suggest that you pay attention to the lower end of growth to ensure this IRP considers the lower end of the scale fully. We appreciate that these future scenarios consider more aggressive adoption of varying technologies including renewables and other distributed energy resources. Recognizing that gas prices are subject to fluctuation, it is important to understand the sensitivity of gas prices being much higher or lower as we predict future conditions.

Sept 5 2018 Sentiment Statement (cont'd)

What should TVA consider as we apply the 2019 IRP strategies in the model?

TVA should be guided by the matrix (slide 90 in RERC deck), after input is incorporated, on the relative level of incentives to be applied to resources in each Strategy. Related to the business decisions, or Strategies, the RERC believes that TVA should consider adding clarification for how the Strategies both differ from each other and how they also purposefully overlap in terms of the promotion level of various technologies underneath each Strategy.

RERC Review and Input to 2019 IRP



Today's Meeting Purpose

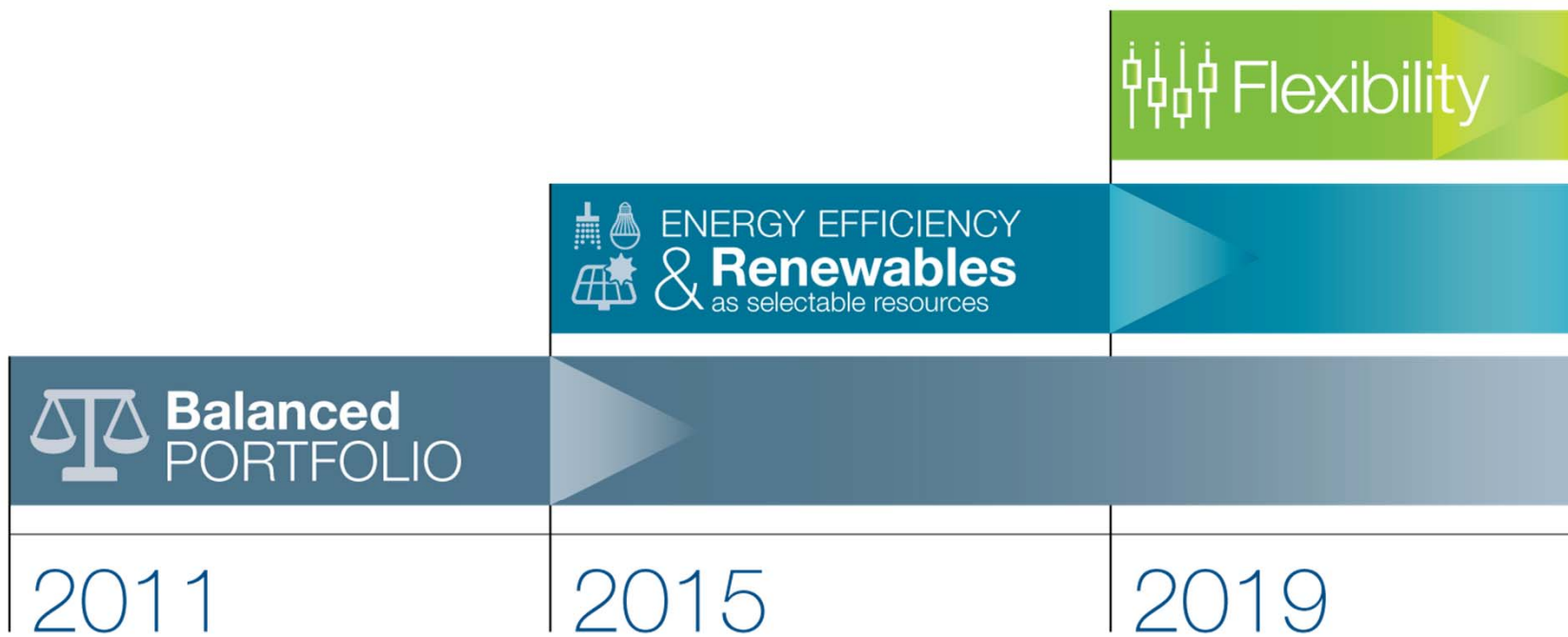
- Provide informational topics on the 2019 Integrated Resource Plan
 - Overview update
 - EIS
 - Metrics
 - Scorecards
- Host a Public Listening Session
- Obtain Advice
 - On the ability of the metrics and scorecards to distinguish and communicate results
 - Considerations for TVA as we apply metrics in the planning process



2019 IRP Update

Brian Child, Director, Enterprise Forecasting and Financial Planning
Amy Henry, Senior Manager, Enterprise Relations

INTEGRATED Resource Plan 2019

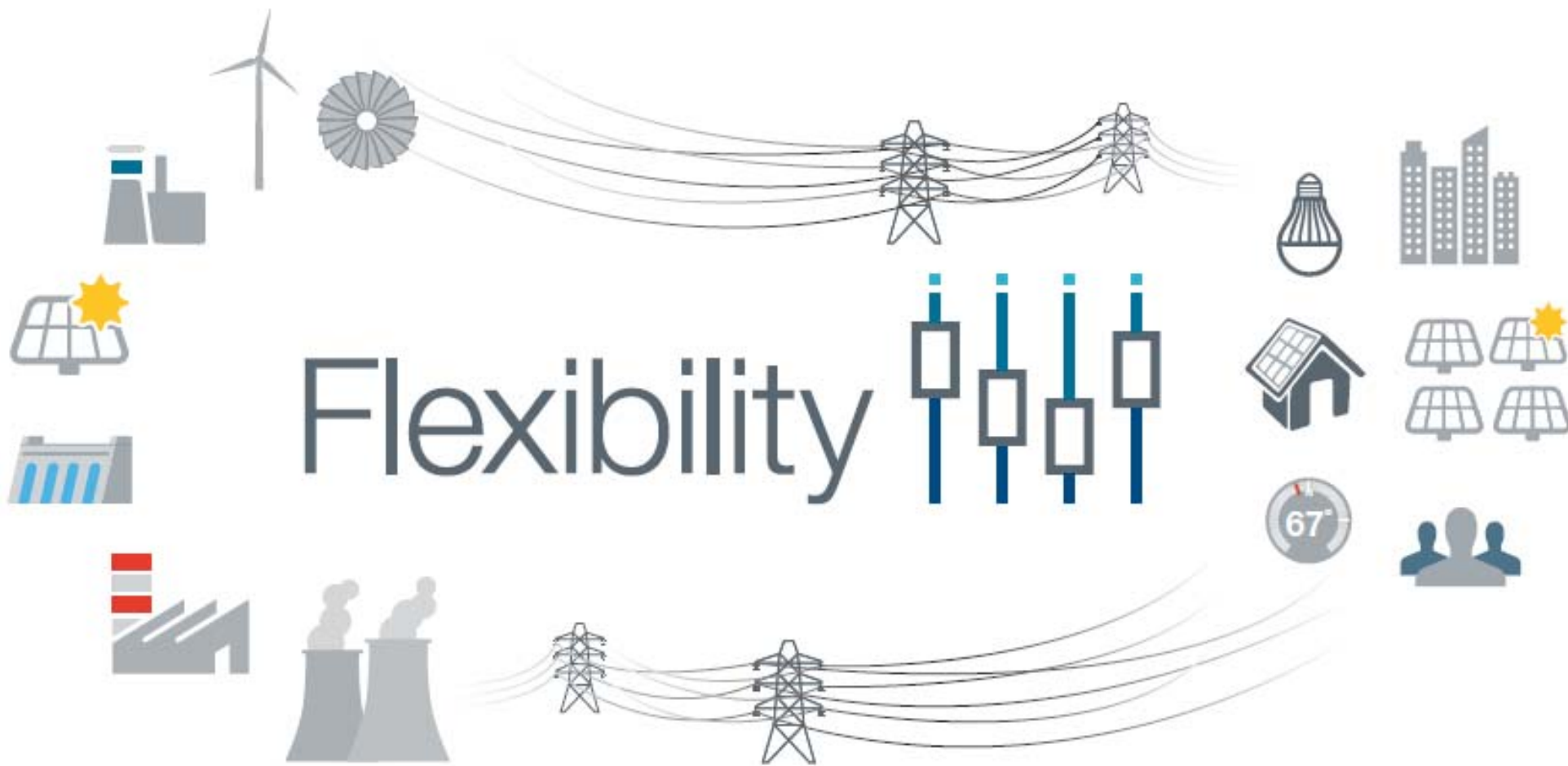
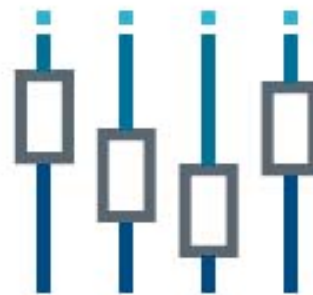


2019 IRP Focus Areas

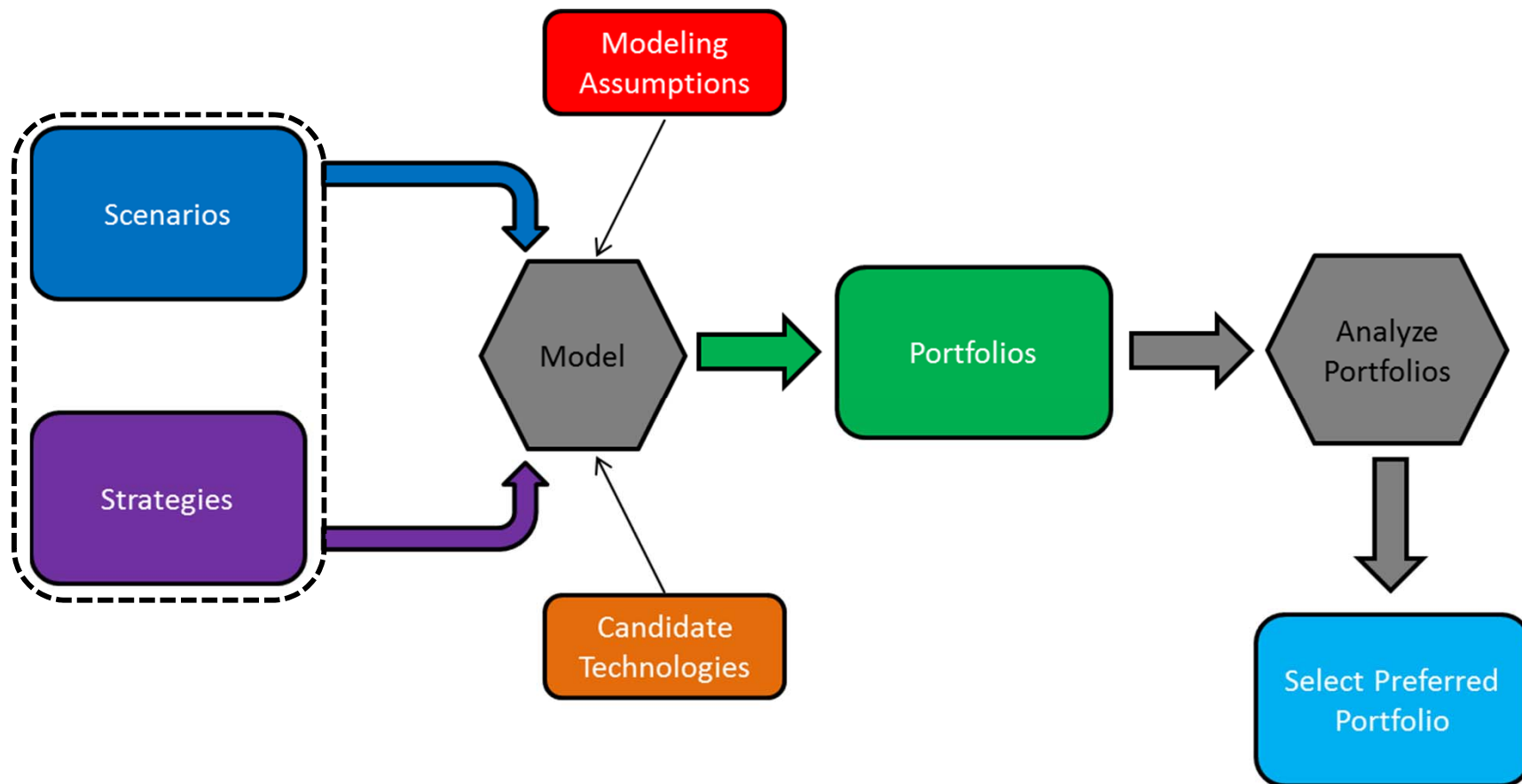
- System flexibility
- Distributed Energy Resources
- Portfolio diversity



Flexibility



Integrated Resource Planning Process



Planned Scenarios & Strategies

Scenarios

1. *Current Outlook*
2. *Economic Turndown*
3. *Valley Load Growth*
4. *Decarbonization*
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6. *No Nuclear Extensions*

Strategies

- A. *Base Case*
- B. *Promote DER*
- C. *Promote Resiliency*
- D. *Promote Efficient Load Shape*
- E. *Promote Renewables*

2019 IRP Schedule: Schedule & Milestones

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



(** indicates timing of Valley-wide public meetings)

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
<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">• Review Reference Case• Finalize Metrics• Follow up on Environmental Impact Statement	<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



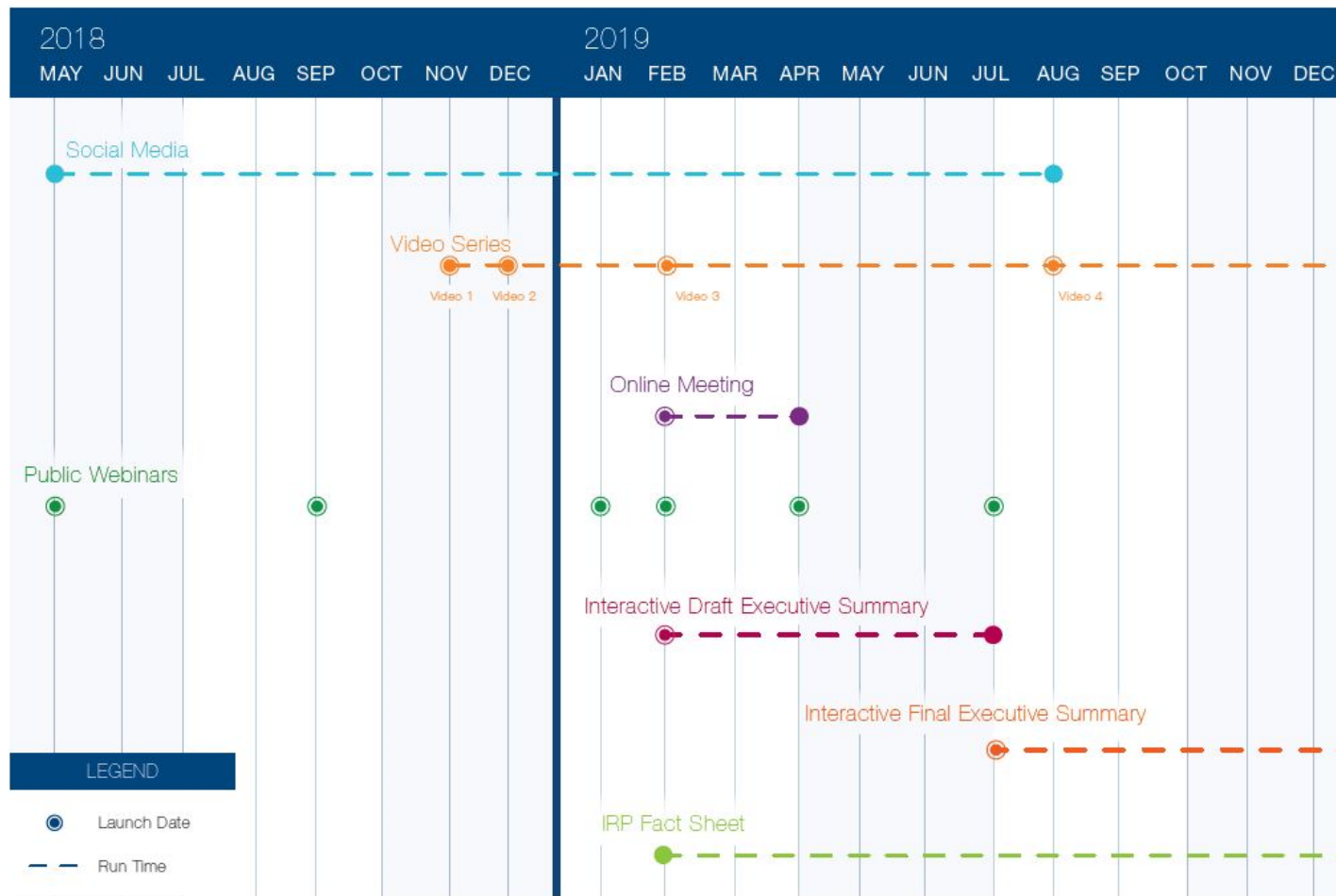
2019 IRP Update

Brian Child, Director, Enterprise Forecasting and Financial Planning
Amy Henry, Senior Manager, Enterprise Relations

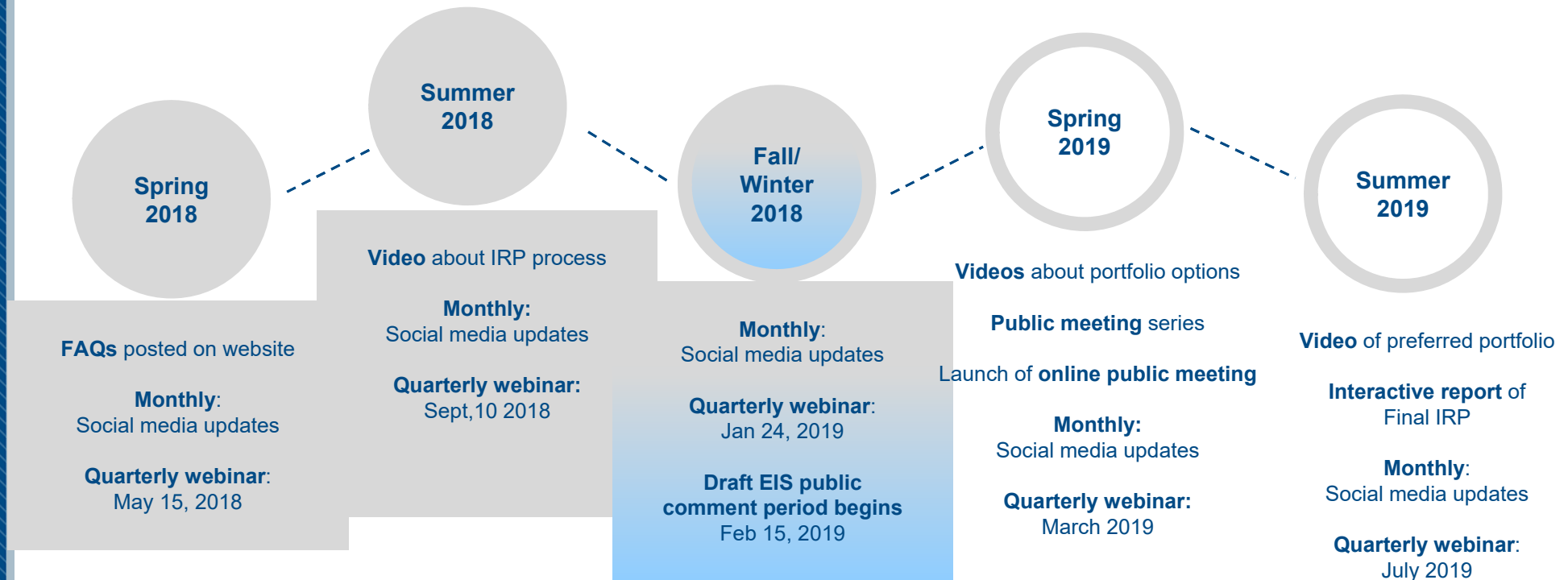
Stakeholder Engagement is a Cornerstone of TVA's IRP Process

- TVA's Integrated Resource Planning is unique
- More informed decision-making
- Better outcomes
- As a federal agency, TVA complies with the National Environmental Policy Act (NEPA)

Public Outreach Communication Tools



Upcoming IRP Public Outreach



Note: Dates Subject to Change

TVA – 2019 IRP Website

TVA Tennessee Valley Authority

About TVA Newsroom Careers Investors Search TVA

Energy Environment Economic Development

2019 Integrated Resource Plan

You are here: Home / Environment / Environmental Stewardship / Integrated Resource Plan

Share this page

Quarterly Public Webinar About IRP Held Sept. 10

TVA held a Quarterly Public Webinar for the 2019 IRP on Sept. 10, 2018. The Webinar recording is below.

TVA has begun work on the 2019 Integrated Resource Plan (IRP)—a comprehensive study that provides direction on how to best meet future electricity demand. Building upon the work done in prior plans, TVA has started the 2019 IRP to proactively address the changing utility marketplace.

The 2019 IRP will explore various scenarios related to expansion of distributed energy resources (DER) in the Tennessee Valley. We will also seek to improve TVA's understanding of the impact and benefit of system flexibility with increasing renewable and distributed resources.

EIS Process

www.tva.com/irp

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

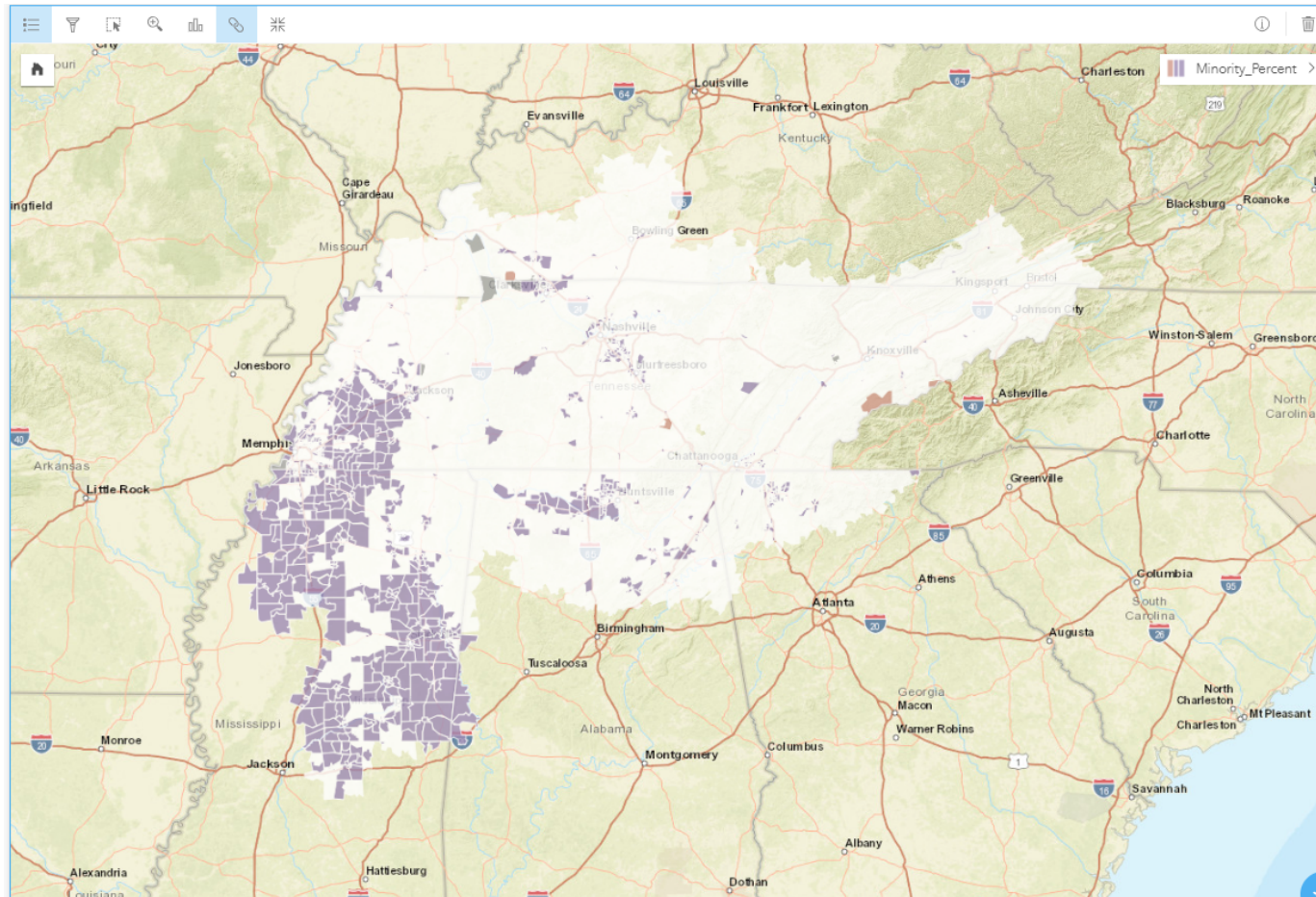
Executive Order 12898 - Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations

- 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...”

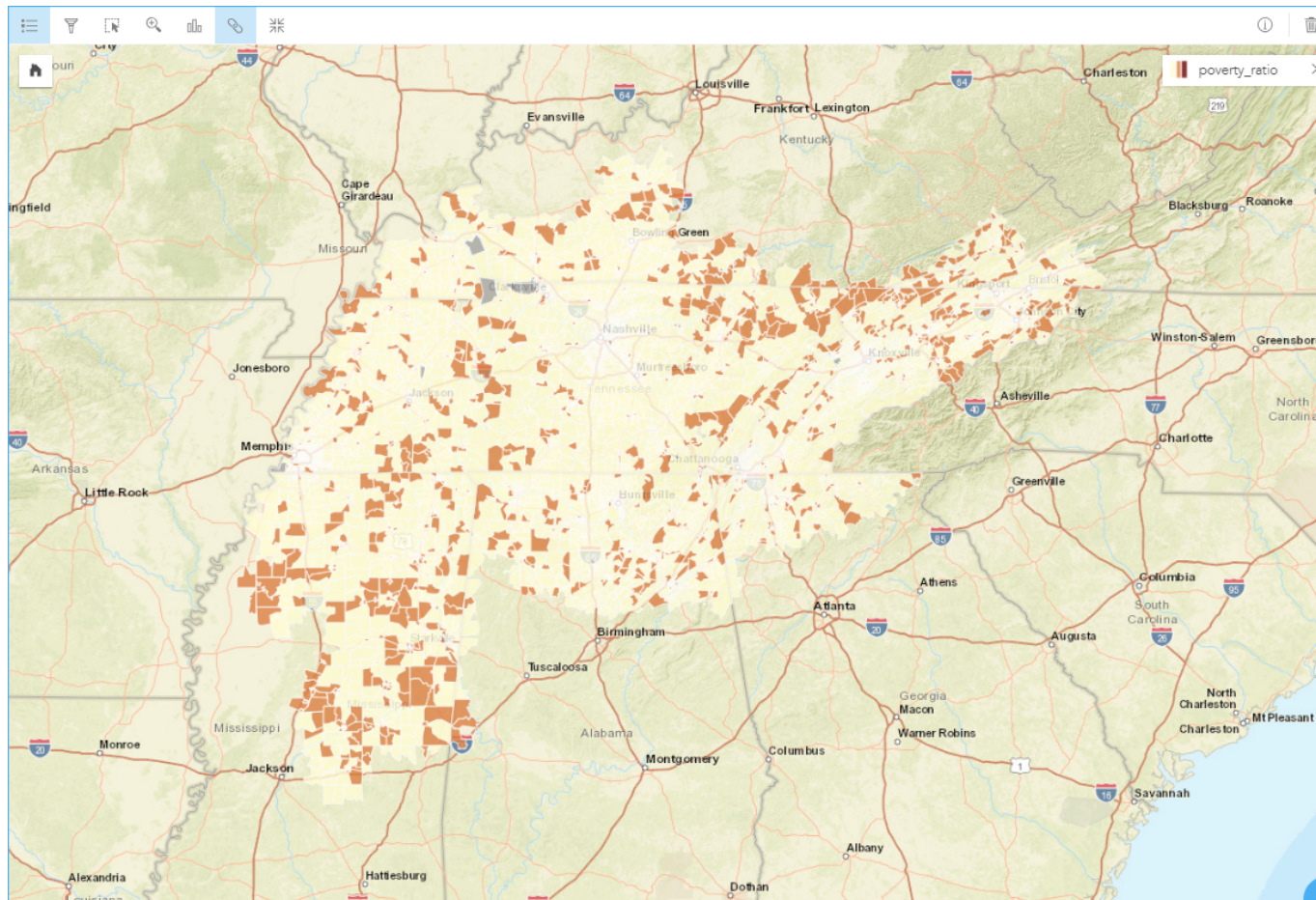
What Is Environmental Justice?

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.

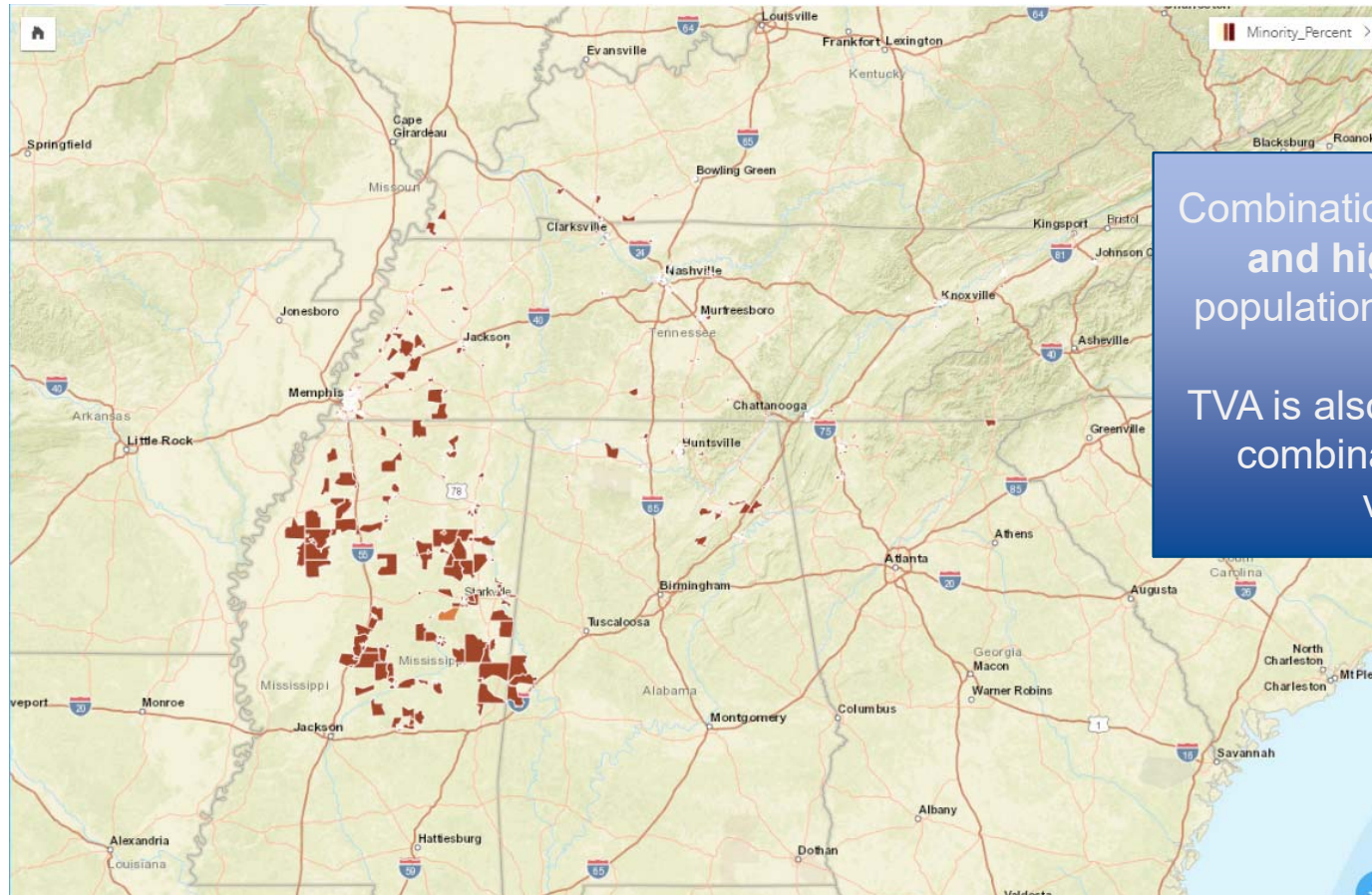
Minority Populations (>21.3%) at Block Group Level



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.

Inclusive Public Outreach

- **Easily understood language**
- **Alternate language format**
- **Target specific audiences**
- **Work through existing relationships**





Public Listening Session

- **Public participation is appreciated**
- **This is a listening session; responses are typically not provided**







IRP Update - Modeling

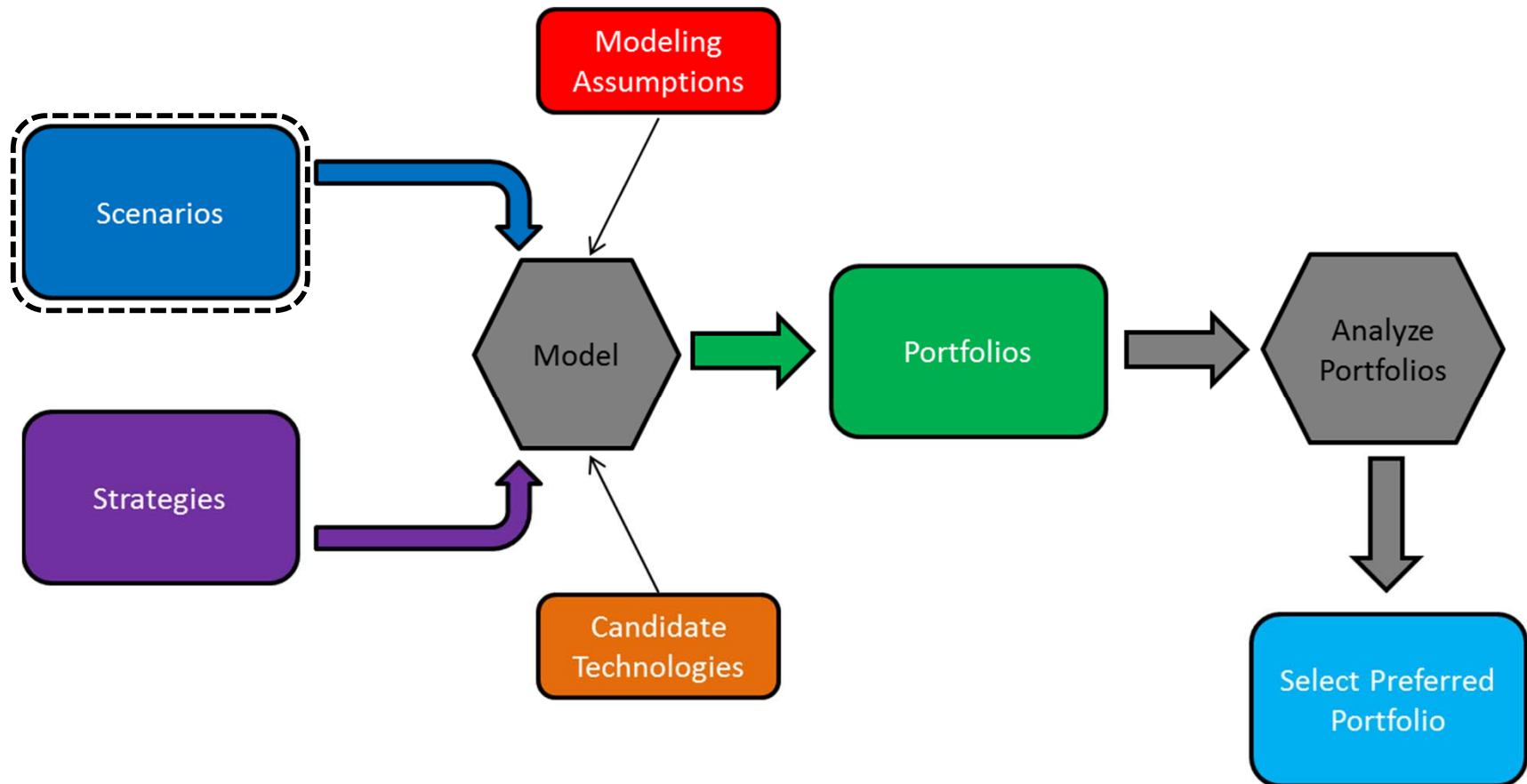
Jane Elliott- Senior Manager, Resource Strategy
Hunter Hydas- Project Manager, 2019 IRP

IRP Update

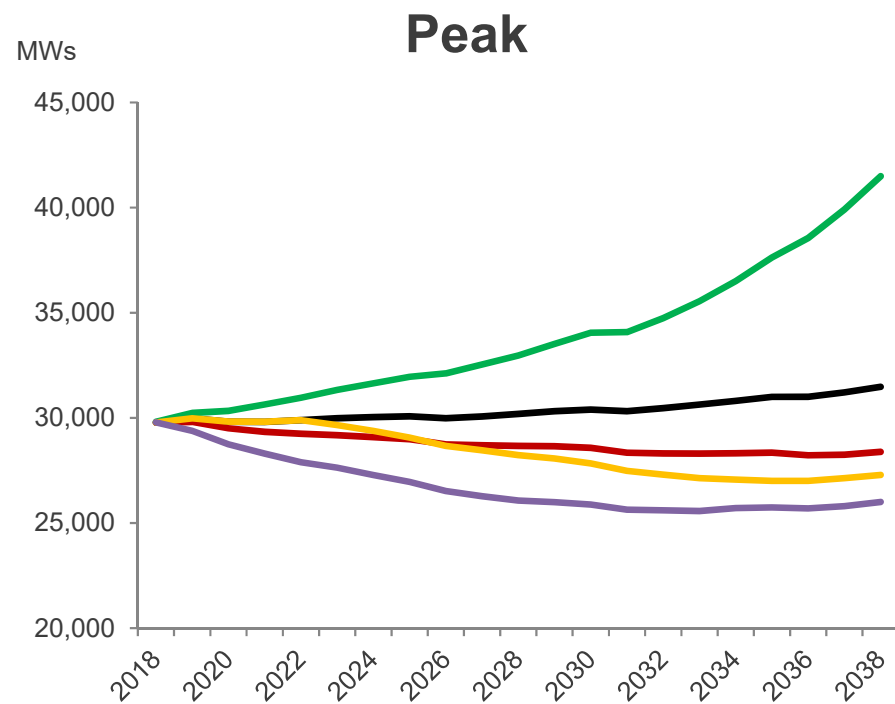
Focus of today's update:

- Scenario design (recap)
- Resource planning framework (recap)
- Final Resource options
- Final Strategy design
- Metrics

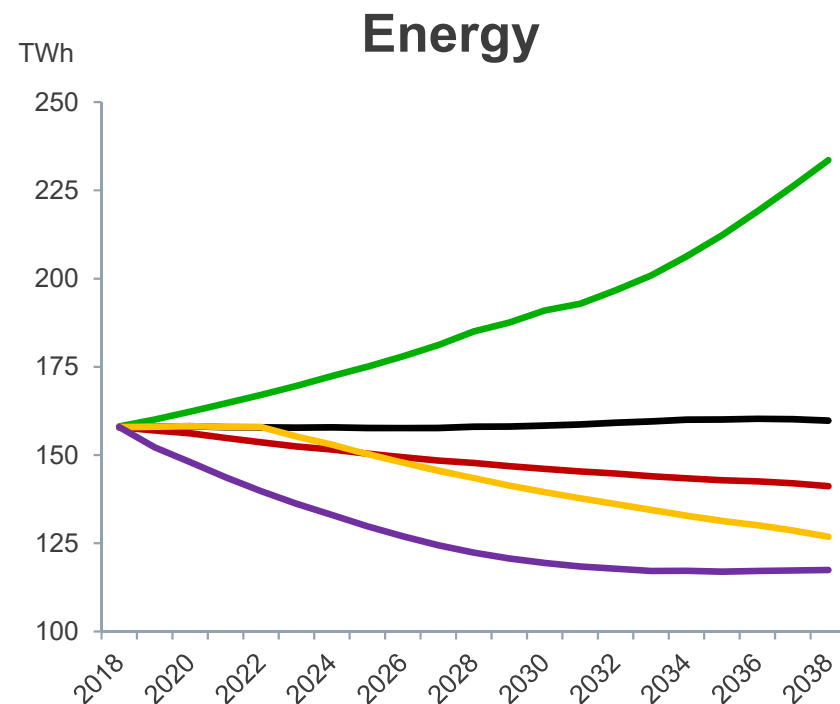
Scenarios Test the Bounds



Scenario Forecasts: Load Outlook



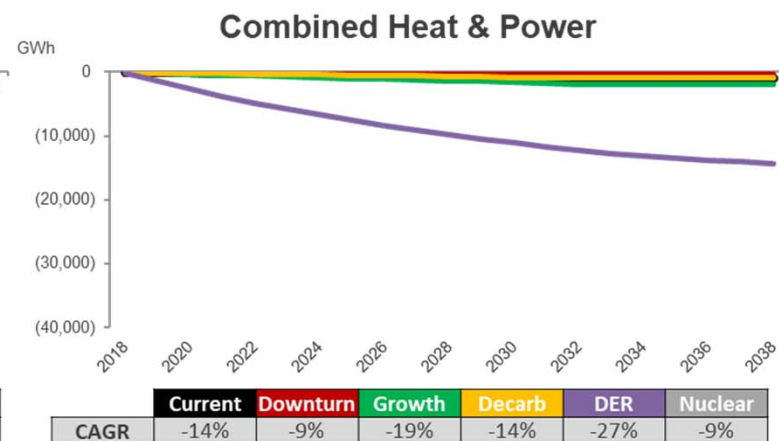
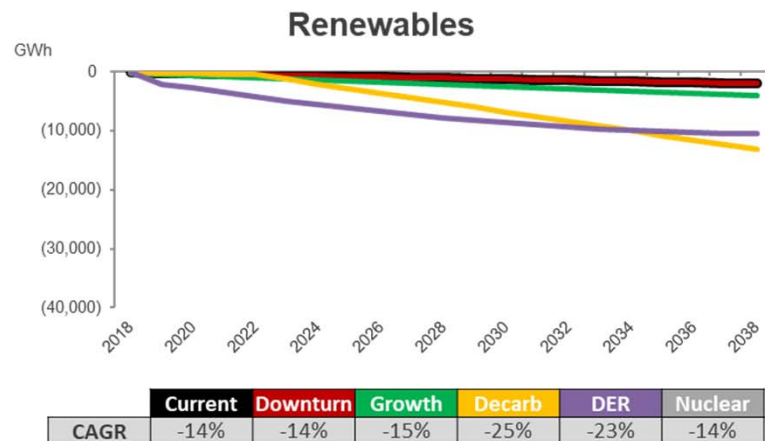
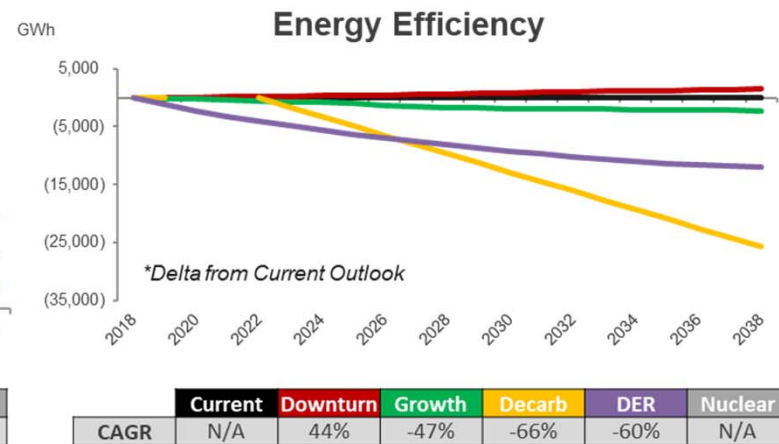
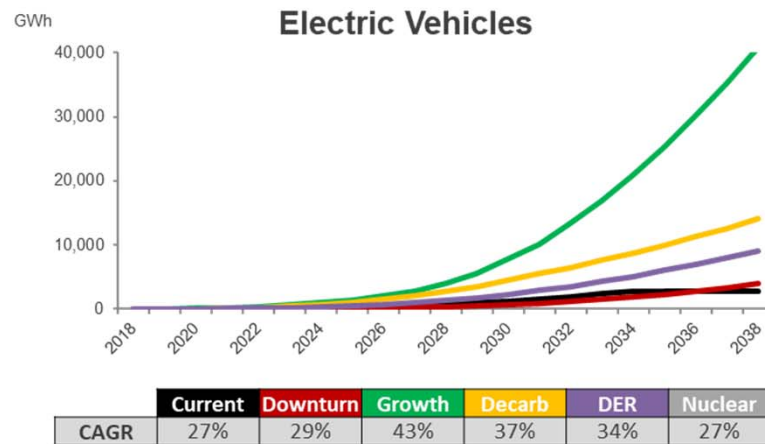
	Current	Downturn	Growth	Decarb	DER	Nuclear
CAGR	0.3%	-0.2%	1.7%	-0.4%	-0.7%	0.3%



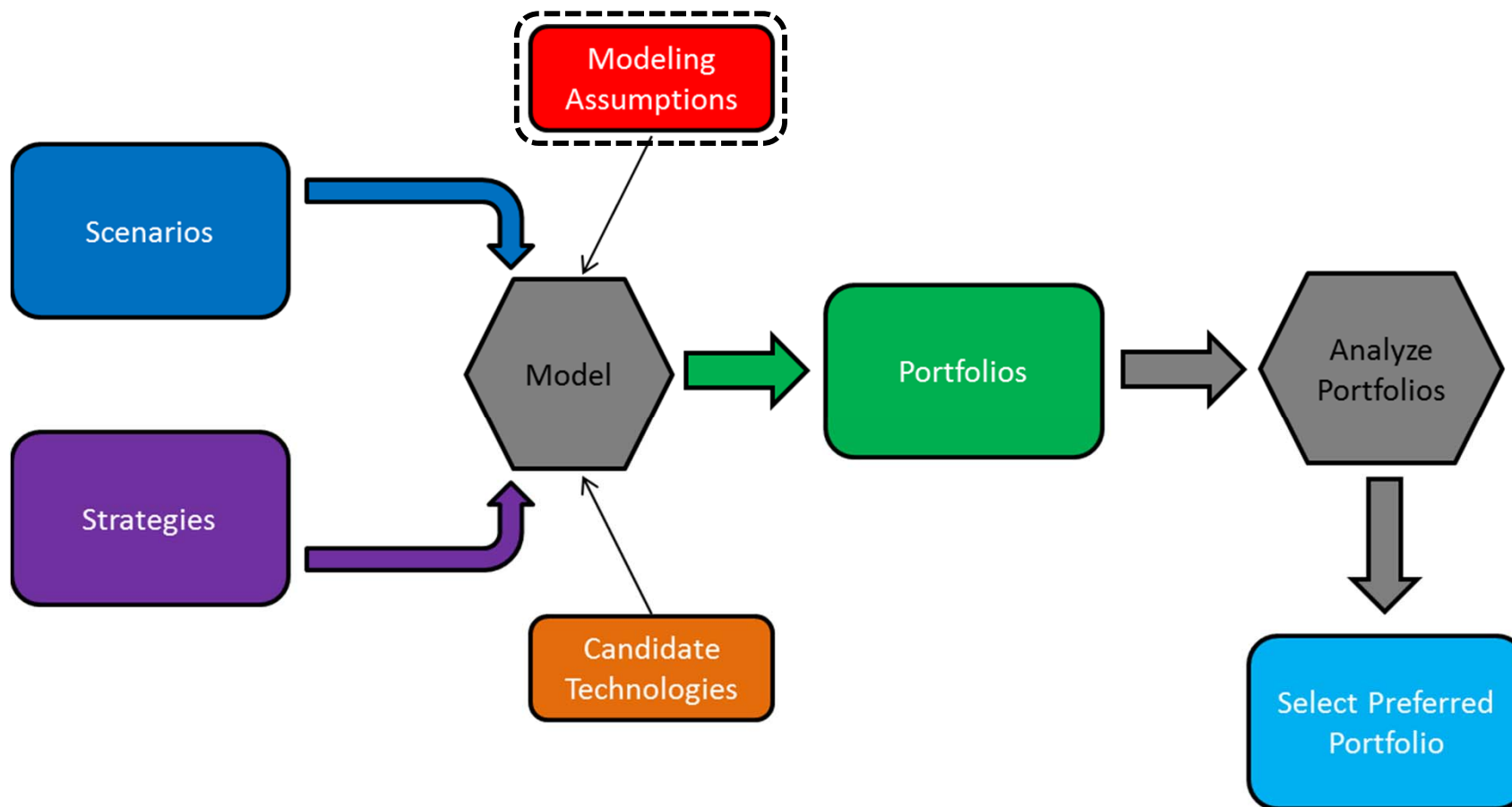
	Current	Downturn	Growth	Decarb	DER	Nuclear
CAGR	0.0%	-0.5%	2.0%	-1.1%	-1.5%	0.0%

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

Scenario Forecasts: Behind the Meter Impacts



Framework Informs Portfolio Optimization

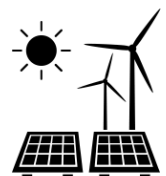


Planning for an Evolving System



Winter Peaking Demand

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



More Renewable Resources

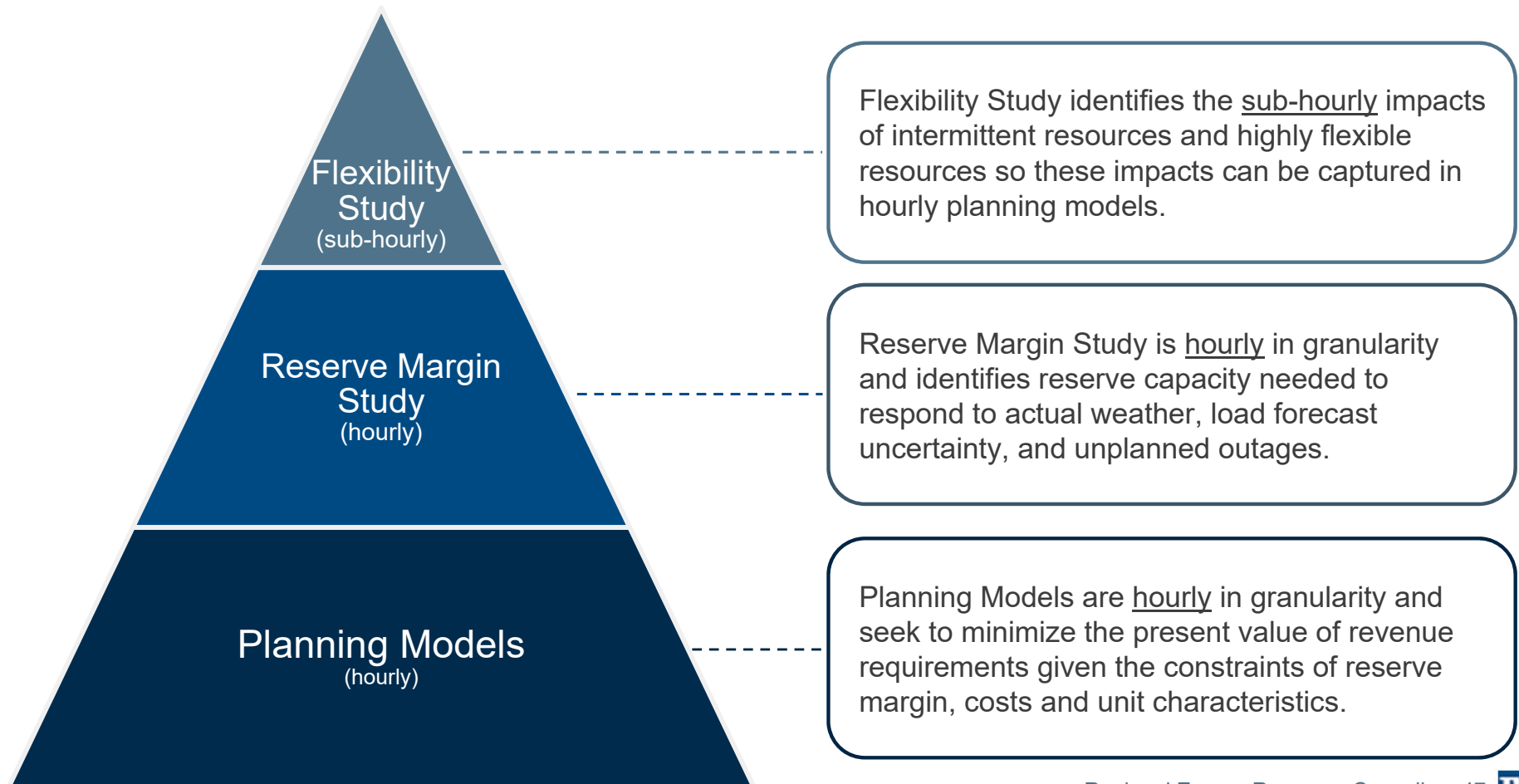
Integration cost recognizes the sub-hourly costs driven by integrating intermittent resources onto the system



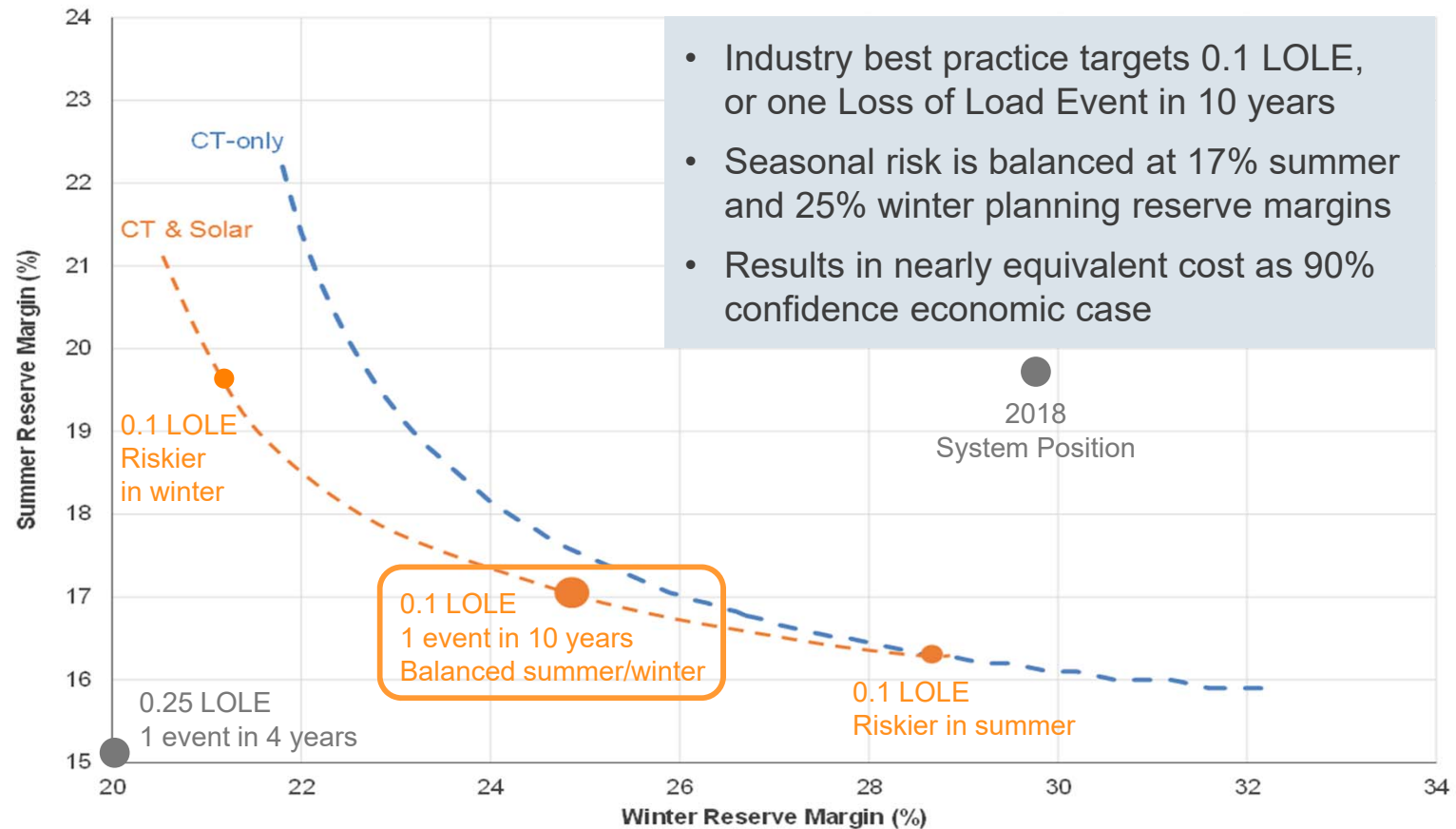
Increasing Need for Flexibility

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

Key Elements of the Modeling Framework

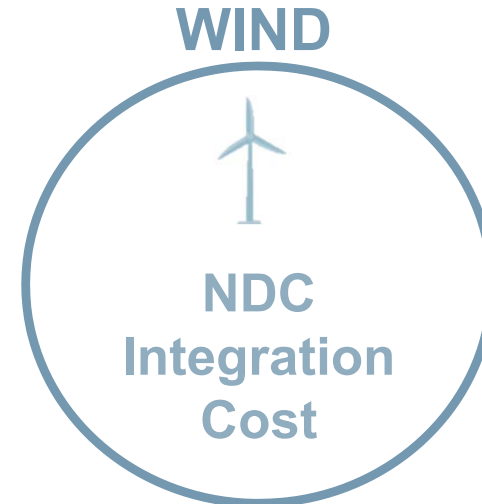
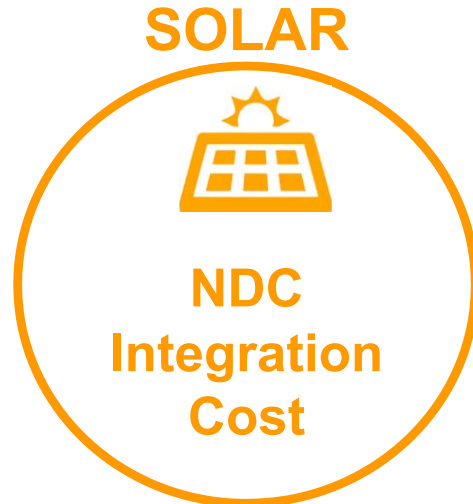


Balancing Seasonal Risk to Achieve 0.1 LOLE



Solar & Wind Capacity and Integration Cost

- Solar and wind are intermittent resources which have unique operating characteristics that are different from thermal and other more traditional resources
- Net Dependable Capacity (NDC) is represented by availability at the peaks, which can vary depending on penetration of the resource
- Intermittent resources require the balance of the system to respond to their variability, driving an integration cost



Size & Portfolio Affect Flexibility Value

Flexibility value **increases** with solar penetration →

\$/kW-year	2,500 MW Additional Solar	5,500 MW Additional Solar
200 MW		
500 MW		
1,000 MW		

Flexibility
value
decreases
with
penetration

↓

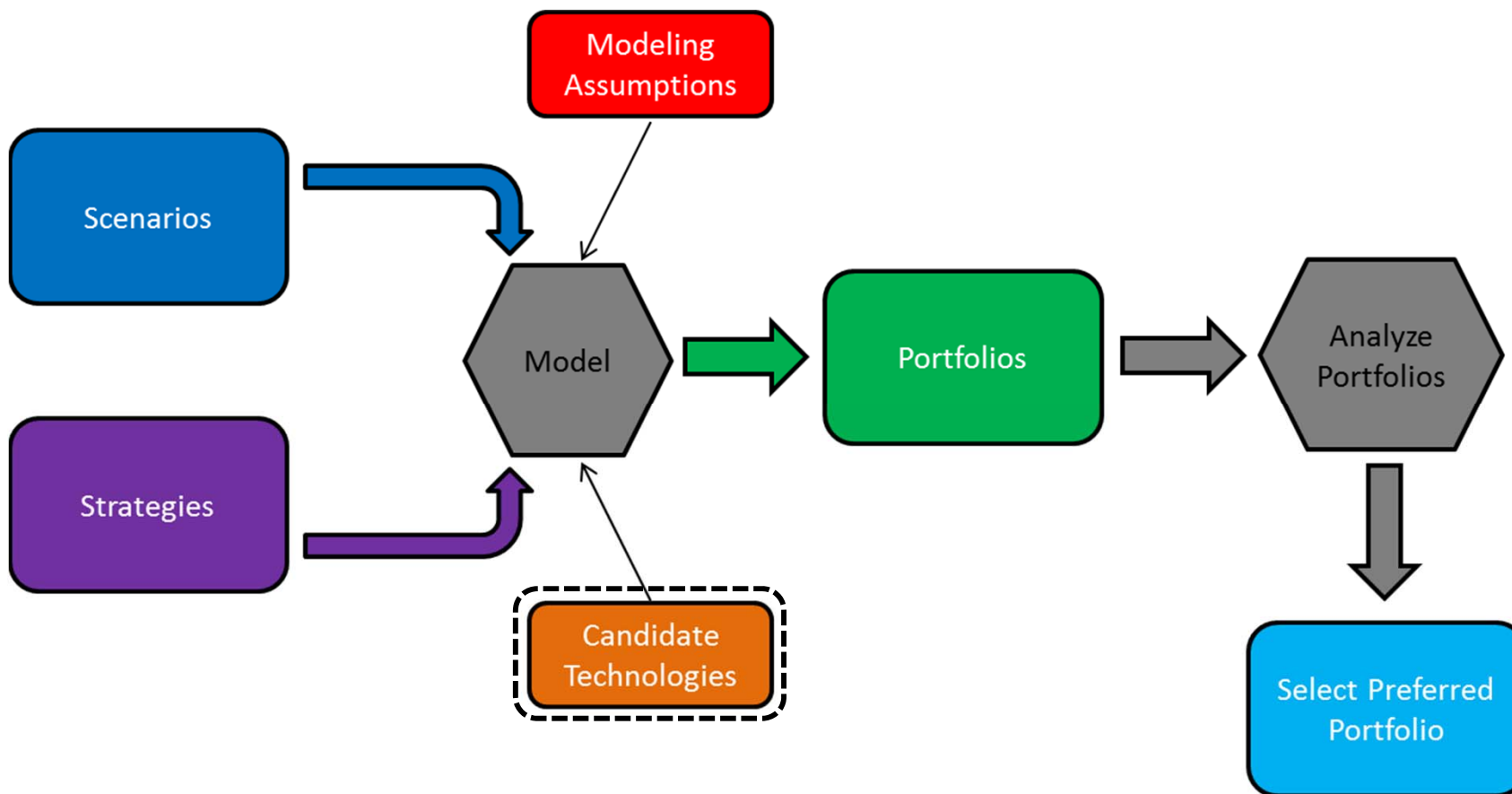
AERO



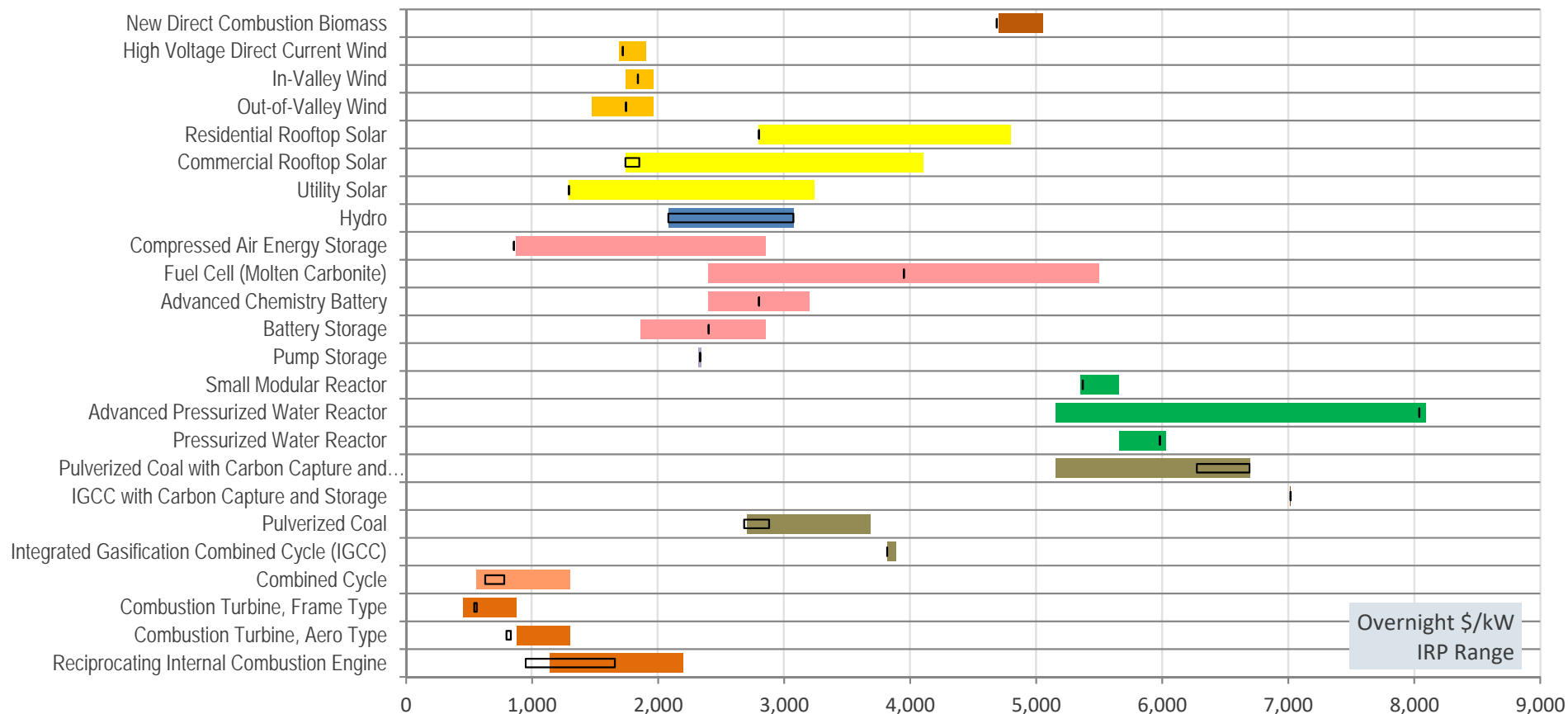
BATTERY



Resource Options Are Offered for Selection

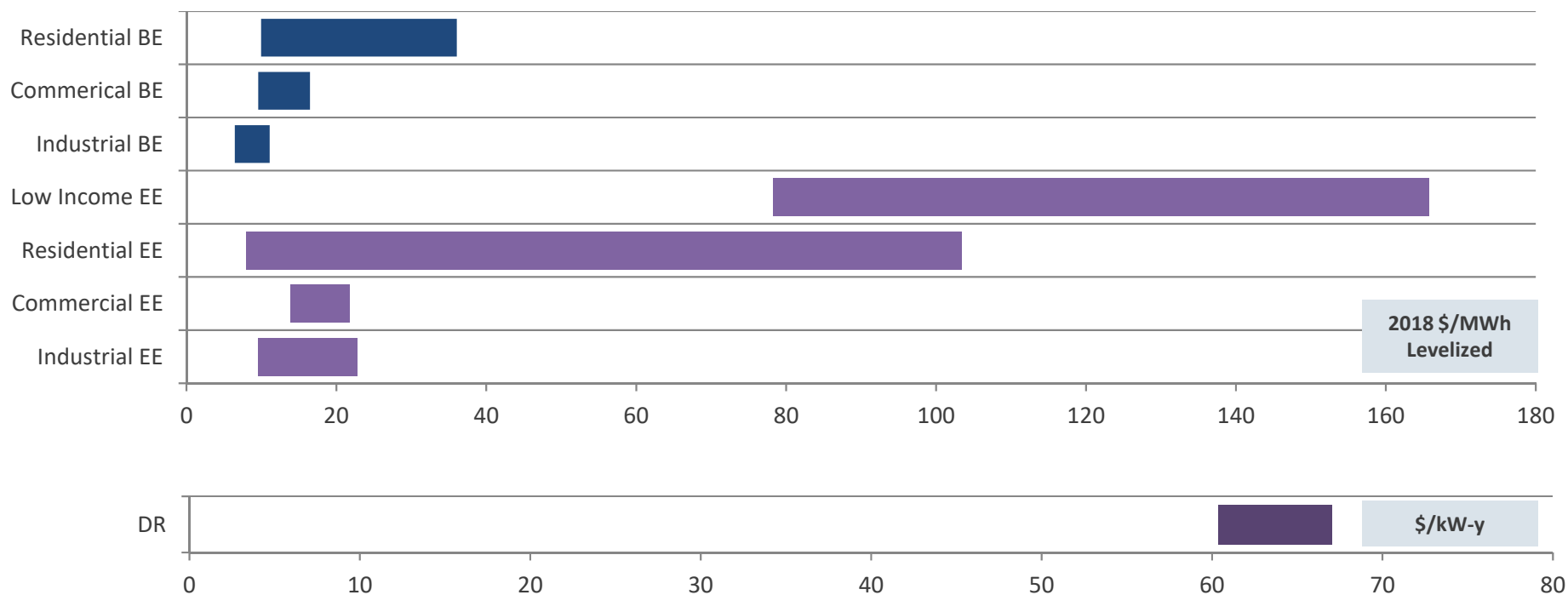


Comparison of Resource Overnight Cost (\$/kW)



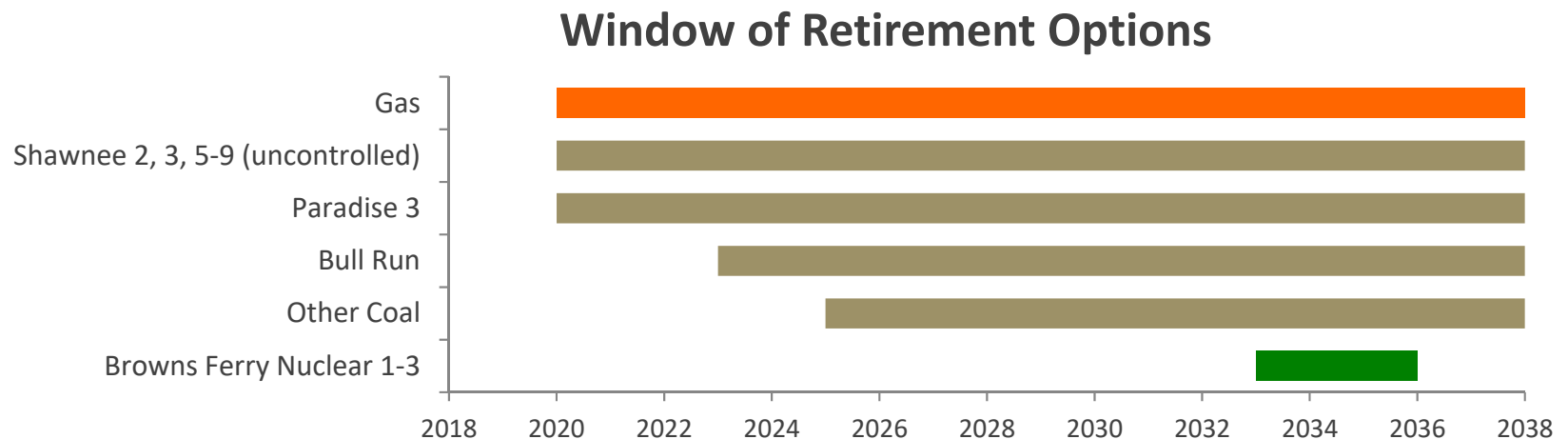
Colored bars reflect benchmark ranges and black outlines represent TVA assumptions;
TVA assumptions outside of benchmark ranges are based on actual costs of TVA projects or vendor quotes.

DER Programmatic Resource Options and Cost

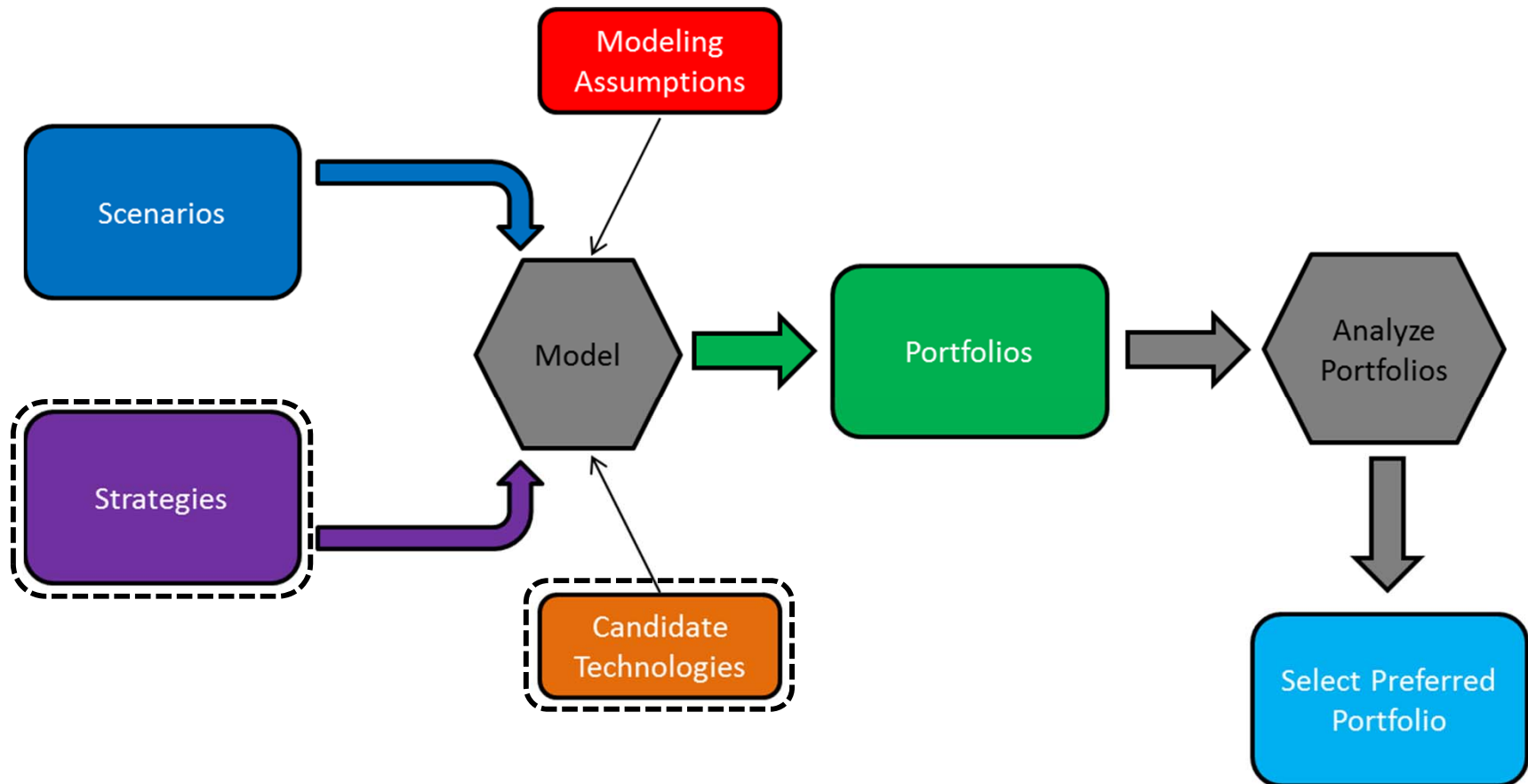


Retirement Options

Total costs can be reduced in low load scenarios or when replacement resources are more economic than the ongoing costs of existing resources. It is important that accurate ongoing costs, demolition/closure costs, and transmission upgrades required to retire resources are considered against the cost of new resources.



Strategies Promote Certain Resource Types



Scenarios & Strategies Have DER Overlap

Strategy design must consider DER adoption holistically for each scenario and strategy pairing, along with aligned cost assumptions

Scenarios

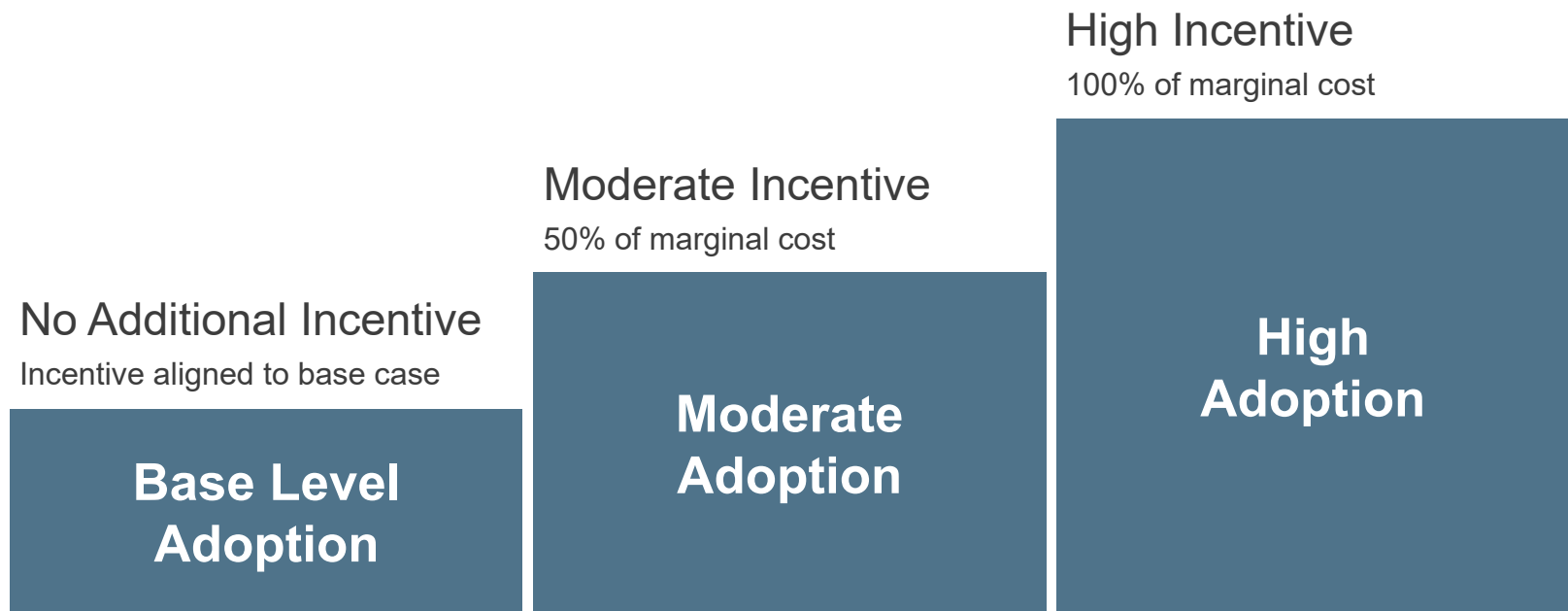
1. *Current Outlook*
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Strategies

- A. *Base Case*
- B. *Promote DER*
- C. *Promote Resiliency*
- D. *Promote Efficient Load Shape*
- E. *Promote Renewables*

Strategies Promote Higher Adoption Levels

Strategies provide incentives to promote adoption of certain resources, with consideration of potential, adoption curve, and reserve margin.



Strategy Design Matrix

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

Low Income Energy Efficiency is promoted in the following manner:

- Pilot program continuation (Base, Resiliency, Renewables)
- Pilot program expanded valley-wide (DER)
- Pilot program expanded valley-wide and incentives increased (Efficient Load Shape)

Distributed Resource Modeling Methodology

Distributed resource adoption at a base, moderate, or high level of incentives will be enforced in the model according to strategy design, prior to optimizing the balance of resources for a portfolio. The individual steps in this process are described below:



This approach for modeling distributed generation allows TVA to gain insights into the impact that distributed resources could have on the TVA system under a variety of different future states.

Running List of Planned Sensitivities

Current Outlook & Valley Growth / Base Case

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

Current Outlook / Base Case

- Enforce promoted resources individually at moderate and high levels *
- Accelerate pace of utility scale solar additions *
- Remove integration cost and flexibility benefit *
- Model high and low natural gas and power prices *
- Model higher ongoing costs for aging coal units

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 *

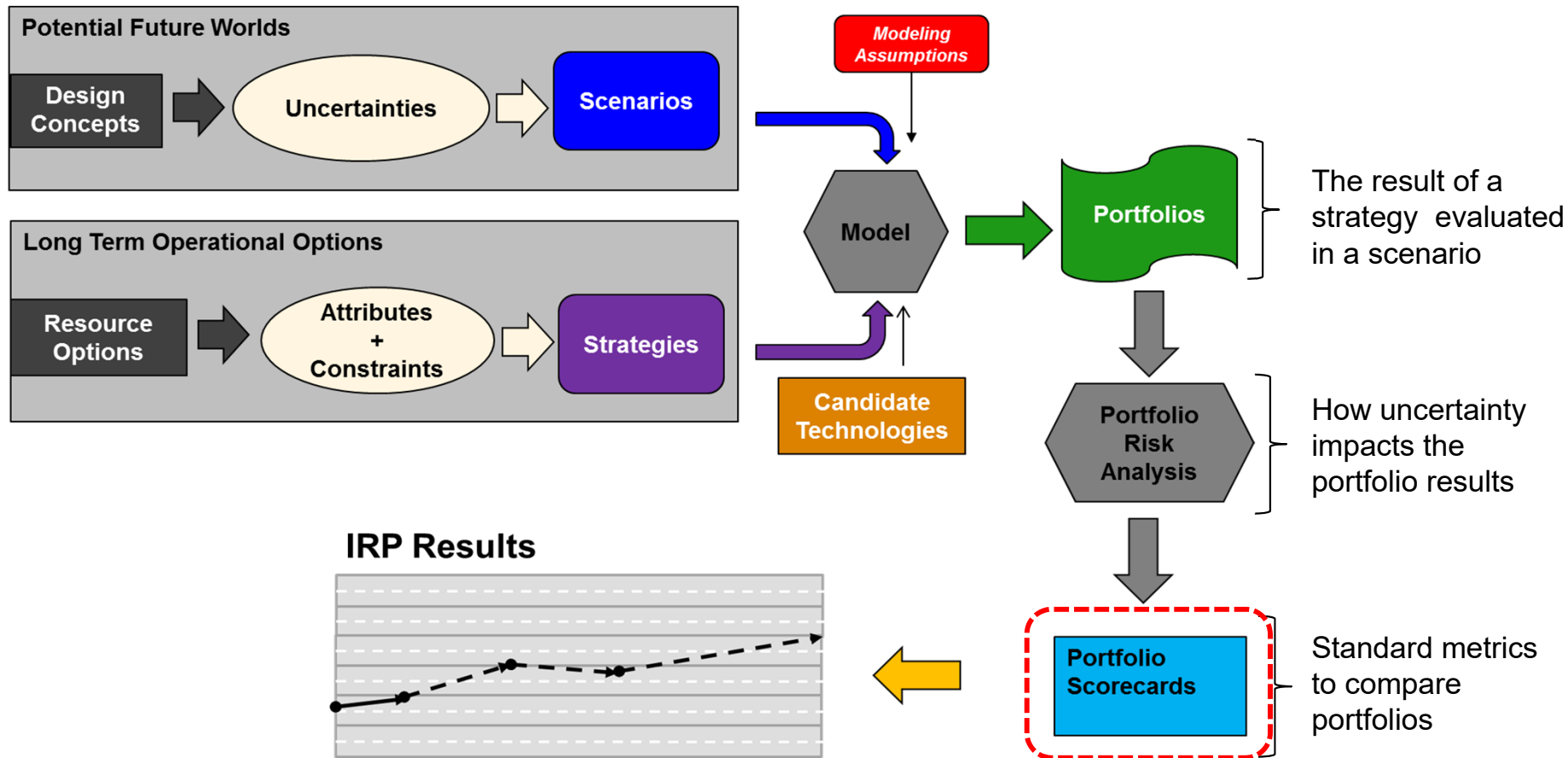
** Included based on IRPWG feedback*



IRP Update – Metrics and Scorecards

Jane Elliott- Senior Manager, Resource Strategy
Hunter Hydas- Project Manager, 2019 IRP

Scorecards Highlight Tradeoffs



TVA's Mission and Strategic Imperatives

Energy

Delivering affordable, reliable power



Environment

Caring for our region's natural resources

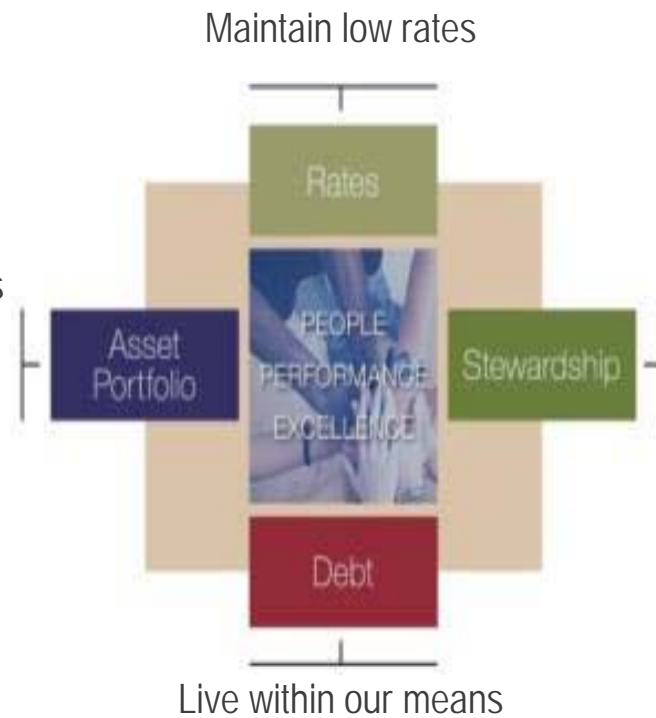


Economic Development

Creating sustainable economic growth



Meet reliability expectations & provide a balanced portfolio



Be responsible stewards

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	Primary Metric	Formula
Cost	PVRR (\$Bn)	Present Value of Revenue Requirements over Planning Period
	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
Operational 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)



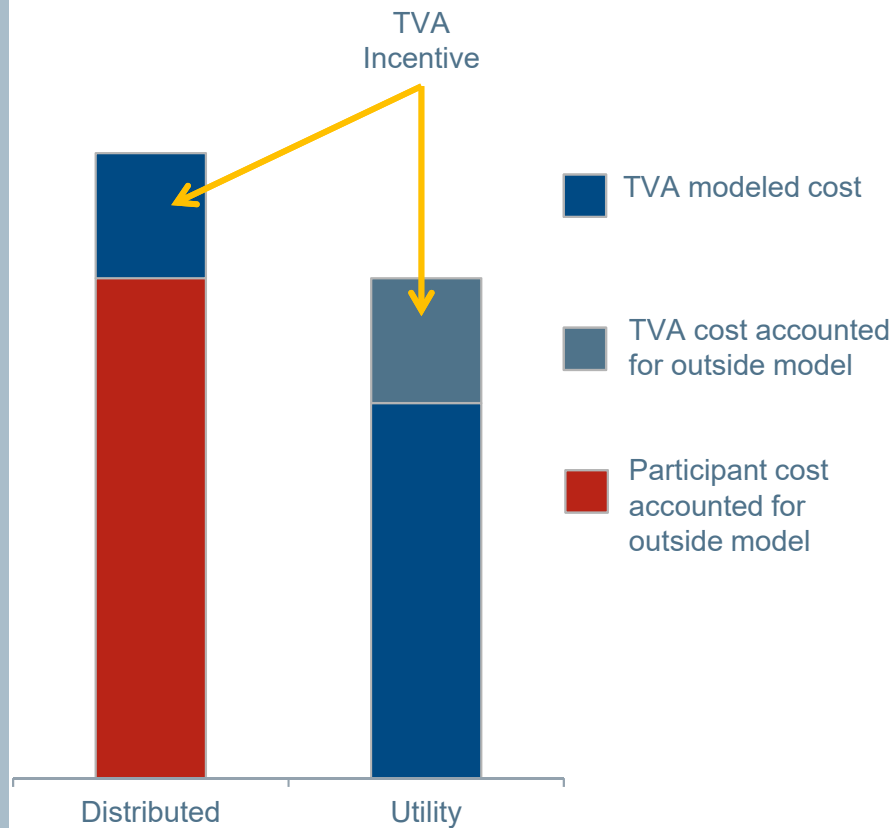
** New metric for 2019

2019 IRP Primary Metrics Alignment

IRP Scorecard Metrics		TVA Mission		
		Low-Cost Reliable Power	Economic Development	Environmental Stewardship
Cost	PVRR (\$Bn)	✓	✓	
	System Average Cost Years 1-10 (\$/MWh)	✓	✓	
	Total Resource Cost (\$Bn)	✓		
Risk	Risk/Benefit Ratio	✓		
	Risk Exposure (\$Bn)	✓		
Environmental Stewardship	CO2 (MMTons)		✓	✓
	Water Consumption (MMGallons)			✓
	Waste (MMTons)			✓
Operational Flexibility	Flexible Resource Coverage Ratio	✓		
Valley Economics	Percent Difference in Per Capita Income	✓	✓	



Total Resource Cost



- Utility and distributed resources receive the same incentives
- The TVA modeled cost for a distributed resource is the incentive, with the balance of the cost carried by the participant
- Utility scale resources are modeled at the lower cost for resource selection



CAISO Flexible Capacity Needs Assessment

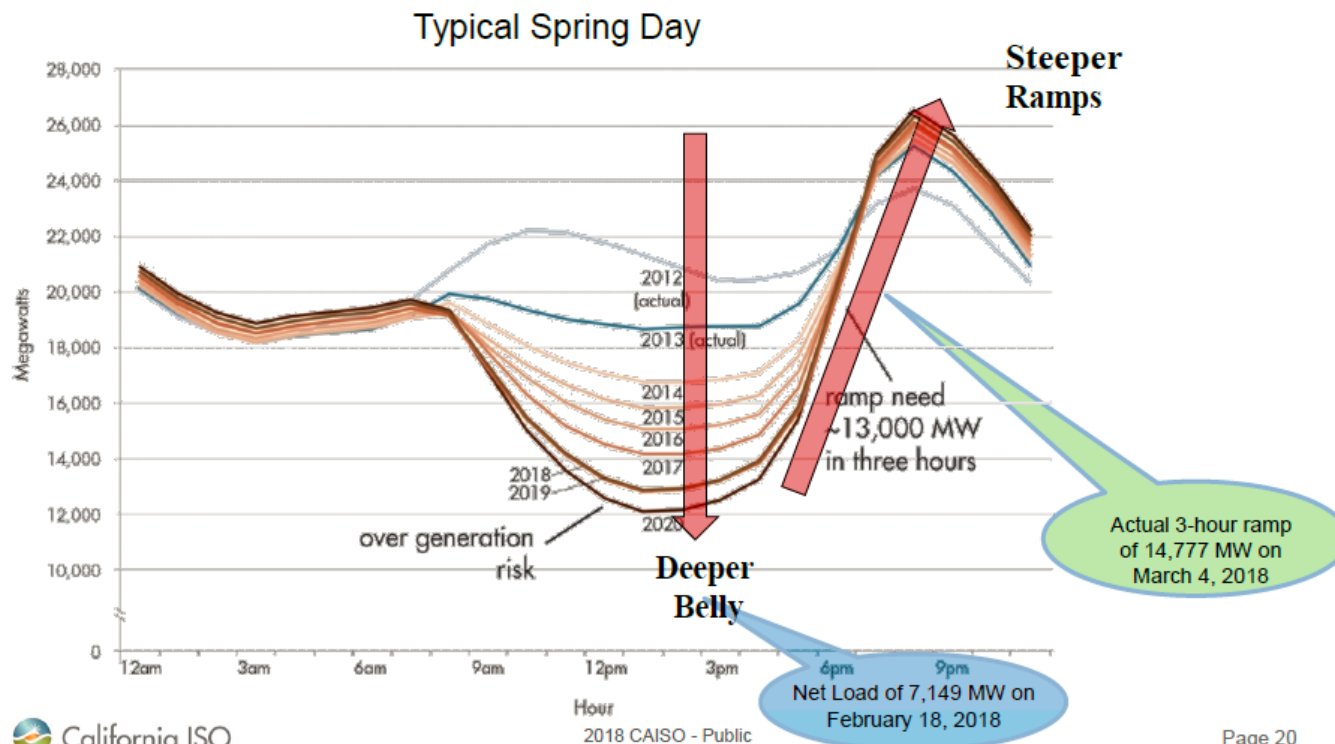
Net-load is a NERC accepted metric¹ for evaluating additional flexibility needs to accommodate VERs

- Net load is the aggregate of customer demand reduced by variable generation power output
- Net-load is more variable than load itself and it increases as VER production increases
- The monthly three-hour flexible capacity need equates to the largest up-ward change in net-load when looking across a rolling three-hour evaluation window
- The ISO dispatches flexible resources to meet net-load

¹ NERC Special Report
Flexibility Report Requirements and metrics for Variable Generation: Implications for System
Planning Studies, August 2010 . http://www.nerc.com/files/IVGTF_Task_1_4_Final.pdf

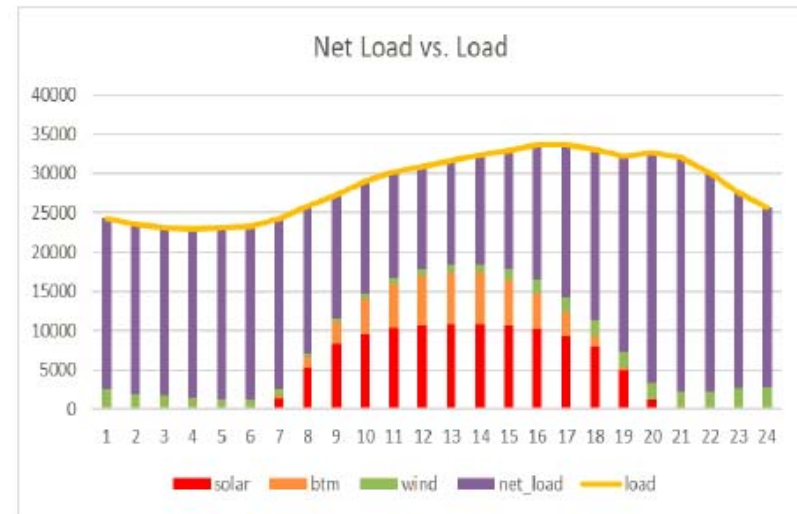
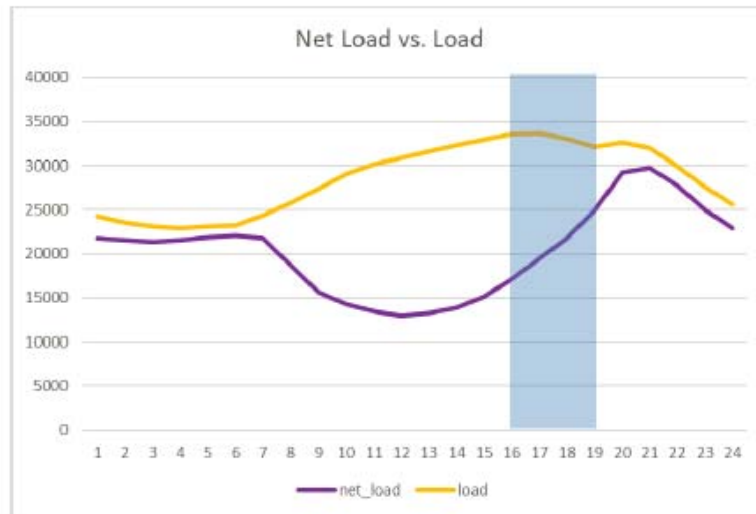
CAISO Flexible Capacity Needs Assessment

Actual net-load and 3-hour ramps are about four years ahead of the CAISO's original estimate primarily due to under forecasting roof-top solar PV installation



CAISO Flexible Capacity Needs Assessment

Understanding Negative Contributions of Load to the three hour net load ramp



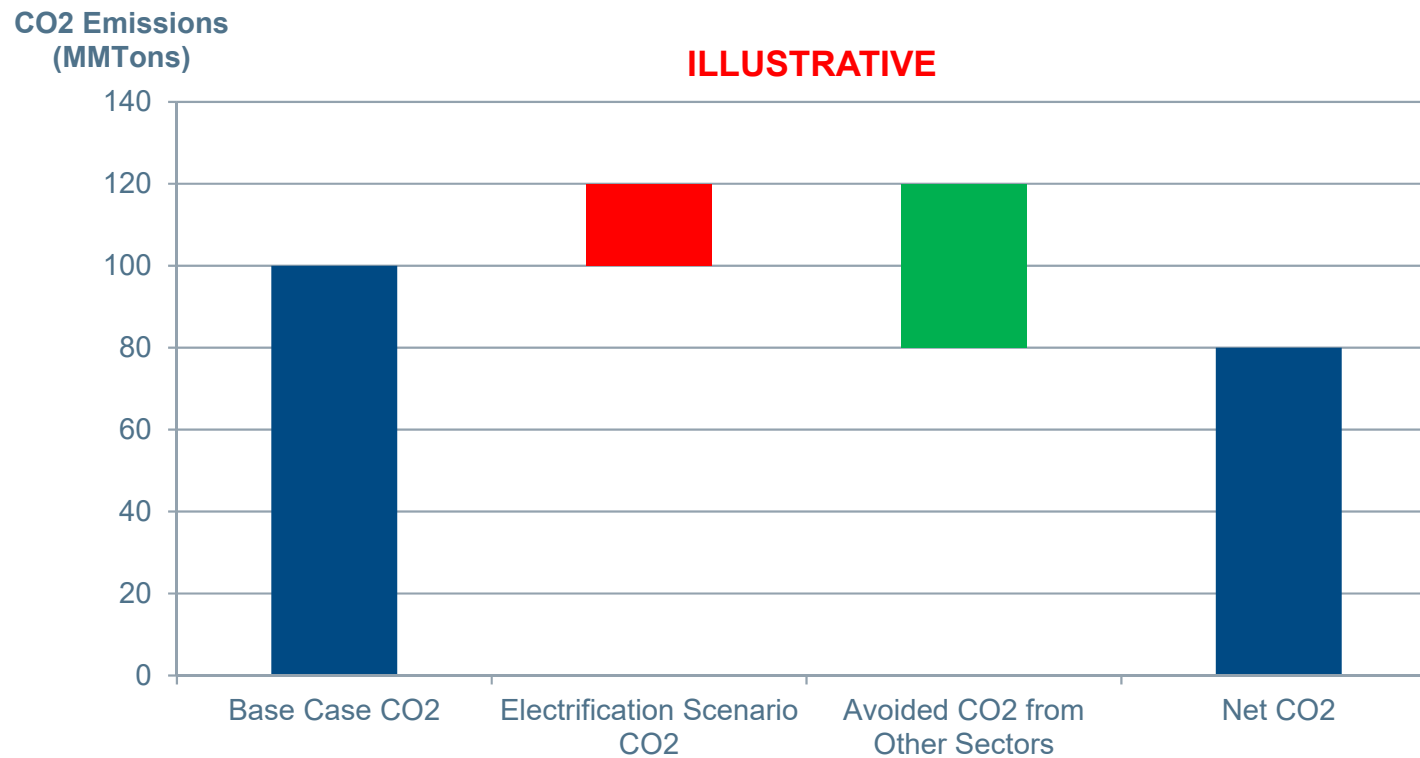
2019 IRP Secondary Metrics

Category	Secondary 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
	Land Use (Acres)**	Acreage Needed for Expansion Units in Each Portfolio (2038)
Operational 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

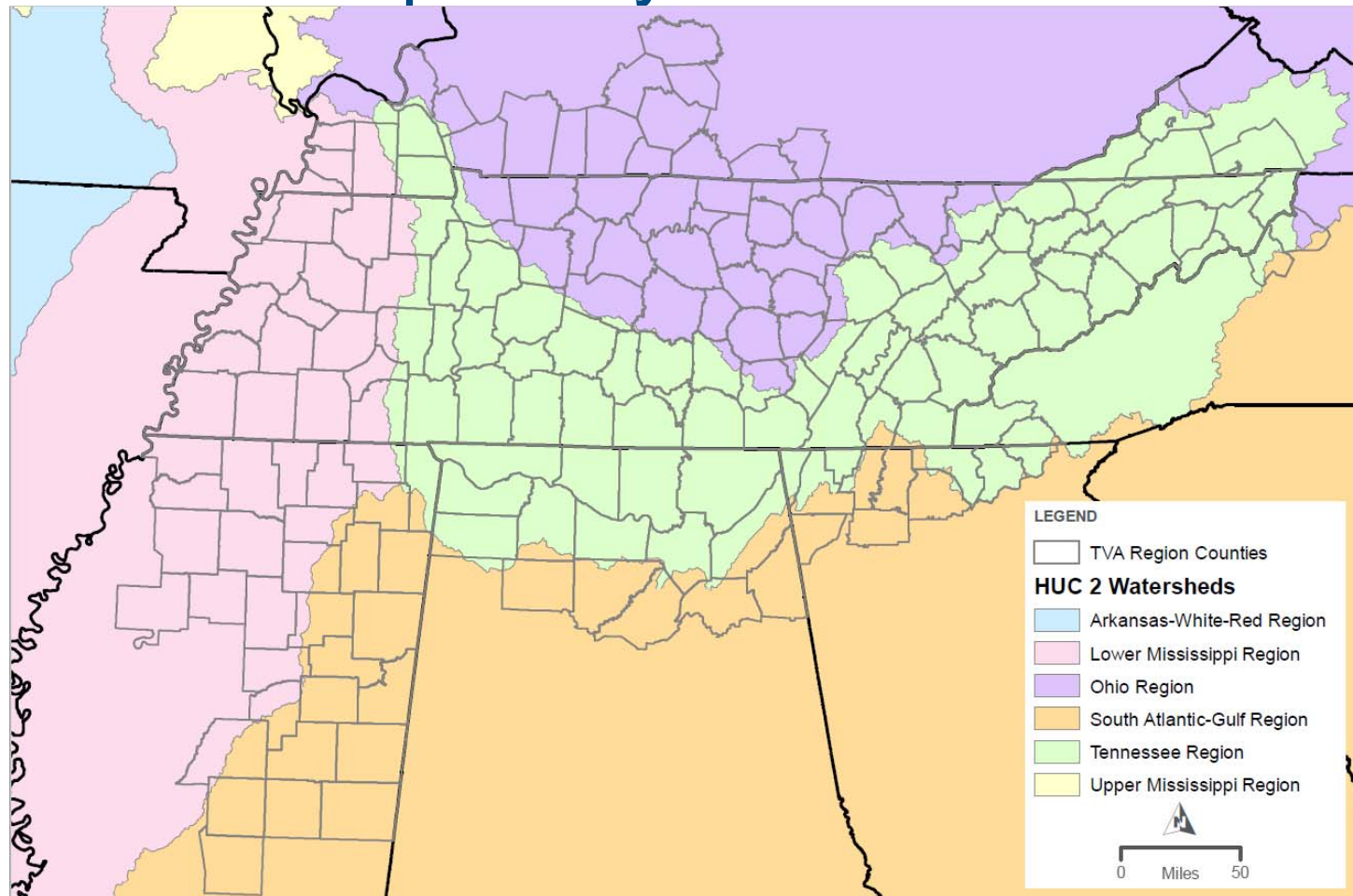


** New metric for 2019

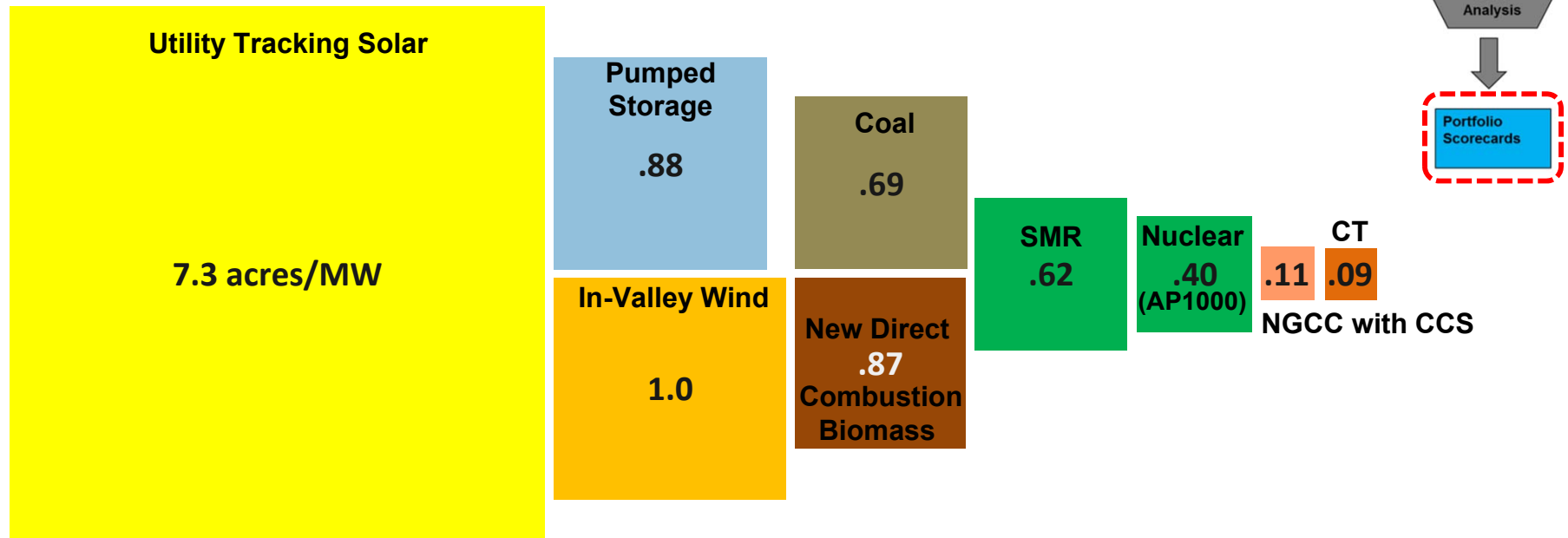
Net CO₂ Emissions



Water Consumption by Basin



Land Use



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



2015 IRP- Strategy D Scorecard

Strategy D	Cost		Risk		Environmental Stewardship			Flexibility	Valley Economics
Scenarios	PVRR (\$Bn)	System Average Cost (\$/MWh)	Risk/Benefit Ratio	Risk Exposure (\$Bn)	CO2 (MMTons)	Water (Gallons)	Waste (MMTons)	System Regulating Capability (2033) ¹	Percent Difference in Per Capita Income ²
1. Current Outlook	\$134.40	\$76.92	0.937	\$142.37	56.2	72,657,497	3.445	27.7%	0.00%
2. Stagnant Economy	\$127.90	\$75.92	0.984	\$135.35	50.7	72,827,257	3.441	22.3%	-0.01%
3. Growth Economy	\$141.34	\$77.54	0.925	\$149.71	57.6	77,481,564	3.733	26.4%	0.03%
4. De-Carbonized Future	\$133.62	\$81.05	1.025	\$142.69	41.8	65,696,112	2.754	20.3%	0.02%
5. Distributed Market Place	\$122.80	\$77.26	1.004	\$129.96	43.5	67,019,931	3.167	25.0%	0.00%

2019 IRP Scorecard

Scenarios	Cost			Risk		Environmental Stewardship			Operational 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 Consumption (MM Gallons)	Waste (MMTons)	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										





Adjourn for Lunch Break
Meeting to reconvene at 1:15 PM



2019 IRP Environmental Impact Statement

Ashley Pilakowski
December 18, 2018

Improvements for the 2019 IRP/EIS

- Streamline documents and increase readability

VOLUME I
INTEGRATED
RESOURCE
PLAN

VOLUME II
ENVIRONMENTAL
IMPACT
STATEMENT

Contents of Draft EIS

1 Introduction

2 TVA Power System

3 Alternatives

4 Affected Environment

5 Anticipated Environmental Impacts

6 Literature Cited

7 List of Preparers

8 EIS Recipients

9 Index

**FOUR MAIN
CHAPTERS**

A diagram consisting of a rectangular box on the right containing the text 'FOUR MAIN CHAPTERS'. A large, light blue arrow points from this box to a second rectangular box on the left. This second box contains a list of chapters, with chapters 2 through 5 highlighted in a darker blue background.

DEIS Chapter 2. TVA Power System

- Provides an overview of TVA's existing power system and its characteristics
 - power sales and purchases,
 - generating facilities,
 - energy efficiency and demand response programs,
 - and the existing transmission system.



DEIS Chapter 3. Alternatives

- Describes the capacity expansion plans or resource portfolios associated with each alternative strategy.
- Presents the metrics used to evaluate the strategies.
- Summarizes the environmental impacts of the alternatives.
- The 2019 IRP EIS will include five Alternatives including the Base Case.
- The Base Case is a resource plan that was developed using the current methodology of resource optimization, consistent with the direction established by the 2015 IRP and will serve as the No-Action Alternative.

DEIS Chapter 4. Affected Environment

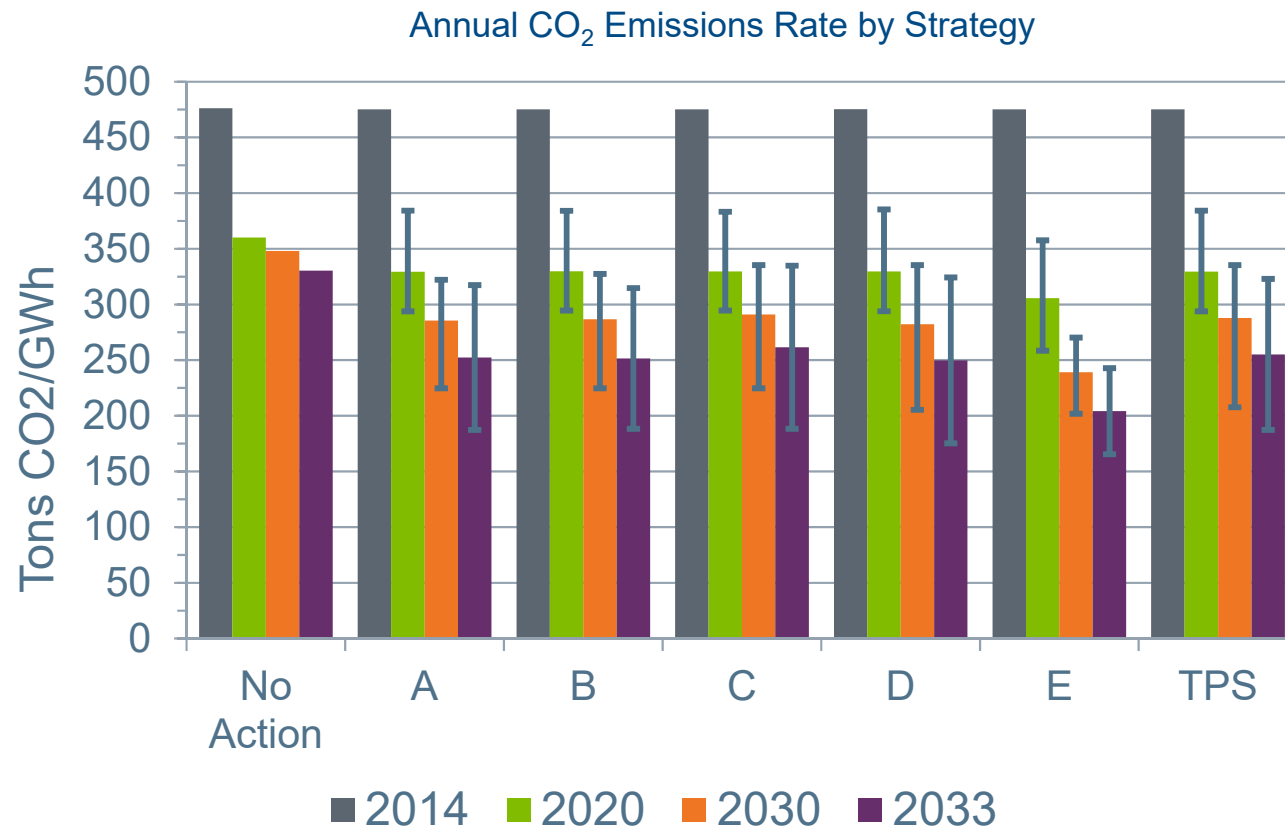


- Existing natural and socioeconomic resources of the Tennessee Valley.
 - Regulatory framework
 - Regional as opposed to site-specific.
 - Existing and forecasted trends
- Includes Air, Land, Water, Socioeconomics and Environmental Justice.

DEIS Chapter 5. Anticipated Environmental Impacts

- Facility Siting and Review Processes
- Environmental Impacts of
 - Supply-Side Resource Options
 - Energy Efficiency and Demand Response Programs
 - Transmission Facility Construction and Operation
 - Alternative Strategies and Portfolios
- Potential Mitigation Measures
- Unavoidable Adverse Environmental Impacts

2015 IRP SEIS Analysis



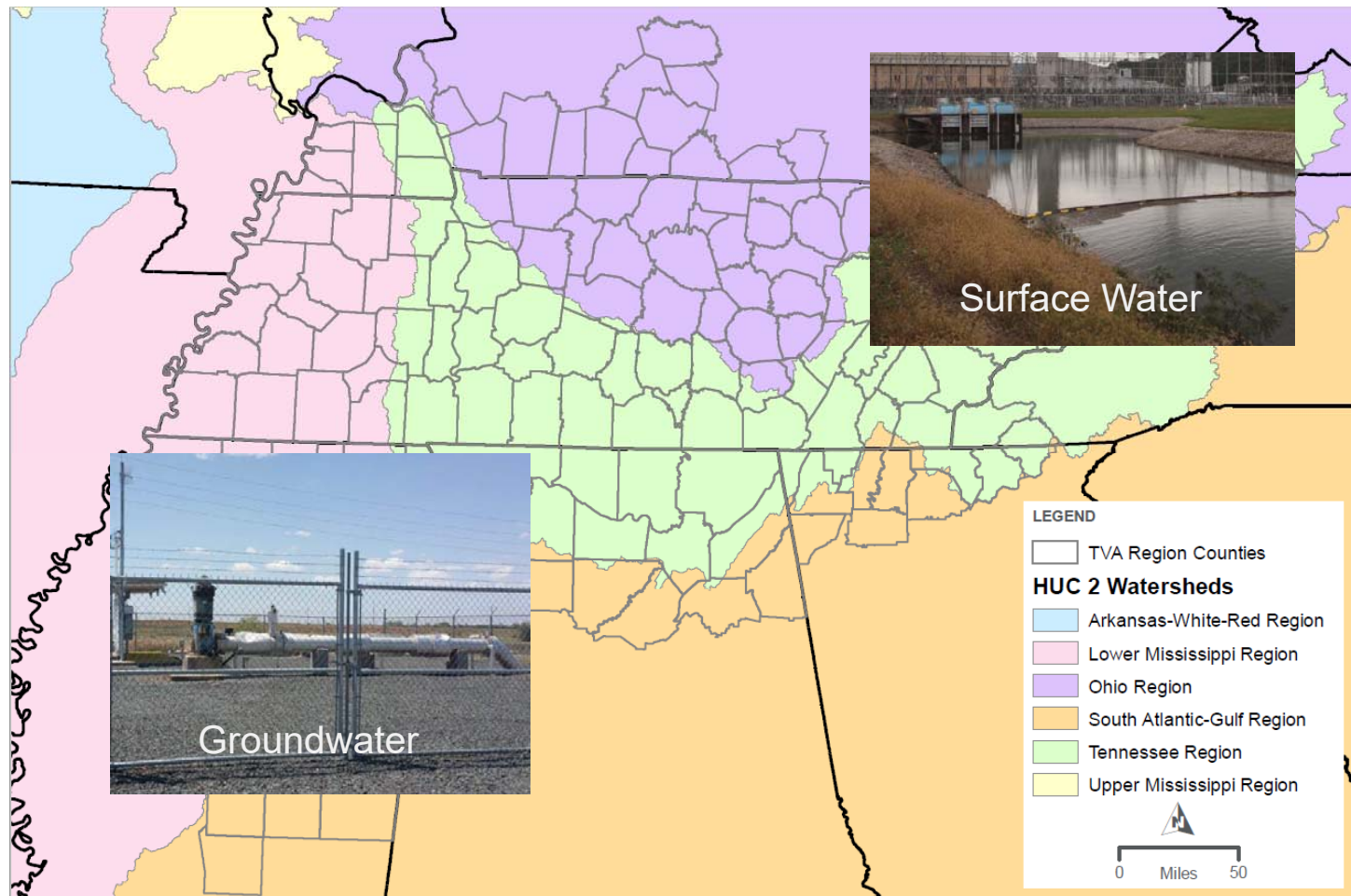
Environmental Impacts Quantified in EIS

- 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**
- land use – facility land requirements
- Coal Combustion Residual production
- coal consumption
- natural gas consumption
- uranium consumption
- spent nuclear fuel production
- life cycle land requirements for nuclear and fossil-fueled generation
- change in per-capita income (REMI results)
- change in employment (REMI results)

* Underline = primary metrics used in Scorecard

* **Bold** = new impacts included in 2019 IRP

Water Consumption by Basin and Source

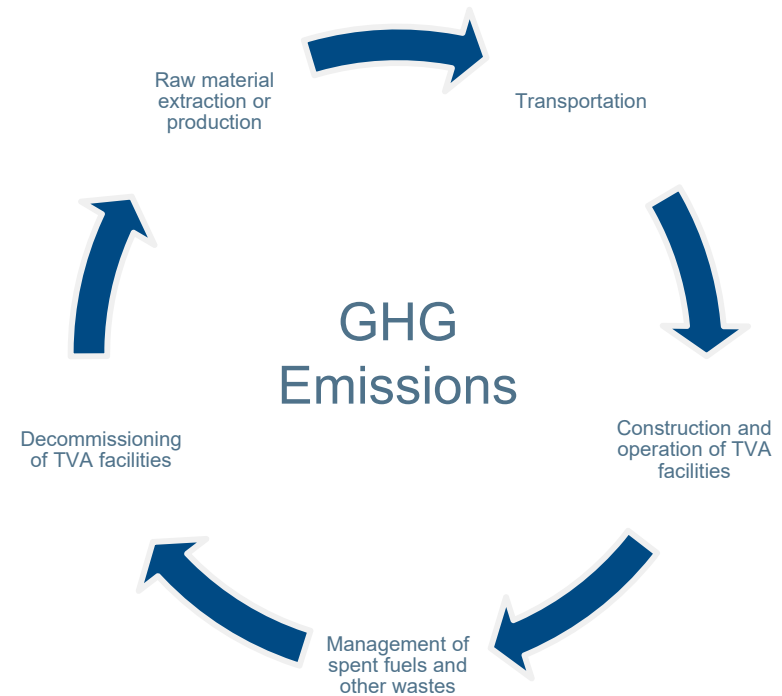


What is Lifecycle Analysis?

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 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







RERC Discussion

Advisory Questions

- Our primary objectives in developing metrics and scorecards are to distinguish individual portfolio outcomes to evaluate differences and to clearly communicate results. How well do you feel that the metrics identified and scorecard designed accomplishes these objectives?
- What should TVA consider as we apply these metrics and scorecards in the IRP and EIS?





RERC Discussion and Advice Statement



Wrap Up and Adjourn

Future RERC Tentative Meeting Dates

- Feb 19-20, 2019, Middle Tennessee
- April 17, 2019, Knoxville, Tennessee
- June 26-27, 2019, Chattanooga, Tennessee



Thank you and please travel safely!
