2019 IRP Working Group

Meeting 2: March 29, 2018


welcome

Introductions

- Name
- Affiliation / Organization

Safety Moment

Building Emergency Plan

Agenda

9:00	Welcome Recap of Meeting 1	Jo Anne Lavender Brian Child
9:20	Distributed Energy Resources Overview	Jay Stowe
10:05	Introduction to Uncertainties & Scenarios	Brian Child
10:20	Load, Economics, & Commodities	Tim Sorrell
11:00	BREAK	
11:15	IRPWG Input & Discussion	Brian Child Jo Anne Lavender
12:15	Lunch	
1:00	Scenarios	Hunter Hydas
2:10	Wrap-Up	Jo Anne Lavender
2:15	Walk to TVA – Systems Operations Center & Trading Floor Tour	
4:30	Adjourn	

IRPWG Meeting 1 Recap

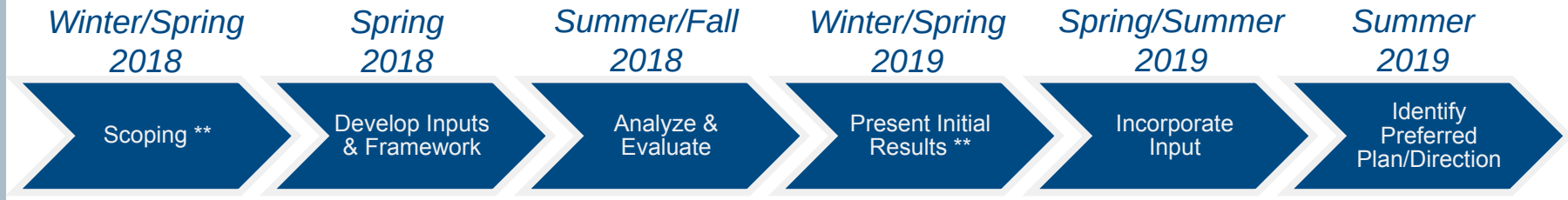
Brian Child
Enterprise Planning

2019 IRP Focus Areas

- Distributed Energy Resources
- System flexibility
- Portfolio diversity

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)
- Initial modeling (June 2018)
- Publish draft EIS and IRP (Feb 2019)
- Complete public meetings (April 2019)
- Board approval and final publication of EIS and IRP (expected Summer 2019)

IRP Working Group Meeting Objectives

February 28th	March 29th	April 26th	June 7th	July 12th
• IRPWG orientation • General overview of process	• Overview of scenario design process • Review uncertainties, current forecasts, and brainstorm/review scenarios • IRPWG feedback	• Discuss proposed scenarios and develop short list • Overview of strategy design process • Brainstorm/review strategies • IRPWG feedback	• Finalize scenarios • Discuss proposed strategies and develop short list • Planning assumptions • Introduce resource options	• Finalize strategies • Continue discussion of resource options • Modeling constraints
		Vote on scenarios	Vote on strategies	


distributed
energy
resources
PRICING
PROGRAMS
PARTNERSHIPS
00080899
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partnerships
pricing
programs
Jay Stowe
SVP, Distributed Energy Resources

Distributed Energy Resources

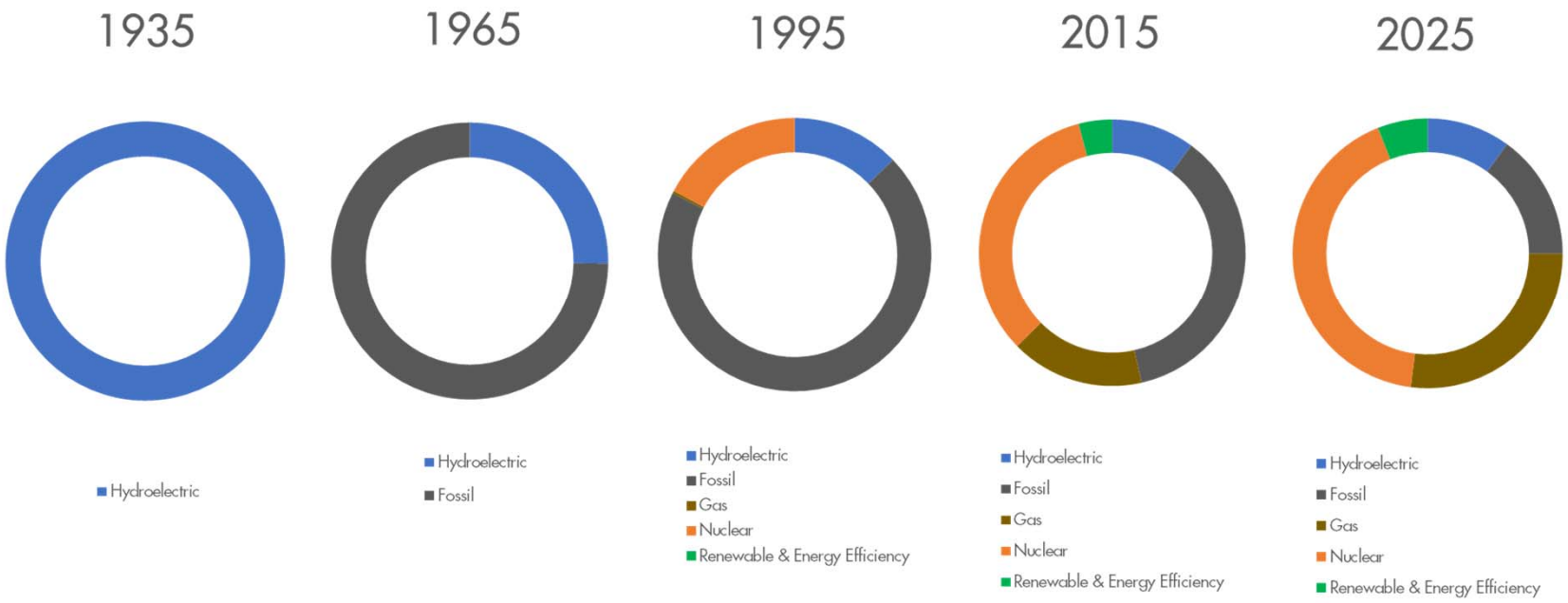
Changing the Utility Industry

What are distributed energy resources?

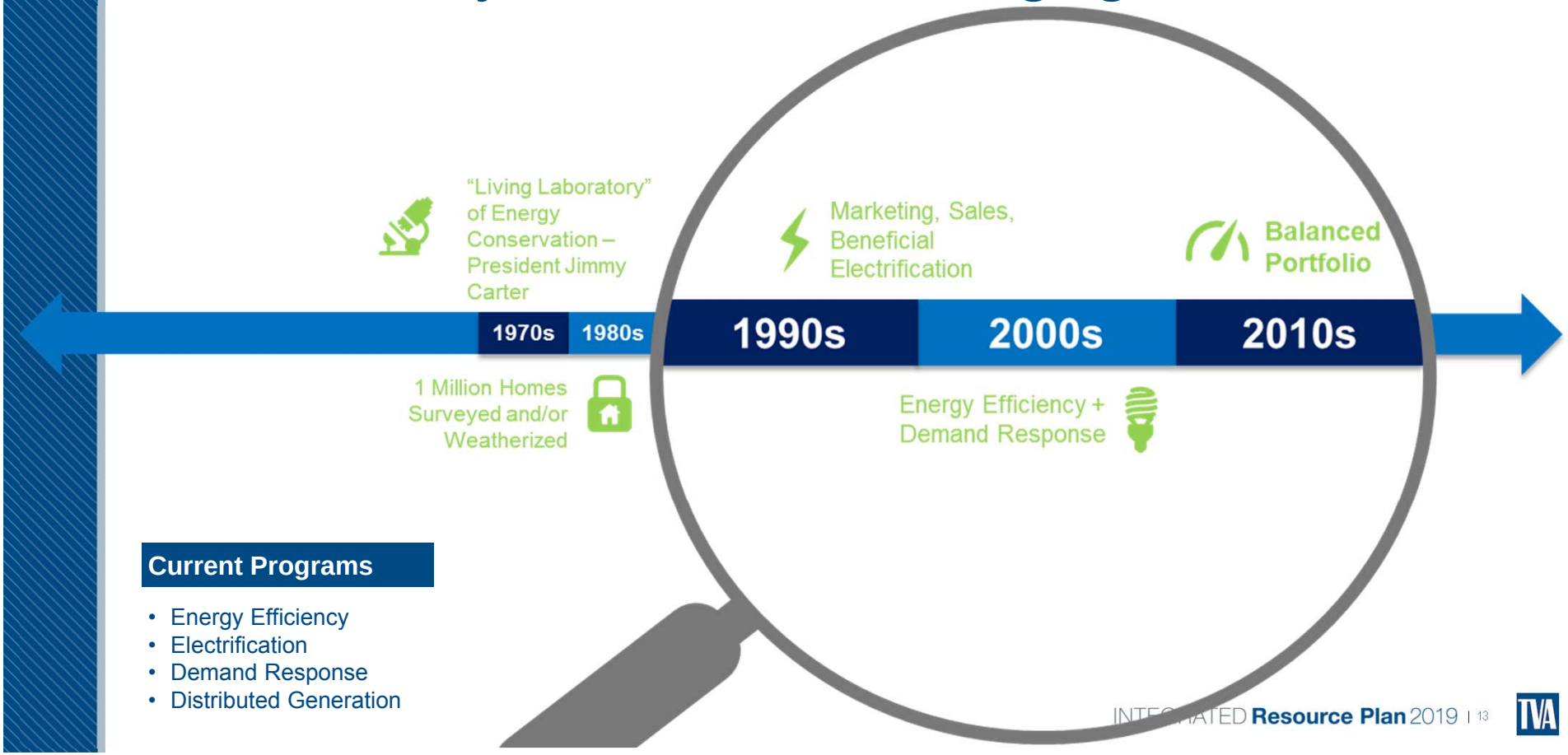
Distributed energy resources include resources and services such as distributed generation, storage, demand response, energy services and energy efficiency programs. Technology advancement and market demand will make these increasingly important resources in the future, providing new opportunities for TVA and LPCs to serve our communities.

Generation Over the Decades

Something bigger is at stake…



A History of Customer Engagement

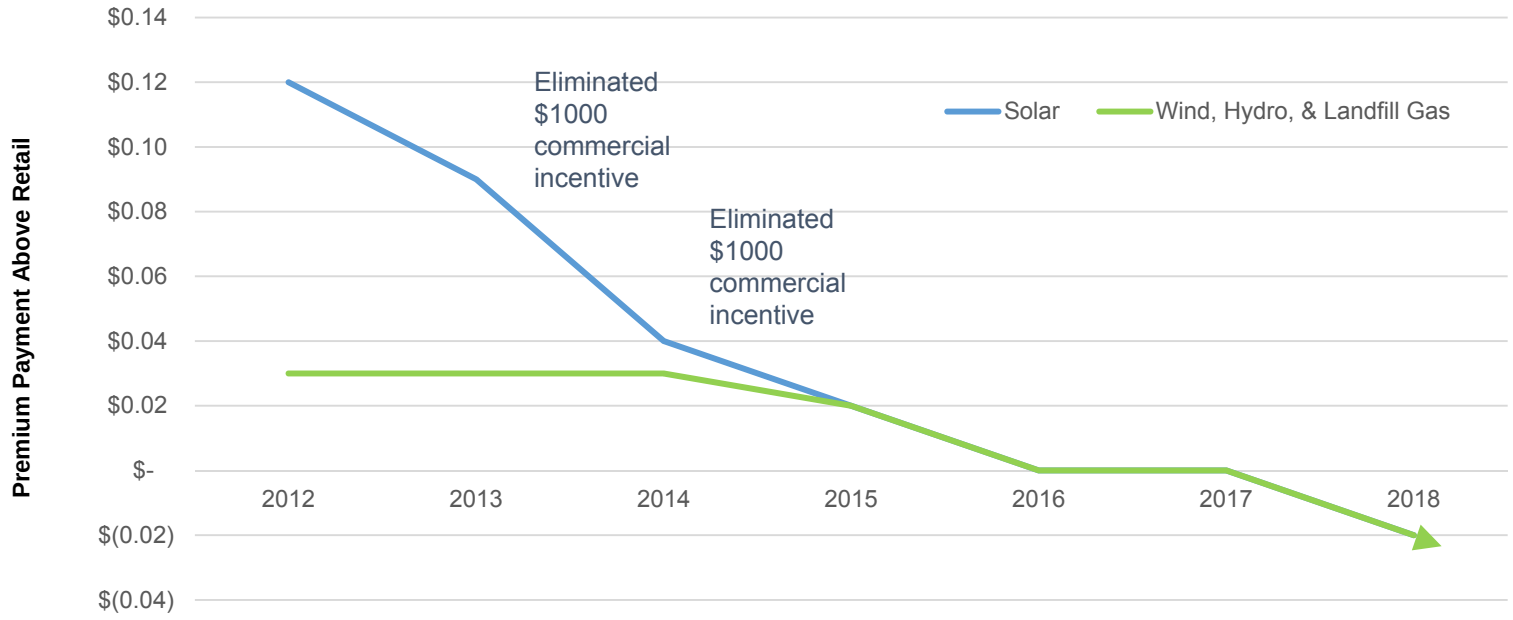


Current Programs

- Energy Efficiency
- Electrification
- Demand Response
- Distributed Generation

History of Incentives

Focus on least-cost and ensuring no cost shifting



Pricing is Foundational

Aligned to better reflect costs

First major price structure change in 20 years to define a long-term direction and next steps

2011
Rate Change

2015
Rate Change

Simplify pricing products and better align pricing with underlying costs to provide power

Improve the pricing structure to keep rates low, ensure fairness, and reflect the value of the grid

2018
Rate Change

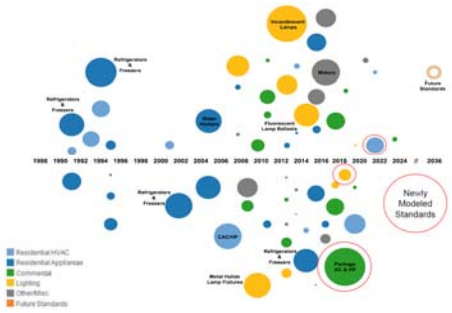
Next Steps

Develop long-term pricing strategy to inform future rate changes

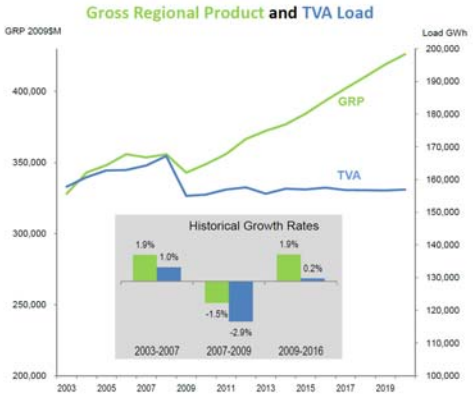
Consumer Behaviors & Preferences

Nationally, new installed capacity from renewable sources surpassed natural gas, nuclear power, coal and oil combined in 2016

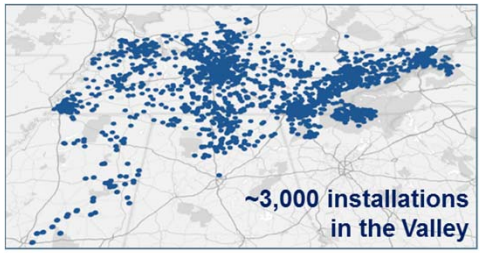
Energy efficiency penetration continues



Load is declining despite economic recovery



Renewables are becoming more attractive



Companies are committing to renewables

RE 100

- Committed to 100% renewable electricity
- 87 companies to date

Walmart, Nestlé, GM, Google, MARS, Unilever

Stated Renewable Energy Goals

- Publicly stated renewable energy goals, but not RE100 commitment

amazon, Cargill, Dow, 3M, Caterpillar, Waste Management

Business Renewables Center

- Committed to accelerating procurement of wind and utility-scale solar energy
- 160+ members

FedEx, Sprint, GM, Johnson & Johnson, Lockheed Martin

REBA

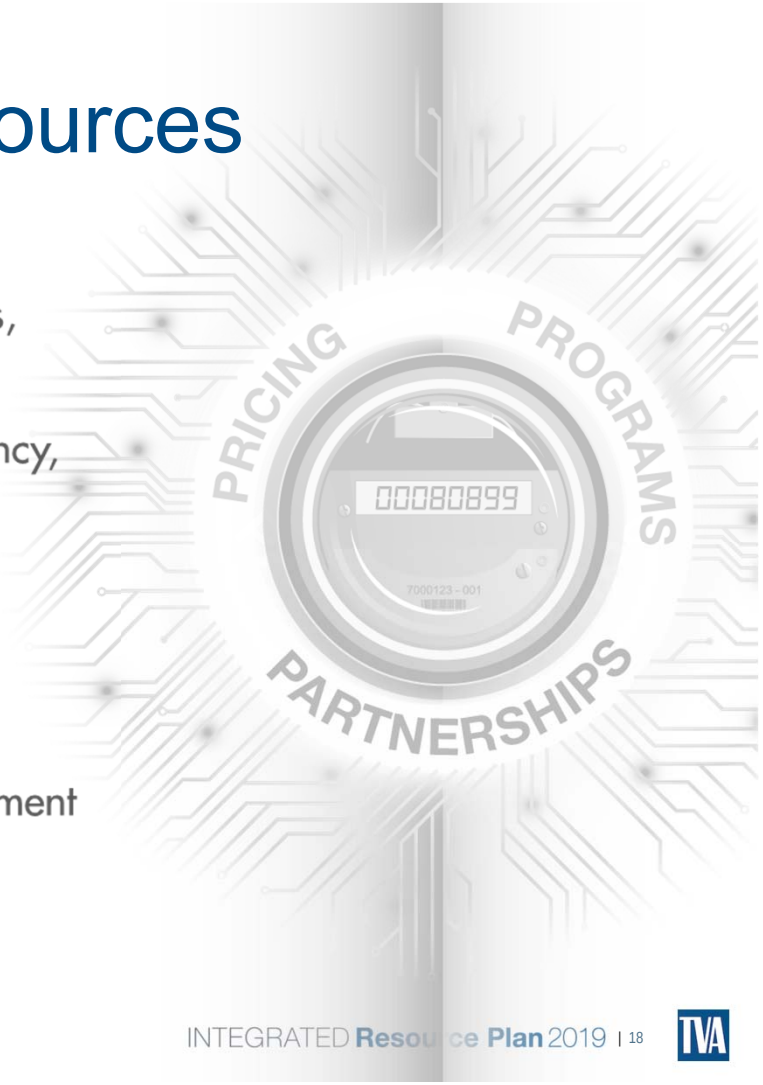
- Goal of growing corporate demand for renewables
- 58 signatures to date

Target, McDonald's, Unilever, Nestlé, 3M, Hilton Worldwide, DuPont

Distributed Energy Resources

The TVA DER Organization (est. 2016)

- Rate design & administration, power contracts, and demand-side pricing and management
- Energy utilization programs for energy efficiency, demand response and electrification
- Renewable implementation & management
- Analysis and management of new and novel transactions and new business ideas
- Enterprise-wide stakeholder relations management and research & development



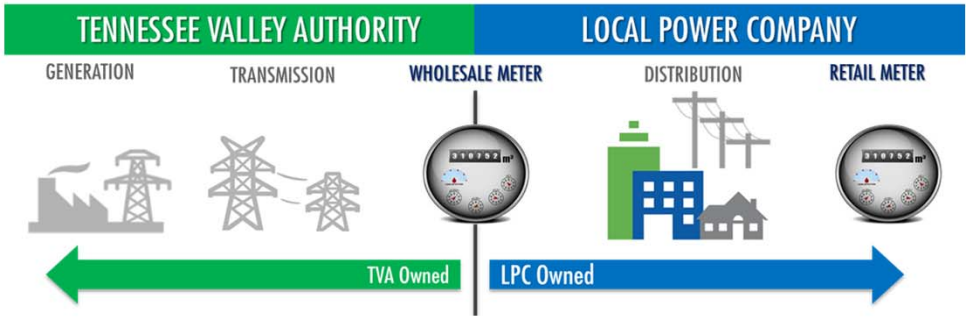
We continue to seek input…

Key themes from TVA leaders, Local Power Companies and other Stakeholders

DER Strategic Direction

Leveraging the strengths of the Tennessee Valley Public Power Model with distributed energy solutions that are economic, sustainable and flexible

- Reaffirm all requirements contract
- Provide options for LPCs to own distributed generation
- Eliminate incentives



FLEXIBILITY. CHOICE. LOCAL CONTROL.

DER Strategic Direction

Leveraging the strengths of the Tennessee Valley Public Power Model with distributed energy solutions that are economic, sustainable and flexible

- Ensure no cost shifting by charging what it costs
- Where value is created to benefit the system, pay what it is worth
- Customers choose programs & services and pay for what they select

FLEXIBILITY. CHOICE. LOCAL CONTROL.

Now What?

Deliberate and thoughtful approach – partnering with Local Power Companies

When	What
Today	Partnerships – Determine Customer Interface Approach
September 2019 (as part of new 10-year plan bringing together): – Informed by Integrated Resource Plan (IRP) – New debt and rate trajectory – Progress on wholesale rate alignment – New revenue and cost projections	Programs – Options for Customer Choice
	Pricing – Long-term Strategy
	Process, alignment of people, and technology needs

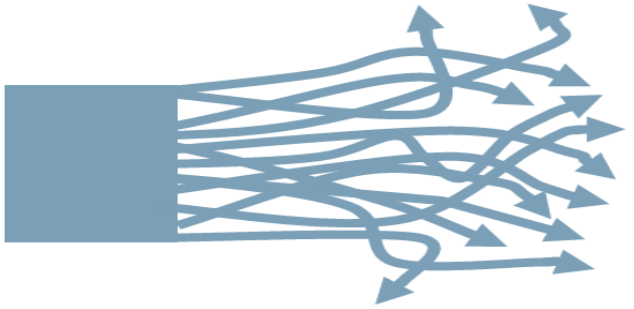
FLEXIBILITY. CHOICE. LOCAL CONTROL.

Introduction to Uncertainties & Scenarios

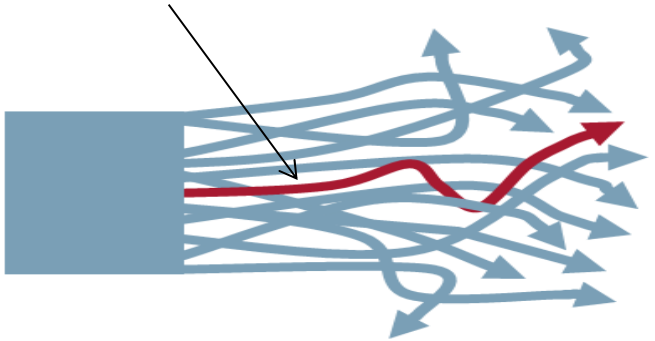
Brian Child
Enterprise Planning

A Maze of Future Possible Paths

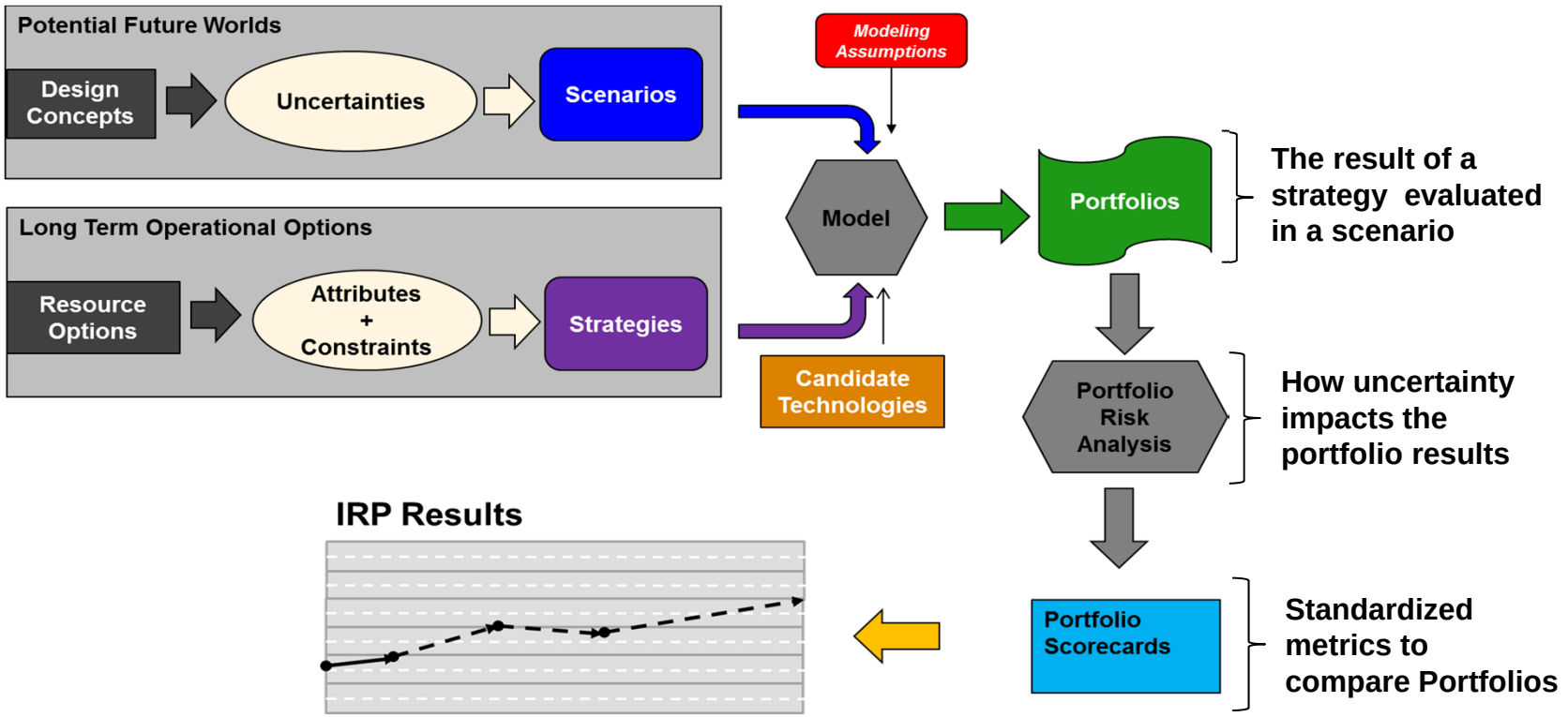
- Our industry faces rapid and unpredictable change, driven by:
  - Uncertain growth rates
  - Volatile regulatory future
  - Maturity of new generation technologies
  - Fluctuating fuel costs
  - Uncertainty over nuclear generation
  - Growth of distributed energy resources
- Drivers interact and new drivers may emerge that can change the future path
- Considering only the most likely path is risky
- Commitment to a single forecast could discourage strategic thinking and ignore significant business risks



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



How Integrated Resource Planning Works



Scenarios and Strategies Establish Framework

Scenarios
Outside TVA's Control

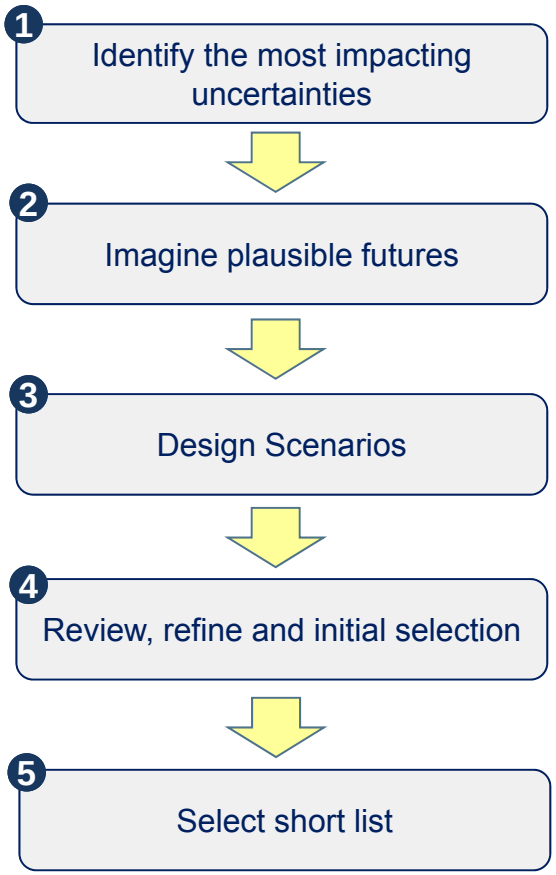
- Describe potential outcomes of factors (uncertainties) outside of TVA's control
- Represent possible conditions and are not predictions of the future
- Include uncertainties that could significantly impact operations, such as:
  - Load forecasts
  - Commodity prices
  - Environmental regulations
- Lends insight to riskiness of portfolio choices

Strategies
Within TVA's Control

- Test various business options within TVA's control
- Defined by a combination of resource assumptions, such as:
  - DER portfolio
  - Nuclear expansion
  - Energy storage
- Consider multiple viewpoints
  - Public scoping period comments
  - Assumptions that would have the greatest impact on TVA long-term

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

Process for Building Scenarios



- Identify trends and factors with an unknown outcome, or "uncertainties," that could potentially affect the business environment
- Select the ones that would have the biggest impact on TVA's business

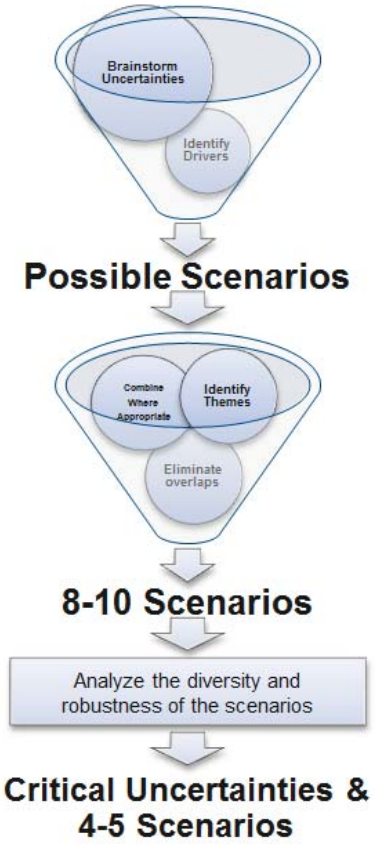
- The next step is to imagine different futures
- Building blocks to help frame what it is about these futures that matters

- Develop stories that describe the plausible futures
- Define the list of scenarios and group them by common themes

- Discuss the draft scenarios and refine description narratives
- Analyze proposed scenarios and define selection criteria (e.g. probability of occurrence, potential impact on the business, etc.)
- Collect stakeholder input

- Finally, select a short list of scenarios that covers the range of the most critical uncertainties

In Reality, the Process is Not Linear



- Brainstorming produces numerous but vague possible futures and uncertainties
- Identifying the drivers of change as well as common themes allows us to group the scenarios and consolidate overlapping possibilities
- Candidate scenarios will be assessed for diversity and robustness to determine if they are internally consistent and that variation of uncertainties across all scenarios makes sense

2015 IRP Uncertainties

Uncertainty	Description
Electricity Demand	The customer energy requirements (GWh) for the TVA service territory including losses; it represents the load to be served by TVA
Natural Gas Prices	The price ($/MMBtu) of the commodity including transportation
Market Power Price	The hourly price of energy ($/MWh) at the TVA boundary; used as a proxy for market price of power
Coal Prices	The price ($/MMBtu) of the commodity including transportation
Regulations	All regulatory and legislative actions, including applicable codes and standards, that impact the operation of electric utilities excluding CO2 regulations
CO2 Regulation/Price	The cost of compliance with possible CO2 related regulation and/or the price of cap-and-trade legislation, represented as a $/Ton value
Distributed Generation Penetration	National trending of distributed generation resources and potential regional activity by customers or third party developers (not TVA)
Energy Efficiency Adoption	An estimate of the adoption of energy efficiency measures by customers nationally; a measure of interest/commitment of customers in general to adopt EE initiatives, recognizing the impacts of both technology affordability and electricity price on willingness to adopt efficiency measures
Economic Outlook (National/Regional)	All aspects of the regional and national economy, including general inflation, financing considerations, population growth, GDP and other factors that drive the overall economy

Current Forecasts

Tim Sorrell
Enterprise Forecasting

Forecast Outlook

- Economic
  - General growth
  - Inflation
  - Population
- Loads
  - Energy & demand
  - Modifiers
- Commodity demand & prices
  - Natural Gas
  - National capacity mix

GDP Growth

Forecast*

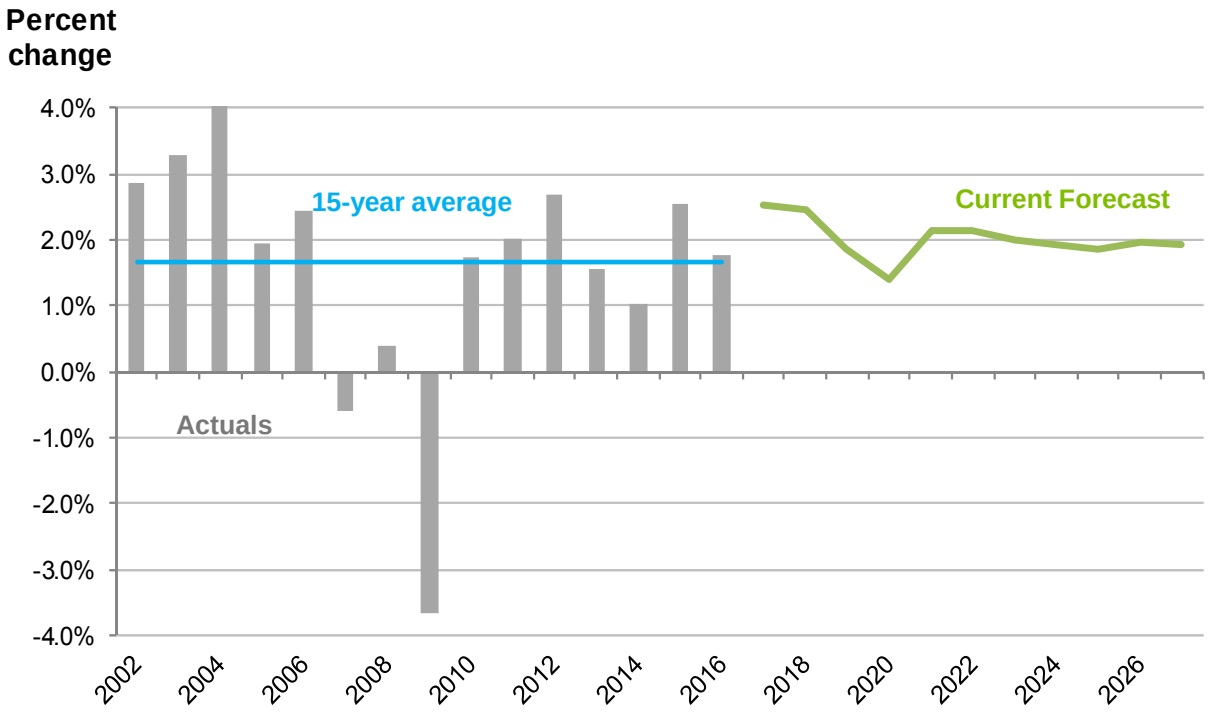
- 2.5% growth in 2018
  1.8% in 2019
  1.4% in 2020
- Long-term trend is 2.0%

Historical**

- 1.9% since 2001
- 2.2% since Great Recession

*Consensus reflects median forecast from:
- Federal Reserve Board
- Congressional Budget Office
- Conference Board
- Kiplinger
- Moody's Analytics
- University of Tennessee-Knoxville / IHS
- Wells Fargo

**Source: Bureau of Economic Analysis (BEA)



Inflation – GDP Implicit Price Deflator

Forecast*

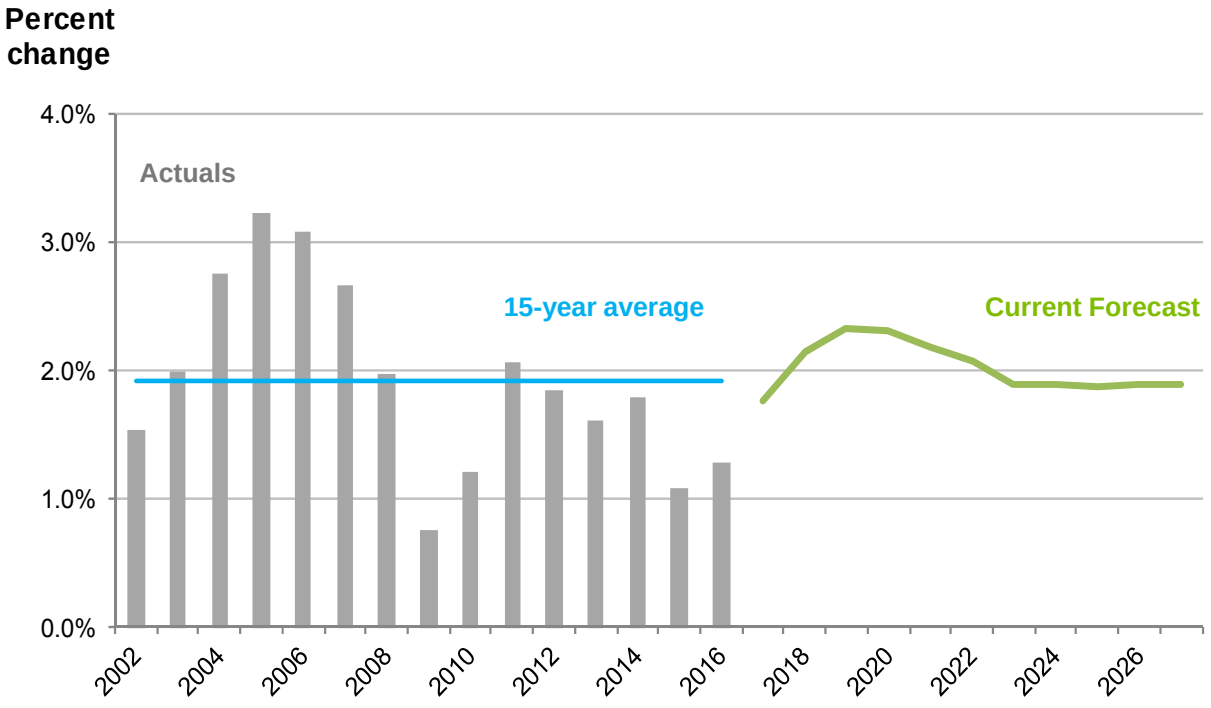
- Expected to peak 2019 – 2020 at 2.3%
- Long-term rate is now 1.8% (below the FED's target rate of 2%)

Historical**

- 1.9% since 2001
- 1.6% since Great Recession

*Consensus reflects median forecast from:
- Federal Reserve Board
- Congressional Budget Office
- Conference Board
- Kiplinger
- Moody's Analytics
- University of Tennessee-Knoxville / IHS
- Wells Fargo

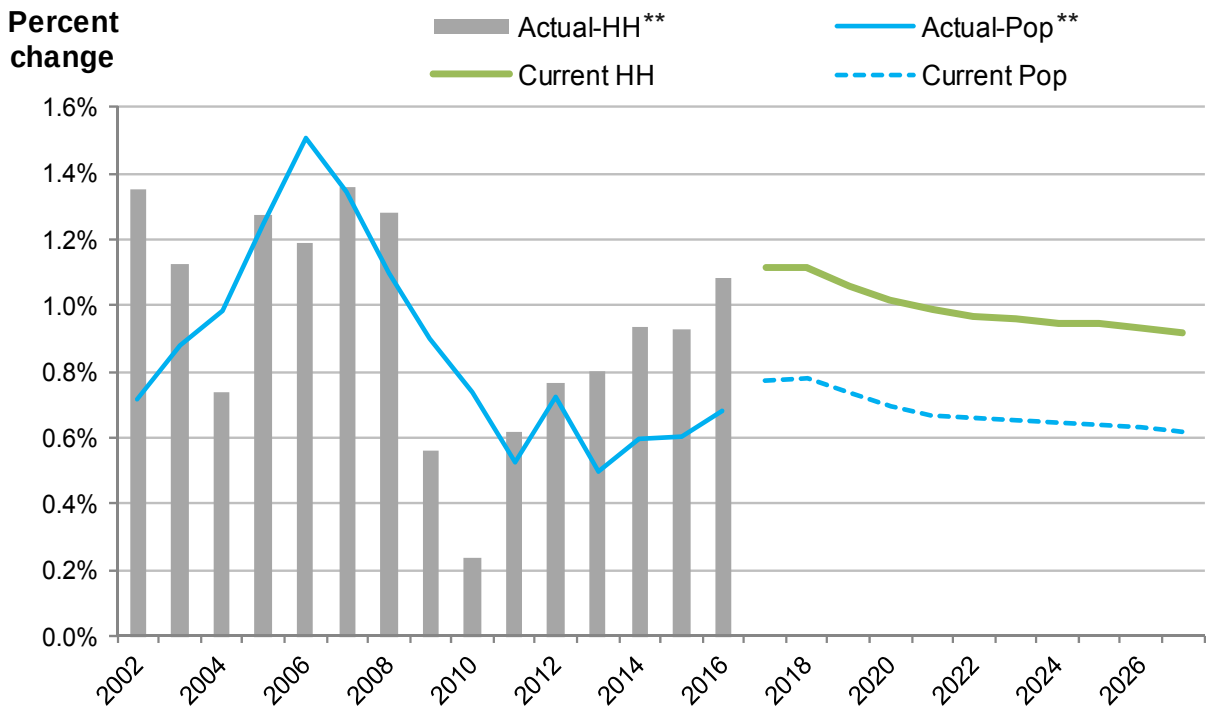
**Source: Bureau of Economic Analysis (BEA)



TVA Household & Population Growth

Forecast*

- Given a “graying” base, expect faster growth in HH’s relative to POP
- Growth through 2028
  - Population 0.7%
  - HH 1.0%

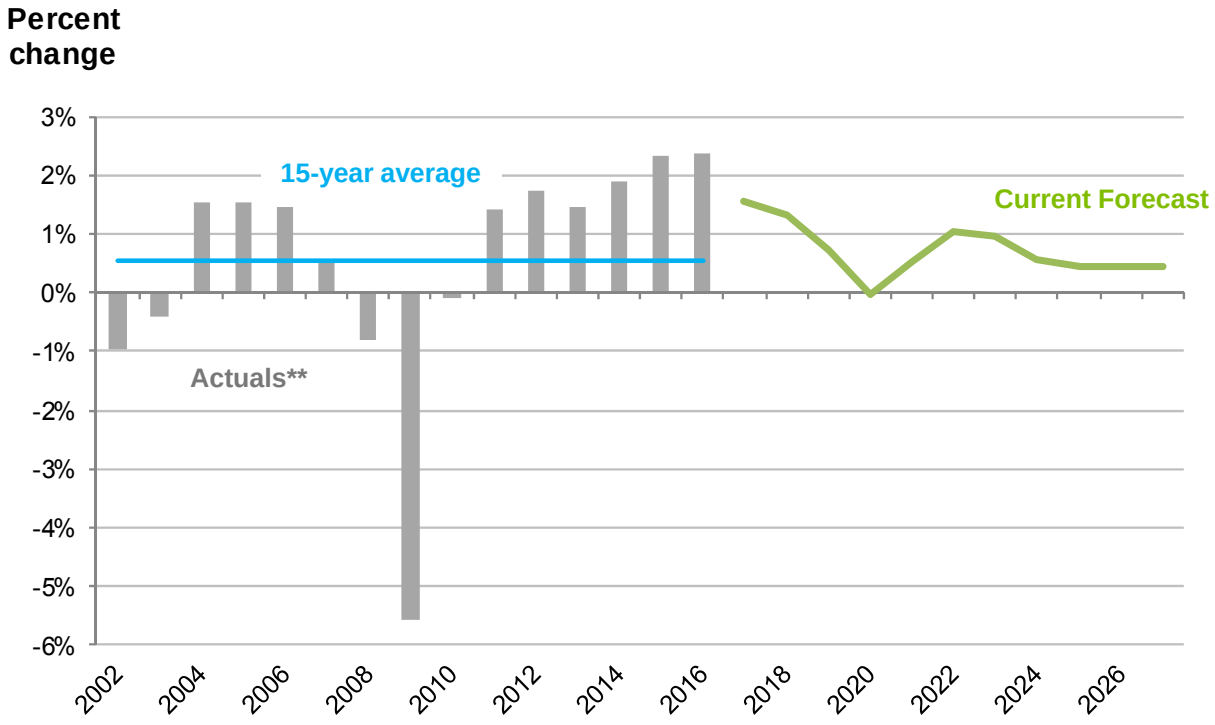


*Source: Internal TVA forecast
**Source: Bureau of the Census (BoC)

TVA Total Employment Growth

Forecast*

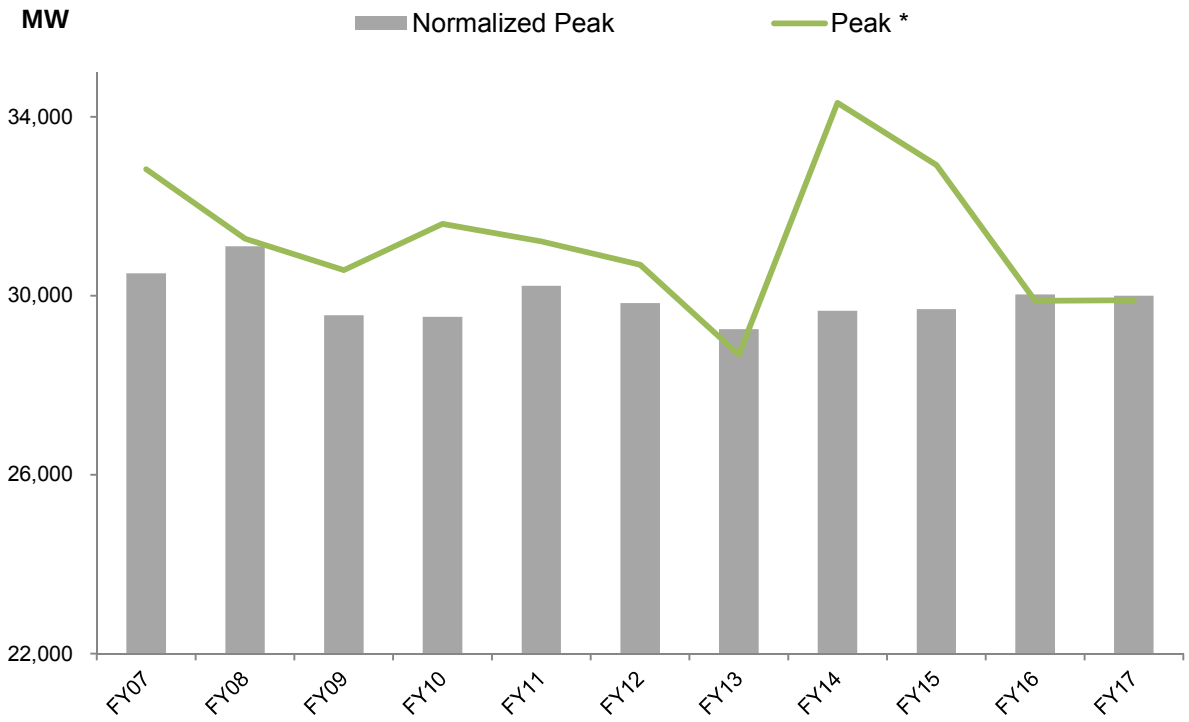
- Employment growth slows as full-employment economy draws in marginal labor
- Unemployment rate at 3.4% as of Nov-2017 (U.S. at 4.1%)
- Demographic factors limit labor force growth
- Long-term YoY rate of 0.6%



*Source: Internal TVA forecast
**Source: Bureau of Labor Statics (BLS)

Weather Normalized Loads**

- Long-term forecasts based on weather-normalized loads
- 15-year normal period
- 2001-2015

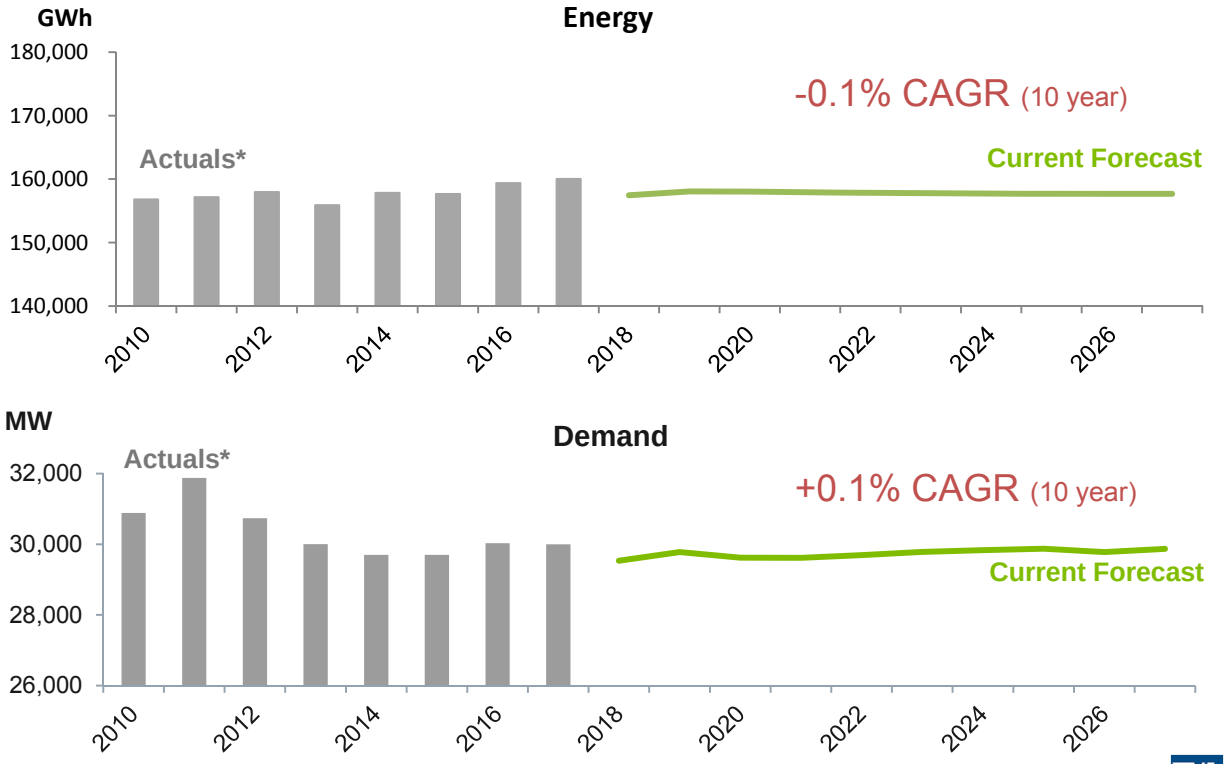


*Includes Demand Response
**Source: Internal TVA data or forecast

Energy & Demand Growth

Forecast*

- TVA
  - Energy declines 0.1% per year
  - Peaks grow by 0.1% per year
  - Winter peaking throughout forecast period
- National
  - Energy CAGR of 0.3%

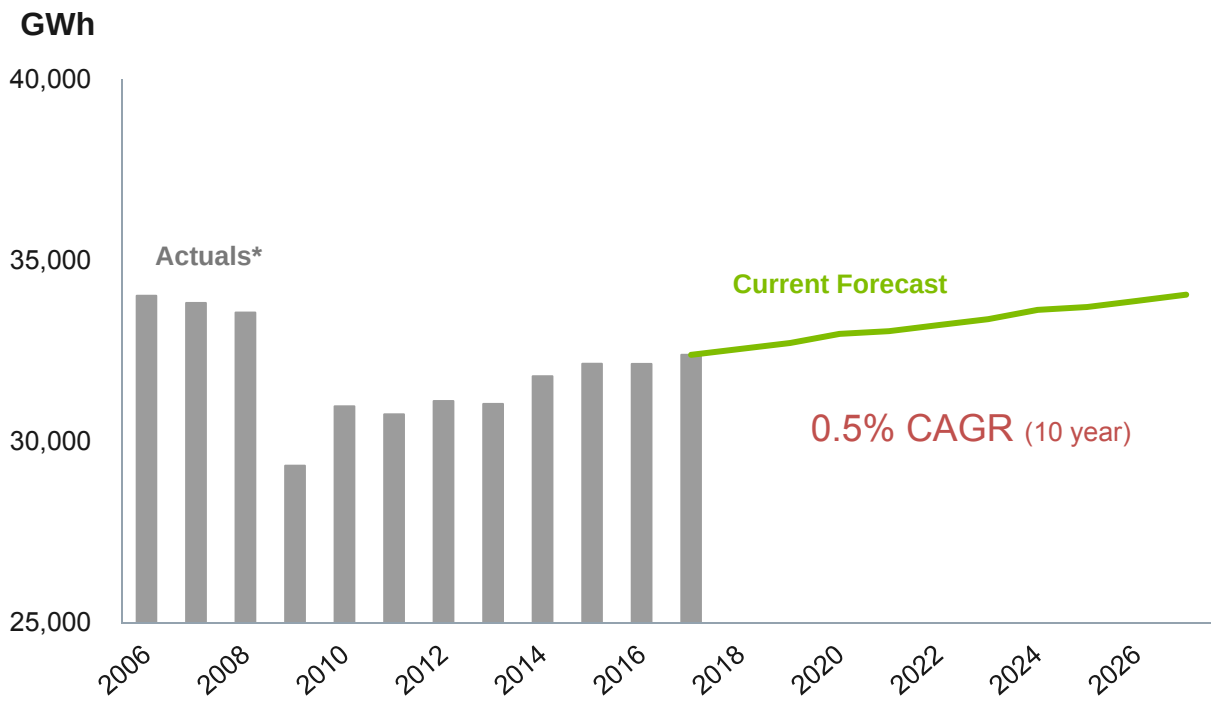


*Source: Internal TVA data or forecast

Large C&I Sales

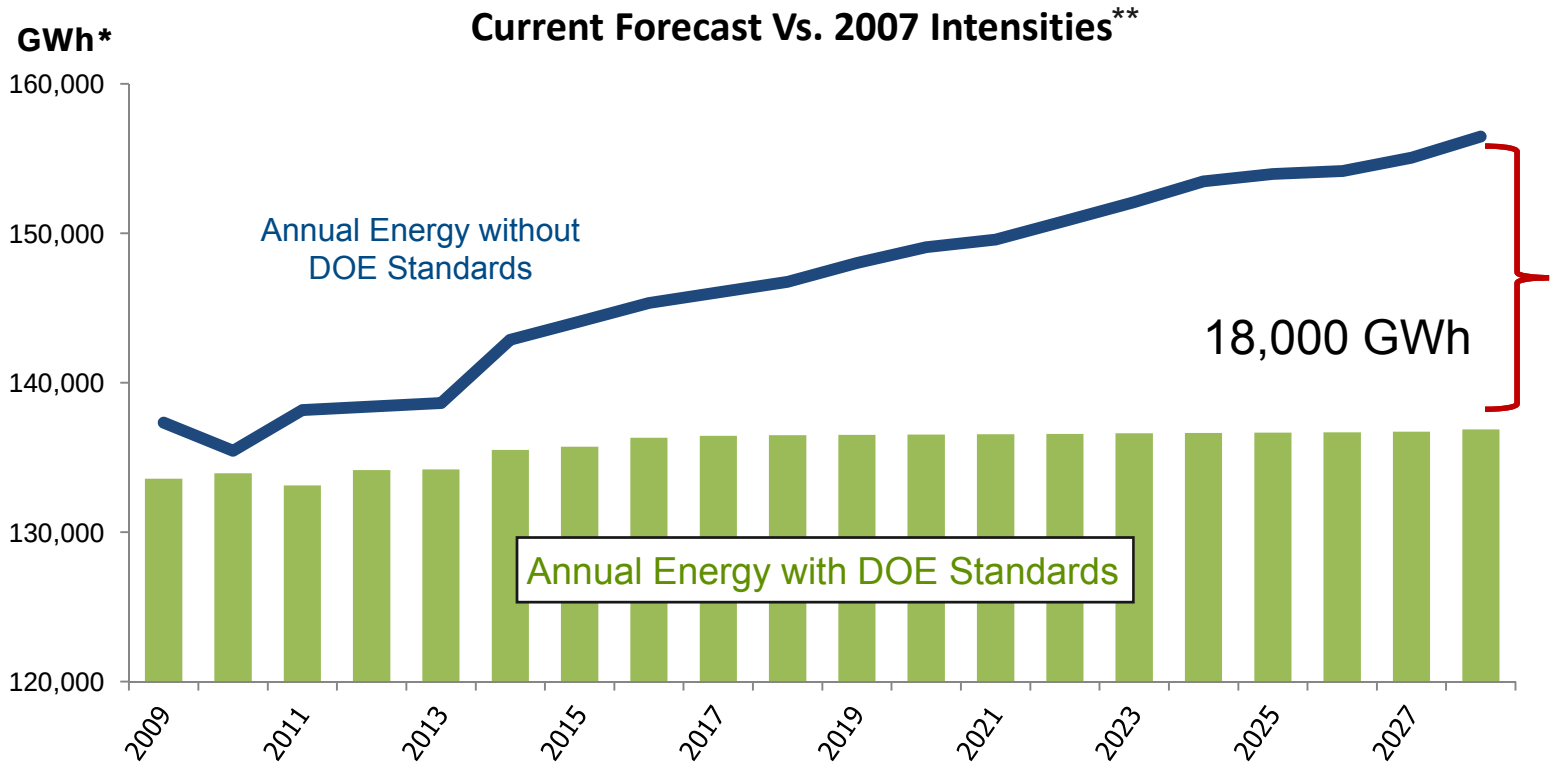
Forecast*

- Manufacturing continues to grow in the TVA region
- Lost 12% of sector in last recession
- Returns to pre-recession levels by end of period
- Customers >1 MW



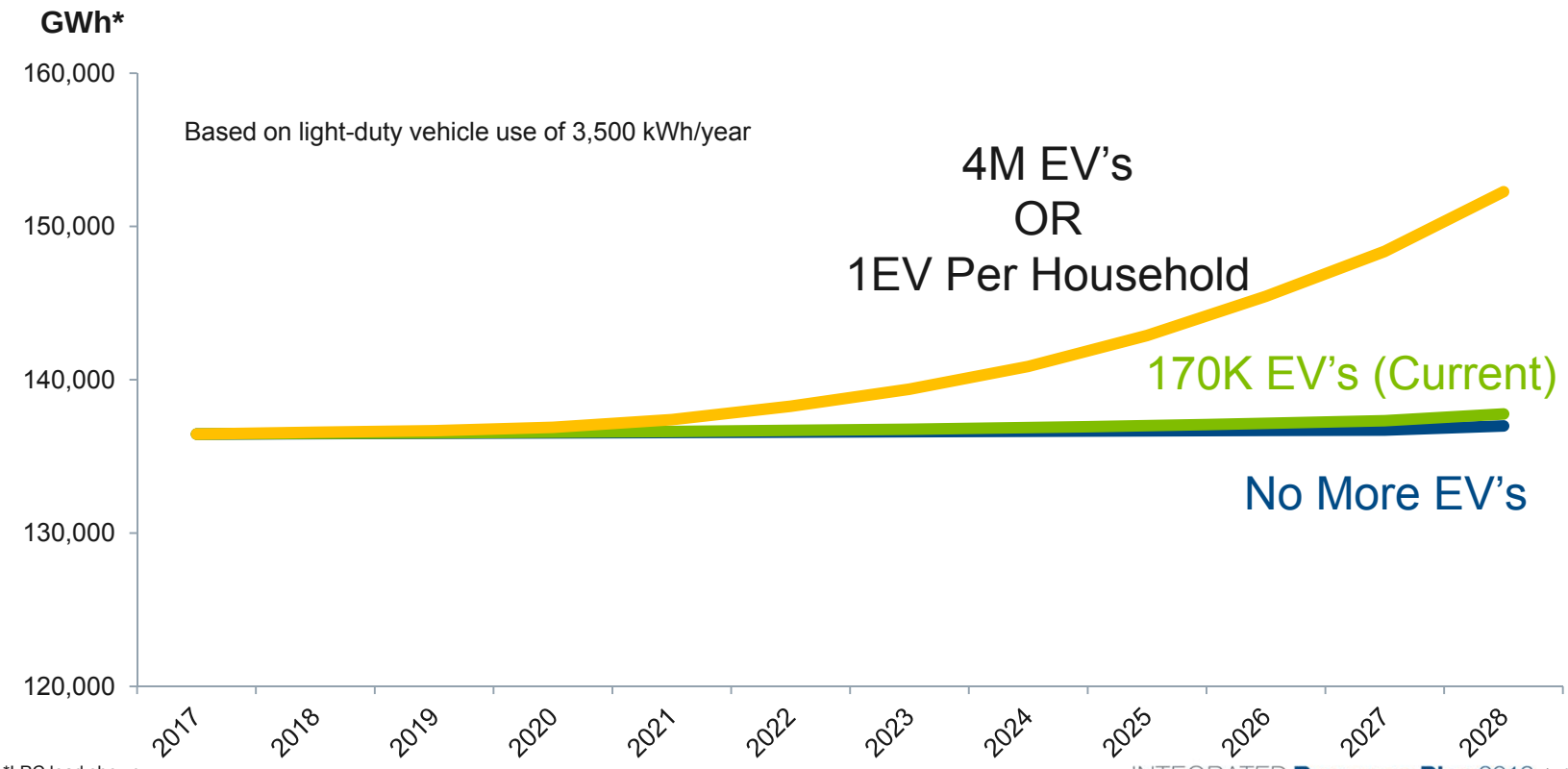
*Source: Internal TVA data or forecast

Impact of DOE Standards Continues



*LPC load shown
** Internal TVA analysis

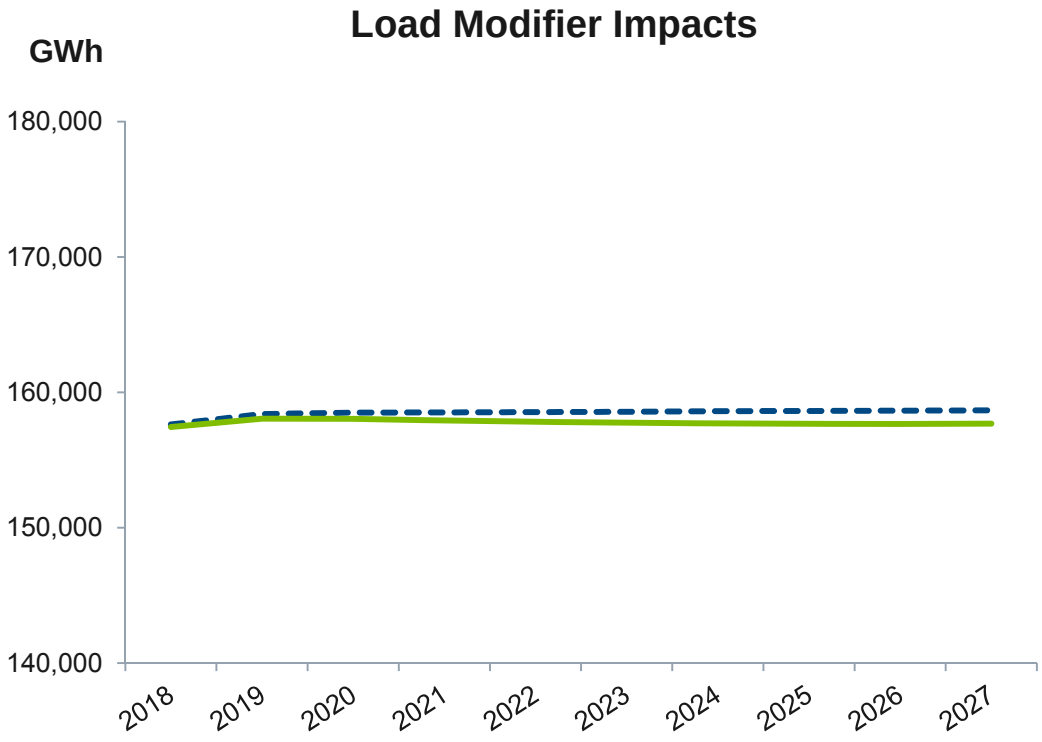
Electric Vehicles**



*LPC load shown
** Internal TVA analysis

Load Adjustments

- Distributed solar*
  - 2% residential & commercial customer count by 2028; 4% by 2038
  - Residential: 5 kW, Commercial: 30 kW
  - Solar tariff slows adoption for next four years
- Electric Vehicle*
  - 170,000 vehicles by 2028
  - 750,000 vehicles by 2038
- 80 MW DER Risk adder impacts energy more than peak*
  - Energy impacts similar in scale to the solar assumption



* Internal TVA analysis

ILB Coal Prices (Nominal)

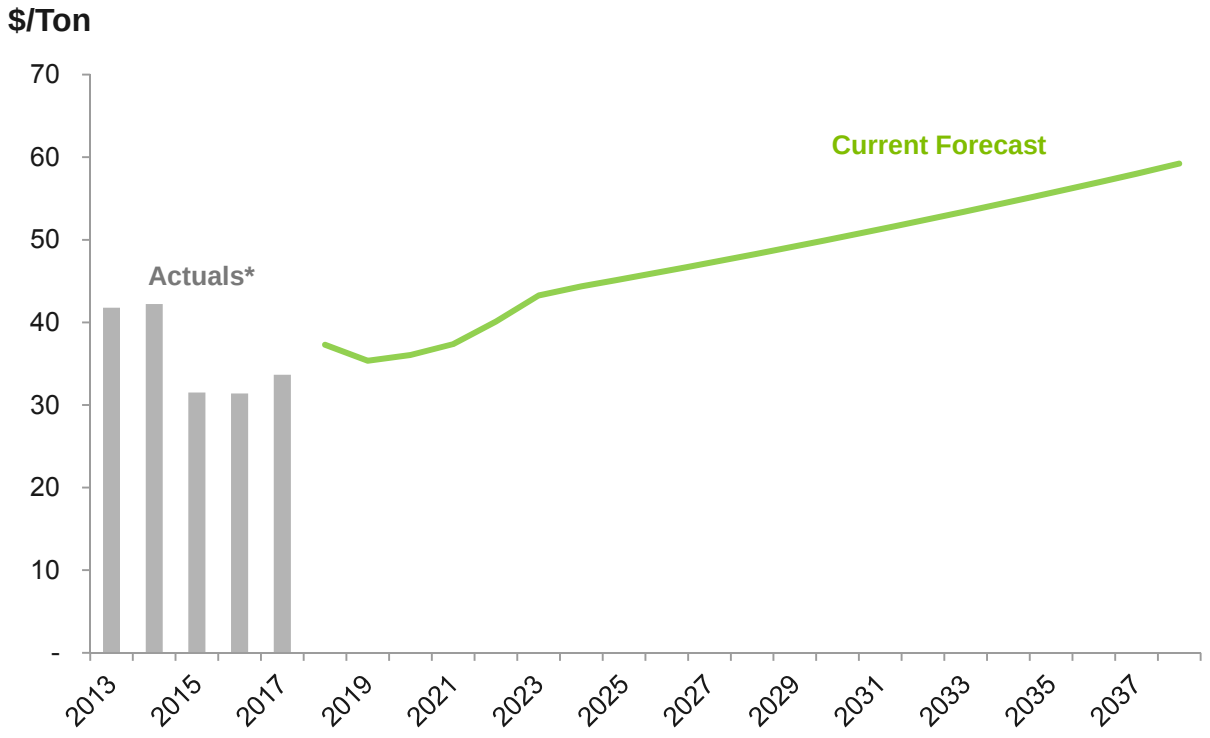
Forecast**

Illinois Basin coal

Gas prices to drive lower growth in coal prices

Coal's competitive position remains unchanged even as regulatory landscape becoming less onerous

Focus will be on efficient & lower-cost mining operations



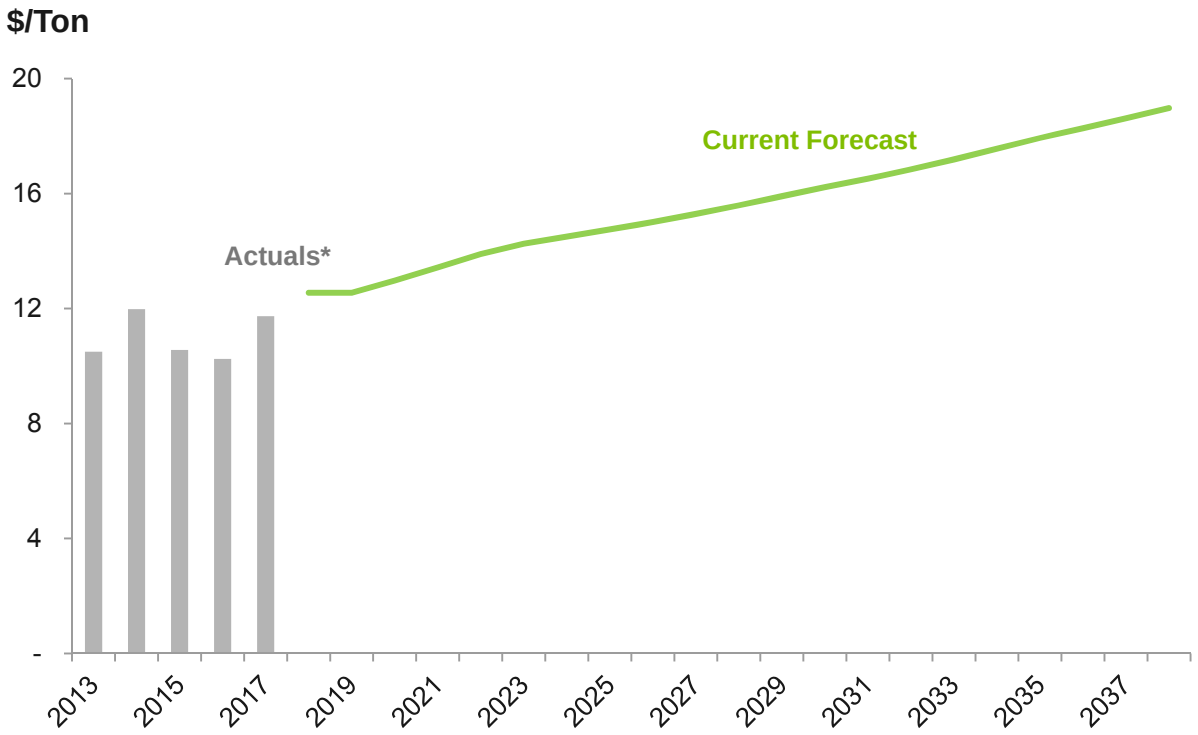
*CoalDesk
** Internal TVA analysis

PRB Coal Prices (Nominal)

Forecast**

Powder River Basin, a western coal

Export demand is limited by West Coast export capacity, with prospects of new capacity looking less likely.

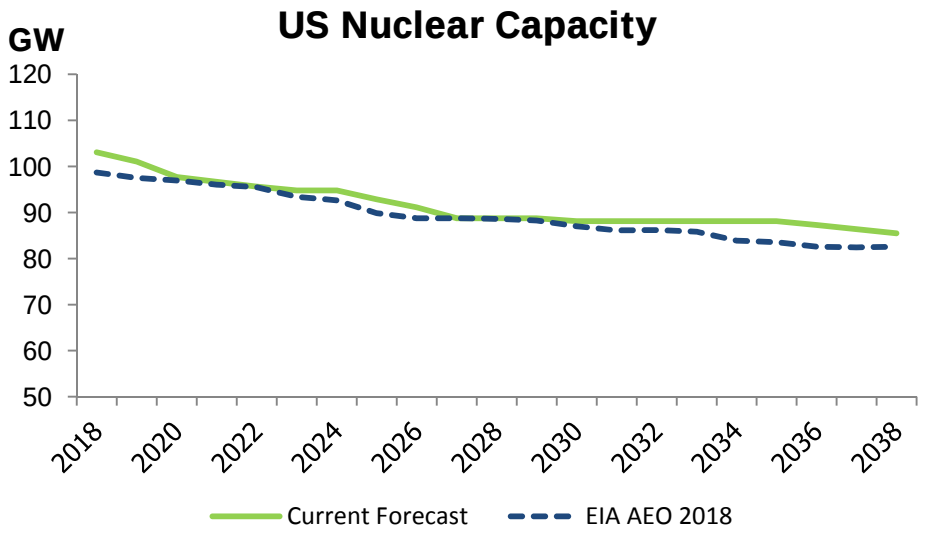


*CoalDesk
** Internal TVA analysis

National Model Assumptions

Forecast

- $0 Carbon Adder
- Nuclear
  - Announced retirements incorporated
  - Most units' licenses extend 80 years



Source: Internal TVA analysis

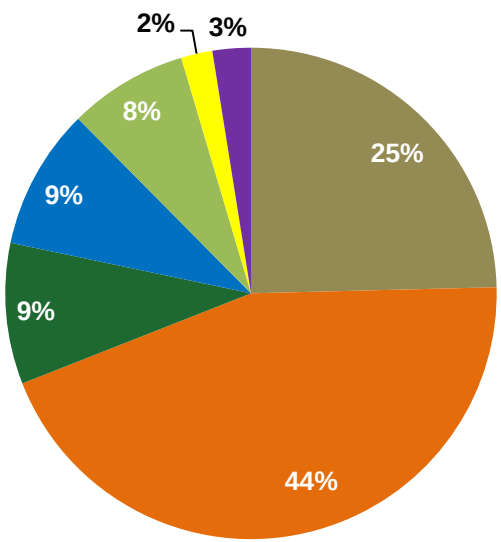
Henry Hub Natural Gas Prices

- Henry Hub is a major distribution point in Louisiana and a significant pricing point for natural gas in U.S.
- Natural gas contracts are traded on the New York Mercantile Exchange (NYMEX)
- The prompt month trading contract is May with a current price of $2.70/MMBtu.
- The average of the NYMEX contracts for the next 10 years is $3.23/MMBtu.
- Historical* averages for a 5-year period since 1990:
  - High: $6.17/MMBtu
  - Low: $1.70/MMBtu

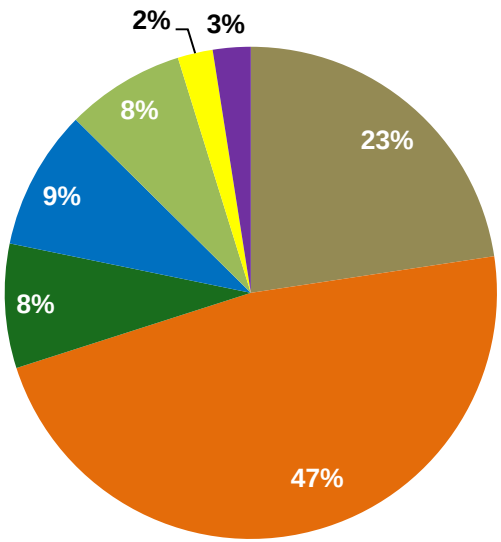
*EIA

National Capacity

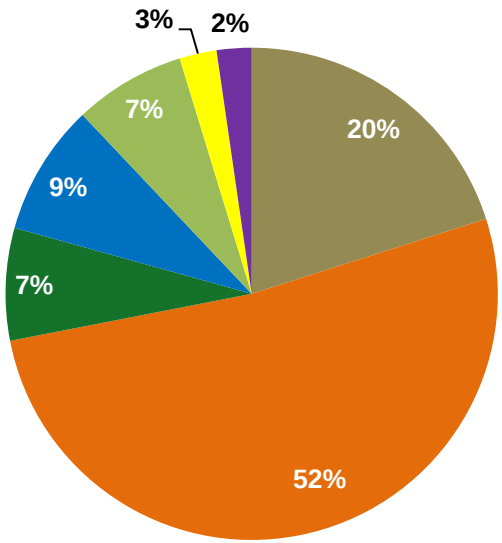
2018
1,069 GW



2028
1,079 GW



2038
1,149 GW

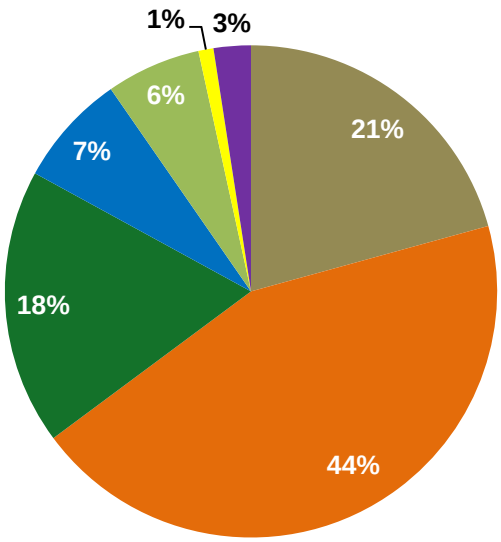


Coal Gas Nuclear Hydro Wind Solar Other

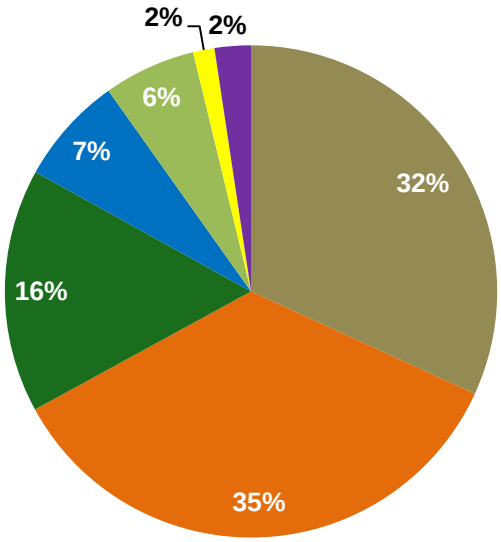
Source: Internal TVA forecast

National Generation

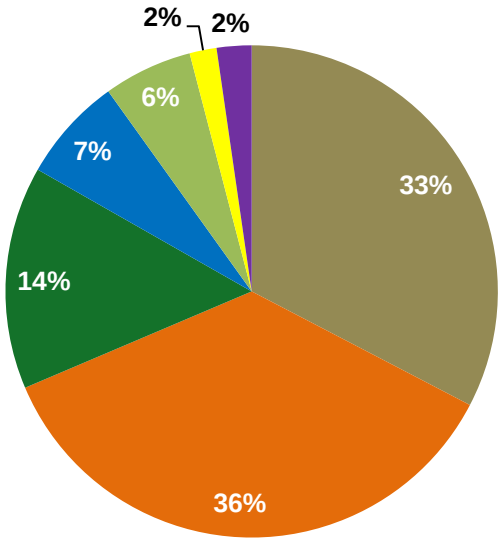
2018
4,024 TWh



2028
4,174 TWh



2038
4,298 TWh



Coal Gas Nuclear Hydro Wind Solar Other

Source: Internal TVA forecast

Summary

- Modest economic & inflation growth
- Flat energy and demand forecasts
- Low natural gas prices drive more gas generation


Break

IRPWG Input & Discussion

Brian Child
JoAnne Lavender

2019 IRP Proposed Uncertainties

Uncertainty	Description
Electricity Demand	The customer energy requirements (GWh) for the TVA service territory, including losses; it represents the load to be served by TVA
Market Power Price	The hourly price of energy ($/MWh) at the TVA boundary; used as a proxy for market price of power
Natural Gas Prices	The price ($/MMBtu) of the commodity, including transportation
Coal Prices	The price ($/MMBtu) of the commodity, including transportation
Solar Prices	The price ($/MWh) of solar power purchase agreements delivered to TVA
Storage Prices	The price ($/kW) of storage new builds
Regulations	All regulatory and legislative actions, including applicable codes and standards, that impact the operation of electric utilities, excluding CO2 regulations
CO2 Regulation/Price	The cost of compliance with possible CO2 related regulation and/or the price of cap-and-trade legislation, represented as a $/Ton value
Distributed Generation Penetration	National trending of distributed generation resources and potential regional activity by customers or third party developers (not TVA)
Energy Efficiency Adoption	An estimate of the adoption of energy efficiency measures by customers nationally; a measure of interest/commitment of customers in general to adopt EE initiatives, recognizing the impacts of both technology affordability and electricity price on willingness to adopt efficiency measures
Economic Outlook (National/Regional)	All aspects of the regional and national economy, including general inflation, financing considerations, population growth, GDP and other factors that drive the overall economy

Feedback from the Working Group: Uncertainties

- Your thoughts about the proposed uncertainties?
- Any other critical uncertainties that should be considered?

Feedback from the Working Group: Plausible Futures

Your thoughts on the range of potential plausible futures? Consider:

- How **technology** is changing
- How **electricity demand** is likely to change in the future
- How **customer preferences** are evolving and impacting the demand for electricity
- How the **regulatory environment** may affect the future
- How the **economy** will change

Adjourn for Lunch Break

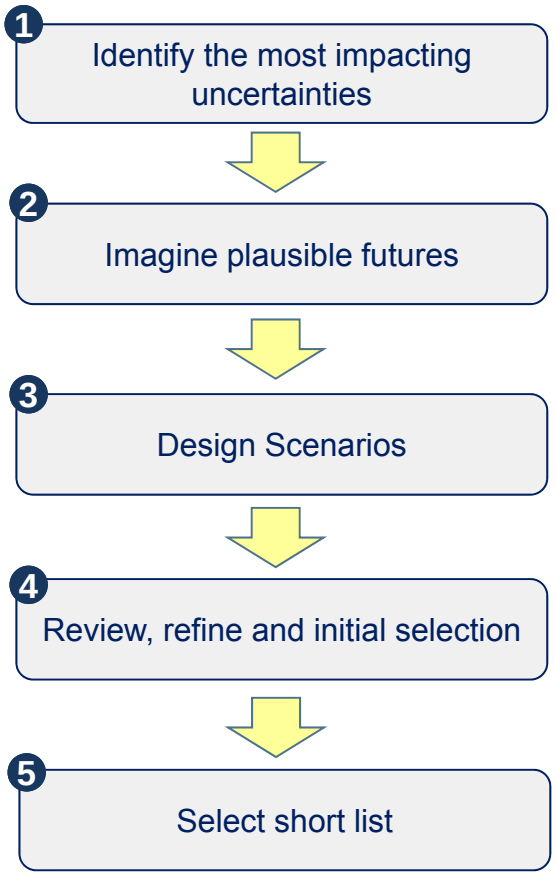
(upstairs in East / West Room – 2nd Floor)

Meeting to reconvene at 1:00

Scenarios

Hunter Hydas
Enterprise Planning

Process for Building Scenarios



- Identify trends and factors with an unknown outcome, or "uncertainties," that could potentially affect the business environment
- Select the ones that would have the biggest impact on TVA's business

- The next step is to imagine different futures
- Building blocks to help frame what it is about these futures that matters

- Develop stories that describe the plausible futures
- Define the list of scenarios and group them by common themes

- Discuss the draft scenarios and refine description narratives
- Analyze proposed scenarios and define selection criteria (e.g. probability of occurrence, potential impact on the business, etc.)
- Collect stakeholder input

- Finally, select a short list of scenarios that covers the range of the most critical uncertainties

Scenarios and Strategies Establish Framework

Scenarios
Outside TVA's Control

- Describe potential outcomes of factors (uncertainties) outside of TVA's control
- Represent possible conditions and are not predictions of the future
- Include uncertainties that could significantly impact operations, such as:
  - Load forecasts
  - Commodity prices
  - Environmental regulations
- Lends insight to riskiness of portfolio choices

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

2015 IRP Scenarios

Scenarios	Description
1 - Current Outlook	Current outlook for the future TVA is using for resource planning studies
2 - Stagnant Economy	Stagnant economy results in flat to negative growth, delaying the need for new generation
3 - Growth Economy	Rapid economic growth translates into higher than forecasted energy sales and resource expansion
4 - De-Carbonized Future	Increasing climate-driven effects create strong federal push to curb GHG emissions: new legislation caps and penalizes CO2 emissions from the utility industry and incentivizes non-emitting technologies
5 - Distributed Marketplace	Customers' awareness of growing competitive energy markets and the rapid advance in energy technologies produce unexpected high penetration rates in distributed generation and energy efficiency

Possible 2019 IRP Scenarios

Declining Economy
- *Weak Economy*

Economic Growth
- *Strong Economy*

Stringent Environmental
- *CO2 Regulation/Legislation*
- *Limited Natural Gas Extraction*
- *Water Scarcity*

Changing Paradigm
- *Advanced Manufacturing*
- *Decarbonized Society*
- *No Nuclear Extensions*

Emerging Technology
- *High DER*
- *Technology Breakthrough*

Scenario Group 1: Declining Economy

Weak Economy

Scenario Narrative

- Prolonged, stagnant economy results in negative growth and delayed expansion of new generation
- Ballooning budget deficits and rising public debt hits record levels
- More tariffs on imports are followed by retaliatory tariff on exports
- Stringent environmental regulations are delayed due to concerns of adding further pressure to the economy
- Weaker demand drives lower cost of new construction, lower productivity and lower real prices

Scenario Group 2: Economic Growth

Economic Boom

Scenario Narrative

- Rapid economic growth translates into higher than forecasted energy sales and energy expansion
- Rebound in commodity exports (gas and other material)
- Strong growth in emerging markets and developing economies, driving productivity growth and lower inflation
- Increasingly positive public attitude toward adoption of energy efficiency programs and distributed generation
- Advances in electric vehicles make it cheaper to buy electric than gas cars

Scenario Group 3: Stringent Environmental

CO2 Regulation/Legislation

Scenario Narrative

- Increasing climate-driven effects create strong federal push to curb GHG emissions, driving CO_2 emission penalties for the utility industry and incentives for non-emitting technologies
- Compliance with new rules increases energy prices and US-based industry becomes less competitive, resulting in lagging U.S. economic growth that fails to rebound to trend levels
- Fracking regulations never materialize, but gas demand is impacted by the CO_2 penalty
- New expansion units are necessary to replace existing CO_2 -emitting fleet

Limited Natural Gas Extraction

Scenario Narrative

- Increasing concern with fossil fuel production and use drive regulations to limit natural gas extraction along with more stringent water regulations
- New legislation moderately penalizes CO_2 emissions from the utility industry and incentivizes non-emitting technologies
- Compliance with new rules increases energy prices and US-based industry becomes less competitive, resulting in lagging U.S. economic growth that fails to rebound to trend levels
- New expansion units are necessary to replace existing CO_2 -emitting fleet

Scenario Group 3: Stringent Environmental

Water Scarcity

Scenario Narrative

- Climate variability leads to prolonged drought and reduced hydro generation as well as hydrothermal limitations for plants that depend on water for cooling
- Population and demographic changes lead to increasing demand for water in urban areas, contributing to localized water scarcity
- Public and political sensitivity to large water users and natural ecosystem impacts

Scenario Group 4: Changing Paradigm

Advanced Manufacturing

Scenario Narrative

- Automation and artificial intelligence drive increased labor productivity, boosting economic growth and lowering inflation
- Increased penetration of artificial intelligence and advanced manufacturing leads to higher energy use in the manufacturing sector and increased need for improved reliability, power quality and reactive capability
- New facilities proactively incorporate energy efficiency and renewable technology

Decarbonized Society

Scenario Narrative

- Driven by customer preference, transportation and other sectors are electrified, resulting in increased sales
- Preference for lower emissions, DER and energy efficiency drives lower demand for emitting generation, resulting in lower gas and coal prices
- U.S. economy in slight decline due to higher electricity prices

Scenario Group 4: Changing Paradigm

No Nuclear Extensions

Scenario Narrative

- Driven by desire for national energy security and resiliency, relicensing of existing and construction of new large scale nuclear both cease
- National energy policy drives carbon regulation and legislation and promotes small modular reactor technology through subsidies to drive SMR technology breakthrough and improved economics

Scenario Group 5: Emerging Technology

High DER

Scenario Narrative

- Consumer growing awareness of and preference for energy choice, coupled with rapid advances in energy technologies, drive high penetration of distributed generation, storage and energy efficiency
- Utilities are no longer the only source of generation and multiple options are available to consumers
- Market shift results in lower loads, decreased need for supply-side generation, but potential impacts to transmission and distribution planning and infrastructure

Technology Breakthrough

Scenario Narrative

- Technology breakthrough in the cost and capability of storage technology, small modular reactors, carbon capture, and energy management
- Technology enables clean fossil generation with a reduced emission profile along with emission-free technologies for a lower-emitting diverse portfolio.

Summary of Scenarios & Uncertainties

Uncertainties (Relative to Current Forecasts)	Potential Scenarios									
	Declining Economy	Economic Growth	Stringent Environmental			Changing Paradigm			Emerging Technology	
	Weak Economy	Strong Economy	CO2 Reg/Leg	Limited NG Extraction	Water Scarcity	Advanced Manufacturing	Decarbonized Society	No Nuclear Extensions	High DER	Technology Breakthrough
Electricity Demand	Very Low	Very High	Low	Low	Low	High	High	Same	Same	Same
Market Power Price	Low	High	High	Very High	Very High	High	High	High	Very Low	High
Natural Gas Prices	Low	High	High	Very High	Very High	High	Low	High	Very Low	Same
Coal Prices	Low	Same	Low	High	Very High	Same	Low	Same	Very Low	Same
Solar Prices	High	Same	Low	Low	Low	Same	Low	Same	Low	Very Low
Storage Prices	High	Same	Low	Low	Low	Same	Low	Same	Low	Very Low
Regulations	Low	Same	High	Very High	Very High	Same	Same	High	Same	Same
CO2 Regulation/Price	Same	Same	Very High	High	Very High	Same	Very High	High	Same	High
Distributed Generation Penetration	Low	High	High	High	High	High	High	High	Very High	Very High
National Energy Efficiency Adoption	Low	High	High	High	High	High	High	High	Very High	Very High
Economic Outlook (National/Regional)	Very Low	Very High	Low	Low	Low	High	Same	Low	Same	Same

Key Points

- The selected scenarios represent an ample breadth of possible futures
- The scenarios cover a wide range of values for the critical uncertainties

Ensuring the Breadth of Scenarios

- The key uncertainties are expressed in relation to the current view of the future (very low, low, same, high, very high)
- This table summarizes the distribution of the uncertainties across the 9 candidate scenarios by counting the number of occurrences of each ranking value

Uncertainties (Relative to Current Forecasts)	Very Low	Low	Same	High	Very High
Electricity Demand	1	3	4	2	1
Market Power Price	1	1	1	6	2
Natural Gas Prices	1	2	2	4	2
Coal Prices	1	3	5	1	1
Solar Prices	1	5	3	1	0
Storage Prices	1	5	3	1	0
Regulations	0	1	6	2	2
CO2 Regulation/Price	0	0	5	3	3
Distributed Generation Penetration	0	1	1	7	2
National Energy Efficiency Adoption	0	1	1	7	2
Economic Outlook (National/Regional)	1	4	4	1	1

Feedback from the Working Group

- From what you've seen so far, what are your initial impressions? Are we missing something?

- Is there another potential scenario you would like to propose?

Next Steps

- Next Steps: Plausible futures from IRPWG brainstorming and TVA early scenario work will be merged for more discussion at the April meeting.

- Please send additional thoughts after today's meeting to us by April 13, 2018. (template to be provided)

IRP Working Group Meeting Objectives

February 28th	March 29th	April 26th	June 7th	July 12th
• IRPWG orientation • General overview of process	• Overview of scenario design process • Review uncertainties, current forecasts, and brainstorm/review scenarios • IRPWG feedback	• Discuss proposed scenarios and develop short list • Overview of strategy design process • Brainstorm/review strategies • IRPWG feedback	• Finalize scenarios • Discuss proposed strategies and develop short list • Planning assumptions • Introduce resource options	• Finalize strategies • Continue discussion of resource options • Modeling constraints
		Vote on scenarios		Vote on strategies

Group Tour:

- **2:15 – 3:00 Walk to TVA Building / Visitor Badging**
- **3:00 – 3:30 Overview TVA Transmission System, *Aaron Melda, VP Transmission Operations and Power Supply***
- **3:30 – 4:00 TVA Systems Operations Center**
- **4:00 – 4:30 TVA Commercial Operations Center (Trading Floor)**
- **4:30 Adjourn and Safe Travels!**