Integrated Resource Plan

TVA'S ENVIRONMENTAL AND ENERGY FUTURE

Planning Inputs

External Stakeholder Review

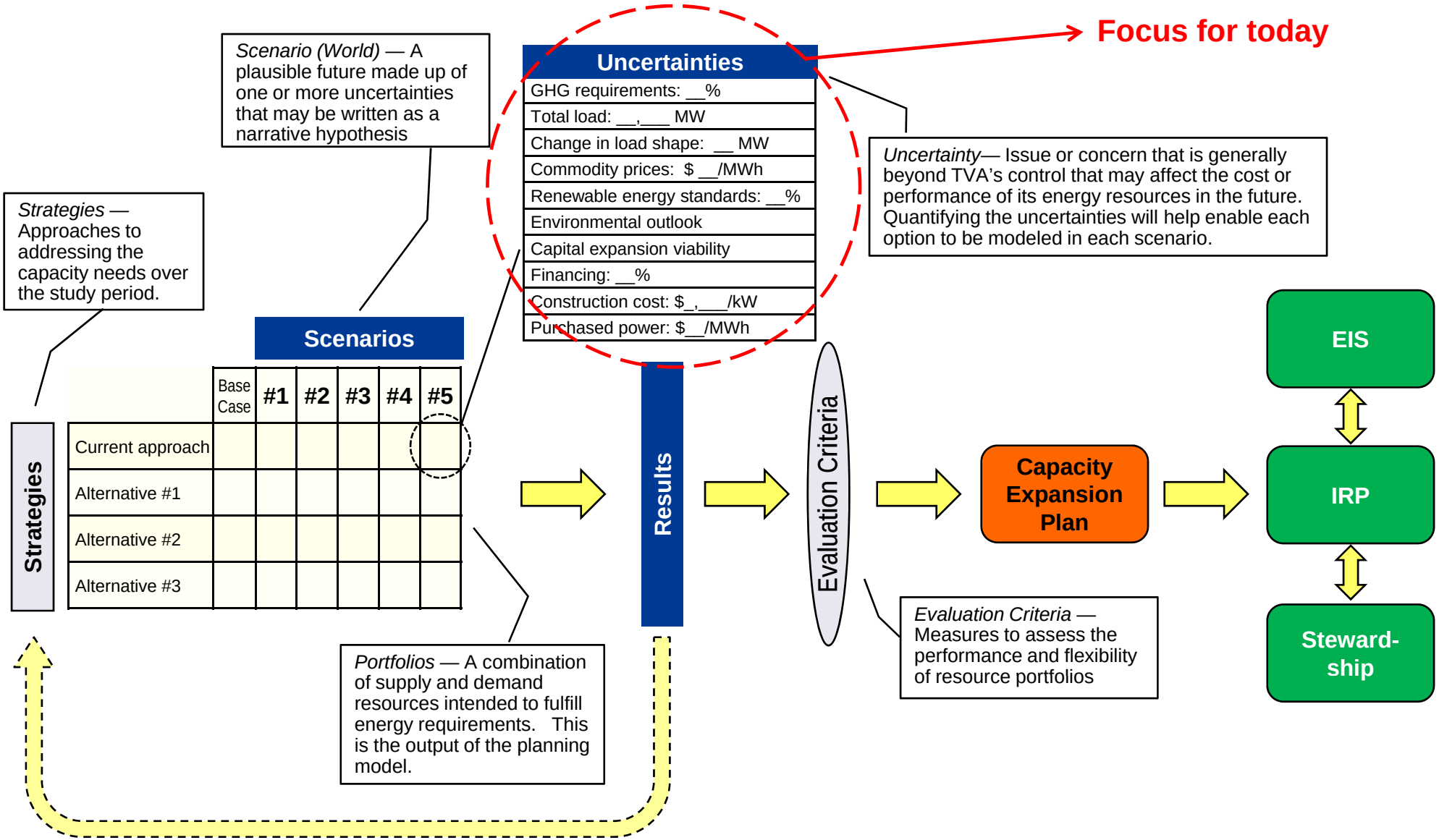
October 23, 2009

Discussion Topics

- Overview
  - Focus of Today's Discussion
  - Approach to Projecting Planning Inputs
- Uncertainties
  - Load Forecast
  - Environmental Outlook
  - Commodity Forecasts
  - Financial Parameters
- Wrap-Up Discussion

Today's objective is to enable understanding of TVA's approach for projecting uncertain variables and inputs to the model.

Overview
IRP Summary Process



Key Uncertainties in the IRP Study

Initial List of Uncertainties
Total load
Change in load shape
Demand side management penetration
Energy efficiency penetration
Technology improvement (e.g., PHEV)
Greenhouse gas regulation
Cost of emissions allowances
Coal ash regulation
Hydrothermal effects (weather)
Judicial mandates
Environmental legislation
Public sentiment for "go green"
Renewable requirements
Cost of capital
Construction cost
Natural gas price
Coal price
Wholesale electricity price
Natural gas infrastructure (pipeline)
Oil price
Cost of purchased power
Availability of purchased power
Price hedging program
Nuclear build out viability
Nuclear legislation
Transmission capability / limitations
Cost/time of transmission expansion
Generating unit availability
Hydro unit availability
Catastrophic event
Retirement of existing assets

- Uncertainties are factors that may impact the cost or performance of TVA's energy resources. They ultimately become attributes to describe the scenarios
- The stakeholder group reviewed this list of uncertainties at the August 18th meeting
- Today's presentation will focus on the highlighted uncertainties (planning assumptions)

Key Uncertainty	Description
Greenhouse gas (GHG) requirements	• Reflects level of emission reductions (CO_2 and other GHG) mandated by federal legislation plus the cost of carbon allowances
Total load	• Reflects variance of actual load to what is forecast • Accounts for impacts of DSM/EE penetration
Change in load shape	Includes effects of factors such as: • Time-of-use rates • PHEV (transportation) • Distributed generation • Economics changing customer base • Energy storage • Energy efficiency • Smart grid / demand response
Commodity prices	Includes natural gas, coal, oil, uranium, and spot price of electricity
Renewable electricity standards (RES)	• Reflects mandates for minimum generation from renewables and the viability of renewable generation sources
Environmental outlook	Includes: • Air emissions (exclusive of GHG) • Water • Land • Waste
Capital expansion viability	For nuclear, fossil, other generation, and transmission, includes risks associated with: • Licensing • Permitting • Project schedule
Financing	Financial cost (interest rate) of securing capital
Construction cost escalation	Includes the following for nuclear, fossil, and other generation: • Commodity cost escalation • Labor and equipment cost escalation
Contract purchase power cost	• Reflects demand cost, availability of power and transmission constraints

Approach to Projecting Planning Inputs

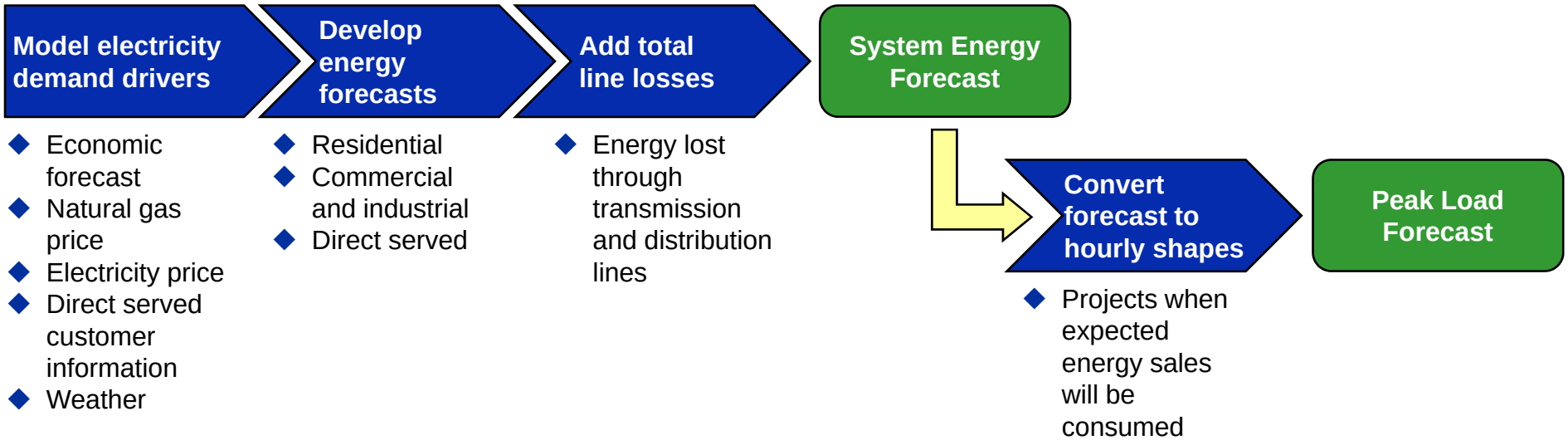
- TVA utilizes a variety of data sources in projecting planning inputs, such as
  - Recent TVA experience and internal expertise
  - Historical and empirical data
  - Industry research and analysis
  - Contract negotiations
  - Input from government agencies, stakeholders, and external organizations

- Today's discussion will cover load forecast, environmental outlook, commodity forecasts, and financial parameters

- In general, the discussion will cover the methodology, drivers, and results / outlook for each topic
  - Methodology is a description of common factors that are considered as well as the process for reconciling their input
  - Drivers are items that have significant influence on the uncertainties
  - Results / outlook are the outcome of the process

Load Forecast Methodology

- Forecasts are based on statistical and econometric modeling techniques



- System energy forecast is developed by:
  - Modeling electricity demand drivers that relate historical sales to future energy consumption
  - Developing energy forecasts for each customer sector (residential, commercial and industrial, and directly served) based on inputs from electricity demand drivers
  - Adding the total transmission and distribution line losses to the sum of total customer energy forecasts. It quantifies the total energy required to meet customer demands
- Peak load forecast is created by:
  - Converting energy forecast to hourly load shapes for 8,760 hours of each year. These shapes are based on typical weather patterns and reflect typical hourly usage for TVA customers
  - Identifying the highest hourly load, which becomes the peak forecast for each year

Drivers – Energy and Demand

Detail of key drivers of electricity demand:

Economic Forecast

- Most important driver of electricity sales
- Accounts for mix of industry in the TVA region and the competitive advantage (disadvantage) in each industry
- Forecasts for employment, production, income and population including information for new industries

Price of Electricity

- Used in two time segments:
  - Current – FY10: current wholesale prices are used for firm power and include an adjustment for the fuel clause adjustment forecast
  - Long Term – FY11: prices are forecast to cover revenue requirements including targeted net income and debt repayment
- Converted to retail by adding historic-based estimates of distributor mark-ups to each major sector

Price of Natural Gas

- Competes with electricity--higher gas prices encourage more use of electrical powered equipment
- Retail price based on the Henry Hub gas price forecast
- Conversion to retail prices is based on recent relationships between wholesale prices and the retail prices charged by local distribution companies

Direct Served Customer Information

- Forecast is based on information from industrial marketing representatives and economic development
- Includes newly announced customers Hemlock Semiconductor (HSC) and Wacker Chemie
- Long-term, little growth is forecast for current customers since large, new customers are likely to be distributor served

Appliance Saturation and Efficiencies

- Appliance saturations are based on data from TVA-conducted residential surveys
- Changes are monitored, including legislated efficiency improvements and energy efficiency programs

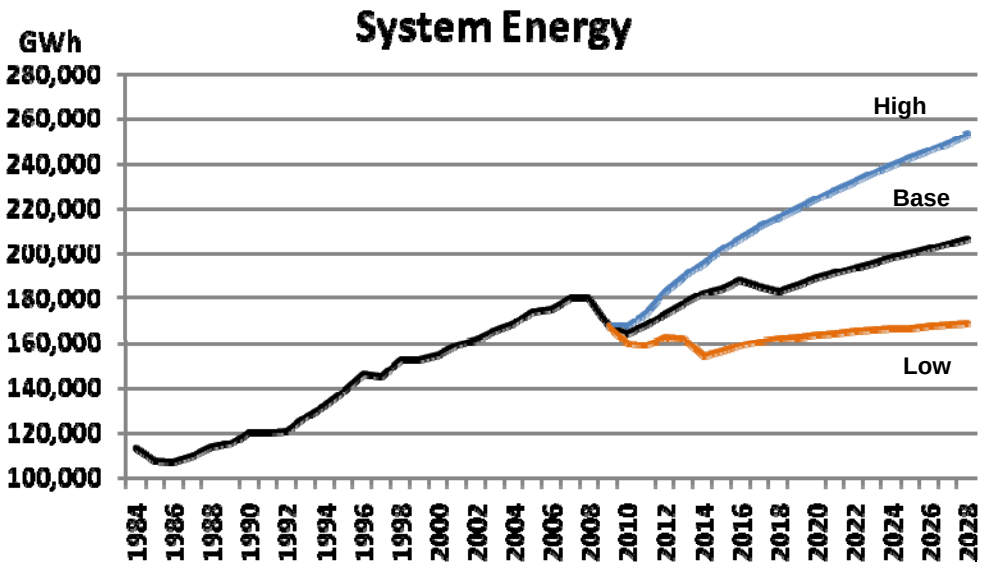
Weather Assumption

- Monthly and annual sector forecasts assume normal weather based on 30 year (1976-2005) daily high and low temperatures
- Variables used are normal, monthly heating degree day and cooling degree day

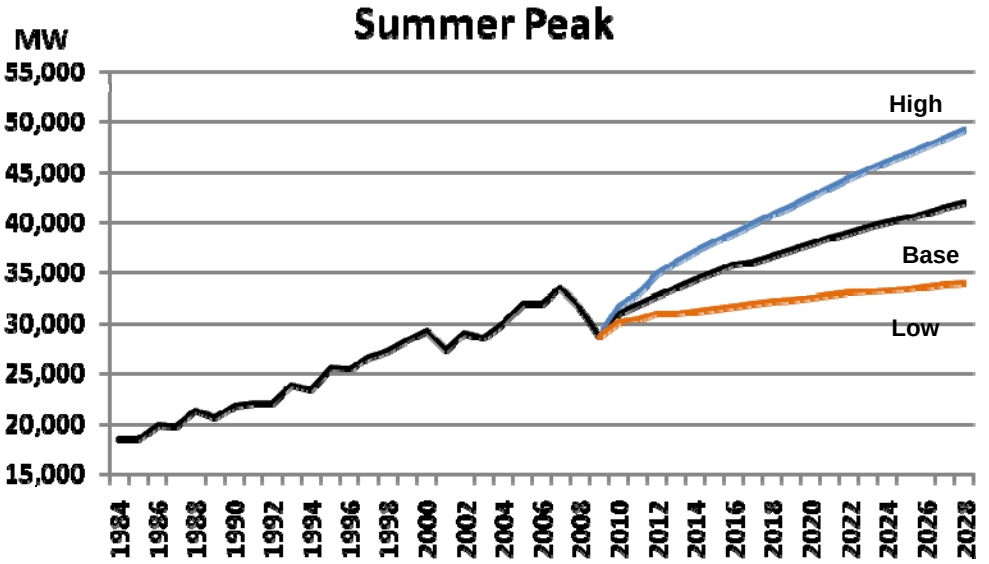
Results – System Energy and Peak Load

- The figures to the right illustrate TVA's forecast for system energy and summer peak load
- High and Low forecasts are estimates of 90th and 10th percentile uncertainty cases from modeled effects of high and low major inputs:
  - Economic forecast
  - Electricity price
  - Natural gas price
  - Direct serve sales
- High and Low forecasts bracket uncertainties such as:
  - Planned new direct serve customers have timing uncertainty
  - Neither the timing or strength of the recovery from recession is certain
- Growth in the less energy intensive sectors, particularly residential, leads to stronger peak growth than energy growth

	Annual Energy		Summer Peak	
	FY09-14	FY09-28	FY09-14	FY09-28
High Case	3.2%	2.2%	5.3%	2.9%
Base Case	1.7%	1.1%	3.6%	2.0%
Low Case	-1.6%	0.0%	1.7%	0.9%



*2009 includes 11 months of actual energy.



Drivers – Energy and Demand (Cont'd)

Each customer sector's energy forecast has different drivers

Residential Model Drivers

- Historical sales
- Number of customers
- Income
- Electricity price
- Gas price
- Weather assumption

Commercial and Industrial Sector Model Drivers

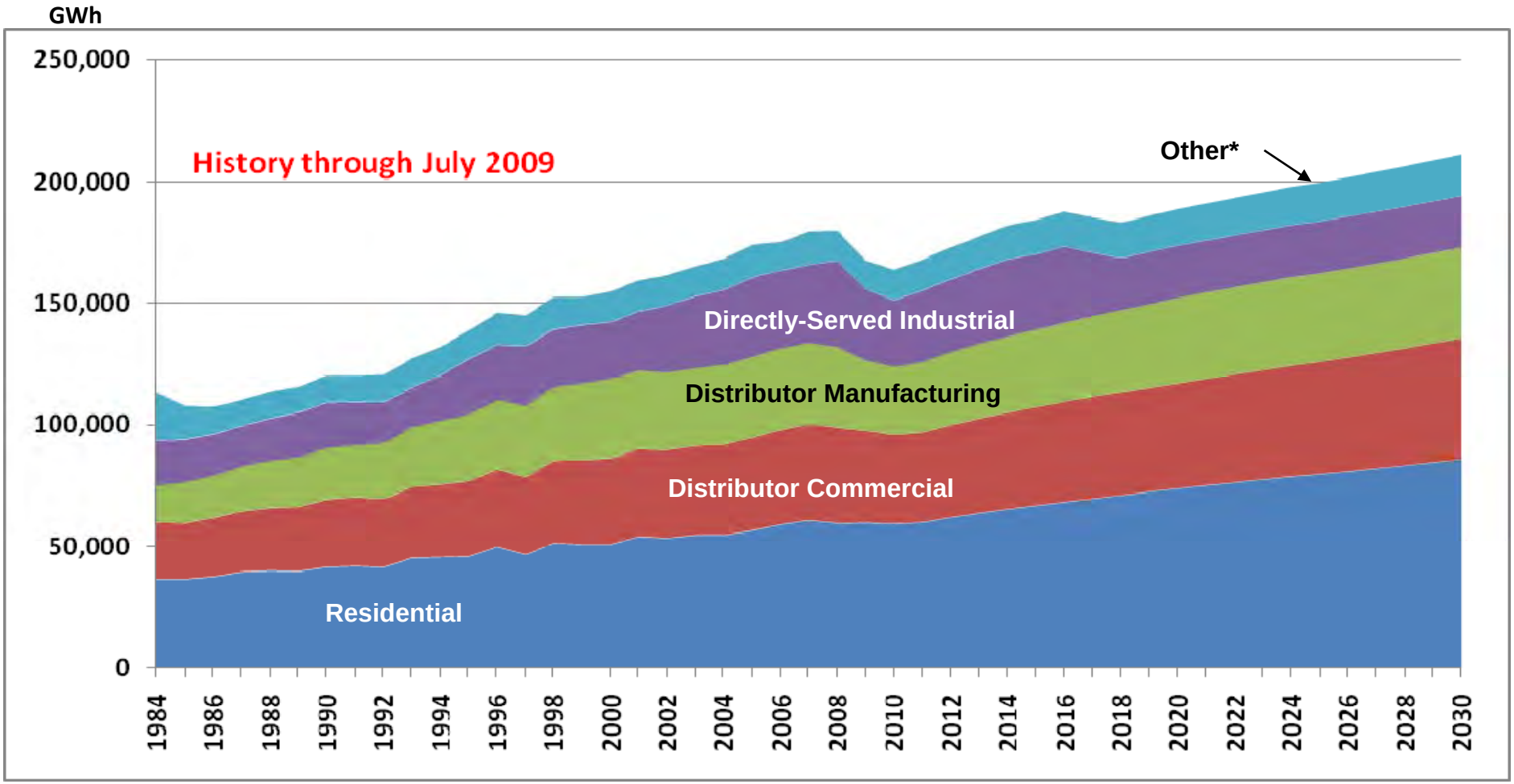
- Historical sales
- Electricity price
- Gas price
- Gross regional product
- Employment
- Changes in appliance efficiency and saturation
- Customer or industry specific information

Directly Served, Individual Customer Sales Drivers

- Historical sales
- Operational outlook from customer resources, industrial marketing
- New customer information from customer resources, economic development
- USEC contract assumption

Results – System Energy Forecast by Sector

The figure below shows the energy history and forecast by customer sector



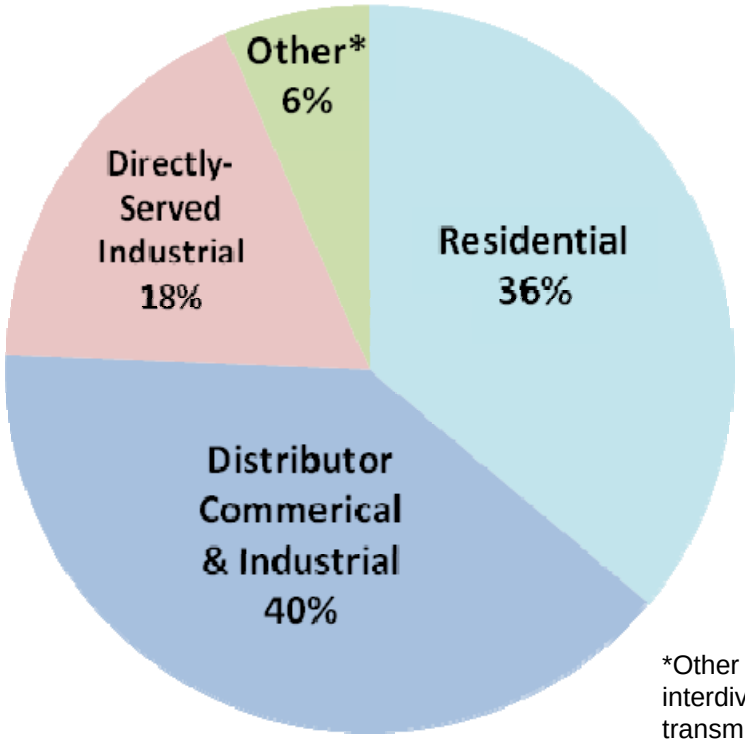
*Other includes outdoor lighting, interdivisional and distribution & transmission losses

Results – System Energy Forecast by Sector (Cont'd)

The pie charts below show the energy forecast by sector

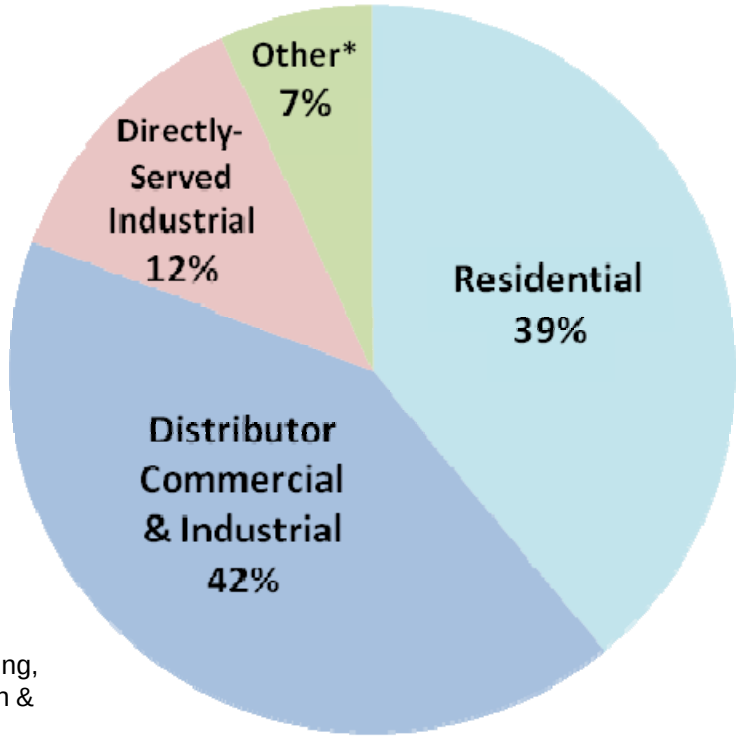
- Directly-served industrial energy is forecast to decrease by 6% from FY 2010 to FY 2020
- Residential (3%), Commercial and Industrial (2%), and Other energy (1%) are projected to increase
- Growth in energy is forecast from sectors with typically lower load factors which will make a greater contribution to the peak

FY 2010



164,000 GWh

FY 2020



189,000 GWh

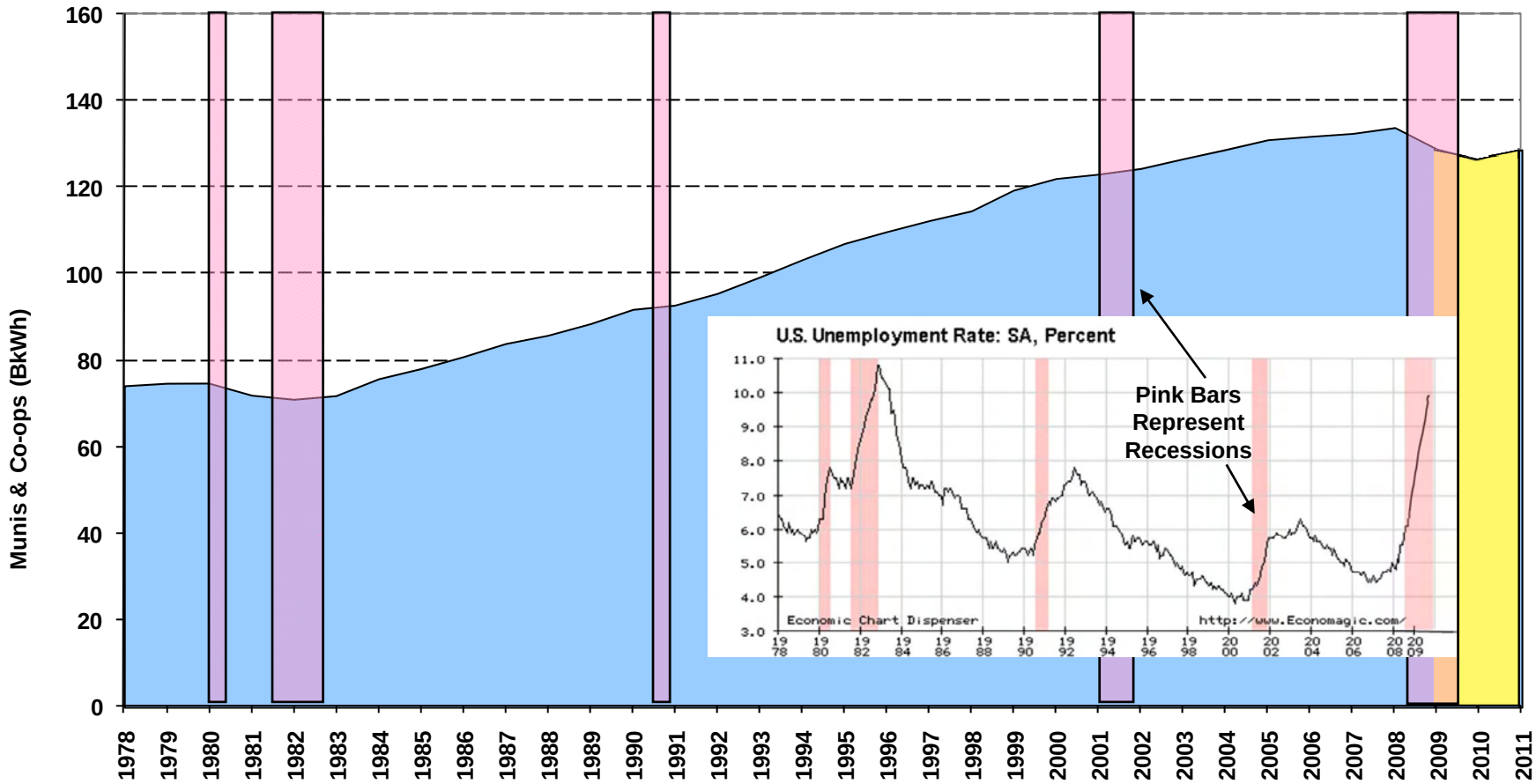
*Other includes outdoor lighting, interdivisional and distribution & transmission losses

Historic Sales Pattern

The figure below shows TVA sales and the impact of recessionary periods

- Recessions typically reduce sales, but both sales and peak demand bounce back after recovery
- The impact of the recession and expected recovery are incorporated into TVA's forecast

TVA Sales - Municipals and Cooperatives
1978 - 2008 *(actual);* 2009 - 2011 *(estimated)*



Energy Forecast Variance

- The tables to the right show the variance between one-year and five-year energy forecasts and actual annual energy
- The average year-ahead energy variance between 1999 and 2008 is 1.2%
- The average five-year energy variance forecasts from 1996 to 2003 is 2.3%

Year-Ahead Energy Forecast Variance

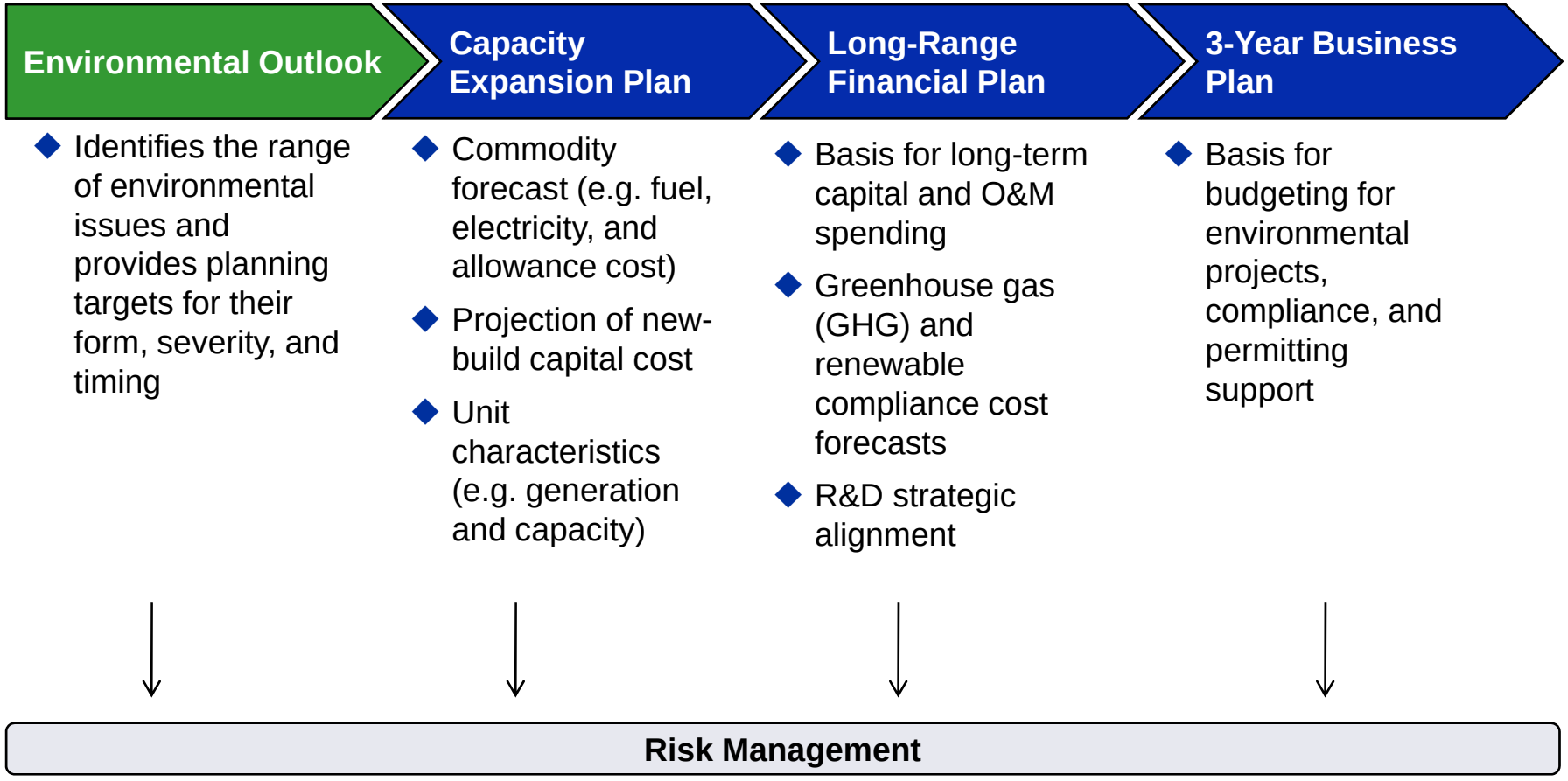
Fiscal Year (FY)	Energy Forecast (GWh)	Annual Energy (GWh)	Energy Variance
1999	156,060	154,477	1.0%
2000	155,306	156,500	0.8%
2001	161,089	158,774	1.4%
2002	164,634	162,347	1.4%
2003	167,288	167,670	0.2%
2004	169,779	170,696	0.5%
2005	173,023	174,962	1.1%
2006	176,889	174,318	1.5%
2007	178,707	175,684	1.7%
2008	185,240	180,477	2.6%

5-Year Ahead Energy Forecast Variance

Forecast FY	Target / Actual FY	5-Year Energy Forecast (GWh)	5-Year Annual Energy (GWh)	Energy Variance
1996	2001	162,949	158,774	2.6%
1997	2002	164,418	162,347	1.3%
1998	2003	168,230	167,670	0.3%
1999	2004	168,480	170,696	1.3%
2000	2005	167,069	174,962	4.7%
2001	2006	179,156	174,318	2.7%
2002	2007	182,385	175,684	3.7%
2003	2008	183,782	180,477	1.8%

Overview

The following diagram outlines how the environmental outlook influences other planning processes



Methodology

TVA gathers information from various internal and external sources in developing the environmental outlook

- Tracks regulatory, legislative, judicial, and policy objectives that shape future environmental requirements on operations

- Establishes cross-functional teams around the following topics:
  - Air
  - Climate change
  - Clean energy (e.g., renewables and energy efficiency)
  - Water
  - Waste

- Engages with external organizations, government agencies, and stakeholders to remain current

- Reviews forecasts and intelligence from leading external sources and uses them as reference. Some examples include:
  - Cambridge Energy Research Associates (CERA) www.cera.com
  - Energy Ventures Analysis www.evainc.com
  - ICF International www.icf.com

Air

Key Developments

- Court vacated then reinstated the Clean Air Interstate Rule until new rule is promulgated
- Clean Air Mercury Rule is vacated. EPA expected to develop a rule regulating Hazardous Air Pollutants (HAPs) in Maximum Achievable Control Technology (MACT) requirements for mercury, acid gas, trace metals, and organics
- Federal district court ruling in the North Carolina nuisance case
- EPA reviewing existing National Ambient Air Quality Standards (NAAQS) and new tighter standards forecasted for ozone and fine particles

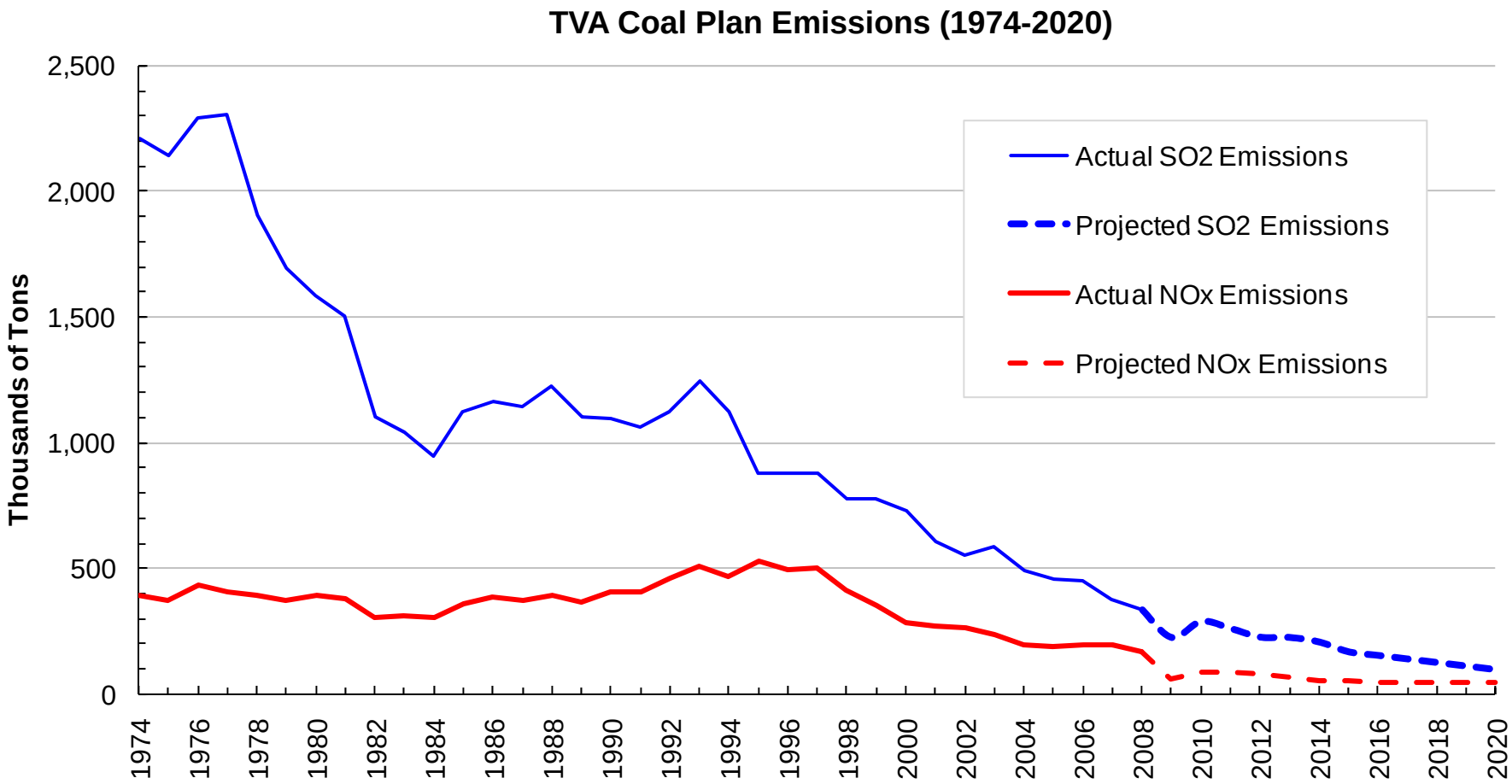
Outlook (Base Case)

- Moving away from cap and trade programs for sulfur dioxide (SO_2), nitrogen oxide (NO_X), and mercury (Hg) emissions
- SO_2 and NO_X emissions to be set by state programs to attain NAAQS and will drive aggressive controls on coal-fired units
- EPA to issue a "Utility MACT" for HAPs requiring strict limits on each plant to control mercury, acid gases, and metals

Air (Cont'd)

The following chart shows the history of TVA's coal plant emissions from 1974-2008, and projected emissions through 2020.

- Annual SO_2 and NO_X emissions have been reduced by nearly 85% and 58% respectively. Summertime NO_X emissions have declined 76% (1974-2008)



Climate Change

Key Developments

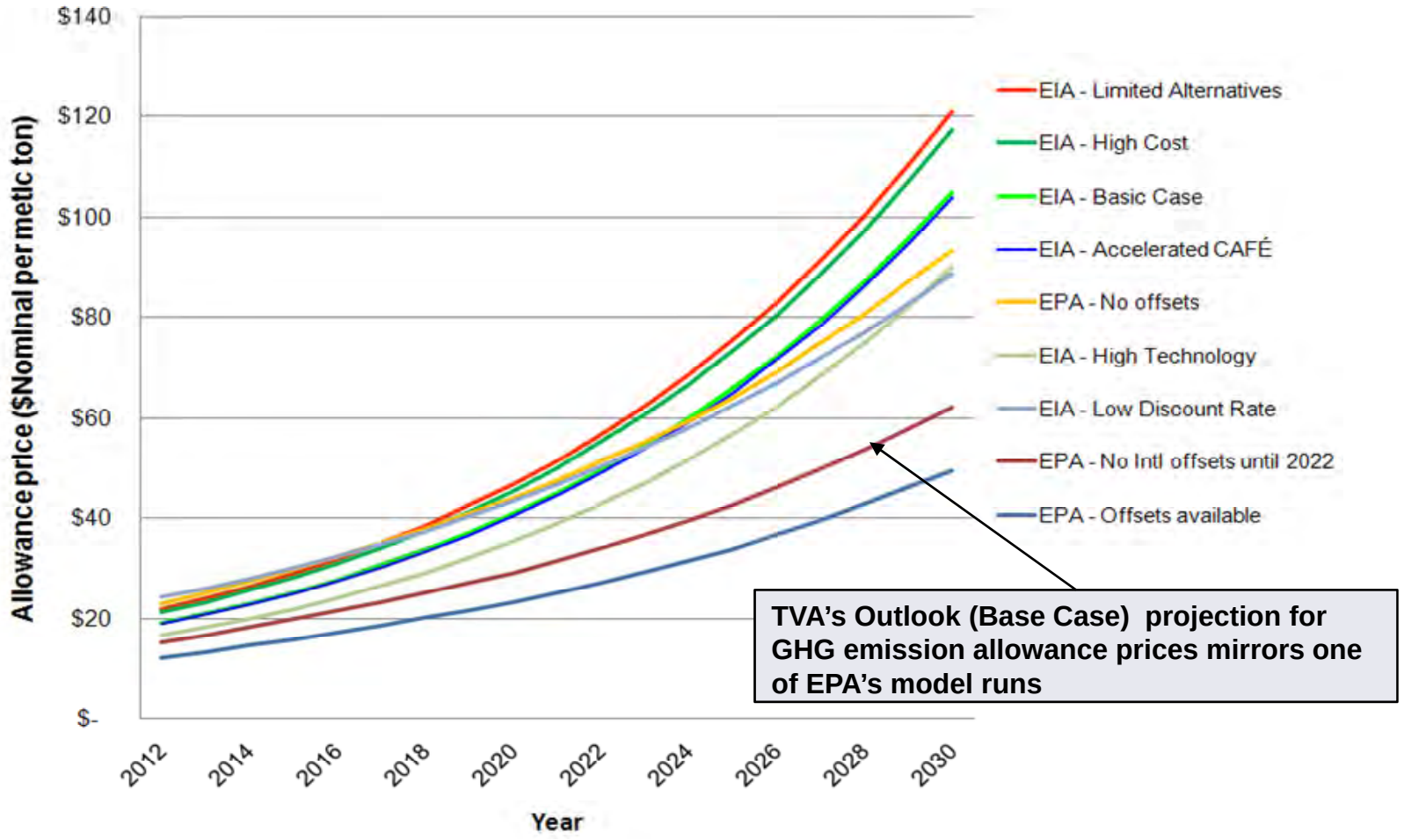
- In June the U.S. House of Representatives passed a comprehensive energy and climate change bill (H.R. 2454, the "American Clean Energy and Security Act of 2009), which includes an economy-wide cap-and-trade program for GHG emissions, including those emitted from power plants
- In September, the U.S. Senate's Environment and Public Works Committee introduced a climate change bill (based on the House legislation), and a Committee vote is expected in November
- EPA is poised to finalize—by Spring 2010—its proposed "endangerment finding", thereby triggering new regulations of GHGs under the Clean Air Act
- EPA recently finalized mandatory GHG reporting requirements, beginning with CY2010 emissions
- In early October, President Obama issued an Executive Order directing Federal agencies to:
  - Meet agency-specific targets for reductions of GHG emissions by FY2020
  - Reduce building energy use
  - Reduce vehicle fleet petroleum consumption
  - Develop and implement annual sustainability plans

Outlook (Base Case)

- GHG cap-and-trade program begins in 2013 with:
  - Retail electric suppliers initially receiving direct allocations of emission allowances, gradually phasing out over time and transitioning to full auction of allowances
  - Significant uncertainty associated with allowance prices and overall cap-and-trade costs is addressed by anticipating the implementation of a price collar mechanism that yields market prices of $17 per ton in 2013 and $62 per ton in 2030

Climate Change (Cont'd)

This figure illustrates some of EPA and EIA's 30+ model projections of GHG allowance prices under H.R. 2454.



As shown above, there is a wide range of projections for GHG emission allowance prices. TVA's modeling scenarios also will consider various prices, ranging from $10 to $104 per metric ton.

Sources
http://www.eia.doe.gov/oiaf/servicerpt/hr2454/index.html EIA, August 2009
http://www.epa.gov/climatechange/economics/economicanalyses.html#hr2454 EPA, June 2009

Renewables

Key Developments

- In June the U.S. House of Representatives passed H.R. 2454, which includes a requirements for retail electric suppliers to comply with an annual combined energy efficiency and renewable electricity standard
- In June, the Senate's Energy and Natural Resources Committee cleared Senator Bingaman's energy bill, including renewable and efficiency requirements for retail electric suppliers
- Significant financial incentives from federal and state governments, along with state renewable standards are directing investments in renewable energy generation assets and infrastructure

Outlook (Base Case)

- Credits for renewable generation will be required to meet new federal compliance obligations
- Combined efficiency and renewable electricity standard with a required annual percentage of 3% in 2012 of adjusted retail sales escalating to 15% by 2021
- The annual requirement can be met with:
  - Generation from a wide variety of renewable energy sources
  - Energy efficiency credits can meet up to 25% of the requirement
  - Purchased renewable energy credits priced at $25 per megawatt-hour (2009 $), increasing with inflation

Water and Waste

Water – Key Developments

- Hydrothermal issues escalate in region
- The Supreme Court upholds cost-benefit variances in 316(b) regulations; EPA proposed rule for cooling water will be released in mid-2010
- EPA announced proposed update on Steam-Electric Effluent Guidelines by 2012 which will set more restrictive wastewater discharge limits on outfalls
- Corp of Engineer's Wolfe Creek Dam repair proceeding

Waste – Key Developments

- Kingston ash release
- EPA announces proposed rule on Coal Combustion Products (CCPs) disposal to be released by end of 2009 requiring design and performance standards for disposal

Water – Outlook

- Hydrothermal releases and plant intakes to require re-focused biological analysis and, in some cases, additional cooling capacity (i.e., cooling towers)
- With additional design standard for coal combustion by-product handling and disposal, forecast additional stringency to EPA's Effluent Guidelines, resulting in more restrictive discharge permits

Waste – Outlook

- EPA to propose Resource Conservation and Recovery Act (RCRA) revisions under "Subtitle C - hazardous" authority requiring "Subtitle D – non-hazardous" operation and design standards
  - CCPs go into products through beneficial reuse or into "Subtitle D- non-hazardous" disposal facilities
  - Wet sluicing of CCPs eliminated over next several years

Methodology

- TVA develops forecasts for three commodities that will be discussed today
  - Gas
  - Coal
  - Electricity

- Commodity forecasts
  - Represent the expected market price for a given commodity
  - Do not represent expected cost to TVA
  - Inform planning (e.g., purchase agreements, generation decisions)

- Forecasts are dependent on origin and point of delivery:

Commodity	Commodity Forecasts
Natural Gas	NYMEX Henry Hub and specific spot by location
Coal	TVA composite coal based on basin pricing and TVA fuel mix – Central Appalachian (CAPP) – Northern Appalachian (NAPP) – Illinois Basin (ILB) – Powder River Basin (PRB) – Uinta
Electricity	Into-TVA

Methodology (Cont'd)

- There are many inputs that are considered in forecasts. Commodity forecast inputs include:
  - Environmental outlook
    - CO_2 reduction requirements
    - Renewable electricity standard
    - Electric efficiency requirements
  - Economic outlook (e.g., GDP, inflation, and interest rates)
  - Demand for energy
    - Annual peak
    - Total energy
  - Capacity expansion cost

- TVA accounts for short-term and long-term conditions in forecasts

- Short-term prices are adjusted to reflect recent market conditions (e.g., NYMEX: NG for natural gas)
  - Includes short-term impacts (e.g., weather, storage)
  - Short-term forecasts are demand-driven

- Long-term prices are based on a structural and economic view of markets
  - Consistent with fundamental supply and demand conditions

Forecasting processes are consistent with standard industry practice.

Methodology (Cont'd)

- Consider the following when evaluating commodity forecasts
  - Vintage of the forecast data
  - Exclusion of transportation costs
    - Natural gas incurs additional cost in pipeline transmission
    - Costs to deliver coal vary widely based on transportation mode and point of delivery
  - Assumptions on regulatory developments, such as climate change legislation
  - Variance of quality parameters of coal
  - Assumptions on storage/reserve conditions and accessibility

- When comparing cost estimates, it is helpful to remember a quote from an EPRI report:
  - "The cost data presented in this report should not be compared with data from other sources unless all factors that significantly affect cost have been identified and included on a consistent basis"

Drivers

The following table summarizes key drivers considered in long-range price forecasts for natural gas, coal, and electricity

Natural Gas	Coal	Electricity
◆ Production cost	◆ Coal type supply and demand	◆ Regional demand
◆ Domestic and global supply	◆ Reserve conditions and accessibility	◆ Fuel prices
– Conventional and unconventional supply	◆ Mine cash costs and capacity expansion costs	◆ Existing generation availability
◆ Storage conditions and accessibility	◆ Mine productivity	◆ Regulatory developments
◆ Regulatory developments	◆ Regulatory developments	– Emissions (e.g., CO_2, SO_2, NO_X, Hg)
– Emissions (e.g., CO_2, SO_2, NO_X, Hg)	– Emissions (e.g., CO_2, SO_2, NO_X, Hg)	◆ Reserve margins
◆ Competing fuel sources	◆ Inter- and intra-fuel competition	◆ Transmission availability
		◆ Scarcity premiums
		◆ Capacity expansion cost

A variety of factors are considered in projecting prices for commodities.

Results – Natural Gas

Confidential – to be provided at meeting

Results – Coal

Confidential – to be provided at meeting

Financial Parameters

Methodology

Inflation

- Inflation is used to escalate constant-dollar values to nominal
- The major measures of inflation are:
  - Consumer Price Index (CPI)
  - Gross Domestic Product (GDP) Implicit Price Deflator (IPD)

Interest rates

- Interest rates are used as a guide in the TVA long-term financing rate from Treasury
- Indicators of interest rates are:
  - 3-month U. S. Treasury bill rates
  - 10-year U. S. Treasury bond rates
  - 30-year U. S. Treasury bond rates

The following table provides sources and methodology for developing TVA's inflation and interest rate outlook

Inflation	Interest Rates
TVA uses the inflation/escalation rate forecasts from IHS Global Insight (GI) as the basis for its forecasts	TVA uses Moody's Economy.com (EC) national economic forecasts of the U.S. economy for its planning
For the first couple of years of the forecast, the GI forecast is checked against Consensus Forecasts and adjusted if notably divergent	TVA applies the inflation outlook to real interest rates from the EC model to produce the nominal interest rate forecasts
GI forecasts consist of outlooks for the next 10 years. TVA performs an econometric analysis of U.S. inflation over the last 60 years for the longer-term outlook	

IHS Global Insight - http://www.ihsglobalinsight.com/EconomicFinancialData
Consensus Forecasts - http://www.consensuseconomics.com/
Moody's Economy.com - http://www.economy.com

Results – Current State and Base Outlook

Inflation

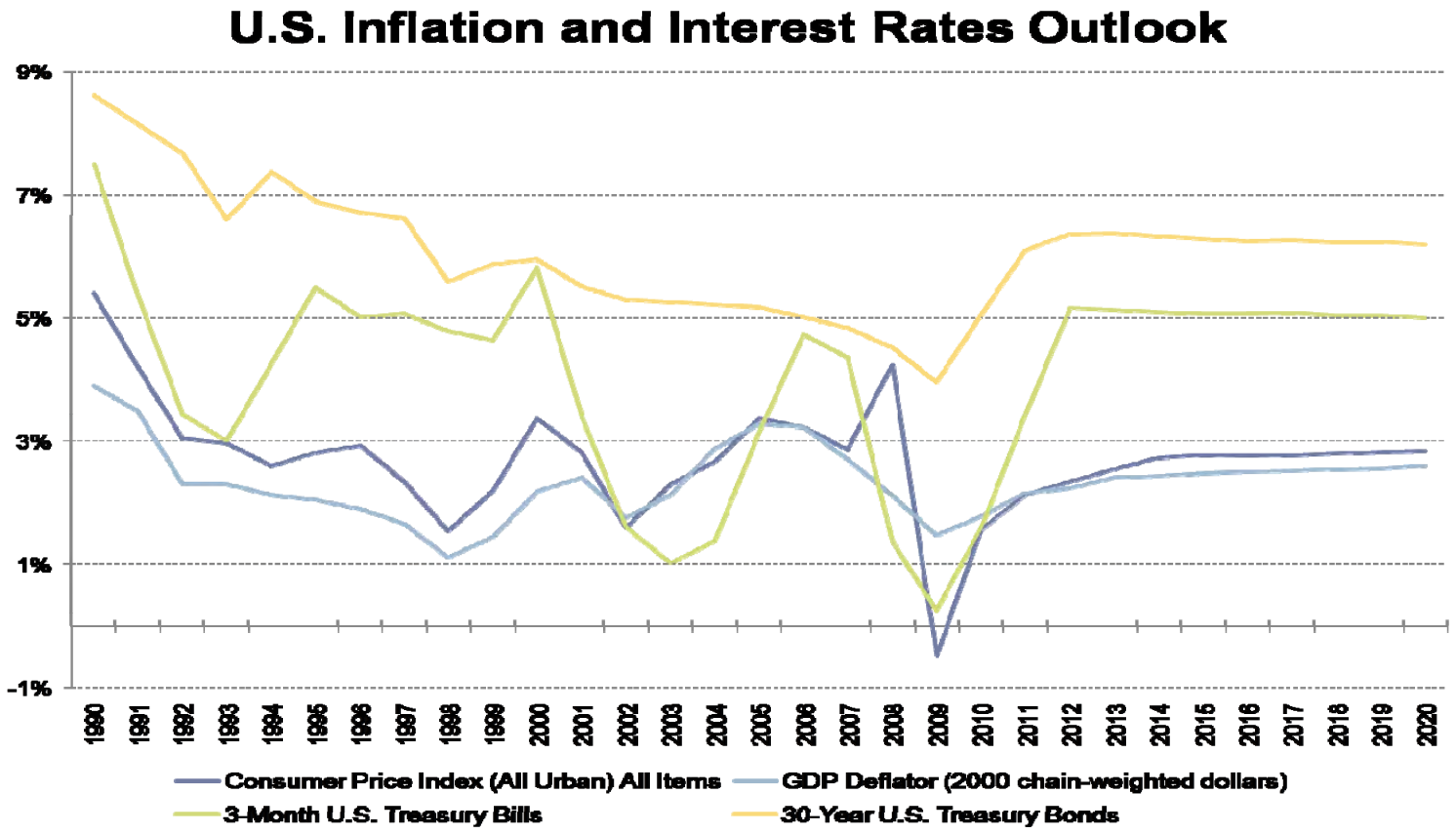
- The economy has been experiencing a deep recession which has led to unemployment and low capacity usage
  - Given the current level of idle resources, inflationary pressures are for the moment low
- Given the Federal budget deficits, the long-term situation is set for serious inflationary pressures
  - Both the Administration and the Federal Reserve are well aware of the danger, and the base forecast assumes that Federal action as the economy recovers limits inflation
- Further inflationary pressures will come in the long-term from world competition for resources as emerging markets become wealthier and domestic consumption rises

Interest rates

- The base forecast assumes that the Federal Reserve will raise interest rates to hold inflation as the economy attains a sustainable recovery
- For the long-term outlook, nominal rates revert to levels that allow for equilibrium real rates-of-return above inflation

Results – U.S. Inflation and Interest Rate Outlook

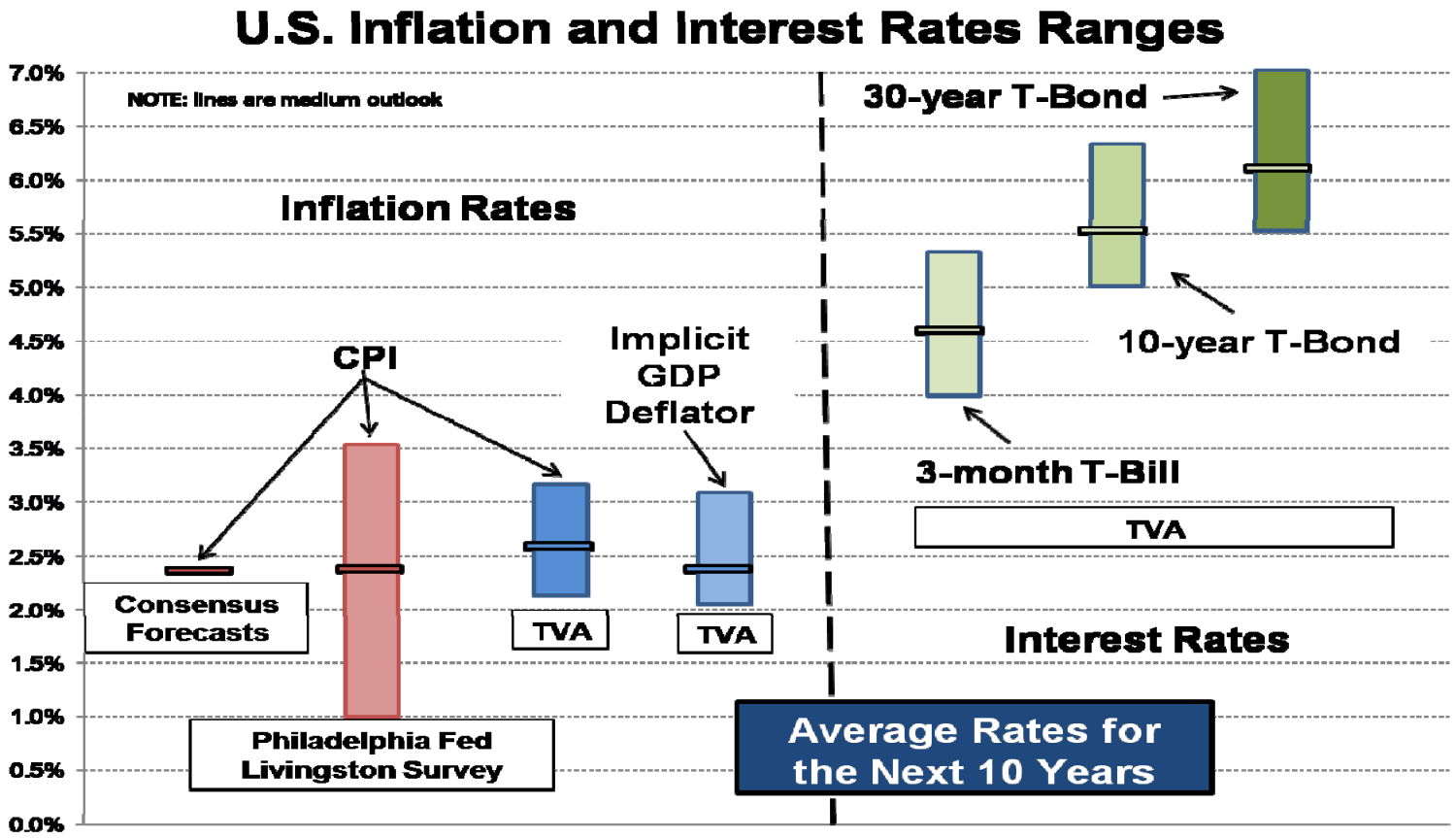
The graph below reflects the outlook resulting from the assumptions described previously



As the U.S. economy recovers, inflation, and interest rates rise and then reflect long-term equilibrium trends.

U.S. Inflation and Interest Rate Comparisons

The graph below shows the TVA base forecasts and the ranges



The TVA base forecast is comparable to forecasts of others. The range lies within the range of other forecasts.

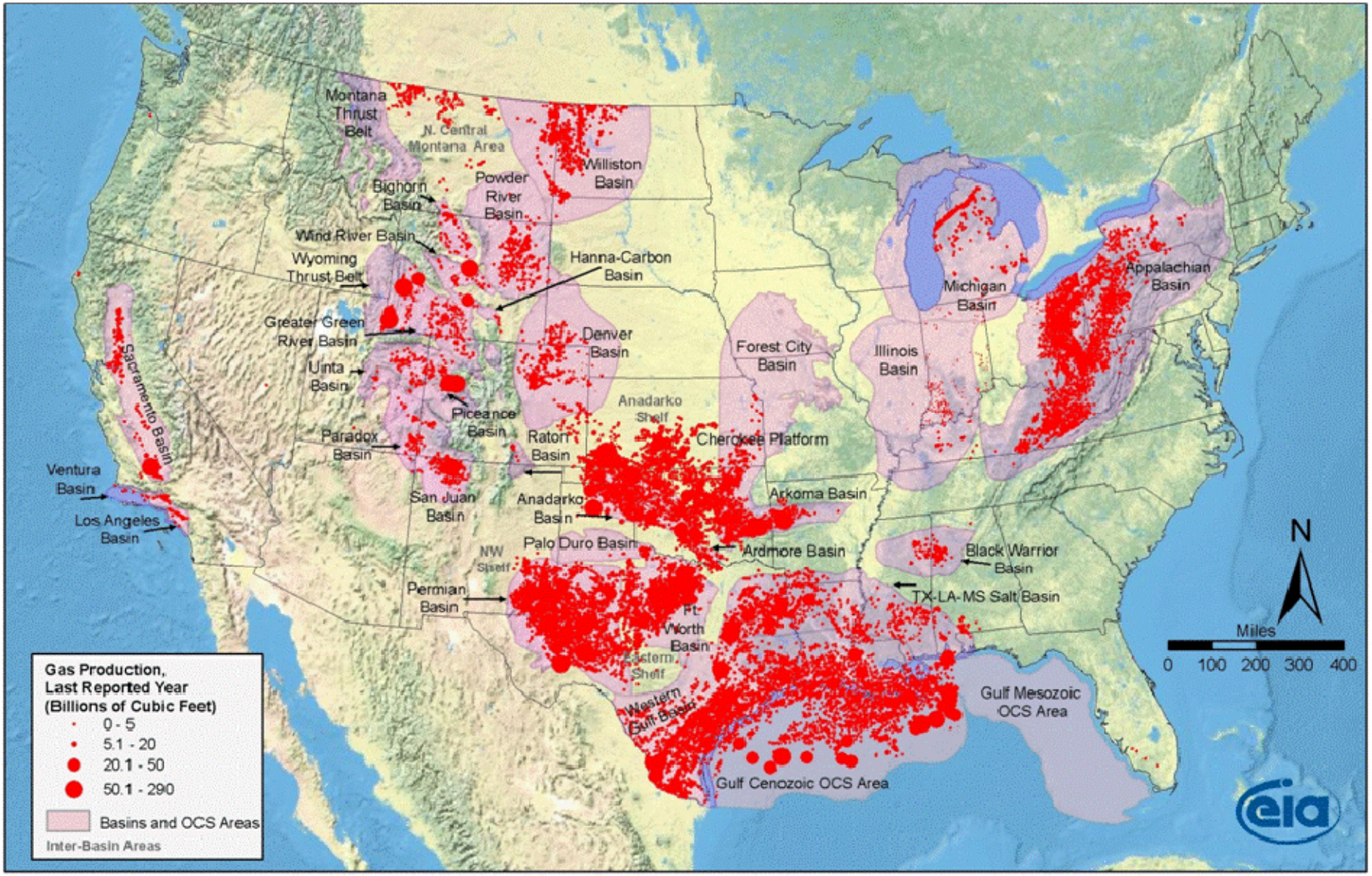
Wrap-Up Discussion

Wrap-Up Discussion

- Additional comments
- Recap of action items and follow-up questions
- Overall feedback on today's discussion

Appendix

U.S. Conventional Natural Gas Basins

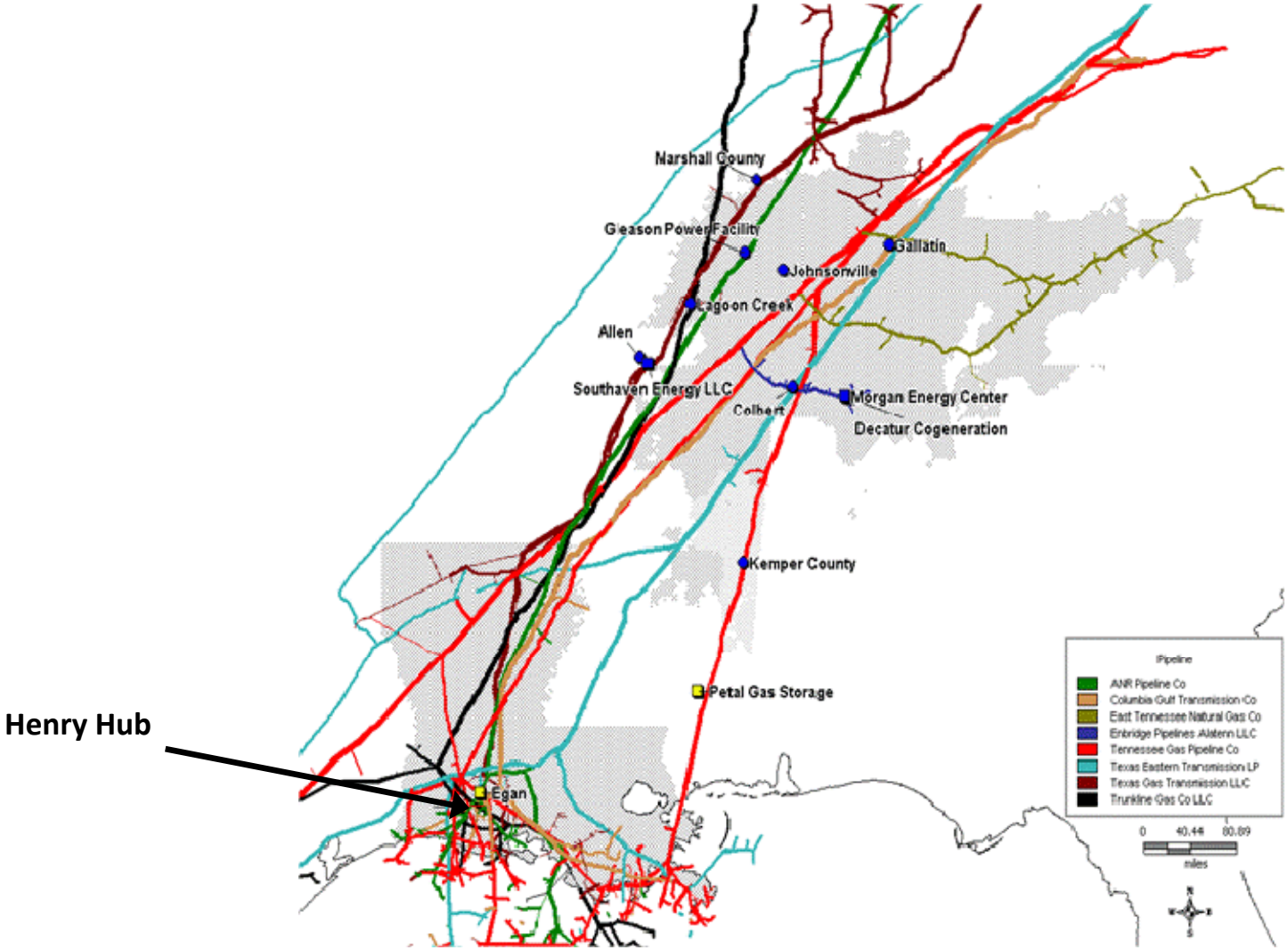


Source: Energy Information Administration based on data from HPDI, IN Geological Survey, USGS
Updated: April 8, 2009

U.S. Natural Gas Shale Plays

Source: Energy Information Administration based on data from various published studies
Updated: May 28, 2009

Major Natural Gas Pipelines Serving Tennessee



U.S. Coal Supply Map