Integrated Resource Plan

TVA'S ENVIRONMENTAL AND ENERGY FUTURE

Objectives

- IRP Scope – Where We Want to Go
- Process – How to Get There
- Efforts to Date for Building the IRP:
  - Benchmarking
  - McKenzie Study for 2008 Environmental Policy
  - PA Consulting Study for 2008 EE/DR Goals
  - EPRI Climate Study
  - Power Planning Process
  - World Scenario Development
- Schedule – When will We Get There
- Stakeholder/Ratepayer Input - Who will Be Involved
- Current Status – Where We Are Now

The Project Scope

- TVA is conducting a study to determine how to meet the demand for electricity over the next 20 years in the Tennessee Valley region. The study is known as the *Integrated Resource Plan, TVA's Environmental and Energy Future (IRP).*

- With the approval of the 2008 Environmental Policy, TVA is planning to conduct an environmental review of the options and methods that TVA can use to meet the objectives set forth in the policy. This includes preparation of a new IRP.

The Process

- Critical steps for review and evaluation:
  - Demand Forecasting
  - Resource Characterization
  - Plan Evaluation Criteria
  - Generation and Demand Side Options Mixes
  - Trade Off Analysis

- Meetings will be focused around these critical steps. TVA staff will present on each subject in the coming weeks and asking the Stakeholder Review Group's (SRG) input into our planning assumptions and methods.

- Public Involvement
  - Public Meetings and Comment Period
  - Identify Issues of Public Concern
  - Integrating Public Opinion into Process

BENCHMARKING EFFORTS

Benchmarking of Utility IRPs

In order to assure that we took advantage of lessons learned and to verify that our high level process steps were consistent with processes used in the industry we have conducted extensive bench marking of utility IRP's including:

- Duke Energy Carolinas
- Florida Power and Light (FPL)
- Georgia Power
- Pacificorp
- Public Service of New Mexico (PNM)
- Progress Energy Carolinas
- Progress Energy Florida
- Northwest Power and Conservation Council

Summary Observations

Topic	Observations
Planned capacity	◆ New generation capacity is predominantly gas and nuclear ◆ Very few coal additions are planned; emission control equipment or retirements are more common ◆ Renewable energy is being pursued through many channels, including PPAs
Typical use of scenarios in utility IRPs	◆ Majority of utility IRPs consider at least two different factors – Typical considerations: high/low carbon, high/low load growth, and fuel price variability ◆ Definition of "scenario" varies by company – Can be description of a "world" or a specific sensitivity (e.g., low growth) – As a result, number of scenarios varies widely
Example industry scenarios	◆ The typical number of scenarios developed is small (i.e., three to four) ◆ The scenario framework is often represented as a 2 X 2 matrix, with two primary factors
Common issues in public testimony	◆ Public utility commissions and constituents are expecting more from energy efficiency and demand side management (DSM) programs ◆ Coal is losing favor as a new generation option; the public will expect plans to manage emissions ◆ Expectations and demand for energy from renewable sources are increasing ◆ Load and demand forecasts are scrutinized carefully ◆ Nuclear investments and efficiency programs that impact rates are highly contested
IRP leading practices	◆ Identify up front the objectives of all key decision-makers and engage them in the process ◆ Establish explicit objectives to direct and bound the planning effort ◆ Make the decision making process transparent ◆ Keep the analytics as simple and flexible as possible or detail will drown out strategy

Industry Context

Application of Bench Marking to TVA's Planning

Topic	Implications	How it is being Used
Summary of other utility IRPs	◆ New generation capacity is predominantly gas and nuclear ◆ Very few coal additions with many more facilities adding emission control equipment or being retired ◆ Renewable energy is being pursued through many channels, including PPAs ◆ Some utilities have established aggressive EE and DSM goals	◆ Establish context and capacity strategies of utilities used in comparison
Uncertainties in other utility IRPs	◆ Most common uncertainties are load forecast, GHG regulation, and gas prices ◆ "Emerging" uncertainties include coal plant retirement, PHEV, and DSM/EE	◆ Utilize uncertainties identified by peers in defining TVA's list of key uncertainties
Scenarios used by other utilities	◆ Definition of "scenario" varies by company – some utilities use "scenario" to describe sensitivity analysis while others use them to bound possible outcomes of uncertainties ◆ Many example scenarios are narrowly defined; TVA's scenarios may need to be broader due to longer timeline and level of public input required ◆ Typical considerations: high/low carbon, high/low load growth, and fuel price variability	◆ Integrate with prior TVA approaches and incorporate comparisons into the development of scenario planning process
Common issues in public testimony	◆ Energy efficiency and DSM programs should be an integral part of the discussion around meeting future electricity needs ◆ The public will likely be unreceptive to new coal generation and will expect plants to manage emissions ◆ There will be a demand for renewable energy ◆ The economic downturn will likely result in significant questioning of load forecasts	◆ Discuss recurring themes in public testimony to identify other areas that may require consideration
Review of evaluation criteria	◆ All utilities reviewed included cost to the customer and reliability as an integral component to evaluating plans ◆ Approximately half of the sample also included carbon/greenhouse gas emissions and quantified risk as evaluation components	◆ Incorporate into discussion and selection of evaluation criteria
Northwest Power and Conservation Council	◆ Conservation and demand reduction are at the forefront of the Council's plan ◆ Plan is regional and not utility specific ◆ Recommendations provide guidance to utilities in the region ◆ High-level process is consistent with those utilized by other utilities	◆ Verifiy TVA's high-level process steps are consistent with processes utilized by the Council and other utilities

Summary of Utility IRPs

- Below is a summary of IRPs that were included in the research

	Duke Energy Carolinas	FPL	Georgia Power	PacifiCorp
Capacity Expansion Plans	◆ 2,890 MW needed by 2012 and 9,010 MW by 2028 ◆ Adding one clean coal unit and a combined cycle by 2012 to add 2,065 MW ◆ Retiring 445 MW of coal by 2012 and an additional 600 MW by 2018 ◆ Preserve the option to secure nuclear capacity by 2018	◆ Complete construction of two combined cycle units by 2010 and add a third by 2011 (~3,650 MW) ◆ Add 400 MW to existing nuclear by 2012 ◆ Build three additional CC units by 2016 to add ~3,650 MW ◆ Two nuclear units in 2018 and 2020 to add 2,000 to 3,000 MW	◆ Focus on adding baseload nuclear/coal and minimize exposure to gas price volatility ◆ Purchase or build 5,000 MW of gas-fired capacity for 2009 to 2012 ◆ Retire two coal (589 MW) units by 2012 ◆ Approved to add 2,200 MW of nuclear by 2016/17	◆ Adding three CCCT units for a total of 1,500 MW between 2011 and 2016 ◆ Adding two supercritical pulverized coal facilities in 2012 and 2014 for 900 MW
Carbon Strategy	◆ Considered a “lower carbon” scenario based on Bingaman and Specter and a “higher carbon” scenario based on Lieberman Warner ◆ Nuclear capacity is required in “higher carbon” scenario ◆ Created Carbon Offset program to customer to buy blocks to cancel out their usage	◆ Does not believe that new coal units are viable generation options due to concerns over greenhouse gas emissions ◆ Focusing on natural gas in the short term and nuclear for the long term	◆ Generally opposes mandatory climate legislation, but actively pursuing carbon capture and alternative technologies via a strong R&D program ◆ Currently installing environmental control at four coal plants and plans to add equipment at two more	◆ Formed a Global Climate Change Working Group to analyze and discuss utility best practices in managing emissions ◆ Also partnered with Big Sky Carbon Sequestration Partnership and EPRI to explore climate change and carbon sequestration opportunities
Renewables	◆ Continue to evaluate market options for renewable generation and enter contracts as appropriate ◆ Entered PPAs with one solar farm and one landfill gas facility ◆ 3% renewable by 2012 and 12.5% by 2021	◆ Sunshine Energy Program: customers can voluntarily contribute and FPL adds 150kW of solar for every 10,000 customers ◆ Adding wind by 2009 ◆ Installing 350 MW of solar capacity by 2012 ◆ Pursue PPA with renewable energy providers	◆ Focused on use of biomass as the primary source of renewable capacity for the future ◆ Considering conversion of coal plant to biomass by 2011 ◆ Allows customers to pay a premium to purchase energy from a portfolio of renewable resources	◆ Add 2,000 MW renewable by 2013 ◆ Wind is the primary candidate for renewable, but biomass and landfill gas are also considered
Energy Efficiency / DSM	◆ Continue to seek regulatory approval of DSM and energy efficiency program portfolios (Save a Watt) ◆ Continue collaborative work to develop and implement additional EE and DSM products and services	◆ Implement 1,539 MW of cost-effective DSM from 2006 to 2017 ◆ Offers seven residential and eleven business DSM programs ◆ Pursuing additional development programs	◆ Expecting to achieve approximately 1,900 to 2,200 MW of demand reduction through DSM programs	◆ Add 100 MW of additional irrigation load control by 2014

Summary of Utility IRPs (Cont'd)

	PNM	Progress Energy Carolinas	Progress Energy Florida	The Council
Capacity Expansion Plans	◆ Does not commit to the additional construction of a large, capital-intensive baseload resource over the twenty-year planning horizon ◆ Long-term requirements are met through energy efficiency initiatives, renewable energy resources, a combined-cycle natural gas facility and Nuclear lease acquisitions	◆ No definitive plans to construct new baseload plants ◆ Adding two gas-fired units (757 MW) by 2011 ◆ Plans for two additional gas units (295 MW) between 2012 and 2016 ◆ Any nuclear additions would be on line after 2018	◆ Total net capacity addition of 3,903 MW by 2017 ◆ Adding two nuclear units in 2016/17 ◆ Gas-fired units will comprise remaining capacity additions ◆ Retiring one coal facility in 2009 and another in 2013	◆ Preparing to construct 400 MW of coal-gasification or conventional coal capacity by 2013
Carbon Strategy	◆ PNM is focused on minimizing carbon emissions ◆ Tested a wide range of carbon costs, including 2010 base prices of $8, $20, $40, and $53 per metric ton, with each price escalating at a rate of 2.5% per year	◆ "Securing our energy future requires a diverse, balanced strategy to meet the energy needs of a growing population and the emerging federal and state policies to reduce carbon emissions and climate change"	◆ Adding scrubbers to one coal facility by 2010	◆ Conservation and renewables are given the highest priority when considering resource options
Renewables	◆ 11 MW of customer-sited photovoltaic capacity planned from 2011 to 2023 ◆ 32 MW of biomass by 2010 ◆ 164 MW of renewable energy source added between 2012 and 2023	◆ "We believe that the best way to meet growth demand is through a balanced mix of energy efficiency, renewable energy, and upgrading plants or constructing new generation." ◆ 3% renewable by 2012 and 12.5% by 2021	◆ "We believe that the best way to meet growth demand is through a balanced mix of energy efficiency, renewable energy, and upgrading plants or constructing new generation."	◆ Incorporating more than 1,100 MW of wind generation capacity between 2005 and 2014 ◆ Securing options (sites and permits) to allow construction of new wind-generating resources as early as 2010 with up to 5,000 MW of capacity through the end of the 20-year planning period
Energy Efficiency / DSM	◆ Expects to achieve 219 MW of energy efficiency savings by 2023	◆ Has fifteen EE and DSM programs in place ◆ Filed for approval for five additional programs ◆ Goal to defer 1,000 MW of generation capacity by 2017 through EE and DSM programs	◆ Goal to reduce 80 MW of demand through DSM programs ◆ Customer education effort to increase awareness of energy efficiency programs	◆ Developing 500 MW of demand response between 2005 and 2009 ◆ Increasing and sustaining the region's efforts to secure cost-effective conservation immediately

Implications for TVA:

- ◆ New generation capacity is predominantly gas and nuclear
- ◆ Very few coal additions with many more facilities adding emission control equipment or being retired
- ◆ Renewable energy is being pursued through many channels, including PPAs
- ◆ Some utilities have established aggressive EE and DSM goals

Common Issues in Public Testimony

The following are common issues from public testimony related to IRPs in North Carolina, South Carolina, Georgia, Florida, New Mexico, and Oregon

- Public utility commissions and constituents are expecting more from Energy Efficiency and Demand Side Management (DSM) programs
  - Consensus comments pushed for expansion of DSM and energy efficiency programs (GA)
  - Commission encouraged utilities to be ambitious in setting load reduction targets through DSM and energy efficiency programs. Public witnesses generally testified in favor of conservation (NC)
  - Commission is permitted to authorize a return-on-equity premium of up to 50 basis points if a utility's annual load growth is offset by more than 20% through energy efficiency and conservation measures (FL)
  - Testimony stressed that company should aggressively pursue more demand reduction programs (NM)
- Coal is losing favor as a new generation option
  - Witnesses expressed concerns related to environmental impact of adding either pulverized coal or integrated gasification combined cycle coal capacity (GA)
  - Commission has demonstrated that they will not support new coal-fired generation as 4,000 MW worth of planned capacity were denied. A 750 MW unit was eventually approved after initial opposition (FL)
  - Natural gas was designated as the baseload generation choice for the next several years, and the commission noted that utilities will be expected to find alternatives to coal-fired capacity in future plans.(FL)
  - Commission declined to support plans to build more coal-fired plants (OR)
  - Many of the customers who commented during public hearings about Santee Cooper's proposed rate hike were not opposed to the idea of paying more for their electricity, but several were opposed to expansion of coal (SC)

Common Issues in Public Testimony (Cont'd)

- Expectations and demand for energy from renewable sources are increasing
  - Customers and testimony requested more energy from renewable sources (NC)
  - Testimony contended that SCE&G was too quick to dismiss renewable options and should be directed to consult a third party to evaluate renewable energy (SC)
  - Utilities are now allowed full cost recovery up to 110 MW for zero greenhouse gas emitting renewable generation (FL)
  - Commission said that utilities should continue efforts to diversify fuel sources and emphasize renewable clean fuels and clean fuel technology (FL)
  - State requires that renewables comprise at least 15% of each utility's total retail sales by 2015 and 20% by 2020 (NM)
- Load and demand forecasts are scrutinized
  - Additional evidentiary hearing held per the request of an intervener to validate load forecast. Load forecasts for 2003 and 2000 were compared to actual changes in load (NC)
  - Forecasts were challenged on the basis that they do not provide sufficient need for new capacity and do not take recent decreases in demand into account (SC)
  - Several questions related to the fluctuating costs of resources, fuel, and carbon and the impact to demand (NM)
- Nuclear investments and efficiency programs that impact rates are highly contested
  - Georgia Power's request to include CWIP for two nuclear units into rate base drew significant opposition before receiving approval (GA)
  - SCANA's two nuclear units were challenged over concerns about the accuracy of construction estimates and the approval of capital cost contingency as an allowable component of capital costs (SC)
  - Duke Energy Carolina's Save a Watt program was rejected because of a lack of transparency, complexity, and the possibility of an unreasonably high rate of return (SC and NC)

Implications for TVA:

- Energy efficiency and DSM programs should be an integral part of the discussion around meeting future electricity needs
- The public will likely be unreceptive to new coal generation and will expect plants to manage emissions
- There will be a demand for renewable energy
- The economic downturn will likely result in significant questioning of load forecasts

Northwest Power and Conservation Council
Overview

Background

- Congress enacted the 1980 Pacific Northwest Electric Power Planning and Conservation Act authorizing the states of Idaho, Montana, Oregon, and Washington to form the Council as an "interstate compact" agency
  - Council is comprised of two Governor appointees from each of the of the four states
- Act directed the Council to develop a 20-year power plan every five years to meet the electrical needs of the region at the lowest possible cost
- The plan must give priority to resources as follows:
  - First, to conservation
  - Second, to renewable resources
  - Third, to generating resources utilizing waste heat or generating resources of high fuel conversion efficiency
  - Fourth, to all other resources
- The Council's plan "serves as an independent, objective source of information on the region's power system and the resource choices it faces"
  - The plan does not fully reflect the situation of each utility in the region and individual utility plans may differ for legitimate reasons

• Process Overview

- The Fifth Northwest Power and Conservation Plan was composed of the following high-level steps
  - Identify plan theme and major issues
  - Define uncertainties and assumptions
  - Apply portfolio model
  - Select preferred alternative
  - Create recommendations and action plan

Northwest Power and Conservation Council Briefing Book (2007)
The Fifth Northwest Electric Power and Conservation Plan (2005)

Overview (Cont'd)

Plan Requirements

- Act requires that the Council's plan include:
  - An energy conservation program
  - Recommendations for research and development
  - Methodology for determining quantifiable environmental costs and benefits
  - Demand forecast of at least twenty years
  - Analysis of reserve and reliability requirements and cost-effective methods of providing reserves designed to insure adequate electric power at the lowest probable cost

Recommendations of the Plan

- The Council's most recent plan (The Fifth Northwest Power and Conservation Plan) recommended:
  - Increasing and sustaining the region's efforts to secure cost-effective conservation immediately
  - Developing 500 MW of demand response between 2005 and 2009
  - Incorporating more than 1,100 MW of wind generation capacity between 2005 and 2014
  - Securing options (sites and permits) to allow construction of new wind-generating resources as early as 2010 with up to 5,000 MW of capacity through the end of the 20-year planning period
  - Preparing to construct 400 MW of coal-gasification or conventional coal capacity by 2013

Implications for TVA:

- Conservation and demand reduction are at the forefront of the Council's plan
- Plan is regional and not utility specific
- Recommendations provide guidance to utilities in the region
- High-level process is consistent with those utilized by other utilities

Pacific Northwest Electric Power Planning and Conservation Act (1980)
The Fifth Northwest Electric Power and Conservation Plan (2005)

Northwest Power and Conservation Council

1. Identify plan theme and major issues

- Identify plan theme, example: cost-effective reduction of the carbon dioxide footprint of the Northwest power system
- Describe major issues; examples include:
  - Climate change and related policies
  - Meeting loads
  - Expanding the menu of resource choices
  - Transmission constraints
  - Power plan interactions with the fish and wildlife program
  - Appropriate avoided cost measures for resource decisions

2. Define uncertainties and assumptions

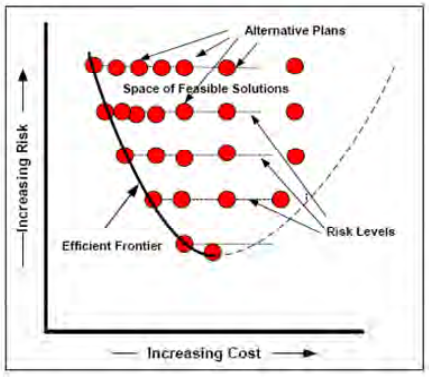
- Define uncertainties; examples include:
  - Load requirements
  - Gas price
  - Hydro-generation
  - Electricity price
  - Forced outage rates
  - Aluminum price
  - CO_2 tax
  - Production tax credits
  - Green tag value
- State resource assumptions; examples include:
  - Max price for wholesale electricity
  - Declining resources (retirement)
  - Transmission

3. Apply portfolio model

- Apply portfolio model (using Monte Carlo analysis in an Excel spreadsheet) to establish a feasibility space
- Each point in the space represents the expected cost and risk values for a single plan over 750 futures

4. Select preferred alternative

- Analyze efficient frontier (example shown below) is made up of plans that have the lowest expected cost for a given level of risk
  - NPV of total system costs and risk are the primary evaluation criteria
- "Stress-test" plans to evaluate sensitivity to different assumptions
- Select preferred alternative based on trade-off between cost and risk



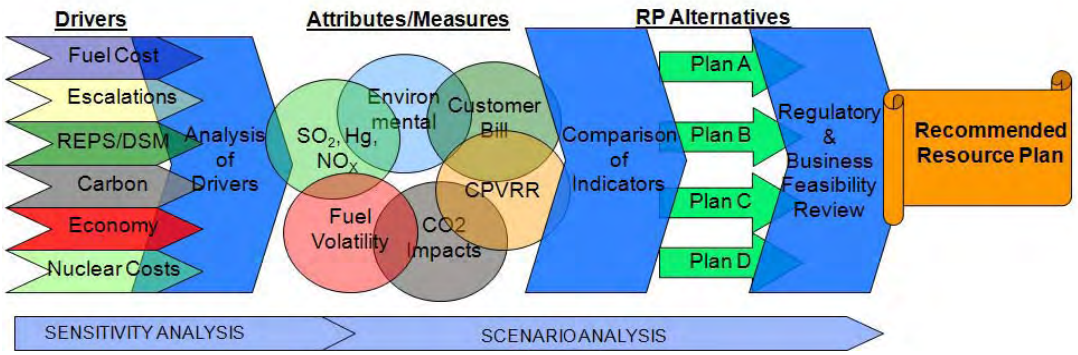
5. Create action plan

- Create action plan comprised of clear choices within the efficient frontier that require commitment within the next five years
- Establish implementation milestones

Issues for the Sixth Pacific Northwest Power and Conservation Plan (2007)
The Fifth Northwest Electric Power and Conservation Plan (2005)

Progress Energy Carolinas

- Process Overview
  - Conducted in two main steps as summarized in the figure to the right
- Sensitivity Analysis
  - Identified which uncertainties and emerging issues could significantly alter the direction that would be required by a resource plan

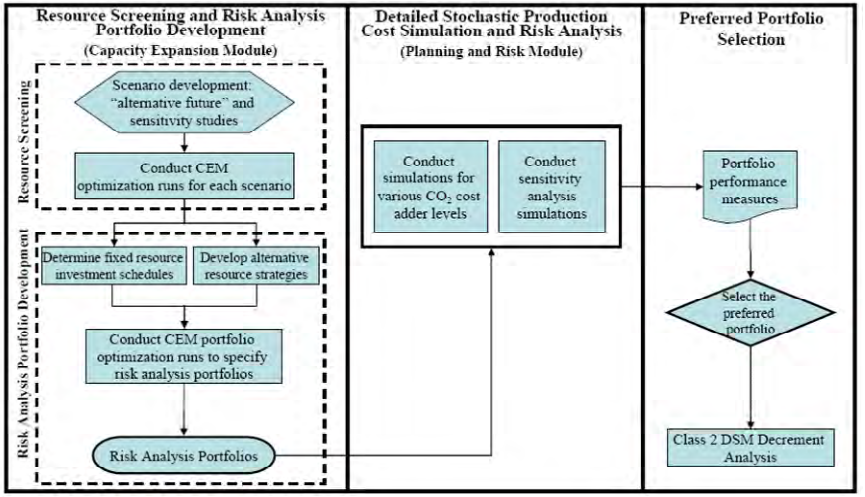


  - Selection of based on the expertise of numerous individuals throughout PEC's organization
  - Conducted sensitivity runs to identify key drivers and the significant variations of the plans that the drivers create
- Scenario Analysis
  - Contemplated and developed future states that bound the potential outcomes of the key drivers such as load, energy, escalations, nuclear capital costs, fuel costs, and carbon costs
  - Tested the alternative plans that are developed in the sensitivity analysis in each scenario
    - Scenarios reflect multiple uncertainties moving in concert instead of changing a single variable at a time as was done in the sensitivity analysis.
  - Determined how each of the plans fare in each scenario and in aggregate to all scenarios
  - Ranked each plan in each scenario using key attributes in the categories of customer cost and environmental
  - Selected the "robust" plan that, on average, ranked highest across all scenarios

Progress Energy Carolinas Integrated Resource Plan (2008)

PacifiCorp

- Process
  - Consisted of three phases: (1) resource screening, (2) risk analysis portfolio development, and (3) detailed probabilistic (stochastic) production cost simulation and resource risk analysis
    - A high-level summary is shown in the figure to the right
- Resource screening
  - Defined 16 alternative future scenarios and associated sensitivity studies
    - Scenarios contained variables intended to favor or weaken the performance of differing resource options

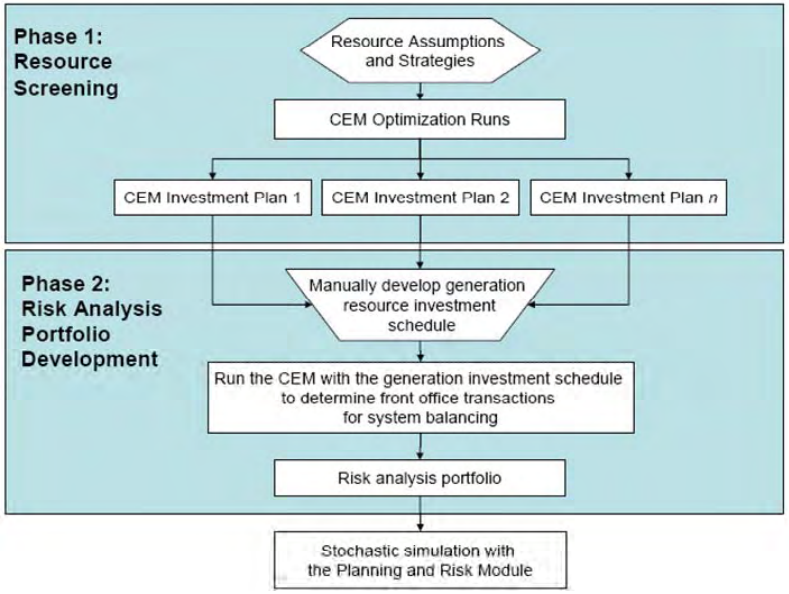


  - Tested wide variations in potential CO2 regulatory costs, natural gas prices, wholesale electricity prices, retail load growth, scope of renewable portfolio standards through scenarios, availability of renewable production tax credits, and the level of achievable market potential for load control and demand-response programs
  - Executed model runs (CEM) for each scenario and sensitivity to created an optimized investment plan and present value of revenue requirements
    - Results become the input to risk analysis portfolio development
- Risk Analysis Portfolio Development
  - Tested outputs from model runs to stochastic production cost simulation
  - Used CEM to build fixed resource investment schedules for wind and distributed resources, and to optimize the selection of other resource options according to specific resource strategies

PacifiCorp Integrated Resource Plan (2007)

PacifiCorp (Cont'd)

- Risk Analysis Portfolio Development (Cont'd)
  - Developed alternative resource strategies to evaluate 1) impacts of incremental resource changes, and 2) specific resource investment policy
  - Optimized against the alternative resource strategies using CEM
  - Selected (manually) the resource investment schedule based on observations across the set of CEM runs. A resource that is routinely selected or chosen for a certain year indicates a robust resource under the set of simulated resource strategies
  - Summary of risk analysis portfolio development in shown in the figure to the right



- Stochastic Simulation of Risk Analysis Portfolios
  - Simulated risk analysis portfolios in PaR to assess stochastic risk in production cost estimates by using Monte Carlo random sampling of five stochastic variables: loads, commodity natural gas prices, wholesale power prices, hydro energy availability, and thermal unit availability
  - Devoted considerable effort to model the effect of CO2 emission compliance strategies. All risk analysis portfolios were simulated with five CO2 adder levels—$0/ton, $8/ton, $15/ton, $38/ton, and $61/ton (in 2008 dollars)—and associated forward gas/electricity price forecasts.
    - Modeled both a cap-and-trade and emissions tax compliance strategy, and expanded its reporting of CO2 emissions impacts
  - The preferred portfolio is selected from among the risk analysis portfolios primarily on the basis of relative cost-effectiveness, customer rate impact, and cost/risk balance across the CO2 adder levels

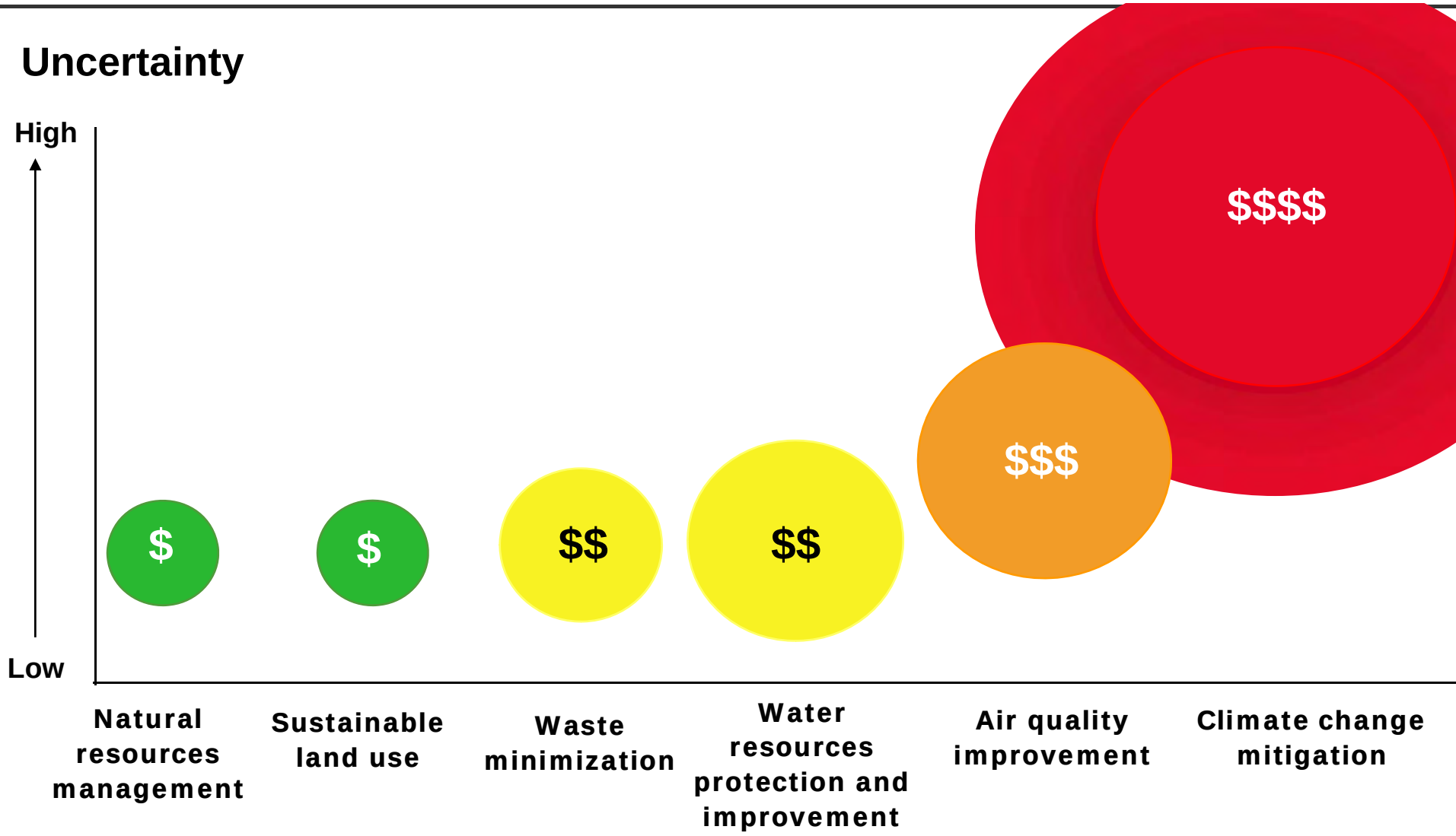
PacifiCorp Integrated Resource Plan (2007)

MCKENZIE STUDY

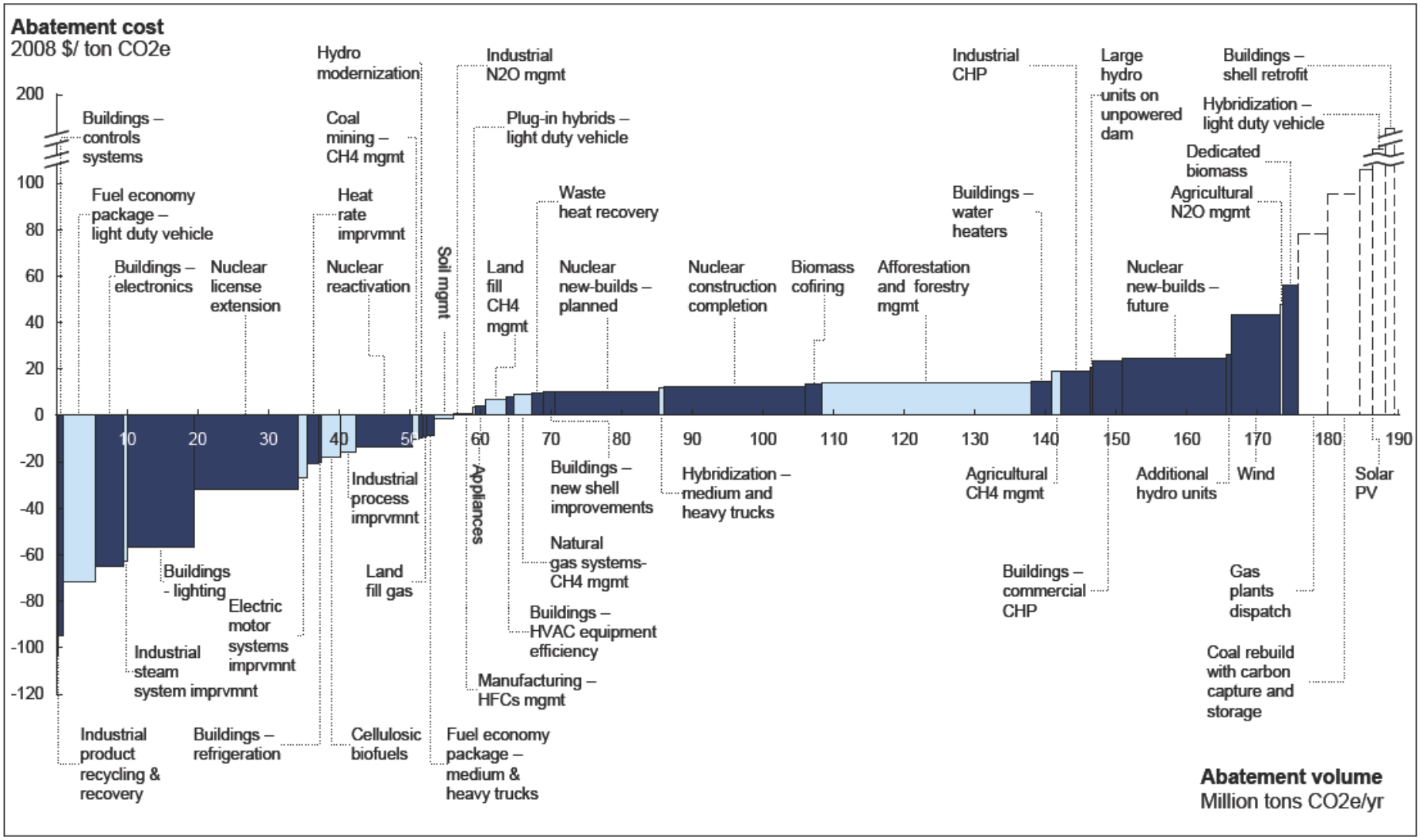
McKenzie Study Objectives

- TVA worked with McKenzie Consulting for developing its 2008 Corporate Environmental Policy
- Strategic Objectives and Critical Success Factors were developed for six key areas:
  - Climate Change
  - Air Quality Improvement
  - Water Resources Improvement
  - Waste Minimization
  - Sustainable Land Use
  - Natural Resource Management
- Of particular emphasis was carbon dioxide abatement opportunities both in the Valley and for TVA

Environmental Areas: Uncertainty



Abatement Opportunities



Opportunities TVA could exercise or influence under $60 ton of CO2

Results from public input on draft Environmental Policy

- **What We Heard**
- More emphasis on a renewable and cleaner energy portfolio
- Increase use of emissions controls and technologies
- Reduce thermal impacts and water consumption
- Reduce TVA's waste footprint
- Increase eco-friendly recreation on TVA lands
- Develop a policy for mineral rights

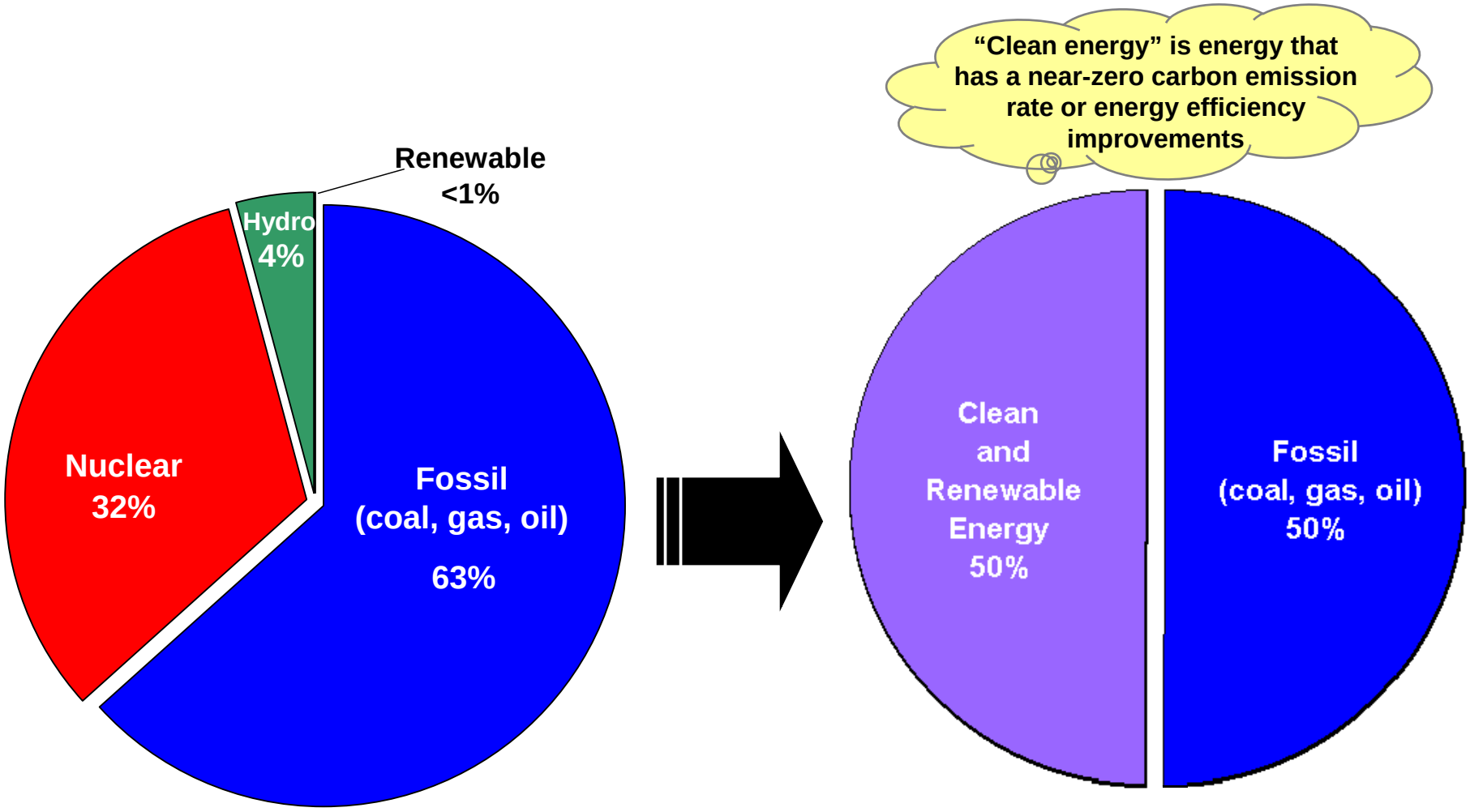
Results from public input on draft Environmental Policy

- **What We Had**
- Tight integration of TVA's three-fold mission
- The scope of the policy – six areas constant
- Commitment to energy efficiency and demand response
- Commitment to a cleaner generation portfolio
- Importance of collaborative partnerships and public education

Current Renewable Energy Portfolio

Source	Capacity (MW)	Energy (MWh)
Generation Partners Wind	0.04	10.6
Generation Partners Solar	0.35	282
TVA Solar	0.30	329
TVA Wind	2.00	1,811
Middlepoint Landfill Gas PPA	2.70	5,698
Biomass Cofiring at Colbert Fossil Plant	7.00	2,358
Digester Gas (Methane) at Allen Fossil Plant	8.00	34,418
Wind PPA with Invenergy	27.0	50,947
TVA Conventional Hydro	3,786	7,414,000
TOTAL	3,833	7,509,853
Value in GWh		**7,510**
Share of TVA's TOTAL (2008)	12%	4%

TVA Generation Mix



Today, over 35% of TVA's generation comes from non- or low-emitting sources

TVA's Goal is to have over 50% of generation from clean technologies by 2020

Fiscal Year 2008

Integrated Resource Plan

TVA'S ENVIRONMENTAL AND ENERGY FUTURE

Performance Measures - Integrated Mission Framework

Affordable, Reliable Energy:

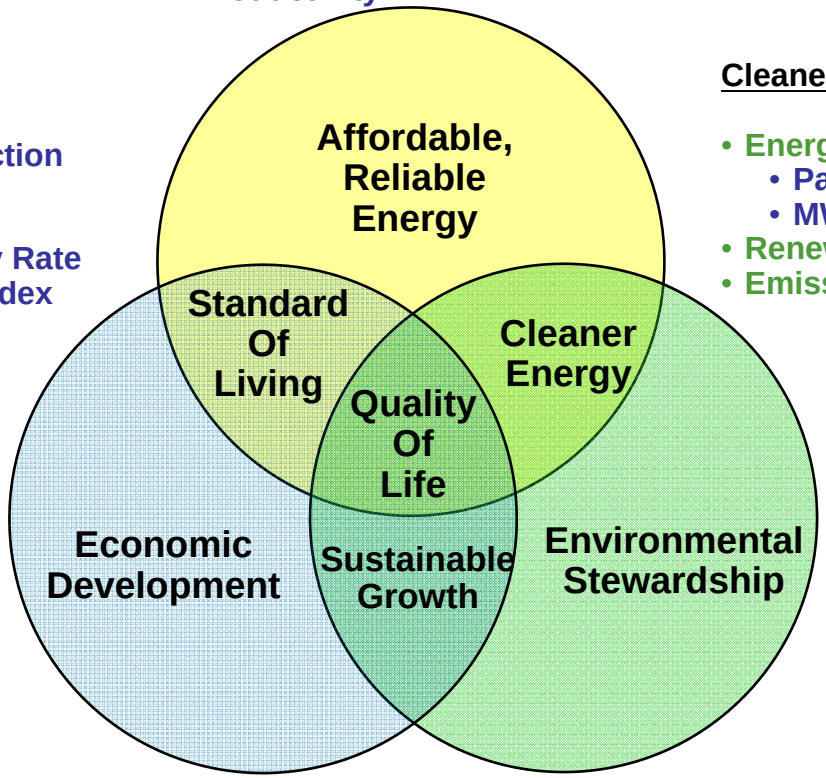
- Connection Point Interruptions
- Equivalent Availability Generation Assets
- Productivity

Standard of Living:

- Customer Satisfaction
- TFO/Asset Value
- Quality of Jobs
- Recordable Injury Rate
- Cultural Health Index

Cleaner Energy:

- Energy Efficiency Targets:
  - Participation in DSM Initiatives
  - MW Reduction
- Renewables Targets
- Emission Rates (CO_2, SO_2, NO_X, Hg)



Economic Development:

- Economic Development Index
- Jobs Created and Retained
- Environment Footprint of Recruited Industries

Environmental Stewardship:

- Environmental Performance
- Stream Miles Improvement
- Waste Reduction
- Recreational Use
- Land Meeting Desired Uses

Sustainable Growth:

- Average Retail Price of Power

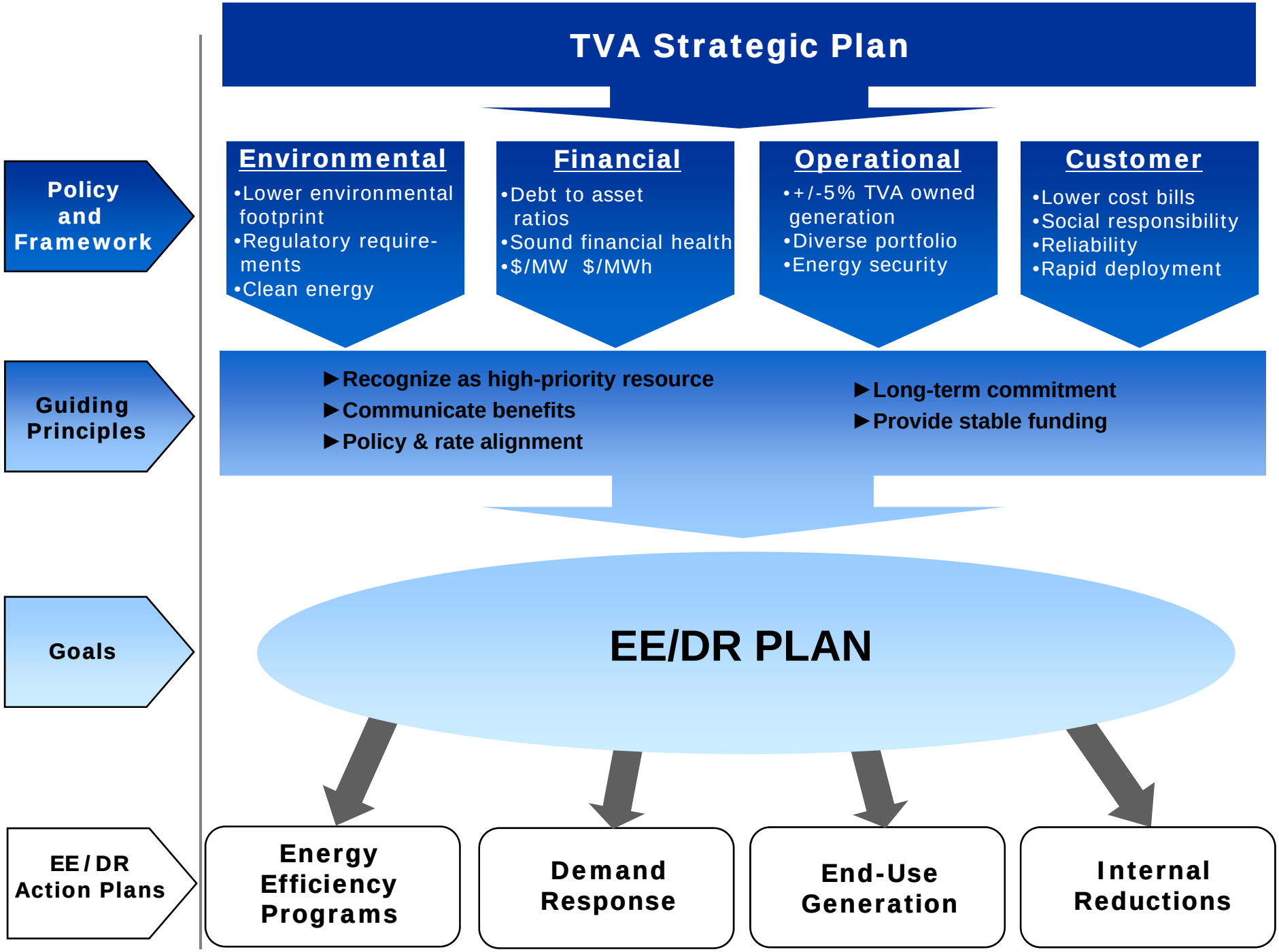
TVA level Metrics

Environmental Metrics

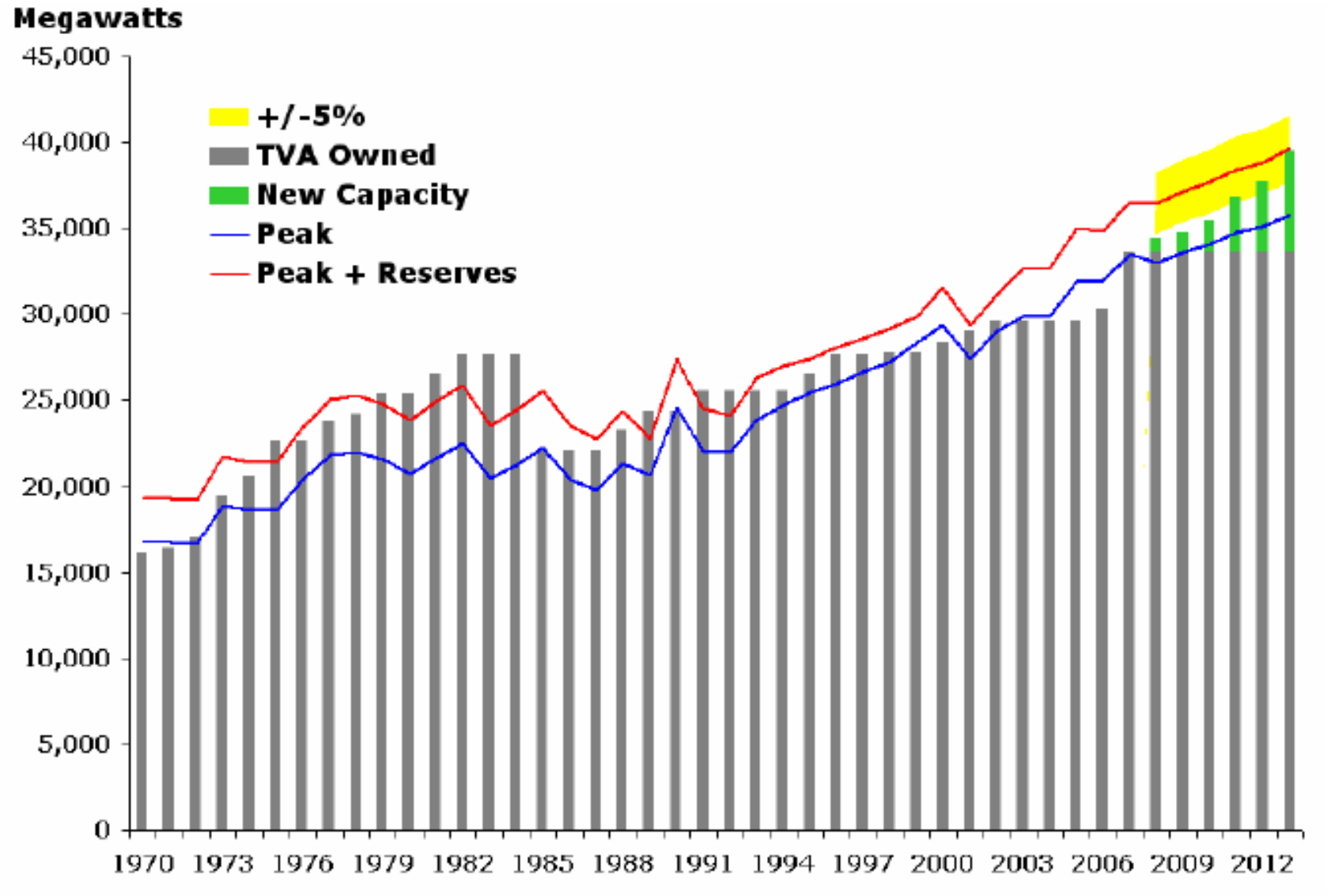
PA CONSULTING STUDY

Energy Efficiency/Demand Response Plans

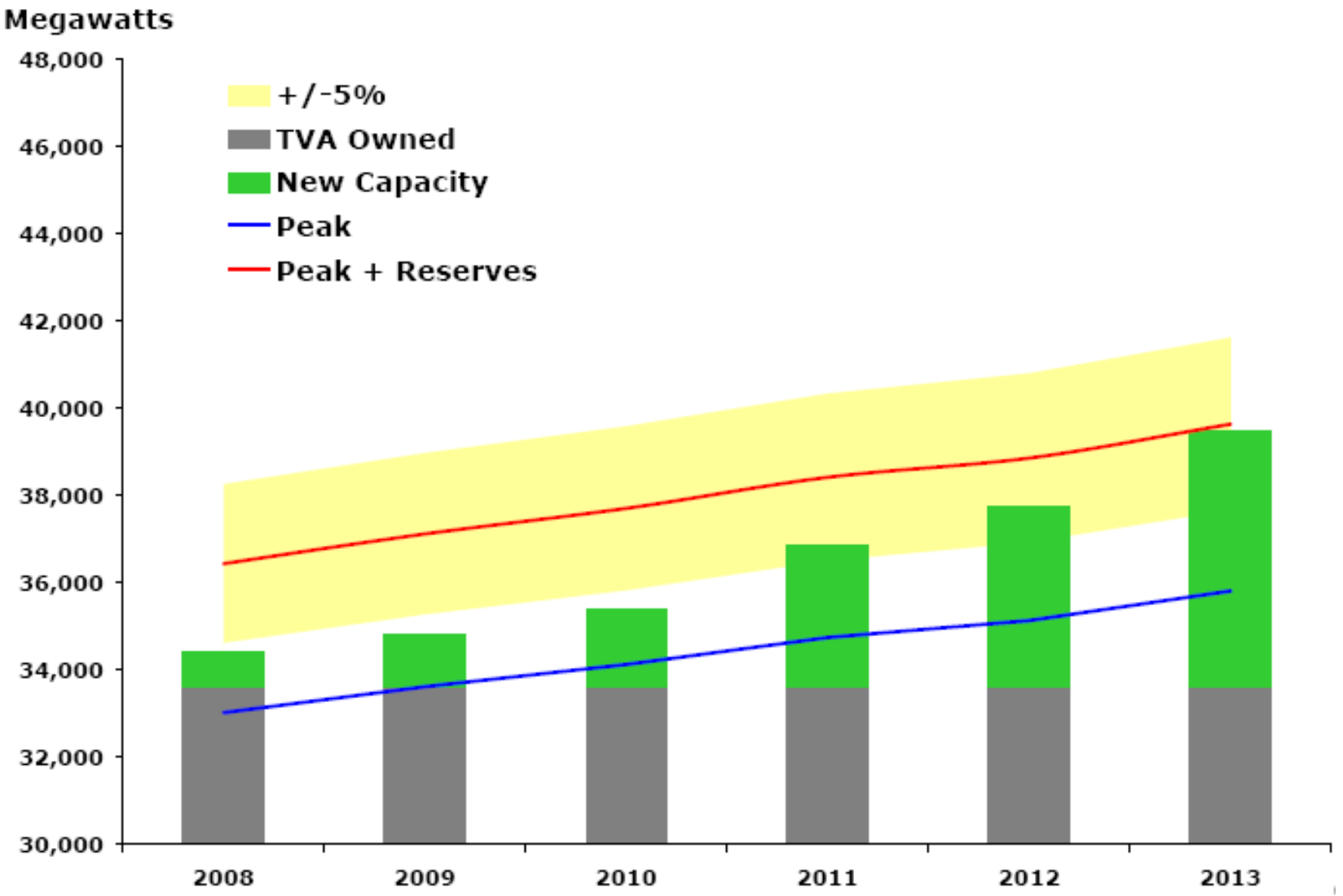
- "In partnership with others, TVA will strive to be a leader in energy-efficiency improvements and peak demand reduction over the next five years." (TVA Strategic Plan)
- Study completed with PA Consulting Group in 2008 for load characterization/situation analysis to meet the EE/DR goals
- How does TVA accomplish 1,400 MW reduction?


TVA Strategic Plan
Policy and Framework
Environmental
•Lower environmental footprint
•Regulatory require-ments
•Clean energy
Financial
•Debt to asset ratios
•Sound financial health
•$/MW $/MWh
Operational
•+/-5% TVA owned generation
•Diverse portfolio
•Energy security
Customer
•Lower cost bills
•Social responsibility
•Reliability
•Rapid deployment
Guiding Principles
►Recognize as high-priority resource
►Communicate benefits
►Policy & rate alignment
►Long-term commitment
►Provide stable funding
Goals
EE/DR PLAN
EE/DR Action Plans
Energy Efficiency Programs
Demand Response
End-Use Generation
Internal Reductions

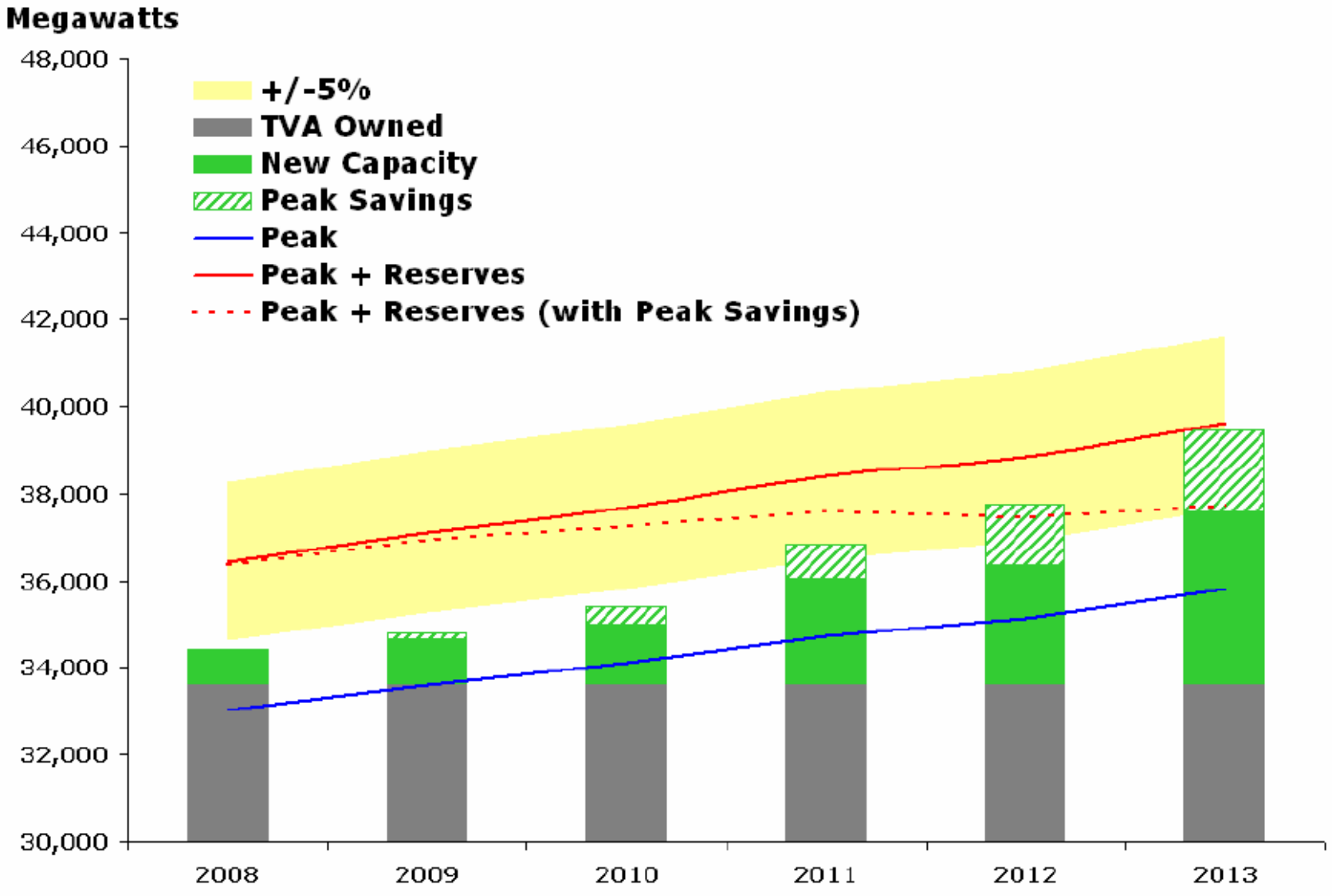
Projected Peak Demand Growth



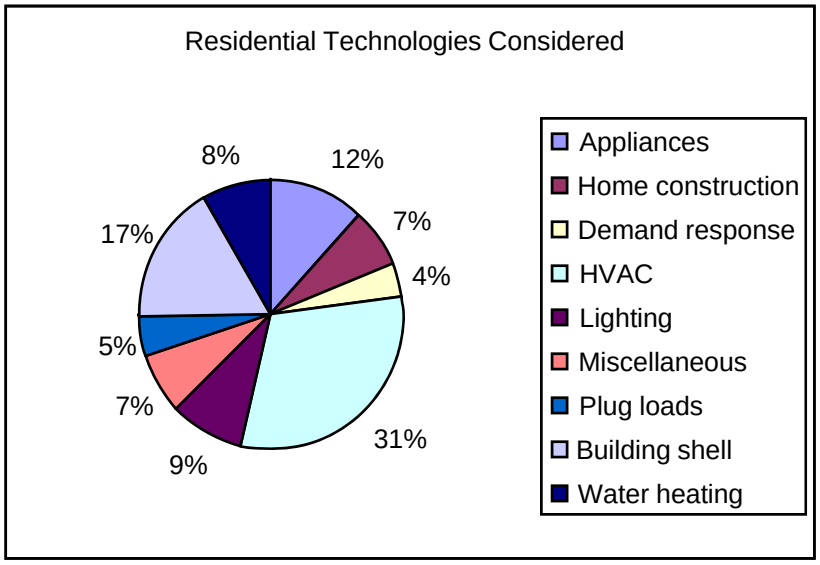
Projected Peak Demand Growth



Projected Peak Demand Growth

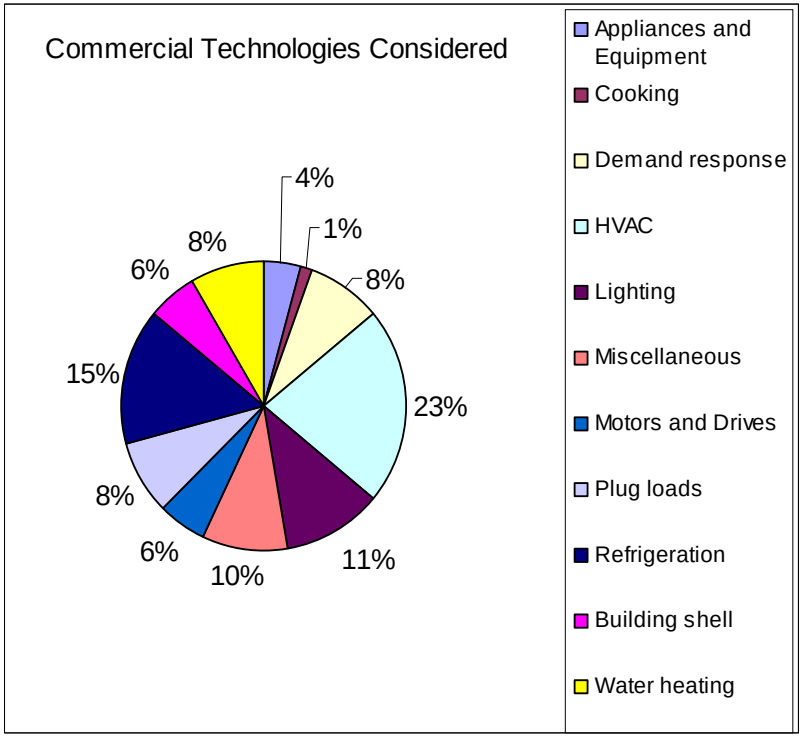


DSM Technologies Considered



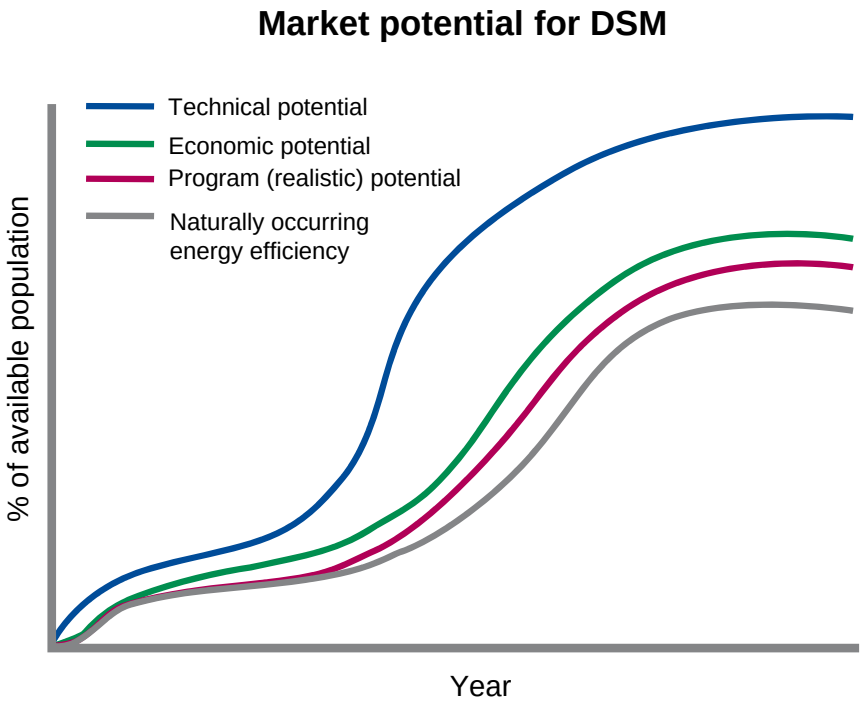
109 DSM technologies were considered for application in homes, as shown above

66 DSM technologies were considered for application in commercial, institutional, or industrial buildings, as shown below

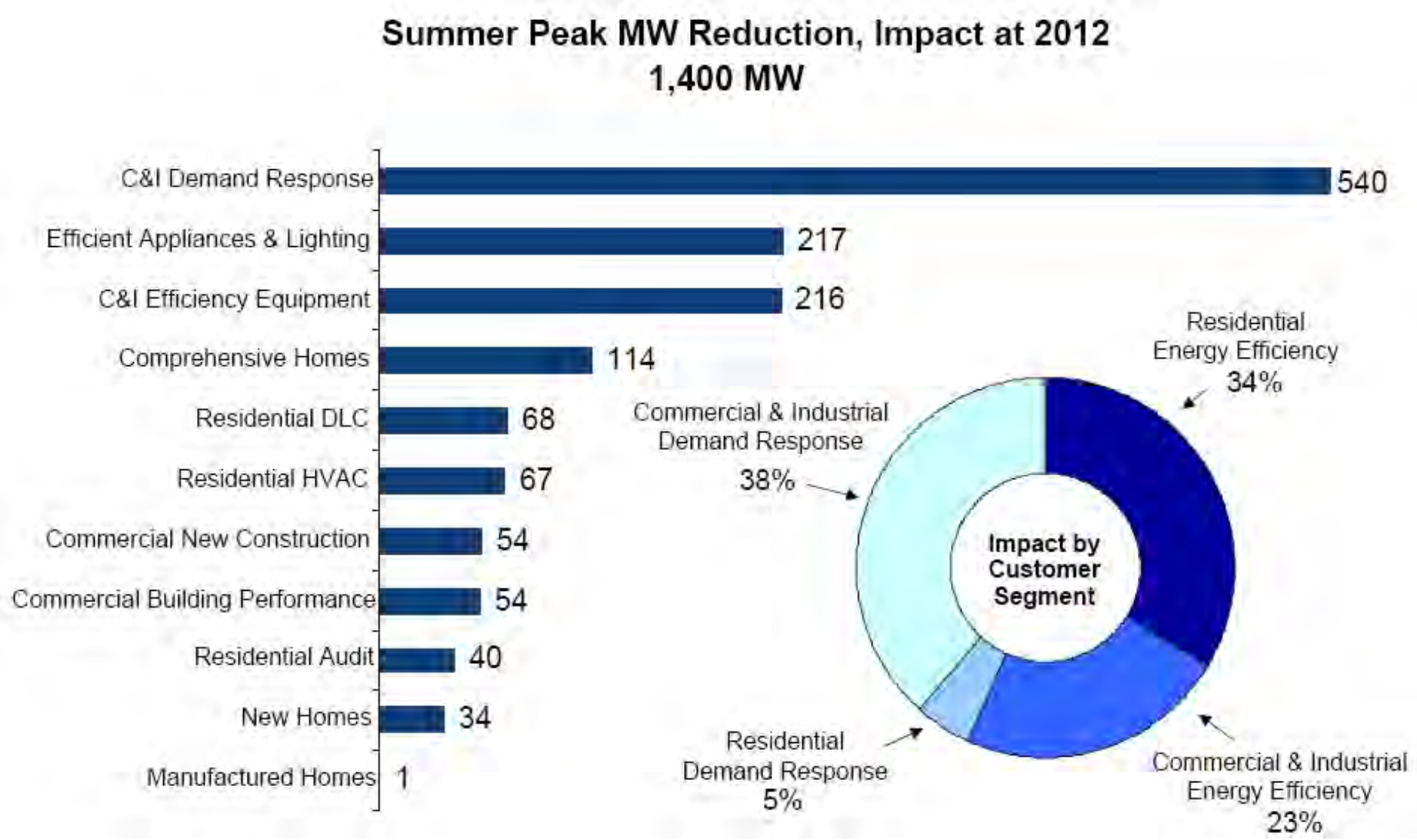


TVA Potential for Energy Efficiency

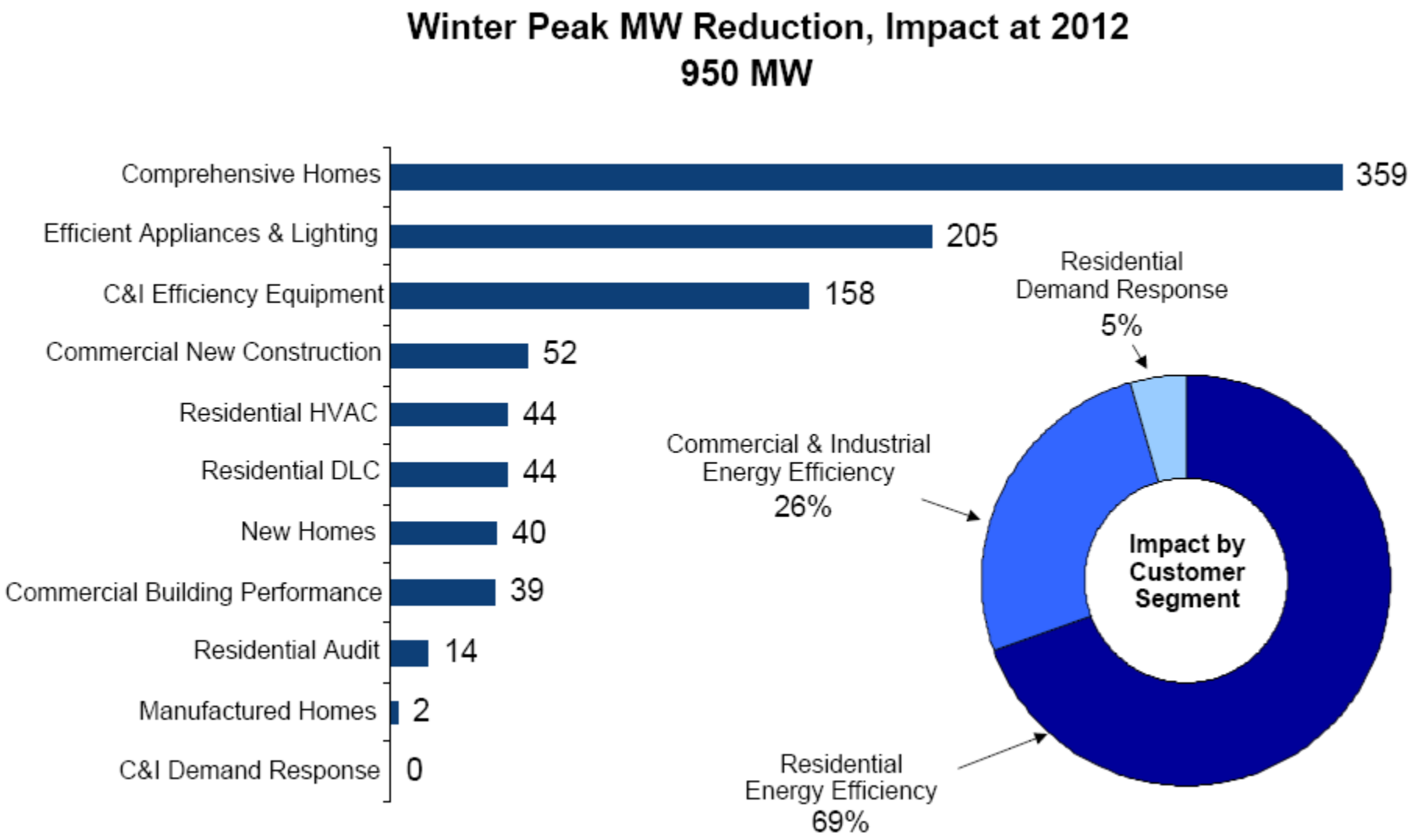
- **Technical potential – the maximum penetration of a technology. This is considered unachievable and represents the upper limit of penetration.**
- **Economic potential – the penetration of a technology in the marketplace based on purely economic criteria (for the customer) with current pricing and energy savings estimates applied.**
- **Program (realistic) potential – the penetration of a technology assumed to be applicable for new promotional programs for a technology, tempered by technical and economic and participation estimates.**
- **Naturally occurring DSM – the penetration of a technology as it is occurring currently, with regular market forces working.**



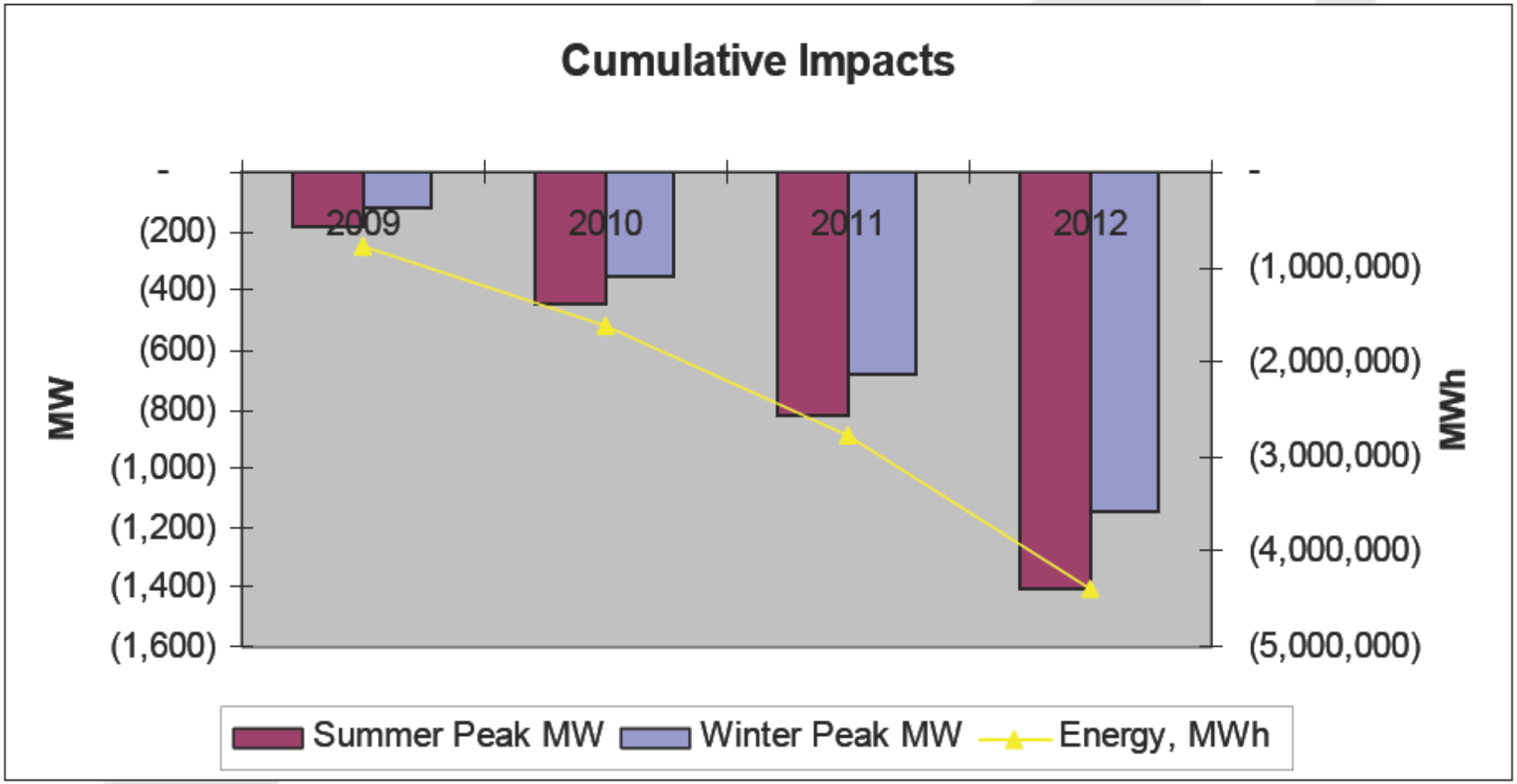
Summer Peak Demand Impacts (Megawatts)



Winter Peak Demand Impacts (Megawatts)



Potential Program Impacts through 2012



Comments on EE/DR Plan

- **Customer input**
  - Ready to see TVA return to a leadership position in energy efficiency
  - TVA should help distributors communicate with their customers effectively
  - Have concerns regarding the effect on operations
  - Programs must be consistent and sustainable
  - Industrial customers concerned about cross-subsidies

Comments on EE/DR Plan

- **Public input**
  - Want TVA and distributors to do more
  - Need incentives to afford efficiency improvements
  - Want continued support of end-use generation options
  - Need education and awareness
- **Employee input**
  - Excited TVA is moving back towards energy efficiency

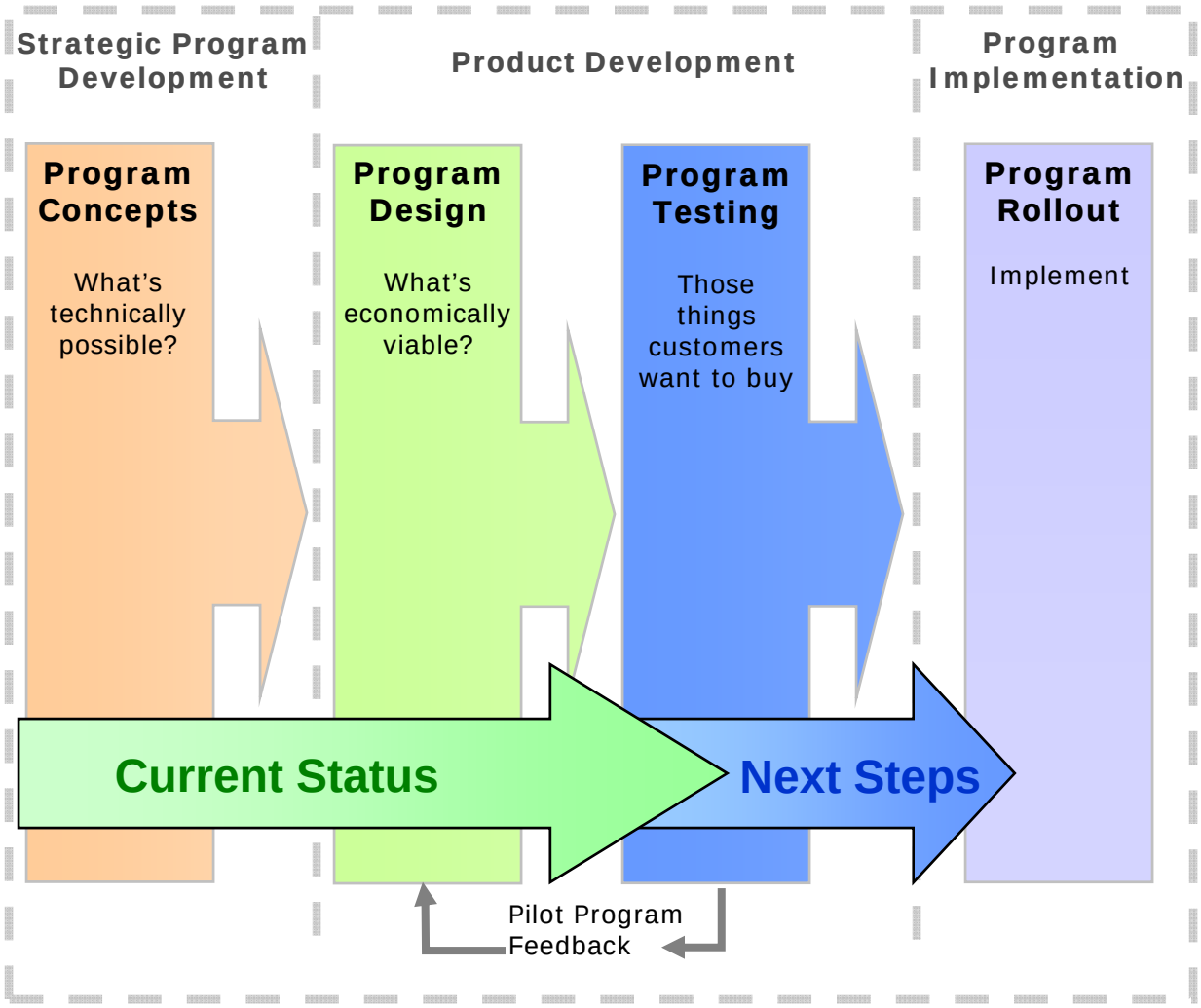
Status of EE/DR Plan Development

Completed

- Technical feasibility
- Program concepts

Next Steps

- Refining value proposition
- Testing ideas
- Developing pilots
- Implementing pilots



EPRI CLIMATE STUDY – LITERATURE REVIEW

EPRI Climate Study

- TVA has contracted with EPRI to conduct a literature review of the impacts of climate change on the TVA region
- EPRI collaborating with Industrial Economics, Inc., and independent experts to conduct review
- Review focusing on:
  - Water Resources
  - Agriculture
  - Forest Resources
  - "Unmanaged" Ecosystems
  - Recreation
  - Air Quality

EPRI Climate Study

- A1B scenario from IPCC 2007 Fourth Assessment Review used as reference case for projections
- Where possible, impact projections made for short term (~2020 - 2030) and long term (late century)
- TVA has reviewed draft report; final report expected late August - September

RESOURCE PLANNING AND SCENARIO DEVELOPMENT

The Resource Planning Process

- Questions to be Considered:

How much energy will our customers use in the future?

Will we be able to meet the projected energy use?

Are additional resources needed?

What alternatives do we have to meet our resource needs?

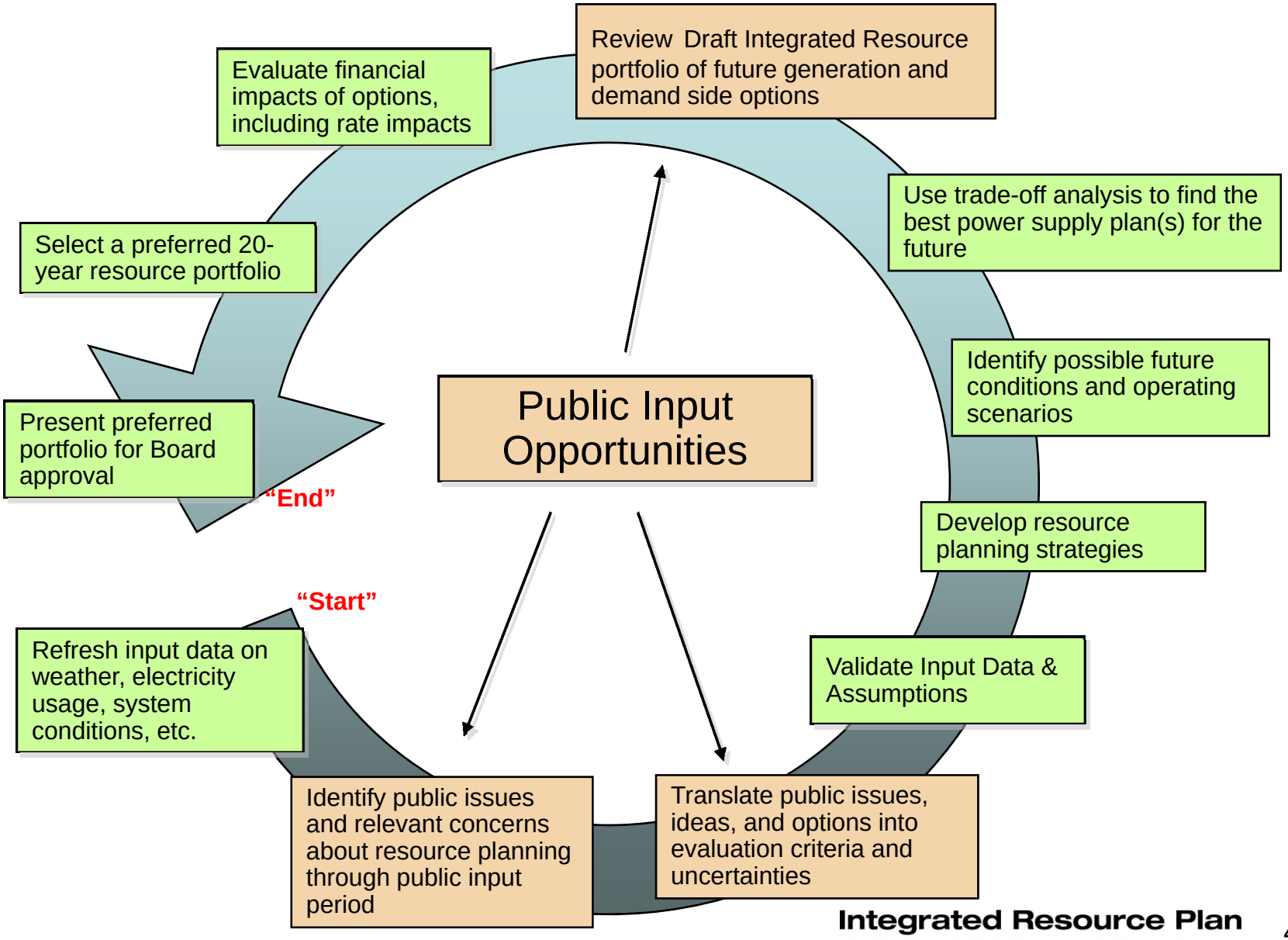
Are there strategic considerations that will limit the alternatives we can consider?

How do we properly evaluate all of these resource alternatives?

How do we find the best solution?

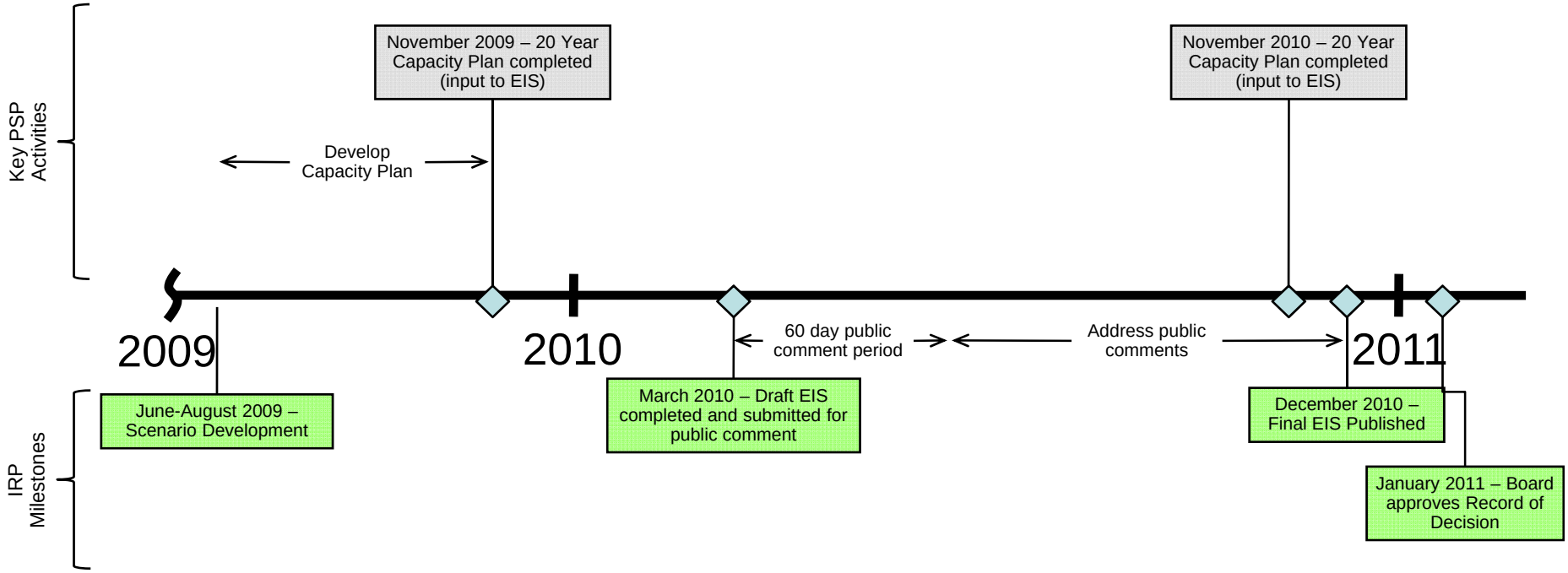
Which plan (portfolio) do we select?

TVA's 2011 Integrated Resource Planning Process

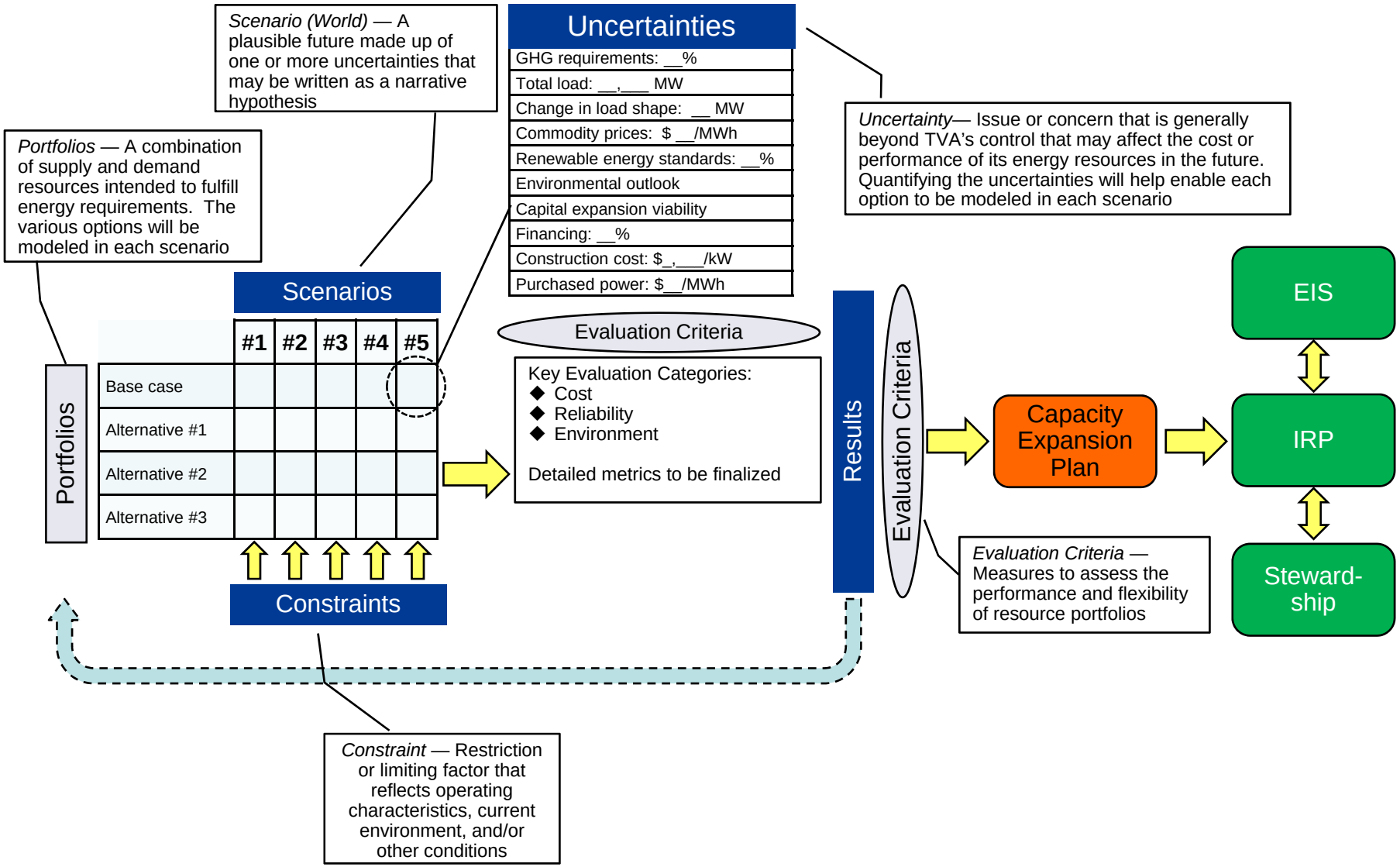


IRP and Power Supply Planning Milestones

- The approach for developing TVA's Integrated Resource Plan (IRP) is integrated into the existing Power Supply Planning (PSP) process
- The PSP high-level timeline and IRP milestones are shown below:



IRP World Scenario Construct



Scenarios Used by Other Utilities

- The tables below provide a brief summary of scenarios developed by other utilities

Duke Energy Carolinas

Two primary scenarios modeled:

- High carbon – Prices used based on Lieberman/Warner legislation (e.g., declining economy-wide GHG cap between 2012 and 2050 at a level 70% below 2005 emission levels)
- Low carbon – Prices used based on "safety-valve" approach contained in Bingaman/Specter legislation (e.g., gradually declining economy-wide GHG cap between 2012 and 2030 at 1990 emission levels)
- In each scenario, the following sensitivities were analyzed
  - Construction cost for nuclear plant
  - Fuel price variability – coal price (45% higher than base case and 25% lower); natural gas price (+/- 25% than base case)
  - Emission allowance price variability
  - Lower baseload in high carbon scenario to reflect likely possibility of "price-induced" conservation

FPL

Scenarios focused on fuel prices:

- Developed low, medium, and high price forecasts for
  - Oil
  - Natural gas
  - Solid fuel

Georgia Power

Nine different scenarios developed:

1. High economic growth
2. Low economic growth
3. High fuel price – fuel and electricity prices 20% higher than base case forecasts
4. Low fuel price – fuel and electricity prices 20% lower than base case forecasts
5. Extreme weather year –hottest summer in the past 15 years and coldest winter from the past 15 years
6. Mild weather year –summer weather from the coolest year and winter weather from the warmest year
7. Worst case – low economic growth, high prices, and mild weather
8. Best case – high economic growth, low prices, and extreme weather
9. Aggressive DSM implementation

PacfiCorp

16 different scenarios developed:

1. Business As Usual – no new regulatory requirements and medium load growth
2. Low cost coal
3. Low cost coal with low load growth
4. Low cost coal with high load growth
5. High cost coal
6. High cost coal with low load growth
7. High cost coal with high load growth
8. Favorable wind environment
9. Unfavorable wind environment
10. High DSM potential
11. Low DSM potential
12. Medium load growth
13. Low load growth
14. High load growth
15. Low cost portfolio bookend
16. High cost portfolio

Industry Context

Scenarios Used by Other Utilities (Cont'd)

PNM

27 different scenarios, which modeled different combinations of the following sensitivities:

- Load forecast
  - Low load forecast
  - Mid load with increasing load factor
  - Mid load forecast
  - Mid with decreasing load factor
  - High load forecast
- Natural gas price
  - Low natural gas price
  - Middle natural gas price
  - High natural gas price
  - $15 natural gas price
  - $20 natural gas price
  - $10 natural gas price @ 6% esc
- 2010 CO_2 cost
  - $8/metric ton
  - $20/metric ton
  - $40/metric ton
  - $53/metric ton
- Resource options
  - No new nuclear
  - New coal must have CCS
  - Retire 240 MW of SJ
  - New resources renewable or DSM

Progress Energy Carolinas

Six primary scenarios:

- Low Stress – carbon legislation not enacted/very minor, commodity markets reemerge and grow, low escalation rates, "renewable set asides" completed, low fuel prices
- CO_2 Moderate – legislation results in carbon tax and continues demand for nuclear
- CO_2 Aggressive (strict climate, high cost) – legislation results in significant carbon tax/cap, increased nuclear demand which drives up prices, energy/load reductions due to technology (e.g., "personal" renewables) and economic factors
- Current Trends – current world scenario including CO_2 tax "mid case"
- PHEV – "load profile flattens through valley fill from technology shift associated with PHEV and due to petrol prices"
- Load Cliff – significant loss of load through industrial customers and lessening load growth

Progress Energy Florida

Developed high and low plan sensitivities for :

- Load forecast
- Fuel forecast – price projections for natural gas
- Financial forecast – cost of capital and escalation rates

The Council

- The Council's plan does not follow a traditional scenario planning approach and uses modeling to create feasibility space

Implications for TVA:

- Definition of "scenario" varies by company – some utilities use "scenario" to describe sensitivity analysis while others use them to bound possible outcomes of uncertainties
- Many example scenarios are narrowly defined; TVA's scenarios may need to be broader due to longer timeline and level of public input required
- Typical considerations: high/low carbon, high/low load growth, and fuel price variability

Uncertainties in Other Utility IRPs

- The following table summarizes uncertainties used in other utility IRPs

Uncertainty	Duke Carolinas	FPL	Georgia Power	PacifiCorp	PNM	Progress Carolinas	Progress Florida	The Council (2005)	TVA EV 2020
Load Forecasts	X	X	X	X	X	X	X	X	X
GHG Regulation	X	X	X	X	X	X	X	X	X
Natural Gas Prices	X	X	X	X	X	X	X	X	X
Renewable Requirements	X	X			X				
Cost of Capital	X			X		X	X		
DSM/EE Effectiveness	X				X				X
Wholesale Prices			X	X				X	
Construction Cost	X		X			X			
Coal Prices	X		X			X			
Hydro Unit Availability			X					X	
Aluminum Price & Load								X	
"Green Tags"								X	
Renewable Prod Credits								X	
Nuclear Performance									X
Reg Approval of DSM					X				
PHEV						X			
Coal Plant Retirement					X				
Co-product Revenue									X
How Described in IRP	Areas of Uncertainty	Uncertainty	Sensitivities	Risk	Uncertainty and Risk	Drivers	Plan Sensitivities	Uncertainty	Uncertainty

Implications for TVA:

- Most common uncertainties are load forecast, GHG regulation, and gas prices
- "Emerging" uncertainties include coal plant retirements, PHEV, and DSM/EE

Industry Context

Review of Evaluation Criteria

- Three common evaluation criteria emerged from review of other utility IRPs
  - Customer rate impact / present value of revenue requirements
  - Environmental impact / emissions
  - Reliability / loss-of-load
- The Council used the following evaluation criteria
  - Net present value of total system cost
  - Risk
- Progress Energy Carolinas was the most transparent in their weighting of evaluation criteria and used the following normalized attributes
  - 70% "customer" composed of the following:
    - 40% Total cost
    - 30% Price growth
    - 30% System fuel price volatility
  - 30% "environmental" composed of the following:
    - 10% SO_2 emissions
    - 5% NO_X emissions
    - 70% CO_2 emissions
    - 15% mercury emissions

Implications for TVA:

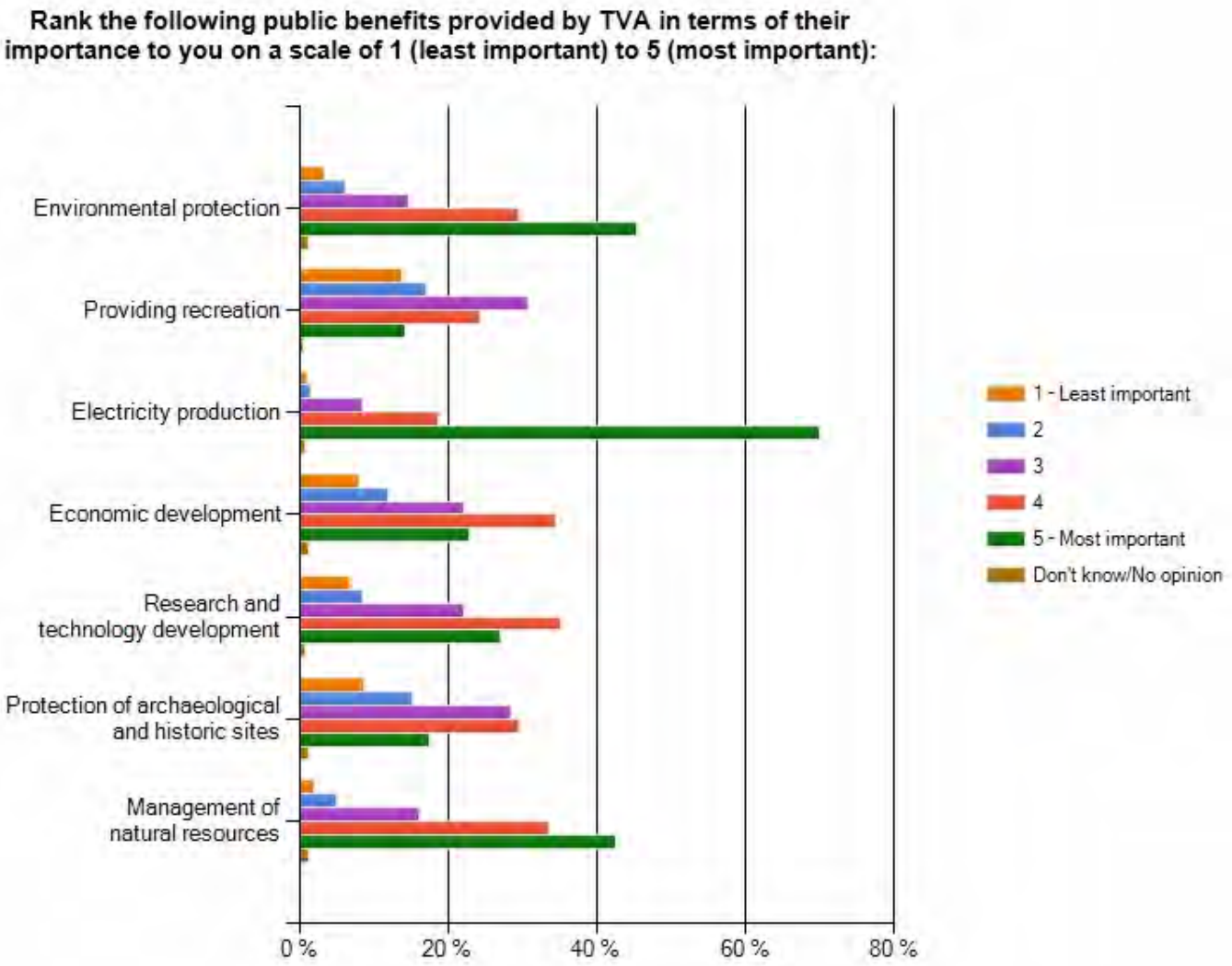
- All utilities reviewed included cost to the customer and reliability as an integral component to evaluating plans
- Approximately half of the sample also included carbon/greenhouse gas emissions and quantified risk as evaluation components

PUBLIC RESPONSE TO DATE

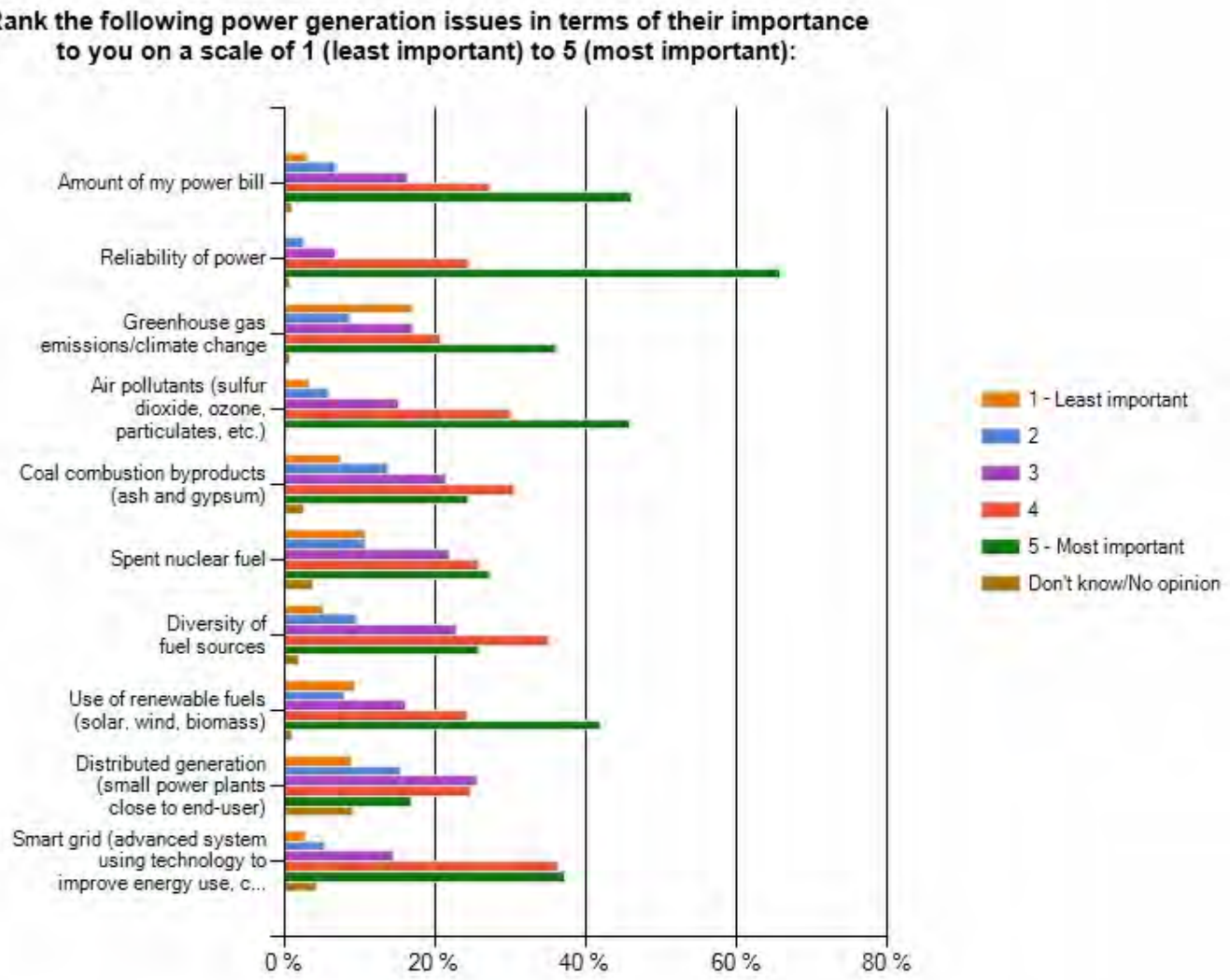
Questions for Public Consideration

- Rank importance (scale of 1 to 5) of the public benefits provided by TVA
- How often do you visit TVA reservoirs
- Rank importance (scale of 1 to 5) of various types of power generation and delivery options
- Rank importance (scale of 1 to 5) of TVA's responsibility in caring for natural and cultural resources on property under its control.
- Likelihood of participation in TVA programs to help consumers reduce their use of electricity? Likelihood of participation if there were financial incentives to help offset the programs costs?
- Additional amount (per month) willing to be paid for TVA to increase its proportion of power generation from sources that do not emit greenhouse gases
- Participation in Green Power Switch program
- What do you value most about TVA managed lands and reservoirs
- What is your biggest concern related to TVA's power system

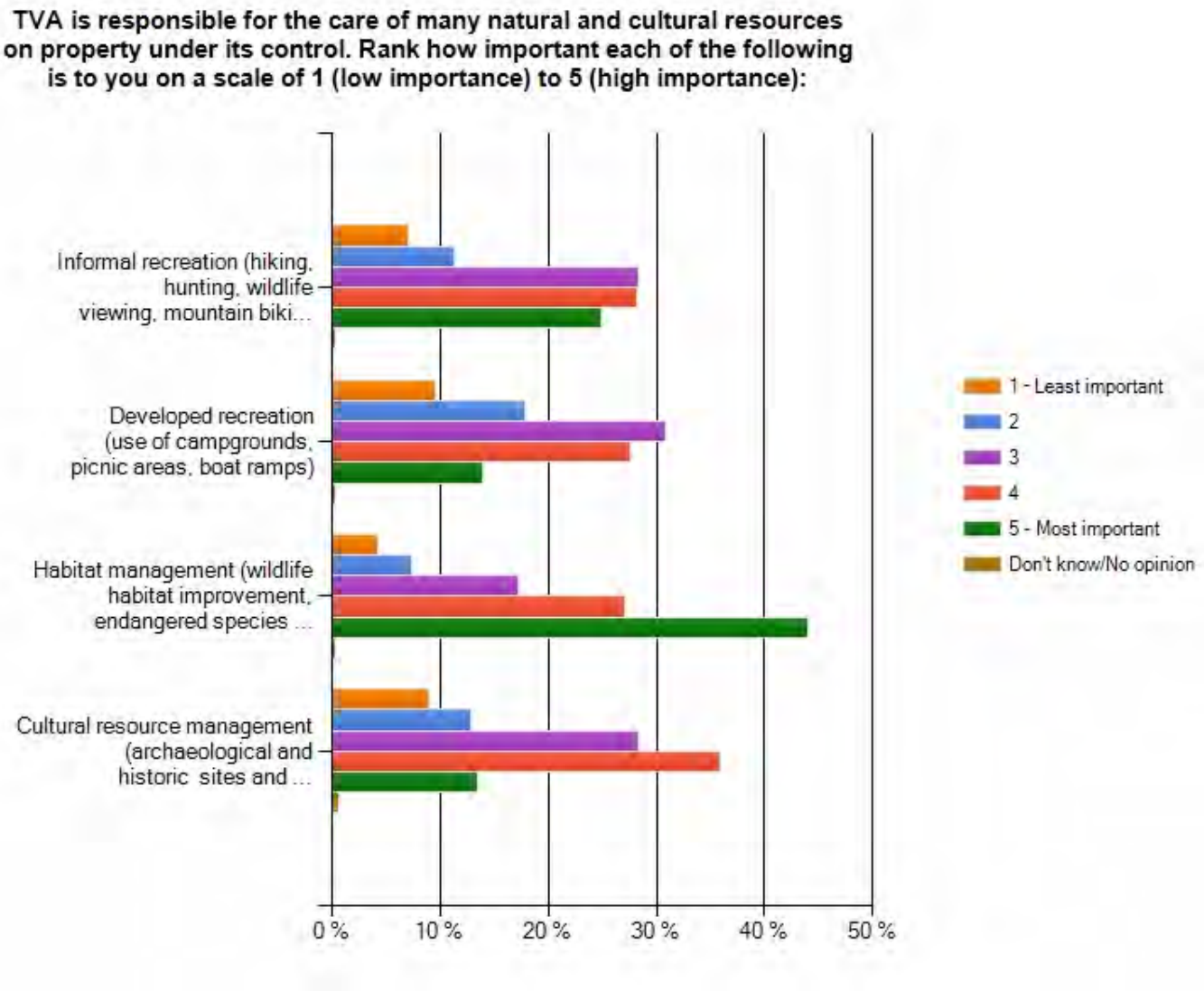
Summary of Scoping Questionnaire Responses – Comments to Date



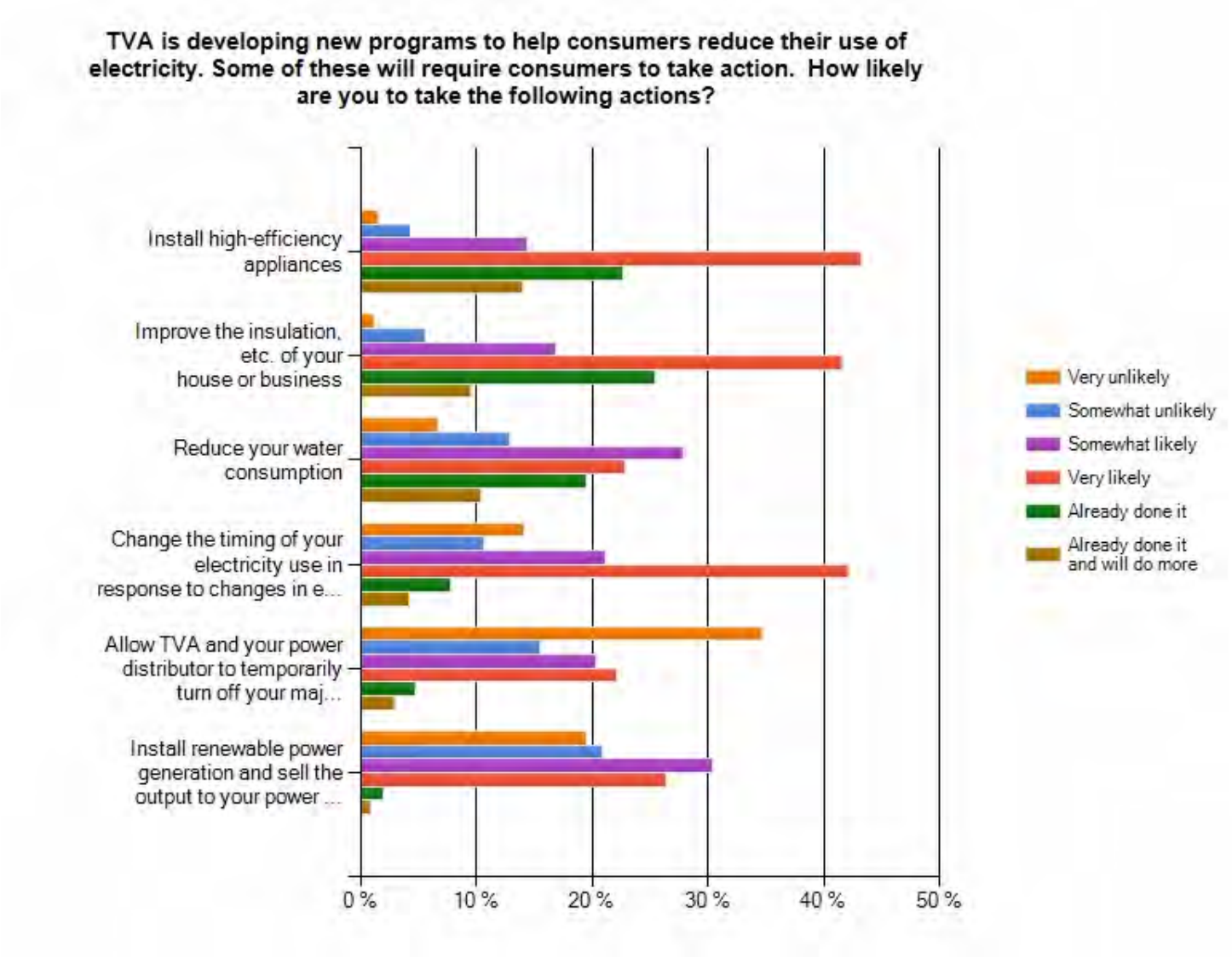
Summary of Scoping Questionnaire Responses



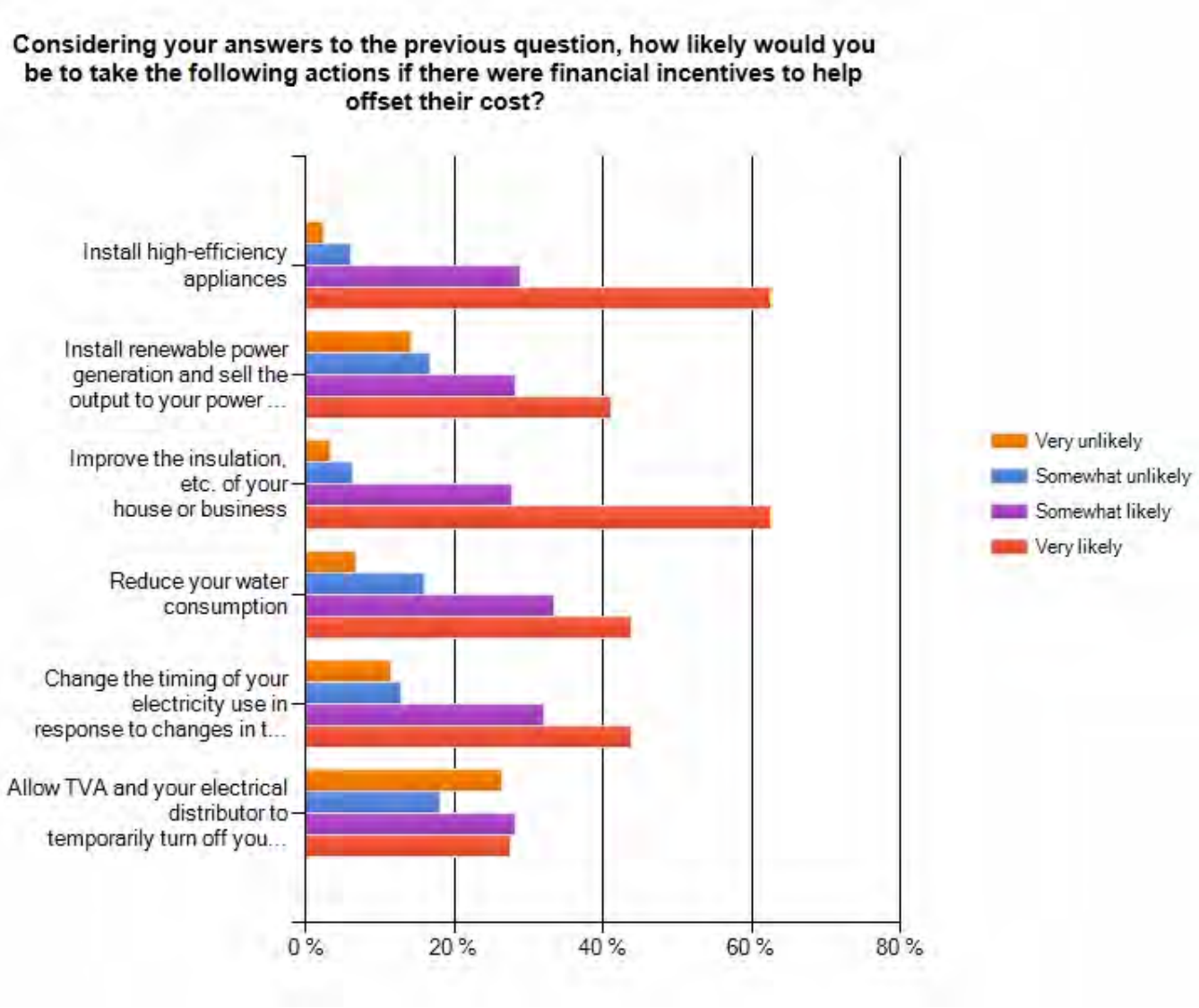
Summary of Scoping Questionnaire Responses



Summary of Scoping Questionnaire Responses



Summary of Scoping Questionnaire Responses



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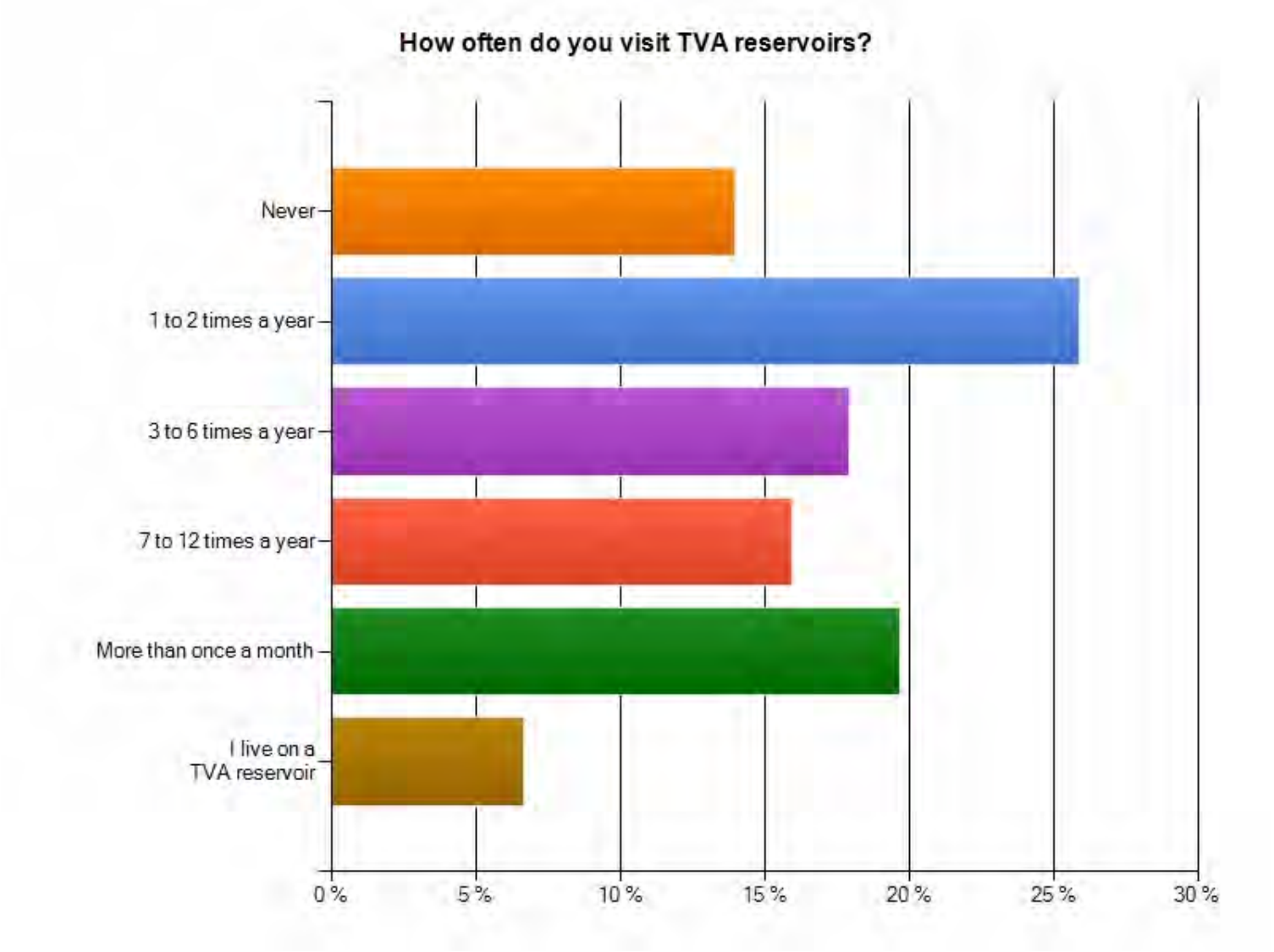

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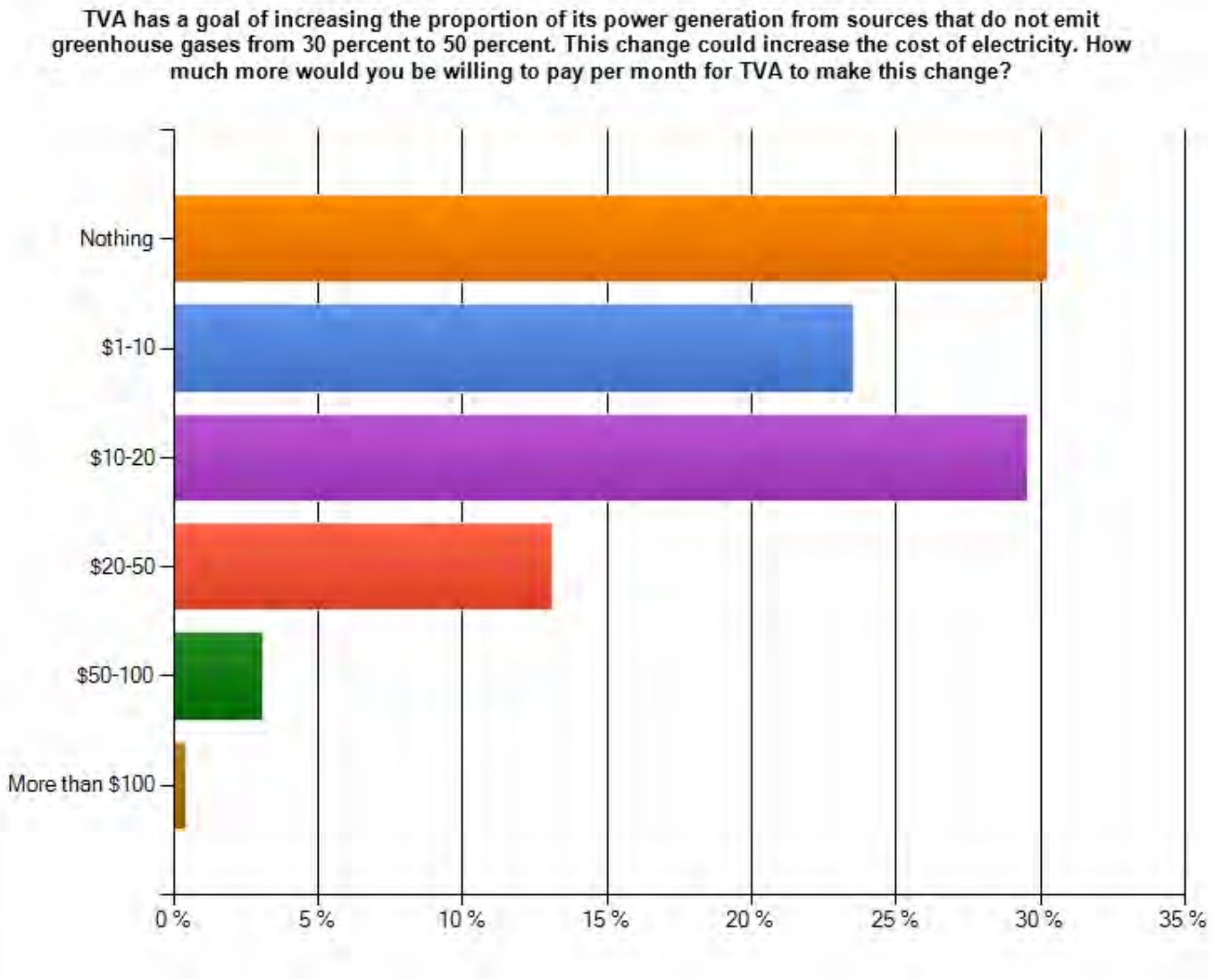

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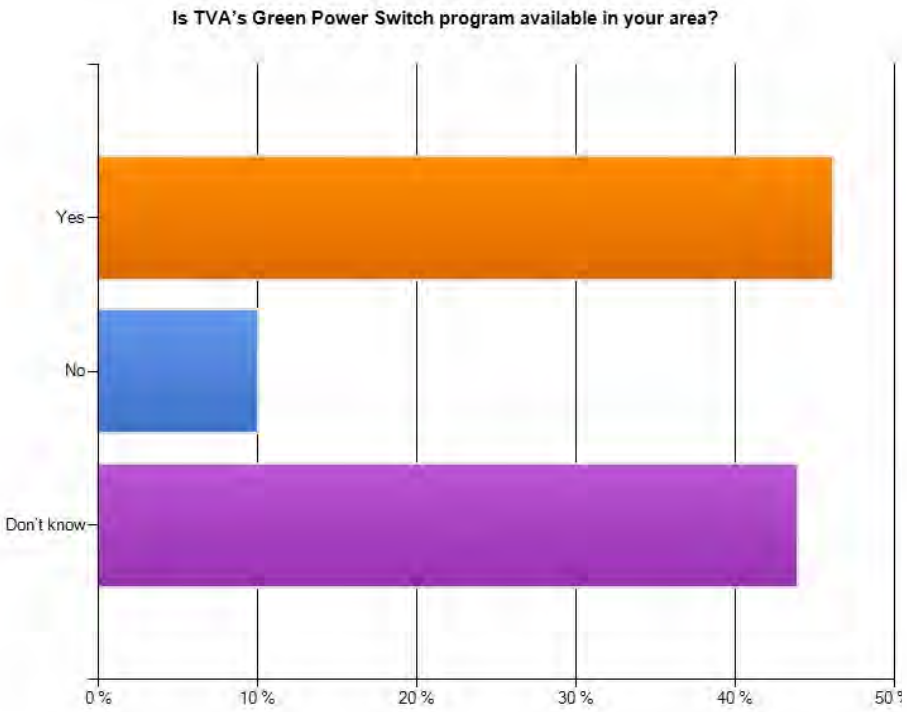
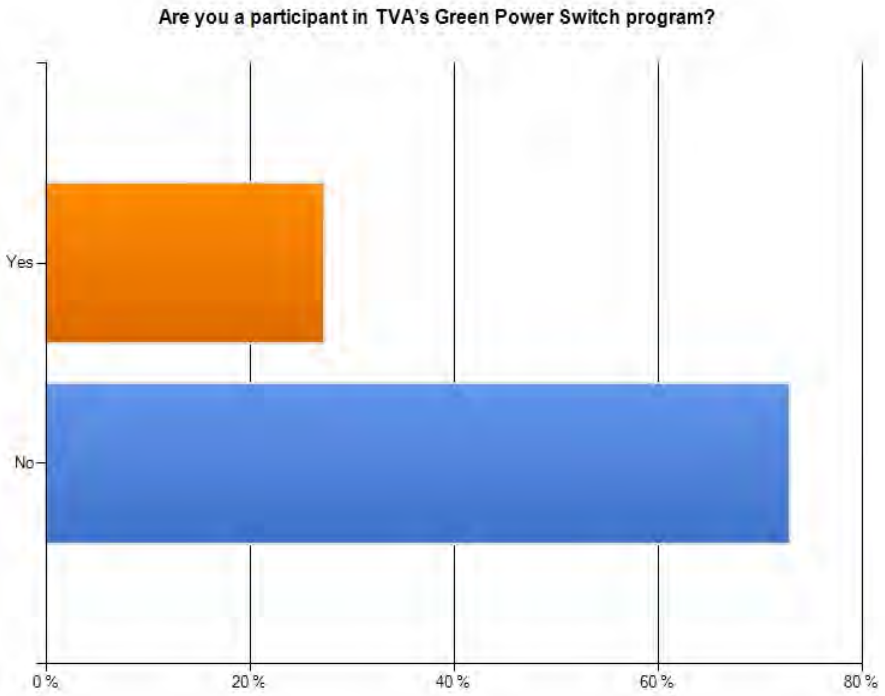




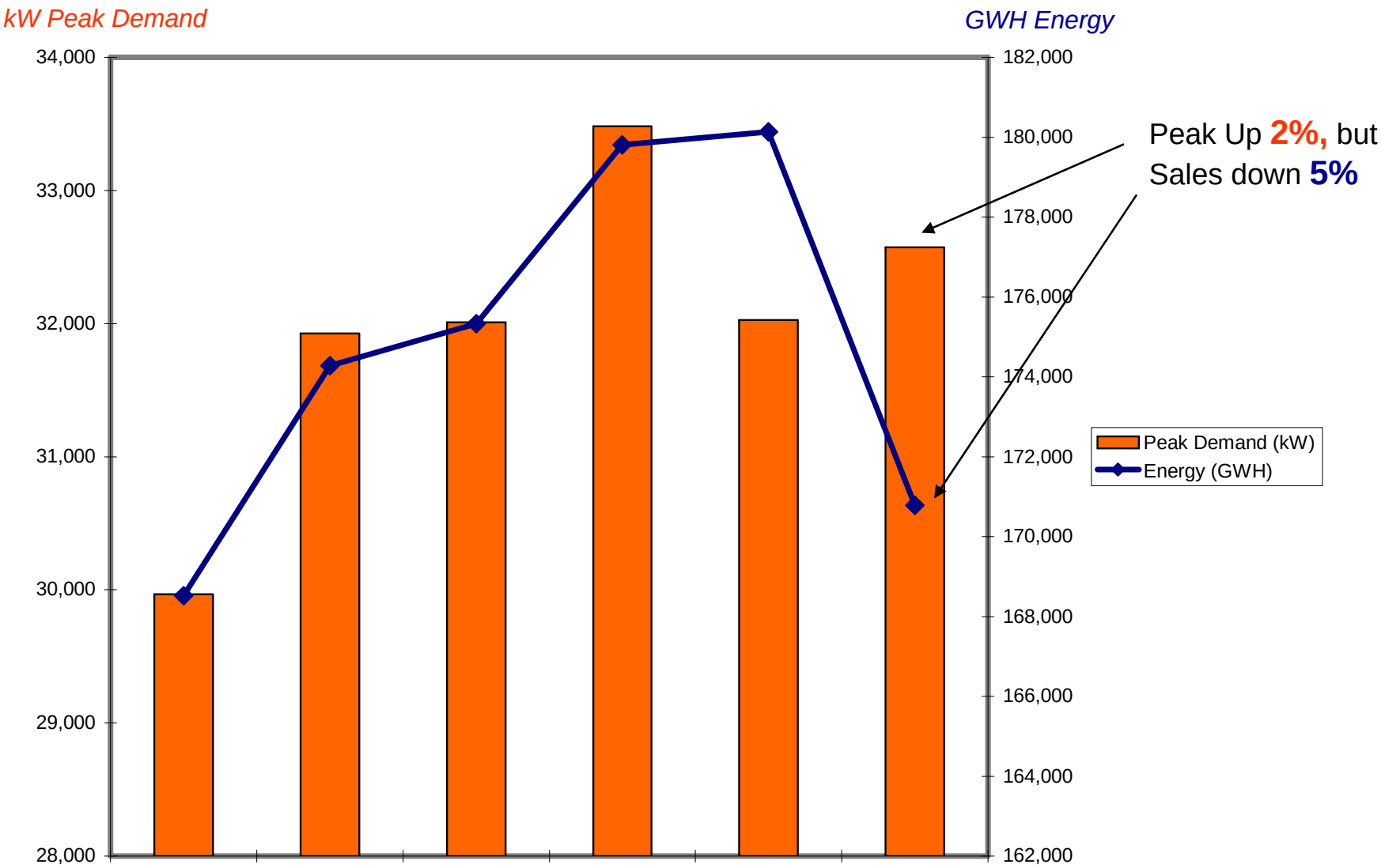
Summary of Scoping Questionnaire Responses

What is your biggest concern related to TVA's power system? The 20 most frequently mentioned concerns (370 responses):

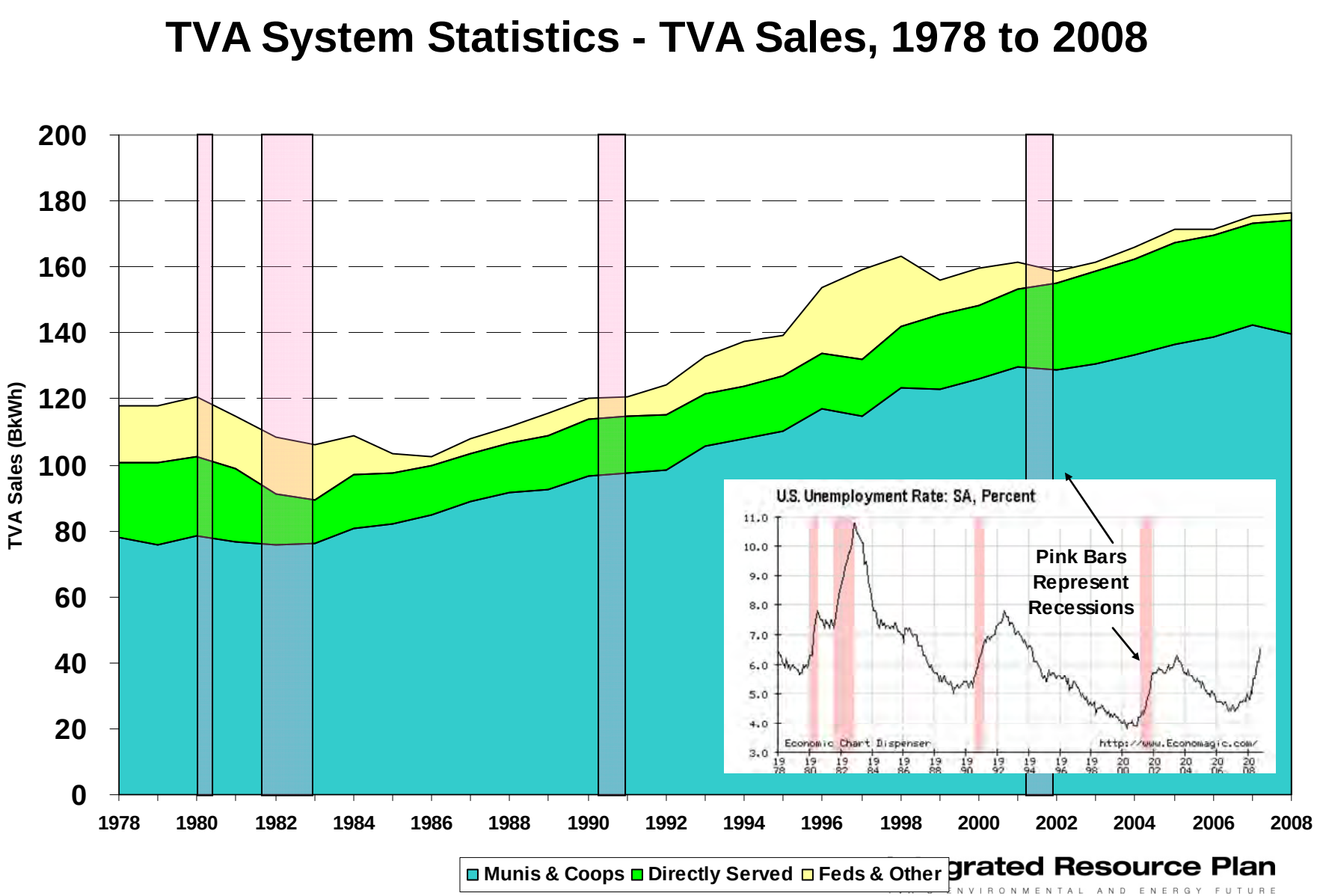
- Cost of power (73)
- Pollution / environmental damage (59)
- Increase use of renewable energy (49)
- Increase use of nuclear energy (41)
- Decrease / stop use of coal (37)
- Fallacy of manmade global warming (29)
- Problems with TVA leadership / management (28)
- Decrease / stop use of nuclear power (25)
- Reliability (24)
- Coal ash / waste management (24)
- Spent nuclear fuel (23)
- Cost of future environmental compliance (18)
- Continued reliance on old / outdated plants, especially coal plants (17)
- Increase energy conservation efforts (15)
- Meeting demand (14)
- Increase R&D / be innovator (13)
- Decrease greenhouse gas emissions (11)
- Kingston ash spill (11)
- Decrease spending on green power – too expensive (10)
- Politics / political interference (9)

WHERE ARE WE TODAY?!?

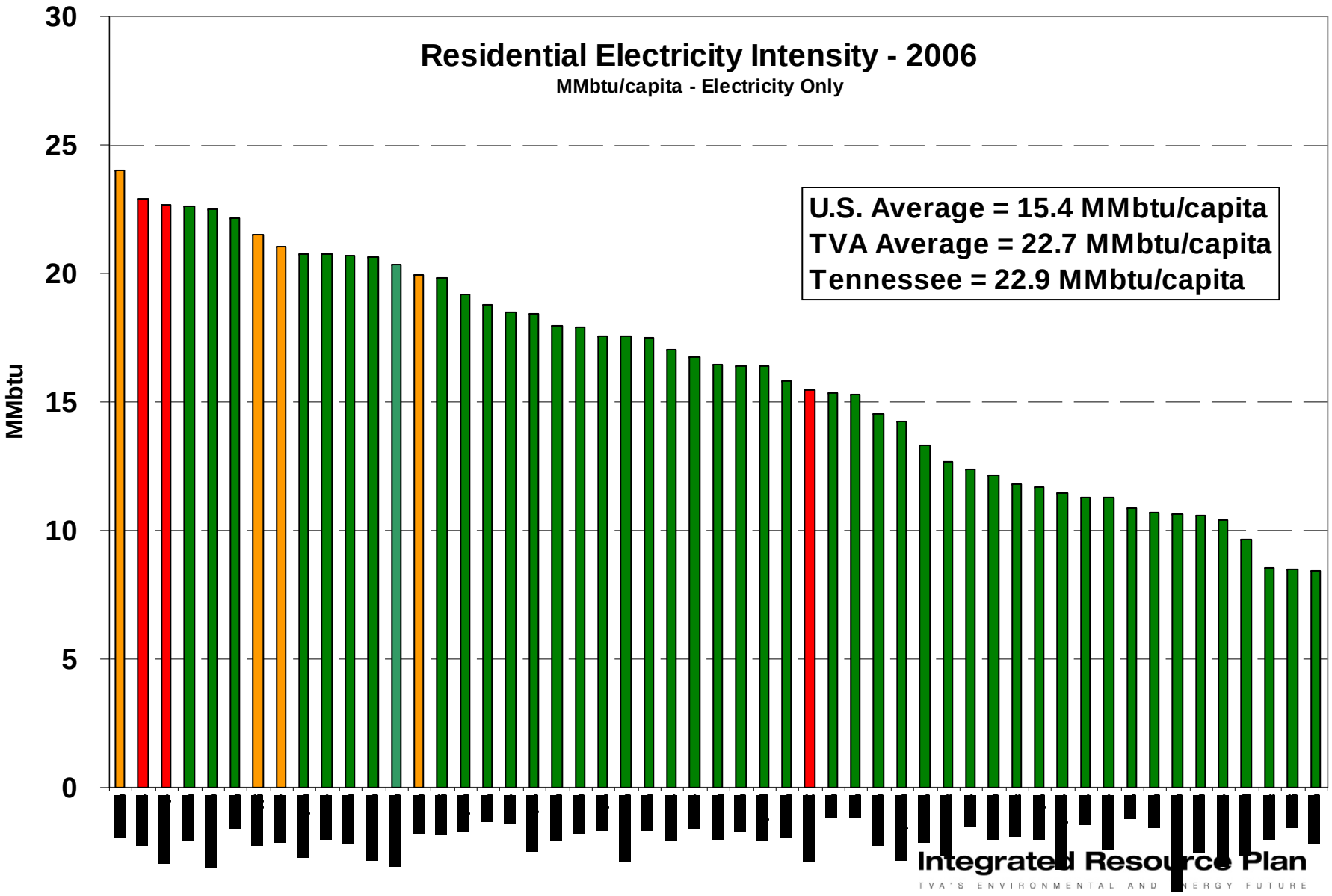
TVA Energy vs. Peak Demand



Recessions Bring Temporary Sales Slumps



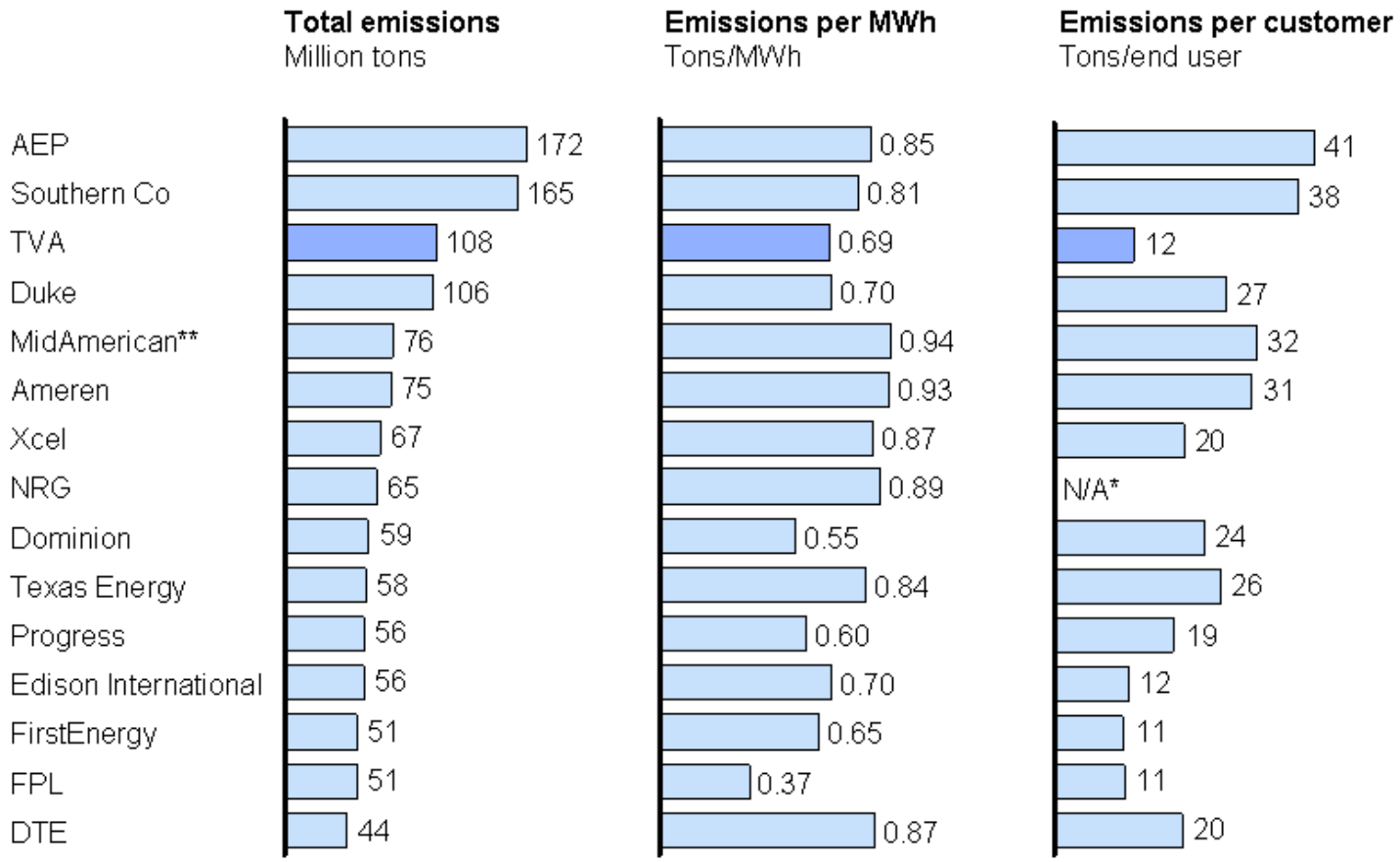
Electrical Intensity (EIA National Data)



Carbon Intensity

TVA IS ONE OF THE LARGEST CO2 EMITTERS IN THE COUNTRY

Top 15 CO2 emitters in the U.S., 2007

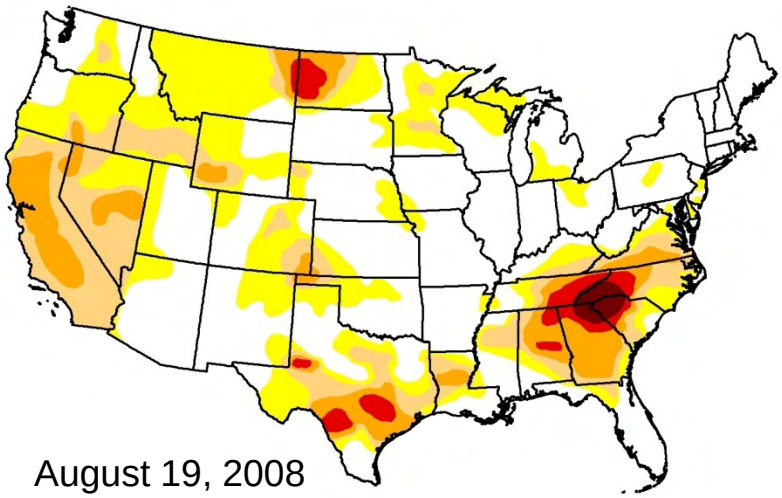


* The end-user customer number is not available for NRG

Source: Energy Velocity 2007; Company websites

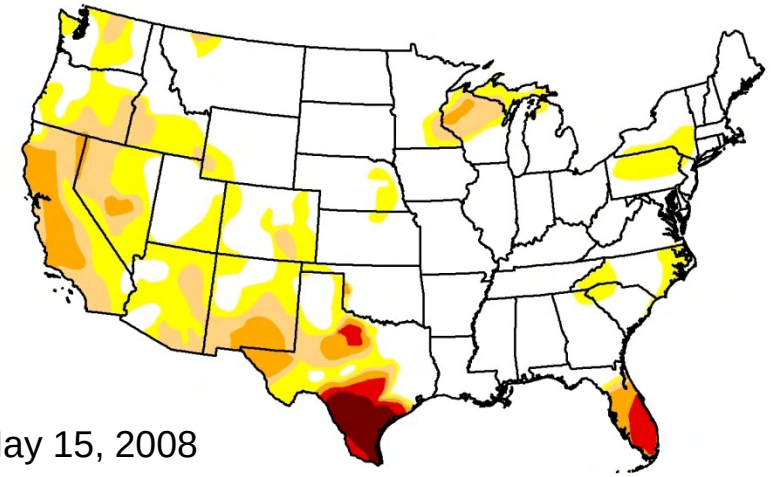
Drought Improving…

Last year….
(when budget was developed)



August 19, 2008

Now…

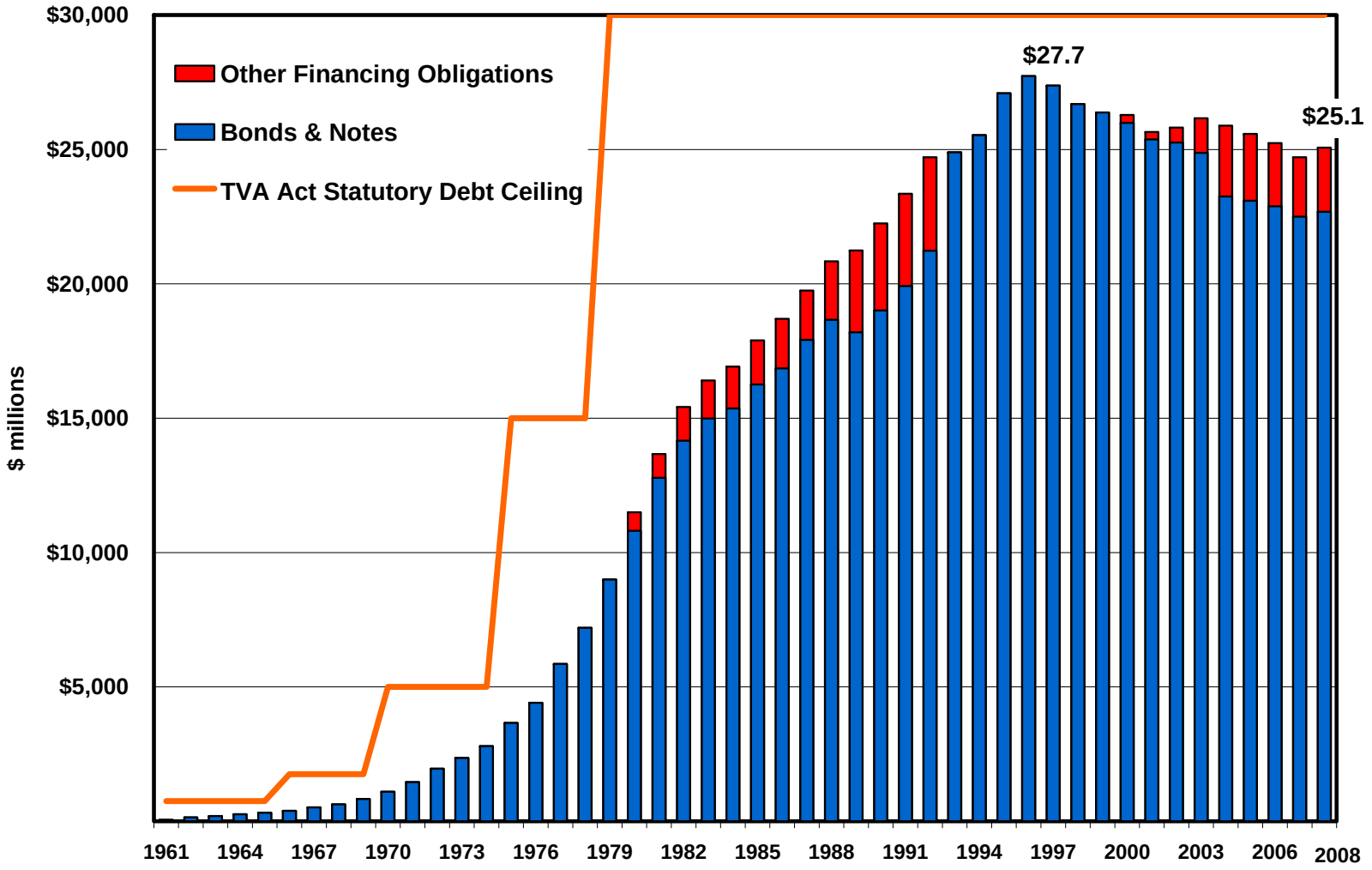


May 15, 2008

D0 Abnormally Dry
D1 Drought - Moderate
D2 Drought - Severe
D3 Drought - Extreme
D4 Drought - Exceptional

Calendar Year to Date	Rainfall (basin total)	Runoff (basin total)
May 12, 2008	16.54 in. (81% of normal)	9.17 in. (65% of normal)
May 12, 2009	18.52 in. (92% of normal)	12.07 in. (86% of normal)

TVA Debt


$30,000
$25,000
$20,000
$15,000
$10,000
$5,000
$ millions
Other Financing Obligations
Bonds & Notes
TVA Act Statutory Debt Ceiling
$27.7
$25.1
1961
1964
1967
1970
1973
1976
1979
1982
1985
1988
1991
1994
1997
2000
2003
2006
2008

Smart Grid and Electric Transportation

SCHEDULES AND STATUS

IRP Project Schedule and Milestones

- Early 2010: Draft IRP and EIS issued for public comment
- Late 2010: Finalize IRP and EIS and select preferred portfolio(s)
- January 2011: Present preferred portfolio(s) to Board for approval

Status

- 4 public meetings have been held
- 549 survey responses submitted (as of July 27)
- Additional written comments also submitted
- Currently TVA staff is developing resource strategies and scenarios, and integrating the public comments
- Draft scenarios will be presented at the August meeting

Conclusion

- Reminder that future meetings will be structured around the steps of the IRP process with TVA experts giving overviews at each step. The SRG will be asked to review materials away from the meetings and be prepared for dialog at the appropriate time.
    - Demand Forecasting
    - Resource Characterization
    - Plan Evaluation Criteria
    - Generation and Demand Side Options Mixes
    - Trade Off Analysis
- Additionally, we will summarize the public comments being received and consider how to best incorporate these into the planning process