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Southern Alliance for Clean Energy

TVA's 2015 Integrated Resource Plan

August 4, 2015

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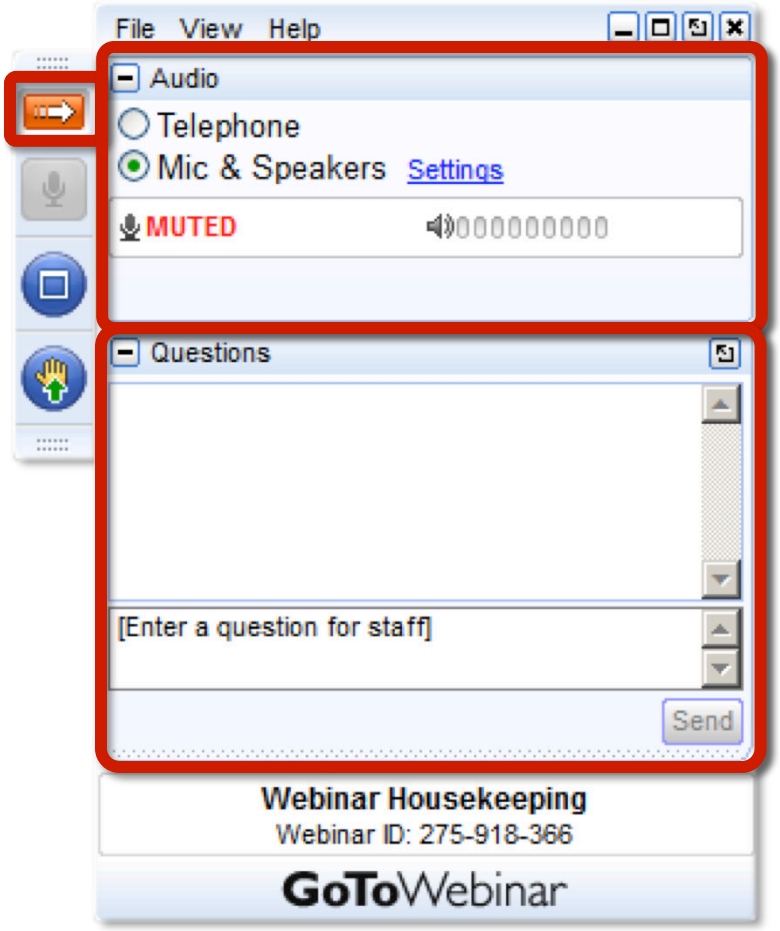

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For over 30 years the Southern Alliance for Clean Energy has worked to promote responsible energy choices that work to address the impacts of Global Climate Change and ensure clean, safe and healthy communities throughout the Southeast.

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Overview

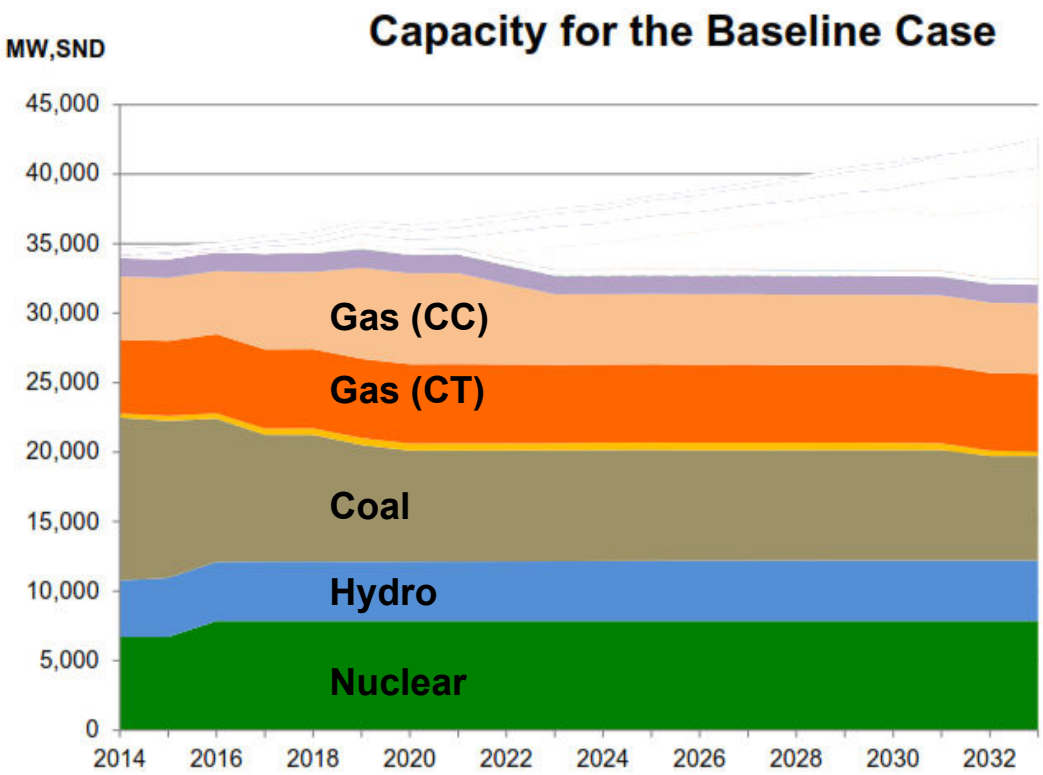
TVA's Integrated Resource Plan (IRP)

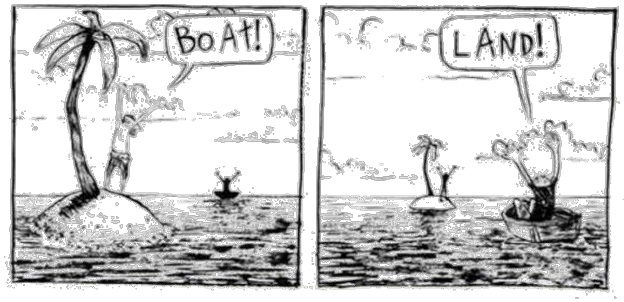
- Detailed plan outlining how TVA will generate electricity and meet projected energy demands both in the short-and long-term (20 yrs)

- Includes a forecast of expected annual energy peaks and overall energy demand (including a "reserve margin")

- The plan does not require TVA to make any actions, rather it sets up energy "scenarios" and applies "strategies" aimed at meeting demand under each scenario

Perspective: TVA Today





Perspective...

Stakeholder Engagement

Involved several stakeholder groups:

- ✓TVA IRP Working Group
- ✓TVA Resource Planning Groups (EE and RE)
- ✓TVA's Regional Energy Resource Council (RERC)

- TVA staff conducted numerous public meetings during both the scoping process and the public comment period
- TVA conducted sensitivity analyses based on stakeholder feedback on the draft IRP

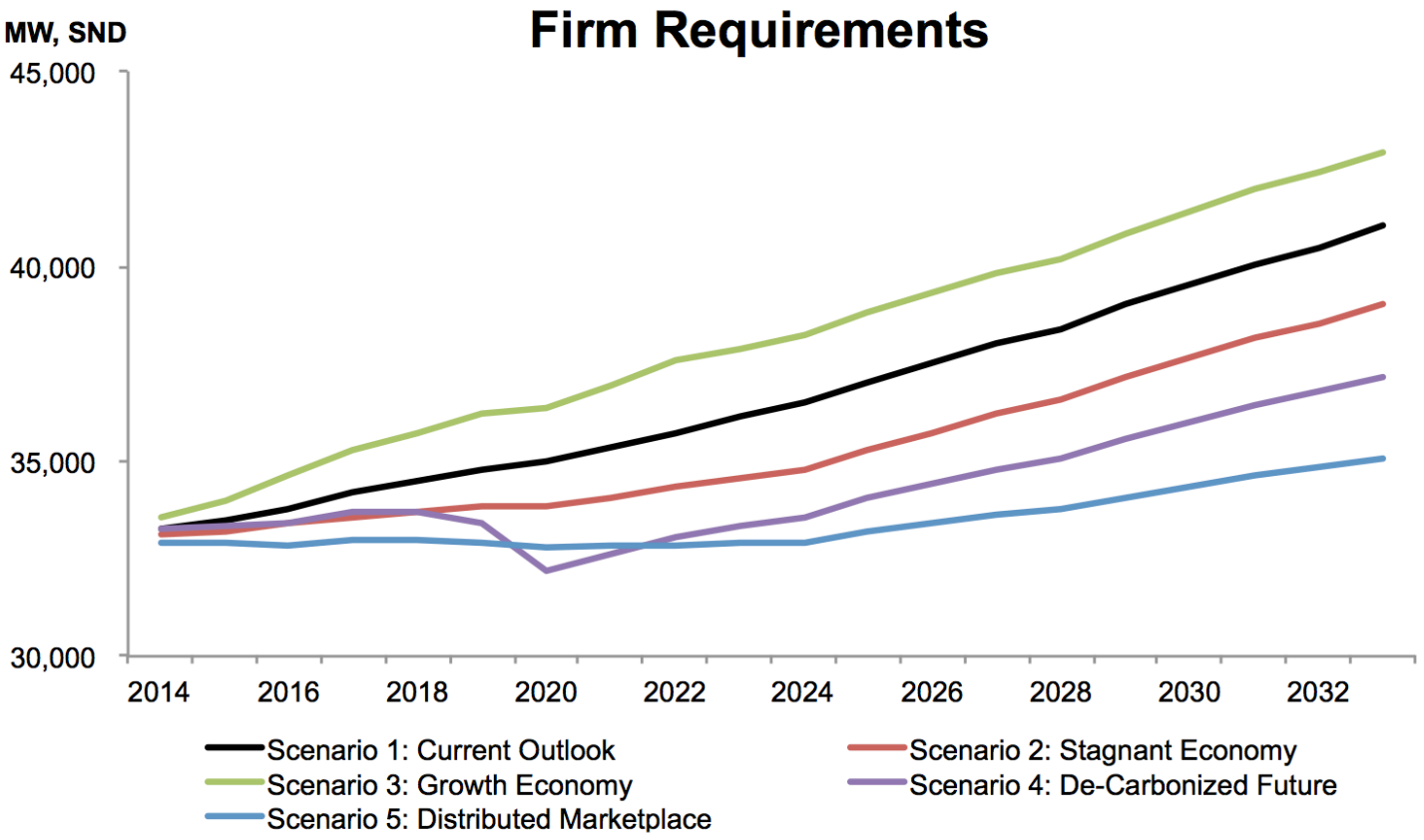
IRP Environmental Analysis

- TVA must comply with the National Environmental Policy Act (NEPA) since it is a federal entity
- Supplemental Environmental Impact Statement (SEIS)

The TVA Resource Planning Process Step by Step

- Project customer demand for electricity in the future
- Define the resources currently available to meet customer demand and how that will change in the future
- Compare future customer demand with existing resources
- Identify all resources (supply- and demand-side) that will be considered to meet future need
- Test different resource combinations (portfolios) to evaluate performance
- Select the preferred combination of resources

TVA's Expected Capacity Needs



Final IRP Recommendations

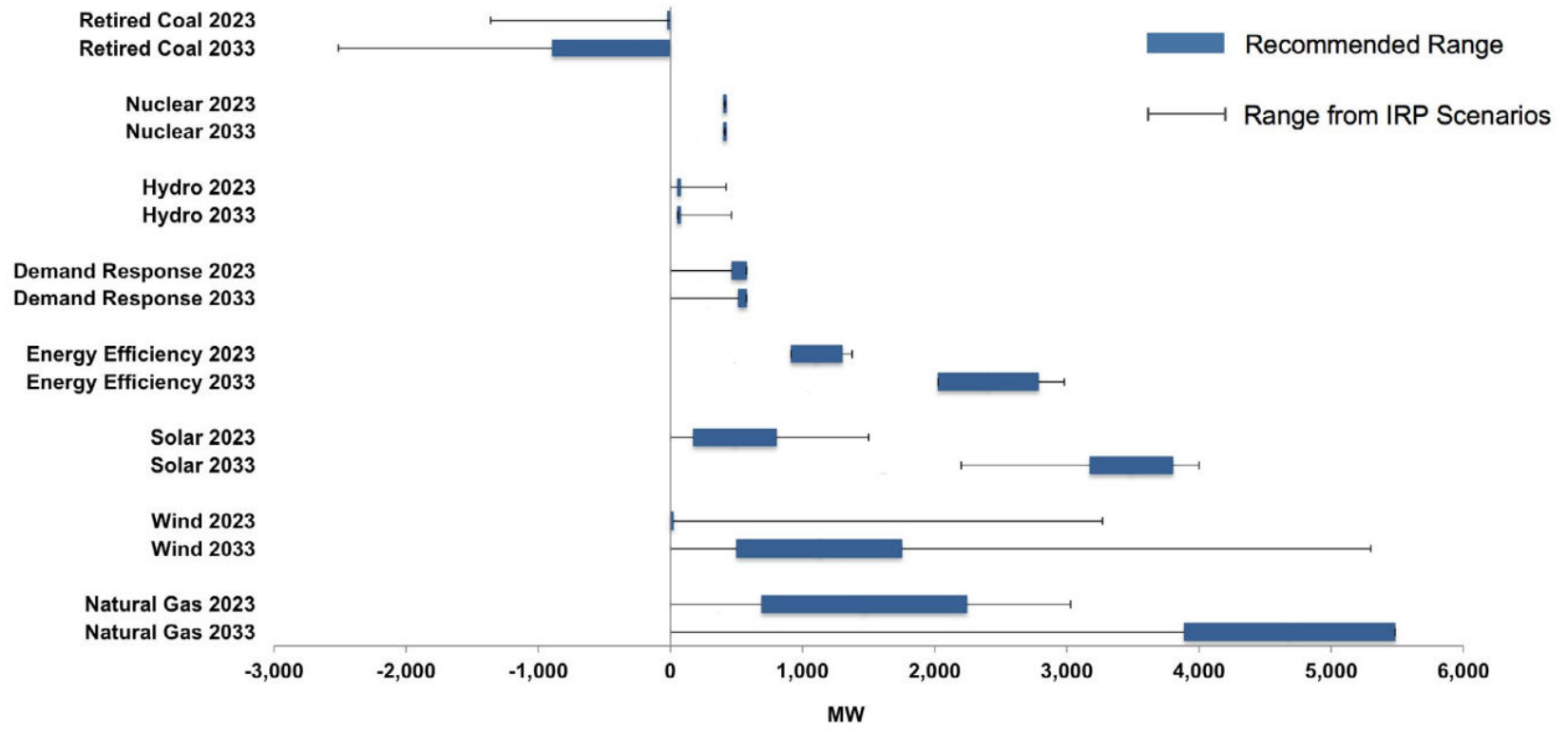
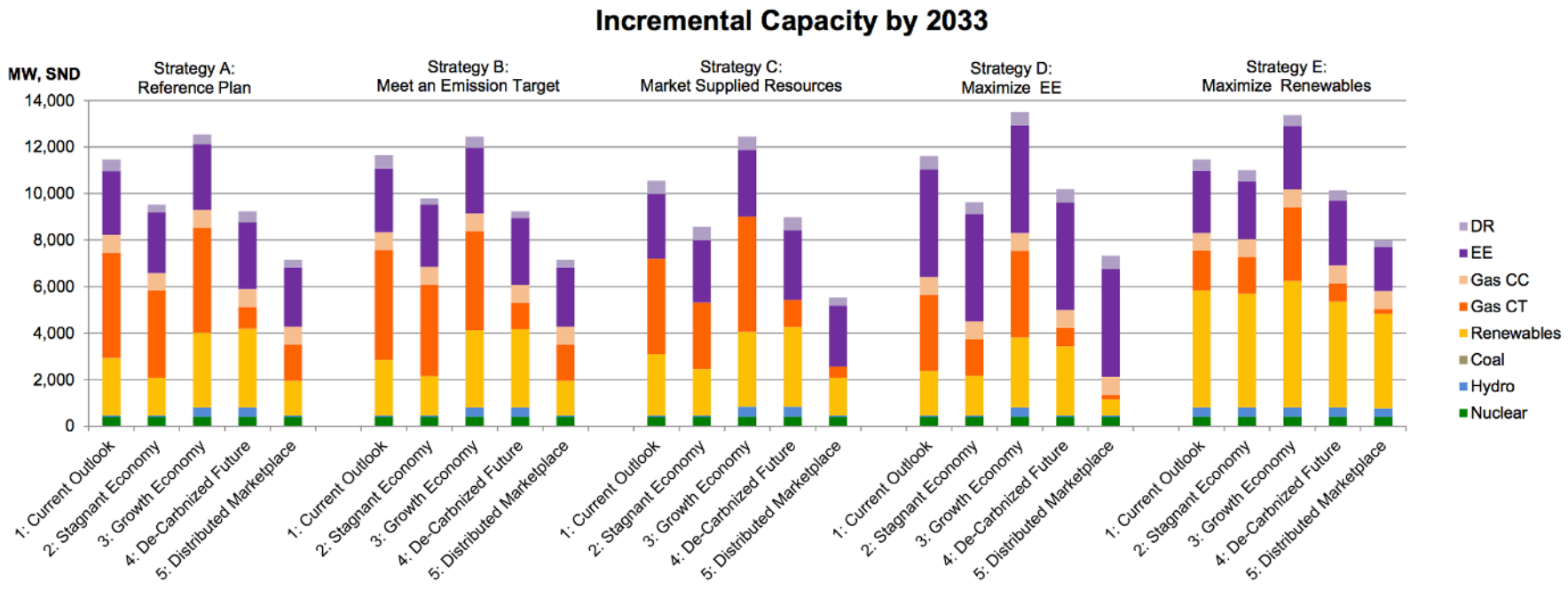
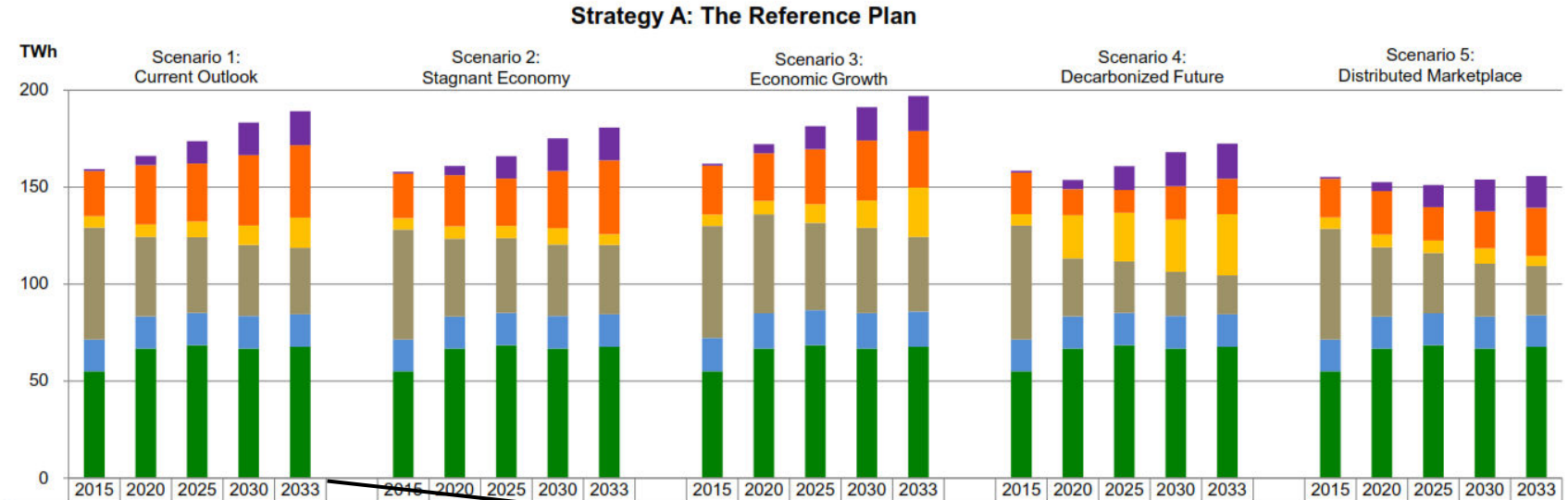


Figure 9-3: Range of MW Additions by 2023 & 2033[15]

IRP Planning Results: Capacity Additions



IRP Planning Results: Energy Forecast (Reference Case)



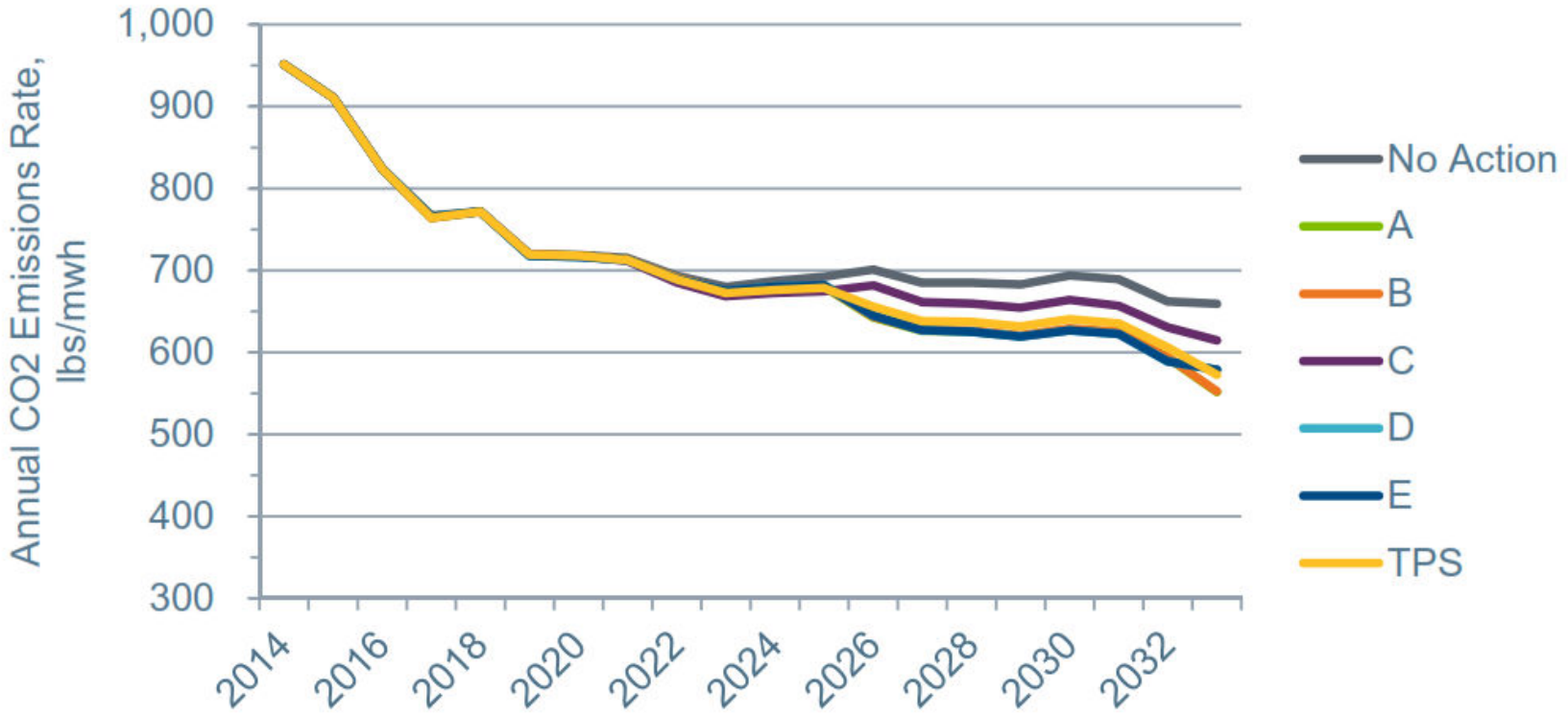
	Scenario 1: Current Outlook					Scenario 2: Stagnant Economy					Scenario 3: Economic Growth					Scenario 4: Decarbonized Future					Scenario 5: Distributed Marketplace				
	2015	2020	2025	2030	2033	2015	2020	2025	2030	2033	2015	2020	2025	2030	2033	2015	2020	2025	2030	2033	2015	2020	2025	2030	2033
EEDR	1	5	12	17	17	1	5	12	17	17	1	5	12	17	18	1	5	12	17	18	1	5	12	16	16
Gas	25	28	31	29		21	13	12	17	18	20	22	17	19	25										
Ren	7	10	14	25		6	22	25	27	32	6	6	6	8	5										
Coa	51	45	44	39		59	30	27	23	20	57	36	31	27	25										
Hyd	18	18	18	18		16	17	17	17	17	16	16	16	17	16										
Nuc	67	69	67	68		55	67	69	67	68	55	67	69	67	68										

	2015	2020	2025	2030	2033
EEDR	1	5	12	17	17
Gas	23	31	30	36	37
Renewables	6	6	8	10	16
Coal	58	41	39	37	34
Hydro	16	17	17	17	17
Nuclear	55	67	69	67	68

Major Takeaways

- Growth is slowing: Base case = 1% per year
- No need for new "baseload" power
  - Browns Ferry nuclear uprate is TVA's last planned addition of baseload
- "Least cost" plan appears to meet Clean Power Plan emission targets (Note: for TVA not necessarily TN)
- Coal use cut by half with possibility of retirements in the long term
- Solar is adopted, but gradually
- Energy efficiency is on a growth trajectory – but not high enough to position TVA as a leader

TVA's Options to Meet EPA's Clean Power Plan Targets



Recommendations: Energy Efficiency

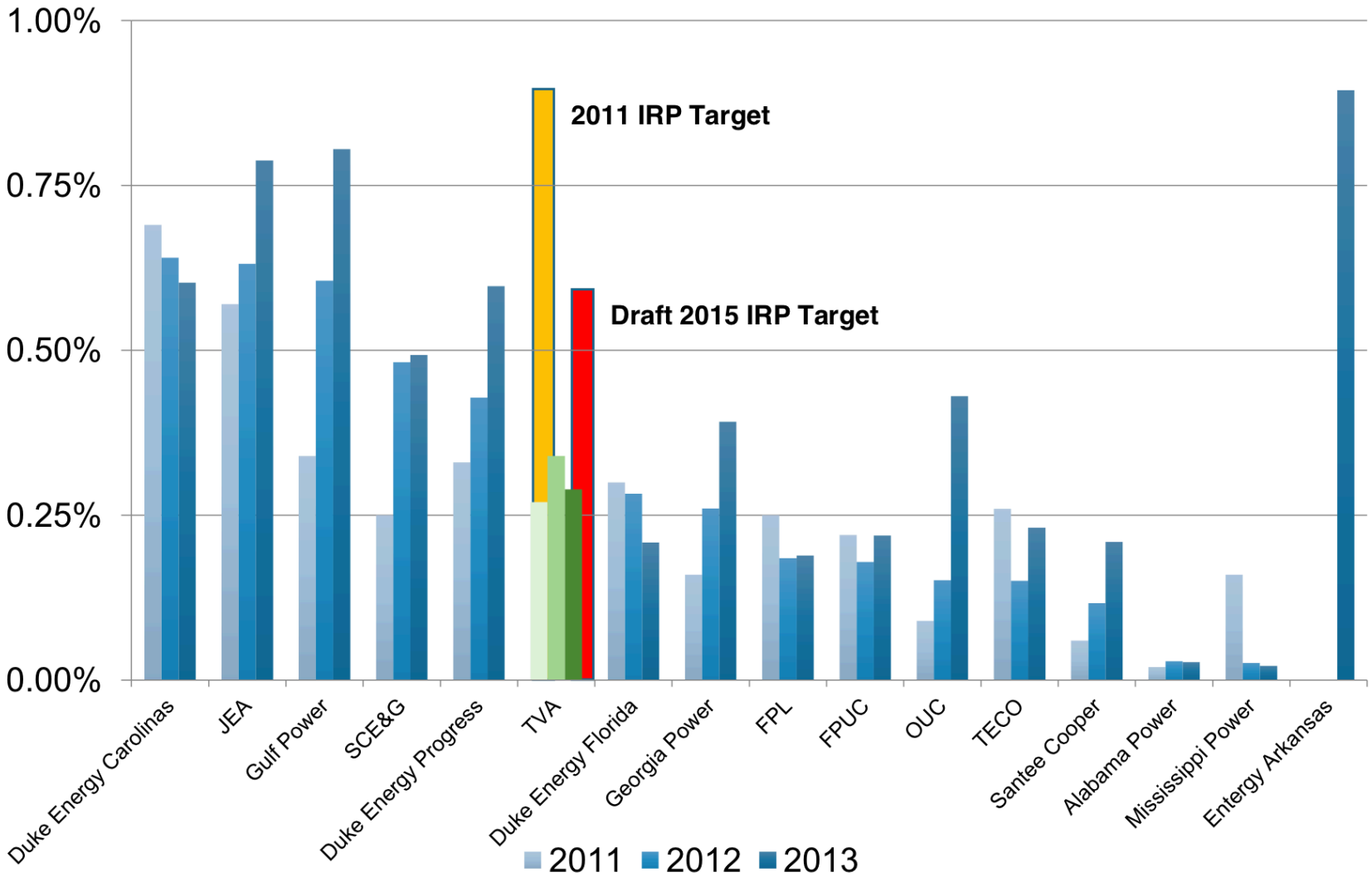
Restore – even expand – the energy efficiency budget that was cut in 2014

- Increase EE budget by 50% annually
  - until TVA begins to achieve annual net energy savings in excess of 1% prior year retail sales
- Support ensuring that EE spending remains as cost-effective as it has been in the past
- Program design changes and customer access should not be limited by arbitrary budget caps

Re-invigorate the Energy Efficiency Information Exchange

- Program improvement consultation
- Measurement & verification study review
- Forecasting of future program impacts and costs

TVA's Energy Efficiency Programs: Less than Half of Regional Leaders



TVA's Renewable Energy Plans

Overall, TVA has said that development of solar and wind will be highly dependent on pricing, performance and integration costs.

Solar

- 150 – 800 MW by 2023
- 3,150 – 3,800 MW by 2033

Wind

- 500 – 1,750 MW by 2033
- "Evaluate accelerating wind deliveries into the first 10 years of the plan if operational characteristics and pricing result in lower-cost options."

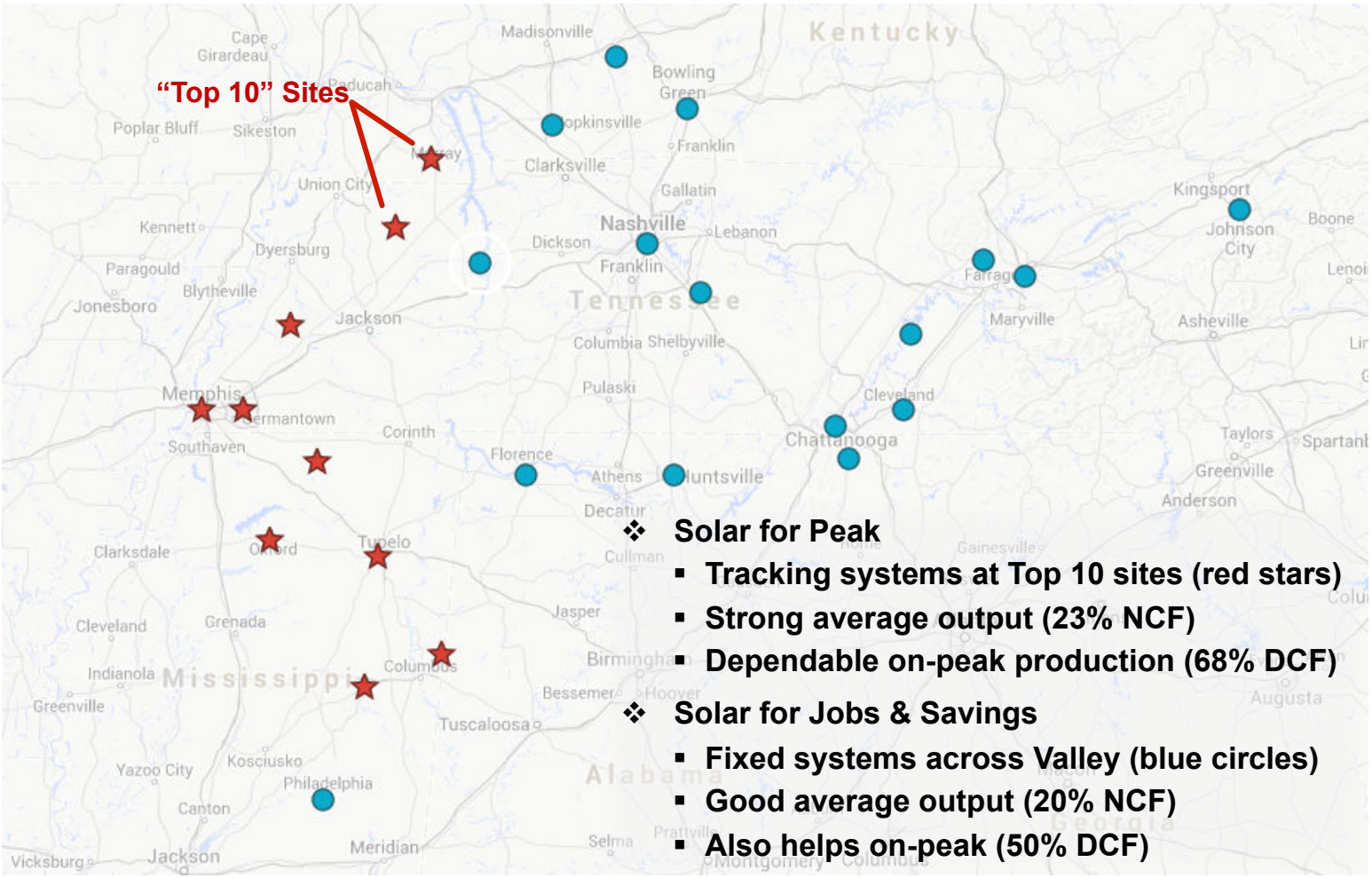
TVA's Buffalo Mountain Wind Farm (Anderson County, TN)

Solar

West TN Solar Farm (5 MW)

- **2015 IRP supports development of nearly 1 GW of solar power in 5-10 years**
  - Despite TVA's assumption of slightly higher-than-market prices for solar
  - Indications that significantly higher quantities could be cost-effective
- **Utility-scale solar requires land**
  - TVA can access to brownfields, poor quality agricultural land
  - Could also be developed on rooftops, etc. where conditions are right
- **Although it is the easier resource to model, not all solar should be developed at utility-scale**

TVA on the Cutting Edge: Solar Across the Valley



- **Solar for Peak**
  - Tracking systems at Top 10 sites (red stars)
  - Strong average output (23% NCF)
  - Dependable on-peak production (68% DCF)
- **Solar for Jobs & Savings**
  - Fixed systems across Valley (blue circles)
  - Good average output (20% NCF)
  - Also helps on-peak (50% DCF)

Wind

- **TVA evaluated 3 different wind resources**
  - Wind technology cost & performance assumptions were outdated

- **Final IRP**
  - If wind cost and performance meets near-term expectations then …TVA will consider accelerating wind into the first 10 years

TVA's Buffalo Mountain Wind Farm

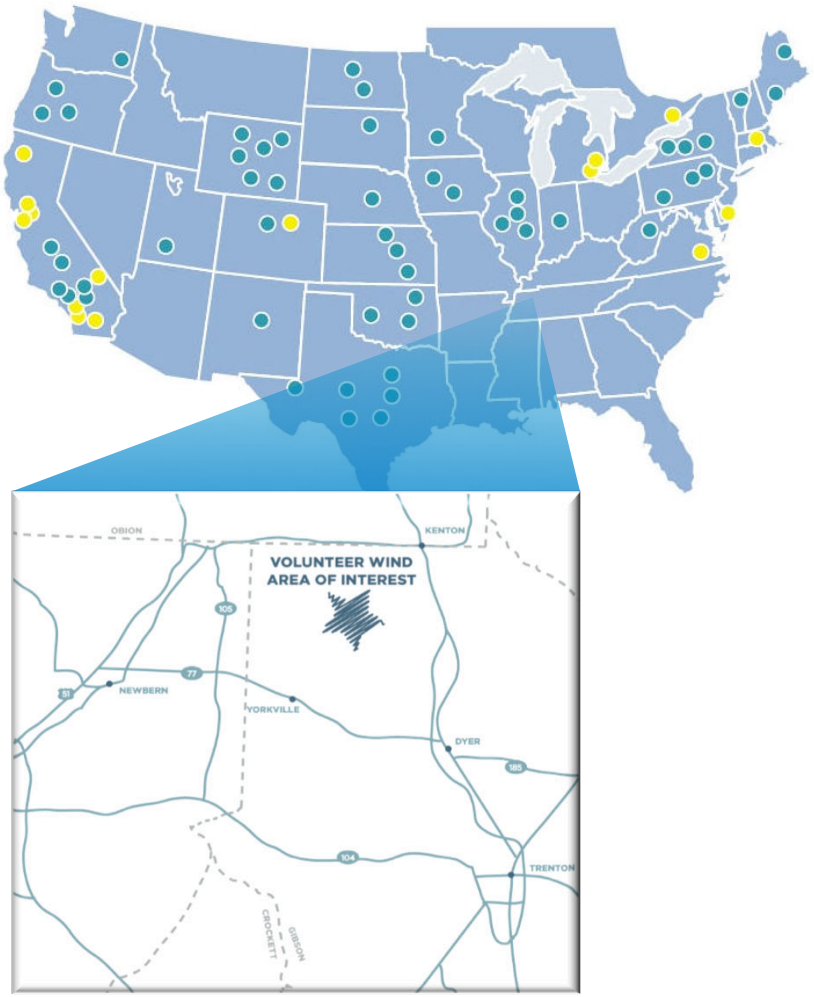
Potential for Wind Development in TN Valley

In July 2014, Apex Wind Energy announced it is developing Volunteer Wind

- Gibson County, TN
- ~100 miles NNE of Memphis
- Could be a 150 MW project
- Sited on active farmland
- Could be constructed in 2017

Other "public" projects

- NextEra developing northeast of Huntsville, AL
- Pioneer Green Energy's project in Cherokee County, AL is blocked by the Alabama Legislature



A Growing Clean Energy Economy

- **Contracts will be driven by TVA's evaluation of value to system**
- **TVA continues to assess cost and performance of wind energy**
- **Focus on Utility-Scale Solar**
  - IRP did not evaluate how TVA should address growth of distributed (rooftop) solar
  - TVA likely to continue to pursue utility-scale solar projects, like its recent $61 / MWh project in Northern Alabama
- **In 2015 – Tennessee had 44,269 clean energy jobs**
  - Growth of 6.3% last year is three times the overall state job growth of 2.2%
  - Energy efficiency makes up 47% of TN's clean energy jobs

Recommendations: Renewable Energy Development Plan

- **TVA should direct and manage renewable energy development with the same level of planning as for conventional energy development.**
  - ➢ Designate solar energy development zones
    - Advantageous solar resources
    - Availability of transmission line capacity
    - Expedited interconnection review process
  - ➢ Develop solar and wind in concert
    - Recognize solar-summer, wind-winter peak pattern
  - ➢ Use RFP process to guide developer submissions to meet TVA cost and performance targets
    - Model off Georgia Power's Advanced Solar Initiative process

Recommendations: Bellefonte

- **Permanently close Bellefonte**
- **Most recent budget value is $66 million per year**
  - Reallocating this to energy efficiency could increase the EE budget by more than 50%.
- **"… none of the strategies in the IRP include completion of Bellefonte Units 1 and 2, the ultimate fate of this plant will eventually be decided by the TVA Board of Directors."**
  - "Although work on the Bellefonte Unit 1 site was slowed in 2014, TVA believes that the resulting budgeting and staffing levels should be sufficient to preserve Bellefonte for potential future development. TVA plans to utilize its integrated resource planning process to help determine how Bellefonte best supports TVA's overall efforts to continue to meet customer demand with low-cost, reliable power." (TVA, Submitted to Congress February 2015)

What's Next?

- TVA staff will present the final IRP to the Board of Directors for approval during the **August 21** meeting in Knoxville, TN
- IRP is a roadmap, not an absolute
- TVA will continue to update its costs and performance assumptions for specific resources throughout the 20-year planning period

Questions?

Thank You!

Please send any further questions to:

angela@cleanenergy.org

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