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TVA's Final IRP: Setting a Course for the Valley's Energy Future

Webinar Presentation, March 2011

About Us

- **The Southern Alliance for Clean Energy (SACE) has been a leading voice for energy reform to protect the quality of life and treasured places in the Southeast for over 25 years. Founded in 1985, SACE is the only regional organization primarily focused on developing clean energy solutions throughout the Southeast.**

- **As we look towards the future, SACE's commitment to preserve, restore and protect our environment through the use of innovative technology, grassroots and grasstops education, and pioneer policy work remains steadfast.**

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Outline of today's webinar:

- **Overview of the integrated resource planning (IRP) process.**
- **Taking the IRP from draft to final.**
- **The IRP's final recommended planning strategy.**
- **The key issues facing TVA:**
  - Coal idling
  - Renewable energy generation
  - Energy efficiency
  - Beyond 2020
  - Nuclear capacity expansion
- **Wrap up, questions and discussion**

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Overview of TVA's IRP timeline

- In June 2009, TVA announced an integrated resource planning process to determine a strategy for meeting power demand through 2029.
- The process generally followed industry standards, modified to account for TVA's economic and environmental statutory directives.
- On September 16, 2010 TVA released a Draft IRP for public review and comment.
- After 3 months of refining the IRP's proposed strategy, TVA released its final Integrated Resource Plan on March 4, 2011.
- TVA's Board of Directors is scheduled to adopt the IRP at the April 14th Board meeting.
- TVA has committed to reiterating the IRP process no later than 2015.

What is Integrated Resource Planning (IRP)?

- **Modeling process used by utilities to determine:**
  - The best possible mix of supply side (such as new power plants) and demand side (such as energy efficiency) resources to meet future energy demand at the least cost and least risk.

- **TVA's IRP also considers TVA's statutory directives to steward the environment, support economic development and further technological innovation.**

TVA's IRP and the NEPA process

- TVA released a Final Environmental Impact Statement (EIS) in conjunction with its release of the Final IRP.

- The Final EIS is a "programmatic EIS" which is more general and will not alleviate TVA's responsibility to do full NEPA review for specific future projects.
  - TVA will, however, be able to refer back to this programmatic EIS when it drafts future EISs for specific projects.

- The Final EIS provides detailed analysis of the environmental impacts of TVA's various resource options for meeting the Valley future electricity demand.

TVA's IRP Stakeholder Review Group:

- **TVA's Stakeholder Review Group (SRG) includes representatives of the environmental, business and industrial communities, TVA-served states and the distributor community.**

- **SRG met almost monthly since June 2009.**

- **Through the SRG, SACE provided input into several aspects of the IRP process, including:**
  - How aggressively TVA should invest in energy efficiency;
  - Whether TVA should idle coal-fired generation in favor of investing in costly pollution control measures;
  - How aggressively TVA should be pursuing renewable energy resources;
  - Whether increased nuclear capacity is a necessary part of TVA's future generation requirements.

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Resource planning in a nutshell:

- **TVA created 5 potential strategies for meeting future demand that covered a wide range of resource options.**

- **These 5 strategies were analyzed under 8 possible future scenarios to see how they performed.**

- **Two strategies were discarded as too costly or too risky. The remaining three strategies that performed best were analyzed further to see if a different combination of those characteristics performed even better.**

Summary of TVA's Draft Strategies

Attributes	A – Limited Change in Current Resource Portfolio	B – Baseline Plan Resource Portfolio	C – Diversity Focused Resource Portfolio	D – Nuclear Focused Resource Portfolio	E – EE/DR and Renewables Focused Resource Portfolio
EE/DR	– 1,940 MW & 4,725 annual GWh reductions by 2020	– 2,100 MW & 5,900 annual GWh reductions by 2020	– 3,600 MW & 11,400 annual GWh reductions by 2020	– 4,000 MW & 8,900 annual GWh reductions by 2020	– 5,900 MW & 14,400 annual GWh reductions by 2020
Renewable Additions	– 1,300 MW & 4,600 GWh competitive renewable resources or PPAs by 2020	– Same as Planning Strategy A	– 2,500 MW & 8,600 GWh competitive renewable resources or PPAs by 2020	– Same as Planning Strategy C	– 3,500 MW & 12,000 GWh competitive renewable resources or PPAs by 2020
Fossil Asset Layup	– No fossil fleet reductions	– 2,000 MW total fleet reductions by 2017	– 3,000 MW total fleet reductions by 2017	– 7,000 MW total fleet reductions 2017	– 5,000 MW total fleet reductions by 2017
Energy Storage	– No new additions	– Same as Planning Strategy A	– Add one pumped storage unit	– Same as Planning Strategy C	– Same as Planning Strategy A
Nuclear	– No new additions after WBN2	– First unit online no earlier than 2018 – Units at least 2 years apart	– Same as Planning Strategy B	– Same as Planning Strategy B	– First unit online no earlier than 2022 – Units at least 2 years apart – Additions limited to 3 units
Coal	– No new additions	– New coal units are outfitted with CCS – First unit online no earlier than 2025	– Same as Planning Strategy B	– Same as Planning Strategy B	– No new additions
Gas-Fired Supply (Self-Build)	– No new additions	– Meet remaining supply needs with gas-fired units	– Same as Planning Strategy B	– Same as Planning Strategy B	– Same as Planning Strategy B
Market Purchases	– No limit on market purchases beyond current contracts and contract extensions	– Purchases beyond current contracts and contract extensions limited to 900 MW	– Same as Planning Strategy B	– Same as Planning Strategy B	– Same as Planning Strategy B
Transmission	– Potentially higher level of transmission investment to support market purchases – Transmission expansion (if needed) may have impact on resource timing and availability	– Complete upgrades to support new supply resources	– Increase transmission investment to support new supply resources and ensure system reliability – Pursue inter-regional projects to transmit renewable energy	– Same as Planning Strategy C	– Potentially higher level of transmission investment to support renewable purchases – Transmission expansion (if needed) may have impact on resource timing and availability

Defined model inputs

Constraints in model optimization

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The Draft IRP narrowed down TVA options for further refinement.

- **Based on the initial analysis, the TVA was able to exclude Strategy A (limited change in TVA's resource portfolio) and Strategy D (nuclear-focused portfolio) as either too costly or too risky compared to the IRP's other alternatives.**

- **For the Final IRP, TVA then sought to find the optimal strategy by giving the model additional freedom to choose among the characteristics of the 3 remaining strategies.**

From draft to final: shaking things up to find the right mix.

• Attributes from the planning strategies retained in the Draft IRP were provided to the model for optimization.

• EE/DR and renewable inputs were “unhinged,” allowing the model to choose among the various packages.

Attributes	Range of Options Tested				
EE/DR	– 2,100 MW & 5,900 annual GWh reductions by 2020	– 3,600 MW & 11,400 annual GWh reductions by 2020	– 5,100 MW & 14,400 annual GWh reductions by 2020		
Renewable Additions[1]	– 1,500 MW competitive resources or PPAs by 2020	– 2,500 MW competitive resources or PPAs by 2029	– 2,500 MW competitive resources or PPAs by 2020	– 3,500 MW competitive resources or PPAs by 2029	– 3,500 MW competitive resources or PPAs by 2020
Fossil Capacity Idled	– 2,400 MW total fleet reductions by 2017	– 3,200 MW total fleet reductions by 2017	– 4,000 MW total fleet reductions by 2017	– 4,700 MW total fleet reductions by 2017	

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The Final IRP's key directives:

Component	Range provided	Timeframe
Coal Capacity Idled	2,400 – 4,700 MW	By 2017
Renewable energy additions	1,500 – 2,500 MW	By 2020
Energy efficiency targets	11,400 to 14,400 GWh	By 2020
Nuclear additions	1,150 – 5,900 MW	2013 - 2029
Coal additions	0 – 900 MW	2025 - 2029
Natural Gas additions	900 – 9,300 MW	2012 - 2029

Summary of the issues:

- **Coal idling:** **TVA should be planning to idle *at least* 4,000 MW of coal-fired generation.**

- **Renewable energy:** **TVA completely missed the mark on its analysis of RE.**

- **Energy efficiency:** **TVA has made some big improvements from where they were, but there's still room for improvement.**

- **Nuclear expansion:** **TVA has yet to make a convincing case for building additional nuclear reactors.**

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Issue: Coal Plant Idling

- **The Final IRP recommends between 2,400 and 4,700 MW of coal-fired idling by 2017.**
- **This represents between about 17% and 32% of TVA's coal-fired fleet.**
- **Includes the 1,000 MW that TVA has already committed to idling.**

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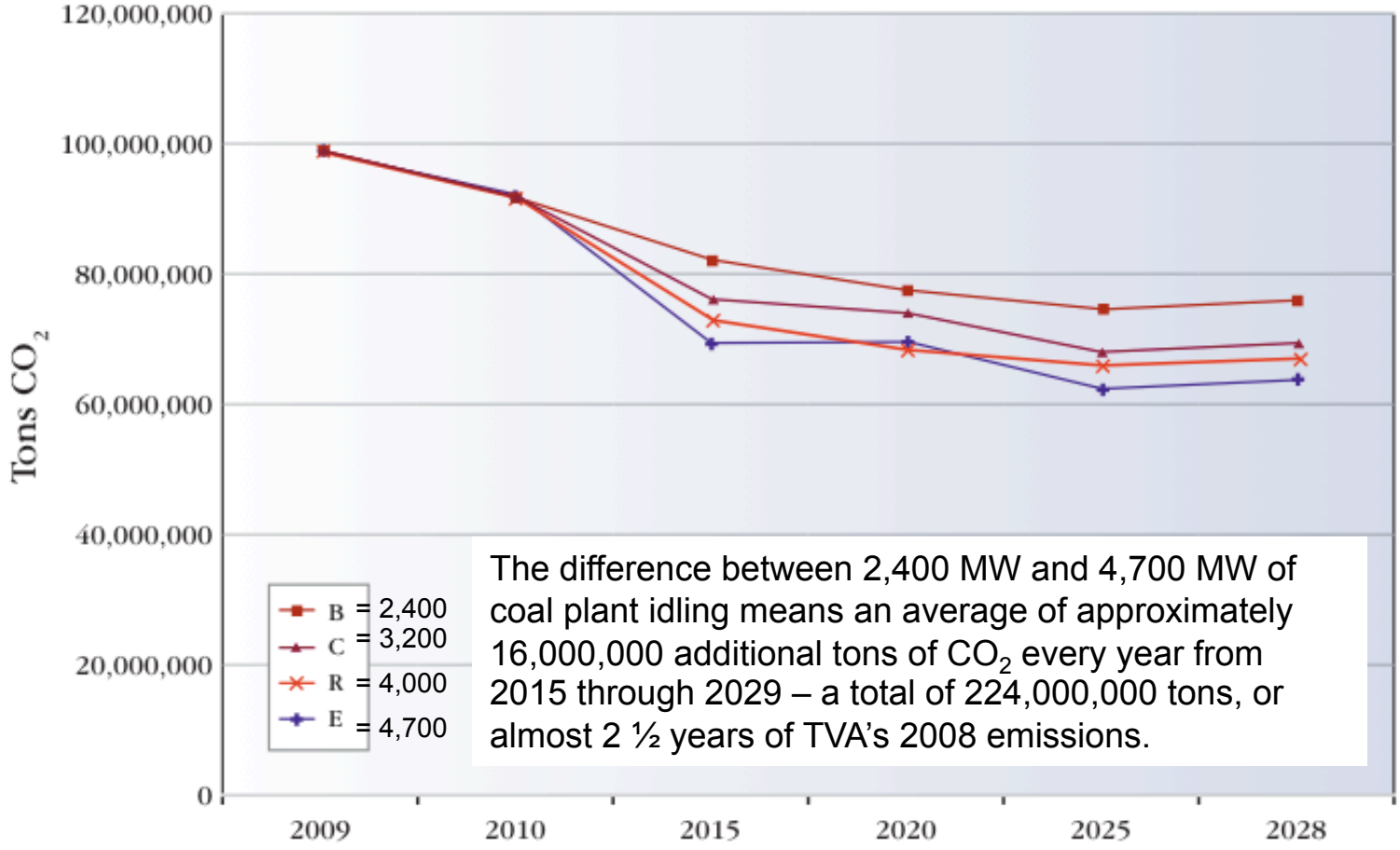
CO_2 emissions: the difference between 2,400 and 4,700 MW is 224 million tons of CO_2 between 2015 and 2029.



The difference between 2,400 MW and 4,700 MW of coal plant idling means an average of approximately 16,000,000 additional tons of CO_2 every year from 2015 through 2029 – a total of 224,000,000 tons, or almost 2 ½ years of TVA's 2008 emissions.

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The difference between 2,400 and 4,700 MW: Other air emissions

- **Sulfur Dioxide:** an additional 140,000 tons between 2015 and 2029
- **Nitrous Oxides:** an additional 70,000 tons between 2015 and 2029
- **Mercury:** an additional 5,000 lbs between 2015 and 2029.

The difference between 2,400 and 4,700 MW: Cost and risk to TVA and its customers

	Idled Capacity	High growth Scenario 1	Low growth Scenario 3	Currently projected Scenario 8
PVRR (2010B$)	2,400	170.9	108.6	123.1
	3,200	172.4	108.0	123.1
	4,000	175.3	107.6	122.0
	4,700	177.6	108.2	122.5
Short-term Rate Impacts $/MWh (level 2011 – 2018)	2,400	82.24	74.00	76.79
	3,200	82.49	73.21	76.74
	4,000	82.85	72.55	76.56
	4,700	83.56	72.90	76.92
Risk/Benefit Ratio	2,400	1.41	0.88	1.07
	3,200	1.41	0.90	1.07
	4,000	1.39	0.94	1.08
	4,700	1.39	0.95	1.08
Risk Ratio	2,400	0.229	0.086	0.142
	3,200	0.232	0.091	0.143
	4,000	0.228	0.097	0.148
	4,700	0.227	0.100	0.149

PVRR = Present Value of Revenue Requirements. Numbers represent the estimated cost of a given strategy (in mm$) over the the planning period.

Short-term rate impacts are the impact of a given strategy (in $/MWh) on TVA's retail rates.

Risk/Benefit Ratio is the potential of exceeding the expected PVRR versus the potential benefits of not exceeding the expected PVRR. Lower values represent a more favorable strategy.

Risk Ratio represent the potential of exceeding the expected PVRR. Lower values represent strategies with less risk of exceeding the expected PVRR.

In almost every case, the difference between idling 2,400 MW and 4,700 MW is less than 5% in the respective cost or risk metric. In several instances, this difference actually favors higher levels of coal-fired idling

Pursuing 4,700 MW of coal-fired idling does not to add significant levels of either cost or risk to TVA's long-term strategy.

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Issue: Renewable Energy

- **The Final IRP completely misses the mark on renewables, recommending between 1,500 and 2,500 MW of renewable energy by 2020.**

- **This includes the 1,600+ MW of wind power that TVA has already contracted for from outside the Valley.**

- **The IRP's lack of renewables is a result of TVA's lack of sophistication surrounding these resources.**

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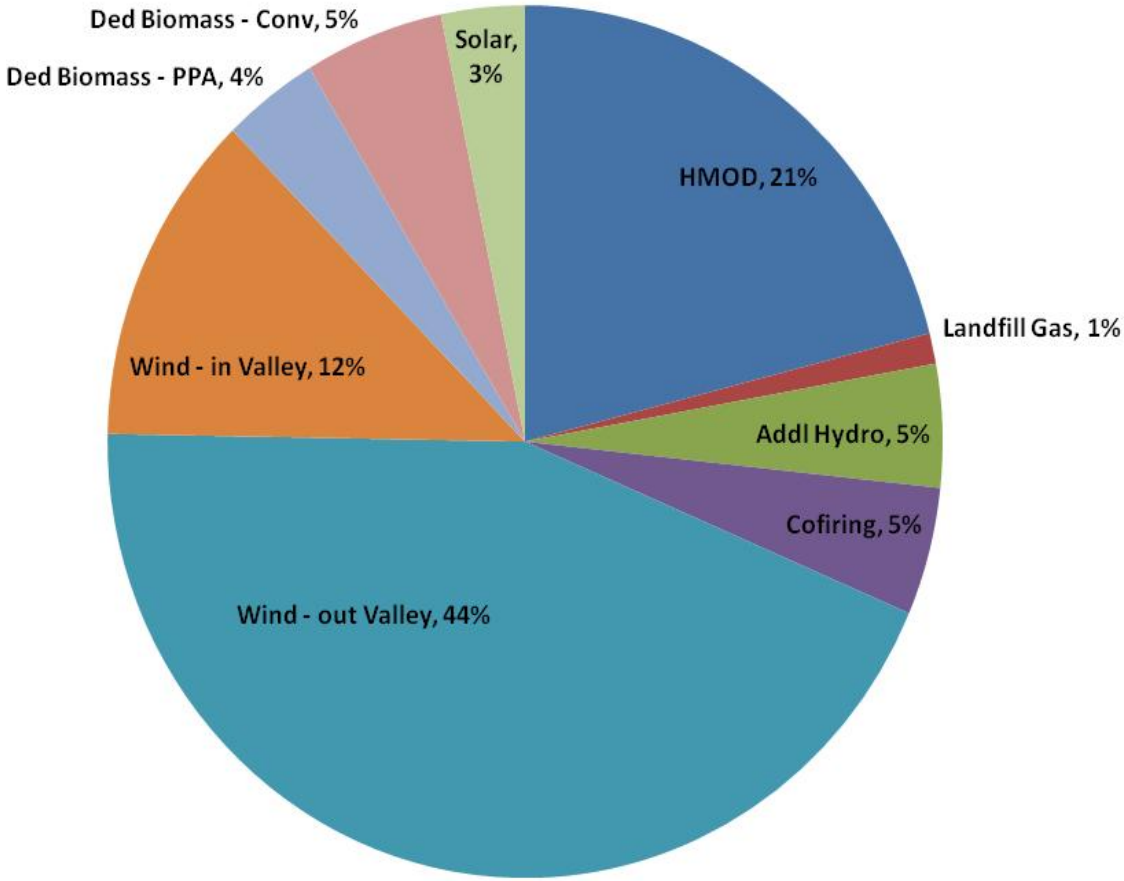
TVA's proposed 2,500 MW RE portfolio falls short.



Resource	Percentage	MW by 2020
Solar	**3%**	**75 MW**
Wind-in Valley	**12%**	**300 MW**
Ded. Biomass	**4%**	**100 MW**
Ded. Biomass Conv.	**5%**	**125 MW**
HMOD	21%	525 MW
Landfill Gas	1%	25 MW
Addl. Hydro	5%	125 MW
Cofiring	5%	125 MW
Wind-out Valley	**44%**	**1,100 MW**

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IRP Renewables: Solar

IRP's suggested solar capacity in 2020: 75MW

Current solar capacity in the Valley: 5+ MW

Capacity in queue for next 12 months: 45+ MW

Estimated feasible capacity: 2,200 – 5,200 MW

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IRP Renewables: In-Valley Wind

Suggested in-Valley wind capacity in 2020: 300 MW

Current in-Valley wind capacity: 30 MW

Capacity in queue for next 12 months: 0 MW

Estimated capacity currently available: 1,247 MW

Estimated feasible capacity: 4,200 MW

***using 80 – 100 meter hub heights**

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IRP Renewables: Biomass

Suggested dedicated biomass in 2020: 225 MW

Current in-Valley biomass capacity: 85 MW

Capacity in queue for next 12 months: 15 MW

Estimated available capacity using low-value resources: 1,100 MW

***includes fuel sources such as wood waste, logging residue, slash and brush, etc.**

Estimated available capacity of all biomass resources: 5,000 MW

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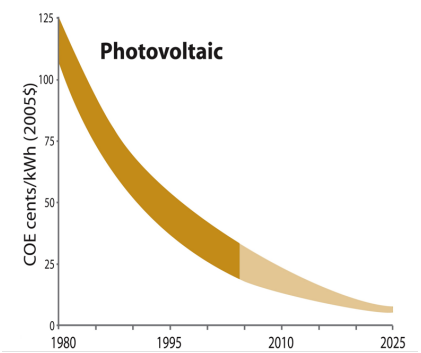
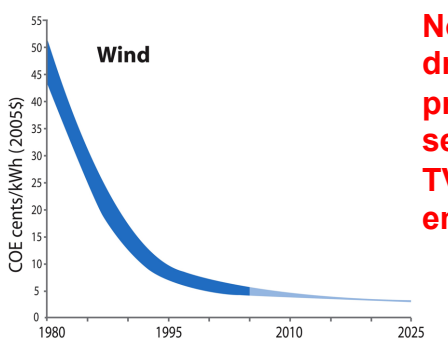
IRP Renewables: why so low?

- **TVA hasn't done the analysis or built the institutional knowledge to feel comfortable relying on in-Valley renewables.**

- **Example: TVA has input excessively high cost estimates for RE resources.**
  - TVA's estimated cost of in-Valley solar is approximately 30 cents/kWh, nearly twice what we're seeing for large solar installations.

- **Example: TVA did not consider well-documented declining cost trends for renewables.**





Not only have renewable energy costs declined dramatically over the past decade, they are projected to continue declining for the next several years, reaching grid parity in the process. TVA's cost estimates remained static across the entire planning period.

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Source: NREL Energy Analysis Office (www.nrel.gov/analysis/docs/cost_curves_2005.ppt)

Issue: Energy Efficiency

- **The Final IRP recommends between 11,400 and 14,400 GWh of energy efficiency by 2020.**

- **This would represent between 6.2% and 7.9% of estimated demand in 2020.**

- **7.9% of projected demand in 2020 would be a significant improvement over TVA's historical performance, but still short of national best practices of 1% or more.**

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Going after 14,400 GWh of Energy Efficiency or more could mean hundred of millions in savings.

- **TVA's current goal of 6,000 GWh in 2015 is estimated to save customers more than $350 million in 2015 alone and save TVA the cost of more than 1,900 MW of additional capacity needs.**

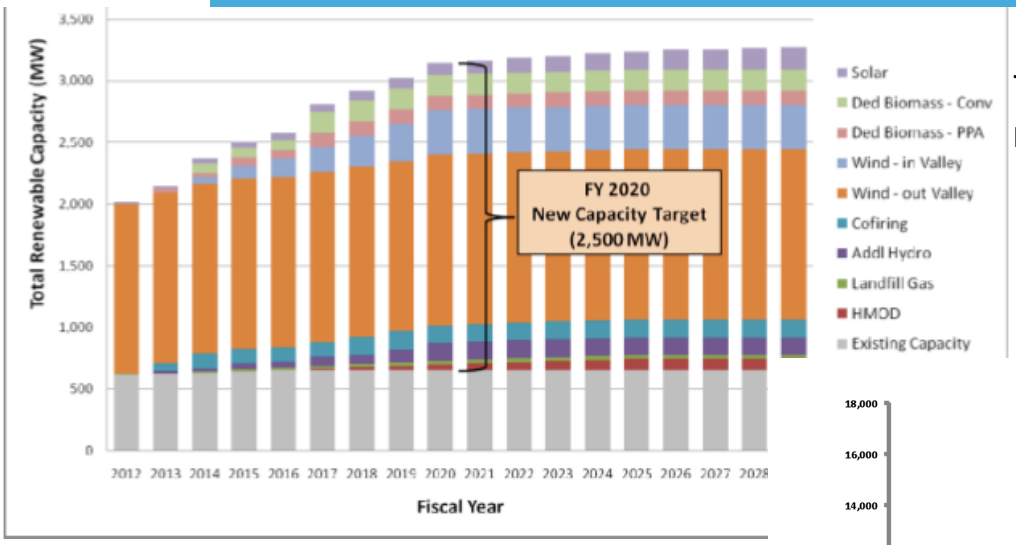
- **Based on these estimates, the difference between 11,400 GWh and 14,400 GWh in 2020 equates to:**
  - Approximately 1,500 MW of additional avoided capacity needs
  - Approximately $174 million in additional customer savings in 2020 alone

- **However, if TVA were to pursue 10% (18,300 GWh) reductions in demand by 2020, it would mean:**
  - An estimated additional $226 million in customer savings in 2020 alone
  - An estimated additional 1,200 MW of avoided capacity needs

IRP Efficiency: why not higher?

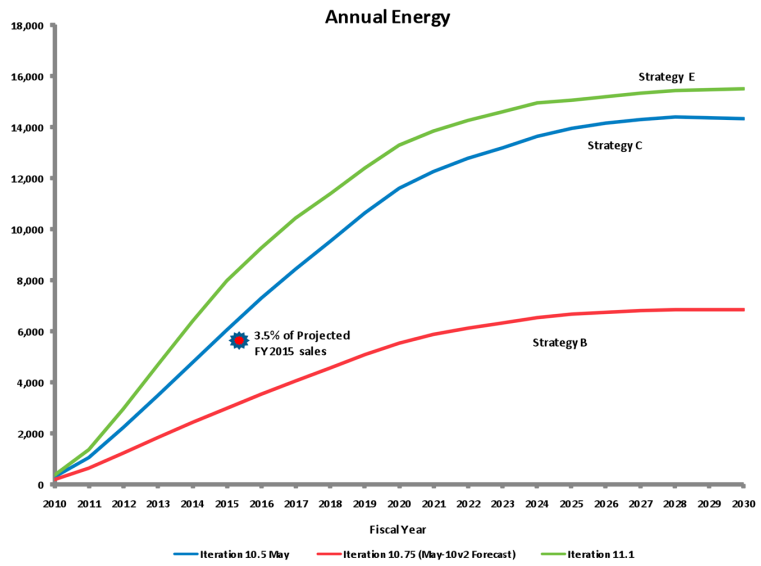
- TVA hasn't completed the proper analysis to truly understand efficiency's potential
- TVA staff are unwilling to rely on continued efficiency opportunities in the outer years of the planning process
- The distributor community adds another layer of complexity to TVA's efforts on efficiency.

Issue: Renewables and Efficiency after 2020…



TVA assumes essentially no additional renewable energy resources after 2020.

TVA assumes essentially no incremental gains in energy efficiency after about 2020.



****TVA has essentially eliminated these options from consideration for meeting capacity needs after 2020.**

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Issue: Nuclear Expansion

- The Final IRP recommends between 1,150 and 5,900 MW of additional nuclear capacity between 2013 and 2029.
- This includes the 1,150 MW Watts Bar Unit 2 that is expected to come online in 2013.
- After Watts Bar, Bellefonte units 1 and 2 could come online in between 2018 and 2022.
- Under high-growth scenarios, the IRP would add potentially two more, supposedly AP100 model, nuclear reactors in 2024 and 2026.
- The IRP simply does not make the case that TVA needs to assume the costs and risks associated with expanding its nuclear portfolio.

Anticipated capital expenditures to add nuclear capacity beyond Watts Bar 2

- **IRP recommends Bellefonte 1 & 2 in 2020 and 2022 respectively.**
  - Estimated annual costs:

Capitol ($MM)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total
BLN1	$205	$158	$149	$623	$775	$773	$938	$666	$452	$98		$4,836
BLN2				$76	$312	$505	$585	$637	$685	$583	$345	$3,728
Total	**$205**	**$158**	**$149**	**$699**	**$1,087**	**$1,278**	**$1,523**	**$1,303**	**$1,137**	**$681**	**$345**	**$8,564**

- **Possible additional reactors (under high-growth scenarios) are two AP1000 in 2024 and 2026**
  - Estimated costs: $14 billion+ in 2010 dollars

Nuclear: why the rush?

- The IRP's shortcoming regarding efficiency and renewables leaves suspect the conclusion that nuclear expansion is required.
- TVA is concerned that it may lose valuable nuclear crews if they can't be rolled directly from WB to BLN.
- Because BLN reactors are a 40-year old design that has never been licensed in the US, the NRC may not approve construction of this design beyond 2020.
- Even a couple years of delayed or slowed investment would provide significant financial benefits to TVA and its customers and provide time for cheaper, safer alternatives to come to market.

Summing it up: The Good, Bad and the Ugly

- **The Good:**
  - The IRP process was a robust, transparent process that includes significant public input.
  - TVA has committed to reiterating this process no later than 2015.
  - TVA's willingness to have a serious discussion about it's aging coal-fired generation and commit to initial idling.
- **The Bad (or at least not-as-good):**
  - TVA and its distributors can do more on energy efficiency to maximize the benefits to the people of the Valley.
- **The Ugly:**
  - TVA treatment of renewable energy resources misses the mark
  - TVA's enthusiasm for nuclear power is misguided

Question?
Comments?
Concerns?

- **Additional resource:**
  - www.cleanenergy.org
  - www.tva.com/environment/reports/irp/index.htm

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