



**AEP/Southwestern Electric Power Company
Integrated Resource Plan
Stakeholder Committee Report**

With Company Responses – October 2018

**Meeting Held August 14, 2018
Fayetteville, Arkansas**



SWEPCO Stakeholder Report

November 9, 2018

Primary Author: Simon Mahan, Southern Renewable Energy Association

The Stakeholder Committee of the Southwestern Electric Power Company's 2018 Integrated Resource Planning process would like to commend the company on an excellently prepared IRP and a thoroughly collaborative process. The Arkansas Public Service Commission (PSC) IRP Guidelines underscore the importance of a robust stakeholder engagement process, and SWEPCO has exceeded those Guidelines. Even when SWEPCO and the Stakeholder Committee disagreed, SWEPCO still performed additional analysis at the request of the Stakeholder Committee and provided rationale.

The Stakeholder Committee would like to encourage SWEPCO to expeditiously implement the findings of this IRP. Due to the federal tax credits for renewable energy expiring soon, the Stakeholder Committee encourages SWEPCO to immediately issue Requests for Proposals for up to 2,000 megawatts of wind energy, and 1,500 megawatts of solar energy. The Stakeholder Committee also encourages SWEPCO to continually evaluate ways to incorporate energy storage, and towards that end, issue a 250 megawatt/1,000 MWh RFP.

The Stakeholder Committee thanks SWEPCO staff for their efforts and would like to encourage the Arkansas PSC, Arkansas PSC staff, and other Arkansas utilities to emulate SWEPCO's practices and attitude towards stakeholder engagement in future IRP planning.

Southwestern Electric Power Company 2018 Integrated Resource Plan

Stakeholder Committee Timeline

August 7, 2018 – SWEPCO emails stakeholders meeting agenda, draft IRP

August 14, 2018 – SWEPCO IRP Stakeholder Meeting, Fayetteville, Arkansas

August 15, 2018 – SWEPCO provides Stakeholder Committee with slides from Stakeholder Meeting

August 17, 2018 – SWEPCO IRP Stakeholder Committee submits questions to SWEPCO

August 29, 2018 – SWEPCO provides responses to the questions submitted by the Stakeholder Committee

September 4, 2018 – SWEPCO IRP Stakeholder Committee holds conference call to discuss responses

September 24, 2018 – SWEPCO provides the Stakeholder Committee with Preliminary IRP Modeling Results

October 5, 2018 – SWEPCO hosts a webinar for the Stakeholder Committee to discuss the Preliminary IRP Modeling Results



October 12, 2018 – SWEPCO IRP Stakeholder Committee holds conference call to discuss Preliminary IRP Modeling Results, and develop a list of requests and modifications

October 16, 2018 – SWEPCO IRP Stakeholder Committee submits additional sensitivity runs to SWEPCO

October 31, 2018 – SWEPCO provides response to the Stakeholder Committee additional sensitivity runs

November 9, 2018 – SWEPCO IRP Stakeholder Committee files Stakeholder Report

Stakeholders Involved

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Company Response:

The Company would like to thank all of the Stakeholders for both participating in the Stakeholder meeting held in Fayetteville, Arkansas on August 14, 2018 and for developing very constructive comments and feedback on the Company's DRAFT IRP.

As referenced in the Stakeholder Report, stakeholders submitted two sets of questions to SWEPCO following the August 14th stakeholder meeting. Below are those questions with SWEPCO's responses.

**Southwestern Electric Power Company
Responses to
1st Set of Stakeholder Questions for SWEPCO Arkansas IRP
Submitted August 17, 2018
Responded August 29, 2018**

GENERAL

1. Provide specific individual information regarding SWEPCO's existing generating units, including:
 - Dollar per megawatt-hour (\$/MWh) generation costs, for the past five years for each unit
 - Efficiency in BTU/kWh, for the past five years for each unit
 - Generation in MWh, and annual capacity factor, for the past five years for each unit

RESPONSE: See Attached Excel workbook, tab labeled SWEPCO Plant Data for the requested information.

2. Provide the average age of the existing generation fleet by technology type.
 - This request does not pertain solely to SWEPCO's generation units, but encompasses the entire United States electric industry.
 - Technology types should include coal steam turbine, natural gas combustion turbine, natural gas steam turbine, natural gas combined cycle, natural gas reciprocating engine, nuclear reactor, hydro, and other technologies that may be relevant to the company's current fleet and possible generation resources.
 - Stakeholders believe this can be done relatively easily with the ABB/Ventyx data and software suite.
 - Also provide the average age of retired generation units by technology type that have retired in the past 10 years.

RESPONSE: See Attached Excel workbook, tab labeled US Unit Age for the requested information.



3. Provide estimated rate impact by customer class, estimated overall SWEPCO system costs, and other financial metrics to compare and contrast implications of various scenarios and/or sensitivities.
RESPONSE: The modeling in the IRP estimates the overall production costs of various scenarios and does not estimate rate impacts by class. This is generally not practical in an IRP as it cannot be known if future resources will be owned or acquired through purchase power agreements, which affect rates differently. We should encourage the stakeholders to focus on the overall production cost impacts. The modeling results will show incremental cost over the first, or base year, of the plan.
4. How will SWEPCO evaluate potential PURPA projects?
RESPONSE: PURPA projects are evaluated on an as needed basis and upon request by third parties.
5. Would the model runs make recommendations with regards to retirements and deactivation schedules, or are those independent of the modeling?
RESPONSE: Based on stakeholder input, portfolios modeled for the draft IRP update will include specific scenarios where units are retired during the planning period.
6. Are any units “must run”? If so, please list them and at what capacity factors or parameters they are considered “must run”. Are any units “hard wired” to run in the model?
RESPONSE: To the extent units are designated as “must run,” they will be identified in the draft IRP update.
7. How will SWEPCO evaluate potential “corporate off-taker” or “Green Tariff” type renewable energy projects?
RESPONSE: This type of information is not considered in the planning process. Renewable projects are selected due to economics or to fill a capacity need.

STORAGE

8. Explain SWEPCO’s methodology regarding energy storage evaluations, including, but not limited to:
 - Energy arbitrage pricing, usage rates (e.g., subhourly, hourly, daily, weekly, etc.), and general performance time periods (e.g., charging from 10AM-1PM, discharging from 1PM-4PM).
RESPONSE: The IRP model will dispatch the storage resource when its revenues are greater than its expenses from a variable perspective. The IRP model is an hourly simulation. The resource will charge when it is least costly and discharge when it can make the most revenue.
 - Possible ancillary services and pricing values.
RESPONSE: The current IRP model used for this IRP will not quantify the value of ancillary services.
9. Provide a citation for capital cost estimate provided on slide 45.
RESPONSE: The capital cost estimate citation is on slide 45.
10. Explain how the ITC is factored with energy storage.
RESPONSE: The current IRP storage resource does not include the impact of ITC.



11. Explain how energy storage is modeled.

RESPONSE: Storage is modeled as an independent resource that has capital and operating and maintenance expense and can earn revenue based on its variable cost relative to market pricing and it provides capacity value to meet the Company's capacity obligation.

12. What "value stack" components are considered, and at what values?

RESPONSE: Energy. The energy values are the Fundamental Commodity prices shown in the Stakeholder presentation. All resources are evaluated against the four pricing Scenarios presented at the Stakeholder presentation and included in the DRAFT IRP.

COAL

13. What are the coal transportation costs?

- What are the past five years of coal transportation costs, on a dollar per ton basis and a dollar per megawatt hour basis?
- What is SWEPCO's forecast for coal transportation costs to be used for this IRP, on a dollar per ton basis and a dollar per megawatt hour basis?

Provide the all-in delivered cost of PRB coal on a dollar per ton basis and a dollar per megawatt hour basis, and forecasts.

RESPONSE: The coal transportation and commodity contract prices are confidential information. The attached Excel workbook, on the tab labeled "Coal Transp Data," shows publicly available coal transportation costs from the PRB basin to the states in and around SWEPCO's service territory. Cost of PRB coal will be based on the Fundamental Forecast, which has been provided in the Stakeholder Meeting slides. The actual historical information can be found in the FERC FORM 1.

WIND

14. Provide a synopsis of why the Wind Catcher project was rejected and steps SWEPCO plans to take in the future to improve the likelihood of approvals.

RESPONSE: Wind Catcher provided a unique opportunity to get ahead of Public Service Company of Oklahoma (PSO) and SWEPCO's traditional integrated resource plans by aggregating smaller renewables projects into a viable option. The Wind Catcher project included a dedicated 765 kV tie line to deliver power directly to the Tulsa load center and would glean full benefits of the Renewable Energy Production Tax Credit (PTC). Despite the suite of guarantees offered by AEP, the risk profile was viewed by the Public Utility Commission of Texas as unacceptable. SWEPCO and other AEP operating companies will continue with their respective resource plans for smaller projects to fill their needs.

15. What are the capital cost assumptions for wind?

RESPONSE: The Company's assumptions for wind are represented in a levelized cost approach and were provided both in the Stakeholder presentation and in the Draft IRP on page 90.

16. Why does the 600 MW annual limit exist?

RESPONSE: The 600MW annual limit is a planning assumption that the Company believes is reasonable for this IRP. The limit is based on historical RFPs and regulatory approvals. The actual



quantity of wind resources added in a given year will be determined as the company evaluates future proposals and responses to RFPs.

17. Why does the 1,900MW limit exist?

RESPONSE: The cumulative 1,900MW limit is also a planning assumption that recognizes an overall penetration limit of intermittent resources within SPP. A further description of these planning assumptions is provided in the Draft IRP on page 90.

18. Will SWEPCO model multiple different tranches for wind energy?

RESPONSE: At this time, the Company is only modeling one tranche; however, initial runs are selecting all of the Wind resources subject to annual and cumulative constraints. Therefore, there would be limited value in adding another level of wind as it would not change the results.

NATURAL GAS

19. How do economies of scale affect new natural gas generation facilities?

RESPONSE: Larger gas facilities offer a lower installed cost per kW than smaller gas facilities because there are certain balance-of-plant costs that remain relatively independent of the facility size.

20. Why did SWEPCO choose such large natural gas facility capacities as opposed to smaller modular configurations?

RESPONSE: The Company chose the configuration shown because of the low installed cost and high efficiency levels. The Company is modeling a 25% share of the resource. This is discussed on page 96 of the DRAFT IRP.

EFFICIENCY

21. Does the energy efficiency savings include the 1% or 1.5% goal increase? Is SWEPCO modeling an increase in the EE goals?

RESPONSE: In order to preserve equal footing among all resource selections, SWEPCO allowed the model to optimize its resource selections based on the economics of EE costs and potential savings. EE costs and savings were derived from the Electric Power Research Institute's (EPRI) "2014 U.S. Energy Efficiency Potential Through 2035" report as well as through input from the SWEPCO DSM team. At the stakeholders' request, SWEPCO can run a scenario with a predetermined amount of EE to compare the costs of this scenario to the Preferred Plan.

DG SOLAR

22. Provide comment on the distributed/net meter solar information provided in the article, "Utilities' eyes on state's solar-power surge; dispute arises on generators' credit," Arkansas Democrat Gazette, July 22, 2018 (<http://www.arkansasonline.com/news/2018/jul/22/utilities-eyes-on-state-s-solar-power-s/>)

RESPONSE: For this IRP, distributed solar resources were evaluated based on historical rooftop solar additions, future estimated costs of rooftop solar, and the current level of federal incentives. As a result of this analysis, SWEPCO determined an assumed growth rate to embed distributed solar resources in the model. Distributed solar resources were embedded in amounts equal to a



Compound Annual Growth Rate of 4.4% over the planning period. SWEPCO will continue to monitor any changes to net-metering laws and its effect on rooftop solar costs. If projected costs were to change because of net-metering rule changes, SWEPCO may make the necessary adjustments at that time to its distributed generation resource assumptions.

UTILITY-SCALE SOLAR

23. Please provide methodology to calculate LCOE for utility-scale solar, including capital cost, capacity factor, regional differences, etc.

RESPONSE: The LCOE shown for utility-scale solar is for discussion purposes, the model does not utilize this value to make resource decisions. The LCOE values shown include the Company's WACC, the installed capital cost, the ongoing O&M and the expected output for the resource configuration. The detailed assumptions can be provided in the draft IRP update.

24. Why does the 300 MW annual limit exist?

RESPONSE: The 300MW annual limit is a planning assumption that the Company believes is a reasonable for this IRP. It is based on historical RFPs, regulatory approvals, and the fact that the Company currently does not have any utility-scale solar.

25. Why does the 1,300 MW total limit exist?

RESPONSE: The cumulative 1,300MW limit is also a planning assumption that recognizes an overall penetration limit to intermittent resources within SPP. A further description of these planning assumptions is provided in Section 4.5.5.1.1, page 85 of the DRAFT IRP.

26. Explain how the ITC was factored into the solar energy pricing.

RESPONSE: The ITC is reflected in the overall cost of the solar resource.

ELECTRIC VEHICLES

27. Explain SWEPCO's assumptions on electric vehicle adoption.

RESPONSE: SWEPCO has created 3 different electric vehicle (EV) adoption scenarios (high, medium, and low). The medium EV scenario assumes the number of EVs in SWEPCO territory increases at a rate of 30% per year through 2030. The high adoption scenario assumes an average increase of 40% per year and the low scenario assumes a rate of growth of 25% per year. The total number of EV's in SWEPCO's territory as of Dec 2017 was only 303 (88% of those are in AR). Even with the relatively aggressive growth assumptions on EV's, the impact of EV's on SWEPCO's load by 2030 is well within the High and Low Economic scenarios that are modeled in the IRP analysis.

TRANSMISSION

28. How will SWEPCO evaluate potential transmission opportunities?

RESPONSE: Transmission opportunities generally are not in the scope of an IRP process. Such solutions would or could surface in an RFP process soliciting additional resources.



SWEPSCO IRP
2nd Set of Stakeholder Committee Requests
Submitted on October 16, 2018
Responded on October 31, 2018

- 1) SWEPCO should reduce wind energy prices and solar energy prices to align with the NREL Annual Technology Baseline.
- 2) SWEPCO should evaluate several types of wind energy resources at several different price points and performance levels, as provided below:

		2019	2020	2021	2022	2023*	2024*	2025*
TRG1	Overnight \$/kW	\$730	\$687	\$739	\$787	\$1,133	\$1,075	\$730
	Capacity Factor	50%	50%	51%	51%	52%	52%	53%
	LCOE \$/MWh	\$19	\$21	\$22	\$23	\$27	\$26	\$24
TRG5	Overnight \$/kW	\$840	\$803	\$839	\$874	\$1,208	\$1,142	\$1,075
	Capacity Factor	44%	45%	45%	46%	47%	48%	48%
	LCOE \$/MWh	\$25	\$26	\$27	\$28	\$31	\$29	\$28
TRG7	Overnight \$/kW	\$1,013	\$991	\$1,023	\$1,054	\$1,384	\$1,313	\$1,241
	Capacity Factor	35%	36%	37%	38%	38%	39%	40%
	LCOE \$/MWh	\$39	\$40	\$39	\$39	\$41	\$39	\$36

PTC included through 2022. *Excludes PTC

- 3) SWEPCO should increase its cap on wind energy to beyond 60% and consider increasing its annual limit to 1,000 MW per year or higher.
- 4) SWEPCO should update its solar power pricing, as provided below:

		2019	2020	2021	2022	2023	2024	2025
Mid	Overnight \$/kWdc	\$707	\$707	\$707	\$707	\$707	\$784	\$775
	Capacity Factor AC	20%	20%	20%	20%	20%	20%	20%
	LCOE \$/MWhAC	\$32	\$32	\$32	\$32	\$32	\$38	\$38

ITC incorporated with step-down through 2023.

- 5) SWEPCO should increase the amount of solar allowed in the model to at least 25% of its total energy, with annual additions of up to 1,000 MW annually.
- 6) SPP uses 20% capacity value for wind and 70% capacity value for solar in their ITP process. SWEPCO should use these same values for new generation.

RESPONSE TO REQUESTS 1-6: [In response to the Stakeholders' first 6 requests contained in its 2nd request for information, the Company has performed an analysis with increased levels of wind and solar](#)



resources available for the model to select from during the optimization process. It is important to note the Company does not believe the Stakeholder recommended input assumptions are realistic or achievable, or that such a plan would result in an acceptable level of risk allocation for the Company and the commissions that regulate SWEPCO to execute and approve such a plan.

In addition to the 1,400 MW of wind capacity allowed in the Company's original optimization runs, the Company allowed an additional 1,000 MW of wind capacity in the Stakeholder optimization run. The additional 1,000 MW wind capacity had the following characteristics:

- An additional 600 MW of wind was available at the Company's wind prices which are comparable to the Stakeholders' TRG1 wind prices.
- An additional 200 MW of wind was available at the Stakeholders' TRG5 wind prices.
- An additional 200 MW of wind was available at the Stakeholders' TRG7 wind prices.
- All wind resources could be added beginning in 2022 and 1,000 MW of wind capacity could be added in a single year.
- A 48% capacity factor and 30% capacity credit was assumed for all Company and Stakeholder wind alternatives.

Also, in addition to the 1,300 MW of utility solar capacity allowed in the Company's original optimization runs, the Company allowed an additional 850 MW of solar in the Stakeholder optimization run. The additional 850 MW solar capacity had the following characteristics:

- The LCOE cost curve provided by the Stakeholders was assumed for the Stakeholder solar resource.
- All solar resources could be added beginning in 2021 and 1,000 MW of solar capacity could be added in a single year.
- The Company assumed a 28% capacity factor for all solar resources, not the 20% capacity factor suggested by the Stakeholders.
- A capacity credit of 70% was assumed for both the Company's solar alternative and the Stakeholder alternative.

The following table provides a summary of the wind and solar installed capacity for the Stakeholder optimization run:



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Installed Capacity (MW)

	AEP Wind	Stakeholder Wind TRG5	Stakeholder Wind TRG7	Stakeholder Solar	AEP Solar
2018	0	0	0	0	0
2019	0	0	0	0	0
2020	0	0	0	0	0
2021	0	0	0	0	0
2022	1,000	0	0	0	0
2023	2,000	0	0	850	0
2024	2,000	0	0	850	0
2025	2,000	200	0	850	150
2026	2,000	200	200	850	300
2027	2,000	200	200	850	450
2028	2,000	200	200	850	600
2029	2,000	200	200	850	750
2030	2,000	200	200	850	900
2031	2,000	200	200	850	1,050
2032	2,000	200	200	850	1,200
2033	2,400	200	200	850	1,300
2034	2,400	200	200	850	1,300
2035	2,400	200	200	850	1,300
2036	2,400	200	200	850	1,300
2037	2,400	200	200	850	1,300

The Stakeholder optimization run produces the following capacity expansion plan:

	302 MW (25% Share of 1500 MW)							Capacity Reserves Above		
	GE 7HA.02 CC Firm Capacity (MW)	Commercial DSM Firm Capacity (MW)	Residential DSM Firm Capacity (MW)	Distributed Solar Firm Capacity (MW)	Utility Solar Firm Capacity (MW)	CVR Firm Capacity (MW)	Wind Firm Capacity (MW)	Firm Generation Capacity with New Additions (MW)	Required Generation with New Capacity Additions (MW)	Reserve Margin with New Capacity Additions (%)
2018	0	0	0	3.30	0	0	0	5,745	627	25.7
2019	0	0	0	3.30	0	0	0	5,679	472	22.2
2020	0	5	3	3.30	0	24	0	5,636	573	24.7
2021	0	9	6	3.63	0	24	0	5,588	482	22.6
2022	0	13	8	3.63	0	24	300	5,894	754	28.4
2023	0	11	9	3.96	595	24	600	6,679	1,520	45.0
2024	0	16	10	3.96	595	24	600	6,684	1,504	44.5
2025	0	15	9	4.29	700	37	660	6,753	1,554	45.5
2026	0	13	7	4.62	805	37	720	6,805	1,584	46.0
2027	0	12	6	4.62	910	37	720	6,907	1,607	46.0
2028	0	8	4	4.95	1,015	37	720	7,007	1,688	47.6
2029	0	9	4	4.95	1,120	37	720	7,112	1,768	49.0
2030	0	7	4	5.28	1,225	37	720	7,041	1,671	46.8
2031	0	6	4	5.61	1,330	37	720	7,145	1,748	48.3
2032	0	4	3	5.94	1,435	37	720	7,248	1,823	49.6
2033	0	3	2	5.94	1,505	48	780	7,299	1,846	49.9
2034	0	1	2	6.27	1,505	58	840	7,367	1,891	50.7
2035	0	1	1	6.60	1,505	58	840	7,367	1,860	49.8
2036	0	1	1	6.93	1,505	67	840	7,016	1,475	41.8
2037	0	0	1	7.26	1,505	67	840	6,662	1,090	33.9



The Company does not believe the Stakeholders' recommended assumptions are reasonable or would result in an acceptable level of risk allocation for the Company or the commissions that regulate SWEPCO. An example of this risk results from using the Stakeholder's lower price resource assumptions which result in a portfolio that is \$1.9 billion less expensive than the Company's base plan (or about 5.5% less expensive). These assumptions create capacity reserves of approximately 1,900 MW above what is needed to meet the SPP required minimum reserve margin of 12%, and reserve margins of more than 50% in some years. While this exercise does validate the Company's conclusion that the forecasted value of both wind and solar within the IRP modeling construct is significant, the Company continues to support its Preferred Portfolio as being more realistic and achievable over the planning period.

SWEPCO should develop a 500 MW renewable energy corporate procurement scenario for evaluation.

Response: Currently, renewable resources are projected to be lower cost than market energy and therefore, the Company would not readily assign this lower cost generation to benefit a specific customer. The Company plans to offer a Renewable Energy Credit tariff for customers that are interested in supporting renewable energy.

We request methodology and metrics regarding transmission costs, including multiple configuration types (e.g., point-to-point, network integration transmission service, self-build, etc.) and costs, and possible capacity, energy, ancillary or any other benefits to those types.

Response: These calculations are generally not performed during IRP development but instead could be appropriate when analyzing responses to RFPs.

SWEPCO should perform the same analysis it performed for the Pirkey unit as for the Dolet Hills unit, with retirement taking place in 2025.

Response: SWEPCO will take this request under advisement in preparing the final IRP.

SWEPCO should provide the data inputs associated with the energy storage "value stack".

Response: The Company agrees there may be additional value to all resources versus what is modeled within the IRP, which is predominately focused on day-ahead energy and capacity value, when "ancillary services" are included in a resource evaluation. These values or "value stack" in SPP at this time include day-ahead energy, regulation up, regulation down, spinning reserves and non-spinning reserves and real time energy, regulation up, regulation down, spinning reserves and non-spinning reserves. The current characteristics of electrochemical energy storage appear to allow this type of resource to be effective in participating in all of these markets, if the resource is designed to respond to these market products. The Company is currently monitoring this value; however, at this time is not comfortable assigning a monetary value to these market products other than day-ahead capacity and energy. This current view does not prevent the Company from choosing to pursue adding energy storage in the future based on all of its characteristics.

SWEPCO should provide an estimate at what value and/or what cost energy storage would begin to be selected in the current model.

Response: Below is a simulation of the breakeven cost needed for the battery storage resource that the Company has included in this IRP. The Company has assumed for the purposes of this calculation that Ancillary Services revenue may range from zero to 50% of the energy revenue earned, ultimately the Ancillary Services revenue will be dependent on the storage design as well as the market. For Scenarios 1, 2 & 3, the Company modified the installed cost to get a breakeven NPV for each Scenario. In



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Scenarios 2 & 3, the value of Ancillary Services was changed to gain a relative understanding of Ancillary Services revenue on breakeven installed cost. In conclusion, based on current conditions the storage resource installed cost would need to be reduced by approximately 80%.

Summary

	Today's Cost	Break-Even Cost		
		Scenario 1	Scenario 2	Scenario 3
Intalled Cost (\$/kWh)	457	85	100	70
Capacity (kWh)	40,000	40,000	40,000	40,000
Installed Cost (\$)	18,280,000	3,410,002	4,011,965	2,808,038
Fixed O&M (\$/kW-yr.)	39	39	39	39
Ancillary Svs Rev. as % of Energy	25%	25%	50%	0%
Fixed Charge Rate (FCR) for 20 Yr. Asset (%)	13%	13%	13%	13%
Discount to Today's Cost(%)		-81%	-78%	-85%
NPV (\$)	(22,104,995)	0	0	0

SWEPSCO should provide a narrative of lessons learned from the Windcatcher deal, and recommendations and steps it plans to take to improve the likelihood of a positive outcome of future projects.

Response: "A narrative of lessons learned from the Windcatcher deal" is not an appropriate topic for the Arkansas IRP, particularly given that the Arkansas Public Service Commission approved the Application in APSC Docket No. 17-038-U.