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APPLICATION OF SOUTHWESTERN ELECTRIC POWER COMPANY FOR CERTIFICATE OF CONVENIENCE AND NECESSITY AUTHORIZATION AND RELATED RELIEF FOR THE ACQUISITION OF WIND GENERATION FACILITIES	§	BEFORE THE STATE OFFICE OF ADMINISTRATIVE HEARINGS

REDACTED

DIRECT TESTIMONY

OF

CHARLES S. GRIFFEY

ON BEHALF OF TEXAS INDUSTRIAL ENERGY CONSUMERS

January 14, 2020

SOAH DOCKET NO. 473-19-6862
PUC DOCKET NO. 49737

APPLICATION OF SOUTHWESTERN ELECTRIC POWER COMPANY FOR CERTIFICATE OF CONVENIENCE AND NECESSITY AUTHORIZATION AND RELATED RELIEF FOR THE ACQUISITION OF WIND GENERATION FACILITIES	**§**	**BEFORE THE STATE OFFICE OF ADMINISTRATIVE HEARINGS**

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DIRECT TESTIMONY OF CHARLES S. GRIFFEY

I. INTRODUCTION

Q. PLEASE STATE YOUR NAME, OCCUPATION, AND BUSINESS ADDRESS.

A. My name is Charles S. Griffey, and I am a consultant providing services concerning the electric and natural gas industries. My address is 2918 Todville Road, Seabrook, Texas 77586.

Q. ON WHOSE BEHALF ARE YOU PROVIDING TESTIMONY?

A. I am testifying on behalf of Texas Industrial Energy Consumers ("TIEC").

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?

A. I address whether Southwestern Electric Power Company's ("SWEPCO") request to acquire partial ownership of three wind facilities (the "Wind Projects") under development should be granted. The Wind Projects are the 999 MW Traverse facility, the 287 MW Maverick facility, and the 199 MW Sundance facility, for a combined total of 1485 MW. SWEPCO's co-owner would be its affiliate Public Service of Oklahoma ("PSO"), and SWEPCO's proposed share of the Wind Projects is 810 MW. The total installed cost of SWEPCO's share is $1.1 billion.

Q. PLEASE OUTLINE YOUR FORMAL EDUCATION AND CERTIFICATIONS.

A. I have a Master of Business and Public Management from the Jones Graduate School of Business at Rice University and a Bachelor of Science in Chemical Engineering from Rice University. I am a Chartered Financial Analyst and a Professional Engineer registered in the State of Texas.

Q. PLEASE STATE YOUR PROFESSIONAL EXPERIENCE.

A. Prior to becoming a consultant in 2009, I was employed by Reliant Energy, Inc. ("Reliant") as Senior Vice President of Regulatory Affairs and Market Design. I was responsible for Reliant's nationwide efforts in the design of competitive markets, regulatory affairs including interface with state commissions and Regional Transmission Organizations, and government affairs. Reliant owned generation in a number of states and had retail operations in Texas and the Mid-Atlantic region.

I began working for Houston Lighting and Power ("HL&P"), the electric utility serving parts of Southeast Texas and the predecessor company to Reliant, in 1989 in Corporate Planning where I worked on resource planning, including determining what power plants to construct, what projects to cancel, evaluation of owning plants compared to power purchases, and determination of marginal cost. Beginning in 1995, I was also responsible for the rate department, and eventually I became Vice President of Regulatory Planning, with responsibility for resource planning, financial planning, rates, and rate design and cost allocation. Subsequently, I helped lead the integrated utility's efforts in restructuring the ERCOT market and transitioning the company for competition, integrating both wholesale and retail market design and operations, restructuring of utility functions and affiliate issues, and public policy advocacy.

Before working for Reliant, I worked at Austin Energy, at the Public Utility Commission of Texas ("Commission"), and for Bechtel Group, Inc. as an engineer on the Coolwater Coal Gasification Project.

Q. PLEASE DESCRIBE YOUR EXPERIENCE WITH MATTERS PERTAINING TO RATE IMPACTS, RESOURCE PLANNING AND UTILITY DECISION MAKING REGARDING GENERATION PROJECTS.

A. While at HL&P I was responsible for resource planning, financial planning and rates. I evaluated decisions to retire plants, reactivate plants, and add new power plants, as well as the economics of power purchases and demand-side management. I also worked with the Electric Power Research Institute to examine how to use options analysis to evaluate the decision to retire a unit or add a resource, as well as general resource planning economic issues. I helped develop HL&P's generation and integrated resource planning models, and I helped transition the company's models away from traditional revenue-requirement utility planning models to value-based planning models and ultimately market-based models and decision analysis. While at Reliant Energy, I participated in evaluations of power plant construction, mothballing, and retirements using state-of-the-art probabilistic and market-based models.

During my employment at HL&P, the company built one new plant, signed several purchased power agreements, and terminated proposed natural gas plants and a lignite plant. Later, I helped lead the transition of the company to wholesale and then retail competition. I am very familiar with traditional resource planning concepts as well as the evolution of those concepts as competitive markets developed and market prices became available. Later as an executive at Reliant, I also served as part of the Wholesale Leadership Team overseeing the Company's generation fleet, the Retail Leadership Team overseeing the retail business, and the Strategic Planning Committee, along with the CEO, CFO and Senior VP of Strategy. As part of those groups, I actively participated in decisions regarding new and existing generating units and projects.

Previously I served on the staff of the PUC and testified as to the prudence of utility fuel procurement and integrated resource planning.

Q. PLEASE DESCRIBE YOUR CONSULTING EXPERIENCE ON RESOURCE PLANNING ISSUES.

A. As a consultant I have testified on the prudence of utility resource planning and evaluated utility resource planning in numerous jurisdictions. I have testified on the prudence of SWEPCO's decision to complete construction of the Turk coal plant in Texas PUC Docket No. 40443 and Southwestern Public Service Company's decision to enter into solar purchased power agreements in Texas PUC Docket No. 48973. I testified that Mississippi Power Company's continued efforts to complete the Kemper integrated gasification combined-cycle plant in Mississippi were imprudent, and I have also testified regarding proposed combined-cycle gas plants in Louisiana and Texas, Public Service Company of Colorado's plan for early retirement of two coal plants to replace them with renewables, Vectren South's proposal to build a solar facility in Indiana, and NIPSCO's plan to retire its coal fleet in favor of renewables.

Q. WHAT REGULATORY COMMISSIONS AND COURTS HAVE YOU TESTIFIED BEFORE?

A. Yes. I have testified before the Federal Energy Regulatory Commission ("FERC") and the state regulatory commissions of Colorado, Indiana, Kansas, Louisiana, Maryland, Mississippi, New Mexico, Pennsylvania, and Texas. I have testified or provided expert reports to state and federal courts and provided testimony before the Texas Legislature. As a consultant, I have testified on behalf of ratepayer coalitions, industrial customers, retail electric providers, generators, fuel suppliers, and the Staff of the Texas Public Utility

Commission. Exhibit CSG-1 lists the testimony I have presented and a summary of my work experience.

Q. IS YOUR TESTIMONY BASED ON YOUR PERSONAL KNOWLEDGE AND EXPERIENCE AND THE INFORMATION YOU REVIEWED IN THIS CASE?

A. Yes.

Q. DID YOU RELY ON SOURCES OF INFORMATION THAT YOU REGARD AS RELIABLE AND ARE ORDINARILY AND CUSTOMARILY USED AND RELIED ON BY THOSE INVOLVED IN THE ELECTRIC INDUSTRY?

A. Yes. The RFIs and discovery materials that I relied upon are attached as Exhibit CSG-3.

Q. PLEASE SUMMARIZE YOUR TESTIMONY.

A. SWEPCO's request should not be granted because its flawed resource planning analysis does not properly capture the relative risks, benefits, and costs of the wind facilities. Its analysis is flawed in the following ways:

1. SWEPCO's natural gas price forecast is too high, and its uncertainty bands are too narrow. SWEPCO's "fundamentals" forecast has been consistently too high for years, yet SWEPCO has not changed its process. Simply adjusting SWEPCO's overstated gas prices to more reasonable levels, without any other corrections to SWEPCO's model, shows that the Wind Projects are uneconomical;

2. Independent of gas prices, SWEPCO has likely overstated its forecasted price of Southwest Power Pool (SPP) wholesale power, as evidenced by its projection of flat implied market heat rates. The current futures market prices for power delivered to the SPP South Hub, which SWEPCO identifies as the hub closest to its generation, are below SWEPCO's calculated breakeven prices;

3. SWEPCO has improperly inflated the assumed benefits of the Wind Projects by assuming the enactment of a carbon tax, which would increase the price of electricity, while ignoring the possibility that a carbon mitigation policy, if any, could be implemented through continued subsidies to renewable projects, which would lower the price of electricity applicable to the Wind Projects;

4. SWEPCO understates the congestion costs associated with the Wind Projects by assuming that those costs will not increase after 2029. SWEPCO also assumes that a generation tie-line would be economic if congestion increases, yet it does not include the cost of the generation tie-line in all of the cases where it limits congestion. SWEPCO admits that the PROMOD model, upon which the congestion estimates are based, understates congestion, but it did not make any adjustments to correct this deficiency;

5. SWEPCO conducted a sole-source solicitation for build/transfer/own (BTO) wind projects. In doing so, it fails to demonstrate that these projects are better for ratepayers than other resources, such as solar, or purchased power agreements (PPAs), or buying financial forwards;

6. SWEPCO claims that the Wind Projects represent a hedge on future price increases, but it fails to recognize that its customers are already largely hedged against higher power prices (both natural gas and market heat rates) through SWEPCO's coal plants and against higher market heat rates by its gas fleet. Instead, SWEPCO's proposed acquisition of the Wind Projects would put it in a long position on power in the SPP at ratepayer expense. This means that the Wind Projects would effectively place

ratepayers in the position of being merchant wind generators. This reinforces the next point that a regulated utility's cost of capital is the wrong rate to use to discount the cash flows of the Wind Projects;

7. SWEPCO fails to recognize the difference in the relative certainty of the *costs* it would be incurring in acquiring the Wind Projects, compared to the large uncertainty in the *benefits* of the projects, which are based on forecasts on avoided energy costs over 30 years into the future. The benefits should be discounted at an appropriate risk-adjusted discount rate, which is higher than the utility's regulatory approved rate of return;

8. SWEPCO does not need capacity, which means it does not have to acquire a resource at this time. Acquiring the Wind Projects now will lock in the detriment to ratepayers if power prices remain low. If, on the other hand, SWEPCO foregoes the Wind Projects, and power prices increase, SWEPCO can likely still mitigate those costs. When a decision can be delayed, the ability to delay is an option that has significant value when the future benefits of a project are uncertain.

In summary, SWEPCO has failed to properly analyze the relative costs and benefits of the Wind Projects, the appropriateness of the Wind Projects relative to other resources, and the value of the ability to delay a decision in order to gather additional information in the face of uncertainty. A reasonable utility monitoring the market and valuing the ability to delay making what amounts to a billion-dollar, 30-year position on energy prices would not acquire the Wind Projects.

II. OVERVIEW OF SWEPCO'S PROPOSAL AND ANALYSES

Q. PLEASE SUMMARIZE SWEPCO'S PROPOSAL.

A. After the PUC's rejection of its Wind Catcher Project in 2018, SWEPCO developed a proposal to acquire three wind facilities (the "Wind Projects") and to build a tie-line in the future if necessary for congestion relief. SWEPCO performed a sole-source solicitation for BTO projects and selected the three highest scoring projects from its request for proposals (RFP). SWEPCO did not perform an all-source solicitation to determine whether other resources, such as solar, were more economic than the BTO projects. Nor did SWEPCO consider PPAs, which could have been more economical due to the seller's ability to use the production tax credits (PTCs) more efficiently.

SWEPCO does not have a forecasted capacity need until 2030,[1] so the economics of the Wind Projects are largely driven by whether the benefits provided by the Wind Projects' energy production (market price of power minus marginal cost of production, multiplied by MWh production) exceed their capital and operations and maintenance costs.

Q. UPON WHAT FACTORS DOES REGULATORY REVIEW OF RESOURCE ACQUISITION DECISIONS FREQUENTLY REVOLVE?

A. Two of the most important factors are the utility's economic modeling (including its assumed forecast for natural gas prices) and the utility's decision-making process in selecting a resource, and both those factors are involved in this case.

[1] SWEPCO Response to TIEC 1-19 Attachment 6.

Q. PLEASE DESCRIBE SWEPCO'S ECONOMIC ANALYSIS.

A. SWEPCO created a base case "fundamentals" forecast of power prices, based on (1) its fundamentals forecast of natural gas prices and (2) supply and demand forecasts for electricity. This base case fundamentals forecast includes an assumption that a price on CO2 emissions will be in place by 2028, and that no further tax subsidies will be available for future wind facilities after the expiration of the production tax credits in 2023. SWEPCO then dispatched the Wind Projects against the forecasted market prices to determine energy benefits. SWEPCO adds the forecasted PTC benefits, then subtracts the cost of the projects (capital plus O&M) and a forecast of the cost of congestion. SWEPCO also ran a number of sensitivity cases on energy prices, CO2 taxes, the inclusion of a tie line, and the level of output of the Wind Projects.

Q. HAVE SWEPCO'S FUNDAMENTALS FORECASTS PROVEN TO ACCURATELY FORECAST PRICES IN THE PAST?

A. No. SWEPCO's fundamentals forecasts have proven to be unreasonably high for over the past ten years. It is the same forecasting approach that underlay SWEPCO's proposed CCN for the Wind Catcher project, which the Texas PUC rejected. Even SWEPCO admits that its forecasts over the last ten years have proven to be too high.[2]

Q. HAS SWEPCO LEARNED ANY LESSONS OVER THE LAST TEN YEARS OF CONSISTENTLY ERRONEOUS GAS FORECASTS?

A. No. SWEPCO states that it does not have any documents concerning "lessons learned" regarding natural gas forecasting.[3]

[2] SWEPCO Response to TIEC 7-11.

[3] SWEPCO Response to TIEC 7-12.

Q. HAS SWEPCO MODIFIED ITS FUNDAMENTALS FORECAST METHODOLOGY IN LIGHT OF ITS EXPERIENCE?

A. No.[4]

Q. IS THIS A REASONABLE RESPONSE TO CONSISTENT OVER-FORECASTING?

A. No. This is discussed in more detail in Section III.A of my testimony.

Q. DID SWEPCO CALCULATE A BREAKEVEN POWER PRICE AND BREAKEVEN GAS PRICE FOR ITS PROPOSAL?

A. Yes.

Q. ARE THE BREAKEVEN GAS AND POWER PRICES BELOW FUTURES MARKET PRICES?

A. No. SWEPCO's breakeven natural gas and power prices are in fact higher than futures market prices, which means that the proposed Wind Projects would likely raise, rather than lower, ratepayer costs, particularly given that SWEPCO has the option to not act at this time.

Q. WHAT OTHER ISSUES ARE THERE WITH SWEPCO'S ECONOMIC ANALYSIS?

A. SWEPCO's economic modeling is also unreasonable because it (1) assumes power prices for the output of the Wind Projects that are likely overstated by not reflecting future wind penetration in the SPP, (2) biases its analysis in favor of the Wind Projects by considering the possible passage of carbon tax while giving no consideration to the possible extension of the PTCs or ITCs, (3) undercounts congestion costs, (4) includes speculative capacity

[4] SWEPCO Response to TIEC 7-13.

savings, and (5) uses too low of a discount rate for the energy benefits relative to the discount rate used for the costs of the Wind Projects.

Q. PLEASE DESCRIBE HOW SWEPCO MADE ITS DECISION TO ACQUIRE THE WIND PROJECTS.

A. At a high level, SWEPCO appears to assume that the pending expiration of production tax credits ("PTCs") for wind resources offers an opportunity for lower cost wind power than might be available in the future. SWEPCO undertook a BTO wind-only RFP, and evaluated the RFP bids using a combination of the PROMOD, Aurora, and Plexos models to determine the benefit of acquiring the Wind Projects.[5]

Q. WHAT DECISION CRITERIA DOES SWEPCO RELY UPON TO JUSTIFY ACQUIRING THE WIND PROJECTS?

A. As shown Mr. Torpey's testimony, in its P50 Base Case with Carbon Costs, SWEPCO determined that the Wind Projects would avoid NPV $1.34 billion in energy costs net of congestion, while incurring NPV $841 million in costs net of PTCs, yielding what it calculated as a NPV $567 million net benefit.[6] SWEPCO discounted both the benefits (primarily the energy revenue received) and the cost of the Wind Projects at the same discount rate of 7.09%, which is SWEPCO's regulatory weighted average allowed rate of return; in other words, it treated the energy revenue of the Wind Projects as being of equal certainty with the costs of the Wind Projects.

[5] Pfeifenberger Direct at 41.

[6] It also included $70 million NPV in capacity benefits.

Q. WHAT DOES SWEPCO'S LOW CASE WITH NO CARBON COSTS ANALYSIS SHOW?

A. In its P50 Low Gas with No Carbon Costs case ("Low Gas/No CO2") SWEPCO determined that the Wind Projects would receive NPV $1.08 billion in energy revenue net of congestion, while incurring NPV $841 million in costs net of PTCs, yielding what it calculated as a NPV $236 million net benefit.[7] Again, it treats the benefits and the costs as equally certain.

Q. ARE THE MAJORITY OF THE COSTS OF THE WIND PROJECTS CERTAIN?

A. Yes. The investment cost is relatively certain. The O&M costs are less certain but are only about 12% of the overall costs.[8]

Q. ARE THE ENERGY SAVINGS BENEFITS OF THE WIND PROJECTS CERTAIN?

A. No. SWEPCO justifies the Wind Projects based on benefits associated with energy revenue. According to SWEPCO, the energy revenue benefits are a function of (1) natural gas prices and (2) the heat rate associated with avoided generation from purchases from the rest of SPP. Not only are natural gas prices uncertain, there is also uncertainty associated with future energy prices from other SPP providers and the heat rate of future technologies.

The Wind Projects also produce PTC benefits, which are relatively certain, although there are risks associated with the level of energy production, possible changes in tax law, and AEP's tax appetite. Thus, I have netted the relatively certain PTC benefits

[7] It also included $29 million in capacity benefits in the Low Gas/No CO2 case.

[8] SWEPCO Response to TIEC 2-16.

against the relatively certain costs in my quantitative analyses. This has the same effect as treating the PTC benefits as being similarly certain as the costs.

Q. HAVE THE COMMISSIONERS PREVIOUSLY DISCUSSED HOW UTILITIES OUGHT TO MAKE DECISIONS WHEN FACING UNCERTAIN BENEFITS?

A. Yes. The question was discussed in the Commission's decision regarding SWEPCO's Wind Catcher proposal. During the discussion, the Commissioners discussed how to deal with uncertain benefits and certain costs. For instance, Chairman Walker touched on the theme of investments under uncertainty:

> Chairman Walker: We know that the costs are likely, although some are projected, but the benefits are based on a lot of assumptions that are questionable.[9]

Q. GIVEN THE ASYMMETRY IN CERTAINTY, HOW SHOULD THE COMMISSION COMPARE THE COST AND BENEFITS OF ACQUIRING THE WIND PROJECTS?

A. The Commission should recognize that the projected benefits are significantly more uncertain than the costs and plan and evaluate accordingly.

Q. DOES SWEPCO HAVE A CAPACITY NEED AT THIS TIME?

A. No. SWEPCO does not project a capacity need until at least 2030.[10]

Q. WHY IS SWEPCO'S LACK OF A CAPACITY NEED IMPORTANT?

A. SWEPCO's lack of a capacity need means that it does not have to make a now-or-never decision to acquire resources for economic energy savings – it has the ability to wait and see how the future unfolds. I should also note that capacity projections are highly

[9] Transcript of PUCT Open Meeting on July 26, 2017 for Docket 47461 at 40.

[10] SWEPCO Response to TIEC 1-19, Attachment 6. Also, Mr. Torpey's benefits model does show any capacity savings until a number of years after that.

uncertain, and any number of factors could reduce or eliminate the need for capacity ten years out. The ability to wait, particularly in a volatile natural gas and energy price environment, is an option that has value. Dealing with certain costs and uncertain benefits requires a level of care, particularly when a utility has the option to wait. Whether and how SWEPCO considered that option is a key factor in judging the reasonableness of the decision-making process beyond whether they used the right point forecast for natural gas and power.

Q. HAVE THE COMMISSIONERS ACKNOWLEDGED THAT UTILITIES HAVE AN OPTION TO WAIT TO MAKE INVESTMENTS FOR ECONOMIC ENERGY SAVINGS?

A. Yes. At the same Open Meeting discussing Wind Catcher, Commissioner D'Andrea challenged SWEPCO regarding its claim that approving Wind Catcher was the only way to deal with the potential for high future avoided costs:

> Mr. Coe [for SWEPCO]: What we have here is a choice. We can certify this project or not. Are there risks associated with both choices? Yes, but the risk of not certifying the project is much greater. There's nothing that protects customers from the higher energy prices and gas prices; whereas on the low side the Company has provided many benefits...
>
> Comm. D'Andrea: This is something that keeps coming up. There are good things that can protect them. Right?...You know, if we denied [Wind Catcher], say, presumably you wouldn't just sit on your hands and say, whatever; we're stuck with natural gas now. We're not going to do anything. We're not going to build wind. Right?[11]

[11] Transcript of PUCT Open Meeting on July 26, 2017 for Docket 47461 at 26.

Q. ARE THERE WAYS TO EVALUATE PROJECTS WHEN FACING UNCERTAINTY AS TO THEIR BENEFITS?

A. Yes. Quantitative techniques have been developed to make economic decisions under uncertainty, which I will address in Section IV.D of my testimony. These techniques include using payback methods, hurdle rates, and risk-adjusted discount rates.

Q. ARE THERE OTHER ISSUES WITH SWEPCO'S APPROACH?

A. Yes. SWEPCO states that the Wind Projects will not change the dispatch of its system.[12] Further, it offers all of its generation into the SPP market for dispatch, yet it claims that it should get 10% of the purchased power savings from offering its generation into the SPP market. It no longer makes sense to offer a utility an incentive to market next day and real-time power, as this now happens automatically. Yet, by acquiring the Wind Projects, SWEPCO would render some of the power generated by its existing power plants unnecessary for retail needs, transforming that generation into off-system sales for which it intends to earn a 10% incentive. This makes no sense and should not be allowed.

Q. HOW MUCH DOES SWEPCO PROJECT IN OFF-SYSTEM SALES FROM ITS CURRENT UNITS IF THE WIND PROJECTS ARE APPROVED?

A. In the P50 Base Gas/No CO2 case, the off-system sales margins from SWEPCO's existing plants are $208 million. In the P50, Low Gas/No CO2 case, the projected off-system sales margins are $117 million.[13] This is approximately half of the $236 million customer net benefits for that case.

[12] SWEPCO Response to TIEC 1-21.

[13] Updated Torpey Benefits Model Final at "Inputs" tab.

Q. HOW SHOULD THE COMMISSION ASSESS SWEPCO'S PROPOSED WIND PROJECTS?

A. The regulatory compact affords a utility a reasonable opportunity to earn a reasonable return on invested capital used and useful in proving electric service. A utility should behave rationally given the circumstances and the information available to it; the fact that it is regulated should not cause it to make uneconomic decisions. The PUC is directed to regulate public utilities as a substitute for competition,[14] which suggests that it should require utilities to apply the same type of rational decision-making that the forces of competition mandate in a market.

The Commission should review the economic risk associated with the benefits of the Wind Projects, which are largely driven by future natural gas prices and the impact of technological improvements on future energy prices. The Commission should then compare the risk-adjusted value of the future benefits with the risk-adjusted cost of the Wind Projects, taking into account the fact that SWEPCO does not have a projected capacity need until 2030 at the earliest. The Commission should also take into account the fact that, if a utility has no near-term capacity need, then it has flexibility to deal with higher energy prices in the future by pursuing future opportunities. It does not have to make an irrevocable long-term commitment today.

[14] PURA § 11.002(b).

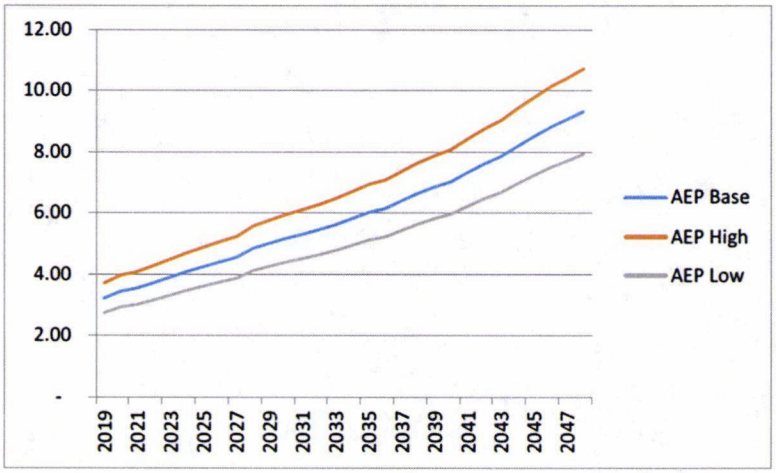
III. REASONABLENESS OF SWEPCO'S ECONOMIC ANALYSES

A. SWEPCO's Forecasted Gas Prices Are Unreasonably High

Q. WHAT NATURAL GAS PRICES DOES SWEPCO USE IN ITS ECONOMIC MODELING?

A. SWEPCO's projected natural gas prices for its three cases (High, Base, and Low) are shown on a levelized basis on the table below.[15]

Figure 1
Comparison of AEP Gas Forecasts ($/MMBtu)



Q. HOW DOES SWEPCO FORECAST NATURAL GAS PRICES?

A. AEP periodically creates a "fundamentals" forecast of power and commodity prices for use by its subsidiaries such as SWEPCO.[16] AEP creates a bottom-up set of assumptions for supply and demand of commodities such as natural gas, as well as assumptions about future resource additions, which it uses to create forecasts of expected prices through an "iterative" process.[17] The nomenclature is that a forecast completed in the latter part of

[15] The No CO2 cases are approximately $0.20/MMBtu lower in each year after 2027.

[16] SWEPCO Response to TIEC 1-5.

[17] Bletzacker Direct at page 3, line 8 through page 5, line 11 and page 6, lines 13-23 and SWEPCO Response to TIEC 1-4.

2018 would be known as a 2H 2018 forecast, while one completed in the first part of 2019 would be called a 1H 2019 forecast. In this case, SWEPCO relied upon its 1H 2019 fundamentals forecast.

Q. DOES SWEPCO USE A LONG-TERM TRENDED NYMEX[18] FUTURES MARKET PRICE FOR ANY PURPOSES?

A. No.[19]

Q. DO ANY OTHER UTILITIES OF WHICH YOU ARE AWARE USE A LONG-TERM TRENDED FORECAST OFF OF THE NYMEX MARKET PRICE?

A. Yes. SPS uses the trended NYMEX with weighting declining from 100% to 25% through time as part of its gas price forecasting.

Q. SWEPCO CLAIMS THAT FUTURES MARKET PRICES CANNOT BE RELIED UPON AFTER APPROXIMATELY TWO YEARS WHEN THE OPEN INTEREST ON EXCHANGES IS LOW.[20] IS THERE EVIDENCE THAT FUTURES MARKET PRICES ARE MORE RELIABLE THAN SWEPCO BELIEVES AND MORE RELIABLE THAN SWEPCO'S OWN FUNDAMENTALS COMMODITY FORECASTS?

A. Yes. In 2017, SWEPCO was required by the Louisiana Public Service Commission to buy a five-year forward strip[21] of natural gas. SWEPCO was able to purchase this five year strip in July 2017 for delivery beginning in April 2018 for a delivered price of [redacted]/MMBtu.[22] This is equivalent to [redacted]/MMBtu at Henry Hub given the basis differential of [redacted]/MMBtu to the gas delivery points.[23] NYMEX futures for Henry Hub

[18] In this testimony I use NYMEX to refer to futures prices for Henry Hub delivery.

[19] SWEPCO Response to TIEC 1-1.

[20] Bletzacker Direct at 24.

[21] A strip is an around the clock purchase of the same quantity of commodity for constant delivery in future years.

[22] SWEPCO Responses to TIEC 1-7 (HS) and TIEC 8-1 (HS)

[23] SWEPCO Response to TIEC 8-1.

delivery closed at $2.81/MMBtu for the same time period on July 26, 2017,[24] which is [redacted] to what SWEPCO was able to purchase natural gas for on July 27, 2017. Thus, SWEPCO's own purchases show that the quoted NYMEX price was an accurate reflection of actual forward prices at least six years into the future. Meanwhile, SWEPCO's "fundamentals" forecasts closest to the transaction date were $5.28/MMBtu for the late 2016 forecast and $4.33/MMBtu for the late 2018 forecast, as shown in the table below:

Figure 2
Comparison of Actual Market Purchase to NYMEX and SWEPCO Forecasts[25]
($/MMBtu)

Equivalent Henry Hub Market Purchase for April 2018-March 2023, executed July 27, 2017	[redacted]
NYMEX Henry Hub Futures Price for April 2018- March 2023 on 7/26/17	$2.81
SWEPCO Fundamentals Gas Forecast 2H 2016 for April 2018 – March 2023 Delivery	$5.28 (Base) and $4.45 (Low)
SWEPCO Fundamentals Gas Forecast 2H 2018 for April 2018 – March 2023 Delivery	$4.33 (Base) and $3.65 (Low)

The values in the table demonstrate that the NYMEX price accurately reflects the actual purchase price, while SWEPCO's fundamentals forecasts closest in time to the transaction, including SWEPCO's low-case forecasts, are far too high and are unreliable. While these are forward prices agreed upon the date of the transaction (which provide price certainty) and not future spot prices,[26] this demonstrates that transactions can be

[24] https://web.archive.org/web/20170726080405/https://www.cmegroup.com/trading/energy/natural-gas/natural-gas.html.

[25] Low case calculated as 85% of Base Case per Mr. Bletzacker's statement that "the aggregate percentage expression [standard deviation]...varies very little between forecasts," and SWEPCO calculates the current standard deviation at 15.7%. See SWEPCO Responses to TIEC 1-6 and 5-7.

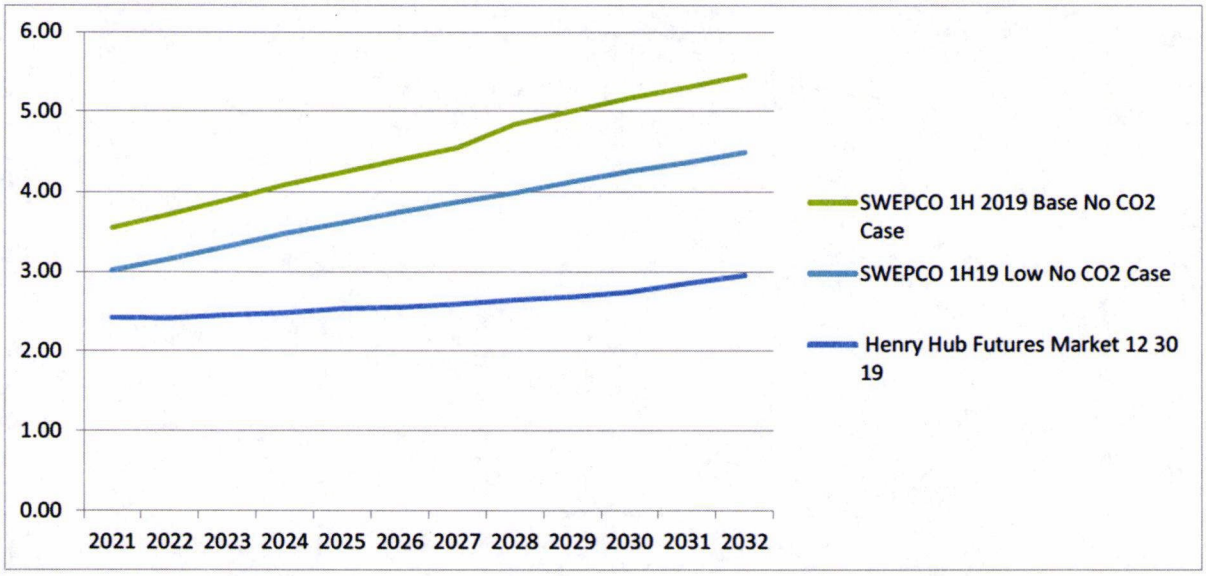
[26] The theoretical relationship between expected spot prices and futures prices is that the futures price divided by the risk-free rate equals the expected spot price divided by appropriate risk adjusted discount rate (including

accomplished at the forward price well into the future. Yet SWEPCO dismisses futures prices as unreliable and insists that economic analyses rely upon its fundamentals forecast.

Q. HOW DO SWEPCO'S FORECASTS COMPARE TO ACTUAL MARKET GAS PRICES?

A. I show the Henry Hub futures (NYMEX) prices compared with SWEPCO's base no-carbon and low no-carbon cases in the chart below:

Figure 3
SWEPCO Gas Forecasts and Breakeven Compared to Current Futures Price ($/MMBtu)[27]



The current NYMEX is well below any of AEP's recent fundamentals forecasts, including its "Low Gas/No CO2 Case" forecast. The differences are quite dramatic, as even SWEPCO's most recent low-case gas price forecast is 150% above current futures market prices by 2032.

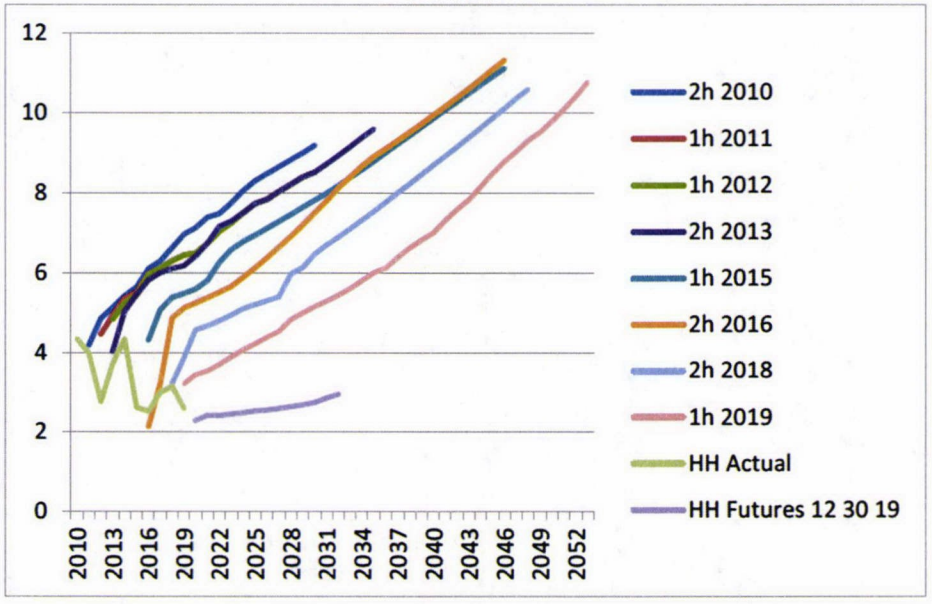
adjustment for returns for holding the physical commodity). The appropriate risk premium to use to discount natural gas spot prices is discussed later in my testimony.

[27] Henry Hub futures price from ICE dated 12/23/19.

Q. HAVE SWEPCO'S GAS PRICE FORECASTS PROVEN ACCURATE OVER TIME?

A. No. While it is unlikely that any point forecast of gas prices will match actual market outcomes, SWEPCO's forecasts have proven to be wildly and consistently overstated. The chart below (and attached as Exhibit CSG-2 in full-size) shows actual prices at Henry Hub in light green, and the NYMEX Henry Hub futures price as of 12/30/19 in light purple. The other lines are the gas forecasts that SWEPCO has used. With the exception of the most recent forecast, these forecasts all share a common feature in that they rapidly escalate from current market conditions and then demonstrate an approximately linear upward trajectory in excess of inflation in the medium term before escalating at inflation in the long-term. The most current forecast rapidly escalates in the near term, but then maintains escalation in excess of inflation throughout the period.

Figure 4
Comparison of SWEPCO Gas Forecasts for Henry Hub to Historical and Current Market
$/MMBtu



Q. HAS SWEPCO EVER COMPARED ITS FUNDAMENTALS FORECASTS TO ACTUAL RESULTS, AS YOU DID ABOVE?

A. No. SWEPCO claims that it "has not completed any formal study to compare its weather-normal long-term gas price forecasts to actual (weather-affected) results."[28] As can be seen from the quote above, SWEPCO is claiming that it doesn't make sense to compare forecasts based on expected weather with those based on actual weather. But since weather is a random variable, over time the effects of weather should be washed out and the trend should emerge. The trend is that SWEPCO's natural gas forecasts have been far too high.

Q. DOES SWEPCO ADMIT THAT ITS NATURAL GAS PRICE FORECASTS HAVE BEEN TOO HIGH?

A. Yes, although it notes that its forecasts have been decreasing through time.[29]

Q. DOES SWEPCO AGREE THAT IT IS APPROPRIATE TO JUDGE A FORECAST BY HOW WELL IT PREDICTS THE FUTURE?

A. No. SWEPCO says it "does not believe hindsight is a valid way to evaluate a forecast."[30] This is an extraordinary statement. Hindsight should not be used to evaluate the prudence of a particular set of actions, but if one does not compare one's forecasts to what actually occurred, one can never learn why the forecasts do not reflect reality. One can spend large sums of money and have a wonderful model, but if the model consistently does not comport with reality, it is not fit for its purpose and should be discarded. After ten years of consistently overstated gas prices, SWEPCO should not be relying on the failed modeling being turned out by the fundamentals forecasts.

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[28] SWEPCO Response to TIEC 1-8.

[29] SWEPCO Response to TIEC 7-11.

[30] *Id.*

Q. HAS SWEPCO LEARNED ANY LESSONS FROM THESE FAILED FORECASTS OVER THE LAST DECADE?

A. No.[31] When asked, SWEPCO says that "has not identified any documents concerning 'lessons learned' regarding natural gas forecasting" over the last ten years. In 2010, SWEPCO forecasted that gas prices in 2019 would be nearly $7/MMBtu, and as late as 2016 it still projected they would be over $5/MMBtu in 2019. In reality, prices averaged about $2.60/MMBtu throughout 2019. Yet SWEPCO sees nothing wrong with its approach to gas price forecasting. In fact, it says that its forecasts "are not predictions of energy market outcomes but are modeled projections of what may happen,"[32] which leads to a conclusion that the Commission should not place much reliance on SWEPCO's forecasts.

Q. HAS SWEPCO MADE ANY CHANGES TO ITS FORECASTING METHODOLOGY OVER THE LAST DECADE IN LIGHT OF BEING CONSISTENTLY WRONG?

A. No.[33]

Q. WHAT REASONS MIGHT EXPLAIN WHY SWEPCO HAS CONSISTENTLY FORECASTED GAS PRICES TO BE TOO HIGH?

A. There are two major reasons, one technical and the other based on corporate incentives for regulated utilities.

Q. WHAT IS THE TECHNICAL REASON?

A. Gas prices are affected by, among other things, improvements in extraction technology and the methods of locating reserves. The fracking revolution is an example. While it is known

[31] SWEPCO Response to TIEC 7-12.

[32] *Id.*

[33] SWEPCO Response to TIEC 7-13.

that technological advances may occur, it is unknown if and when they may occur. This type of uncertainty is sometimes called "known unknowns."

There is also uncertainty associated with events that simply are not foreseeable at all (e.g., geopolitical events ten or twenty years into the future that could affect commodity prices). This type of uncertainty is sometimes considered an "unknown unknown." SWEPCO does not adequately consider known unknowns nor give meaningful thought to the possibility of unknown unknowns. With regard to known unknowns, SWEPCO states

> known unknowns must be based on "substantial evidence" before being considered. Substantial evidence is enough evidence that a reasonable mind could accept as adequate support for inclusion in a long term forecast. For example, substantive Final Investment Decisions in technological advances affecting long-term prices and trends would qualify as substantial evidence.[34]

The short way to describe that response is that SWEPCO accounts for known unknowns only when they become known. Effectively, it makes no effort to consider the impact of known unknowns. With respect to the impact of unknown unknowns, SWEPCO says

> The possibility of unknown unknowns are assumed to be in balance and ultimately exert no upward or downward bias to long-term forecasted natural gas prices. Ultimately, the future outcomes, events, circumstances, or consequences that cannot be planned for are approximated within the bounds of the Company's High and Low Band forecasts.[35]

[34] SWEPCO Response to TIEC 7-10.

[35] SWEPCO Response to TIEC 7-10.

Q. DO SWEPCO'S HIGH AND LOW BANDS ADEQUATELY CAPTURE CONTINGENCIES SUCH AS UNKNOWN UNKNOWNS THAT CANNOT BE PLANNED FOR?

A. No. The purpose of using sensitivity cases in economic modeling is to determine whether a project is viable under a wide range of probable outcomes. Accordingly, the sensitivity cases presented should cover a wide range of the probability distribution. For instance, SWEPCO presents a P95 sensitivity case for the expected capacity factor, which means that it is modeling the bottom end of a 90% range of outcomes, or a range of outcomes that covers slightly less than two standard deviations from the mean.[36] However, SWEPCO's high and low cases are only one standard deviation from the mean by its definition. This means that at best these cases only bound two-thirds of the probability distribution. Additionally, SWEPCO incorrectly calculates the volatility of gas prices and thus the standard deviation. The result is that SWEPCO understates the annual volatility in gas prices, and therefore presents an overly narrow range of probable outcomes.

Q. HOW DOES SWEPCO CALCULATE THE ANNUAL VOLATILITY OF GAS PRICES?

A. It calculates a standard deviation of the average Henry Hub price in each of the last five years, and then takes the average of the five years of annual standard deviation.[37] Its estimated standard deviation is 15.7%.[38] It then creates low and high cases that are ~85% and ~115% of the base case in every year into the future (e.g., the Low Case in year 30 is only 15% lower than the year 30 Base Case gas price), effectively creating high and low

[36] In a normal distribution, one standard deviation from the mean bounds 68% of outcomes, two standard deviations bound 95% of outcomes, and three standard deviations bound 99.7% of outcomes.

[37] SWEPCO Response to TIEC 1-6.

[38] SWEPCO Response to TIEC 5-7, Attachment 1.

forecasts that stay tightly within a 15% band around its biased expected value and claiming that there is a two-thirds chance that actual gas price result will be within this band.

Q. WHAT IS WRONG WITH THIS?

A. First, for a commodity whose price exhibits random walk tendencies,[39] volatility should be calculated based on the change in price, not the price itself.[40] Typically, the distribution of changes in prices, not the distribution of prices itself, is how price volatility is measured for commodities and financial instruments. So SWEPCO's approach of taking the average of the daily prices to get an annual price and then measuring the standard deviation of the annual prices bears no resemblance to typical statistical measures of volatility. Second, the average of the daily volatility is not the same as the annual volatility. If the average daily volatility is 2% (i.e., on average, prices change 2% each day), that does not mean that the annual volatility is 2% (i.e., that prices change 2% each year). Statistically, in a lognormal price forecast that is typically used in financial modeling, volatility increases with the square root of time. In other words, uncertainty increases the further out in time a forecast goes, so the range of probable of outcomes should increase over time, like a cone, rather than stay a narrow band like SWEPCO assumes.

These errors explain why over the last ten years actual results have never been above SWEPCO's calculated one-standard-deviation low case band of 15% below the base case. If SWEPCO's one-standard-deviation range was correctly calculated, there should be a two-thirds chance of gas prices being within 15% of SWEPCO's base forecast every year.

[39] As a first approximation, many financial instruments and commodities are modeled using a random walk.

[40] Dixit and Pindyck, Investment Under Uncertainty at 64-75. This results in a lognormal distribution to future prices.

However, instead of every two out of three years being within 15% of SWEPCO's base forecast, zero out of ten years have been, and actual prices have always been below SWEPCO's Low Case, much less its Base Case.

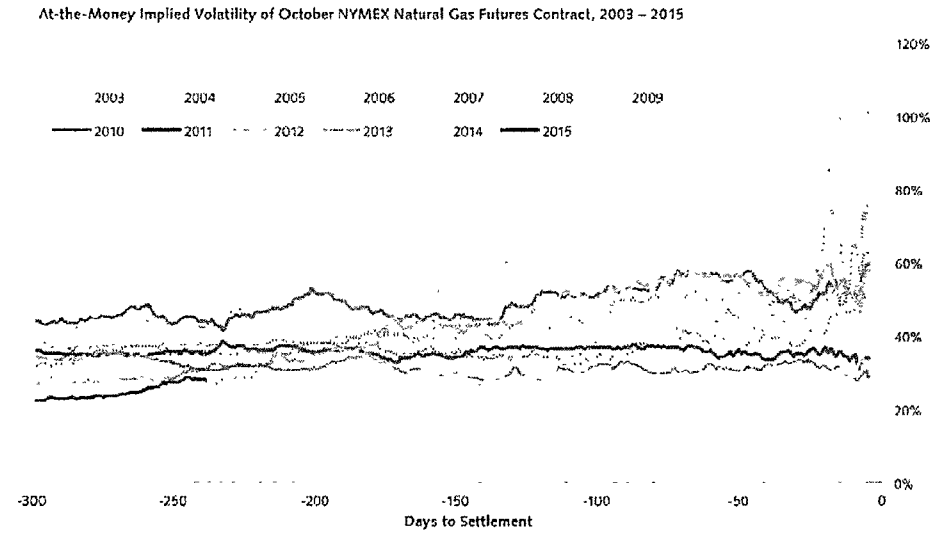
Q. ARE THERE OBSERVABLE, MARKET-BASED INDICATORS OF THE VOLATILITY OF NATURAL GAS PRICES?

A. Yes. Annualized volatility can be observed from how futures contracts trade for particular time frames.

Q. WHAT DO MARKET VOLATILITIES LOOK LIKE?

A. The figure below shows the implied volatility of futures contracts for natural gas:

Figure 5
Natural Gas Volatility over Time[41]



In recent years the volatility of ~ one year forward natural gas futures prices has been approximately 25%. It can be seen that the years with higher price levels, e.g., 2005-2009,

[41] Shale Game: Market Dynamics in North American Natural Gas, D.E. Shaw & Co., December 2014, Vol. 5, No. 1.

had higher volatilities, and that volatility started moderating as prices came down from the needle peaks during aforementioned periods.

Q. WHAT WOULD THE FIVE YEAR LOWER BOUND FOR A ONE STANDARD DEVIATION MOVE BE AT 25% VOLATILITY AND 15% VOLATILITY?

A. The lower bound of a one standard deviation range can be calculated using the following formula, where the volatility is the standard deviation:

Lower confidence interval = expected price * (1+standard deviation) ^ (-square root of time)

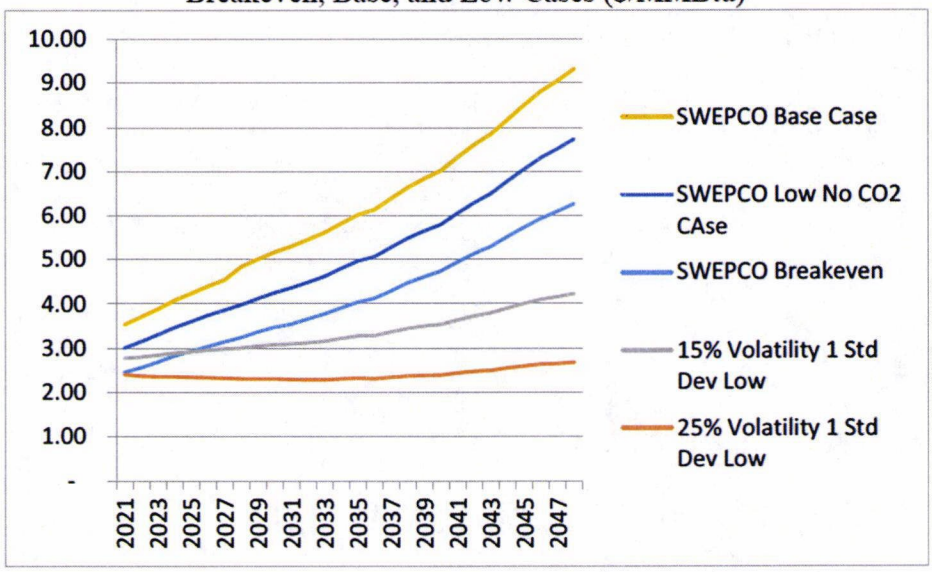
In five years at 25% volatility, the lower confidence interval would be (1+0.25)^(-2.24), or 61% of the expected price.[42] So, in the case of SWEPCO's forecast, the lower bound would be 61% of $4.08/MMBtu (SWEPCO's projected price in 5 years), or $2.49/MMBtu, not the $3.47/MMBtu that SWEPCO calculates. Thus, if SWEPCO had correctly calculated the lower bound of a one standard deviation rage, it would have shown that it was below its calculated breakeven gas price of $2.83 for 2024. At 15% volatility, one standard deviation below the mean in 5 years would be $2.90/MMBtu, not the $3.47/MMBtu that SWEPCO calculates.

Q. PLEASE COMPARE A CORRECTLY CALCULATED LOW CASE WITH 15% AND 25% VOLATILITY TO SWEPCO'S LOW AND BREAKEVEN CASES, ASSUMING THAT SWEPCO'S BASE FORECAST WERE ACCURATE.

A. Please see below:

[42] The square root of 5 is 2.24.

Figure 6
Comparison of 1 Standard Deviation Low Cases to SWEPCO's
Breakeven, Base, and Low Cases ($/MMBtu)



The correctly calculated one standard deviation cases are well below SWEPCO's breakeven case, even presuming that SWEPCO's Base Case was an unbiased estimate of the future expected value of gas prices, which it is not. At 25% volatility, a one-standard-deviation low case would be below SWEPCO's calculated breakeven price for the entire study period. At 15% volatility, a one-standard-deviation low case would be below SWEPCO's breakeven for every year after 2025. Note that a correctly calculated one-standard-deviation range increases in width over time, consistent with the fact that the uncertainty of a forecast increases the further out in time it goes. In contrast, SWEPCO's low case forecast stays at 15% below its base case forecast throughout the study period.

Q. DO RECENT THIRD PARTY GAS PRICE FORECASTS SUPPORT YOUR VIEW THAT SWEPCO'S NATURAL GAS PRICE FORECASTS ARE TOO HIGH?

A. Yes. The figure below shows two recent forecasts from Platts' Analytics (formerly PIRA).[43] The two forecasts are [redacted] SWEPCO's respective Base and Low Cases:

Figure 7
Comparison of SWEPCO Cases to Recent 3rd Party Forecasts (HS)

[redacted]

Q. SWEPCO RELIES ON COMPARISONS TO ONE OF THE JANUARY 2019 EIA FORECASTS TO JUSTIFY ITS OWN HIGH FORECASTS. IS IT APPRORIATE TO RELY ON THIS FORECAST IN EVALUATING SWEPCO'S PROPOSED PROJECTS?

A. No. EIA forecasts of gas prices have always been lagging indicators and have historically overstated future gas prices, particularly since the advent of the shale revolution. This is due in part to the nature of the EIA forecasting process. It is both time consuming and suffers some of the same flaws as SWEPCO's fundamentals forecasts. Indeed, academics

[43] SWEPCO Second Supplemental Response to TIEC 5-2, Attachments 2 and 3 (HS). SWEPCO also recently provided various projections from IHS Markit, but it is unclear what scenarios these represent and what assumptions underlie them, so I have not used them. Note that Platts' 9 30 19 case [redacted]. SWEPCO Third Supplemental Response to TIEC 5-2, Attachment 4 (HS).

and energy modelers have noted that EIA, despite knowing of the potential for shale gas for decades, failed to forecast low prices by not addressing the issues of known unknowns and unknown unknowns in its process.[44] The Commission itself has noted that the EIA Reference Case has been too high and has focused on the EIA Low Case in the past.[45]

Q, HOW DOES THE EIA LOW CASE COMPARE TO SWEPCO'S LOW CASE?

A. The January 2019 EIA high resource and technology case is approximately 10% lower than SWEPCO's own low case, and only 5% above SWEPCO's calculated breakeven gas price case.[46] It is expected that the 2020 EIA forecasts will be issued as soon as this month, and I would request the opportunity to update this testimony if those forecasts are issued prior to the hearing in this case.

Q. WHAT MIGHT BE THE INCENTIVE-BASED REASONS WHY SWEPCO'S GAS PRICE FORECASTS ARE CONSISTENTLY HIGH?

A. High natural gas price forecasts make utility investments in generation technology, particularly renewables and coal, appear more reasonable. Utilities only earn a return on invested capital used and useful in providing electric service. They do not earn a return on fuel (although some receive a small percentage of savings on power purchase/sales to encourage them to pursue opportunities). Thus, utilities have a natural incentive to build higher initial cost/low fuel cost power plants. Such plants can only be justified if the

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[44] "Generally speaking, most analytical approaches in the energy sector do not consider disruptions well. In the case of the shale gas revolution, modelers were aware of the uncertainties associated with shale gas development and even noted it in their forecasts, but had no coherent method for inserting such knowledge into the definitive outputs of the work itself." Energy Transitions, August 2019, "Interrogating uncertainty in energy forecasts: the case of the shale gas boom," Reed, et. al.

[45] *Application of Southwestern Electric Power Company for Certificate of Convenience and Necessity Authorization and Related Relief for the Wind Catcher Energy Connection Project in Oklahoma*, Docket No. 47461, Final Order at FoF 89 (Aug. 13, 2018).

[46] Comparing levelized prices based on the period 2022-2051.

projected fuel savings outweigh the higher initial cost. Projecting high natural gas prices provides a justification for adding new plants to a utility's rate base.

Q. ARE SWEPCO'S FORECASTS CONSISTENT WITH SUCH INCENTIVES?

A. Yes.

Q. DO RATEPAYER GROUPS HAVE SIMILAR INCENTIVES?

A. No. If a proposed plant or PPA would have the effect of reducing electricity prices, ratepayers would have every reason to support it. If a plant were not needed for reliability reasons and would be expected to increase rates, ratepayers would have reason to oppose it. That is the case with the Wind Projects.

Q. WHAT OTHER COMMENTS DO YOU HAVE ON GAS PRICE FORECASTING?

A. Putting aside the absolute level of the various forecasts at any point in time, natural gas prices have been falling over the last decade because of technological improvements in the ability to recover oil and gas from shale deposits, and that price change has been significant. Any forecasting approach that only relies on known data without consideration of future technological improvement will always result in a trailing forecast, and likely one that overstates future gas prices as SWEPCO's Fundamentals Forecast has consistently done. Furthermore, it is not just the level of the forecasts that is important, but how they move over time.[47] The uncertainty in future gas prices makes it critical to examine how long it takes benefits to accrue to cover the cost of a project. If the payback on a project occurs

[47] Indeed, given the high volatility gas prices, a decision-maker should be wary of placing too much significance on any third-party forecasts, or a combination of forecasts, at any particular point in time (other than the forward market). The NYMEX futures have significance in that they can be transacted upon at a particular point in time, but more importantly, options on natural gas futures provide information on the underlying volatility of the commodity, and the volatility can be used to better inform decisions.

very late in its life in the face of highly uncertain benefits, that means that the choice to acquire the project is not a reasonable one. Further, in the face of highly uncertain benefits, it is often more valuable to delay an investment decision until more information about the future becomes known.

Q. WHAT WOULD BE THE ECONOMIC EFFECT OF USING NATURAL GAS FUTURES PRICES BASED ON THE NYMEX MARKET RATHER THAN SWEPCO'S NATURAL GAS PRICES?

A. This change alone would reduce the net benefits of SWEPCO's P50 Low Gas/No CO2 case from $236 million NPV to negative $160 million NPV, or a reduction of $396 million NPV.[48] This number includes the impact of lower projected congestion costs due to lower power prices. This calculation was done by reducing the gross energy benefits (i.e., the projected revenues from the Wind Projects) and the projected congestion costs by the percentage difference between SWEPCO's Low Gas/No CO2 case and current NYMEX prices, consistent with how SWEPCO calculated its breakeven gas price. This comes out to be about $246 million per $1/MMBtu drop in natural gas prices from the Low Gas/No CO2 case.

B. <u>SWEPCO's Power Price Projections Are Unreasonably High.</u>

Q. ASIDE FROM NATURAL GAS PRICES, ARE THERE ANY OTHER ISSUES WITH SWEPCO'S PROJECTIONS OF POWER PRICES?

A. Yes. The problems with SWEPCO's projections of power prices can be seen in the implied market heat rates. The implied market heat rate is the power price divided by the gas price.

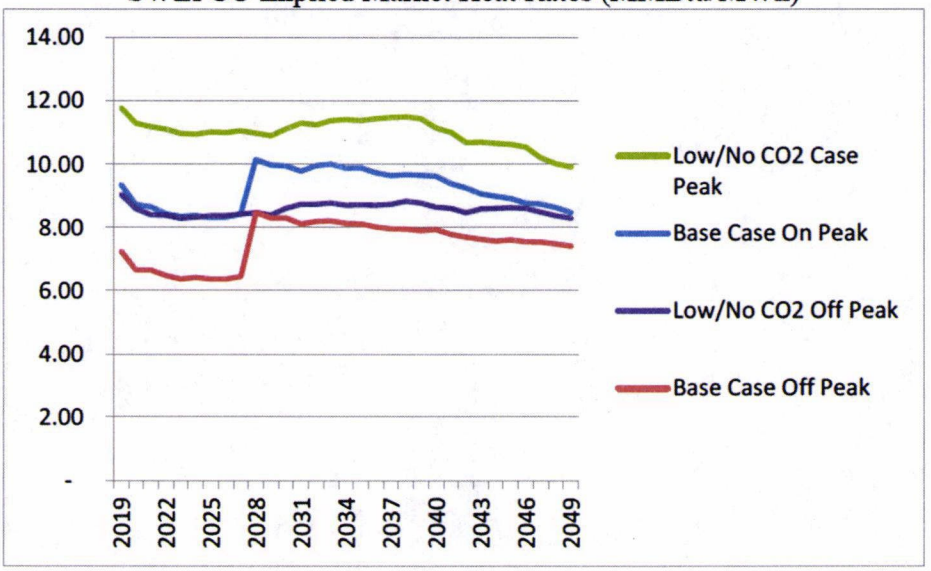
[48] Based on SWEPCO's assumed discount rate of 7.09%.

The implied market heat rate decreases as technology improves and with greater penetration of low variable cost resources such as renewables.

Q. WHAT DO SWEPCO'S IMPLIED MARKET HEAT RATES FOR ITS BASE CASE AND LOW GAS/NO CO2 FORECASTS LOOK LIKE?

A. Please refer to the figure below:

Figure 8
SWEPCO Implied Market Heat Rates (MMBtu/MWh)



For the Base Case this figure shows a slight decline in implied heat rate for prices in SPP through 2028, at which point there is a step change to reflect the assumed imposition of a CO2 tax. Thereafter, the implied heat rate gradually declines, but it remains higher than before 2028. In the Low / No CO2 case, for on-peak prices the implied heat rate is basically flat through the early 2040s, and then declines slightly. The off-peak implied heat rate in the Low Gas/No CO2 case is basically flat.

Q. ARE THERE REASONS TO QUESTION THE CREDIBILITY OF SWEPCO'S IMPLIED HEAT RATES?

A. Yes. As mentioned earlier, SWEPCO's modeling did not add any additional wind resources after 2020. Thus, there is no pressure from additional wind resources on the prices when the Wind Projects would be operating. This has the impact of limiting the decline in implied heat rates of the generation-weighted prices achieved by the Wind Projects.

Q. WHAT IS THE RISK ASSOCIATED WITH ASSUMING FLAT IMPLIED HEAT RATES THROUGH 2040?

A. The generation-weighted price of the wind projects is very close to the forecasted SPP on-peak price in each case. Assuming flat implied heat rates means that the on-peak price is increasing with SWEPCO's gas price forecast, and it also means that SWEPCO is not forecasting significant technology-driven declines in power prices nor considering the impact of accelerated renewables penetration. The net effect is to make the Wind Projects appear more economic. There is a great deal of technology risk in long-term forecasts of implied heat rates. This risk is in addition to the price risk associated with gas prices, such that the combined risk will be in excess of gas price volatility. SWEPCO appears to be ignoring this risk.

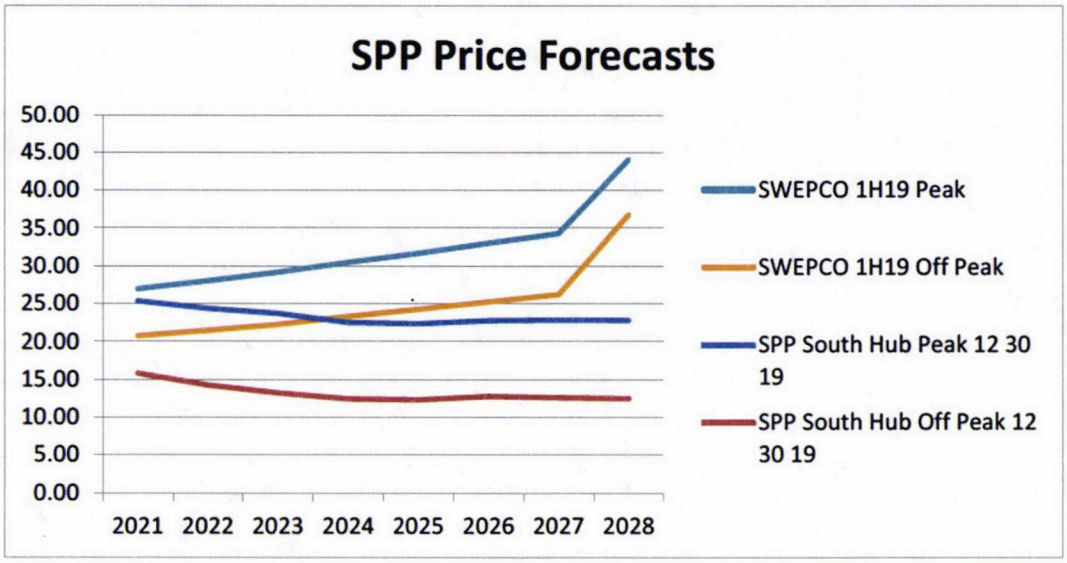
Q. WHY SHOULD THE RISK OF IMPROVED TECHNOLOGY BE CONSIDERED ASYMMETRIC?

A. Technological improvements serve to improve efficiency and lower costs. To have symmetric technological risk, one would have to assume that technological advances would somehow reduce efficiency. That is not a reasonable assumption. There may be symmetric political risk, but there is not symmetric technology risk.

Q. ARE THERE FORWARD MARKETS FOR SPP SOUTH HUB POWER PRICES[49]?

A. Yes. Market prices for power are shown compared to SWEPCO's Base Case fundamentals forecast in the figure below:

Figure 9
($/MWh)



Forward prices for power deviate significantly from SWEPCO's fundamentals forecast as well, particularly in the out years. SWEPCO's Base Case forecast increases at approximately 4% per year through 2027, before leaping in 2028. Beginning in 2028, SWEPCO introduces a price for CO2 into its fundamentals forecast, while the market price does not appear to share that certainty. In contrast, the market prices are forecast to drop for both on-peak and off-peak prices, such that the market on-peak price ends up lower than SWEPCO's off-peak forecast in 2024. The price difference between AEP's power forecast and market prices is $10/MWh-$15/MWh by 2027 and grows to $15/MWh-

[49] SWEPCO identified this hub as being closest to its generation. See SWEPCO Response to TIEC 10-1.

$20/MWh in 2028. Given the Wind Projects are expected to produce over 3 million MWhs annually, this is a difference in benefits of $45-$60 million annually. The differences in expected prices could be due variously to market expectations of greater renewable penetration, lower gas prices, and the relationship of forward prices to spot prices as reflected in the risk-adjusted discount rate that needs to be applied to spot prices.[50]

Q. WHAT DO THE SPP SOUTH HUB FORWARD MARKETS SHOW HAPPENING TO IMPLIED HEAT RATES?

A. The market implied heat rates decline by 2 MMBtu/MWh between now and 2028, which is significantly different than the flat implied heat rates assumed by SWEPCO during that period. Again, this casts doubt on SWEPCO's forecasts.

Q. WHAT IS THE EFFECT ON SWEPCO'S ECONOMIC ANALYSIS OF USING MORE REALISTIC POWER PRICE PROJECTIONS?

A. Using the trended implied heat rate from the SPP forward prices, and assuming NYMEX futures natural gas prices adjusted for basis differential, would reduce benefits of SWEPCO's P50 Low Gas/No CO2 case from $236 million NPV to negative $173 million NPV, or a reduction of $409 million NPV.[51] Again, this includes the effect of a reduction to projected congestion costs due to lower power prices.

[50] Since forward prices are certain when a contract is entered, they are discounted near the risk-free rate, while spot prices must be discounted at a risk-adjusted discount rate (including any convenience yield). This fundamental relationship helps explain the phenomenon of "backwardation" exhibited by many commodity futures prices.

[51] Discounted at SWEPCO's assumed rate of 7.09%.

C. SWEPCO's Assumptions Regarding Future Carbon Policy Bias Its Analysis.

Q. DOES SWEPCO RELY UPON THE EXPIRATION OF PTCS IN MAKING ITS PROPOSAL TO ENTER THE WIND PROJECTS?

A. Yes.[52]

Q. DID SWEPCO QUANTIFY A PROBABILITY THAT PTCS WOULD NOT BE EXTENDED?

A. No. SWEPCO says that "[i]n light of the comprehensive PTC phase out recently enacted by Congress, SWEPCO/AEP does not believe there is a substantial likelihood of the PTC or similar subsidy for wind generation being reenacted in the near term. The Company's tax planning and forecasting is based on current law and does not incorporate predictions regarding future legislative activity. SWEPCO/AEP has not analyzed that possibility for the latter part of the 2021-2051 period."[53]

Q. DOES SWEPCO TAKE THE SAME APPROACH TO ASSUMING A CO2 TAX?

A. No. While SWEPCO does not incorporate predictions regarding future legislative activity for the extension of the PTCs, it does in half of its scenarios assume the implementation of CO2 taxes. For CO2 taxes, SWEPCO states that the "Fundamentals Forecast is not merely concerned with the current status of regulations and other current conditions that affect prices, but instead must also reflect reasonable expectations regarding future conditions that affect prices."[54]

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[52] "[D]ue to the phase out of PTCs, there is a relatively limited period of time for SWEPCO to take full advantage of the potential acquisition of the wind resources for the benefit of customers." Smoak Direct at 10.

[53] SWEPCO Response to TIEC 9-5.

[54] SWEPCO Response to TIEC 9-3.

Q. WHAT IS THE IMPACT OF IGNORING THE POSSIBILITY OF A PTC EXTENSION WHILE ASSUMING THAT CO2 TAXES WILL BE HIGHLY LIKELY TO BE PUT IN PLACE?

A. Assuming the passage of a CO2 tax increases the value of acquiring the Wind Projects now. On the other hand, if Congress once again extends PTCs or ITCs, it would decrease the value of the Wind Projects by making greater renewables penetration more likely and by increasing the option value of delay.

Q. WOULD A REASONABLE UTILITY HAVE PUT SOME PROBABILITY ON THE LIKELIHOOD OF THE PTCS BEING EXTENDED?

A. Yes.

Q. WHAT IS YOUR JUSTIFICATION FOR THAT CLAIM?

A. Both PTCs for wind and ITCs for solar have been critical to the development of such resources. As such, a powerful lobby has developed around ensuring that such subsidies continue. The lobby is not just for solar and wind developers, but also the tax equity investors[55] who are oftentimes the actual beneficiaries of the credit, and the large banks who finance the projects.[56] As a result, the PTC has been extended 10 times since 1999, and the ITC has been extended twice since its originally scheduled expiration in 2007.[57,58] In contrast, Congress has never enacted a federal carbon tax.

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[55] Marc Gunther, "Why Google Invests in Clean Energy," GreenBiz (Feb. 1, 2012), *available at* https://www.greenbiz.com/blog/2012/02/01/why-google-invests-clean-energy

[56] Solar Lendscape, kWh Analytics, *available at* https://www.kwhanalytics.com/solar-lendscape/.

[57] Congressional Research Service, "The Renewable Electricity Production Tax Credit: In Brief" (Nov. 27, 2018), *available at* https://fas.org/sgp/crs/misc/R43453.pdf.

[58] The History and Future of the Solar ITC, Energy Sage, *available at* https://news.energysage.com/the-history-and-future-of-the-solar-itc/.

Q. HAVE LOBBYING EFFORTS TO EXTEND THE PTCS BEEN UNDERWAY?

A. Yes. For example, the American Wind Energy Association ("AWEA") has made a U-turn on its previous support for the phase-out of PTCs, claiming that "the market 'has changed significantly since 2015' meaning continued tax credit support was still needed by the industry."[59]

Q. HAS CONGRESS RECENTLY PASSED A BILL EXTENDING THE PTCS?

A. Yes. While green energy supporters were pushing a continued subsidy for another five years,[60] legislation passed and enacted in December has extended a portion of the PTC for another year at the 60% level.[61]

D. SWEPCO Understates the Level of Congestion

Q. HOW DOES SWEPCO ESTIMATE CONGESTION?

A. SWEPCO ran a production cost model called PROMOD to estimate congestion costs in 2024 and 2029 based on assumptions used by the Southwest Power Pool (SPP) in its transmission planning. Its fundamentals power forecast was produced with the Aurora model, however, so SWEPCO adjusted the forecast from PROMOD to Aurora based on the 7X24 implied heat rates for the power prices from each model.[62] SWEPCO then interpolated congestion costs between 2024 and 2029, but held them flat after 2029.[63] This assumption means that congestion costs increase with power costs up to 2029, but are then

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[59] https://www.windpowermonthly.com/article/1666463/us-policy-failures-prompt-continued-need-ptc.

[60] https://www.wsj.com/articles/return-of-the-tax-games-11576022797.

[61] https://nawindpower.com/house-passes-bill-with-wind-ptc-extension-included. Taxpayer Certainty and Disaster Tax Relief Act of 2019 at 14-15. https://amendments.rules.house.gov/amendments/HWC_103_xml1217190022572257.pdf.

[62] Pfeifenberger Direct at 40-41.

[63] SWEPCO Response to TIEC 2-9.

disconnected from the increases in power costs used in its fundamentals forecast. From 2029 to 2051, SWEPCO's assumed electricity prices nearly double (increasing by 3% annually), but its projected congestion costs remain constant. Since the cost of congestion is correlated with the cost of electricity, SWEPCO's assumption does not make sense.

Q. HOW DOES SWEPCO UNDERSTATE THE AMOUNT OF CONGESTION THAT SHOULD BE EXPECTED?

A. It understates the congestion in two ways. First, SWEPCO holds congestion constant in nominal terms after 2029, despite the fact that its projections of energy cost are growing (and doing so at a rate in excess of inflation).[64] SWEPCO's support for this assumption is that either (1) SPP will build new transmission to relieve congestion or other technologies to address congestion, such as batteries, will become cost effective, or (2) SWEPCO will build the generation tie if it becomes cost-effective to do so.[65] The second reason that SWEPCO understates congestion is that it bases its congestion estimates on PROMOD, which is known to understate the cost of congestion.

Q. WHY DO YOU DISAGREE WITH SWEPCO'S DECISION TO HOLD CONGESTION CONSTANT AFTER 2029?

A. It is inconsistent with the rest of its approach to planning and does not include the cost that is incurred to receive the benefit in half of the cases. For instance, one should not claim that the gen-tie will limit congestion in the future without including the cost of that gen-tie in the analysis. Further, it is inconsistent to assert that cost-effective new technology will mitigate the cost of congestion, but somehow the same cost-effective new technology will not limit the energy price increases that SWEPCO projects. SWEPCO's assumption allows

[64] SWEPCO Response to TIEC 2-9.

[65] *Id.*

it to show escalating net energy benefits for the Wind Projects after 2029 based on nothing but unsupported assumptions.

Q. ARE THERE OTHER REASONS THAT CONGESTION IS UNDERSTATED?

A. Yes. SWEPCO relies on congestion estimates from PROMOD, which is not capable of accurately estimating congestion.

Q. DOES SWEPCO ADMIT THAT PROMOD UNDERSTATES CONGESTION?

A. Yes.[66]

Q. WHAT ARE THE REASONS PROMOD UNDERSTATES CONGESTION?

A. Mr. Pfeifenberger explains some of them in his testimony:

> The PROMOD simulations, like those of similar other nodal market simulations, make certain simplified assumptions about market conditions that tend to yield conservatively low market price fluctuations and congestion levels. For example, PROMOD simulations generally use long-term projections of fuel prices (which do not have as much daily and monthly volatility as actual fuel prices), weather-normalized loads (which do not include occasional heat waves or unusual cold weather), and a fully intact transmission system (i.e., no temporary transmission outages). Thus, the simulations do not capture the actual daily or monthly fluctuations in these variables, nor the added stresses associated with the encountered more challenging system conditions. The simulations are based on perfect foresight of daily real-time conditions—which approximates day-ahead power markets but understates real-time market uncertainties, including variances in wind generation output and therefore the likely generation curtailment driven by the uncertainty of real-time market conditions and temporary transmission outages.[67]

[66] Ali Direct at 5, SWEPCO Response to TIEC 2-34.

[67] Pfeifenberger Direct at 5, line 15 through 6, line 5.

Q. DID SWEPCO MAKE ANY ADJUSTMENTS TO THE PROMOD RESULTS FOR CONGESTION TO ACCOUNT FOR PROMOD'S UNDERSTATEMENT OF CONGESTION?

A. No. It uses the PROMOD results without adjusting for its known understatement of congestion. The only adjustments it makes are to scale the PROMOD SPP power price results to match the AURORA results.[68] This does not address the understatement of congestion costs and is another flaw in SWEPCO's analysis that biases the results in favor of the Wind Projects.

Q. CAN YOU SUMMARIZE THE IMPACT OF BOTH OF THESE SOURCES OF ERROR?

A. Both result in understated congestion costs. SWEPCO was aware that PROMOD understates congestion, yet it assumes that these already understated costs will not grow with energy prices or inflation after 2029, because of either technological advances or the addition of transmission (the cost of which it does not include in the analysis). At the same time, SWEPCO assumes no technological advancements that would cause the price of energy to not increase as rapidly in its fundamentals forecasts. All of these assumptions combine to understate the cost of congestion and curtailment.

Q. WHAT IS THE IMPACT OF FIXING SWEPCO'S ASSUMPTION OF CONGESTION COSTS REMAINING FLAT AFTER 2029?

A. Removing the assumption of flat nominal congestion after 2029 and escalating congestion by the level that power prices increase reduces SWEPCO's NPV of benefits of the Wind Projects by $49 million from SWEPCO's Low Gas/No CO2 case. What this also means is that the breakeven power and gas prices are higher than what SWEPCO calculated.

[68] Pfeifenberger Direct at 40-41.

SWEPCO calculated that the breakeven power price would be 21% lower than the Low Gas/No CO2 case, but this is based on the understated congestion. If congestion is higher, than the breakeven power price will not be 21% lower, but on the order of 16% lower, all else being equal.

E. SWEPCO'S Purported Capacity Benefits Are De Minimis and Speculative.

Q. WHAT LEVEL OF CAPACITY BENEFIT DOES SWEPCO CALCULATE IN THE LOW GAS NO CO2 CASE?

A. It calculates a NPV benefit of $29 million.

Q. IS THIS A MEANIGFUL NUMBER?

A. No, it is *de minimis* relative to the claimed energy benefits of SWEPCO's projections, and it is also quite speculative.

Q. WHY IS IT SPECULATIVE?

A. SWEPCO only shows a capacity benefit from the Wind Projects in 2038 in its modeling, but if that need is pushed out, as has happened in the past, the assumed capacity benefit will be further discounted or eliminated. The calculation is based on avoiding future capacity costs based on SWEPCO's projection of avoided capital costs almost twenty years into the future. Again, these projections are good deal more uncertain than the costs of the Wind Projects, yet SWEPCO discounts both cash flows at it regulatory rate of return.

F. Summary of Quantitative Impact of SWEPCO's Incorrect Assumptions

Q. WHAT IS THE TOTAL IMPACT OF THE ISSUES WITH SWEPCO'S ECONOMIC ANALYSIS YOU HAVE IDENTIFIED?

A. See the chart below:

Figure 10

Summary of Impacts of Issues For Low Gas/No CO2 Case ($ Millions)

	Individual Impact	Cumulative Impact	Adjusted Low Gas/No CO2 Case
Net Benefits in Low Gas/No CO2 Case	—	—	$236
Gas price forecast is too high	$(396)	$(396)	$(160)
Implied heat rates do not decrease	$(13)	$(409)	$(173)
Congestion is understated	$(49)	$(458)	$(222)
25-Year Useful Life	$(63)	$(521)	$(285)
Capacity benefit is speculative	$(29)	**$(550)**	**$(314)**

Q. WHAT DOES FIGURE 10 SHOW?

A. The left hand column shows the individual quantitative impact of making each of the aforementioned adjustments in my testimony (which were all to the Low Gas/No CO2 case), as well as the adjustment recommended by Mr. Pollock to analyze the Wind Projects based on a 25-year life.[69] The individual impact of each adjustment takes into account the effect of all of the prior adjustments, such that the cumulative impact, shown in the middle column, does not include overlapping impacts. The far right column shows the adjusted SWEPCO's Low Gas/No CO2 case with the cumulative impact of the adjustments. As the bottom line in Figure 10 shows, the total cumulative impact of all of the adjustments is a

[69] This adjustment is calculated by removing the last five years of projected benefits, taking into account all of my prior adjustments to projected energy savings, which results in a $77 million NPV decrease. As Mr. Pollock sets forth in his testimony, the net revenue requirement impact of shortening the recovery of the Wind Projects from 30 to 25 years is a $14 million NPV decrease in the costs of the project, which I have netted against the NPV decrease in net benefits from removing the last five years of projected benefits.

$550 million NPV decrease from SWEPCO's Low Gas/No CO2 case, which results in a $314 million NPV net cost to ratepayers.

Q. WHAT LEVEL OF ENERGY PRODUCTION DOES THIS ASSUME?

A. This analysis assumes that the Wind Projects will have a capacity factor at SWEPCO's forecasted P50 level.

Q. ARE THERE RISKS ASSOCIATED WITH THAT LEVEL OF ENERGY PRODUCTION?

A. Yes. SWEPCO has only guaranteed energy output from the Wind Projects at the P95 level.

Q. WHAT IS THE IMPACT OF THE ANALYSIS AT SWEPCO'S GUARANTEED ENERGY PRODUCTION LEVELS?

A. Assuming a P95 capacity factor would reduce the expected savings from the figure shown above by an additional $178 million NPV, for a total net cost of $492 million NPV.

IV. REASONABLENESS OF SWEPCO'S DECISIONMAKING PROCESS

A. SWEPCO's Decision to Have a Sole-Source Solicitation for Build-Transfer-Own Wind Power Is Not Reasonable.

Q. IS SWEPCO'S DECISION TO CONDUCT A SOLE SOURCE SOLICITATION FOR BUILD/TRANSFER/OWN WIND POWER REASONABLE IN THIS CASE?

A. No. The justification SWEPCO provides is that it believes acquiring owned wind power provides it with greater ability to manage congestion risk, the potential to run the projects at the end of their useful lives, and the ability to offer the "limited guarantees" around capital cost, PTC eligibility and production that SWEPCO has made.[70]

[70] SWEPCO Response to TIEC 2-4.

Q. WHY DO YOU CALL THESE GUARANTEES LIMITED?

A. Chiefly, SWEPCO is still making ratepayers bear the economic risk around energy prices, while it would get its nearly guaranteed rate of return if the Wind Projects are approved. This is an asymmetric risk/return profile for customers on projects that is justified almost solely based on SWEPCO's inflated forecasts of future prices. As discussed above, SWEPCO's forecasting track record is not good.

Also, SWEPCO declines to make guarantees about reliability curtailments (customers bear them under SWEPCO's proposal),[71] yet SWEPCO knows that [redacted].[72] Nor is SWEPCO making a commitment around future ongoing capital expenditures or O&M expense.[73]

Q. ARE THERE DIRECT COSTS ASSOCIATED WITH ACQUIRING AND OWNING THE WIND PROJECT AS COMPARED TO A PPA?

A. Yes. The most obvious one is that SWEPCO cannot efficiently use all of the PTCs, which causes them to have to create a deferred tax asset ("DTA") and charge customers for it. This DTA costs customers NPV $123 million. It is 52% of SWEPCO's calculated net benefit in the P50 Low Gas/No CO2 case, and is 19% of the overall value of the PTCs. There are other more efficient ways to cost-effectively capture the value of the PTCs through either PPAs with third parties, or a PPA with a related entity, such as what NIPSCO is doing with its Rosewater Wind Project. SWEPCO complains that these options are either higher cost-of-capital approaches or too complex.[74] But a $123 million loss of benefit can

[71] SWEPCO Response to TIEC 2-3.

[72] [redacted] SWEPCO Response to TIEC 2-4 Confidential Attachment 1.

[73] SWEPCO Response to TIEC 2-15.

[74] SWEPCO Responses to TIEC 2-5 and 2-6.

support a higher cost of capital and more complexity. Yet SWEPCO has failed to quantify or seriously study these alternatives or the value of any of the purported reasons that it gives in order to make a comparison of cost-effectiveness. Furthermore, [redacted] .[75]

Q. WHAT OTHER RESOURCES SHOULD SWEPCO HAVE EVALUATED OTHER THAN ACQUIRING WIND PROJECTS?

A. There are any number of other alternatives that could provide more value to customers than acquiring the Wind Projects. If the goal was to acquire resources that produce power at less than expected avoided costs, a reasonable utility would have opened an all-source solicitation, including allowing for wind and solar resources to offer PPAs, and then determined the most cost-effective path. Instead, SWEPCO chose the path that would allow it to build rate base and earn a return, rather than looking for the best option for customers.

Q. IS THERE EVIDENCE THAT SOLAR AND NATURAL GAS RESOURCES ARE MORE COST-EFFECTIVE THAN WIND RESOURCES UNDER SWEPCO'S OWN ASSUMPTIONS?

A. Yes. The expansion plans under every case from the Aurora model runs used to produce SWEPCO's fundamentals forecast do not contain any new wind resources selected by the optimization engine during the next thirty years, although there are new solar and gas

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[75] [redacted] SWEPCO Response to TIEC 2-4 Supplemental, Confidential Supplemental Attachment 2.

resources selected by the optimization engine.[76] There is no new wind added after the resources already in the queue in 2019 and 2020. Given that result from its own models, it is inexplicable why SWEPCO chose a wind-only approach for its solicitation.

Q. ARE THERE OTHER OPTIONS THAN NEW RESOURCES TO HEDGE ENERGY PRICE VOLATILITY?

A. Yes. If SWEPCO is seeking to fix energy price volatility, it could have sought fixed price PPAs from other power providers to determine what they might offer. Power from other utilities is broadly available in SPP, as SPP carried capacity in excess of peak load of 35% in 2018.[77] Critically, a futures market for power with delivery at the SPP South Hub is available, as are Henry Hub futures for natural gas. If a firm wants to hedge energy prices for a time, it does not have to acquire physical assets to do so.

Q. PLEASE COMMENT ON THE AVAILABILITY OF FIXED PRICE RENEWABLE PPAS.

A. Renewable developers have been taking on more merchant risk. Commercial and industrial customers are driving a large amount of recent renewables development, but they have not been signing power contracts for the full life of the assets. Instead, they are signing shorter-term contracts, e.g., five years, and the renewables developers are taking the future risk of lower prices.[78]

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[76] SWEPCO Response to TIEC 11-5 Attachment 1 and 11-6 Attachment 1

[77] SPP Annual State of the Market Report for 2018 at 195. https://www.spp.org/documents/59861/2018%20annual%20state%20of%20the%20market%20report.pdf. The Market Monitor noted "[a] relatively high peak available capacity percentage such as this has positive implications for both reliability and mitigation of the potential exercise of market power within the market. However, it also contributes to downward pressure on market prices, negatively affects revenue adequacy, and can burden ratepayers with additional and potentially unnecessary costs."

[78] SWEPCO Response to TIEC 7-4.

Q. IS SWEPCO AWARE OF THIS TREND?

A. Yes.[79]

Q. WHAT INCENTIVE WOULD A UTILITY HAVE TO ACQUIRE ASSETS IN LIEU OF ENTERING INTO A PPA?

A. SWEPCO cannot use PPAs to build rate base nor earn a return. Its financial interest is in owning assets.

That leaves SWEPCO's customers bearing the commodity risk. SWEPCO has sought to own the Wind Projects in lieu of looking at other types of resources or shorter-term renewable contracts, despite the readiness of renewable developers to accept more merchant risk. Therefore, it is unreasonable for SWEPCO to lock customers into long-term assets with such a bad risk profile. With gas prices low in the near term at a minimum and the possibility of technological improvements putting pressure on prices in the medium to long term, it becomes almost impossible for the Wind Projects to pay for themselves on a risk-adjusted basis. It is unreasonable for SWEPCO to lock itself and its ratepayers into a $1.1 billion investment when the decision could be deferred.

B. <u>The Wind Projects Are Not Really a Hedge But a Merchant Long Position</u>

Q. SWEPCO CLAIMS THE WIND PROJECTS REPRESENT A HEDGE AGAINST HIGHER PRICES.[80] IS THIS TRUE?

A. No.

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[79] SWEPCO Response to TIEC 7-3.

[80] "The range of results for the various P50 cases in ERRATA Figure 3 show that the Selected Wind Facilities have an attractive profile of benefits that essentially create a "hedge" against future gas price increases and possible carbon regulations." Pfeifenberger Direct at 50.

Q. PLEASE EXPLAIN WHY NOT.

A. SWEPCO says the Wind Projects or projects just like them will be built in any case in SPP.[81] They also state that the addition of the Wind Projects will not change the dispatch of SWEPCO's existing power plants.[82] If that is the case, then the Wind Projects are not really a hedge, but a merchant long position on power in SPP. To further expand, if the Wind Projects do not displace SWEPCO's own power plants, then those plants are the existing hedge against higher-cost power purchases from SPP. SWEPCO owns enough power plants to cover its customers' energy needs. The plants that are "in the money" will operate and already hedge against higher energy prices. The Wind Projects operate very little in the peak hours, and thus do not provide a hedge during the time when higher cost plants operate. Thus, the Wind Projects effectively add a long position to the hedged position that already exists and is being paid for by SWEPCO's customers.

Q. ARE THERE IMPLICATIONS TO SWEPCO ADDING A LONG POSITION?

A. Yes. It means that the Wind Projects have the risk profile of a merchant power plant. That means that the revenues of the Wind Project should be discounted at the WACC for merchant plants in SPP, i.e., the appropriate risk adjusted rate for SPP power, not at a regulated utility cost of capital. This further supports the need to discount benefits at a higher rate than the costs of the Wind Projects, as discussed below.

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[81] "The Company believes that because the selected facilities and others in the SPP footprint are in advanced stages of the SPP interconnection process, it is reasonable to assume that the selected or similar other facilities would likely be built regardless of whether or not SWEPCO purchases them. As a result, the Company believes that whether SWEPCO purchases the selected wind facilities will not have a significant impact on the total amount of wind generation in the SPP footprint." SWEPCO Response to TIEC 5-9. See also SWEPCO Response to TIEC 6-1 where it reiterates that the wind projects will be built and will not change SPP dispatch.

[82] "[T]he dispatch of SWEPCO's existing fleet is not expected to change between the With and Without Wind cases" under any scenario. SWEPCO Response to TIEC 1-21. See also SWEPCO's Response to TIEC 5-9.

Q. IS THERE ANOTHER IMPLICATION TO THE DISPATCH OF THE EXISTING PLANTS NOT CHANGING?

A. Yes. SWEPCO offers all of its plants into the SPP market at cost. The addition of the Wind Projects will not change that practice, but SWEPCO claims that the addition of energy from the Wind Projects will be first in line for retail customers, turning some of the sales from its existing plants that occur when the Wind Projects are operating into off-system sales. SWEPCO currently retains 10% of the savings for these off-system sales. Thus, the addition of the long position from the Wind Projects changes the accounting of some of the sales from the existing power plants into earnings opportunities for SWEPCO. The Commission should not allow this to occur. Under the SPP construct, SWEPCO needs no incentive to offer its plants into the market and should not earn 10% of the savings in any case, but it is particularly egregious for SWEPCO to add a long position and then profit from both the rate base addition and a slice of the existing power plant sales.

Q. ARE FUEL DIVERSITY[83] AND MITIGATING FUEL COST VOLATILITY[84] SEPARATE REASONS TO JUSTIFY LOCKING INTO THE WIND PROJECTS TODAY?

A. No. First, "fuel diversity," and mitigating "fuel cost volatility" are basically the same thing. They reflect a concern on the part of a utility that high natural gas prices lead to high energy prices and higher rates. On a strategic level, the question is what cost should be paid, if any, to protect against high gas and energy prices, and for how long. To answer that question, one needs to be able to quantify the value of the protection. SWEPCO has not even tried to do that.[85] It is unreasonable for a utility to not quantify these claimed benefits

[83] Brice Direct at 16, Smoak Direct at 10.

[84] Smoak Direct at 10.

[85] SWEPCO Response to TIEC 2-27.

if they form part of the basis for entering the Wind Projects; if they are not quantified, it is unreasonable to justify entering the Wind Projects on any basis other than achieving lower energy prices.

Equally critical in this case, not acquiring these Wind Projects today does not prevent SWEPCO from taking other action to avoid higher energy prices in the future. Solar power and other renewable resources will still be available in the future, and other technologies and savings opportunities are bound to be available. As discussed in further detail in the next section, locking into a decision today that is premised on protecting against higher energy prices in 2030, 2035, or 2040 is not a reasonable thing to do unless that decision also provides enough value in the near term such that the projects are far enough in the money that it makes sense to act. The Wind Projects do not provide sufficient near-term value.

C. SWEPCO Did Not Adequately Evaluate the Investment Decision Given the Uncertainty of the Benefits and Its Option to Wait.

Q. HOW WOULD YOU DESCRIBE SWEPCO'S DECISION CRITERION?

A. SWEPCO uses a criterion that as long as the NPV of benefits (avoided energy) was greater than the NPV of cost (the investment and O&M costs of the Wind Projects), discounting both cash flows at the same discount rate, the decision, according to SWEPCO, would be sound.

Q. IS THIS AN APPROPRIATE DECISION CRITERION IN THIS CASE?

A. No.

Q. PLEASE EXPLAIN WHY SWEPCO'S DECISION CRITERION IS NOT RESONABLE.

A. As a general matter, the "invest when NPV of benefits > NPV of cost," rule is only appropriate when (i) there is no uncertainty in the benefits, or (ii) either an investment is reversible at no cost or, if the investment is irreversible, then the investment decision has to be made now.[86] These are two very important exceptions, and they demonstrate why SWEPCO's decision-making process is not reasonable.

As to uncertainty in benefits, an investment has two cash flow streams to be compared—the costs of the investment and the benefits received (which are simply avoided costs in this case). These two cash flow streams have very different risk profiles. Once the investment costs are expended they are almost entirely certain, and the investment costs make up approximately 90% of the total cost of the Wind Projects according to SWEPCO. The benefits, however, are a function of natural gas prices and the interaction of that commodity input with the bids of generators and the impact of uncertain future resource additions on market prices. The investment costs are much more certain than projected avoided energy benefits.

With regard to irreversibility, acquiring these Wind Projects is irreversible. However, the decision to acquire wind energy or another resource for economic energy savings does not have to be made at this time. Thus, the risks of acting versus not acting are not symmetrical. If SWEPCO acts, it is locked into a billion-dollar investment that cannot be reversed. If gas prices remain low, SWEPCO would not have any ability to mitigate the negative impact of the Wind Projects on its ratepayers. If SWEPCO does not

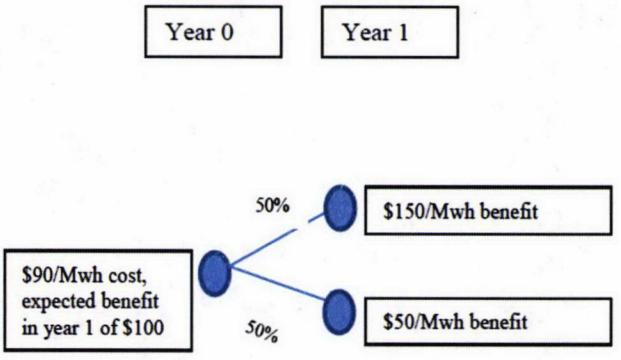
[86] Investment Under Uncertainty, Dixit and Pindyck, Princeton University Press, 1994, at 6.

act now, and gas prices significantly increase in the future, SWEPCO will still have the ability to take actions that would mitigate the impact of higher gas prices on ratepayers, including procuring renewable power. While the downside risks are locked in if SWEPCO acts, SWEPCO still has the ability to capture any upside benefits in the future if it does not act. In other words, SWEPCO has the option to delay making a decision on acquiring a resource for economic energy savings to see how the future unfolds and how its projected benefits could change. This option to delay has value. SWEPCO should not act unless the expected benefits of the Wind Projects are so great that they exceed the value of its option to delay.

Q. CAN YOU PROVIDE A SIMPLE EXAMPLE OF WHY ONE SHOULD LOOK AT THE OPTION TO DELAY MAKING A DECISION GIVEN UNDERLYING UNCERTAINTY IN FUTURE BENEFITS?

A. Please see the figure below:

Figure 11
Simple Example of the Value of Option to Wait



Suppose that a utility has the opportunity to enter a one year PPA with a price of $90/MWh for the quantity of 1 MW. The PPA would start one year from now, and at the time the offer is made, the expected price for the one year future time period is $100/MWh.

A naïve investment rule based on NPV benefit > NPV cost would say to enter the PPA with an expected value of $10/MWh. However, the future expected price is not known with certainty. Rather, it can vary by $50/MWh in either direction, such that in one year the price will either be $150/MWh or $50/MWh, with a 50% probability of each occurring. If the utility waits 1 year to enter the PPA and the price goes up, the payoff would be 50% * ($150/MWh – 90/MWh) = $30/MWh. In the case where the price goes down, the utility would not enter the PPA, and the payoff would be 50% * $0/MWh = $0/MWh. The expected value of the payoff is $30/MWh in the wait one year scenario, compared to an expected $10/MWh in the enter-the-PPA-today scenario. Thus, the option to wait has a value of $20/MWh. In other words, even if the expected price of a PPA in one year was as much as $110/MWh instead of $90/MWh, it would still make sense to defer the decision.

Q. DOES SWEPCO'S ECONOMIC ANALYSIS GIVE CONSIDERATION TO THE ASYMMETRIC RISKS OF THE PROJECT AND ITS OPTION TO WAIT?

A. No. SWEPCO's decision-making criterion that it should pursue the Wind Projects as long as the NPV of the benefits exceeds the NPV of the costs, discounted at the same rate, is flawed because (i) it ignores that the benefits are systematically more risky than the costs in this case, and (ii) it ignores that SWEPCO has a valuable option to wait.

D. <u>Employing appropriate Decision-Making Techniques makes clear that the Commission should not approve the Wind Projects.</u>

Q. HOW SHOULD THE COMMISSION EVALUATE UNCERTAIN BENEFITS COMPARED TO RELATIVELY CERTAIN COSTS?

A. There are a variety of techniques available. The traditional approaches employed by competitive firms are to look at payback periods, apply a hurdle rate in excess of the certain cost of the investment, or to discount the avoided energy benefits at the appropriate risk-

adjusted discount rate. I address the payback, hurdle rate, and risk-adjusted discount rate approaches.

Q. HOW DOES THE PAYBACK APPROACH WORK?

A. One can either look at the simple payback, which is the number of years of nominal benefits it takes to recover the nominal cost of an investment or course of action. Here the nominal cost revenue requirements of the Wind Projects is $3.2 billion, and there is little uncertainty around that value.[87] Based on the Low Gas, No CO2 analysis by SWEPCO, the simple payback does not occur for 27 years. Since the asset life is assumed to be 30 years, the simple payback approach tells a utility manager that acquiring the Wind Projects is very risky and entirely dependent on the level of the natural gas price and energy price forecast.

Without yet addressing the appropriate discount rate, if one takes SWEPCO's approach and uses its regulatory weighted average cost of capital as the discount rate, the NPV payback is in 2042, 23 years from when the analysis was made. Again, this analysis informs a utility manager that the decision to acquire the Wind Projects is quite risky and entirely dependent on SWEPCO's historically unreliable forecasts of future gas prices and technology changes.

Q. DID SWEPCO EVER ANALYZE THE PAYBACK PERIOD OF THE BENEFITS?

A. No. While SWEPCO calculated projected annual savings, it never analyzed how far into the future it took for the Wind Projects to breakeven.

[87] SWEPCO states it already factored output degradation into its analysis. If degradation is faster than forecast, that is another risk to achieving the payout, but it can be ignored at this point while the principles are demonstrated.

Q. WOULD A REASONABLE UTILITY EVALUATE HOW LONG IT TAKES FOR A RESOURCE ACQUISITION TO BREAKEVEN?

A. Absolutely. Relying on NPV alone when evaluating a project with a significant amount of uncertainty is unreasonable. Firms regularly look at payback metrics in addition to NPV.

Q. WHAT IS THE PAYBACK PERIOD OF THE BENEFITS COMPARED TO THE COSTS?

A. I show the projected nominal benefits compared to the relatively certain nominal cost (net of PTC and the deferred tax asset) from SWEPCO's Low Gas/No CO2 analysis in the figure below. These values are shown on an NPV basis in the subsequent figure, discounted as SWEPCO does at its regulatory ROR. In both cases, I use SWEPCO's calculation of the fuel and capacity savings, which, as set forth above, is unrealistically high.

Figure 12
Nominal Breakeven for Wind Projects Based on SWEPCO Data
($Millions)

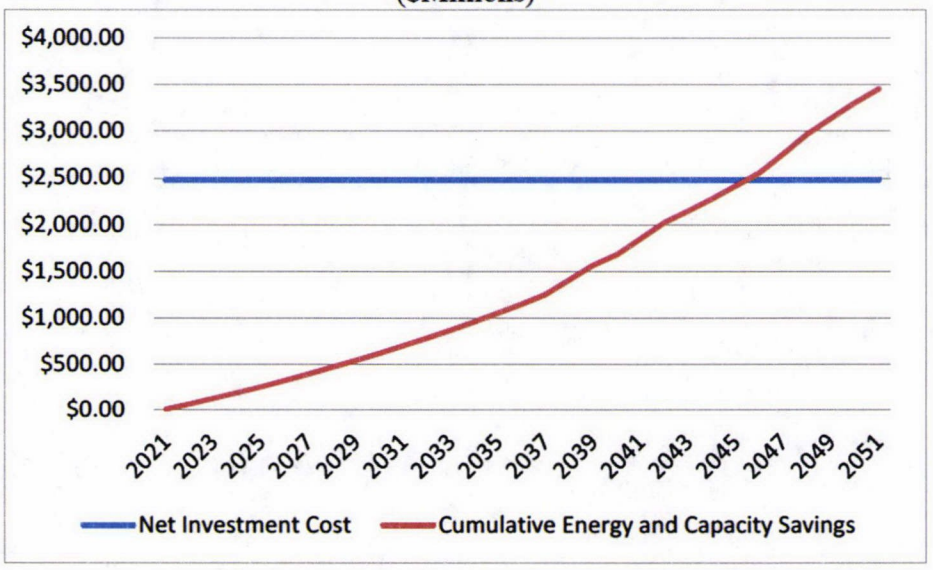
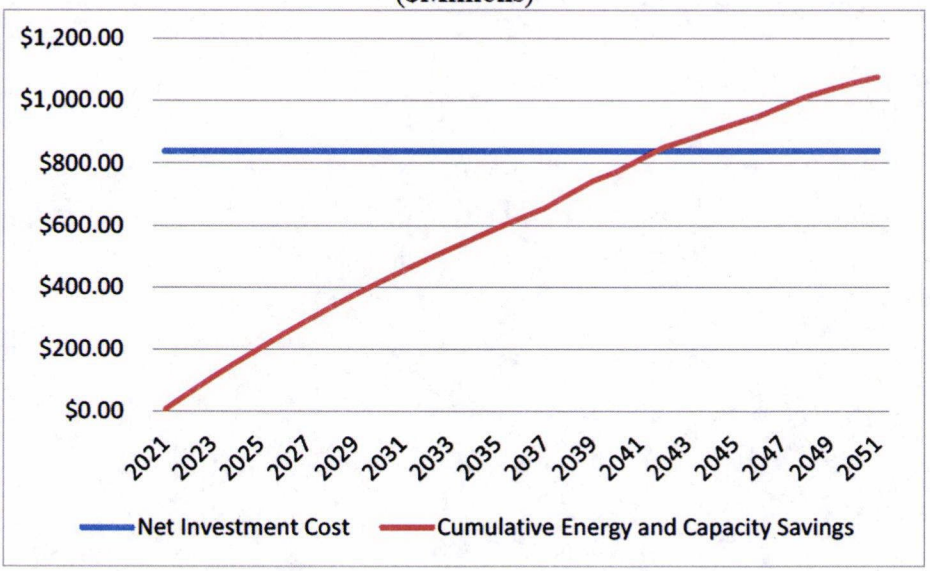


Figure 13
NPV Breakeven for Wind Projects Based on SWEPCO Data
($Millions)



As can be seen in the figures above, if SWEPCO had looked at the payback periods for the Wind Projects, it would have seen that on a nominal basis, the benefits would not have exceeded the costs until 2046, while on a NPV basis the payback period would have been in 2042. These are 23-27 years out from the time the decision was made.

Q. WHY DO YOU SHOW THE COSTS AS A FLAT LINE, RATHER THAN AS ANNUAL COSTS?

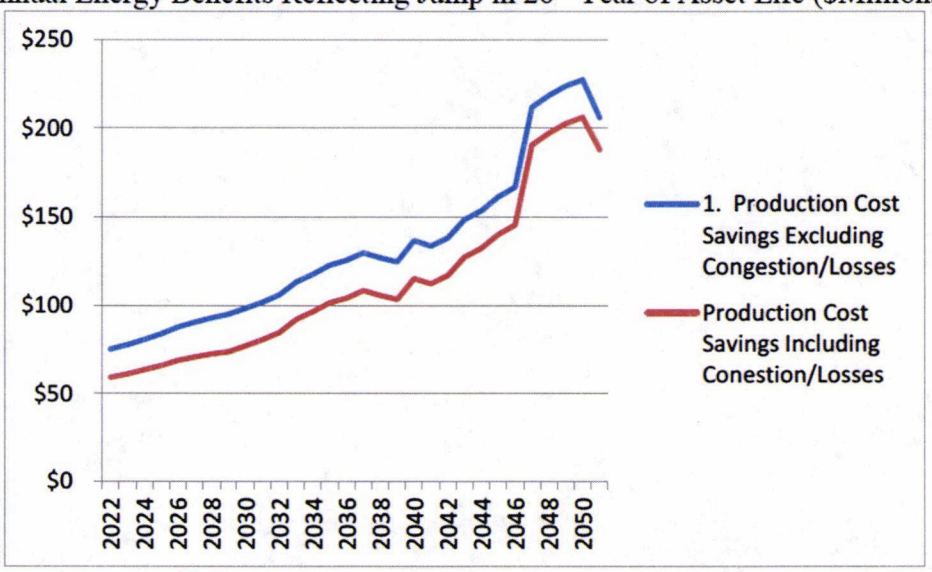
A. Because this is an acquisition, once SWEPCO commits to owning the Wind Projects, the costs became nearly certain. The question to be answered is when the energy savings, which are much more uncertain and only accrue as time passes, will approach the committed costs that are nearly certain beginning on day one. That is one way a reasonable utility would compare certain costs to uncertain benefits.

Q. DOES THE PAYBACK ANALYSIS SHED ANY LIGHT ON SWEPCO'S DECISION TO CLAIM A THIRTY YEAR LIFE FOR THE WIND PROJECTS?

A. Yes. Given the paybacks do not occur until 2042 and 2046, the decision to model a 30 year life instead of a 20 year or 25 year life is important. At a twenty year life, the Wind Projects do not payback at all, while with a 25 year life, they barely payback. In the Low Gas/No CO2 case, adding five years of zero variable cost power adds NPV $150 million in energy benefits and NPV $67 million in net customer benefits. That means that approximately 30% of the net benefits occur in years 2047-2051. More interestingly, the annual energy benefits make a step change in the year 2047, making a 27% jump from 2046; including congestion and losses the jump is 33%. The figure below shows the incongruous nature of the jump. I cannot think of a reason to place any credibility on a jump in claimed energy savings that far out in time.

Figure 14

Annual Energy Benefits Reflecting Jump in 26th Year of Asset Life ($Millions)



Q. GIVEN THE VOLATILITY OF GAS PRICES, WOULD A REASONABLE UTILITY MANAGER HAVE COMMITTED TO A PROJECT WITH SUCH LENGTHY PAYBACK PERIODS?

A. No. Also, note that the NPV payback period above was based on using SWEPCO's own analysis, including SWEPCO's approach of discounting both costs and benefits at its WACC of 7.09%. As discussed in further detail below, no investor or valuation professional would use such a discount rate for valuing cash flows dependent on natural gas prices given their volatility.

Q. HOW WOULD YOU APPLY THE HURDLE RATE METHOD?

A. Many companies deal with uncertainty by requiring that projects beat not just the cost of capital, but a hurdle rate in excess of the cost of capital. In the case of the Wind Projects, one can analyze how much higher the discount rate for the benefits would have to be in order to just breakeven with the their costs. Using the values from the Low Gas No CO2 case, the discount rate for the benefits would have to be only 9.01% to equalize the NPV compared to the discount rate of 7.09% used by SWEPCO for discounting the costs of the Wind Projects, i.e., a change of less than 2%. That is not very much for a commodity as volatile as natural gas/electric power. For benefits based on a volatile commodity, actual hurdle rates would be much higher (as I discuss in my testimony below, the risk premium for natural gas is significant), which again demonstrates that acquiring the Wind Projects is not be justified.

Q. HOW WOULD YOU APPLY THE RISK-ADJUSTED DISCOUNT RATE METHOD?

A. Financial theory says that the value of the benefits should be discounted at the appropriate risk-adjusted rate. The appropriate risk-adjusted rate for the benefits of the Wind Projects

is not the same as a utility's weighted rate of return, because that rate is valuing the systematic risk of the overall regulated utility business, whereas the risk-adjusted discount rate should be valuing the systematic risk of the cash flow associated with the avoided energy cost (the value of capacity in these calculations is *de minimis*). The systematic risk is a function of the volatility of the avoided energy cost and the correlation of that volatility with the overall volatility of financial markets.

Q. HOW CAN ONE DETERMINE THE APPROPRIATE RISK-ADJUSTED DISCOUNT RATE?

A. There are a variety of ways, including examining the correlation of returns for natural gas and power prices and the financial markets as well as directly examining the cost of capital associated with oil and gas production companies. For example, the Texas Comptroller values oil and natural gas reserves by determining the WACC of companies engaged in oil and gas production, and publishes the WACC of those companies every year. The WACC of oil and gas companies encapsulates the systematic risk associated with natural gas prices. The Comptroller then adds risk premia for a variety of other risks (single field risk, etc.).

Q. WHAT DISCOUNT RATE DID THE COMPTROLLER PUBLISH IN 2014?

A. In September 2019 the Comptroller published its "Discount Rate Range for Oil and Gas Properties." In that publication, the Texas Comptroller calculated a WACC of 12.75% for oil and gas production, and makes various adjustments for the risk associated with oil and

gas production from individual properties.[88] The Comptroller also looks at sales and other criteria, and determined the appropriate range of discount rates to be 12.98% - 19.89%.[89]

Q. WHAT DO THE ECONOMICS OF THE WIND PROJECTS LOOK LIKE IF THE DISCOUNT RATE DETERMINED BY THE TEXAS COMPTROLLER WAS USED?

A. Taking the lower end of the range of discount rates of 12.98% and applying that to the avoided energy cost benefits of the Wind Projects, the NPV of energy savings benefits would be $545 million. The NPV of the cost, net of PTCs, would be unchanged at $840 million, because the cost of the revenue requirement cash flows as well as the PTC benefits have no additional systematic risk beyond the utility rate of return. Thus, discounting the avoided energy cost benefits of the Wind Project at a risk adjusted discount rate based on gas price volatility means that the Wind Projects are a net loser for customers of $295 million based on the Low Gas/No CO2 case. This result is in-line with the results of substituting AEP's Low Gas/No CO2 case with NYMEX and SPP forward market prices for gas/power discussed in the preceding subsection, suggesting that discounting using a risk premium (~5% above the utility rate of return) similar to that used by the Texas Comptroller for valuing natural gas properties aligns the NPV outcome for the forward and spot forecasts.

[88] Texas Comptroller's 2014 Property Value Study Discount Rate Range for Oil and Gas Properties, September 2019.

[89] *Id.*

Q. PLEASE SUMMARIZE THE OUTCOME OF USING A RISK-ADJUSTED DISCOUNT RATE FOR THE CASH FLOWS ASSOCIATED WITH THE WIND PROJECTS.

A. Financial theory holds that the appropriate discount rate for a series of cash flows is the risk-adjusted discount rate. The appropriate risk-adjusted discount rate is function of the volatility of the cash flows and the correlation of those cash flows to the market, i.e., the systematic risk of the cash flows. The systematic risk is multiplied by the market cost of risk and added to the risk free rate to get the risk-adjusted discount rate. An alternate method is to directly calculate risk-adjusted discount rates from companies directly involved in producing a commodity.

The cash flow benefits in the case of the Wind Projects are the avoided energy costs. On-peak, these are driven by natural gas prices. Thus, the closest approximation to a risk-adjusted discount rate for the benefits is the WACC of oil and gas producers. The Texas Comptroller uses this method to value oil and gas properties, and in 2019 the Comptroller determined that the WACC for oil and gas was 12.98%- 19.89%. Applying a 12.98% discount rate to the projected avoided energy benefits in the Low Gas/No CO2 case yields a NPV of $545 million. A simple way to describe this result is that an investor would not be expected to pay more than $545 million for the right to receive the benefits of the Wind Projects.

The cost of the Wind Projects net of PTCs is NPV $840 million discounting at SWEPCO's WACC. There is no additional systematic risk above SWEPCO's WACC for these cash flows and there should be no risk premium applied on top of that rate. An investor that appropriately considers the differing risk profiles of the costs versus the benefits would not pay $840 million to receive the risk-adjusted benefit of $545 million for

the Wind Projects. Ratepayers are in the same position as the investors, because they are the ones that receive the benefits and pay the costs. The Commission should not approve SWEPCO's acquisition of the Wind Projects with a risk-adjusted loss of $295 million.

V. CONCLUSION

Q. SHOULD THE COMMISSION APPROVE SWEPCO'S REQUEST TO ACQUIRE THE WIND PROJECTS?

A. No. SWEPCO relies on "fundamentals" forecasts for gas and power prices that are higher than market expectations, and consistently far too high historically. SWEPCO also undercounts congestion costs and includes speculative capacity benefits. Correcting these errors renders the Wind Projects uneconomic.

Moreover, SWEPCO makes a series of errors in its approach to evaluating the Wind Projects. SWEPCO fails to understand that the benefits of the Wind Projects are significantly more uncertain than the costs, which are reasonably known (but for the need for a gen-tie). SWEPCO ignores a fundamental financial tenet that the correct discount rate to use for evaluating cash flows is tied to the risk of the project, not the firm's cost of capital, much less its regulatory rate of return. SWEPCO misrepresents that the Wind Projects are a hedge, when in fact they create a long position in SPP power that puts customers in the same shoes as a merchant wind generator. SWEPCO also ignores that it does not have to make an irreversible decision today, because it has no immediate need for wind resources. Instead, SWEPCO has the valuable option to delay making a decision until more information is available as to the likely path of avoided energy costs. SWEPCO ignores that option by treating the risks of acting and not acting as equal.

Q. DOES THIS COMPLETE YOUR TESTIMONY?

A. Yes.

AFFIDAVIT OF CHARLES S. GRIFFEY

COMES NOW Charles S. Griffey, of proper age and duly sworn, and states that the attached Testimony in the above-captioned matter was prepared by him or under his supervision and control and that it is true and correct to the best of his knowledge and belief, and would be same if given orally under oath.

Charles S. Griffey

STATE OF FLORIDA §
§
COUNTY OF LEE §

SUBSCRIBED AND SWORN to before me this 09 day of JANUARY, 2020. Witness my hand and official seal.

Tiffany Jasmine Maher

Notary Public

Tiffany Jasmine Maher
State of Florida
My Commission Expires 09/04/2023
Commission No. GG 910165

Exhibit CSG-1

Statement of Qualifications

Attachment CSG-1
Statement of Qualifications

CAREER SUMMARY

Senior energy executive who managed the regulatory planning and government affairs function for one of the nation's leading competitive electricity companies. Consulted closely with other senior executives to devise and implement commercial/regulatory/political strategies to manage risks and position the firm to be successful in competitive wholesale and retail electric markets. Recognized as leader in electric market design and as an expert witness on electric policy, market design, and resource planning matters. Skilled in:

- ◊ Corporate Strategy/Risk Management
- ◊ Electric Market Design
- ◊ Policy Advocacy
- ◊ Power Plant Economics
- ◊ Rate Setting and Design
- ◊ Retail and Wholesale Competition

PROFESSIONAL EXPERIENCE

Energy Consultant, Houston, Texas **2009 – Present**

Provide consulting services across the energy value chain, from generation to customer sales for both electricity and natural gas. Clients include independent power producers, large industrial consumers, and retail electric providers. Sample engagements include:

- Expert testimony on utility mergers
- Expert testimony and consulting on resource planning and early retirement
- Expert testimony and consulting expert on cost of combined cycle gas turbines
- Expert testimony on rate case issues, including return and capital structure
- Expert testimony on transmission planning
- Expert testimony on mitigation of generation market power
- Expert testimony on prudence of a decision to construct a coal-fired generating plant
- Expert testimony on distributed generation
- Expert testimony in civil litigation regarding commercial reasonability of retail electric contracts.
- Consulting services related to decision to build cogeneration at industrial facilities
- Consulting services to large industrial companies regarding electric market design.
- Consulting services to a large retail electric provider regarding market opportunities and regulatory/government affairs.
- Consulting services to a developer of compressed air energy storage on regulatory and government affairs.
- Expert testimony regarding market design, the meaning of PURPA and the appropriate payment to Qualifying Facilities for power provided to the grid.
- Expert testimony in a contract dispute between a retail electric provider and a customer regarding pass-through charges.
- Consulting expert on interpretation of purchased power contract between an investor-owned utility and a municipally-owned utility.
- Expert testimony on retail rate design.
- Develop and implement advocacy plan to avoid power plant retirements from a proposed policy to ban once-through cooling in a coastal state; manage compliance filing for two power plants.
- Advise on the economics of energy storage technologies.
- Advise on the feasibility of opening additional retail gas markets to competition.
- Advise on how to structure a regulatory and government affairs organization.

Adjunct Professor of Management at Rice University's Jones Graduate School of Business 2010-2016, specializing in the economics of the electricity value chain, management of risk, and related public policy considerations.

RRI ENERGY (RELIANT ENERGY, INC.), Houston, Texas **1989 – 2009**

Sr. VP Regulatory Affairs and Market Design *2007 - 2009*

Reporting directly to the CEO, co-managed the company's national, regional, and state level government, regulatory, community affairs, and communications functions, with emphasis on electricity regulation, competitive market design, and associated legislation. Oversaw a staff of 70 people and a managed a budget of $30 million.

- Managed to an outcome wherein no laws or regulations harmful to the company were passed.
- Analyzed risk associated with the company's retail business (~ 1.8 million customers) and the wholesale business (~14,000 Mw installed capacity) and implemented regulatory risk mitigation strategies that aligned with corporate vision and goals.
- Coordinated policy between retail and wholesale business units to establish sound policy and design principles and to present a single voice to external stakeholders.
- Testified on electric policy, smart energy, and demand response in legislative, regulatory, and judicial arenas, drawing effectively on significant industry knowledge and experience.
- Achieved outstanding results on employee survey regarding departmental leadership and management capability (100% score on treating employees fairly, holding them accountable, making use of their skills, trusting them to make appropriate decisions, and improving own performance based on employee feedback).

Sr. VP Regulatory Affairs *2003 - 2007*

- Managed Reliant's national regulatory and market design efforts and legislative efforts in Texas.
  - Achieved Texas PUC ruling on excess mitigation credits that effectively averted requirement that Reliant Energy pay $375 million to CenterPoint Energy to lower stranded cost; and,
  - Successfully designed rules at Texas PUC regarding provider of last resort, price to beat, customer protections, and financial standards for retailers.
- Collaborated closely with legislative and executive branches in Texas, including Governor, Lt. Governor, Speaker, Chairs and members of Senate Business and Commerce and House Regulated Industries to achieve:
  - Successful transition to retail competition in Texas, creating a political/regulatory environment to allow Reliant's $500 million contribution margin retail business the opportunity to thrive with appropriate government oversight; and,
  - Settlement of the political/regulatory intervention in retail pricing following Hurricanes Katrina and Rita. The settlement led to a phase-in of price increases which set the stage for a successful 2007 legislative session and emergence into full competition
- Provided expert witness testimony in regulatory, government, and court proceedings.
- Intimately involved in settlement of Reliant Energy's issues regarding the 2000-2001 California Energy crisis. Led response to FERC's March 2003 report accusing Reliant Energy of "churning" in its purchases of natural gas for its California power plants.

VP Regulatory Strategy and Planning *1998 - 2003*

Directed Reliant's Texas regulatory and market design efforts. Responsible for financial forecasting, rates, and capital budgeting for Reliant Energy HL&P through 2001, including analysis of capital investment and mothball decisions, power purchase and sales agreements.

- Created and developed risk adjusted wholesale price forecasting tool that provided a distribution of future prices for use in investment analysis to value real options in the generation fleet and the retail contract portfolio.

- Led regulatory strategy to move Reliant Energy from being a regulated utility to becoming separate companies – a wires-only transmission and distribution utility and a company involved in competitive generation and retail activities.
- Heavily involved in passage and implementation of SB 7, the Texas law that moved ERCOT to a competitive market, including:
  - Competitive market design,
  - IPO of Reliant Resources, its option to buy Texas Genco, and use of that option price as the stranded cost valuation method for purposes of the statutory stranded cost true-up, and
  - Settlement of initial Price to Beat rate, and securitization of regulatory assets worth $760 million.

Various positions in Corporate/Regulatory Planning *1989 - 1998*

Led a variety of processes that involved evaluation and establishment of company's generation, resource planning, rate setting, and load forecasting, including power plants, energy efficiency, and demand response.

AUSTIN ENERGY, Austin, Texas **1988 - 1989**
Manager, Gas Purchasing and Fuel Planning

Held overall responsibility for purchasing natural gas for the utility's power plants, as well as planning construction of second gas pipeline to serve power plants.

PUBLIC UTILITY COMMISSION OF TEXAS, Austin, Texas **1986 - 1988**
Fuel Analyst

Investigated prudence of utility fuel and power procurement and integrated resource planning.

BECHTEL GROUP, INC., Houston, Texas **1981 - 1983**

Process Design Engineer

Worked on the Coolwater Coal Gasification Power Plant, the first IGCC ever built.

EDUCATION

JESSE H. JONES GRADUATE SCHOOL OF BUSINESS, RICE UNIVERSITY, Houston, Texas
Master of Business and Public Management, *1985*
Majors - Finance and Entrepreneurship
Honors - Outstanding Finance Student

RICE UNIVERSITY, Houston, Texas
BS, Chemical Engineering, *1981*

PROFESSIONAL CERTIFICATIONS

CHARTERED FINANCIAL ANALYST, No. 12245

PROFESSIONAL ENGINEER IN THE STATE OF TEXAS, NO. 73184

Testimony before the Public Utility Commission *of* Texas

Docket	On behalf of	Description
6032	*PUCT Staff*	*Petition of Central Power & Light Company for fixing of refund with interest and amendment of monthly interim fuel factor. Performed fuel forecast.*
6611	*PUCT Staff*	*Petition of Southwestem Electric Power Company for recovery of unrecovered fuel expense with interest thereon and the setting of revised fixed fuel factors. Performed prudence investigation which resulted in fuel refunds; fuel forecast.*
6765	*PUCT Staff*	*Application by Houston Lighting & Power Company for authority to change rates. Prudence of fuel procurement and fuel forecast.*
6963	*PUCT Staff*	*Investigation regarding the reasonableness of Houston Lighting & Power Company's Spring Creek and Ken McGee Coal Contract Costs. Prudence of long-term coal contracts.*
6992	*PUCT Staff*	*Investigation regarding Texas-New Mexico Power Company for a Certificate of Convenience and Necessity for a proposed generating station (coal-fired) within Robertson County. Economic study of best and most economic option for utility resource acquisition.*
7195/6755	*PUCT*	*Application of Gulf States Utilities Company for authority to change rates. Inquiry of the Public Utility Commission of Texas into the prudence and efficiency of fhe planning and management of the construction of the River Bend Nuclear Generating Station. Prudence of fuel procurement and fuel forecast*
7460	*PUCT Staff*	*Application of El Paso Electric Company for authority to change rates. Prudence of fuel procurement and fuel forecast.*
7510	*PUCT Staff*	*Application of West Texas Utilities Company for authority to change rates. Prudence of fuel procurement and fuel forecast.*
7512	*PUCT Staff*	*Application of Lower Colorado River Authority for authority to change rates. Prudence of fuel procurement and fuel forecast.*
10473	*HL&P*	*Notice of Intent of Houston Lighting & Power Company for a Certificate of Convenience and Necessity for DuPont Project, Webster Units 1 & 2 Refurbishment Project, and Greens Bayou Units 3 & 4 Refurbishment Project. Economic study of resource procurement.*
10832	*HL&P*	*Houston Lighting & Power Company's Standard Avoided Cost Calculation for the Purchase of Firm Energy and Capacity from Qualifying Facilities Pursuant to Subst. R. 23.66(h)(3). History of resource planning and appropriateness of marginal cost.*
I1000	*HL&P*	*Application of Houston Lighting & Power Company for a Certificate of Convenience and Necessity for the DuPont Project. Economic study of resource procurement.*
11999	*HL&P*	*Application of Houston Lighting & Power Company for Approval of Tariff for Economic Improvement Service - Rate Schedule EIS.* Appropriateness of marginal cost.
12138	*HL&P*	*Notice of Intent of Houston Lighting & Power Company for a Certificate of Convenience and Necessity for Advanced Gas Turbine Projects. Economic study of resource procurement.*
12065	*HL&P*	*Complaint of Kenneth D. Williams Against Houston Lighting & Power Company,* Prudence of utility planning; industry restructuring.

Testimony before the Public Utility Commission *of* Texas

Docket	On behalf of	Description
12957	*HL&P*	*Application of Houston Lighting & Power Company for Approval of Experimental Tariff for Special Contract Pricing, Rate Schedule SCP. Appropriateness of marginal cost.*
I5000	*HL&P*	*An Investigation into Issues Related to the Electric Utility Industry and Regulatory Restructuring.* Industry restructuring.
15001	*HL&P*	*An Investigation into Potentially Stranded Investment in the Electric Utility Industry in Texas.* Industry restructuring.
15002	*HL&P*	*An Investigation into the Scope of Competifion in the Electric Utility Industry in Texas.* industry restructuring.
21665	*Reliant*	*Application* of *Reliant Energy, Incorporated for a Financing Order to Securitize Regulatory Assets and Other Qualified Costs.* Industry restructuring and securitization of regulatory assets.
21956	*Reliant*	*Application of Reliant Energy, Inc. for Approval of Business Separation Plan.* Industry restructuring.
22355	*Reliant*	*Application* of *Reliant Energy HL&P for Approval of Unbundled Cost Of Service Rate Pursuant to PURA $39.207 and Public Utility Commission Substantive Rules25.344.* Industry restructuring and recovery of stranded costs.
23950	*Reliant*	*Petition* of *Reliant Energy, Inc. to Establish Price to Beat Fuel Factor and Request for Good Cause Exception to Subst. R.25.47.* Industry restructuring and setting of default service rate.
24790	*Reliant*	*Petition to Appoint Provider of Last Resort Pursuant to PURA 39.7 06 for Residential and Small Non-Residential Customers in the Entergy, TXU East-DFW, and TXU West-DFW Service Areas and for Large Non-Residential Customers in the Reliant North, Reliant South, CPL Gulf Coast, CPL Valley, WTU, and SWEPCO Service Areas.* Industry restructuring and setting of POLR rate.
29526	*Reliant*	*Application Of CenterPoinf Energy Houston Electric For A True-Up Filing.* Rate design for stranded cost true-up
35620	*Reliant*	*Application of CenetrPoint Houston Electric LLC for Approval to Implement Advanced Meter Information Network Pursuant to PURA 39.107(i).* Benefits of smart meter deployment.
37361	*Occidental*	*Application of Southwestern Public Service Company for Authority to Revise Its Tariff for Purchase of Non-Firm Energy from Qualifying Facilities.* Appropriate price to pay for non-firm energy deliveries in SPP
38448	*Just Energy*	*Petition of Just Energy Texas, LP for the Commission to Resolve a Billing Dispute.* Nature of unaccounted for energy and how to calculate the amount of unaccounted for energy to bill a customer under a contract allowing pass-through of such charges
40443	*TIEC*	*Application Of Southwestern Electric Power Company For Authority To Change Rates And Reconcile Fuel Costs.* Prudence of decision to continue construction of Turk coal plant and impact of Turk Plant on Texas
40449	*Occidental*	*Complaint of Ascendant Renewable Energy Corp. Against Southwestern Public Service.* Appropriate interconnection procedure for a distribution level Qualifying Facility in SPP and interpretation of SPS tariffs and contracts
40545	*PUCT Staff*	*Petition of Calpine for Approval of Voluntary Mitigation Plan.* Evaluation of market power mitigation under proposed plan

41223 *Occidental*	*Application Of Entergy Texas, Inc. and ITC Holdings Corp. for Approval of Change of Ownership and Control of Transmission Business.* Determination of whether transaction is in the public interest
41437 *Occidental*	*Application of EntergyTexas, Inc. for Approval of LQR Tariff.* Appropriate price to pay for deliveries of non-firm energy from QFs
42511 *TIEC/Luminant*	*Complaint Of Calpine Corporation And NRG Energy, Inc., Against The Electric Reliability Council Of Texas And Appeal Of Decision Concerning The Houston Import Project.* Determination of whether ERCOT followed its procedures in approving the Houston Import Project
43695 *Occidental*	*Application Of Southwestern Public Service Company For Authority To Change Rates.* Issues regarding post test year adjustments, transmission charges, and cost allocation and rate design
44547 *TIEC/Luminant*	*Application of Centerpoint Energy Houston Electric, LLC to Amend a Certificate Of Convenience and Necessity for a Proposed 345-Kv Transmission Line Within Grimes, Harris, And Waller Counties.* Appropriate transmission planning procedures.
45188 *TIEC*	*Joint Report And Application Of Oncor Electric Delivery Company Llc, Ovation Acquisition I, L.L.C., Ovation Acquisition Ii, L.L.C., And Shary Holdings, L.L.C. For Regulatory Approvals Pursuant To Pura §§ 14.101, 37.154, 39.262(L)-(M), And 39.915.* Public interest findings with respect to the sale/transfer/merger of a utility with a REIT.
45624 *TIEC*	*Application Of The City Of Garland, Texas, For A Certificate Of Convenience And Necessity For The Proposed Rusk To Panola Double-Circuit 345-Kv Transmission Line In Rusk And Panola Counties, Texas.* Conditions for the line to be in the public interest and proper way to do a cost/benefit analysis for a DC tie.
46050 *TIEC*	*Application Of AEP Texas Central Company, AEP Texas North Company, And AEP Utilities, Inc. For Approval Of Merger.* Estimation of merger savings.
46238 *TIEC*	*Joint Report And Application of Oncor Electric Delivery Company LLC And Nextera Energy, Inc. for Regulatory Approvals Pursuant to Pura §§14.101, 39.262 And 39.915.* Public interest findings with respect to the sale/transfer/merger of a utility.
45414 *TIEC*	*Review of the Rates of Sharyland Utilities, L.P., Establishment of Rates for Sharyland Distribution & Transmission Services, L.L.C., and Request For Grant of A Certificate of Convenience And Necessity and Transfer of Certificate Rights.* Whether to include federal income tax as expense of a public utility REIT, issues regarding transfer of development of transmission lines among affiliates of electric utility, recovery of regulatory asset.
46416 *TIEC*	*Application of Entergy Texas, Inc. for a Certificate of Convenience and Necessity to Construct Montgomery County Power Station.* Appropriate method to use to analyze resources of different lives, and appropriateness of including imputed debt as a cost for PPAs.
46831 *FMI*	*Application of El Paso Electric Company to Change Rates.* Appropriateness of cost allocation, issues regarding interruptible rates and customers contracts, rates for residential distributed solar resources, possible directed purchase options.
47576 *TIEC*	*Application of The City of Lubbock Through Lubbock Power and Light for Authority to Connect a Portion of Its System with the Electric Reliability Council of Texas.* Appropriate method to evaluate whether a utility outside of ERCOT joining ERCOT is in the public interest.
48400 *TIEC*	*Joint Application of Rayburn Country Electric Cooperative, Inc. and Lone Star Transmission, LLC to Transfer Load to Ercot, and for Sale of Transmission Facilities and Transfer of Certificate Rights in Henderson and Van Zandt Counties.* Evaluate whether a utility outside of ERCOT joining ERCOT is in the public interest and best method to interconnect to ERCOT.

48929 *TIEC*	*Joint Report And Application Of Oncor Electric Delivery Company LLC, Sharyland Distribution & Transmission Services, L.L.C., Sharyland Utilities, L.P., And Sempra Energy For Regulatory Approvals Under Pura §§ 14.101, 37.154, 39.262, And 39.915.* Public interest findings with respect to the sale/transfer/merger of a utility.
48973 *TIEC*	*Application of Southwestern Public Service Company for Authority to Reconcile Fuel and Purchased Power Costs.* Prudence of decision to enter into solar power contracts and proper analysis techniques for resource planning.
49421 *TIEC*	*Application of Centerpoint Energy Houston Electric, LLC for Authority to Change Rates.* Financial ring-fencing and context for return on equity, debt, and capital structure.
49849 *TIEC*	*Joint Report And Application of El Paso Electric Company, Sun Jupiter Holdings LLC, And IIF US Holding 2 LP for Regulatory Approvals Under PURA§§ 14.101, 39.262, And 39.915.* Public interest findings with respect to the sale/transfer/merger of a utility.

Colorado Public Service Commission

16A-0396E *Coalition of Ratepayers*	*In The Matter Of The Application Of Public Service Company Of Colorado For Approval Of Its 2016 Electric Resource Plan.* Whether retirement of two coal units and implementation of the Colorado Energy Plan is the lowest cost alternative for ratepayers.
17A-0797E *Coalition of Ratepayers*	*Re. In The Matter Of The Application Of Public Service Company Of Colorado To Modify The Depreciation Schedules For The Early Retirement Of Comanche 1 And Comanche 2 Generating Units, Establish A Regulatory Asset To Collect Incremental Depreciation, Reduce The Renewable Energy Standard Adjustment Collection To One Percent, And Implement A General Rate Schedule Adjustment, Contingent On The Approval Of The Colorado Energy Plan Portfolio In Proceeding No. 16A-0396E.*Issues with PSCo's evaluation of economics of early retirement in favor of Colorado Energy Plan and deferral of accelerated depreciation into a regulatory asset.

Indiana Utility Regulatory Commission

45806 Alliance Coal	*Verified Petition of Southern Indiana Gas and Electric Company D/B/A Vectren Energy Delivery of Indiana, Inc., for: (1) Authority to Construct, Own and Operate a Solar Energy Project and a Finding that Such Project Constitutes a Clean Energy Project Pursuant to Ind. Code Ch. 8-1-8.8; (2) Issuance of a Certificate Of Public Convenience And Necessity for the Construction of the Solar Energy Project Pursuant to Ind. Code Ch. 8-1- 8.5; and (3) Authority to Timely Recover Costs Incurred During Construction and Operation of the Project in Accordance with Ind. Code § 8-1-8.5-6.5 and Ind. Code § 8-1- 8.8-11.* Economics of a solar project in Indiana.
45159 ICARE, ICC	*Petition Of Northern Indiana Public Service Company LLC Pursuant To Ind. Code §§ 8-1-2-42.7, 8-1-2-61 And, Ind. Code § 8-1- 2.5-6 For (1) Authority To Modify Its Rates And Charges For Electric Utility Service Through A Phase In Of Rates; (2) Approval Of New Schedules Of Rates And Charges, General Rules And Regulations, And Riders; (3) Approval Of Revised Common And Electric Depreciation Rates Applicable To Its Electric Plant In Service; (4) Approval Of Necessary And Appropriate Accounting Relief; And (5) Approval Of A New Service Structure For Industrial Rates.* Flaws in NIPSCO's Integrated Resource Plan.
45194 ICC	*Verified Joint Petition Of Northern Indiana Public Service Company Llc ("Nipsco") And Rosewater Wind Generation Llc (The "Joint Venture") For (1) Issuance To Nipsco Of A Certificate Of Public Convenience And Necessity For The Purchase And Acquisition Of A 102 Mw Wind Farm ("The Rosewater Project"); (2) Approval Of The Rosewater Project As A Clean Energy Project Under Ind. Code § 8-1-8.8-11; (3) Approval Of Ratemaking And Accounting Treatment Associated With The Rosewater Project; (4) Authority To Establish Amortization Rates*

For Nipsco's Investment In The Joint Venture; (5) Approval Pursuant To Ind. Code § 8-1-2.5-6 Of An Alternative Regulatory Plan Including Establishment Of Joint Venture Through Which The Rosewater Project Will Support Nipsco's Generation Fleet And The Reflection In Nipsco's Net Original Cost Rate Base Of Its Investment In Joint Venture; (6) Approval Of Purchased Power Agreements Through Which Nipsco Will Receive The Energy Generated By The Rosewater Project, Including Timely Cost Recovery Pursuant To Ind. Code § 8-1-8.8-11 Through Nipsco's Fuel Adjustment Clause; (7) Authority To Defer Amortization And To Accrue Post-In Service Carrying Charges On Nipsco's Investment In Joint Venture; (8) To The Extent Generally Accepted Accounting Principles Would Treat Any Aspect Of Joint Venture As Debt On Nipsco's Financial Statements, Approval Of Financing; (9) Approval Of An Alternative Regulatory Plan For Nipsco In Order To Facilitate The Implementation Of The Rosewater Project; And (10) To The Extent Necessary, Issuance Of An Order Pursuant To Ind. Code § 8-1-2.5-5 Declining To Exercise Jurisdiction Over Joint Venture As A Public Utility. Reasonableness of proposal to build a 102 MW of wind project.

45195 ICC — *Verified Petition Of Northern Indiana Public Service Company LLC For Approval Pursuant To Ind. Code §§ 8-1-2-42(A), 8-1-8.8-11, And To The Extent Necessary Ind. Code §8-1-2.5-6, Of A Renewable Energy Power Purchase Agreement With Jordan Creek Wind Farm LLC, Including Timely Cost Recovery.* Reasonableness of proposal to purchase 400 Mw of wind energy.

45196 ICC — *Verified Petition Of Northern Indiana Public Service Company LLC For Approval Pursuant To Ind. Code §§ 8-1-2-42(A), 8-1-8.8-11, And To The Extent Necessary Ind. Code § 8-1-2.5-6, Of A Renewable Energy Power Purchase Agreement With Roaming Bison Wind, LLC, Including Timely Cost Recovery.* Reasonableness of proposal to purchase 300 Mw of wind energy.

Kansas Corporation Commission

12-KG&E-17-CON *Occidental* — *Application Of Kansas Gas And Electric Company For Approval Of The Energy Supply Agreement Between Kansas Gas And Electric Company And Frontier El Dorado Refining Company LLC.* Economics of special contracts and customer bypass of utility service.

LOUISIANA PUBLIC SERVICE COMMISSION

Dockets	On behalf of	Description
U-32538	*Occidental*	*In Re: Joint Application of Entergy Louisiana, LLC, Entergy Gulf States Louisiana, LLC, Mid South Transco, LLC, Transmission Company Louisiana I, LLC, Transmission Company Louisiana II, LLC, ITC Holdings Corp. and ITC MidSouth LLC for Approval of Change of Ownership of Electric Trnasmission Businesses, For Certain Cost-Recovery Related Adjustments and for Related Relief.* Determination of whether transaction is in the public interest
U-33950	*Occidental*	*In Re: Entergy Louisiana, LLC Compliance Submission Regarding Deactivation Of Little Gypsy 1, Ninemile 3, And Willow Glen 2 And 4, As Required By Order No. U – 33510.* Evaluation of economics of decision to deactivate Willow Glen 2 and 4.
U-34283	*Occidental*	*In Re: Application of Entergy Louisiana, LLC for Approval to Construct Lake Charles Power Station, and for Cost Recovery.* Appropriate method to use to analyze resources of different lives, and appropriateness of including imputed debt as a cost for PPAs.
U-34447	*Occidental*	*Application Of Entergy Louisiana , LLC Regarding Continued Participation In The Midcontinent Independent System Operator, Inc. Regional Transmission Organization.* Recommended conditions to for ELL to continue membership in MISO, recommended change case for measurement of benefits of MISO membership.

MARYLAND PUBLIC SERVICE COMMISSION

9063	*Reliant*	*In The matter of The Optimal Market Design For The Electric Industry In Maryland.* Wholesale and Retail Market design.

Mississippi Public Service Commission

2015-UN-80	*Greenleaf*	*Notice Of Intent Of Mississippi Power Company For A Change In Rates Supported By A Conventional Rate Filing Or, In The Alternative, By A Rate Mitigation Plan In Connection With The Kemper County IGCC Project.* Amount of investment to count as prudent for the CCGT portion of an IGCC. Reasons why Kemper IGCC project should be abandoned.
2017-AD-112	*Greenleaf*	*Encouraging Stipulation of Matters In Connection With the Kemper County IGCC Project.* Amount of prudent investment in Kemper CCGT that should be allowed in rates, and setting of O&M expense and annual revenue requirement.

New Mexico Public Resource Commission

19-00018-UT	Westmoreland	*In The Matter Of Public Service) Company Of New Mexico's Consolidated Application For Approvals For The Abandonment, Financing And Resource Replacement For San Juan Generating Station Pursuant To The Energy Transition Act.* Consideration of Replacement Resources.

Pennsylvania Public Utilities Commission

P-00032071	*Reliant*	*Duquesnse Light Company Petition for Approval of Plan for Post Transition POLR Service.* Wholesale and Retail Market design and supply procurement.
P-00052188	*RESA*[1]	*Petition of Pennsylvania Power Co. for Approval of Interim PLR Supply Plan.* Wholesale and Retail Market design.

Testimony Filed with the Federal Energy Regulatory Commission

FERC Dockets	**On behalf of**	**Description**
ER98-927-000	*Reliant*	*Application of Reliant Energy Mandalay, L. L.C., to sell energy, capacity and ancillary services at market based rates.* Market Power study.
ER98-928400	*Reliant*	*Application of Reliant Energy Ellwood, L.L. C., to sell energy, capacity and ancillary services at market based rates.* Market Power study.
ER98-930-000	*Reliant*	*Application of Reliant Energy Etiwanda, L.L. C., to sell energy, capacity and ancillary services at market based rates.* Market Power study.
ER98-93 1400	*Reliant*	*Application* of *Reliant Energy Cool Water, L. L. C., to sell energy, capacity and ancillary services at market based rates.* Market Power study.
ER98-2878-000	*Reliant*	*Application of Reliant Energy Ormond Beach, L. L C.,* to *sell energy, capacity and ancillary services at market based rates.* Market Power study.
ER99-3 143-000	*Reliant*	*Application of Reliant Energy Indian River, L. L. C., to sell energy, capacity and ancillary services at market based rates.* Market Power study.

[1] Retail Electric Suppliers' Association

EL13-61-000	*Occidental*	*Exelon Wind et al Complaint and Petition for Enforcement.* Determination of whether a Legally Enforceable Obligation was established between a QF and a utility
ER19-1486-000	*Load/Customer Coalition*	*PJM Interconnection, L.L.C.* Comments on ORDC design
EL19-58-000	*Load/Customer Coalition*	*PJM Interconnection, L.L.C.* Comments on ORDC design

CIVIL LITIGATION

CAUSE NO. C-356-10-A	*Lorali, Ltd, Danhana, Ltd, RGV Warehouse, Ltd, and Richann, Inc. v. Sempra Energy Soultion, LLC and Priority Power, LL, 92nd Judicial Court, Hidalgo County, Texas.* Commercial Reasonability of Retail Electric Contracts and Wholesale and Retail Market Design.
CAUSE NO. A-09-CA-917-SS	*JD Wind v. Public Utility Commission of Texas, United States District Court, Western District of Texas, Austin Division.* History of PURPA implementation and avoided cost.
CAUSE NO. D-1-GN-10-004130	*Exelon Wind v. Public Utility Commission of Texas, State District Court, Austin, Texas.* History of PURPA implementation and avoided cost.
CAUSE NO. D-1-GN-12-0021S6	*Lower Colorado River Authority v. Central Texas Electric Cooperative, Fayette Electric Cooperative and San Bernard Electric Cooperative.* Damages calculation for breach of purchased power contract.
CAUSE NO. 121-001-B	*Lower Colorado River Authority v.City Of Kerrville, Acting By And Through Kerrville Public Utility Board.* Damages calculation for breach of purchased power contract.
CAUSE NO. 3:08-cv-780-CWR-LRA	*The State Of Mississippi, Ex Rel. Jim Hood, Attorney General For The State Of Mississippi, Plaintiff, v. Entergy Mississippi, Inc., Et Al., Defendants.* Reasonableness of power procurement by utility.

LEGISLATIVE TESTIMONY

Joint Meeting of Texas House Interim Committee of Natural Resources and House Regulated Industries, May 2009 – Advanced Metering

Texas House Regulated Industries, February 2007 - State of the Electric Industry

Texas Senate Business and Commerce, February 2007 – State of the Electric Industry

Texas House Regulated Industries, March 2005 - State of the Electric Industry

Exhibit CSG-2

Comparison of SWEPCO Gas Forecasts for Henry Hub to Historical and Current Market

$/MMBtu

EXHIBIT CSG-2
Comparison of SWEPCO Gas Forecasts for Henry Hub to Historical and Current Market
$/MMBtu

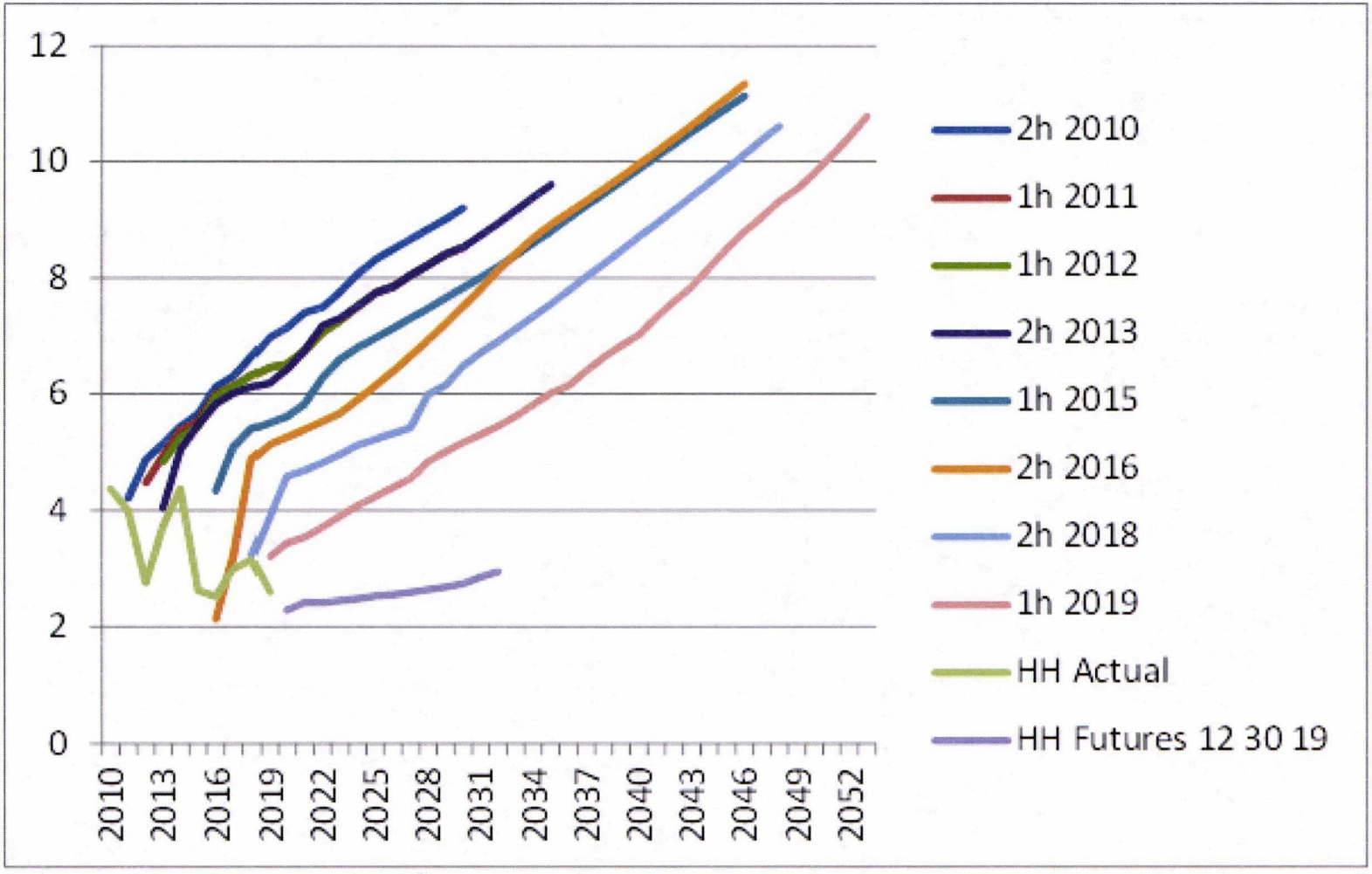


Exhibit CSG-3 PUBLIC

RFIs and Discovery Relied Upon

(Native Excel Files on CD)

D. 49737
Exhibit CSG-3 PUBLIC
RFIs and Discovery Relied Upon
(CD)

PUC DOCKET NO. 49737

SOUTHWESTERN ELECTRIC POWER COMPANY'S RESPONSE TO TEXAS INDUSTRIAL ENERGY CONSUMERS' FIRST REQUEST FOR INFORMATION

Question No. TIEC-1-1:

Does AEP use a trended long-term forecast of the NYMEX Henry Hub natural gas settlement prices for any purpose? If so, please state for what purposes AEP uses a trended NYMEX forecast and the trending methodology AEP applies to quoted NYMEX prices.

Response No. TIEC-1-1:

SWEPCO has not identified any NYMEX-trended long-term natural gas price forecast utilized by AEPSC or any regulated AEP company.

Prepared By: Connie S. Trecazzi — Title: Economic Forecast Anlyst Staff

Sponsored By: Karl R. Bletzacker — Title: Dir Fundamental Analysis

PUC DOCKET NO. 49737

SOUTHWESTERN ELECTRIC POWER COMPANY'S RESPONSE TO TEXAS INDUSTRIAL ENERGY CONSUMERS' FIRST REQUEST FOR INFORMATION

Question No. TIEC-1-4:

Please describe in detail how AEP creates the Fundamentals Forecast and provide all underlying data and calculations for its 2018 and 2019 long-term natural gas price forecasts. Please also state whether AEP has made any changes to its methodology for creating the Fundamentals Forecast since creating the 2016 Fundamentals Forecast that was used to evaluate the Wind Catcher project, and provide a detailed description of any such changes to the methodology.

Response No. TIEC-1-4:

Please refer to Bletzacker Direct Testimony page 3, line 8 through page 5, line 11 and page 6, lines 13-23 for the description of how AEPSC creates the Fundamentals Forecast. Specifically, long-term natural gas price forecasting begins with an assessment of natural gas demand for the electric generation, residential, commercial and industrial sectors when combined with net LNG exports, net pipeline exports and other factors (including lost and unaccounted-for gas), which yields the U.S total natural gas demand. Natural gas price elasticity, identified in the referenced Bletzacker Direct Testimony, is defined as the % change in total demand divided by the % change in price. It is the application of natural gas price elasticity to U.S. total natural gas demand (inclusive of Aurora model-driven values for electric generation sector demand) that impact Fundamentals Forecast prices. Many Aurora model iterations (Bletzacker Direct Testimony, page 5, figure 1) are run. Retained data is contained in the workpapers of Karl R. Bletzacker. AEPSC has made no changes in forecasting methodology since the 2016 Fundamentals Forecast used to evaluate the Wind Catcher Energy Connection project.

Prepared By: Connie S. Trecazzi — Title: Economic Forecast Anlyst Staff

Sponsored By: Karl R. Bletzacker — Title: Dir Fundamental Analysis

PUC DOCKET NO. 49737

SOUTHWESTERN ELECTRIC POWER COMPANY'S RESPONSE TO TEXAS INDUSTRIAL ENERGY CONSUMERS' FIRST REQUEST FOR INFORMATION

Question No. TIEC-1-5:

How often does AEP create its Fundamentals Forecast?

Response No. TIEC-1-5:

AEPSC has no rigid schedule for the creation of new Fundamentals Forecasts. However, as evidenced in TIEC 1-9, nine Fundamentals Forecasts have been completed from 2010 to 2019. The Fundamentals Analysis team continuously evaluates material changes in the long-term energy market drivers for indications that a new Fundamentals Forecast is warranted.

Prepared By: Connie S. Trecazzi — Title: Economic Forecast Anlyst Staff

Sponsored By: Karl R. Bletzacker — Title: Dir Fundamental Analysis

PUC DOCKET NO. 49737

SOUTHWESTERN ELECTRIC POWER COMPANY'S RESPONSE TO TEXAS INDUSTRIAL ENERGY CONSUMERS' FIRST REQUEST FOR INFORMATION

Question No. TIEC-1-6:

a. Referring to page 4 of the Direct Testimony of Karl R. Bletzacker, where SWEPCO states that its low gas price forecast is one standard deviation below the base case forecast:

b. a. Please provide the percent volatility used in determining that level of standard deviation for each year of the forecast.

c. b. How was this level of volatility determined?

d. c. Does the volatility level in AEP's forecasts change each year?

e. d. Why does AEP believe that one standard deviation below the base case is a reasonable low price case?

f. e. In determining the amount of the standard deviation each year, does AEP rely on a normal distribution, a lognormal distribution, or some other probability distribution?

Response No. TIEC-1-6:

The Low Case is a scenario which bounds the low end of the range with plausible fuels pricing (including natural gas) decreased by approximately 1 standard deviation (detailed below) and paired with decreased load from the electric generation sector. Likewise, the High Case is a scenario which bounds the high end of the Base Case with plausible fuels pricing (including natural gas) increased by approximately 1 standard deviation (detailed below) and paired with increased load from the electric generation sector. Specifically, to determine the standard deviation; 1) Henry Hub daily spot prices are averaged, by year, for the prior five full calendar years (2014, 2015, 2016, 2017 and 2018); 2) MS Excel calculates the standard deviation of the Henry Hub daily spot prices for each calendar year (expressed as $/mmBtu); 3) Henry Hub daily spot price standard deviation for each calendar year is divided by the year's Henry Hub daily spot price average to create a percentage expression of each year's standard deviation, and; 4) each of the five years' percentage expression is averaged to create an aggregate view.

a. As described in the methodology above, no set percent volatility is used in determining the standard deviation.

b. N/A

c. Please see the methodology above. However, Company witness Bletzacker's recollection is that, although there is some variation between years, the aggregate percentage expression (see 4 above) varies very little between forecasts.

d. The general underlying assumption is that approximately 2/3rds of the daily spot fuel prices lie within +/- one standard deviation, and when those bounds are paired with a supportive load forecast, the resulting specific scenario also serves as a proxy for multitude of other fuel price/load outcomes. It is Company witness Bletzacker's experience that fuel price and load are the primary drivers of Aurora energy market model power prices (excluding changes in regulation).

e. AEP's methodology to determine the amount of the standard deviation each year is set forth above.

Prepared By: Connie S. Trecazzi — Title: Economic Forecast Anlyst Staff

Sponsored By: Karl R. Bletzacker — Title: Dir Fundamental Analysis

PUC DOCKET NO. 49737

SOUTHWESTERN ELECTRIC POWER COMPANY'S RESPONSE TO TEXAS INDUSTRIAL ENERGY CONSUMERS' FIRST REQUEST FOR INFORMATION

Question No. TIEC-1-8:

Has AEP ever compared its previous long-term gas price forecasts in its Fundamentals Forecast to actual results? If so, please provide such studies or analyses. If not, please explain why not.

Response No. TIEC-1-8:

No. AEPSC has not completed any formal study to compare its weather-normal long-term gas price forecasts to actual (weather-affected) results. As described in Bletzacker Direct Testimony, page 6, lines 1-12, it is imperative to account for the impact of weather on energy consumption and prices.

Prepared By: Connie S. Trecazzi — Title: Economic Forecast Anlyst Staff

Sponsored By: Karl R. Bletzacker — Title: Dir Fundamental Analysis

PUC DOCKET NO. 49737

SOUTHWESTERN ELECTRIC POWER COMPANY'S RESPONSE TO TEXAS INDUSTRIAL ENERGY CONSUMERS' FIRST REQUEST FOR INFORMATION

Question No. TIEC-1-19:

Please provide the following inputs and outputs for each of the base case No CO2 and low gas case No CO2 evaluations with and without the wind projects for each year of the study period:

a. gas prices, including Henry Hub price and the delivered price at each facility;

b. coal prices, including Powder River Basin price, rail transport as applicable, and delivered prices for western coal plants and for lignite plants;

c. expansion and retirement plan showing unit type, size, fuel, and heat rate;

d. price for purchases from SPP;

e. price of sales to SPP;

f. energy from each facility;

g. MMBtus consumed at each facility;

h. capital expenditures at each facility;

i. O&M at each facility, both fixed and variable;

j. total energy costs, broken down by fuel sources and purchased power;

k. cost per MWh of each of the three wind facilities for which a CCN is sought;

l. nonfuel revenue requirement of each facility.

Response No. TIEC-1-19:

Portions of the information responsive to this request are CONFIDENTIAL under the terms of the Protective Order. The Confidential information is available for review at the Austin offices of American Electric Power Company (AEP), 400 West 15th Street, Suite 1520, Austin, Texas, 78701, (512) 481-4562 during normal business hours.

At this time, the Company is reviewing a portion of its analysis which may lead to an updated/supplemental response to this request as well as new workpapers for Company witness Torpey's economic benefit analysis.

See Confidential Attachment 2 to this response for the confidential workpapers supporting the project screening analysis results presented in his Confidential Exhibit JFT-2.

a. Henry Hub prices are provided in TIEC_1_019_Attachment_3.xlsx. The delivered gas prices used in Mr. Torpey's analysis are currently being reviewed and are not available. This review may lead to an updated/supplemental response to this request as well as new workpapers for Company witness Torpey.

b. TIEC_1_019_Confidential_Attachment_5.xlsx provides dispatch coal prices (i.e., excluding fixed costs) and accounting coal prices (i.e., including fixed costs).

c. Expansion and retirement plans are provided in TIEC_1_019_Attachment_6.xlsx. Unit data used in Mr. Torpey's analysis is being reviewed and is currently not available. This review may lead to an updated/supplemental response to this request as well as new workpapers for Company witness Torpey.

d. See TIEC_1_019_Attachment_8.xlsx.

e. See TIEC_1_019_Attachment_9.xlsx.

f & g. This information is currently not available. The Company is reviewing a portion of its analysis which may lead to an updated/supplemental response to this request as well as new workpapers for Company witness Torpey's economic benefit analysis.

h. Capital expense is not a variable cost of production and was not modeled in the PLEXOS analysis in this proceeding for units other than the wind facilities. Capital and fixed O&M (see item i) were input in witness Torpey's revenue requirement calculations on the Inputs worksheet of the file "AEP Witness Torpey Benefits Model Final" which can be found as item number 5 in this docket on the PUCT interchange.

i. See item h. Fixed O&M is not a variable cost of production and was not modeled in the PLEXOS analysis in this proceeding for units other than the wind facilities. Variable O&M used in Mr. Torpey's analysis is being reviewed and is currently not available. This review may lead to an updated/supplemental response to this request as well as new workpapers for Company witness Torpey.

j. The requested information is currently being reviewed and is not available. This review may lead to an updated/supplemental response to this request as well as new workpapers for Company witness Torpey.

k. The requested values can be found in "Summary Preliminary Customer Savings Plan GenTie_HoldCongestG BASE 041219.xlsx" provided in "TIEC_1_19_Confidential_Attachment_2_Ex_JFT-2_Workpapers.zip."

l. See the screening analysis provided in "TIEC_1_19_Confidential_Attachment_2_Ex_JFT-2_Workpapers.zip," which shows the estimated costs per MWh of all the facilities based on information available during the screening phase. The facilities were not modeled individually once the screening process was completed and these three projects were selected for analysis of the customer benefits as a combined portfolio.

Attachments 3, 6, 8 and 9 are provided via the attached flash drive.

Prepared By: Jon R. Maclean — Title: Resource Planning Mgr

Prepared By: James F. Martin — Title: Regulatory Case Mgr

Sponsored By: John F. Torpey — Title: Mng Dir Res Plnning&Op Anlysis

PUC DOCKET NO. 49737

SOUTHWESTERN ELECTRIC POWER COMPANY'S RESPONSE TO TEXAS INDUSTRIAL ENERGY CONSUMERS' FIRST REQUEST FOR INFORMATION

Question No. TIEC-1-21:

Please refer to the page 21 of the Direct Testimony of John F. Torpey, where SWEPCO states that its forecast shows a minimal change in generation from its existing fleet and a minimal change in price at its generation hub:

a. Is that true in both the base case and the low gas case?

b. If true, does that mean that SWEPCO expects that SPP prices will be in excess of the marginal cost of operating its existing fleet?

Response No. TIEC-1-21:

a. Yes

b. SWEPCO's generating units are operated along with the units of the other SPP members, to meet the total SPP load requirements on the most economical basis, based on price offers, subject to transmission limitations. SWEPCO simulates that operation by means of the *PLEXOS®* simulation model, a production-costing computer program developed by Energy Exemplar. In the *PLEXOS®* model, SWEPCO's units are dispatched to the SPP price. As Mr. Torpey says on page 21 of this direct testimony, "The addition of the Selected Wind Facilities is not expected to have a significant impact on the SWEPCO Gen Hub energy prices..."; and as such, the dispatch of SWEPCO's existing fleet is not expected to change between the With and Without Wind cases under each scenario.

Prepared By: Jon R. Maclean	Title: Resource Planning Mgr
Prepared By: James F. Martin	Title: Regulatory Case Mgr
Sponsored By: John F. Torpey	Title: Mng Dir Res Plnning&Op Anlysis

PUC DOCKET NO. 49737

SOUTHWESTERN ELECTRIC POWER COMPANY'S RESPONSE TO TEXAS INDUSTRIAL ENERGY CONSUMERS' SECOND REQUEST FOR INFORMATION

Question No. TIEC 2-3:

Would SWEPCO agree to not exclude curtailments from its energy production guarantee? If not, please explain why not.

Response No. TIEC 2-3:

SWEPCO continues to support the capital cost, PTC eligibility, and minimum production guarantees described in the Direct Testimonies of Company witnesses Brice and Smoak, because these are reasonable guarantees to provide in the context of this case.

Prepared By: Christopher N. Martel — Title: Regulatory Consultant Sr

Prepared By: Jonathan M. Griffin — Title: Regulatory Consultant Staff

Sponsored By: Thomas P. Brice — Title: VP Regulatory & Finance

PUC DOCKET NO. 49737

SOUTHWESTERN ELECTRIC POWER COMPANY'S RESPONSE TO TEXAS INDUSTRIAL ENERGY CONSUMERS' SECOND REQUEST FOR INFORMATION

Question No. TIEC 2-4:

Please explain why SWEPCO limited the RFP to build-own-transfer projects and did not request proposals for wind purchase power agreements (PPAs). Please provide all analyses, presentations, and internal correspondence regarding SWEPCO's decision to pursue build-own-transfer projects instead of PPAs.

Response No. TIEC 2-4:

The information responsive to this request is CONFIDENTIAL under the terms of the Protective Order. The Confidential information is available for review at the Austin offices of American Electric Power Company (AEP), 400 West 15th Street, Suite 1520, Austin, Texas, 78701, (512) 481-4562, during normal business hours.

As discussed on pages 13-14 of the Direct Testimony of Company witness Brice, ownership of wind generating facilities will provide several benefits to the Company and its customers, as compared to adding more wind PPAs. For example, ownership enables the Company to respond to changes in the market, to effectively manage congestion risk, to potentially run the facilities beyond their estimated useful life, and to offer the guarantees described by Company witnesses Brice and Smoak.

Subject to the Company's previously-filed privilege objection, documents responsive to this request are provided in TIEC 2-4 Confidential Attachment 1.

Prepared By: Joseph A. Karrasch	Title: Dir Renewable Energy Devlpmnt
Prepared By: Edward J. Locigno	Title: Regulatory Analysis & Case Mgr
Prepared By: Christopher N. Martel	Title: Regulatory Consultant Sr
Prepared By: Jonathan M. Griffin	Title: Regulatory Consultant Staff
Sponsored By: Thomas P. Brice	Title: VP Regulatory & Finance
Sponsored By: Jay F. Godfrey	Title: VP Energy Mktng & Renewables

SOAH DOCKET NO. 473-19-6862
PUC DOCKET NO. 49737

SOUTHWESTERN ELECTRIC POWER COMPANY'S SUPPLEMENTAL RESPONSE TO TEXAS INDUSTRIAL ENERGY CONSUMERS' SECOND REQUEST FOR INFORMATION

Question No. TIEC 2-4:

Please explain why SWEPCO limited the RFP to build-own-transfer projects and did not request proposals for wind purchase power agreements (PPAs). Please provide all analyses, presentations, and internal correspondence regarding SWEPCO's decision to pursue build-own-transfer projects instead of PPAs.

Response:

The information responsive to this request is CONFIDENTIAL under the terms of the Protective Order. The Confidential information is available for review at the Austin offices of American Electric Power Company (AEP), 400 West 15th Street, Suite 1520, Austin, Texas, 78701, (512) 481-4562, during normal business hours.

As discussed on pages 13-14 of the Direct Testimony of Company witness Brice, ownership of wind generating facilities will provide several benefits to the Company and its customers, as compared to adding more wind PPAs. For example, ownership enables the Company to respond to changes in the market, to effectively manage congestion risk, to potentially run the facilities beyond their estimated useful life, and to offer the guarantees described by Company witnesses Brice and Smoak.

Subject to the Company's previously-filed privilege objection, documents responsive to this request are provided in TIEC 2-4 Confidential Attachment 1.

Supplemental Response No. TIEC 2-4:

The information responsive to this request is CONFIDENTIAL under the terms of the Protective Order. The Confidential information is available for review at the Austin offices of American Electric Power Company (AEP), 400 West 15th Street, Suite 1520, Austin, Texas, 78701, (512) 481-4562, during normal business hours

On September 25, 2019 the Company was order to produce privilege log items 15, 16, and 19 through 37 in response to TIEC 2-4.

Please see TIEC 2-4 Confidential Supplemental Attachment 2.

Prepared By: Joseph A. Karrasch	Title: Dir Renewable Energy Devlpmnt
Prepared By: Edward J. Locigno	Title: Regulatory Analysis & Case Mgr
Prepared By: Christopher N. Martel	Title: Regulatory Consultant Sr
Prepared By: Jonathan M. Griffin	Title: Regulatory Consultant Staff
Prepared By: Lynn M. Ferry-Nelson	Title: Dir Regulatory Svcs
Sponsored By: Thomas P. Brice	Title: VP Regulatory & Finance
Sponsored By: Jay F. Godfrey	Title: VP Energy Mktng & Renewables

PUC DOCKET NO. 49737

SOUTHWESTERN ELECTRIC POWER COMPANY'S RESPONSE TO TEXAS INDUSTRIAL ENERGY CONSUMERS' SECOND REQUEST FOR INFORMATION

Question No. TIEC 2-5:

Does SWEPCO agree that tax equity investors would be more likely to efficiently monetize the wind production tax credits (PTCs) generated by the proposed wind projects than AEP? If not, why not?

Response No. TIEC 2-5:

SWEPCO believes that although tax equity investors may be more likely to efficiently monetize the wind production tax credits generated by the proposed wind projects, using a tax equity structure would subject customers to a higher cost of capital. In addition, the use of a tax equity structure would add legal, ownership, financial and tax complexity to the project. SWEPCO has the ability to access capital and fund this project at its weighted average cost of capital which is lower than a tax equity structure that would require the project to be financed with 100% equity while avoiding the complexity and risk associated with a tax equity structure.

Prepared By: Renee V. Hawkins — Title: Mng Dir Corporate Finance

Prepared By: Carrie M. Luedtke — Title: Corp Finance Analyst Prin

Sponsored By: Noah K. Hollis — Title: Corp Finance Mgr

PUC DOCKET NO. 49737

SOUTHWESTERN ELECTRIC POWER COMPANY'S RESPONSE TO TEXAS INDUSTRIAL ENERGY CONSUMERS' SECOND REQUEST FOR INFORMATION

Question No. TIEC 2-6:

Has SWEPCO considered a structure that would more efficiently monetize the wind PTCs, such as the joint venture structure that Northern Indiana Public Service Company (NIPSCO) has proposed for its Rosewater Wind Project? If not, why not?

Response No. TIEC 2-6:

The Company is familiar with the tax equity structure proposed for NIPSCO's Rosewater Wind Project. However, the Company did not consider the use of tax equity for the wind facilities proposed in this proceeding for the reasons stated in the response to TIEC 2-5.

Prepared By: Renee V. Hawkins — Title: Mng Dir Corporate Finance

Prepared By: Carrie M. Luedtke — Title: Corp Finance Analyst Prin

Sponsored By: Noah K. Hollis — Title: Corp Finance Mgr

PUC DOCKET NO. 49737

SOUTHWESTERN ELECTRIC POWER COMPANY'S RESPONSE TO TEXAS INDUSTRIAL ENERGY CONSUMERS' SECOND REQUEST FOR INFORMATION

Question No. TIEC 2-9:

Please explain why AEP believes that it is a reasonable assumption that congestion costs will not increase consistent with the increase in power prices after 2029.

Response No. TIEC 2-9:

Holding congestion and loss-related costs constant assumes that in the long-run, if congestion costs were to increase as dispatch costs increase, new transmission upgrades will become cost-effective, meaning that SPP's planning process will advance cost-effective transmission solutions to address transmission congestion. Additionally, costs of substitute technologies, such as battery storage, co-located solar/wind and storage, are continuing to decrease, which is expected to reduce the future costs of addressing transmission congestion. As a result, holding 2029 congestion constant in nominal dollar terms was viewed as a reasonable assumption. If, in fact, congestion were to increase beyond the assumed levels (as is approximated by the higher congestion levels in the "No SPP Upgrade" case), AEP will be able to mitigate the higher congestion costs, for example, by cost-effectively constructing a gen tie—as is evaluated by Company witness Torpey in the gen tie cases.

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