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SOAH DOCKET NO. 473-22-04394
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APPLICATION OF ENTERGY TEXAS, INC. FOR AUTHORITY TO CHANGE RATES	§ § §	BEFORE THE STATE OFFICE OF ADMINISTRATIVE HEARINGS

REBUTTAL TESTIMONY

OF

ALLEN J. BECKER

ON BEHALF OF

ENTERGY TEXAS, INC.

NOVEMBER 2022

ENTERGY TEXAS, INC.
REBUTTAL TESTIMONY OF ALLEN J. BECKER
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EXHIBIT

Exhibit AJB-R-1 Résumé of Allen J. Becker

I. INTRODUCTION

Q1. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Allen J. Becker. I am the sole member of Allen J. Becker, Consulting Meteorologist, LLC. My business address is 2516 N. 86th Street, Wauwatosa, Wisconsin 53226.

Q2. WHAT IS YOUR OCCUPATION?

A. I am a consulting meteorologist. Since 1996, I have worked primarily for the wind energy industry, where my areas of expertise have included wind farm site selection, wind resource assessment and evaluation, design of monitoring programs, and preparation of financeable wind resource assessments. In recent years, my practice has focused on expert witness work for legal proceedings involving meteorological factors.

Q3. PLEASE DESCRIBE YOUR EDUCATIONAL AND PROFESSIONAL EXPERIENCE.

A. In 1987, I received a Bachelor of Science in Meteorology, with honors, from San Jose State University. I also received a Master of Science in Meteorology from San Jose State University in 1992. My employment background has been divided between the academic and consulting fields.

As a college and university instructor, I have 13 years of experience teaching meteorology courses, including general meteorology, aviation meteorology, cloud physics, climatology, online coursework, and computers in meteorology. This includes teaching positions at the University of Wisconsin, Milwaukee (1999–2000), San Jose State University (1988–1998), and Foothill and DeAnza Community Colleges and Cabrillo Community College (1991–1998).

My meteorological consulting work has focused on two areas: as an expert witness in legal proceedings and as a consultant in the wind energy field. As to the latter area, I have 20 years of professional experience in wind energy meteorology, which includes wind energy resource assessments; wind turbine micrositing in the United States, Mexico, Nicaragua, Honduras, Italy, and offshore; database management; meteorological tower data analysis; and power performance testing.

I am a Certified Consulting Meteorologist (CCM #704), a title conferred by the American Meteorological Society. I have also been a member of several professional societies, including the American Meteorological Society and the American Wind Energy Association.

Additional details regarding my education and professional background are provided in my résumé, attached as Exhibit AJB-R-1.

Q4. ON WHOSE BEHALF ARE YOU FILING THIS REBUTTAL TESTIMONY?

A. I am testifying on behalf of Entergy Texas, Inc. ("ETI" or "the Company").

Q5. HAVE YOU EVER TESTIFIED BEFORE THE PUBLIC UTILITY COMMISSION OF TEXAS ("COMMISSION")?

A. I provided Rebuttal Testimony in ETI's last base rate case, Docket No. 48371.

Q6. PLEASE STATE THE PURPOSE OF YOUR REBUTTAL TESTIMONY.

A. The purpose of my rebuttal testimony is to respond to the positions taken by Cities witness Karl J. Nalepa on the appropriate weather normalization period to apply in this proceeding.[1] I support Kristin Sasser's proposal to use a 20-year period as a more reasonable and appropriate approach as compared to the 10-year period recommended by Mr. Nalepa.

Q7. DO OTHER WITNESSES TESTIFYING ON BEHALF OF ETI ALSO REBUT MR. NALEPA'S TESTIMONY?

A. Yes. Ms. Sasser, who submitted Direct Testimony on the weather normalization issue, provides an overview of ETI's rebuttal position regarding the normalization period and specifically rebuts Mr. Nalepa's position regarding recent Commission practice. Stefan Boedeker testifies that, *from a statistical perspective*, a 20-year normalization period is superior to the 10-year period. I testify that, *from a climate perspective*, a 20-year normalization period is more reasonable than a 10-year

[1] Cities include the Cities of Anahuac, Beaumont, Bridge City, Cleveland, Dayton, Groves, Houston, Huntsville, Liberty, Montgomery, Navasota, Nederland, Oak Ridge North, Orange, Pine Forest, Pinehurst, Port Arthur, Port Neches, Roman Forest, Rose City, Shenandoah, Silsbee, Sour Lake, Splendora, Vidor, West Orange, and Willis.

period. My Rebuttal Testimony should be read in conjunction with Ms. Sasser's and Mr. Boedeker's Rebuttal Testimonies, which together constitute ETI's overall rebuttal to Cities' recommendation for use of a 10-year weather normalization period in this case.

II. RESPONSES TO KARL J. NALEPA

Q8. PLEASE SUMMARIZE THE POSITION TAKEN BY CITIES WITNESS MR. NALEPA IN HIS DIRECT TESTIMONY.

A. I only address the portion of Mr. Nalepa's testimony relating to his weather normalization adjustment. Essentially, he concludes that the weather adjustment of revenues should be modified to reflect a 10-year weather normalization period. He contends that "Texas has been undergoing a warming trend, and a 10-year weather normalization period more accurately reflects the most recent warming trend."[2] He also testifies that the 10-year period is consistent with recent Commission practice.

Q9. DO YOU AGREE WITH MR. NALEPA'S RECOMMENDATION OF A 10-YEAR WEATHER NORMALIZATION PERIOD?

A. No, I do not. Mr. Nalepa mainly relies on prior rate case dockets to support his recommendation that a 10-year weather normalization period is preferable. While he explains that the Commission requires a 10-year normalization period in other types of proceedings, including the Distribution Cost Recovery Factor ("DCRF")

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2 Direct Testimony of Karl J. Nalepa, page 15, lines 10-11.

applications, Energy Efficiency Cost Recovery Factor ("EECRF") applications, and Earnings Monitoring Reports ("EMR"), it appears he did not perform an independent verification of the purported advantages of using the 10-year period. As discussed herein, I agree with the 20-year normalization period proposed in Ms. Sasser's Direct Testimony.

Q10. PLEASE EXPLAIN WHY YOU DISAGREE WITH MR. NALEPA.

A. As a meteorologist, I believe that while the traditional 30-year "normal" is becoming less appropriate due to recent warming trends, moving to a 10-year period introduces too much volatility, based on the many weather cycles that can skew a given 10-year averaging period. Based on my initial calculations using the contiguous 48-state annual mean temperature data, and similar data for Texas, it appears increasingly appropriate to use a 20-year averaging period for weather normalization. I expand upon this in the discussion below.

Q11. DO YOU AGREE WITH MR. NALEPA'S ASSERTION THAT PAST COMMISSION FINDINGS ADOPTING A 10-YEAR NORMALIZATION SHOULD BE ADOPTED IN THIS PROCEEDING AS WELL?

A. No. Mr. Nalepa relies on Docket No. 40443 and a few other prior rate cases. In the principal rate case cited in support of a 10-year period, Docket No. 40443, it does not appear that the parties advocating for a 10-year period conducted rigorous and independent meteorological analyses in support of that position. It appears that the support for a 10-year period was more of a reaction to the fact that a 30-year period does not reflect a recent warming trend. The Commission's Final Order in Docket No. 40443 states that a 10-year period is a reasonable means of capturing recent weather trends as opposed to a 30-year period. As I discuss below, I agree there have recently been (and continue to be) warming trends, which a 30-year period may not reasonably capture. However, there are also major fluctuations in those trends, and these fluctuations are particularly problematic for the 10-year normalization period, which makes the 10-year period less reliable than a 20-year period.

Q12. BASED ON THE FOREGOING AND YOUR INDEPENDENT REVIEW, DO YOU AGREE WITH MS. SASSER'S PROPOSED 20-YEAR WEATHER NORMALIZATION PERIOD FOR ETI?

A. Yes, I do. Her data analyses are based on temperature, heating-degree days and cooling-degree days, and their non-linear interaction with energy usage among various categories. I present a summary of established climate research findings in support of her analyses. Ms. Sasser accurately states that a 20-year weather normalization period strikes the right balance between the traditional (but increasingly inappropriate) 30-year period and the fact that there is a need to capture more recent trends in climate. The 10-year weather normalization period indeed captures shorter-cycle trends, but it also introduces volatility and masks the more significant temperature trend. Thus, I support the proposed 20-year period as a more reasonable and reliable approach as compared Cities' recommendations for a 10-year period. I discuss this further below.

III. DISCUSSION

Q13. PLEASE DESCRIBE THE AREAS YOU HAVE RESEARCHED FOR YOUR REBUTTAL TESTIMONY.

A. I have examined the climate of the contiguous United States and the effect of recent temperature trends upon Texas in particular.

Q14. PLEASE BRIEFLY DESCRIBE THE TEXAS CLIMATE.

A. Texas is a very large coastal state and as such has an extensive range of climate divisions. The western parts of Texas and the Panhandle region are very dry, while the Gulf Coast and the eastern portion of the state are relatively humid and prone to tropical systems. One way to describe climate divisions within Texas is to refer to the "Köppen" system of climate classifications, one of the most widely used classification systems. Figure 1 below displays the eight major Köppen climate divisions within Texas. Broadly speaking, the eastern half of Texas is subtropical (with hot and humid summers and mild winters), while the western half of Texas is arid desert (with low precipitation and low humidity). Put another way, eastern Texas is primarily influenced by the humid Gulf of Mexico (including tropical storms and hurricanes), while western Texas is influenced by dry continental air. ETI's service area lies within the subtropical portion of the state.

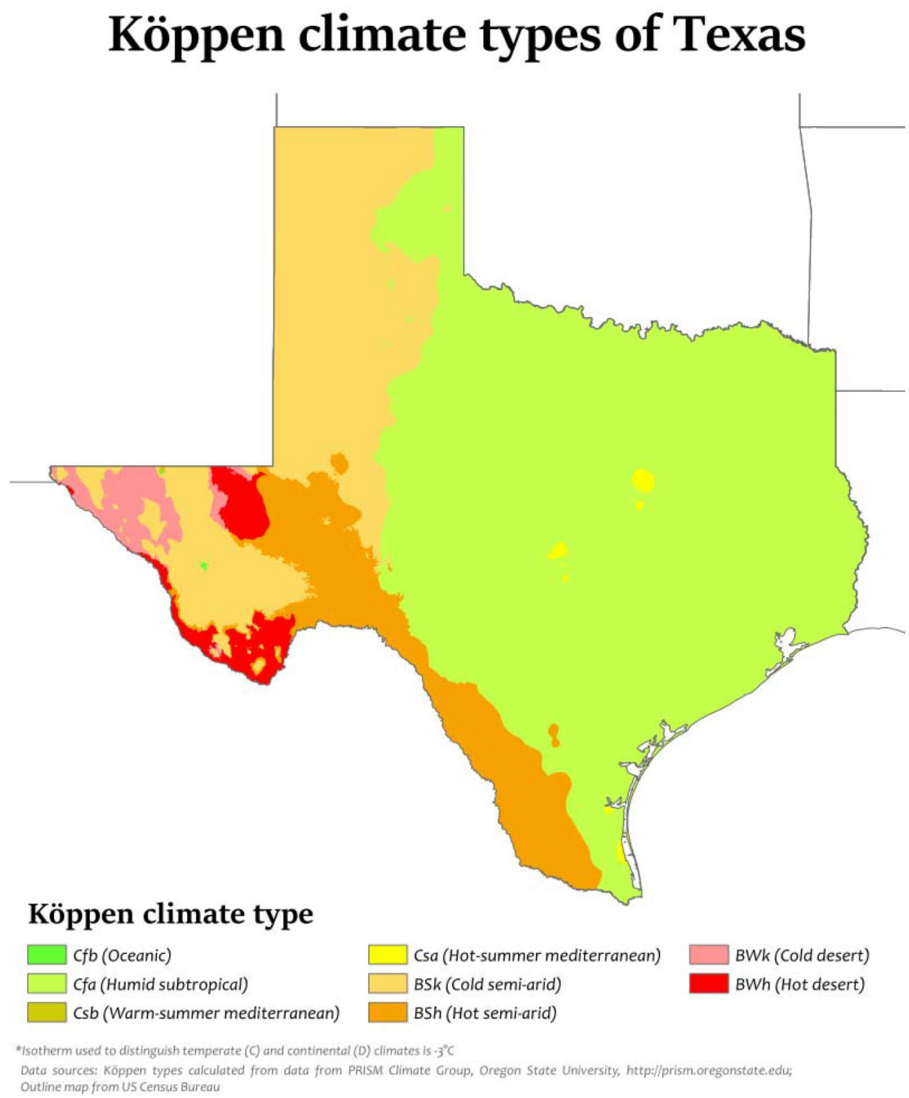

Figure 1: Köppen Climate Types of Texas

Q15. PLEASE DESCRIBE THE ANALYSIS ON THE RECENT WARMING TREND YOU PERFORMED.

A. I have examined the long-term trend as well as fluctuations within that trend. It has become well established that the earth is experiencing temperature changes. While overall mean temperature changes are still relatively small, the effects are expected to be significant. Figure 2 below (from the National Climatic Data Center ("NCDC") and the National Oceanic and Atmospheric Administration ("NOAA")) depicts the trends in average temperature across the United States for the 30-year period of 1991–2020. The values are extrapolated to temperature change in degrees (Fahrenheit) per decade. Note that Texas has experienced warming temperatures, but the effect is quite variable across the entire state, ranging from significant warming to no change at all. Due to natural variability inherent in the complex climate system, not every year is warmer than the preceding year. Thus, while the temperature trend is warming, there are spatial and temporal variations in this trend, both globally and regionally within Texas.

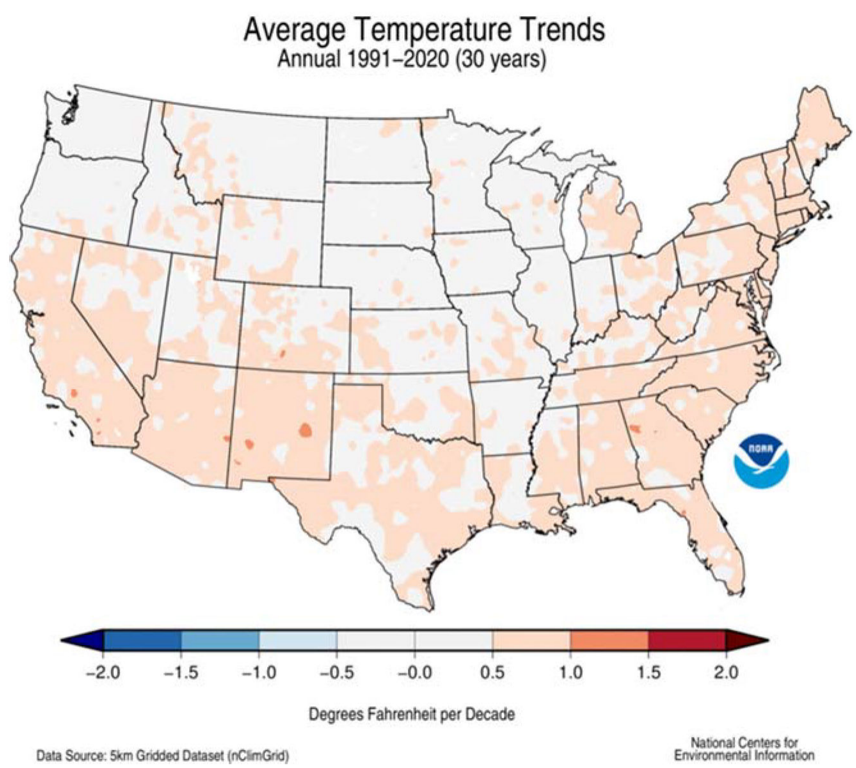

Figure 2: Average U.S. Temperature Trends (NCDC/NOAA)

Q16. PLEASE COMMENT ON THE VARIABILITY WITHIN THE LONG-TERM TREND.

A. Since the 1960s, there has been a clear signal of a warming trend, and average temperatures have risen more quickly since the late 1970s than previously observed. Nine of the top 10 warmest years on record for the contiguous 48 United States have occurred since 1998. Figure 3 below (NOAA, 2022) depicts the average temperature of the contiguous 48 states, expressed as an anomaly from the 1900–2000 mean temperature. Note that while this shows a trend, there are significant fluctuations within that trend. Successive maximums and minimums show continual increases, but within given two- to seven-year periods there are downturns in the temperature trend.

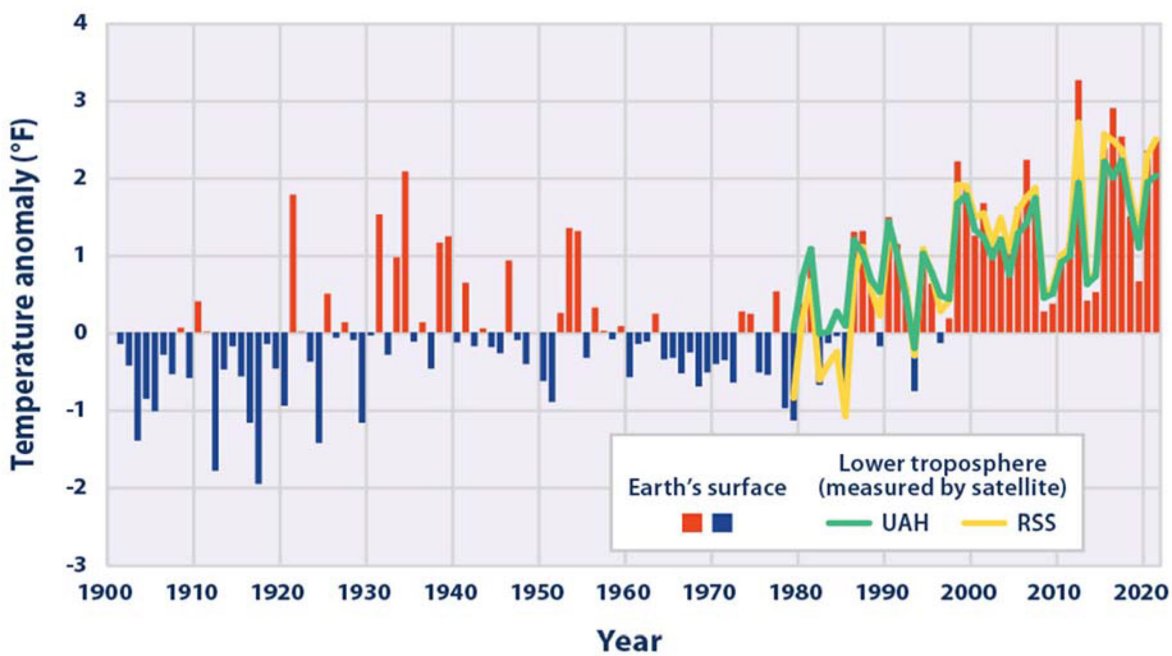

Figure 3: Average U.S. Temperature Trends (NOAA)

Q17. WHAT DO YOU MEAN BY "ANOMALY" AND WHY IS IT APPROPRIATE TO ANALYZE THIS TREND ON SUCH AS BASIS?

A. A temperature anomaly is defined as a departure or difference from a reference value or long-term average. The NCDC, an agency within the U.S. NOAA, and other organizations point out why anomalies are more useful than absolute temperatures when studying the climate and why they have thus become the standard in the meteorological community. The use of absolute temperature values in determining regional climate can be unnecessarily skewed by factors like station location or elevation. In addition, over time, the addition of new stations in a climate region's monitoring network are more difficult to mathematically incorporate. The use of anomalies instead of absolute temperature values is a superior method for several reasons. It better captures trends that are occurring over an entire region (much better spatial correlation than absolute temperature), is easier to calculate, and it also minimizes problems when stations are added, removed, or missing from a given monitoring network, among other reasons.

Q18. HOW HAVE THE TREND AND VARIABILITIES WITHIN THE TREND AFFECTED HOW METEOROLOGISTS CONDUCT WEATHER NORMALIZATION?

A. The World Meteorological Organization has been publishing global climate normals (averages) for several decades. Historically, they have used a 30-year averaging period. These global climate normal averages are used in the meteorological and climatological community in order to place recent climate conditions into a historical context. The analyses are also used by several industry sectors, including energy load forecasting, crop selection and planting timing, construction planning, and many others.

However, the 30-year climate "normal" has been called into question as a predictor of future climate due to the non-stationarity of climatic statistics, specifically the recent warming trend. There has been discussion in the meteorological community regarding work that needs to be undertaken to develop alternatives to the standard 30-year climate normal standard.

Q19. HAS THE METEOROLOGY COMMUNITY DRAWN ANY CONCLUSIONS OR DEVELOPED ALTERNATIVES TO THE TRADITIONAL 30-YEAR AVERAGING PERIOD FOR CLIMATE NORMALS?

A. Yes. The NCDC recognizes that there are increasing concerns with using the traditional 30-year normal. The NCDC concludes that there are several valid alternative approaches to defining a climate "normal" in order to provide a better estimate of current or future climate conditions. They do not conclude which particular method is best but recommend that several approaches (typically shorter averaging periods) be considered in order to determine the best fit for a specific application.

Q20. HAVE YOU CONDUCTED AN ANALYSIS REGARDING A REASONABLE ALTERNATIVE TO THE TRADITIONAL 30-YEAR PERIOD?

A. Yes. I utilized the annual temperature anomaly data for the contiguous 48 United States and performed a simple analysis. Starting with year 2021 data (as a "test" year) and going back 30 years, I posed a simple query: for a given test year, which temperature averaging period (10 years or 20 years) best "forecasts" the observed test year temperatures?

Q21. FROM WHERE DID YOU OBTAIN THE ANNUAL TEMPERATURE ANOMALY DATA FOR THIS ANALYSIS?

A. I obtained temperature data from the NOAA.

Q22. IS THE NOAA CONSIDERED A RELIABLE SOURCE FOR SUCH CLIMATE INFORMATION IN THE METEOROLOGICAL COMMUNITY?

A. Yes, very much so. The NOAA is a scientific agency within the United States Department of Commerce and is the universally-recognized source for reliably-archived and quality-controlled data.

Q23. FOR WHAT TYPES OF PURPOSES DO METEOROLOGISTS USE THE TYPE OF METHODOLOGY BY WHICH YOU CONDUCTED YOUR ANALYSIS?

A. My analysis used prior years' average temperature as a "forecast" for a given test year's temperature. This is a simple but objective approach designed to estimate the likely conditions for a given year. In order to refine such a forecast right before a test year starts, stakeholders would refer to NOAA's National Centers for Environmental Protection ("NCEP") latest seasonal/monthly forecast outlook products, as these products are based on emerging short-term trends.

For instance, in my experience with wind resource assessments for energy companies, it is standard practice to identify a weather station (or set of stations) that can be used as a long-term normal. Current conditions at a proposed wind farm location are then compared to the identified "normal" stations, and this comparison enables a reasonable prediction of future conditions. Each industry will have specific predictive needs and thus the methodology described here may be modified to suit those needs. But, the essential feature remains the same—using established normals, possibly modified to address future trends, to predict future conditions.

Q24. HAS YOUR METHODOLOGY BEEN REVIEWED IN THIS PROCEEDING?

A. Yes. Mr. Boedeker, the statistician expert witness in this proceeding, has reviewed my rebuttal testimony and the methodology used in my analysis. As Mr. Boedeker states in his rebuttal testimony, he agrees with the methodology I used for this analysis.

Q25. PLEASE DESCRIBE THE RESULTS OF YOUR ANALYSIS.

A. As shown in the table below, for the contiguous 48 United States over the last decade (2012 through 2021), the method of using the 20-year averaging period to forecast a given test-year's result is better than the 10-year method four out of ten times, performing a total of 24% better than the 10-year method in those instances. When the 10-year method is better (six out of ten times), it is only by an average of 5% better than the 20-year method. For the test years from 2002 through 2007, the preceding 10-year period was better than the 20-year period as a predictor, but by only a small margin (approximately 19% better).

Thus, analyses of recent years indicate that the 20-year averaging cycle is an increasingly better "climate normal" period for predicting the following year's temperature. I believe it does a better job of smoothing out the volatility inherent in the climate system's move toward warmer temperatures. In other words, in my opinion, while there is a warming trend, there is significant variability within that trend such that the 20-year weather normalization period is more reasonable than the 10-year period. I discuss some of these climate variabilities further below.

Q26. PLEASE DESCRIBE THE PROCESS USED TO REACH THESE RESULTS.

A. As I mentioned above, I took the NOAA temperature anomaly for each of the 1992–2021 "test years" and compared it to the average anomaly for both the prior 10-year period and the prior 20-year period. I then took the two differentials and determined which was closer to the actual test year temperature anomaly and by how much. This analysis is presented in the following table:

Test Year	Actual Anomaly	Prior 10-Year Avg. Anomaly	Prior 20-Year Avg. Anomaly	10-Year Difference	20-Year Difference	10-Year Difference (%)	20-Year Difference (%)	Better Method by %
2021	2.49	1.77	1.50	0.72	0.99	29.04%	39.88%	10 (10.8%)
2020	2.35	1.63	1.44	0.72	0.91	30.72%	38.64%	10 (7.9%)
2019	0.66	1.60	1.50	-0.94	-0.84	-142.27%	-127.58%	**20 (14.7%)**
2018	1.5	1.48	1.54	0.02	-0.04	1.60%	-2.50%	20 (0.9%)
2017	2.53	1.39	1.42	1.14	1.11	45.20%	43.90%	**20 (1.3%)**
2016	2.9	1.32	1.27	1.58	1.63	54.50%	56.30%	10 (1.7%)
2015	2.38	1.24	1.18	1.14	1.2	47.80%	50.40%	10 (2.6%)
2014	0.52	1.3	1.2	-0.78	-0.68	-149.80%	-130.30%	**20 (19.5%)**
2013	0.41	1.38	1.14	-0.97	-0.73	-237.10%	-177.80%	**20 (59.3%)**
2012	3.26	1.18	1.01	2.09	2.26	64.00%	69.20%	10 (5.2%)
2011	1.16	1.23	1	-0.07	0.16	-5.80%	13.40%	10 (7.7%)
2010	0.96	1.26	1.03	-0.3	-0.07	-30.80%	-7.30%	**20 (23.5%)**
2009	0.37	1.41	1	-1.04	-0.63	-279.70%	-171.10%	**20 (108.6%)**
2008	0.27	1.6	1.02	-1.33	-0.75	-492.20%	-277.80%	**20 (214.4%)**
2007	1.63	1.45	1	0.18	0.63	10.80%	38.40%	10 (27.6%)
2006	2.23	1.22	0.96	1.01	1.27	45.40%	57.10%	10 (11.7%)
2005	1.62	1.12	0.84	0.5	0.78	30.90%	48.10%	10 (17.2%)
2004	1.08	1.1	0.78	-0.02	0.3	-1.50%	27.40%	10 (25.9%)
2003	1.24	0.9	0.72	0.34	0.52	27.70%	42.30%	10 (14.6%)
2002	1.19	0.84	0.62	0.36	0.57	29.80%	47.70%	10 (17.9%)

Q27. DID YOU PERFORM A SIMILAR ANALYSIS FOR TEXAS IN PARTICULAR?

A. Yes. As shown in my workpapers, the Texas anomaly history is very close to that of the contiguous 48 United States. I conducted the same analysis discussed above for Texas specifically, and the results are similar (though even better for the 20-year period). Using the most recent decade (2012 through 2021), the 20-year averaging period to forecast a given year's result is better than the 10-year six of ten times.

However, when the 20-year method is better, it is so by an average of 30%, whereas when the 10-year method is better it is so by only 5%. See the following table:

Test Year	Actual Anomaly	Prior 10-Year Avg. Anomaly	Prior 20-Year Avg. Anomaly	10-Year Difference	20-Year Difference	10-Year Difference (%)	20-Year Difference (%)	Better Method by %
2021	1.5	1.81	1.39	-0.31	0.11	-20.67%	7.33%	**20 (13.3%)**
2020	2.3	1.63	1.37	0.67	0.93	29.13%	40.43%	10 (11.3%)
2019	1.3	1.62	1.41	-0.32	-0.11	-24.62%	-8.08%	**20 (16.5%)**
2018	1.4	1.57	1.46	-0.17	-0.05	-12.14%	-3.93%	**20 (8.2%)**
2017	2.7	1.32	1.285	1.14	1.11	51.11%	52.41%	10 (1.3%)
2016	2.6	1.31	1.195	1.58	1.63	49.62%	54.04%	10 (4.4%)
2015	1.2	1.33	1.165	1.14	1.2	-10.83%	2.92%	**20 (7.9%)**
2014	0.2	1.37	1.205	-0.78	-0.68	-585.00%	-502.50%	**20 (82.5%)**
2013	0.5	1.41	1.155	-0.97	-0.73	-182.00%	-131.00%	**20 (51.0%)**
2012	3.2	1.13	0.985	2.09	2.26	64.69%	69.22%	10 (4.5%)
2011	2.7	0.97	0.86	-0.07	0.16	64.07%	68.15%	10 (4.1%)
2010	0.5	1.11	0.885	-0.3	-0.07	-122.00%	-77.00%	**20 (45.0%)**
2009	1.2	1.19	0.81	-1.04	-0.63	0.83%	32.50%	10 (31.7%)
2008	0.9	1.34	0.75	-1.33	-0.75	-48.89%	16.67%	**20 (32.2%)**
2007	0.2	1.25	0.7	0.18	0.63	-525.00%	-250.00%	**20 (275.0%)**
2006	2.5	1.08	0.62	1.01	1.27	56.80%	75.20%	10 (18.4%)
2005	1.4	1	0.54	0.5	0.78	28.57%	61.43%	10 (32.9%)
2004	0.6	1.04	0.52	-0.02	0.3	-73.33%	13.33%	**20 (60.0%)**
2003	0.9	0.9	0.415	0.34	0.52	0.00%	53.89%	10 (53.9%)
2002	0.4	0.84	0.395	0.36	0.57	-110.00%	1.25%	**20 (108.8%)**

Q28. HAVE YOU PROVIDED THE UNDERLYING DATA USED IN YOUR ANALYSIS?

A. Yes, I have provided the data in my workpapers. This provides parties the opportunity to review the temperature data and examine my results.

Q29. DO YOU BELIEVE USING THE 20-YEAR APPROACH BETTER REDUCES THE RATE OF ERROR?

A. I do. As Mr. Boedeker states in his Rebuttal Testimony, the use of more data points leads to a lower margin of error and a higher confidence level in the results.

Q30. YOU MENTIONED ABOVE THAT THE 20-YEAR PERIOD DOES A BETTER JOB OF SMOOTHING OUT THE VOLATILITY INHERENT IN THE CLIMATE SYSTEM'S MOVE TOWARD WARMER TEMPERATURES. WHAT ARE SOME OF THE FACTORS CAUSING THIS VOLATILITY?

A. In the last several decades, research has identified several large-scale atmospheric "oscillations" that are cyclical in nature and have far-reaching "teleconnections."[3] Teleconnections is a concept referring to the statistical correlation between recurring global atmospheric cycles and distant locations on the planet. The most famous oscillation is the well-known "El Niño" pattern, where warm ocean temperatures in the eastern Pacific Ocean affect temperatures and rainfall in the United States, including Texas, and also affect the strength of the Atlantic basin's hurricane season each year. El Niño is part of a larger cycle called the "El Niño Southern Oscillation," or ENSO. It typically occurs every two to seven years, averaging every five years, but the cycle (and intensity of occurrence) can be quite irregular. The typical El Niño pattern is well correlated with Texas experiencing

3 *See*, for example, https://www.ncdc.noaa.gov/teleconnections/.

cooler temperatures in the February to April period. Also, El Niño is correlated with higher-than-normal precipitation in Texas during the December to March period. The opposite phase of the ENSO cycle from El Niño is called "La Niña," when eastern Pacific Ocean temperatures are cooler than normal. The La Niña pattern brings drier/warmer weather to Texas when it occurs. Figure 4 below shows the variable effect of El Niño on Texas's February to April temperature means.[4]

[4] This particular analysis was performed in 1997 and used a 102-year climate normal period (1895, the start of reliable temperature records, to 1996, the most recent year of the study) in order to assess the effects of "strong" El Ninos throughout the 20th century on several Texas climate divisions.

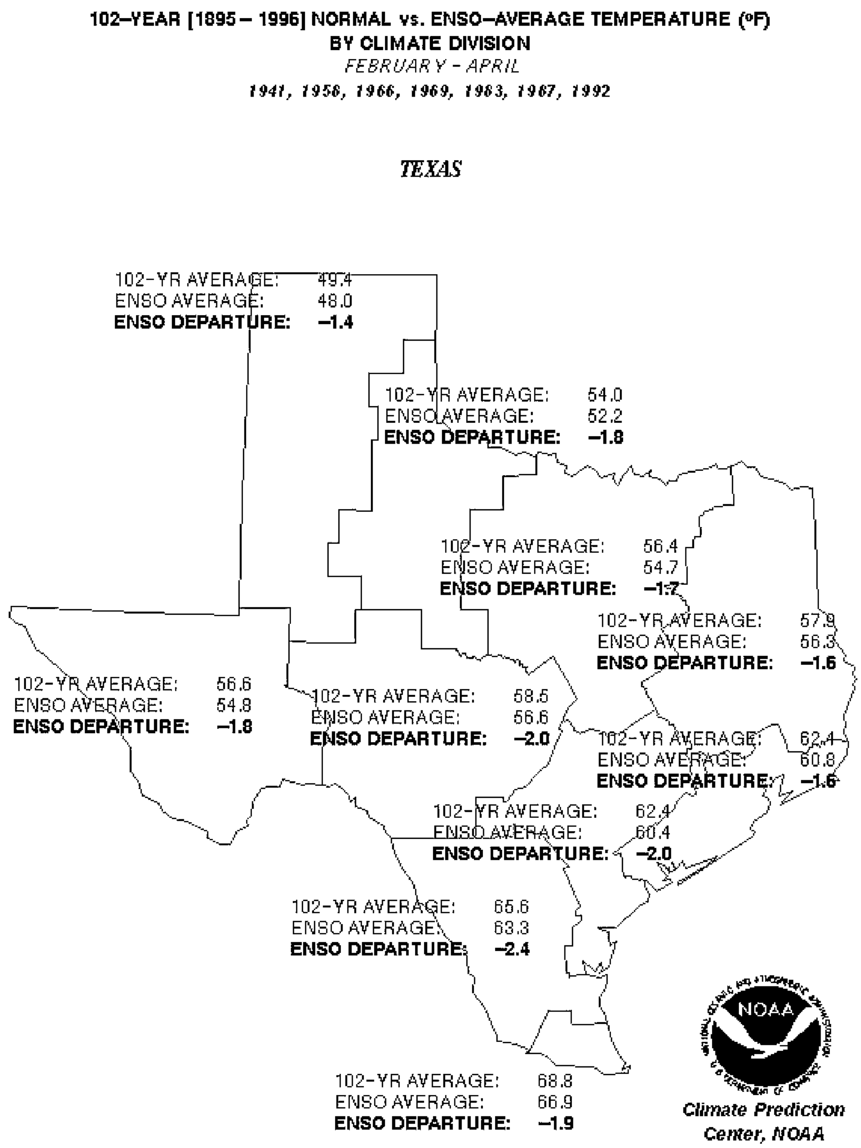

Figure 4: Effect of El Niño on February–April Texas Temperature (NOAA)

Q31. PLEASE CONTINUE.

A. There are other global cycles that are documented statistically to affect weather in the United States. One example is the "Arctic Oscillation" ("AO") which relates to the influence of Arctic weather upon the weather of the United States. A recent famous example of the Arctic Oscillation occurred in January 2014, when the "polar vortex" (cold swirl of air centered on the North Pole in the Arctic) protruded farther south than normal. This AO effect caused very cold winter temperatures in the United States. The AO cycle has no precise periodicity but has extremes approximately every 10 to 20 years. The US-NOAA Climate Prediction Center ("CPC") utilizes the ENSO, the AO, and other cycles to formulate their monthly and seasonal outlook forecasts. Some other atmospheric cycles used by the NOAA CPC in their forecasts are the "Pacific/North American" ("PNA") and the "North Atlantic Oscillation" ("NAO"). All of these cycles are natural modes of climate variability and, for a given short period of years, can interrupt the long-term trend of increasing regional and global temperatures.

Another important factor for the Texas coastal area are hurricanes and other tropical systems. Hurricanes affect the Houston area and Southeast Texas on average about once per decade. The official "return period" for a hurricane coming ashore within 50 miles of Houston is about nine years, with a major hurricane within 50 miles of Houston expected every 25 years on average. Hurricanes obviously bring clouds and rain, providing relief from summer heat, but they also saturate the ground, which can lead to evaporational cooling of the lower atmosphere. During an El Niño pattern, there is increased "wind shear" in the upper atmosphere which significantly reduces the likelihood of formation of Atlantic-basin hurricanes. Thus, there are cycles in hurricane frequency that roughly mimic the ENSO cycle's period—approximately five-year cycles of increased hurricane activity followed by a two- to three-year reduction in hurricane activity.

Q32. BASED ON YOUR OBSERVATIONS, IS 20 YEARS A MORE REASONABLE NORMALIZATION PERIOD THAN 10 YEARS?

A. Yes. The above discussion of cyclical variability in large-scale atmospheric phenomenon demonstrates the need to avoid climate averaging periods that are overly influenced by the volatility of these cycles. A 10-year averaging cycle can quite easily be dominated by a strong phase of one or more of the atmospheric teleconnection cycles, and thus is too short of an averaging period in my opinion. A 20-year normalization period does a better job of capturing the temperature trend while also avoiding volatility caused by shorter-period cycles in the atmosphere.

IV. CONCLUSION

Q33. PLEASE SUMMARIZE THE CONCLUSIONS YOU HAVE REACHED AS A RESULT OF YOUR ANALYSIS.

A. I concur with Ms. Sasser's testimony that a 20-year weather normalization period balances the need to have a sufficient number of sample years for a reliable average with the need to capture recent weather trends. I agree there are recent weather trends and that there is a need to reasonably capture those trends in the normalization period. However, the period should not be so short that it is easily dominated by the weather volatilities I discuss above. I believe a 10-year period runs this risk.

Q34. DO YOU BELIEVE YOUR TESTIMONY AND ANALYSIS WILL ASSIST THE COMMISSION IN ITS DETERMINATION IN THIS CASE?

A. Yes. This testimony provides an objective discussion of the benefits of using a 20-year weather normalization period over a 10-year weather normalization period and compares the two methods using reliable historical data. Which method should be used (and the benefits of each) is a contested issue in this proceeding, and thus my testimony will assist the Administrative Law Judges and the Commission in determining which approach is more reasonable and should be adopted.

Q35. DOES THIS CONCLUDE YOUR DIRECT TESTIMONY?

A. Yes.

AFFIDAVIT OF ALLEN BECKER

THE STATE OF WISCONSIN)
)
COUNTY OF MILWAUKEE)

This day, Allen J. Becker, the affiant, appeared in person before me, a notary public, who knows the affiant to be the person whose signature appears below. The affiant stated under oath:

My name is Allen J. Becker. I am of legal age and a resident of the State of Wisconsin. The foregoing testimony and exhibits offered by me are true and correct, and the opinions stated therein are, to the best of my knowledge and belief, accurate, true, and correct.

Allen J Becker

Allen J. Becker

SUBSCRIBED AND SWORN TO BEFORE ME, notary public, on this the 14th day of November 2022.

Notary Public, State of Wisconsin

My Commission expires:
9/4/2023

DIETRICH GLENN
NOTARY PUBLIC
STATE OF WISCONSIN

ALLEN J. BECKER

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EXPERT WITNESS

- Certified Consulting Meteorologist (American Meteorological Society CCM #704).
- Court testimony and depositions involving wind and weather conditions (1992-2022; testimony in over twenty cases).
- Analysis and reporting in over 110 cases involving severe weather, winds, precipitation, ice, hail, temperature, and moisture conditions for personal injury and structural failure cases (1992-2022).
- Testimony as expert meteorologist in mock jury trial (for CLE credits), co-produced by State Bar of Wisconsin and the Wisconsin Chapter of the American Board of Trial Advocates (ABOTA, 2014).

METEOROLOGICAL CONSULTING

- Twenty+ years of professional experience in wind energy meteorology. Wind energy resource assessments, wind turbine micrositing (United States, Italy, Mexico, Nicaragua, offshore, and Honduras), database management, meteorological tower data analysis, and power performance testing, with Richard Simon, MS, Windots, LLC and V-Bar, LLC (1996-2012). Independent wind resource assessment and consulting (2013-2019).
- Wind flow modeling and data processing for Richmond, California toxic cloud incidents (1993-94, 1999), for Unocal Oil Refinery long-term releases (1994-1996), and for Tosco Oil Refinery releases (1996-99).
- Development of a PC-based wind analysis and display system for National Weather Service Cooperative Program for Operational Meteorology (COMET), with Doug Sinton, Ph.D., Frank Ludwig, Ph.D., and Peter Lester, Ph.D. (1991-93).
- Analysis of aircraft turbulence incidents, with Peter Lester, Ph.D. (1986-87).
- Field study of winds in California, with Richard Simon, MS: Operated and maintained weather instruments, coordinated observations; statistical analyses (1984-85).

PUBLICATIONS

- Applications of a diagnostic wind model to stratus forecasting for aircraft operations in the San Francisco Bay region. Preprints, Seventh Conf. on Aviation Weather Systems, Long Beach, CA, Amer. Meteor. Soc., J29-J32, 1997. With F. Ludwig, D. Sinton, and W. Strach.
- An on-line diagnostic wind model applied to the San Francisco Bay region. Preprints, 13th Int. Conf. on Interactive Information and Processing Systems (IIIPS) for Meteorology, Oceanography, and Hydrology, Long Beach, CA, Amer. Meteor. Soc., J25-J27, 1997. With R. T. Cheng, J. Feinstein, F. Ludwig, and D. M. Sinton.
- Evaluation of the WOCSS Wind Analysis Scheme for the San Francisco Bay Area, Journal of Applied Meteorology, October 1994. With A. Bridger, F. Ludwig, and R. Endlich.
- User's Manual for Realtime Mesoscale Analysis and Display System. Report to National Weather Service, 1994. With F. Ludwig and D. Sinton.
- Meteorological Analyses for the Richmond Toxic Cloud Release of 26 July 1993. Report to Litigation Committee and Walt Dabberdt Associates, 1994. With F. Ludwig and R. Endlich.
- Performance of the "Winds on Critical Streamline Surfaces (WOCSS) Model" in simulating San Francisco Bay Area wind flows. Report to Bay Area Air Quality Management District, 1989. With A. Bridger.

COLLEGE FACULTY

- 13 years' experience teaching meteorology courses (general meteorology, aviation meteorology, cloud physics, climatology, online coursework, and computers in meteorology). University of Wisconsin (Milwaukee), 1999-2000, San Jose State University, California, 1988-98. Foothill and De Anza Community Colleges, Cabrillo Community College, California, 1991-98. Summer training programs for National Weather Service forecasters, 1987-92.

EDUCATION

- MS Meteorology, San Jose State University, May 1992. GPA: 3.9/4.0. Courses included: Numerical Modeling, Boundary Layer Meteorology, and Research Methods. Master's Thesis: "Implementation of a Mesoscale Boundary Layer Wind Model in the San Francisco Bay Area." Alumni Association Scholarship, SJSU, April 1988.
- BS Meteorology, San Jose State University, May 1987, with honors. GPA (major): 3.6/4.0. Senior Thesis: "Sounding Analysis Technique for Prediction of Clear Air Turbulence." Dean's Scholar, School of Science, SJSU, 1986-87. Department of Meteorology (SJSU): Gary Quinby Award for Service (May 1987).

PROFESSIONAL SOCIETIES

- American Meteorological Society: Member 1985-2022.
- American Wind Energy Association: Business Member 2004-2015.
- San Jose State University Student AMS Chapter: President 1986-87, Secretary/Treasurer. 1985-86.