Docket		A. 21-09-013 et al.
Exhibit Number	:	
Commissioner	:	
Administrative Law Judge	:	Jessica Hecht and Zhen Zhang

DIRECT TESTIMONY
OF
AARON L. ROTHSCHILD

ON BEHALF OF
WILD TREE FOUNDATION

January 31, 2022

Contents

I. STATEMENT OF QUALIFICATIONS

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

A. My name is Aaron L. Rothschild. My title is President, and my business address is 15 Lake Road, Ridgefield, CT.

Q. BY WHOM ARE YOU EMPLOYED AND IN WHAT CAPACITY?

A. I am President of Rothschild Financial Consulting ("RFC").

Q. PLEASE STATE YOUR EDUCATIONAL ACHIEVEMENTS AND PROFESSIONAL DESIGNATIONS.

A. I have a B.A. degree in mathematics from Clark University (1994) and an M.B.A. from Vanderbilt University (1996).

Q. PLEASE DESCRIBE YOUR BUSINESS EXPERIENCE.

A. I performed financial analysis in the telecom industry in the United States and Asia Pacific from 1996 to 2001, investment banking consulting in New York, complex systems science research regarding the power sector at an independent research institute, and I have prepared rate of return testimonies since 2002. See Appendix C for my resume.

Q. HAVE YOU PREVIOUSLY TESTIFIED BEFORE THE CALIFORNIA PUBLIC UTILITIES COMMISSION, OR OTHER STATE COMMISSIONS? IF SO, WHICH COMMISSIONS?

A. Yes, I have previously testified before the California Public Utilities Commission ("CPUC" or "Commission"). My expert witness experience also includes testifying in over

50 cost of capital proceedings before the following state commissions: California, Colorado, Connecticut, Delaware, Florida, New Jersey, Maryland, North Dakota, Pennsylvania, South Carolina, and Vermont. I testified on behalf of the Public Advocates Office in the Commission's last cost of capital proceeding, A.19-04-014 [consolidated.] See Appendix D for the list of dockets for each of my testimonies.

Q. ON WHOSE BEHALF ARE YOU PROVIDING THIS TESTIMONY?

A. I am testifying on behalf of Wild Tree Foundation ("Wild Tree").

Q. WHAT IS THE PURPOSE OF YOUR DIRECT TESTIMONY IN THIS PROCEEDING?

A. On August 23, 2021, Southern California Edison ("SCE"), Sand Diego Gas & Electric Company ("SDG&E"), and Pacific Gas and Electric Company ("PG&E") (together "the Utilities") each filed Cost of Capital ("COC") applications outside of the three-year cycle of the Cost of Capital Mechanism ("CCM").[1] The purpose of my testimony is to provide my recommendation to the California Public Utility Commission ("CPUC" or the "Commission") regarding whether current financial conditions meet the requirements in D.08-05-035, permitting the Utilities to file application outside of the CCM process. My recommendation regarding whether or not the Utilities should be permitted to file cost of capital applications at this time is based on determining if financial markets meet the following criteria established in D.08-05-035:

> Do the financial impacts on the Utilities described in the applications, where they are largely attributed to the COVID-19 pandemic, constitute an extraordinary or catastrophic event that materially impacts their respective

[1] The relevant application numbers are: Southern California Edison (21-08-013), San Diego Gas & Electric Company (21-08-014), Pacific Gas and Electric Company (21-08-015).

cost of capital and / or capital structure and impacts them differently than the overall financial markets.[2]

II. INTRODUCTION AND SUMMARY OF RECOMMENDATIONS

Q. HOW IS YOUR TESTIMONY ORGANIZED?

A. First, I provide a summary of my recommendations. Second, I explain why the Utilities' conclusion that the CCM should be suspended is invalid. The Utilities' conclusion is incorrect because they (1) use different criteria than required by the scoping memo, (2) rely upon market speculation when objective measures of investors' expectations are available, and (3) have utilized flawed analytical techniques that distort financial reality, including using out of date data that materially overstates relevant electric utility beta coefficients. Third, I show that a proper analysis of beta coefficients reveals that the relative risk of electric utility companies was not significantly different during the measurement period (October 1, 2020 – September 30, 2021) than before the pandemic. Fourth, I present a further analysis of stock option data that shows that investors' perceived downside risk of electric utility company stocks has remained relatively flat throughout and since the pandemic. Fifth, I provide an overview of the impact of the pandemic on capital markets, which provides additional evidence that the impact of the pandemic on the Utilities' cost of equity was brief and not even close to the catastrophe claimed by the Utilities. Technical details regarding my methodology for calculating historical and option-implied betas are provided in Appendix B. All calculations underlying the data presented in this testimony are provided as workpapers in Exhibit A.

[2] D.08-05-035 at p. 16, COL 6.

Q. PLEASE PROVIDE A SUMMARY OF YOUR RECOMMENDATION AND CONCLUSIONS.

A. My testimony demonstrates that the CPUC should deny the Utilities' off-cycle COC applications. Instead, the CPUC should maintain the Utilities' rates for the 2022 test year based on applying a CCM-adjusted Return on Equity ("ROE") as previously approved.

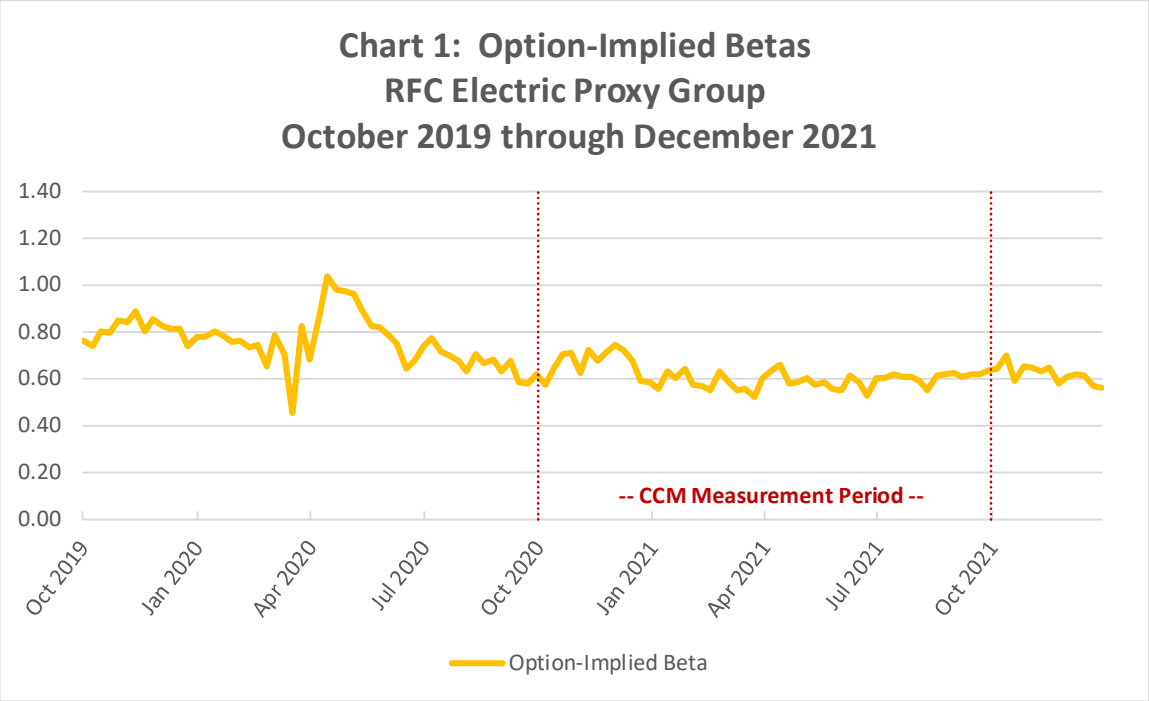
I make this recommendation because the COVID-19 pandemic does not constitute an extraordinary or catastrophic event that has materially affected the utilities' COC, as claimed by the Utilities' experts. While the COVID-19 pandemic is an ongoing global health catastrophe, the impact on capital markets and U.S. Corporations, including the Utilities' cost of equity, has been far from a catastrophe. Morningstar's US Market Index was up 20.9% in 2020 and 25.78% in 2021.[3] Regarding the impact on utility stocks, Morningstar concluded in a recent presentation that they are now among the industries that are "least overvalued."[4] Becoming "least overvalued" is not a catastrophe.

Financial data (as elaborated upon in Section VII starting on page 25) indicate that the capital market upheaval of March 2020, including its impact on electric utilities' cost of equity was brief. Although stock and bond prices remain more volatile than before COVID-19, market data show that investors' volatility expectations have declined for both the overall market and electric utility companies since mid-March 2020. As shown on Chart 7 on page 30, electric utility stocks have underperformed the overall market since the last COC proceeding in 2019, but as shown on Chart 8 on page 30, they have slightly outperformed the market in the last 6 months. Additionally, as discussed in Section VI starting on page 23, stock option data show that investors considered utility stocks

[3] Morningstar, *2022 U.S. Stock Market Outlook* (January 2022) at p. 5.
[4] *Id*. at p. 13.

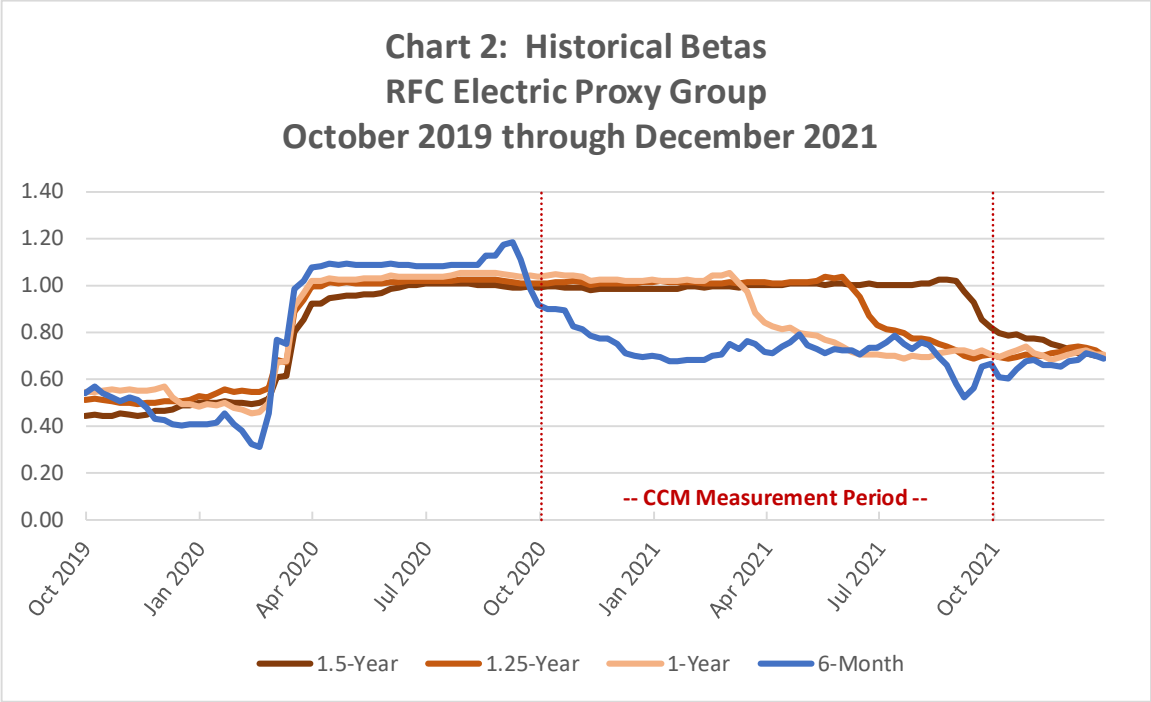
increasingly less risky than the overall market throughout the pandemic because they believed there was an increasingly lower chance of a large drop in their stock prices (see Chart 6 on page 25).

As explained in Section V on page 14, even though forward-looking option-implied and historical beta coefficients[5] calculated based on any time horizon for utility companies increased sharply during the onset of the pandemic in March 2020, most of these beta coefficients have come back down. As shown in Chart 1 below, option-implied betas[6] returned to pre-pandemic levels by June 2020 and continued to decline throughout the CCM measurement period of October 2020 to September 2021. The average option-implied beta for the CCM measurement period was 0.61, considerably lower than the pre-pandemic baseline average of 0.81 for the fourth quarter of 2019.

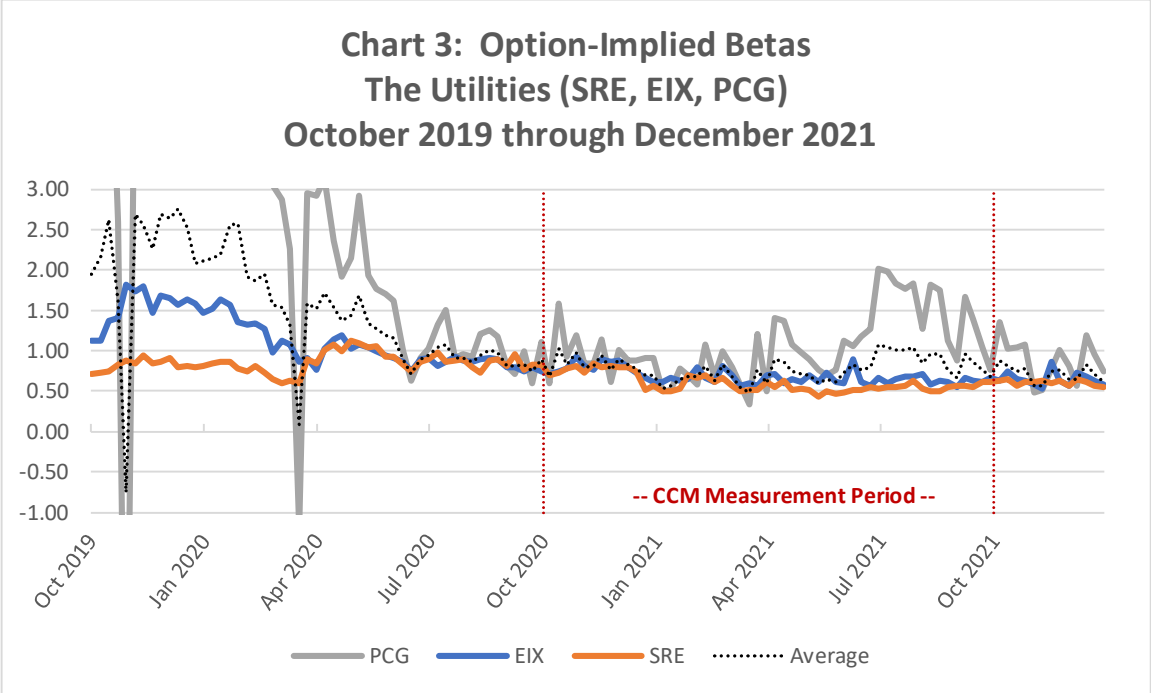


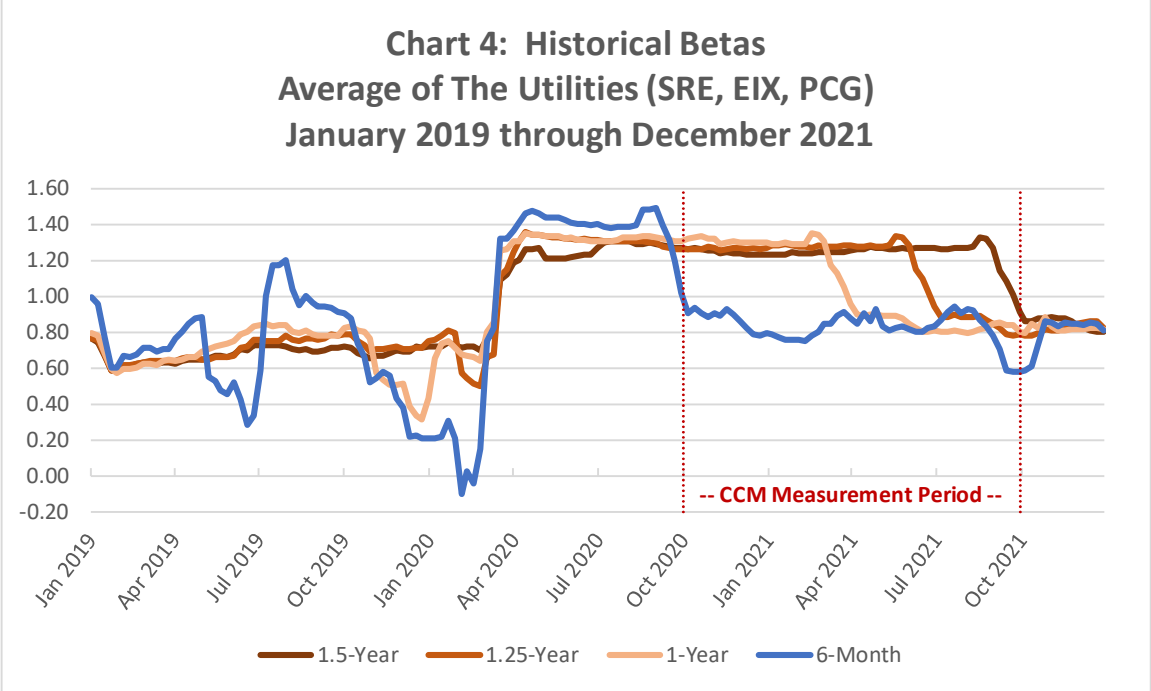
[5] Beta coefficients are a generally-accepted measure of risk that impacts the cost of equity.
[6] Option-implied beta coefficients are discussed in detail in Section V and Appendix B.

As shown in Chart 2 on page 6, historical beta coefficients calculated based on time horizons shorter than two years have also already reverted back to lower levels, consistent with the earlier drop in option-implied betas. Historical beta coefficients calculated based on a 6-month time horizon came down significantly starting roughly 6 months after March 2020. 1-year historical betas started to come down roughly 1-year later. And so on.



Even though option-implied and historical beta coefficients for the Utilities have been generally higher than the average of the electric utilities in the RFC Electric Proxy Group, Chart 3 and Chart 4 starting on page 7 show that the same general trends discussed above apply to the Utilities as well. Appendix A shows the same data presented in Chart 4 separated out for each of the three Utilities.





In Chart 3 above, one can see that PG&E's relatively high and volatile option-implied betas preceded the pandemic and therefore could not have been caused by the pandemic. In fact, the option-implied betas for PG&E were considerably lower during the measurement period than before the pandemic – PG&E's option-implied betas averaged

1.06 during the measurement period and 4.05 in the fourth quarter of 2019. In the initial stages of the pandemic, PG&E option-implied betas were significantly higher than for Edison International and Sempra, but by June 2020, they came down significantly.

As explained in Section V starting on page 14, the Utilities' experts falsely claim that electric utility company betas were significantly higher during the measurement period of October 2020 to September 2021 and remain elevated to date. They arrive at this invalid conclusion because they rely upon narrow, limited, and static approaches to calculating beta coefficients that result in unreliable conclusions regarding how the pandemic has impacted the cost of equity of the Utilities. Using the Utilities' experts' stale 5-year and 3-year historical beta coefficients exclusively to conclude that the CCM should be suspended would be like maintaining a tsunami warning on California beaches for years after the Hunga-Tonga-Hunga-Ha'apai volcano erupted on January 14, 2022.

Betas calculated based on more relevant market data, including the current expectations of investors reflected in option-implied betas, demonstrate that the relative risk of electric utilities has not been materially impacted by the pandemic and therefore is not a catastrophe by any reasonable measure.

III. RESPONSE TO THE UTILITIES' CLAIM THAT THE COVID-19 PANDEMIC JUSTIFIES AN OFF-CYCLE COC

Q. PLEASE SUMMARIZE YOUR RESPONSE TO THE UTILITIES' CLAIM THAT THE PANDMEIC JUSTIFIES AN OFF-CYCLE COC.

A. My responses to the Utilities are summarized below:

1. **Testimony that does not address the criteria for determining if an off-cycle COC should be allowed should be given no weight.** The Scoping memo clearly explains that the relevant criteria involve determining (1) if the pandemic materially impacted the Utilities' cost of capital and (2) if it impacted the Utilities cost of capital differently than the overall market, as established by D.08-05-035 and related Commission orders. Unable to demonstrate that these criteria have been met, the Utilities have attempted to add their own made-up criteria. For example, even though Dr. Vilbert concedes that by the end of 2021 economic conditions are largely the same as before the pandemic,[7] he claims that an off-cycle COC proceeding is justified because the "assumed relationship" between interest rates and the cost of equity has been affected.[8] Regarding Dr. Villadsen's claim that an off-cycle COC proceeding is justified, she states "the traditional relationship between government bond rates and equity return has changed, and, as a result, the CCM ROE adjustment may not adequately measure changes in investors' required return on equity."[9] SDG&E's expert Mr. Coyne states, "following the extraordinary circumstances associated with COVID-19, the monetary and fiscal policy responses, and economic recovery, the utility industry increasing cost of equity diverged from declining interest rates, rendering the CCM adjustment mechanism

[7] A.21-08-013, Direct Testimony of Michael Vilbert on behalf of PG&E (January 18, 2022) ("Vilbert Testimony") at p. 2-3:23 -25.
[8] Vilbert Testimony at p. 2-3:4 – 10.
[9] A.21-08-013, Direct Testimony of Bente Villadsen on behalf of SCE (January 18, 2022) ("Villadsen Testimony") at p. 16:6-9.

inappropriate under these circumstances."[10] This is not the relevant standard and the Commission should not give these testimonies any weight. Dr. Villadsen has also tried to change the criteria by implying that the CCM adjustment should be suspended because "absent these monetary policy actions, it is unlikely that the interest rates would have declined enough to meet the 100 basis points trigger for the CCM's FAM to operate."[11] The cause of interest rate changes is immaterial to the requirements of the CCM, and the Commission should not be distracted by this irrelevant testimony.

2. **Measuring the degree to which the Utilities' cost of capital has been impacted should be based on objective measures of investors' expectations (market-based methods), not "expert" speculation.** The actual cost of capital the Utilities will pay when they raise money will be determined by the market and not by financial publications or the opinions of rate of return witnesses. If investors are influenced by interest rate forecasts published by Blue Chip Financial Forecasts, for example, the price of stocks and bonds will reflect this. Therefore, interest rate forecasts are, at best, unnecessary. But using interest rate forecasts, and personal speculations, instead of market-based data in cost of equity calculations is not just a redundancy. Capital market speculations, including published interest rate forecasts, is financial astrology in most cases and should not be

[10] A.21-08-013, Direct Testimony of James M. Coyne on behalf of SDG&E (January 18, 2022) ("Coyne Testimony") at p. JMC-11:4-7.
[11] Villadsen Testimony at p. 11:7-9.

used in financial testimony.[12] In the 2019 Energy COC proceeding, the Utilities used increased interest rate forecasts that were higher than investor expectations as indicated by market data. In PG&E's 2019 COC testimony, Dr. Vilbert claimed, "I do not believe the current yield on the long-term Treasury bond is a good estimate of the risk-free rate that will prevail over the relevant time period. Interest rates are expected to increase."[13] It turned out that interest rates declined substantially. Those who are willing to provide forecasts of the unforecastable often argue that their forecast would have been correct if not for a specific unexpected event. However, capital markets are fundamentally unpredictable because there are always unexpected events (e.g., war, pandemics, natural disasters) that impact capital markets, including interest rates. Consumers were overcharged in the 2019 Energy COC proceeding based, in part, upon such speculations.

The Utilities' forecasts of increased interest rates have been proven wrong over and over again. Despite their obvious inability to forecast capital markets, the Utilities' experts are yet again relying upon capital market speculations in this proceeding.

3. **The Utilities' witnesses rely upon flawed analytical methodologies**. As explained in the introduction, the Utilities have falsely claimed that electric utility betas were high during the measurement period and remain high as of December 31, 2021. Historical and option-implied betas for electric

[12] If an expert really believed they could forecast capital markets better than the overall market they would likely use this information to make millions of dollars as a trader instead of putting their forecasts in a public document.
[13] A.19-04-014, Direct Testimony of Michael Vilbert on behalf of PG&E (April 22, 2019) at p. 2-57:13 - 15, available at: https://docs.cpuc.ca.gov/PublishedDocs/SupDoc/A1904015/2037/283492541.pdf .

utilities increased briefly during the onset of the pandemic in March 2020 but have since come back down practically to pre-pandemic levels. As discussed below, the beta calculations of the Utilities' witnesses are artificially inflated because they use stale data and narrow, limited, and static approaches in their calculations.

IV. RFC ELECTRIC PROXY GROUP

Q. WHAT COMPANIES DID YOU USE IN YOUR COMPARABLE PROXY GROUP?

A. As shown on Table 1 on page 13, the comparable proxy group used in my beta and option-implied skew analyses, referred to as the RFC Electric Proxy Group, consists of 26 of the 36 publicly traded electric utility companies covered by Value Line. I used the same 26 companies that Dr. Vilbert included in his "electric utility sample."[14] I chose to use the same comparable companies as the Utilities to ensure the results are comparable. SDG&E witness Mr. Coyne's proxy group consists of only 20 companies,[15] 17 of which are included in my proxy group.[16]

[14] Exhibit B: A.21-08-013, PG&E Data Response to Wild Tree_OO3-Q001.
[15] Exhibit C: A.21-08-013, SDG&E Data Response to Wild Tree_003-Q001.
[16] The RFC Electric Proxy Group does not include the following companies that are in Mr. Coyne's proxy group: Consolidated Edison, Eversource, and Portland General Electric Company.

TABLE 1: RFC ELECTRIC PROXY GROUP COMPOSITION

	Company Name	Ticker
1	AMEREN	AEE
2	AMERICANELEC.PWR.	AEP
3	ALLETE	ALE
4	AVISTACORP.	AVA
5	BLACKHILLSCORP.	BKH
6	CMSENERGYCORP.	CMS
7	CENTERPOINTEN'RGY	CNP
8	DTEENERGYCO.	DTE
9	DUKEENERGY	DUK
10	EDISONINTERNAT'L	EIX
11	ENTERGYCORP.	ETR
12	EVERGY,INC.	EVRG
13	EXELONCORP.	EXC
14	IDACORP,INC.	IDA
15	ALLIANTENERGY	LNT
16	MGEENERGYINC.	MGEE
17	NEXTERAENERGY	NEE
18	NORTHWESTERN	NWE
19	OGEENERGYCORP.	OGE
20	OTTERTAILCORP.	OTTR
21	P.S.ENTERPRISEGP.	PEG
22	PINNACLEWEST	PNW
23	SOUTHERNCOMPANY	SO
24	SEMPRAENERGY	SRE
25	WECENERGYGROUP	WEC
26	XCELENERGY	XEL

V. BETA COEFFICIENTS DEMONSTRATE THAT THE PANDEMIC HAS NOT MATERIALLY IMPACTED THE UTILITIES' COST OF EQUITY

Q. PLEASE SUMMARZE THE UTLITIES' EXPERTS' CLAIMS REGARDING THE INCREASE IN BETA COEFFICIENTS AND THE COST OF EQUITY OF THE UTILITIES SINCE THE ONSET OF THE COVID PANDEMIC.

A. The Utilities' following claims regarding betas are based upon flawed analyses and should be given no weight by the Commission:

- PG&E's witness, Dr. Vilbert, claims that "the beta estimates for regulated electric utilities have increased substantially from their historical values of approximately 0.55 to approximately 0.95 at the end of September 2021."[17] He asserts that "PG&E's beta was 1.11 as of the end of September 2021, an increase from 0.74 at the beginning of March 2020, which means that PG&E is now riskier than the average for the capital market."[18] Furthermore, he states that "neither the sample average beta nor PG&E's beta show any indication of returning to the pre-pandemic levels . . . both the utility sample average beta and PG&E's beta have held steady at their elevated levels for more than a year. This suggests that the change in risk for the electric utility industry will continue, at least in the near term and perhaps longer."[19]
- SCE's witness Dr. Villadsen states that "Today's (year-end 2021) beta of approximately 0.90 is higher than in the past. At the time of the last cost of capital proceeding for California's electric utilities, in which the CCM was continued, the average

[17] Vilbert Testimony at p. 2-14:4-6.
[18] *Id*. at p. 2-14:6 - 8.
[19] *Id*. at p. 2-14:8 - 13.

electric beta was well below current levels at approximately 0.57."[20] She asserts that "EIX's Value Line beta was 1.0 as of October 22, 2021 (the most recent available as of December 31, 2021), while the sample average was 0.90"[21] and "the rolling three-year beta for EIX is slightly higher than the sample average, all else equal, indicating non-diversifiable risk drivers have contributed to an increased systematic risk for the Company."[22]

- SDG&E's witness James Coyne states: "Beta coefficients have increased substantially between January 2020 and June 2021 for the utility companies used in my cost of capital analysis, and this shift has been sustained through December 2021."[23] He claims that betas for his utility peer group average for December 2021 are either 0.89 or 0.884 and Sempra betas for December 2021 are either 1.00 or 0.926.[24]

Q. DO YOU AGREE WITH THE UTILITIES' EXPERTS' CLAIMS THAT THE BETA COEFFICIENTS OF REGULATED UTILITY COMPANIES DEMONSTRATE THAT RISK HAS INCREASED FOR THE UTILITIES?

A. No, I do not. As stated previously, the Utilities' experts rely upon narrow, limited, and static approaches to calculating beta coefficients that result in unreliable conclusions regarding how the pandemic has impacted the cost of equity of the Utilities. In particular, the Utilities rely exclusively on 5-year and 3-year beta coefficients that are based on capital market data that is no longer relevant. This approach does not produce credible results upon which the Commission should base a decision.

[20] Villadsen Testimony at p. 16:10-14.
[21] *Id*. at p. 17fn44.
[22] *Id*. at p. 17:3-5.
[23] Coyne Testimony at p. JMC-9:3-5.
[24] *Id.* at p. JMC-9:Figure 4.

Using a superior approach to calculating betas that relies upon relevant historical and forward-looking option data shows that even though beta coefficients did rise across the board during the onset of the Covid pandemic back in March 2020, the increase in beta values—and thus the relative risk—of the electric utility industry was relatively short-lived. The results of my option-implied and historical beta calculations are presented in Chart 1 and Chart 2 and the surrounding text from page 5 to page 6 above. Furthermore, a comprehensive measure of historical and option-implied beta coefficients, which I call "hybrid" betas, shows that the relative risk of regulated utility companies has returned close to pre-pandemic levels and continues to come down.

Q. PLEASE EXPLAIN YOUR "HYBRID" BETA.

A. My Hybrid Beta is simply a beta coefficient based on the combination of option-implied betas and historical betas, giving equal weight to each. The historical component takes into consideration short- (6-month), medium- (2-year), and long-term (5-year) time horizons, with a weighing of 50%, 30%, and 20%, respectively.

Q. HOW WERE HYBRID BETAS FOR ELECTRIC UTILITY COMPANIES AFFECTED BY THE PANDEMIC AND HOW HAVE THEY EVOLVED SINCE?

A. Chart 5 on page 17 shows how hybrid betas have evolved since before the onset of the Covid pandemic through December 31, 2021. For comparison, Chart 5 also includes each of the components that contribute to the hybrid beta, most of which are presented in Chart 1 and Chart 2 above.

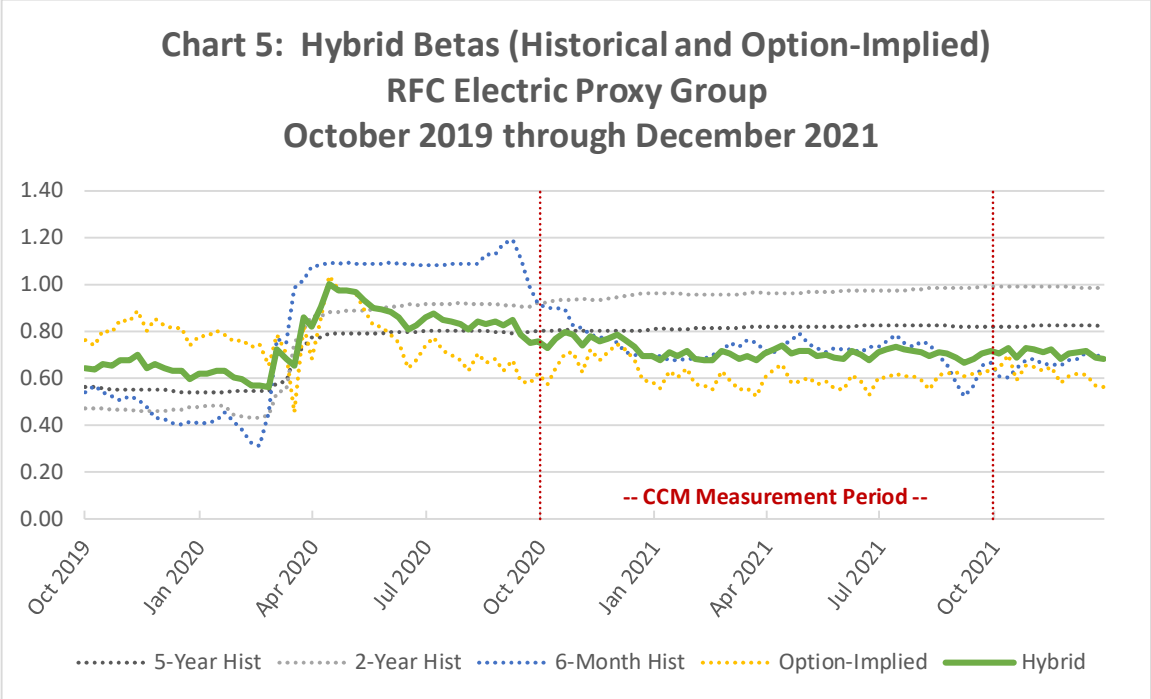


Chart 5 above shows that the average hybrid beta for regulated electric utilities for the three months ended December 2019 before the onset of the Covid pandemic was 0.65. While hybrid betas also peaked in March and April 2020 reaching highs of almost 1.00, these betas were essentially back to pre-pandemic levels by December 2020 and continued to decline, with an average value of 0.71 during the CCM measurement period and a value of 0.68 as of the end of December 2021. It should be noted that including the elevated 2-year and 5-year historical betas in the calculation of the hybrid betas yields conservatively high results. Nonetheless, this comprehensive hybrid beta measure shows that there was not a material impact on the Utilities' cost of equity.

Q. HOW DID YOU DECIDE ON THE RELATIVE WEIGHTS YOU ALLOCATE TO EACH COMPONENT OF YOUR HYBRID BETAS? IS THERE ANY ACADEMIC SUPPORT FOR YOUR APPROACH?

A. I am not aware of any academic study specifically focused on the optimal relative weight of historical betas to predict future betas. However, the authors of the paper I relied upon for guidance on the calculation of my option-implied betas did attempt to quantify the predictive power of 6-month option-implied ("forward-looking") betas as well as that of 6-month ("180-day"), 1-year, and 5-year historical betas by back-testing historical predictions with actual *ex post* results, or "realized" betas, for the 30 companies in the Dow Jones Index. In addition to using each of the betas above independently, they also measured the predictive power of a "mixed" beta consisting of a simple average of the six-month option-implied beta and the 6-month historical beta.

Their conclusions for predicting 6-month future betas are as follows:

> The forward-looking beta outperforms the other methods ten times, and the same is true for the 180-day historical beta. The mixed beta is the best performer in seven cases, and the 1-year historical beta in three cases. The 5-year historical beta is always outperformed by at least one other method, and it often ranks last. The 180-day historical beta clearly dominates the two other historical methods.[25]

Their conclusions for predicting 1-year and 2-year future betas are as follows:

> Somewhat unexpectedly, the performance of the forward-looking beta compared to that of the 180-day historical beta is much better [for the one-year prediction] than [for the six-month prediction], and this conclusion carries over to [the two-year prediction]. The mixed beta also perform [sic] well. It is perhaps not surprising that the performance of the 180-day historical beta [for the one- and two-year predictions] is poorer than [for the six-month prediction], because the horizons used in the construction of realized betas are no longer equal to 180 days. What is harder to explain is why the correlation between realized beta and forward-looking beta is in many cases higher [for the one- and two-year predictions] than [for the six-

[25] Peter Christoffersen, Kris Jacobs, and Gregory Vainberg, *Forward-Looking Betas* (April 25, 2008) at p. 16.

> month prediction]. Finally, it is also interesting that the 1-year and 5-year historical betas do not perform well [for the one-and two-year predictions]. In summary, [for the one-year prediction] either the forward-looking beta or the mixed beta is the best performer in nineteen out of thirty cases. [For the two-year prediction], this the case twenty-two times out of thirty.[26]

Their conclusions strongly support the use of 6-month historical betas, 6-month option-implied betas, and/or an average of the two as predictors of future betas 6 months, 1 year, or 2 years into the future. They also seem to indicate that historical betas lose predictive power the longer the period that is used.

I decided on the composition of my hybrid betas primarily based on the conclusions of the authors above. A mixed or hybrid beta made up of 50% historical betas and 50% forward-looking option-implied betas seemed to be the best way to go in most capital market conditions. When capital markets are changing rapidly, as they have between the onset of the pandemic and the measurement period, option-implied betas should arguably be given greater weight because they provide a direct measure of investors' current expectations. Though the predictive power of longer-term historical betas seems to be quite reduced, it is not zero, so in an effort to preserve the effect of longer-term market trends in my hybrid betas, I chose to further subdivide the historical component into 50% (25% of the hybrid) for the stronger predicting 6-month historical betas, 30% (15% of the hybrid) for the 2-year historical betas, and 20% (10% of the hybrid) for the 5-year historical betas. Once again, when capital markets are changing rapidly, as they have between the onset of the pandemic and the measurement period, shorter-term historical betas should arguably be given greater weight because they more accurately reflect current market conditions.

[26] *Id.* at p. 17.

It should be noted that I have used this exact weighing of historical and option-implied betas in the calculation of hybrid betas in numerous cost of capital proceedings in seven states since before the pandemic. Even though the highly inflated 2-year and 5-year historical betas could very well be excluded or replaced by shorter-term historical betas, which are considerably lower, I have chosen to leave the composition unaltered for the sake of consistency and with the understanding that the resulting hybrid betas are conservatively high.

Q. HAVE DR. VILBERT AND DR. VILLADSEN RECOGNIZED THE IMPORTANCE OF CONSIDERING HISTORICAL BETA COEFFICENTS OVER SHORTER TIME PERIODS WHEN CAPITAL MARKETS ARE EXHIBITING SIGNIFICANT CHANGE?

A. Yes. In a book published by Dr. Vilbert and Dr. Villadsen, they stated that:

> The choices for the interval for the return data and the length of the beta estimation window involve trade-offs between obtaining more observations through the choice of a longer window and/or more frequent return data, ensuring that no structural change has occurred during the estimation window…[27]

The book further explains that:

> Balancing these considerations, economists typically recommend estimating beta … over the most recent 2- to 5-year period, …except if there are reasons to think that the industry might be subject to recent changes in systematic risk so that the use of a more recent data window is desirable.[28]

The March 2020 capital market upheaval is precisely the type of "recent change in systematic risk" for which Dr. Villadsen recommends "use of a more recent data window." Nonetheless, Dr. Vilbert and Dr. Villadsen do not calculate betas based on more recent

[27] Bente Villadsen, Michael J. Vilbert, Dan Harris, and A. Lawrence Kolbe, *Risk and Return For Regulated Industries* (May 2017) at p. 74.
[28] *Id.* at p. 76.

data. As shown on Chart 2 on page 6, electric utility company historical betas based on more recent data are considerably lower because the impacts of the pandemic on the cost of equity of utility companies were short-lived and considerably lower than claimed by the Utilities.

Q. YOU PREVIOUSLY STATED YOU HAVE CONCLUDED THAT THE EFFECT OF THE ONSET OF THE COVID PANDEMIC ON BETA COEFFICIENTS WAS RELATIVELY SHORT-LIVED. IF IT WAS SHORT-LIVED, WHY DID IT HAVE SUCH A SIGNIFICANT AND SEEMINGLY PERMANENT EFFECT ON THE 5-YEAR BETA COEFFICIENTS CITED BY THE UTILITIES' EXPERTS?

A. Small, gradual digressions from the norm can take a long time to be reflected in a beta regression based on a large number of data pairs, such as 5-year beta coefficients. However, even one extremely strongly correlated data pair can have a large and permanent effect on a regression analysis. The onset of the Covid pandemic created not one, but several, very strongly correlated market movements, mostly over the course of two weeks in March 2020. Two weeks is a short period by any measure when speaking about capital markets. However, with such large and correlated movements, historical beta coefficients across all industries calculated based on any time horizon showed a sharp increase during those two weeks in March 2020. Furthermore, any historical beta coefficient calculated since then based on a time horizon that includes that tumultuous period will result in elevated beta values. Given that as of the writing of this testimony, approximately 1 year and 10 months have passed since March 2020, 2-year and 5-year betas are still resulting in elevated levels.

However, as soon as the tumultuous period is cleared out of any given time horizon, beta values quickly start to reflect the relative risk perceived by investors in the immediate aftermath of those two weeks in March. As shown in Chart 2 on page 6, historical beta coefficients calculated based on time horizons shorter than two years have already reverted back to lower levels as expected. Beta coefficients calculated based on a 6-month time horizon came down significantly starting roughly 6 months after March 2020. 1-year historical betas started to come down roughly 1 year later. And so on.

Similarly, 2-year historical beta coefficients can be expected to come down from their elevated levels at the end of March 2022, and 5-year betas around March 2025.

Q. DO YOU KNOW WHY SCE'S WITNESS DR. VILLADSEN CHANGED THE TIME HORIZON USED TO CALCULATE HISTORICAL BETAS BETWEEN HER TESTIMONY FILED IN AUGUST 2021 AND THAT FILED IN JANUARY 2022?

A. In her testimony attached to its August 23, 2021 application, SCE's witness Dr. Villadsen used a 2-year time horizon to calculate betas. In response to the scoping memo, SCE filed another set of testimony January 18, 2022. In the January 2022 testimony, SCE's witness changed her methodology to use a 3-year time horizon to calculate betas. I do not know why Dr. Villadsen changed her methodology between testimonies, but I do know 2-year historical betas will very likely decrease significantly in March 2022, at the point when the March 2020 market disruption no longer impacts the results.

Q. PLEASE PROVIDE MORE DETAILS ON HOW YOU CALCULATED YOUR HISTORICAL AND OPTION-IMPLIED BETAS.

A. I provide a detailed explanation of my methodology for calculating historical and option-implied betas in Appendix B.

VI. OPTION PRICING ANALYSIS DEMONSTRATES THAT EVEN THOUGH SKEWNESS (INVESTOR-PERCEIVED DOWNSIDE RISK) FOR THE OVERALL MARKET HAS INCREASED OVER THE PAST TWO YEARS, THIS IS NOT THE CASE FOR ELECTRIC UTILITIES

Q. YOU EXPLAINED EARLIER THAT STOCK OPTION PRICES REVEALED THAT INVESTORS FOUND THAT THE SYSTEMATIC RISK (AS MEASURED BY OPTION-IMPLIED BETAS) FOR ELECTRIC UTILITIES, INCLUDING THE UTILITIES, WAS LOWER DURING THE MEASUREMENT PERIOD THAN BEFORE THE PANDEMIC. DO STOCK OPTION PRICES PROVIDE ADDITIONAL EVIDENCE THAT THE COST OF EQUITY FOR THE UTILITIES HAS NOT INCREASED RELATIVE TO THE OVERALL MARKET AS CLAIMED BY THE UILITIES' EXPERTS?

A. Yes. Option-implied Skewness indicates that the cost of equity for electric utilities has declined relative to the overall stock market during the pandemic. Stock option prices provide considerable information regarding investors' expectations. The most well-known measure of investors' expectations as measured by stock option prices is the VIX Index.

The VIX index is a measure of investors' volatility expectations and is referred to as the "fear index" because, all else equal, higher volatility expectations indicate higher uncertainty, risk, and scared investors. However, volatility expectations are only one piece of a multi-dimensional puzzle that reveals the market-based cost of equity. After volatility expectations, the next dimension to explore (referred to as the second moment in statistics) is skew. Option-Implied Skewness reflects investors' expectations regarding the asymmetry of the probability distribution. For example, option-implied probability distributions are almost always negatively skewed for stock market indexes (e.g., S&P 500) and individual stocks which means that investors almost always think there is a greater chance of a large decrease in stock prices than large increases. In the 2019 Energy COC proceeding, Dr. Vilbert referred to option-implied skewness to support his claim that the cost of equity in 2019 was elevated. In particular, Dr. Vilbert stated that the Chicago Board of Options Exchange SKEW Index, which is an index based on stock option prices, was higher (averaging 132.59 in 2018) than the historical average of 119.46. He stated that the SKEW Index "increases as investors become more fearful of tail risk or extreme negative events."[29]

Q. DID DR. VILBERT EXPLAIN WHAT THE SKEW INDEX REVEALS REGARDING HOW THE COST OF EQUITY OF ELECTRIC UTILITY COMPANIES HAS BEEN IMPACTED BY THE PANDEMIC?

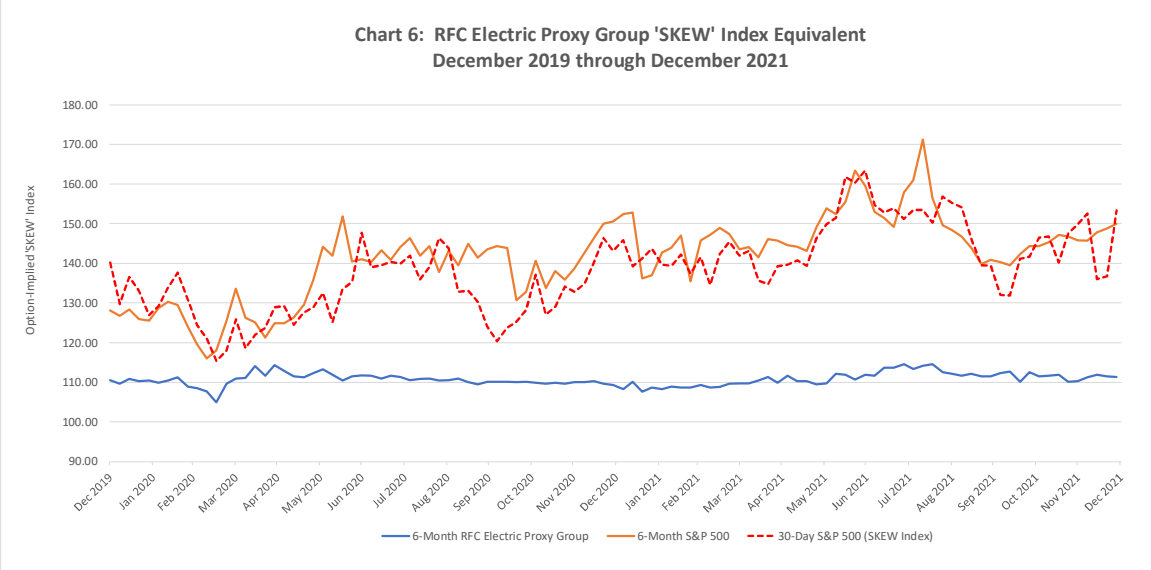
A. No. Dr. Vilbert did not discuss the SKEW Index in his testimony filed on January 18, 2022. Dr. Villadsen discussed SKEW in her testimony attached to SCE's August 2021

[29] A.19-04-014, Direct Testimony of Michael Vilbert on behalf of PG&E (April 22, 2019) at p. 2-38:5 - 6, available at: https://docs.cpuc.ca.gov/PublishedDocs/SupDoc/A1904015/2037/283492541.pdf .

application but did not discuss it in her January 2022 testimony. No Utility witnesses has provided any analysis of skewness for the electric utilities in this proceeding.

Q. WHAT DOES THE SKEW INDEX REVEAL REGARDING THE IMPACT OF THE PANDEMIC ON THE COST OF EQUITY OF THE UTILITIES?

A. As shown in Chart 6 below, the SKEW Index for the S&P 500 increased significantly more than the option-implied skewness for electric utility companies during the pandemic which indicates that the cost of equity for electric utility companies has likely decreased relative to the overall market.



VII. THE CAPITAL MARKET IMPACTS OF THE COVID-19 PANDEMIC DO NOT WARRANT A DEPARTURE FROM THE CCM FOR 2022

Q. PLEASE PROVIDE ADDITIONAL EVIDENCE THAT THE CAPITAL MARKET IMPACTS OF THE COVID-19 PANDEMIC DO NOT CONSTITUTE AN

EXTRAORDINARY OR CATASTROPHIC EVENT THAT MATERIALLY IMPACTS THE UTILITIES' RESPECTIVE COST OF CAPITAL.

A. The spread of COVID-19 significantly impacted the global economy and has tragically taken millions of lives, but its impact on the cost of equity for the Utilities has been far from a catastrophe. The Utilities' experts spend considerable time in their testimonies explaining how the pandemic impacted unemployment rates, GDP growth rates, among other economic impacts. However, our primary concern in this proceeding is to determine if the pandemic caused a material impact on the Utilities' cost of equity. As discussed above, option data indicates that the cost of equity for the Utilities was not materially higher during the measurement period and, in fact, has likely decreased relative to the overall market since the onset of the pandemic. In this section, I provide additional capital market data that supports the results of my analyses of stock option prices.

Q. PLEASE DISCUSS SOME RECENT MARKET DEVELOPMENTS THAT IMPACT THE COST OF EQUITY.

A. Market developments since the onset of the Covid pandemic in March 2020 that have impacted the cost of equity include:

1. **Stock prices crashed and have more than recovered.** The S&P 500, Dow Jones Industrial Average, and other stock indices fell faster in the second half of March 2020 than during the 2007-2008 financial crisis, the crash of 1987, and the Great Depression. As of March 23, 2020, the S&P 500 had fallen approximately 34% from its high reached on February 19, 2020.[30] On August 18, 2020, the S&P 500

[30] The S&P reached a new high of $3,386 on February 19, 2020 and fell to a low of $2,237 on March 23, 2020. ($3,386 - $2,237)/$3,386 = 33.9%.

set a new high, which represents the fastest recovery (126 trading days) from a bear market. As shown in Chart 7 on page 30, electric utility stocks initially fell slightly more than the overall market (about 36% off their peak versus 34% for the S&P 500) and have lagged the market's recovery, but Chart 8 on page 30 shows the RFC Electric Proxy Group has slightly outperformed the market in the last six months as of the end of December 31, 2021, going up 11.21% vs. 10.33% for the S&P 500 Index.[31]

2. **Interest rates reached record lows during the pandemic and investors expect long-term interest rates to remain historically low.** The Utilities' experts claim that interest rates are about to increase is pure speculation because it contradicts investors' expectations as indicated by market data. The price of bonds and interest rates move inversely. The yield on 30-year U.S Treasury bonds remains below what it was before the pandemic – the average yield was 1.85% in December 2021 compared to an average yield of 2.22% in January 2020, before the pandemic started to significantly impact capital markets.[32] If investors expected long-term interest rates to increase, as claimed by the Utilities' experts, they would be purchasing U.S. Treasury bonds expecting to lose money which is unlikely. There is a lot of speculation in the news regarding the possibility that recent spikes in inflation will remain and impact capital markets, including interest rates. Inflation may or may not be high in the future, but for the purposes of this proceeding, what matters most is investors' expectations, not the speculations of journalists and economists. Market-data also indicates that investors expect inflation to be

[31] Chart 7 on page 30.
[32] Chart 9 on page 32.

transitory. As shown on Chart 11 on page 36, the relative market price of inflation protected bonds as compared to regular Treasury bonds indicates that investors expect inflation to be only about 2.5% over the next 5 years and about 2.3% over the next 30-years.[33]

3. **Credit spreads increased sharply during the initial phase of the pandemic, but quickly declined and are now below pre-pandemic levels.** The spread between the yield investors demand to purchase U.S. corporate bonds and U.S. Treasury bonds (see Chart 12 on page 37) increased significantly in the initial phases of the COVID-19 pandemic, but never got as high as it did during the financial crisis of 2007-2008. As of December 31, 2021, the yield spread for Baa credit-rated corporate bonds is 1.85%, below pre-pandemic levels of 1.98% on December 31, 2019, after reaching a high of over 4.00% in March 2020.[34] Credit spreads can be used as a gauge of the cost of equity because, all else equal, when investors demand a lower spread to take on the risk of corporate bonds versus U.S. Treasury bonds they will demand a lower spread to invest in the equity of corporations. Therefore, credit spread data shows additional evidence that the cost of equity has not been materially impacted by the pandemic and is likely a little bit lower.

4. **Investors' stock price volatility expectations have fallen from highs reached during initial phases of the pandemic**. In March 2020, the VIX Index reached levels not seen since the financial crisis of 2007-2008, and even set all-time

[33] Chart 12 on page 37.
[34] Chart 12 on page 37.

records.[35] Volatility expectations remain higher than before COVID-19 but have declined significantly since peaks reached in March 2020.

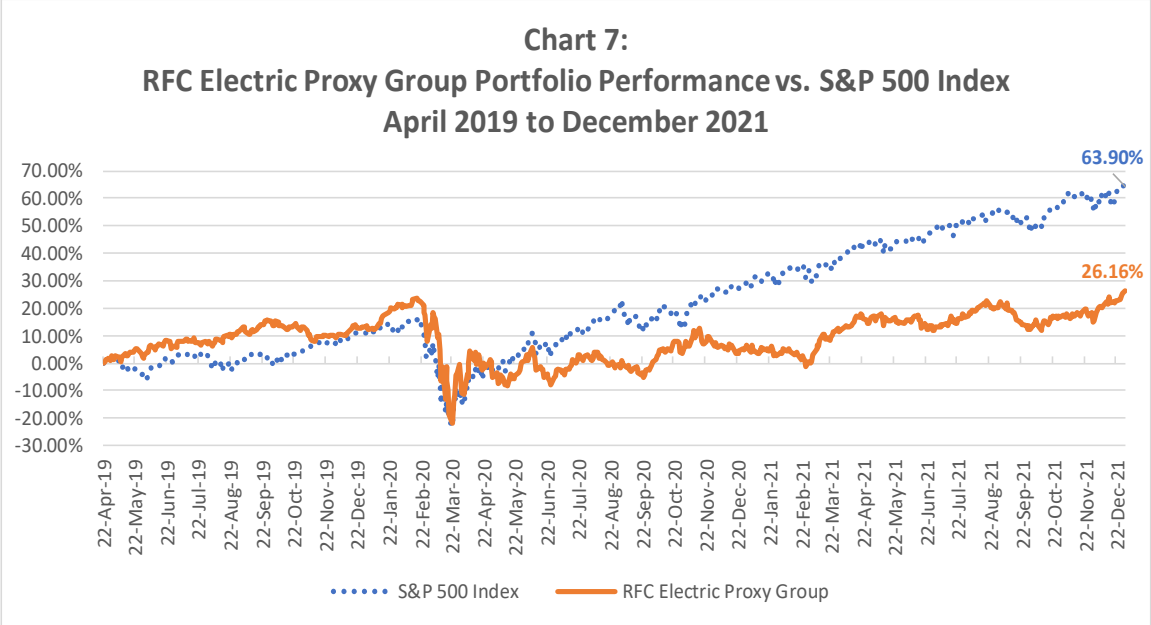
I elaborate on each of the points above in the following sections.

A. Stock Price Trends and Perceived Risk

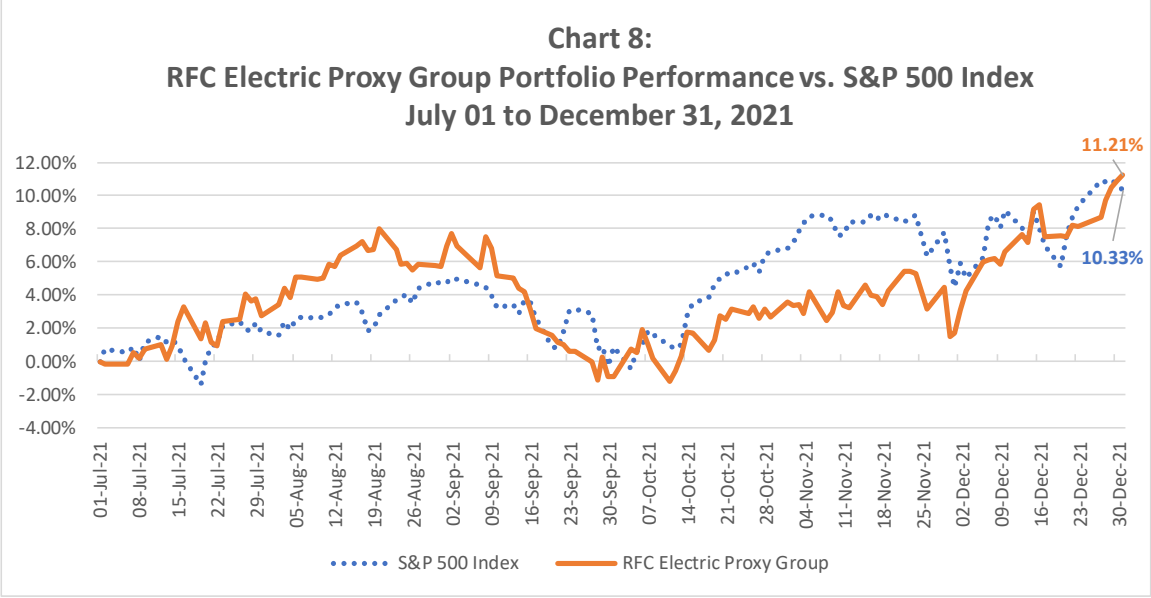
Q. WHAT, IF ANYTHING, DOES STOCK MARKET DATA INDICATE WITH REGARD TO THE COST OF EQUITY?

A. As stock prices have shown an overall increase between 1926 and 2020, price-to-earnings (P/E) ratios have increased significantly as well.[36] This indicates that the cost of equity may be decreasing along with the higher stock prices because investors are paying a higher price for the same earnings. For example, an investor paying $100 for a share of a stock with $10 per year of earnings will earn a 10% annual return, assuming no growth. If this stock goes up to $200 per share, the annual earnings decrease to 5%. As shown in Chart 7 on page 30, until the COVID-19-related crash, stock prices for the S&P 500 and the RFC Electric Proxy Group increased significantly in the nearly 2.4 years since the Utilities' filed their testimonies in the last cost of capital proceeding on April 22, 2019.[37] After the significant losses due to COVID-19 in March 2020, the S&P 500 Index and the stock prices for the RFC Electric Proxy Group have fully recovered and are up nearly 63.90% and 26.16% as of December 31, 2021, respectively.

[35] Chart 14 on page 40.
[36] Roger G. Ibbotson, James P. Harrington, *2021 The Stocks, Bonds, Bills, and Inflation (SBBI) Yearbook* at pp. 10-28.
[37] Application Nos. 19-04-014, 19-04-015, 19-04-017.



As shown in Chart 8 below the RFC Electric Proxy Group has slightly outperformed the market in the last six months as of the end of December 31, 2021, going up 11.21% vs. 10.33% for the S&P 500 Index.



Q. WHAT DOES THE RELATIVE UNDERPERFORMANCE OF ELECTRIC UTILITY STOCKS DURING THE PANDEMIC INDICATE?

A. The relative stock price performance of electric utility stocks is just one piece of a multi-dimensional puzzle that we must construct to measure the cost of equity. As discussed throughout this testimony, betas, credit spreads, option-implied skew, and other measures of risk and investors' expectations indicate that the cost of equity for the Utilities has not been materially impacted as a result of the pandemic.

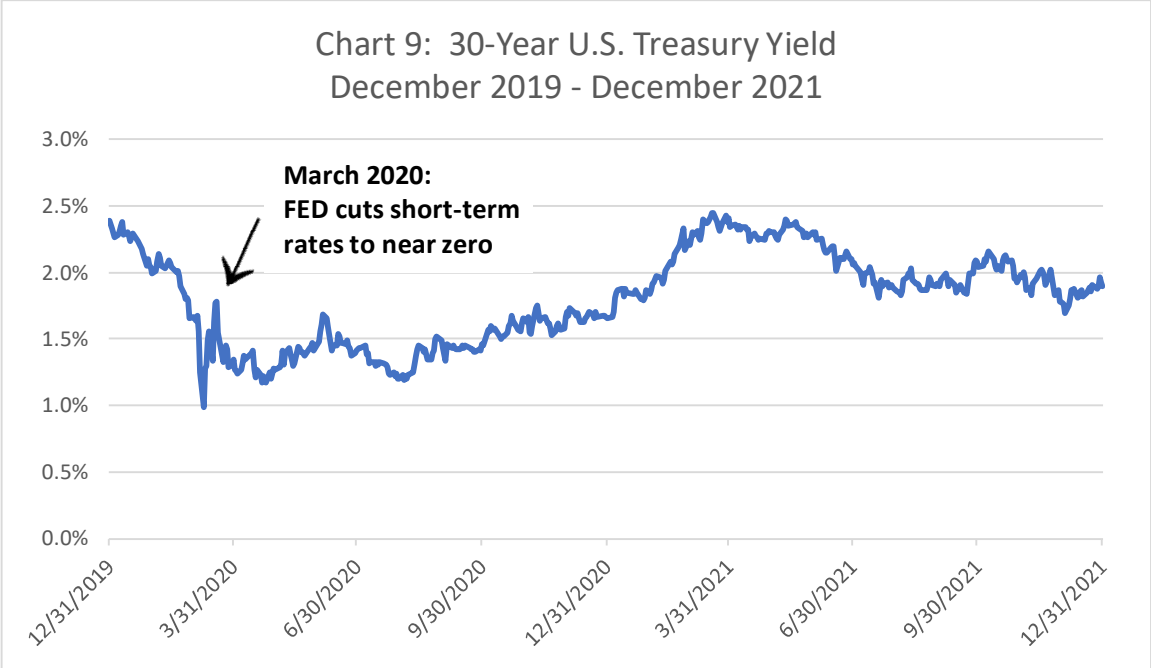
B. Interest Rates and Inflation

Q. PLEASE DISCUSS THE CURRENT INTEREST RATE ENVIRONMENT AND WHAT IT INDICATES REGARDING THE COST OF EQUITY.

A. Two significant interest rate developments occurred in response to COVID-19. First, interest rates have fallen significantly since the beginning of the COVID-19 pandemic. Short-term interest rates are now near 0%. As shown on Chart 9 on page 32, yields on 30-year U.S. Treasuries have fallen from 2.39% as of December 31, 2019 to 1.90% as of December 31, 2021. Federal Reserve officials signaled they are on track to raise its short-term interest rate target in March 2022 and as of January 14, 2022 market prices indicate that collectively investors believe there is a 96.9% chance they will do so.[38] Despite statements by the Federal Reserve declaring that it might start reducing its bond purchasing program sooner than expected, long-term interest rates remain historically low. As of January 28, 2022, the yield on the U.S. Treasury bonds was 2.07%. When the Federal

[38] CME FedWatch Tool, https://www.cmegroup.com/trading/interest-rates/countdown-to-fomc.html# [as of January 14, 2022 08:32:33 CT].

Reserve began to ease its "easy-money" policies back in 2013, the resulting increase in interest rates was called a "Taper Tantrum." This time around, the declining interest rates in response to the Federal Reserve's potential policy changes are being called a "Taper Tranquility."[39] Lower interest rates indicate a lower cost of equity for electric utility companies because many bond investors sell bonds and purchase utility stocks as interest rates decline.



Q. HOW DO YOU RESPOND TO THE UTILITIES' CLAIM THAT INTEREST RATE ARE ABOUT TO INCREASE?

A. The relevant time period in this proceeding is the measurement period (October 1, 2020 – September 30, 2021). As discussed throughout this testimony, the CCM should not be suspended because the cost of equity of the Utilities was not materially impacted by the pandemic during this time. However, the Utilities' witnesses are arguing that low interest

[39] Wall Street Journal, *Why There Is No 'Taper Tantrum' This Time Around* (June 22, 2021), available at: https://www.wsj.com/articles/why-there-is-no-taper-tantrum-this-time-around-11624385116 .

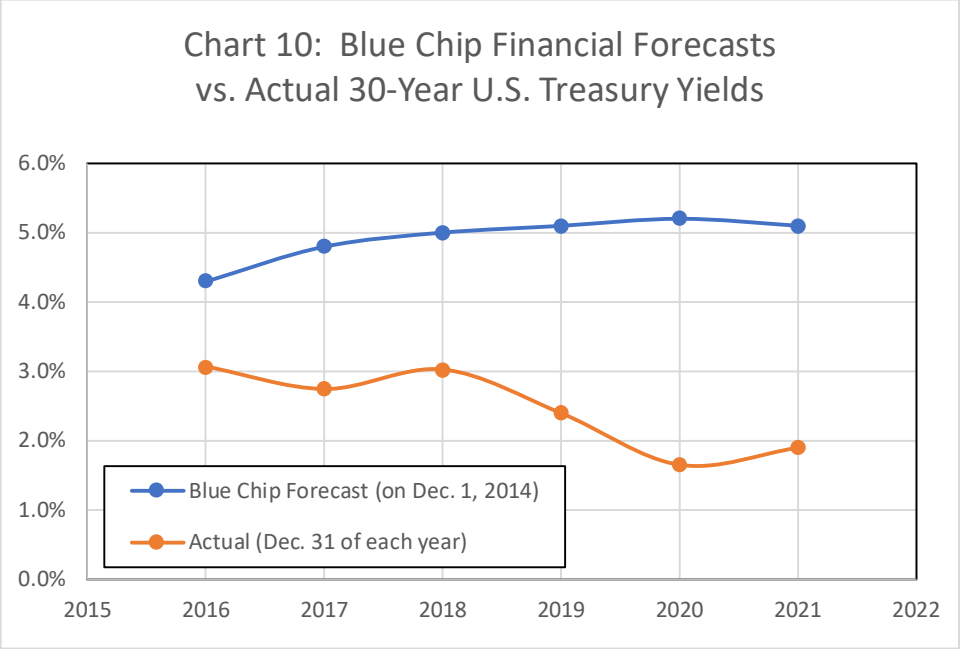
ratees are transitory and will likely increase in the future. The Utilities provide personal opinions and cite published interest rate forecasts in their testimonies. Dr. Vilbert cites Blue Chip Economic Indicators' interest rate forecast of the 10-year and 20-year Treasury bond yield. It is important to recognize that current long-term Treasury bond yields represent a direct observation of investor expectations and there is no need to use "expert" forecasts such as Blue Chip to determine market-based cost of equity.

Many economists and forecasters will continue to be quoted in the press prognosticating on possible developments that are truly unpredictable. The Nobel Laureate Economist Daniel Kahneman stated the following regarding forecasting:

> It is wise to take admissions of uncertainty seriously, but declarations of high confidence mainly tell you that an individual has constructed a coherent story in his mind, not necessarily that the story is true.[40]

As Chart 10 on page 34 shows, Blue Chip Financial forecasted in 2014 that 30-Year U.S. Treasury bonds would be over 5% by 2018 while in fact they turned out to be under 2%.

[40] Daniel Kahneman, *Thinking Fast and Slow* (2011) at p. 212.

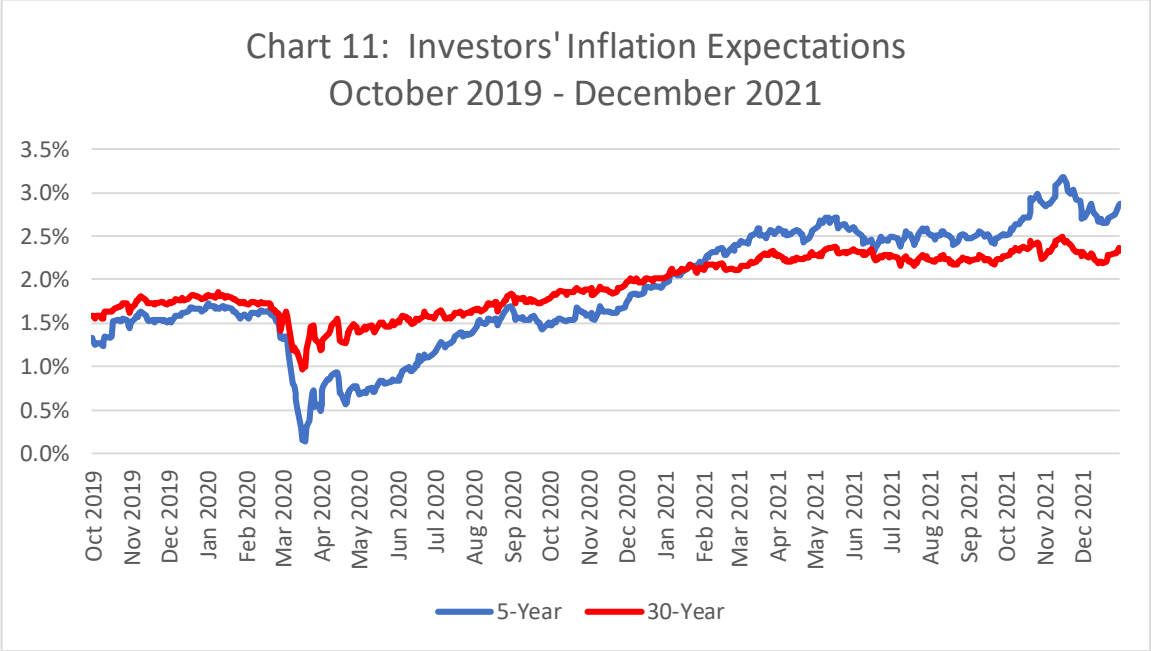


The time covered in Chart 10 above was chosen to provide a concrete example. Blue Chip's interest rate forecasts have been persistently inaccurate. A paper published by the Congressional Budget Office determined Blue Chip consensus forecasts exhibited "significant positive bias" between 1984 and 2012 and "have become more biased and less accurate over time."[41] Interest rates may or may not turn out to be transitory, but it is safe to say interest rates are unpredictable and the Utilities' claim that the CCM should not be suspended because they claim to know interest rates will increases is unjustified.

[41] Congressional Budget Office, Edward N. Gamber, *Did Treasury Debt Markets Anticipate the Persistent Decline in Long-Term Interest Rates?* (September 2017) at p. 2, available at: https://www.cbo.gov/system/files/115th-congress-2017-2018/workingpaper/53153-interestrateswp.pdf .

Q. PLEASE DISCUSS THE CURRENT INFLATION ENVIRONMENT AND WHAT IT INDICATES REGARDING THE COST OF EQUITY.

A. The Federal Reserve has stated that they plan to increase short-term interest rates and unwind their purchase of bonds in order to fight potential increases in inflation. Therefore, inflation can possibly impact the cost of equity because it can impact interest rates. Inflation has increased substantially recently and there is a lot in the news regarding if inflation will continue to rise and how much it could impact the economy, including capital markets and the cost of equity. As stated throughout this testimony, the cost of equity should be based on investors' return expectation because they are the ones providing the capital. As shown in Chart 11 on page 36, investors inflation expectations decreased substantially during the height of COVID's impact on capital markets. In March 2020, investors expected the inflation rate over the next 5-years to be as low as 0.1% and approximately 1% over the 30-year timeframe. As of December 31, 2021, investors expected the inflation rate over the next 5-years to be 2.9% and 2.3% over the 30-year timeframe.

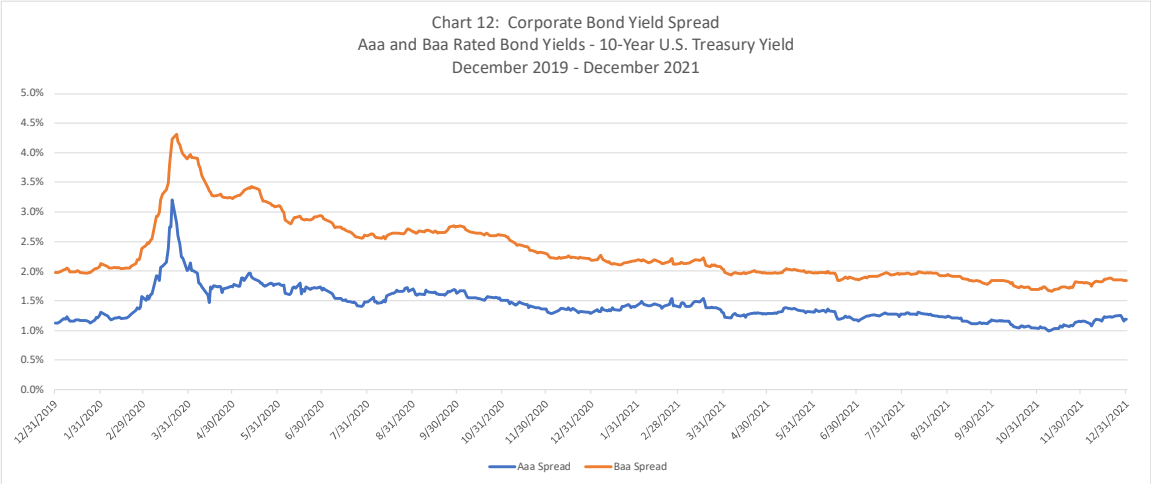


C. Credit Spreads

Q. WHAT DOES AN INCREASING CREDIT SPREAD MEAN FOR THE COST OF EQUITY?

A. The yield spread between corporate bonds and U.S. Treasuries can be used as general gauge of investors' risk tolerance and how much extra return they require to take on more risk. A higher credit spread, all else equal, can indicate a higher cost of equity because if investors are demanding a higher return to take on the risk of buying corpore bonds they are likely also demanding a higher return to take on the risk of investing in stocks. As shown in Chart 12 on page 37, the yield spread between Corporate bonds and Treasury bonds increased significantly during the initial phase of the pandemic in March and April 2020. The interest rate spread between Baa Corp bonds and 10-year U.S. Treasuries peaked at over 4% in mid-March 2020. This chart clearly shows, however, that yield spreads have declined since their peak to pre-pandemic levels and are currently about the

same as before the pandemic. As of December 31, 2021, the yield spread between Baa Corp bonds and 10-year U.S. Treasuries is 1.85%, more than 200 basis points lower than the peak reached in March 2020 and even lower than before the pandemic and below. Between October 2020 and September 2021, the credit spread averaged 2.18% which is only slightly higher than the average credit spread of 2.01% in January 2020. A declining yield spread indicates that the cost of equity is slightly lower than since mid-March 2020. As investors' appetite for risk increases, the cost of equity tends to decline.



D. Volatility Expectations

Q. PLEASE DISCUSS CURRENT STOCK PRICE VOLATILITY EXPECTATIONS AND WHAT THEY INDICATE REGARDING THE COST OF EQUITY.

A. Volatility, uncertainty, and risk are synonymous. There are two primary types of volatility: "realized volatility" and "implied volatility." The former is based on historical returns, which may or may not represent future volatility. On the other hand, implied volatility is calculated from options data, which indicates investors' future expectations for volatility.

As discussed below, the "term structure" of volatility indicates investors' volatility expectations over different forward-looking time periods (e.g., 1-month, 1-year).

Q. PLEASE EXPLAIN THE "TERM STRUCTURE OF VOLATILITY."

A. Investors can expect volatility to increase or decrease over time. Even during the height of a crisis, investors often expect volatility to decrease in coming months or years. In other words, investors expect the current capital market hurricane to pass and the winds to die down. In general (i.e., in "normal" financial markets), investors expect higher volatility for longer time horizons. For example, investors generally expect the chance stock prices will increase or decrease by 10% in 1 year (on an annual basis) to be greater than the chance of a 10% move over the next 30 days (on an annual basis). This makes sense because there is more uncertainty regarding economic and stock market changes the further in the future you look out.

However, during the peak of implied volatility (to date) in mid-March 2020, shortly after the World Health Organization declared COVID-19 a pandemic, the data indicated that investors expected stock price volatility to decrease over time. This implies that investors expected the riskiness of equity investments to decrease over time. As shown in Chart 13 on page 39, before the COVID-19 outbreak, investors expected volatility to increase from less than 15% annually at the 1-month time frame to about 20% annually at the 24-month time frame. Investors expected volatility expectations peeked in March 2020. At this time investors expected stock price volatility would decrease from over 70% at the 1-month time frame to about 38% at the 24-month time frame.

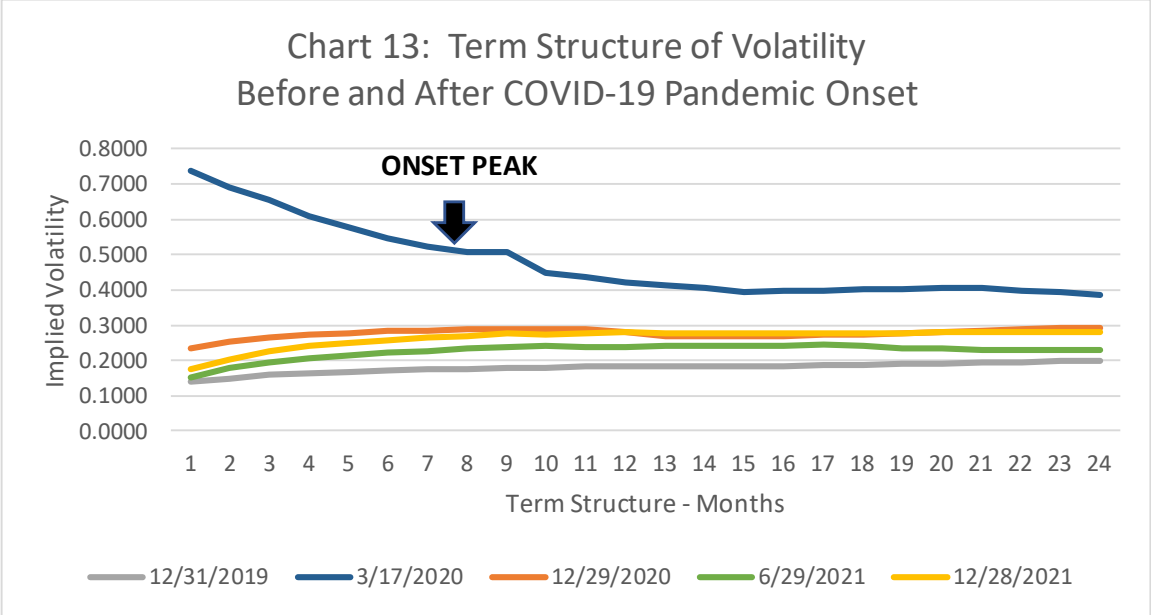
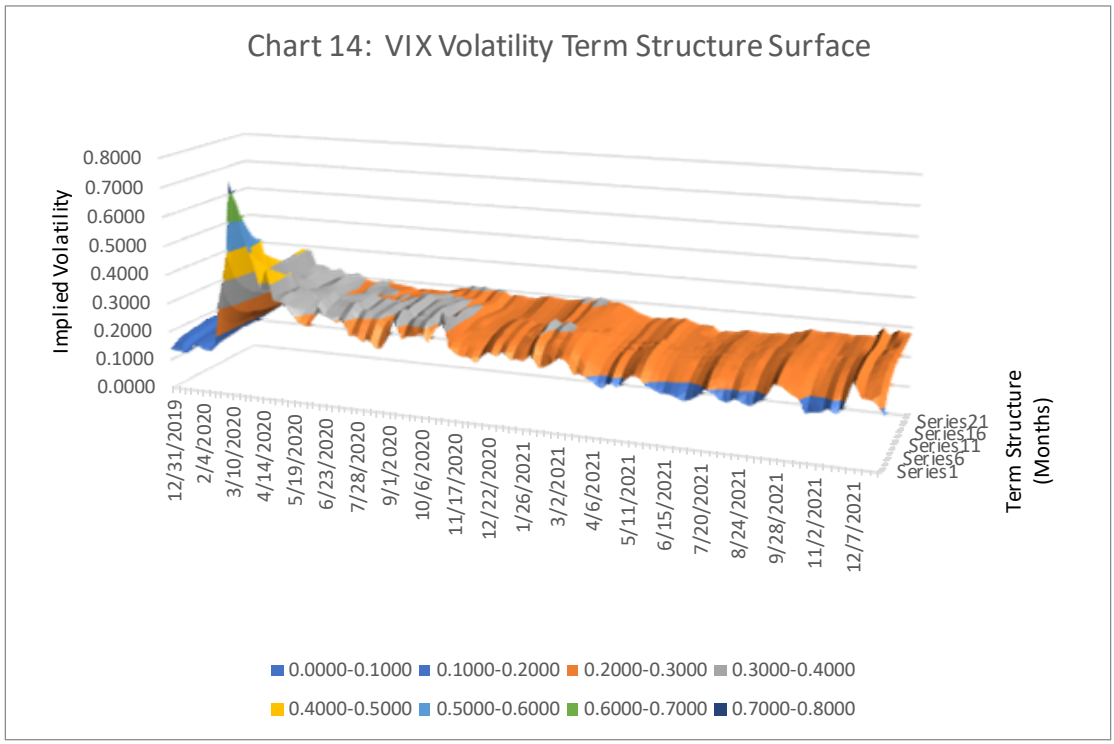


Chart 14 on page 40 provides a 3-dimensional surface[42] to show how the term-structure of volatility has evolved since before the COVID-19 outbreak and how it has changed during and since the outbreak. Chart 13 above is simply three selected cross sections of the same data in the surface in Chart 14. In the surface, one can see that on December 31, 2019, the term structure of volatility is almost flat, increasing slightly from the 1-month to the 24-month time frame. In mid-March 2020, the implied volatility increased over every time period in comparison to December 31, 2019, but one can see that investors expected a declining term structure of volatility. By the end of July 2020, the implied volatility for all time periods had decreased, and the declining term structure moved to a more typical structure in which investors expected higher volatility over longer time periods, as it remains as of December 28, 2021. In late November 2021, the implied volatility increased as the Omicron variant rapidly spread throughout the world, but by the end of December 2021, implied volatility returned to pre-Omicron levels.

[42] The X axis shows the implied volatility. The Y axis shows the data. The Z axis shows market expectation of future implied volatility of different time frames. Series1 = 1 month and Series24 = 24 months.



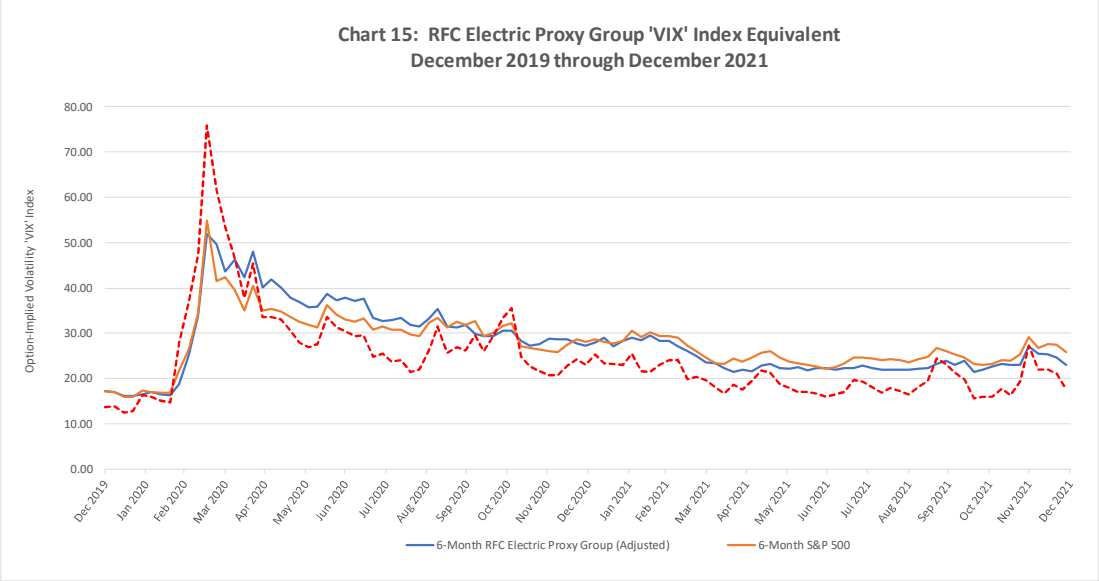
A declining term structure of volatility is important data to consider in determining the appropriate cost of equity for the Utilities because it shows that investors expected risk to decline during the peak of the pandemic's impact on financial markets. Lower risk means a lower cost of equity. Investors' market volatility expectations turned out to be correct. In March 2020, investors expected implied volatility to decline considerably over the next 12 to 24 months, and it has.

Q. HOW HAVE VOLATILITY EXPECTATIONS FOR ELECTRIC UTILITY COMPANIES COMPARED TO VOLATILITY EXPECTATIONS FOR THE S&P 500?

A. The dashed red line and the solid orange line in Chart 15 on page 41 show investors' stock price volatility expectations for the overall market (S&P 500) increased significantly as COVID-19 infections spread to the U.S. and continued to grow exponentially around the world. The dashed red line and solid orange line show volatility expectations over the next

30 days and 6 months, respectively. In December 31, 2019, investors expected an annualized change of 13.78% over the next 30 days. In mid-March 2020, investors' volatility expectations peaked at over 80% (on March 16, 2020, a point not actually shown on the chart, which has weekly data on Tuesdays). As of December 28, 2021, investors expect an annualized change of 17.54%.

The blue line in Chart 15 shows that investors' adjusted[43] 6-month volatility expectations for my RFC Electric Proxy Group, as indicated by their stock option prices, increased along with the market in mid-March 2020, but to a significantly lesser degree. Investors' 6-month adjusted volatility expectations for electric utility companies were higher than for the S&P 500 for the most part from May through August 2020, remained very comparable through mid-July 2021, and have mostly remained below expectations for the market since then through December 2021.



[43] The implied volatility for individual stocks and small groups of stocks is almost always higher than the overall market because of the effects of diversification, even when the underlying stocks in the smaller portfolio are less risky, as is the case with electric utility companies. As a result, Chart 15 adjusts the 6-month expected volatility for the RFC Electric Proxy Group by the difference with the 6-month expected volatility for the S&P 500 Index on December 31, 2019 to facilitate the comparison throughout the chart.

As discussed above, changes in implied volatility do not paint the full cost of equity picture. We must consider implied covariance, or how much investors expect the volatility of returns for electric utility companies to correlate with the overall market (e.g., S&P 500 Index).

Q. HOW IS COVID-19 IMPACTING FINANCIAL MARKETS AND THE COST OF EQUITY FOR ELECTRIC UTILITY COMPANIES?

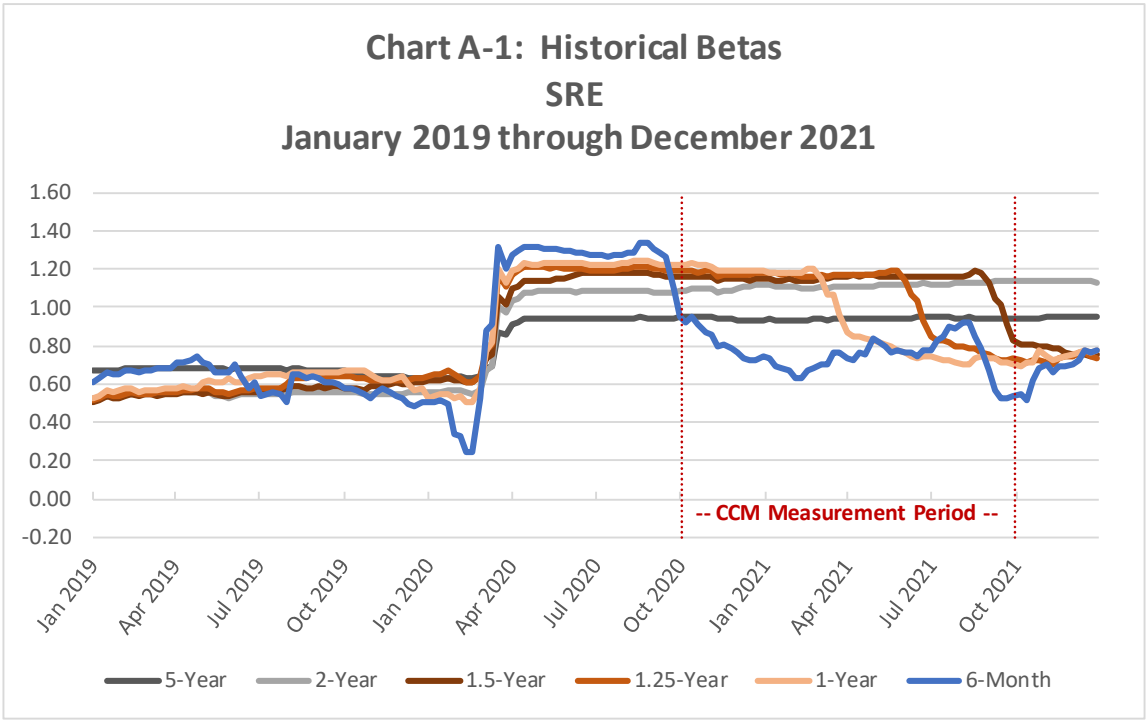
A. As discussed above, financial data indicate that the capital market upheaval the COVID-19 pandemic generated was not long-lasting and did not significantly impact the cost of equity for electric utility companies. Investors know that electric utility companies provide an essential service that will be used and paid for even during a financial crisis.

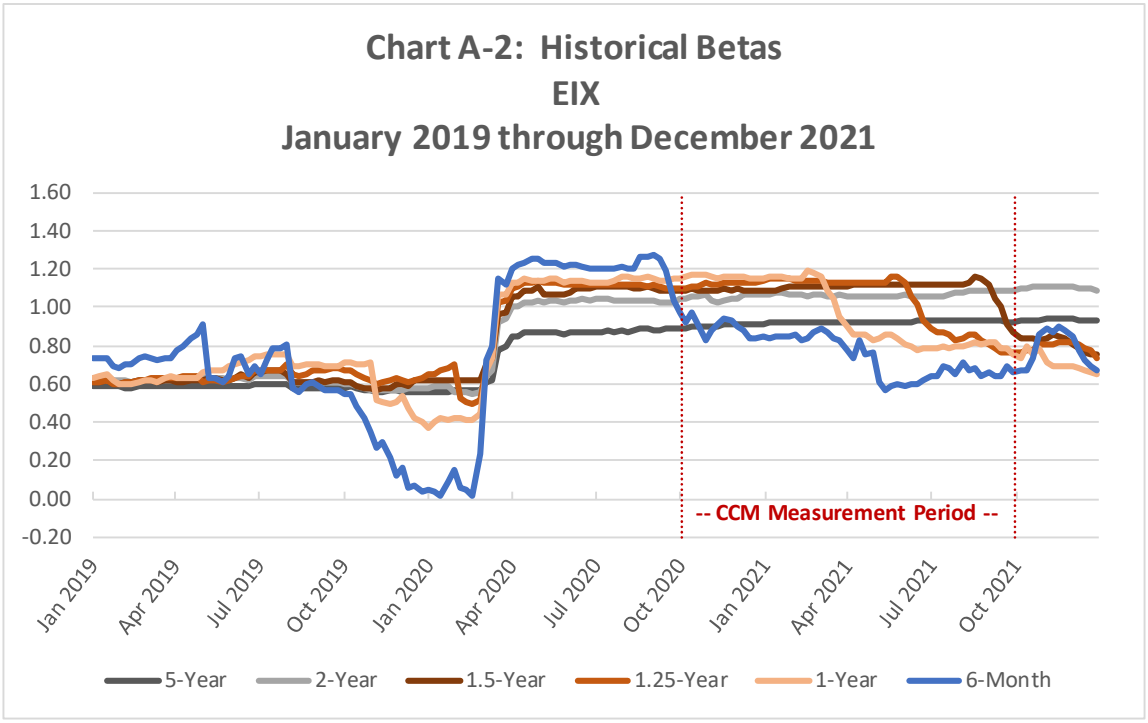
VIII. CONCLUSION

Q. DOES THIS CONCLUDE YOUR DIRECT TESTIMONY?

A. Yes.

APPENDIX A. CALIFORNIA UTILITY BETAS BY COMPANY





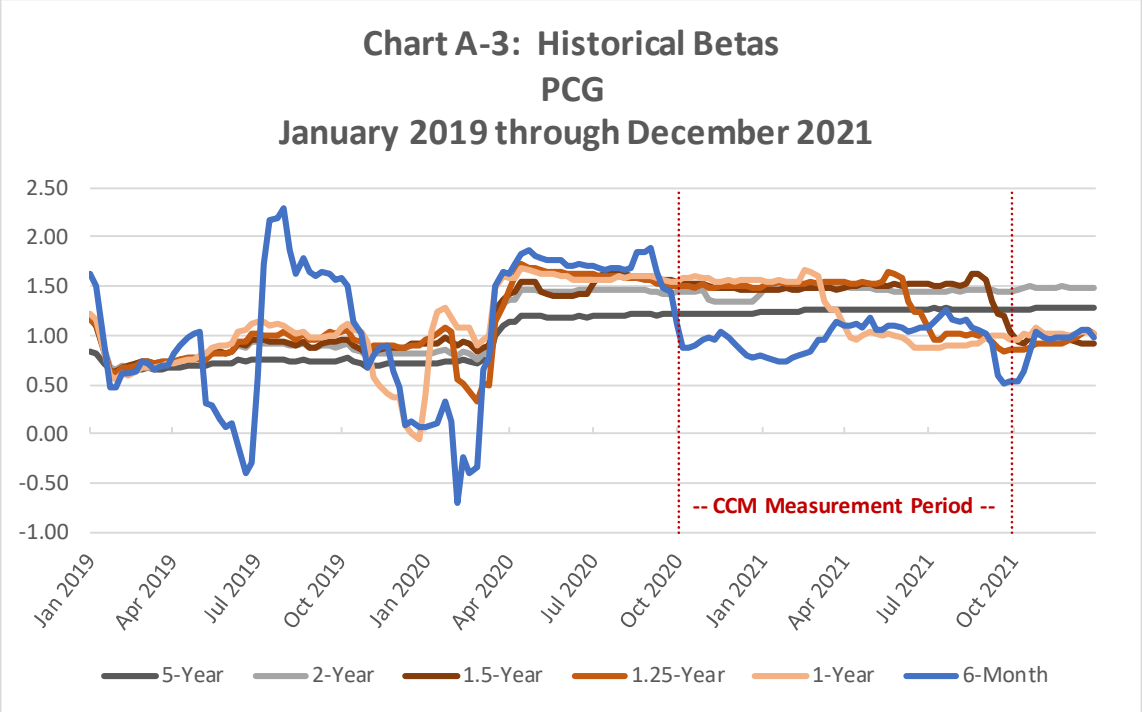


Chart A-3: Historical Betas
PCG
January 2019 through December 2021
2.50
2.00
1.50
1.00
0.50
0.00
-0.50
-1.00
-- CCM Measurement Period --
Jan 2019
Apr 2019
Jul 2019
Oct 2019
Jan 2020
Apr 2020
Jul 2020
Oct 2020
Jan 2021
Apr 2021
Jul 2021
Oct 2021
5-Year
2-Year
1.5-Year
1.25-Year
1-Year
6-Month

1

APPENDIX B. BETA CALCULATION TECHNICAL DETAILS

A. Historical Betas

Q. PLEASE EXPLAIN HOW YOU CALCULATE HISTORICAL BETAS.

A. I calculate historical betas following the methodology used by Value Line, with the following improvements:

1. Value Line uses the New York Stock Exchange Composite Index as the market index, I use the S&P 500 Index.
2. Value Line calculates weekly returns on one day of the week, with a stated preference for Tuesdays, I calculate weekly returns on all days of the week.
3. Value Line only calculates betas every 3 months in their quarterly company reports, whereas I use the same consistent methodology to calculate betas every week during the most recent 3 complete months (October through December 2021).
4. Value Line always uses a 5-year period for the return regression,[44] whereas I calculate historical betas for periods of 6 months, 1 year, 1.25 years, 1.5 years, 2 years, and 5 years.

In the following pages, I explain my rationale for making these improvements to Value Line's beta calculation methodology. The Utilities experts have not used these improvements in their historical beta analyses.

[44] They offer betas calculated over different time periods on their website, including 3 years and 10 years.

Q. WHAT TIME HORIZON DO YOU USE TO CALCULATE BETA COEFFICIENTS WHEN MAKING COST OF CAPITAL RECOMMENDATIONS?

A. Recognizing the pros and cons of different time horizons in calculating historical beta coefficients, I use historical betas based on 5-year, 2-year, and 6-month time horizons, giving them a weight of 20%, 30%, and 50%, respectively. I then combine the resulting historical betas with option-implied betas with equal weight to arrive at a "hybrid" beta that reflects a broad measure of the risk perceived by investors.

This is not a cost of capital proceeding, so I have not calculated a precise cost of equity, but I have relied on the beta calculations above along with 1-year, 1.25-year, 1.5-year historical betas to assess the relative impact of the pandemic on the cost of equity of electric utilities.

Q. WHAT TIME PERIOD HAVE THE UTILITIES USED IN THEIR ANALYSES?

A. PG&E uses a 5-year historical period. In its testimony attached to its August 2021 application, SCE used a 2-year historical period, but in its testimony served January 2022, it changed to a 3-year historical period.[45] SDG&E relied upon Value Line and Bloomberg betas which use a 5-year historical period.[46]

Q. IS THERE A SPECIFIC TIME HORIZON THAT IS CONSIDERED CORRECT OR SUPERIOR WHEN CALCULATING BETA COEFFIENTS?

A. No. Different analysts and data services use different time horizons. For instance, Value Line's published betas use a 5-year time horizon, though they also provide betas calculated

[45] A.21-08-013, SCE Application (August 23, 2021) at Exhibit 2 available at: https://docs.cpuc.ca.gov/PublishedDocs/SupDoc/A2108013/4044/401335157.pdf .
[46] Coyne Testimony at p. JMC-14:fn20.

on a 3-year and 10-year time horizons on their website. Yahoo Finance uses a 3-year time horizon to calculate betas. Bloomberg's default beta calculation uses a 2-year time horizon, even though their terminals also allow users to calculate beta coefficients based on other time horizons they can specify.

Q. ARE THERE BENEFITS TO USING SHORTER OR LONGER TIME HORIZONS WHEN CALCULATING HISTORICAL BETA COEFFICIENTS?

A. There are other variables that go into calculating betas, such as the frequency for calculating the paired returns from which beta coefficients are calculated using a regression. However, all else being equal, a longer time horizon translates into more return data pairs that are used in the regression for calculating beta. This in turn means that betas calculated using longer time horizons generally change more slowly and take longer to reflect changing market conditions and dynamics. This can be a good thing in that a short-lived, relatively small change can have almost no effect on a historical beta coefficient based on a long-time horizon, such as 5 years. The flip side to this is that even permanent changes in market dynamics can take years to be accurately reflected in historical 5-year betas.

Q. WHY DO YOU USE PERIODS OF 6 MONTHS, 2 YEARS, AND 5 YEARS FOR YOUR HISTORICAL BETA CALCULATIONS, AS OPPOSED TO RELYING EXCLUSIVELY ON THE 5-YEAR PERIOD USED BY VALUE LINE?

A. Using shorter periods for the return regression analysis portion of the historical beta calculation allows me to see if the correlation between the returns of each of the companies in my RFC Electric Proxy Group and those of the S&P 500 Index has changed in the last 2 years or 6 months. Using a 5-year period exclusively tends to make recent changes in

the correlation more difficult to identify because of the weight of 5 years of data. This point is particularly relevant in this proceeding due to the extremely strong correlation of stock price returns during March and April 2020 as a result of the onset of the Covid pandemic.

Q. WOULD YOU AGREE THAT CHANGES IN MARKET DYNAMICS WILL HAVE A LARGER EFFECT ON 6-MONTH HISTORICAL BETAS THAN THEY WILL ON 2-YEAR OR 5-YEAR HISTORICAL BETAS?

A. Yes. As with other historical metrics based on a given time period, say, average stock prices, the longer the time horizon under consideration, the more data points are considered, and the smaller the effect of any one given change in the data set.

Q. IS THIS LARGER EFFECT ON 6-MONTH HISTORICAL BETAS FROM CHANGES IN MARKET DYNAMICS A GOOD OR A BAD THING?

A. The answer depends on what the beta will be used for. I would argue that in any attempt to forecast the beta coefficient of a company for any forward-looking analysis such as the cost of capital calculations in this proceeding, more recent historical data should be given more relevance than data from 5 or 10 years ago.

As with using spot values and averages of historical market data, I believe the right answer is to consider historical betas over different time periods, especially during a pandemic because capital markets can change quickly making historical data over longer-timer periods inaccurate or irrelevant. For this reason, I have created my hybrid betas, which take into consideration 6-month, 2-year, and 5-year historical betas along with forward-looking, option-implied betas.

Q. WHY DO YOU CALCULATE YOUR HISTORICAL BETAS USING WEEKLY RETURNS ON EVERY DAY OF THE WEEK AS OPPOSED TO USING ONLY ONE DAY OF THE WEEK, AS VALUE LINE DOES?

A. Using one day of the week to calculate weekly returns for use in the regression analysis used to calculate historical betas has the unintended effect of generating different values of betas depending on the day of the week that is used. To clarify, if one were to use Value Line's precise methodology for calculating a 5-year historical beta for a given company using weekly returns calculated on Tuesdays, the resulting beta value would be different than the resulting value if one were to use the same exact methodology, but using weekly returns calculated on Wednesdays, or any other day of the week. Even though 5-year historical betas should in theory be quite stable and should not change very much from one day to the next, calculating returns on only one day of the week results in differences that can be significant and make no sense conceptually.

Even though there is some correlation due to some overlap, the set of weekly returns calculated on Mondays is a completely different set of numbers than the set of weekly returns calculated on Tuesdays. As a result, there are five 5-year betas that can result from Value Line's methodology, and even though the Monday beta for a given company will change slowly from week to week, the change between the Monday beta and the Tuesday beta, calculated just one trading day apart, can be quite significant.

Since I became aware of this undesirable effect, I began calculating my historical betas based on an all-encompassing set of weekly returns calculated on every trading day in the beta calculation period. This methodology has the effect of averaging out the five possible betas that could result from using only one day of the week for the return

calculations,[47] as Value Line does. In this way, a 5-year beta calculated on any two consecutive trading days would only change minimally, as it should.

Using a daily calculation of weekly returns could be criticized for the resulting overlap in a weekly return from Monday to Monday with that from Tuesday to Tuesday. However, given that the overlap is consistent and equal for the net effect of every trading day, no trading day is given undue weight in the regression. Even though the effect of each trading day appears 5 times in the weekly return data, there are also 5 times the total number of weekly returns in the overall set used in the regression, so any individual trading day has the same relative weight than in Value Line's methodology. The fact that the resulting beta value of this aggregate approach turns out to be a sort of average of the five possible values that would result from Value Line's methodology on different days of the week is the final confirmation that this is the superior approach for calculating a historical beta based on weekly returns.

Using a daily calculation of weekly returns has the added marginal benefit of providing more data pairs to be used in historical beta calculations for shorter periods, such as for 6-month historical betas, where instead of 25 return pairs, the regression is performed on 117 return pairs.

Q. ARE THERE ADDITIONAL BENEFITS TO DOING YOUR OWN HISTORICAL BETA CALCULATIONS?

A. Doing my own historical beta calculations using Value Line's established methodology allows me to see how beta values change from week to week and to use the most up-to-

[47] The resulting beta is not a direct arithmetic or geometric average of the other five betas, but rather a regression based on the union of all five possible sets of weekly returns.

date beta calculations instead of relying on stale beta values that can be more than 3 months old. The Utilities witnesses, on the other hand, do rely upon outdated information. For example, SCE's witness Dr. Villadsen testimony relies upon what she claims to be "the most recent measure" of EIX's Value Line beta as support for her conclusion that "clear indications that the systematic risk of the industry has increased" but she actually uses October 22, 2021 Value Line beta which she states is "the most recent available as of December 31, 2021."[48]

B. Forward-Looking Option-Implied Betas

Q. IS IT POSSIBLE TO CALCULATE BETAS BASED ON INVESTORS' CURRENT EXPECTATIONS?

A. Yes. In addition to historical betas, forward-looking beta coefficients can be calculated based on stock options. These option-implied betas can be a very useful measure of investor forward-looking sentiment and their expectations regarding betas and perceived risk.

Q. WHAT IS A STOCK OPTION?

A. A stock option is the right to buy or sell a stock at a specific price for a specified amount of time. A call option is the right to buy a stock at a specified exercise or strike price on or before a maturity date. A put option is the right to sell a stock at a specified exercise or strike price on or before a maturity date. For example, a call option to purchase Apple Computer stock for $230 on January 17, 2020 allows the owner the option (not the

[48] Villadsen Testimony at p. 17:3-6.

obligation) to buy Apple stock for $230 on that date. At the end of July 2019, Apple stock was trading at about $215 per share. Why would anyone pay for the right to buy a stock higher than the current price? Investors who purchased those call options thought there was a chance Apple stock would be trading higher than $230 on January 17, 2020, and those options gave those investors the right to buy Apple stock for $230 and profit by selling it at the market price on that date, if it was higher. The price of Apple's stock was $317.98 at the close of trading on January 17, 2020. Therefore, the investor who purchased this call option for $635 on July 31, 2019 earned a profit of $8,163[49] at expiry on January 17, 2020. On the other hand, the investor who purchased an Apple put option with the same expiration date and strike price on July 31, 2019 would have lost the price of the option ($2,248) and gained nothing on the expiration date because the right to sell Apple stock for $230 when the price is over $300 is worthless.

The market prices of put options and call options provide information regarding the probability distribution of future stock prices expected by investors. Using established techniques, I am able to use price data for stock options of my RFC Electric Proxy Group companies and the Utilities versus the S&P 500 Index to determine investors' return expectations, including the relationship (covariance) between the return expectations for individual RFC Electric Proxy Group companies and the Utilities versus those for the overall market (S&P 500). This covariance between the expected returns for my RFC Electric Proxy Group and for the S&P 500 indicates what investors expect betas will be in the future. I refer to betas based on option price calculations as "option-implied betas."

[49] $8,163 profit from exercising call option ($31,798 from selling at $317.98 market price - $23,000 cost to purchase at $230) - $635 ($6.35 X 100) option purchase price. Note: Each call option is the right to purchase 100 shares.

Q. PLEASE EXPLAIN HOW YOU CALCULATED OPTION-IMPLIED BETAS.

A. Calculating option-implied betas of a company requires (1) obtaining stock option data for that company and a market index, (2) filtering the stock option data, (3) calculating the option-implied volatility for the company and for the index, (4) calculating the option-implied skewness for the company and for the index, and (5) calculating option-implied betas for the company based on implied volatility and skewness for the company and for the index. There are various ways one could choose to perform the steps above, but I chose to filter stock option data and calculate option-implied volatility[50] and skewness[51] following exactly the same methodology used by the Chicago Board of Options Exchange (CBOE) in the calculation of their widely-used VIX (or Volatility Index) and SKEW Index, respectively. I start my process with publicly available trading information for all the options for a given security (company or index) for a complete trading day. I then filter the option data as described by the CBOE using the following guidelines:

1. Use the mid-quote or mark (average of bid and ask) as the option price.
2. Use only out-of-the-money call and put options.
    - Determine the "moneyness" threshold where absolute difference between call and put prices is smallest (using CBOE "Forward Index Price" formula).
    - Include "at-the-money" call and put options and use average of call and put prices as price for "blended" option.
3. Exclude all zero bids.

[50] Chicago Board of Options Exchange, *CBOE Volatility Index White Paper* (2018). Please note that the cover page says, "proprietary information." However, this document has been in the public domain for over 3 years.
[51] Chicago Board of Options Exchange, *CBOE SKEW Index* (2010). Please note that the cover page says, "proprietary information." However, this document has been in the public domain for over 3 years.

4. Exclude remaining (more out-of-the-money) options when two sequential zero bids are found.

I then apply the series of formulas clearly described in both of the CBOE's white papers to the remaining options to calculate Option-Implied Volatility and Option-Implied Skewness. In the words of the CBOE, each of its two indices is "an amalgam of the information reflected in the prices of all of the selected options."[52] To be clear, Implied Volatility is not exactly the same as the VIX Index, and Implied Skewness is not exactly the same as the SKEW Index, but both indices are directly based on their corresponding statistical value.

Option-Implied Volatility reflects investors' expectations regarding future stock price movements. Option-Implied Skewness reflects investors' expectations regarding how implied volatility changes for strike prices that are closer and further to the current value of the underlying stock price. Once I have calculated the option-implied volatility and skewness for each company and index using the methodology described above, I calculate option-implied betas using the following formula developed by Christoffersen, Chang, Jacobs and Vainberg (2011).[53]

Q. ARE YOUR OPTION-IMPLIED BETAS BASED ON ESTABLISHED METHODOLOGIES?

A. Yes. The purpose of my testimony is to provide the Commission with an independent analysis. However, I do not reinvent the wheel. It is mostly a question of which established methodologies and theories are best to use. There are countless established methodologies

[52] Chicago Board of Options Exchange, *CBOE Volatility Index White Paper* (2018) at p. 8.
[53] Bo-Young Chang, Peter Christoffersen, Kris Jacobs, Gregory Vainberg, Option-Implied Measures of Equity Risk, *Review of Finance* (April 2012) 16: 385-428.

and theories used by investors, scholars, and rate of return witnesses. Further, finance does not stand still and can be affected by numerous factors. For example, Wall Street traders have been increasingly using machine learning to make investment decisions, and the use of quantum computing is likely the next new tool.

My option-implied betas are based on methodologies used by the Chicago Board of Options Exchange (CBOE) and published in peer-reviewed academic journals (e.g., *The Review of Financial Studies*). Option-implied forward-looking betas are a core component of the CAPM method I have used in almost two dozen cost of capital proceedings in seven states since 2018. On April 9, 2020, the Public Service Commission of South Carolina stated the following:

> Amongst the three witnesses, Consumer Affairs Rothschild's approach was unique in that he included the use of both historical and forward-looking, market-based data in his analysis. Based on the testimony and facts presented, the Commission therefore adopts the recommended ROE of 7.46% proposed by witness Rothschild.[54]

This decision, which adopted my ROE recommendation based on option-implied betas, was subsequently upheld by the South Carolina Supreme Court in September 2021.[55]

On September 14, 2021, the Connecticut Public Regulatory Authority stated the following:

> The Authority finds Rothschild's market-based approach for determining a reasonable ROE to be credible and persuasive. Specifically, the Authority finds that the incorporation of investor market return expectations into the historically applied DCF and CAPM methodologies enables the Authority, and all docket participants, to better consider a just and reasonable rate of return based on the same prospective basis that base distribution rates are set. As such, the Authority determines that this added layer of analysis provides appropriate protection to the relevant public interests, both existing and foreseeable, pursuant to Conn. Gen. Stat. § 16-19e(a). Therefore, the

[54] Order Ruling on Application for Adjustment in Rates, Blue Granite Water Company, Docket No. 2019-290-WS, Order No. 2020-306, April 9, 2020, page 43.
[55] The Supreme Court of South Carolina, Opinion No. 28055, Heard June 15, 2021 – Filed September 1, 2021.

> Authority considered Rothschild's DCF and CAPM calculations, as outlined below, in this Decision; moreover, on a going forward basis, the Authority shall consider a similar approach to incorporating investor expectations into the historically applied DCF and CAPM methodologies in all future rate proceedings.[56]

[56] Proposed Interim Decision of the Connecticut Utilities Regulatory Authority, Docket No. 17-10-03RE11, page 21, September 14, 2021.

APPENDIX C. RESUME OF AARON L. ROTHSCHILD

SUMMARY

Financial professional providing U.S. public utility commissions financial tools and expert testimony to assist in rate setting for regulated utility companies (e.g., regulated electric distribution providers, natural gas pipelines). Relevant experience includes developing and applying methodologies that directly measure investors' equity return expectations based on stock option prices, applied mathematics research for utility industry as an affiliate of the New England Complex Systems Institute, and serving as Head of Business Analysis for a major U.S. telecom firm in Asia Pacific.

EXPERIENCE

Rothschild Financial Consulting, Ridgefield, CT **November 2001- present**
Independent consulting firm specializing in utility sector
President

- Provide financial expert testimony (e.g., rate of return and M&A) to regulators, policy makers, foundations, and consumer groups in utility rate case proceedings, including representing the California Public Advocates Office and the Wild Tree Foundation in the ongoing California water and energy cost of capital proceedings
- Developed cost of equity models that have been adopted by the Public Service Commission of South Carolina in 2020 (decision upheld by the South Carolina Supreme Court in September 2021) and the Connecticut Public Regulatory Authority in September 2021
- Developing market-based cost of equity methodology in ongoing regulated natural gas pipeline case before the Federal Energy Regulatory Commission (FERC), including proposing replacing equity analyst earnings per-share forecasts (IBES, Value Line) with options-implied growth expectations to determine authorized return on equity (ROE)
- Present at utility regulation conferences (NARUC/NASUCA and MARC) regarding rate of return, power purchase agreements, complex systems science, and subsidy auctions

360 Networks, Hong Kong **January 2001 - October 2001**
Pioneer of the fiber optic telecommunications industry
Senior Manager

- Business development and investment evaluation
- Negotiated landing rights and formed local partnerships in Korea, Japan, Singapore, and Hong Kong for $1 billion undersea cable project
- Structured fiber optic bandwidth swapping agreement with Enron and Global Crossing
- Established relationships with Hong Kong based Investment Bankers to communicate Asia Pacific objectives and accomplishments to Wall Street

Dantis, Chicago, IL **July 2000- December 2000**
Start-up managed data-hosting services provider
Director

- Built capital raise valuation models and negotiated with potential investors
- Team raised $100M from venture capital firm through valuation negotiations and internal strategic analysis

MFS, MCI-WorldCom, Chicago, Hong Kong, Tokyo September 1996- July 2000
American Telecommunications Company
Head of Business Analysis for Japan operations

- Managed staff of 5 business development analysts
- Raised $80M internally for Japanese national fiber network expansion plan by conducting an investment evaluation and presenting findings to CEO of international operations in London, UK
- Built financial model for local fiber optic investment evaluation that was used by business development offices in Oak Brook, IL and Sydney, Australia

EDUCATION

Vanderbilt University, Nashville, TN 1994-1996
MBA, Finance

- Completed business plan for Nextlink Communications in support of their national fiber optic network expansion, including identifying opportunities from passage of Telecom Act of 1996
- Developed analytical framework to evaluate predictability of rare events
- Provided financial and accounting analysis to Chicago's consumer advocate, the Citizens Utility Board (CUB) as a summer intern

Clark University, Worchester, MA 1990 - 1994
BA, Mathematics

APPENDIX D. TESTIFYING EXPERIENCE OF AARON L. ROTHSCHILD

Filed Rate of Return Testimonies:

California
- Pacific Gas and Electric Company, Application 21-01-004, Securitization, February 2021
- Pacific Gas and Electric Company, Application 20-04-023, Securitization, October 2020
- Southern California Edison, Application 20-07-008, Securitization, September 2020
- San Diego Gas & Electric Company, Application 19-04-017, Rate of Return, August 2019
- Southern California Gas Company, Application 19-04-016, Rate of Return, August 2019
- Pacific Gas and Electric Company, Application 19-04-015, Rate of Return, August 2019
- Southern California Edison, Application 19-04-014, Rate of Return, August 2019
- Liberty Utilities, Application A.18-05-006, Rate of Return, August 2018
- San Gabriel Water Company, Application 18-05-005, Rate of Return, August 2018
- Suburban Water Company, Application 18-05-004, Rate of Return, August 2018
- Great Oaks Water Company, Application 18-05-001, Rate of Return, August 2018
- California Water Service Company, Application 17-04-006, Rate of Return, August 2017
- California American Water Company, Application 17-04-003, Rate of Return, August 2017
- Golden State Water Company, Application 17-04-002, Rate of Return, August 2017
- San Jose Water Company, Application 17-04-001, Rate of Return, August 2017

Colorado
- Public Service Company of Colorado, Docket No. 11AL-947E, Rate of Return, March 2012

Connecticut
- Eversource and United Illuminating, Docket No. 17-12-03RE11, Rate of Return / Interim Rate Reduction, April 2021
- United Water Connecticut, Docket No. 07-05-44, Rate of Return, November 2008
- Valley Water Systems, Docket No. 06-10-07, Rate of Return, May 2007

Delaware
- Tidewater Utilities, Inc., PSC Docket No. 11-397, Rate of Return, April 2012

Florida
- Florida Power & Light (FPL), Docket No. 070001-EI, October 2007
- Florida Power Corp., Docket No. 060001 Fuel Clause, September 2007

New Jersey
- Aqua New Jersey, Inc., BPU Docket No. WR11120859, Rate of Return, April 2012

Maryland
- Delmarva Power & Light, Case No. 9317, Rate of Return, June 2013
- Columbia Gas of Maryland, Case No. 9316, Rate of Return, May 2013
- Potomac Electric Power Company, Case No. 9286, Rate of Return, March 2012
- Delmarva Power & Light, Case No. 9285, Rate of Return, March 2012

North Dakota

- Montana-Dakota Utilities Co., Case No. PU-20-379, Rate of Return, January 2021
- Otter Tail Power Company, Case No. PU-17-398, Rate of Return, May 2018
- Montana-Dakota Utilities Co., Case No. PU-15-90, Rate of Return, August 2015
- Northern States Power, Case No. PU-400-04-578, Rate of Return, March 2005

Pennsylvania

- UGI Utilities, Inc. – Electric Division, Docket No. R-2021-3023618, Rate of Return, May 2021
- Pennsylvania American Water Company, Docket No. P-2021-3022426, Rate of Return, February 2021
- Audubon Water Company, Docket No. R-2020-3020919, Rate of Return, November 2020
- Pennsylvania American Water Company, Docket No. R-2020-3019369 and R-2020-3019371, Rate of Return, September 2020
- Twin Lakes Utilities, Inc., Docket No. R-2019-3010958, Rate of Return, October 2019
- City of Lancaster Sewer Fund, Docket No. R-2019-3010955, Rate of Return, October 2019
- Community Utilities of Pennsylvania Inc. Wastewater Division, Docket No. R-2019-3008948, Rate of Return, July 2019
- Community Utilities of Pennsylvania Inc. Water Division, Docket No. R-2019-3008947, Rate of Return, July 2019
- Newtown Artesian Water Company, Docket No. R-20019-3006904, Rate of Return, May 2019
- Hidden Valley Utility Services, L.P. – Wastewater Division, Docket No. R-2018-3001307, Rate of Return, September 2018
- Hidden Valley Utility Services, L.P. – Water Division, Docket No. R-2018-3001306, Rate of Return, September 2018
- The York Water Company, Docket No. R-2018-3000019, Rate of Return, August 2018
- SUEZ PA Pennsylvania, Inc., Docket No. R-2018-000834, Rate of Return, July 2018
- UGI Utilities, Inc. – Electric Division, Docket No. R-2017-2640058, Rate of Return, April 2018
- Wellsboro Electric Company, Docket No. R-2016-2531551, Rate of Return, December 2016
- Citizens' Electric Company of Lewisburg, PA, Docket No. R-2016-2531550, Rate of Return, December 2016
- Columbia Gas of Pennsylvania, Inc., Docket No. R-2016-2529660, Rate of Return, June 2016
- Columbia Gas of Pennsylvania, Inc., Docket No. R-2015-2468056, Rate of Return, June 2015
- Pike County Light & Power Company, Docket No. R-2013-2397353 (gas), Rate of Return, April 2014
- Pike County Light & Power Company, Docket No. R-2013-2397237 (electric), Rate of Return, April 2014
- Columbia Water Company, Docket No. R-2013-2360798, Rate of Return, August 2013
- Peoples TWP LLC, Docket No. R-2013-2355886, Rate of Return, July 2013
- City of Dubois – Bureau of Water, Docket No. R-2013-2350509, Rate of Return, July 2013
- City of Lancaster – Sewer Fund, Docket No. R-2012-2310366, Rate of Return, December 2012
- Wellsboro Electric Company, Docket No. R-2010-2172665, Rate of Return, September 2010
- Citizens' Electric Company of Lewisburg, PA, Docket No. R-2010-2172662, Rate of Return, September 2010
- T.W. Phillips Gas and Oil Company, Docket No. R-2010-2167797, Rate of Return, August 2010
- York Water Company, Docket No. R-2010-2157140, Rate of Return, August 2010

- Joint Application of The Peoples Natural Gas Company, Dominion Resources, Inc. and Peoples Hope Gas Company LLC, Docket No. A-2008-2063737, Financial Analysis, December 2008
- York Water Company, Docket No. R-2008-2023067, Rate of Return, August 2008

South Carolina

- Palmetto Wastewater Reclamation, Inc., Docket No. 2021-153-S, Rate of Return, September 2021
- Dominion Energy South Carolina, Inc., Docket No. 2020-125-E, Rate of Return, November 2020
- Palmetto Utilities, Inc., Docket No. 2019-281-S, Rate of Return, May 2020
- Palmetto Utilities, Inc., Docket No. 2019-281-S, Accounting, May 2020
- Blue Granite Water Company, Docket No. 2019-290-WS, Rate of Return, January 2020

Vermont

- Central Vermont Public Service Corp., Docket No. 7321, Rate of Return, September 2007

Wisconsin

- American Transmission Company, LLC, ITC, Midwest, LLC, Case No. 19-CV-3418, financial and regulatory analysis regarding requested temporary injunction to halt the construction in Wisconsin of the proposed Cardinal-Hickory Creek transmission line, October 2021