| | | |
|---|---|---|
| Docket | | A. 22-04-008 et al. |
| Exhibit Number | : | WTF-01 |
| Commissioner | : | Alice Reynolds |
| Administrative Law Judge | : | Brian Stevens |

**DIRECT TESTIMONY OF AARON L. ROTHSCHILD**

**ON BEHALF OF WILD TREE FOUNDATION**

**Application of California Energy Companies for Authority to Establish Its Authorized Cost of Capital for Utility Operations for 2023 and to Reset the Cost of Capital Adjustment Mechanism**

Dated: August 8, 2022

## Contents

# I. STATEMENT OF QUALIFICATIONS

**Q1. PLEASE STATE YOUR NAME, TITLE, AND BUSINESS ADDRESS.**

A1. My name is Aaron L. Rothschild. My title is President, and my business address is 15 Lake Road, Ridgefield, CT.

**Q2. BY WHOM ARE YOU EMPLOYED AND IN WHAT CAPACITY?**

**A2.** I am President of Rothschild Financial Consulting ("RFC").

**Q3. PLEASE STATE YOUR EDUCATIONAL ACHIEVEMENTS AND PROFESSIONAL DESIGNATIONS.**

A3. I have a B.A. degree in mathematics from Clark University (1994) and an M.B.A. from Vanderbilt University (1996).

**Q4. PLEASE DESCRIBE YOUR BUSINESS EXPERIENCE.**

A4. 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 A for my resume.

**Q5. HAVE YOU PREVIOUSLY TESTIFIED BEFORE THE CALIFORNIA PUBLIC UTILITIES COMMISSION, OR OTHER STATE COMMISSIONS? IF SO, WHICH COMMISSIONS?**

A5. Yes, I have previously testified before the California Public Utilities Commission ("CPUC" or "Commission"). My expert witness experience 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, Tennessee, and Vermont. See Appendix 2 for the list of dockets for each of my testimonies.

**Q6. ON WHOSE BEHALF ARE YOU PROVIDING THIS TESTIMONY?**

A6. I am testifying on behalf of Wild Tree Foundation ("Wild Tree").

**Q7. WHAT IS THE PURPOSE OF YOUR DIRECT TESTIMONY IN THIS PROCEEDING?**

A7. The purpose of my testimony is to address the cost of capital for the three California Energy Companies ("the Utilities" or "Companies") for the period 2023 to 2025, with test year 2023 which includes the following three components:

1. Cost of Equity
2. Cost of Debt
3. Capital Structure

Based on my analysis of these cost of capital components, I recommend an allowed rate of return ("ROR") for ratemaking purposes, including an appropriate authorized return on equity ("ROE"), cost of debt, and capital structure.

I will address the follow three applicants in this proceeding:

Southern California Edison ("SCE" or "EIX") (A.22-04-009);

Pacific Gas and Electric Company ("PG&E" or "PCG") (A.22-04-008); and

San Diego Gas & Electric Company ("SDG&E" or "SRE") (A.22-04-012).

I do not address the application of Southern California Gas Company ("SoCalGas") (A.22-04-011).

The relevant application number for all applications is A.22-04-008 (Consolidated).

**Q8. PLEASE DEFINE THE COST OF EQUITY, COST OF DEBT, AND CAPITAL STRUCTURE.**

A8.

1. **Cost of Equity (COE):** My COE recommendation is based on the return investors require to provide equity capital to the Utilities based on current capital markets. Since investors must pay the market price of a stock to make an investment, investors' required returns are based on the return they expect to receive on the market price of stocks. In other words, the Utilities' COE is "market-based." An important part of the process of determining the market-based COE is to apply cost of equity models to the financial data of a proxy group of companies that have similar risk characteristics to the Utilities. To arrive at my recommendation, I applied the constant growth and

non-constant growth versions of the Discounted Cash Flow ("DCF") and eight variations of the Capital Asset Pricing Model ("CAPM") to a proxy group of 26 publicly traded electric utility companies ("RFC Electric Proxy Group") using data available through June 30, 2022.[1]

My recommendation is consistent with the following legal standards set by the United States Supreme Court for a fair rate of return:

> The return to the equity owner should be commensurate with returns on investments in other enterprises having corresponding risks.[2]

> A public utility is entitled to such rates as will permit it to earn a return on the value of the property which it employs for the convenience of the public equal to that generally being made at the same time and in the same general part of the country on investments in other business undertakings which are attended by corresponding risks and uncertainties; but it has no constitutional right to profits such as are realized or anticipated in highly profitable enterprises or speculative ventures. The return should be reasonably sufficient to assure confidence in the financial soundness of the utility and should be adequate, under efficient and economical management, to maintain and support its credit and enable it to raise the money necessary for the proper discharge of its public duties. A rate of return may be reasonable at one time and become too high or too low by changes affecting opportunities for investment, the money market and business conditions generally.[3]

2. **Cost of Debt:** My cost of debt recommendation is based on the actual cost of debt paid by the utility to its sources of debt. For example, if a utility issued a bond with a 3%

[1] SCE's witness Dr. Villadsen used a proxy group of 26 electric utility companies. PG&E's witness Dr. Vilbert used a proxy group of 27 electric utility companies. SDG&E's witness Dr. Vilbert used a proxy group of 20 electric utility companies.

[2] *Fed. Power Comm'n v. Hope Nat. Gas Co.*, 320 U.S. 591, 603 (1944).

[3] *Bluefield Water Works & Improvement Co. v. Pub. Serv. Comm'n of the State of W. Va.* 262 U.S. 679, 692-693 (1923).

interest rate three years ago, its authorized cost of debt should be 3% even if interest rates are currently higher or lower than 3%.

3. **Capital Structure:** Capital structure is the percentage of equity and debt that makes up the finances of a utility. For example, if a utility raises $1 million of equity capital and $1 million of debt capital, we say it has a capital structure containing 50% equity and 50% debt. The utility has the burden of proof to demonstrate that its requested capital structure produces the lowest reasonable overall cost capital. My capital structure recommendation is based on my review of the Utilities' justification for their capital structure recommendations, the capital structure of their parent companies, and the capital structure ratios of other electric utility companies.

**Q9. WHAT IS THE DIFFERENCE BETWEEN THE UTILITIES' COST OF EQUITY AND THEIR AUTHORIZED RETURN ON EQUITY?**

A9. The COE is the market-based return investors expect to earn on the market value of any given stock. In other words, the COE is the return investors expect to earn on the market price of equity. As it applies to this proceeding, it is the return investors require to provide equity capital to the Utilities or another investment of comparable risk. The appropriate authorized ROE is based on the Commission's determination of the COE at the time of the proceeding, after reviewing the evidentiary record, which incorporates investor expectations. Once the Commission issues an authorized ROE, the market-based cost of equity will continue to fluctuate as capital markets inevitably continue to change. The authorized ROE is based on a snapshot of the COE, which is constantly changing.

**Q10. THE AUTHORIZED ROES IN THIS PROCEEDING WILL SET RATES FROM 2023-2025. DOES THIS MEAN THAT THE AUTHORIZED ROES SHOULD BE BASED ON WHAT THE COE OF THE UTILITIES WILL BE OVER THAT TIME PERIOD?**

A10. We say the COE is forward-looking because it is based on evaluation of investors' current expectations, not because it is possible to determine what the COE will be in the future because capital markets are unpredictable.

**Q11. CAN THE ROE AND ROR BE CHANGED IN BETWEEN ELECTRIC UTILITY COST OF CAPITAL PROCEEDINGS IN CALIFORNIA?**

A11. Yes. The Cost of Capital Mechanism ("CCM") adds an extra level of capital market risk protection to investors because if interest rates rise or fall significantly between now and the next proceeding, authorized ROEs can be adjusted accordingly. Adopted in D.08-05-035, the CCM provides an automatic adjustment to the adopted ROE when the difference between a 12-month measurement period and the benchmark established in the last cost of capital proceeding exceeds a trigger of 100 basis points.

**Q12. PLEASE DEFINE THE APPROPRIATE RATE OF RETURN.**

A12. The appropriate Rate of Return ("ROR") is based upon the weighted overall cost of capital ("WACC") of the current cost of debt and cost of equity at the time of this proceeding. The weighted cost rate is calculated by multiplying the capital structure ratios of the sources of capital (debt, preferred equity, and equity) times respective cost rates.

WACC = Cost of Debt X Debt Ratio + COE X Common Equity Ratio.

# II. INTRODUCTION AND SUMMARY OF RECOMMENDATIONS

**Q13. HOW IS YOUR TESTIMONY ORGANIZED?**

A13. First, I provide a summary of my recommendations, an overview of cost of equity concepts, and how current capital markets relate to my cost of equity calculations. Second, I provide a more detailed discussion of current capital markets. Third, I provide a detailed explanation of the various models I use in my cost of equity calculations. Forth, I provide recommendation regarding the cost of capital mechanism. Lastly, I provide an evaluation of the Utilities' rate of return testimony.

**Q14. PLEASE PROVIDE A SUMMARY OF YOUR RECOMMENDATIONS.**

A14. Table 1 below shows my ROE recommendations for the Utilities:

**TABLE 1: ALR RECOMMENDED ROES**

| | Recommended ROE Range | Recommended ROE |
|---|---|---|
| **Southern California Edison** | 7.41% - 8.74% | 8.08% |
| **Pacific Gas and Electric Company** | 7.41% - 8.74% | 8.08% |
| **San Diego Gas & Electric Company** | 7.15% - 8.48% | 7.81% |

Exhibit ALR-1

Table 2 through Table 4 on page 8 show my ROE recommendations along with my capital structure and cost of debt recommendations to arrive at my overall rate of return recommendations for each of the Utilities:

**TABLE 2: ALR RECOMMENDED RANGE MIDPOINT - SOUTHERN CALIFORNIA EDISON**
**Application No. 22-04-008 (Consolidated)**

| | Capital Structure Ratios | Cost Rate | Weighted Cost Rate |
|---|---|---|---|
| **Long-Term Debt** | 49.55% | 4.27% | 2.12% |
| **Short-Term Debt** | 0.00% | 0.00% | 0.00% |
| **Preferred Equity** | 5.00% | 5.72% | 0.29% |
| **Common Equity** | 45.45% | 8.08% | 3.67% |
| **Rate of Return** | | | 6.07% |

Exhibit ALR-1, page 1

**TABLE 3: ALR RECOMMENDED RANGE MIDPOINT - PACIFIC GAS AND ELECTRIC COMPANY**
**Application No. 22-04-008 (Consolidated)**

| | Capital Structure Ratios | Cost Rate | Weighted Cost Rate |
|---|---|---|---|
| **Long-Term Debt** | 54.05% | 4.27% | 2.31% |
| **Short-Term Debt** | 0.00% | 0.00% | 0.00% |
| **Preferred Equity** | 0.50% | 5.52% | 0.03% |
| **Common Equity** | 45.45% | 8.08% | 3.67% |
| **Rate of Return** | | | 6.01% |

Exhibit ALR-1, page 2

**TABLE 4: ALR RECOMMENDED RANGE MIDPOINT - SAN DIEGO GAS & ELECTRIC COMPANY**
**Application No. 22-04-008 (Consolidated)**

| | Capital Structure Ratios | Cost Rate | Weighted Cost Rate |
|---|---|---|---|
| **Long-Term Debt** | 48.00% | 3.87% | 1.86% |
| **Short-Term Debt** | 0.00% | 0.00% | 0.00% |
| **Preferred Equity** | 0.00% | 0.00% | 0.00% |
| **Common Equity** | 52.00% | 7.81% | 4.06% |
| **Rate of Return** | | | 5.92% |

Exhibit ALR-1, page 3

**Q15. ARE YOU RECOMMENDING A SPECIFIC ROE OR AN ROE RANGE FOR EACH APPLICANT?**

A15. I recommend both a range of appropriate ROEs and a specific point within that range that I feel would be the most appropriate for each applicant. Applying the various COE models results in a range for the market-based COE and not a precise number. The range that I recommend for each applicant already eliminates the extreme ends of the results of my models and reflects the range of ROEs I feel confident will allow that applicant to raise the capital they need to provide safe and reliable service. However, I also recommend a specific ROE within that range for each applicant because commissions have often requested this specifically. Recommended ranges and specific ROEs for each applicant are summarized in Table 1 on page 7.

**Q16. PLEASE SUMMARIZE HOW YOU DETERMINED YOUR 7.81% TO 8.08% COST OF EQUITY RECOMMENDATIONS FOR THE UTILITIES' ELECTRIC DISTRIBUTION OPERATIONS.**

A16. To arrive at my recommendations, I applied the DCF, including a constant growth and a non-constant growth method and a CAPM analysis to a group of similar companies ("RFC Electric Proxy Group") using data available through June 30, 2022. In all my models, I use

both historical averages and the most recently available spot market data[4] for the inputs wherever it is possible and applicable.

My constant growth DCF model is used by major financial institutions. J.P. Morgan Chase uses the sustainable growth form of the DCF method, as I do, in its 2019 Long-Term Capital Market Assumptions publication.[5] *Principles of Corporate Finance*, a leading financial textbook used in business schools and investment banks around the world, recommends using the very same method I use to calculate the cost of equity for regulated energy utility companies.[6] As discussed in Section 0 - F - Capital Asset Pricing Model on page 74, my CAPM is based on methodologies used by Value Line, the Chicago Board of Options Exchange (CBOE), and published in peer-reviewed academic journals (e.g., The Review of Financial Studies). My CAPM method has also been recognized by other Commissions. 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

[4] Spot market data is data as of a specific date. The benefit of using spot data, as of June 30, 2022, for example, is that it provides the most up to date capital information. However, it is helpful to consider average data over the past 3-months, for example, to smooth out any random, and short-term, movements in the stock market that may not be representative of the future.

[5] 23rd Annual Edition, Long-Term Capital Market Assumptions - Time-tested projections to build stronger portfolios, pp. 62-63.

[6] Brealey, Myers, and Allen (2017), Principles of Corporate Finance, 12th Edition, McGraw-Hill Irwin, New York, page 86-87.

presented, the Commission therefore adopts the recommended ROE of 7.46% proposed by witness Rothschild.[7]

I have determined the cost of equity for the average company in the RFC Electric Proxy Group to be between 7.41% and 8.74%.[8] As shown in Table 5 below, Cost of Equity Model Results, the high-end results of my three cost of equity models, including eight variations of the CAPM, range between 7.86% and 8.99%, with an upper quartile of 8.74%. The low-end results of my three cost of equity models, including eight variations of the CAPM, range between 7.10% and 8.48%, with a lower quartile of 7.41%.

| **TABLE 5: COST OF EQUITY MODEL RESULTS** | | |
|---|---|---|
| **DCF** | **Low** | **High** |
| Constant Growth - Sustainable Growth | 7.92% | 8.02% |
| Constant Growth - Option-Implied Growth | 8.48% | 8.74% |
| Non-Constant Growth | 8.21% | 8.21% |
| **CAPM** | | |
| **Spot Market Values (Jun. 30, 2022)** | | |
| Risk Free Rate - 3-Month T Bill | 7.41% | 8.59% |
| Risk Free Rate - 30-Yr T Bond | 7.98% | 8.99% |
| **3-Mo. Weighted Average (Apr. to Jun. 2022)** | | |
| Risk Free Rate - 3-Month T Bill | 7.10% | 7.86% |
| Risk Free Rate - 30-Yr T Bond | 7.83% | 8.45% |
| **Outer Quartile Range** | **7.41%** | **8.74%** |
| **Midpoint of Range** | **8.08%** | |

Exhibit ALR-2

[7] Public Service Commission of South Carolina, Docket No. 2019-290-WS, *Order Ruling on Application for Adjustment in Rates, Order No. 2020-306* (April 9, 2020) at p. 43.

[8] Exhibit ALR-2.

**Q17. HOW DO YOUR RECOMMENDATIONS COMPARE TO THE RECOMMENDATIONS OF THE UTILITIES' RATE OF RETURN WITNESSES?**

A17. As shown in Table 6 below, my 7.81% to 8.08% cost of equity recommendations result in an overall rate of return of between 5.92% and 6.07%..

**TABLE 6: RECOMMENDATION COMPARISON**

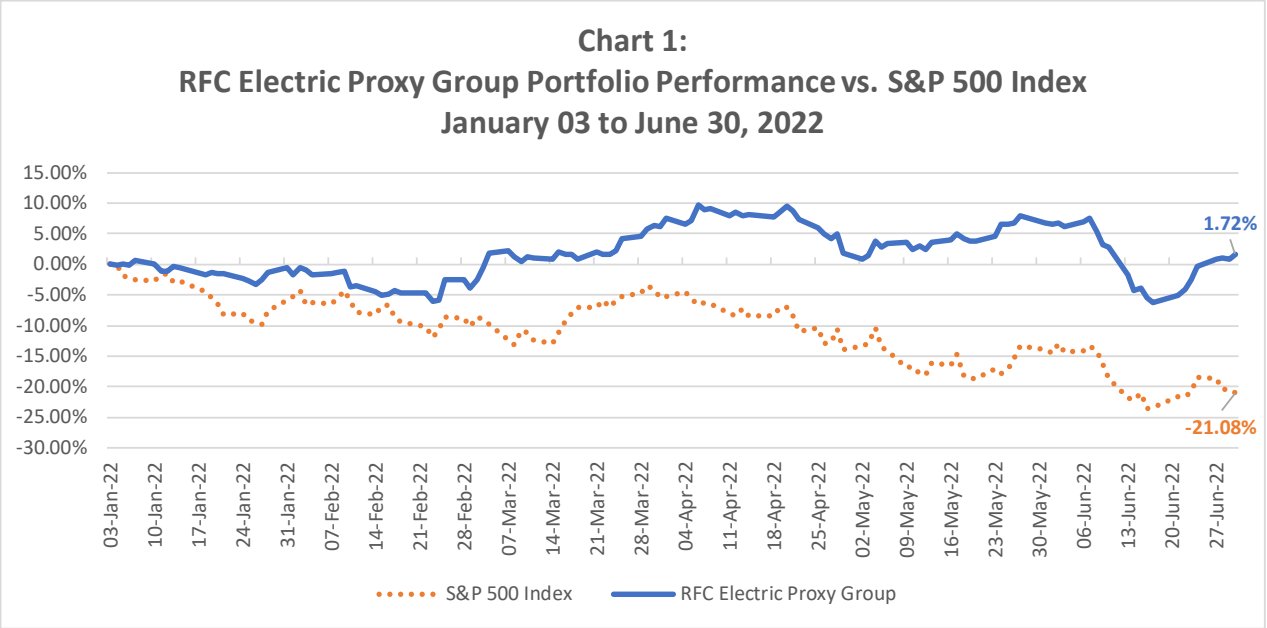
| | Cost of Equity | Cost of Debt | Common Equity % | Long-Term Debt % | Rate of Return |
|---|---|---|---|---|---|
| **Southern California Edison** | | | | | |
| Rothschild [1] | 8.08% | 4.27% | 45.45% | 49.55% | 6.07% |
| Villadsen [2] | 10.53% | 4.27% | 52.00% | 43.00% | 7.60% |
| **Pacific Gas and Electric Company** | | | | | |
| Rothschild [3] | 8.08% | 4.27% | 45.45% | 54.05% | 6.01% |
| Vilbert [4] | 11.00% | 4.27% | 52.00% | 47.50% | 7.78% |
| **San Diego Gas & Electric Company** | | | | | |
| Rothschild [5] | 7.81% | 3.87% | 52.00% | 48.00% | 5.92% |
| Coyne [6] | 10.55% | 3.87% | 54.00% | 46.00% | 7.48% |

[1] Exhibit ALR-1, page 1
[2] SCE-01, page 5, lines 7-17.
[3] Exhibit ALR-1, page 2
[4] Pacific Gas and Electric Company, Chapter 1, page 1-2, Table 1-1.
[5] Exhibit ALR-1, page 3
[6] Direct Testimony of Maritza Mekitarian, page MM-1, Table 1.

**Q18. HOW ARE CURRENT CAPITAL MARKET CONDITIONS IMPACTING ELECTRIC UTILITY STOCKS?**

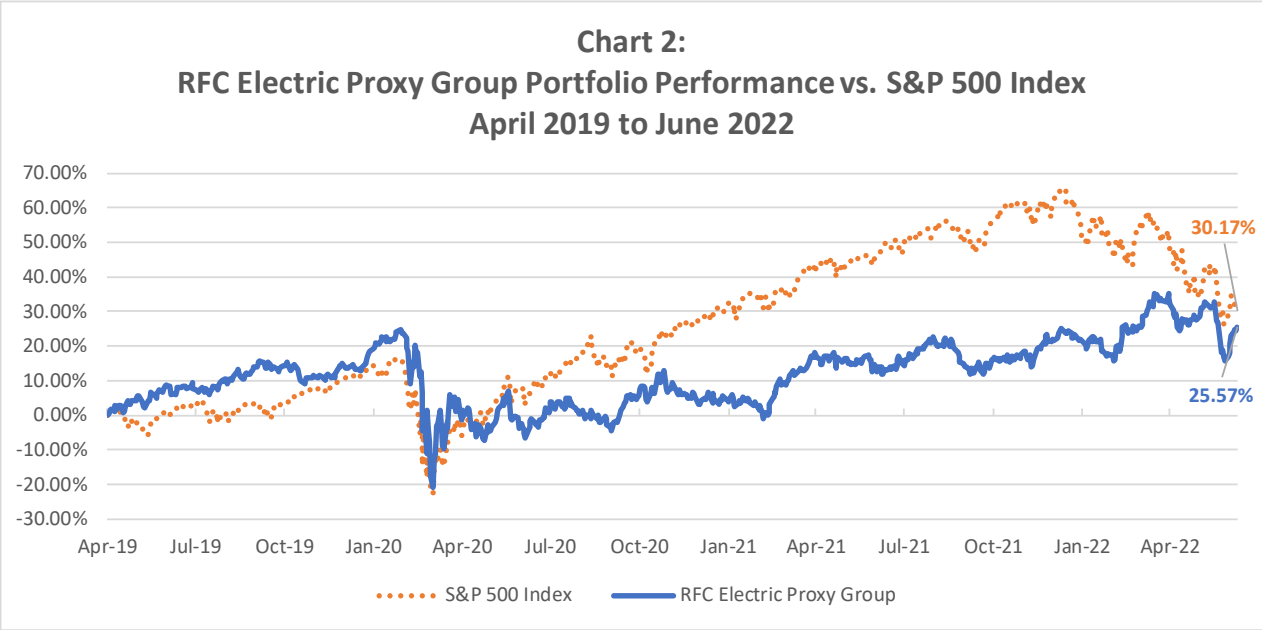
A18. Financial data (as elaborated upon in Section III. COST OF EQUITY IN TODAY'S FINANCIAL MARKETS starting on page 22) indicate that despite high current inflation and recent increases in interest rates, capital market conditions are favorable for electric utility companies to raise low-cost equity capital. As shown in Chart 1 below, the relative

overperformance of electric utility stocks in 2022 is a sharp break from a period of relative underperformance from the initial outbreak of COVID in March 2020, until the end of 2021.




As shown on Chart 2 on page 14, electric utility stocks[9] have significantly outperformed the overall market in the first 6-months of 2022, and particularly since Russia invaded Ukraine on February 24, 2022. Over this time period, electric utility stocks are up nearly 2% while the S&P 500 is down about 21%. Despite the recent significant overperformance of electric utility stocks, they are up a little less than the overall market between the last California cost of capital proceeding and today because of what happened in 2020 and 2021. Over this time period, electric utility stocks are up less than 26% while the S&P 500 is up slightly over 30%.

[9] Many of the utilities in the RFC Electric Proxy Group have some gas distribution operations as well. Mr. Coyne states on page 31, lines 9-12 of his Direct Testimony that 14 percent of the revenue and net income of the companies in his proxy group were from gas operations.




All else equal, the recent relatively strong stock price performance of electric utility stocks indicates a declining cost of equity for electric utility companies since the start of the War in Ukraine. However, the recent exceptional stock price performance of electric utility stocks is only one element among many that we must consider to determine the COE for electric utility companies and what would be an appropriate authorized ROE for the Utilities in this proceeding. Another important element to consider is investors' risk perceptions for electric utility companies. We can use capital market data for insights into investors' risk perceptions for electric utility stocks like analyzing betting odds to indicate which team gamblers believe is most likely to win a game. My testimony can be viewed as an evaluation of the odds implied by market data. I do not attempt to predict the future, but my recommendations ensure the Utilities are competitive in the race to raise capital.

As discussed in Section III.C Option-Implied Skewness (Investor-Perceived Downside Risk) starting on page 38, stock option data show that investors have continued

to consider electric utility stocks to be less risky than the overall market since Russia invaded Ukraine in February 2022. Stock option data shows that investors believe there is a significantly lower chance that electric utility stocks will have a large drop as compared to the overall market. If investors believe that the risk of a large drop in electric utility stock prices is lower, this indicates that the cost of equity for electric utility stocks, including the Utilities, indeed remains lower than the overall market (see Chart 9 on page 41). The stock option data is described in more detail on page 79.

**Q19. PLEASE PROVIDE A SUMMARY OF HOW YOUR SPECIFIC ROE RECOMMENDATIONS FOR THE UTILITIES COMPARED TO RETURN EXPECTATIONS OF MAJOR FINANCIAL INSTITUTIONS.**

A19. My specific ROE recommendations of 7.81% to 8.08% for the Utilities are in the middle of the range of the expectations published by major banks and brokerage houses (4.1 to 8.9%) shown in Table 7 on page 16. My recommendations are consistent with the COE demanded by investors and would enable the Utilities to raise the capital needed to provide safe and reliable service.

| TABLE 7: U.S. EQUITY RETURN EXPECTATIONS AMONG MAJOR FINANCIAL INSTITUTIONS | |
|---|---|
| **Duff & Phelps/Kroll (June 2022) [1]** | **9.0%** |
| **Horizon Actuarial Services, LLC Survey - 20 Year Horizon (August 2021) [2]** | **4.6 - 8.9%** |
| *50% Percentile: 6.9%* | |
| **J.P. Morgan Asset Management - Equity Long-Term Returns (Sep 2021) [3]** | **4.1%** |
| **Charles Schwab - 10-year U.S. Large Cap Returns (March 2022) [4]** | **6.6%** |

Sources:
[1] Kroll Cost of Capital Resource Center, https://www.kroll.com/en/insights/publications/cost-of-capital
Note: Duff & Phelps acquired Kroll in 2021 and rebranded itself as Kroll.
[2] Horizon Actuarial Services, LLC, Survey of Capital Market Assumptions Survey, August 2021, page 17.
Survey participants Include: Bank of New York Mellon, BlackRock, Goldman Sachs Asset Management, J.P. Morgan Asset Management, Merrill, Morgan Stanley Wealth Management, Royal Bank of Canada, UBS.
[3] J.P. Morgan Asset Management - 2022 Long-Term Capital Market Assumptions, September 30, 2021, page 15.
[4] Schwab's 2022 Long-Term Capital Market Expectations, March 1, 2022.

Table 7 above shows that major financial institutions are informing their clients to expect returns on their investments similar to the COE I propose in this testimony. The return expectations published by all these financial institutions are based on their own financial models and are broadly for the overall stock market (e.g., U.S. Large Cap, S&P 500). My ROE recommendations are based on government-regulated electric utility companies only. Given the relatively lower risk associated with monopoly utilities, it is unlikely that investors would expect to earn a higher return for a utility company than for the overall stock market.

**Q20. PLEASE COMPARE YOUR ROE RECOMMENDATIONS TO THE ROES REQUESTED BY THE UTILITIES.**

A20. I recommend different ROEs for the Utilities than their witnesses propose because we utilize fundamentally different analytical approaches to calculate the COE. I focus on using market data (e.g., stock prices, bond yields, stock option prices) to measure investors' expectations as much as possible. On the other hand, the Utilities' witnesses rely almost

exclusively on non-market data, including economists' projections (e.g., interest rates), analysts' forecasts (e.g., 5-year earnings per share growth), and the witnesses' own speculations, even when market data is available.

The ROEs requested by the Utilities, based on their witnesses recommendations, range from 10.53% to 11.00%. As shown in Table 7 on page 16., their requested ROEs are considerably higher than return expectations published by major consulting firms, brokerage houses, and market data publications (4.1% - 9.0%). As I will explain further in my testimony, the Utilities' witnesses' ROE recommendations are above current investor expectations for numerous reasons, including flaws in their models and their decision to not rely on investors' interest rate forecasts represented by current market yields. As explained in more detail herein, Chart 4 on page 29 shows that the non-market-based interest rate forecasts used by the Utilities' witnesses have been consistently inaccurate. Furthermore, analysts' earnings forecasts used by the Utilities' witnesses' discounted cash flow (DCF) analyses have been shown to be overly optimistic.[10]

State utility commissions throughout the United States, as well as the financial industry, have found that the COE of regulated electric utility companies is significantly lower than the ROEs recommended by the Utilities' witnesses in this proceeding

[10] Marc H. Goedhart, Rishi Raj and Abhishek Saxena, Equity Analysts: Still too bullish, Spring 2010, available at: https://www.mckinsey.com/business-functions/strategy-and-corporate-finance/our-insights/equity-analysts-still-too-bullish .

Determining the appropriate cost of capital is a delicate balance. I agree with Mr. Coyne that "If ROE is set too low it harms both investors and rate payers…"[11] If the ROE and overall rate of return is set too low, the Utilities will not be able to access the capital needed to provide safe and reliable service. However, charging consumers above the current market rate for capital is not appropriate or necessary to assure capital is available and will result in an unjustified windfall to the Utilities. My market-based analysis indicates that the ROEs I recommend for the Utilities are sufficient to attract capital, including to fund their capital spending plans. The Cost of Capital Mechanism adds an extra level of capital market risk protection to investors providing capital to the Utilities, should interest rates rise significantly between now and the next proceeding.

**Q21. DO THE UTILITY WITNESSES USE CORRECT DEFINITIONS FOR THE COST OF EQUITY?**

A21. No. All ROE witnesses I have encountered over my more than 20 years in the industry, including the Utilities' three witnesses in this proceeding, define the cost of equity as market-based somewhere in their testimony. However, many of those witnesses, including the three utility witnesses in this proceeding, implicitly define the cost of equity, at least in part, as a hybrid of accounting returns (return on book equity) and return expectations of "expert forecasters" such as economists and equity analysts. For example, as discussed further below,

[11] Mr. Coyne's Direct Testimony, Page 10, lines 11-12.

each of the three witnesses in this proceeding uses Blue Chip interest rate forecasts instead of market-based bond yields as a proxy for the risk-free rate in their CAPM analyses. The three witnesses in this proceeding even go as far as using their personal market speculations to calculate the cost of equity. This characterization of the cost of equity as largely subjective is erroneous and should not be relied upon by the Commission in its decision-making on the applications.

**Q22. IS YOUR MARKET-BASED COST OF EQUITY RECOMMENDATION BASED ON YOUR OPINION OF FUTURE STOCK PRICE RETURNS?**

A22. No. I do not pretend to be able to predict the future. Capital markets are unpredictable and, as explained above, it is investors' expectations that matter since they are the ones providing the capital. Therefore, I provide an expert evaluation of investors' return expectations as indicated by the current market prices of stocks, bonds, and stock options, without attempting to predict future prices. This is an important topic that I will revisit throughout my testimony.

I do use Value Line and Zacks forecasts to estimate the market-based cost of equity in my Discounted Cash Flow analyses. However, I do not use these forecasts mechanically and I go to great lengths to distill the sustainable growth component to ensure it is in line with investors' long-term expectations. My Capital Asset Pricing Model (CAPM) is based on a direct measurement of investors' expectations as indicated by market prices instead of analyst forecasts, which have proven to be unrealistic.

**Q23. ARE YOUR COST OF EQUITY MODELS BASED ON ESTABLISHED METHODOLOGIES?**

A23. Yes. The constant growth DCF model I use is the same one chosen by major financial institutions. For example, J.P. Morgan Chase uses the same sustainable growth form of the DCF method in its 2019 Long-Term Capital Market Assumptions publication.[12] *Principles of Corporate Finance*, a leading financial textbook used in business schools and investment banks around the world, recommends using the very same method I use to calculate the cost of equity for regulated utility companies.[13] As discussed in Section 0. Capital Asset Pricing Model on page 74, my CAPM is based on methodologies used by Value Line, the Chicago Board of Options Exchange (CBOE), and published in peer-reviewed academic journals (e.g., *The Review of Financial Studies*).

My market-based methodology has also been recognized by this and other state commissions. 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

[12] 23rd Annual Edition, Long-Term Capital Market Assumptions - Time-tested projections to build stronger portfolios, pp. 62-63.

[13] BREALEY, MYERS, AND ALLEN, Principles of Corporate Finance, pp. 86-87 (McGraw-Hill Irwin, New York, 12th ed. 2017).

> provides appropriate protection to the relevant public interests, both existing and foreseeable, pursuant to Conn. Gen. Stat. § 16-19e(a). Therefore, the 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.[14]

In September 2021, the South Carolina Supreme Court stated the following in upholding a cost of capital decision of the Public Service Commission of South Carolina:

> The PSC further found Rothschild to be the most credible witness, placing special emphasis on the fact that his analysis "was unique in that he included the use of both historical and forward-looking, market-based data." The PSC explained Rothschild's results from his three chosen analytical models "provide[d] an ROE in the range of 7.46% to 8.75%." Noting it was "[c]onsidering the quality of service issues known to exist with Blue Granite," the PSC concluded the "recommended ROE of 7.46% proposed by witness Rothschild" was appropriate.[15]

**Q24. PLEASE DEFINE YOUR ANALYTICAL APPROACH.**

A24. My COE recommendation is my opinion of the return investors require to provide equity capital to the Utilities based on current capital markets. My recommendation is consistent with the following legal standards set by the United States Supreme Court for a fair rate of return:

> The return to the equity owner should be commensurate with returns on investments in other enterprises having corresponding risks.[16]

[14] Connecticut Utilities Regulatory Authority, *Proposed Interim Decision of the Connecticut Utilities Regulatory Authority, Docket No. 17-10-03RE11* (September 14, 2021) at p. 21. (Note, this case was ultimately settled).

[15] *In re Blue Granite Water Co.* (S.C. 2021) 434 S.C. 180, 191.

[16] *Federal Power Commission v. Hope Natural Gas Company* 320 U.S. 591, 603 (1944).

And

> The return should be reasonably sufficient to assure confidence in the financial soundness of the utility and should be adequate, under efficient and economical management, to maintain and support its credit and enable it to raise the money necessary for the proper discharge of its public duties.[17]

Because the cost of equity is not a published figure like a bond yield, some interpretation is required to determine the appropriate market price. My COE recommendation is based on my computation of what the market indicates investors require (return on investment) to provide capital to companies with comparable risk to the Utilities.

As explained below, I use current market prices (e.g., stocks, bonds, options), which measure investors' expectations directly, to determine the cost of equity, instead of relying solely on historical data and analyst forecasts.

## III. COST OF EQUITY IN TODAY'S FINANCIAL MARKETS

**Q25. PLEASE DISCUSS MARKET DEVELOPMENTS THAT IMPACT THE COST OF EQUITY.**

A25. Market developments that have impacted the cost of equity include:

1. **Utility stock prices have overperformed the overall market as interest rates and inflation have risen in recent months.** In 2022, most equity investors had one of their worst first halves of a year since 1970; the S&P 500 is down about 21% as of June 30,

[17] *Bluefield Water Works & Improvement Company v. Public Service Commission of the State of West Virginia* 262 U.S. 679, 692-693 (1923).

2022. In contrast, capital market data indicates that electric utility stocks have become significantly more attractive to investors in recent months. As shown on Chart 2 on page 14, electric utility stocks have slightly underperformed the overall market since the Utilities' last rate case in April 2019. However, in the first 6-months of 2022, as the Federal Reserve has been increasing the Federal Funds Rate (from near zero to 1.75 as of June 30, 2022) electric utility stocks have significantly outperformed the overall market (S&P 500).

2. **Investors' stock price volatility expectations for the overall market and utilities remain elevated as compared to before the pandemic (2019), but the volatility expectations for electric utility companies have decreased in relation to the overall market.** In March 2020, the VIX Index[18] reached levels not seen since the financial crisis of 2007-2008, and even set all-time records. Volatility expectations remain higher than before COVID-19 but have declined significantly since peaks reached in March 2020. Chart 7 on page 38 shows that since the war in Ukraine investors' volatility expectations[19] for electric utility stocks changed from being mostly slightly higher than the overall to mostly being slightly below the overall market which is another indication that the cost of equity for electric utility companies has declined relative to the overall market.

[18] VIX is the ticker symbol for the Chicago Board of Options Exchange's CBOE Volatility Index. This index is a measure of investors' volatility expectations based on S&P 500 index options. The VIX Index is referred to as the "fear index" because as volatility expectations increase, investors consider markets to be riskier.

[19] I calculated investors' volatility expectations of electric utility companies based on applying the CBOE's methodology for determining the VIX Index to their stock options.

3. **Option-implied skewness (investor-perceived downside risk) for electric utility companies remains relatively low.** Investors' expectations regarding the chance of a large drop in utility stock prices remain significantly below that of the overall market which indicates that the relative cost of equity for electric utility companies remains low.

4. **Credit spreads are now about the same as pre-pandemic levels.** The spread between the yield investors demand to purchase U.S. corporate bonds and U.S. Treasury bonds (see Chart 10 on page 43) increased slightly during the initial phases of the Russian invasion of Ukraine in February 2022. As of June 30, 2022, the yield spread for Baa credit-rated corporate bonds is 2.31%, a little higher than the months before Russian invaded Ukraine (under 2%) and pre-pandemic levels of 1.98% on December 31, 2019. 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. Credit spread data indicates that the cost of equity for the overall market has not been materially impacted by current events, including increasing interest rates and historically high inflation.

**Q26. PLEASE DISCUSS THE CURRENT INTEREST RATE AND INFLATION ENVIRONMENT AND WHAT IT INDICATES REGARDING THE COST OF EQUITY.**

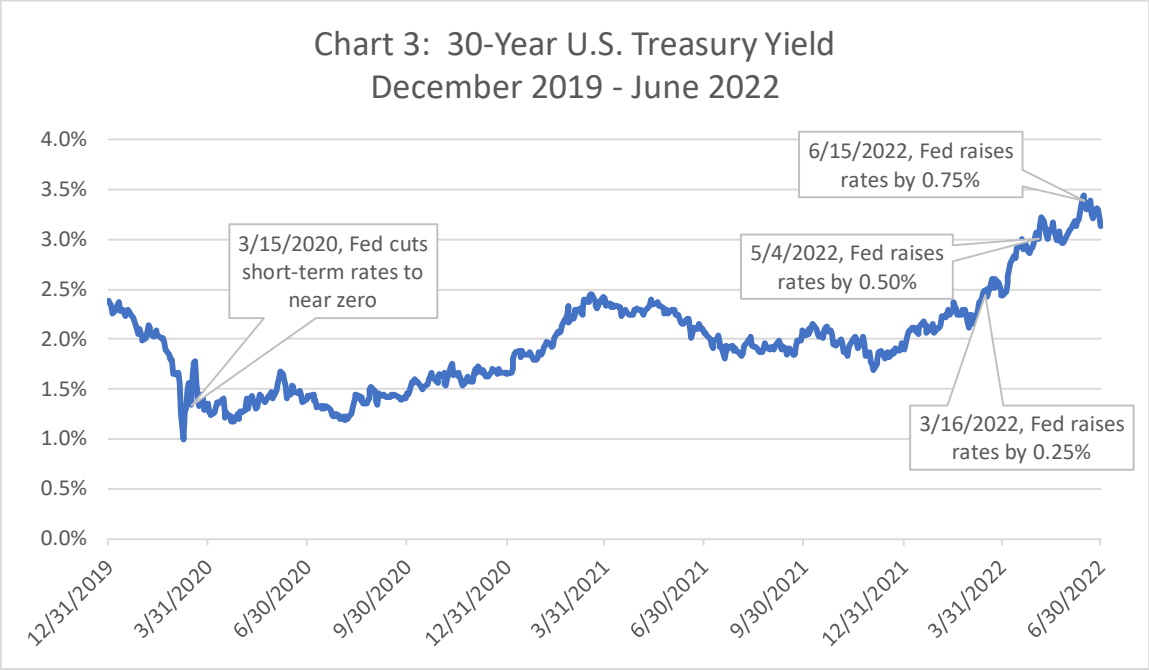
A26. There is a lot of speculation in the news regarding the possibility that recent spikes in inflation will remain and how this will impact capital markets, including interest rates for car loans, mortgages, etc. Inflation may or may not remain high (9.06% as of June 30, 2022)[20], but for the purposes of this proceeding, what matters most is actual, current data of investors' expectations, not the speculations of journalists or economists or utility witnesses. Since February 2022, data shows investors' inflation expectations started to increase, but these expectations started decreasing by the end of March and are now about the same as before Russia invaded Ukraine. As shown on Chart 5 on page 34, the relative market price of inflation-protected bonds as compared to regular Treasury bonds as of June 30, 2022, indicates that investors expected inflation to be 2.58% over the next 5 years and 2.23% over the next 30-years. On the day before Russia started its invasion (February 23, 2022), investors' 5-year inflation expectation was 3.01% and their 30-year inflation expectation was 2.17%.

It's important to remember that interest rates remain at historically low levels despite recent increases. The yield on the 30-year U.S. Treasury bond reached over 15% in 1981 and averaged over 8% in the 1980s and over 6% in the 1990s.[21] As shown on Chart 3 on page 26, yields on 30-year U.S. Treasuries have increased from about 1% on

[20] See YCharts, *U.S. Inflation Rate*, https://ycharts.com/indicators/us_inflation_rate.

[21] The Federal Reserve Bank of St. Louis, *Market Yield on U.S. Treasury Securities at 30-Year Constant Maturity, Quoted on an Investment Basis*, https://fred.stlouisfed.org/series/DGS30.

March 9, 2020 to 3.14% as of June 30, 2022. As expected by investors, in 2022, the Federal Reserve has voted to raise the benchmark federal-funds rate by a quarter percentage point to between 0.25% and 0.5% in March, another 0.5% in April and 0.75% in June. As of June 30, 2022, the Federal Funds rate is 1.50%-1.75%. Higher interest rates, all else equal, generally indicate a higher cost of equity for electric utility companies because fixed income investments become relatively more attractive when they start paying a higher rate (e.g., a bond with an interest rate of 3% is more attractive to investors, all else equal, than when they are paying a 2% rate). However, despite recent increases in interest rates, the stock prices of the companies in the RFC Electric Proxy Group have been significantly outperforming the overall market.



**Q27. HOW DO YOU RESPOND TO SPECULATIONS THAT INTEREST RATES WILL CONTINUE TO INCREASE?**

A27. 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. Analysis of treasury bonds yields demonstrates that investors expect interest rates will not continue to increase. Current long-term interest rates on U.S. Treasuries represent investor's future interest rate expectations because the price of bonds and interest rates move inversely. If investors expected long-term interest rates to increase, as claimed by the Utilities' witnesses, they would be purchasing U.S. Treasury bonds expecting to lose money which is highly unlikely.

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."[22]

The Utilities witnesses have been demonstrably wrong in their past attempts to forecast interest rates. In the 2019 Energy COC proceeding, the Utilities used increased interest rate forecasts that were higher than investor expectations as indicated by market

[22] DANIEL KAHNEMAN, *Thinking Fast and Slow*, p. 212 (2011).

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."[23] It turned out that interest rates declined substantially – so substantially that the CCM adjustment mechanism was triggered. 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.[24]

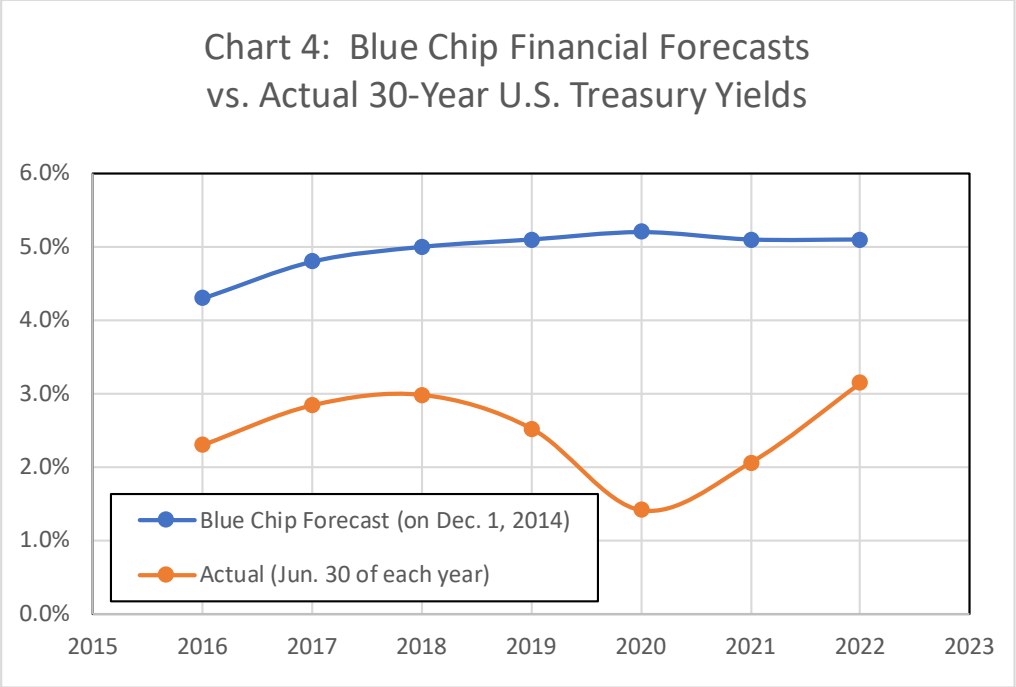
The Utilities continue to rely upon such speculation. SCE's witness Dr. Villadsen, for example, stated in her testimony that she relies upon Blue Chips forecasted yields because, "I do not believe the current yield on long-term Treasury bonds is a good estimate for the risk-free rate that will prevail over the time period relevant to this proceeding."[25]

In fact, Blue Chip's interest rate forecasts have been persistently inaccurate. As Chart 4 on page 29 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 about 3%.

[23] 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 .

[24] *Ibid.*

[25] Dr. Villadsen Direct Testimony, Appendix B: Technical Appendix, Page 6.




The time covered in Chart 4 above was chosen to provide a concrete example of how unreliable Blue Chip forecasts have been. 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."[26] As discussed earlier, some Blue Chip interest rate forecasts have turned out to be correct in recent months. However, it is not reasonable to trust the accuracy of Blue Chip's interest rate forecasts going forward just because of this one example. Interest rates may or may not remain at historically low levels (interest rates remain at historically low levels even after increases in the first 6-months of 2022), but it is safe to say interest rates are

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

unpredictable and utility consumers should not pay higher rates because utility witnesses believe they will increase based on forecasts that have proven to be unreliable.

**Q28. HOW DO RECENT FINANCIAL MARKET DEVELOPMENTS AFFECT THE COST OF EQUITY?**

A28. Capital market data (e.g. stock option prices) indicates that the cost of equity for electric utility companies has decreased relative to the overall market since the onset of the pandemic, with an accelerated decline since Russia invaded Ukraine. The onset of the war in Ukraine has increased market volatility and possibly even increased the cost of equity for the market overall, but Chart 7 on page 38 shows investors volatility expectations[27] for electric utility companies has decreased somewhat relative to the overall market. SCE's authorized ROE should reflect current capital market conditions. In this section, I provide additional capital market data that supports the results of my stock option and other analyses.

Table 8 on page 32 shows a summary of financial markets between December 31, 2019 and June 30, 2022.

- Line 1 of Table 8 shows how the overall stock market (S&P 500) sharply declined during the initial spread of COVID-19, fully recovered, but after regularly reaching new highs in 2021, the S&P 500 is down over 20% in the first 6 months of 2022.

[27] See page 40 for a description of volatility expectations and how they relate to the cost of equity.

- Line 2 shows that interest rates initially declined sharply (30-year U.S. Treasury yields fell from 2.39% to a low of 1.17% on April 24, 2020), bounced back by March 2021, and have since gone above (3.14%) pre-pandemic levels.
- Line 3 shows that in March 2020, investors were demanding an increased credit spread to invest in riskier corporate bonds (151 basis point increase from December 2019 to March 2020), but credit spreads have since come down to only about 30 basis points higher than before pre-pandemic levels.
- Line 4 shows that investors' volatility expectations[28] as measured by the Market Volatility Index (VIX) increased significantly from 13.78 on December 31, 2019 to 75.91 in March 2020 but have since come back down considerably to 28.71 as of June 30, 2022.
- Line 5 shows that stock option prices indicate that the equity risk premium, which also peaked in March and April 2020, has since come down but remains elevated when compared to pre-pandemic levels.
- Lastly, as shown on line 6 of Table 8 and Chart 102 on page 21, option-implied betas for my RFC Electric Proxy Group, which peaked in February 2020, have since decreased to levels below those before the pandemic (0.60 on June 30, 2022 versus 0.74 on December 31, 2019), indicating that investors expect electric utility

[28] See page 40 for a description of volatility expectations and how they relate to the cost of equity.

stock price movements to be less correlated with the overall market than before the pandemic and therefore to be less risky relative to the market.

**TABLE 8: COST OF EQUITY IN TODAY'S FINANCIAL MARKET - SUMMARY**
**MEASURING COVID-19'S IMPACT ON THE COST OF EQUITY**

| | 31-Dec-19 | 19-Feb-20 | 17-Mar-20 | 30-Jun-20 | 31-Dec-20 | 30-Jun-21 | 31-Dec-21 | 30-Jun-22 | |
|---|---|---|---|---|---|---|---|---|---|
| | Pre-Crisis | COVID-19 Crisis | | | | | | | Dec '19 - Jun '22 Delta |
| | | Mkt Peak | Trough | "Recovery" | | | | | |
| 1. Stock Prices (S&P 500) | $3,230.78 | $3,386.15 | $2,529.19 | $3,100.29 | $3,756.07 | $4,297.50 | $4,766.18 | $3,785.38 | **$554.60** |
| *Growth Since 12/31/19* | | *4.8%* | *-21.7%* | *-4.0%* | *16.3%* | *33.0%* | *47.5%* | *17.2%* | |
| 2. Interest Rates (30-Yr) [1] | 2.39% | 2.01% | 1.63% | 1.41% | 1.65% | 2.06% | 1.90% | 3.14% | **0.75%** |
| 3. Credit Spreads (Baa vs. 10-Yr) [2] | 1.98% | 2.05% | 3.49% | 2.93% | 2.18% | 1.87% | 0.00% | 2.31% | **0.33%** |
| 4. Volatility Expectations (30-Day) [3] | 13.78 | 14.38 | 75.91 | 30.43 | 22.75 | 15.83 | 17.22 | 28.71 | **14.93** |
| 5. Market Risk Premium [4] | 4.59% | 4.95% | 9.88% | 8.91% | 8.39% | 6.82% | 8.38% | 7.92% | **3.34%** |
| 6. RFC Electric Proxy Group - Fwd. Beta (6-Mo.) [5] | 0.74 | 0.72 | 0.44 | 0.74 | 0.58 | 0.60 | 0.56 | 0.60 | **-0.14** |

[1] 30-year U.S. Treasury Yield
www.treasury.gov
[2] Baa rated corporate bond yield - 10-year U.S. Treasury Yield
https://fred.stlouisfed.org/series/BAA
https://fred.stlouisfed.org/series/GS10
[3] VIX Index - 30 days
[4] Annualized option-implied market risk premium vs. 30-year Treasury RFR - weighted across all traded expirations
as of last Tuesday before date, assuming 50.0% cumulative probability (median)
[5] Option-implied beta - 6-month, as of last Tuesday before date
Exhibit ALR-4

## A. Inflation

**Q29. IS THERE A WAY TO MEASURE INVESTORS' INFLATION EXPECTATIONS DIRECTLY?**

A29. Yes. It is possible to measure investors' inflation expectations directly simply by subtracting the interest rate of nominal Treasuries and TIPS (Treasury Inflation-Protected Securities) of comparable maturities. This difference is referred to as the "breakeven inflation rate" because it represents what inflation would have to be for an investor to "break even" or make the same return on both nominal Treasuries and TIPS. For example, if the yield on a

nominal 10-year Treasury is 2.5% and TIPS of the same duration are 1.5%, an investor would make the same real return on both bonds if the inflation rate is 1% over the next 10 years.

Nominal yield – real yield = breakeven inflation rate

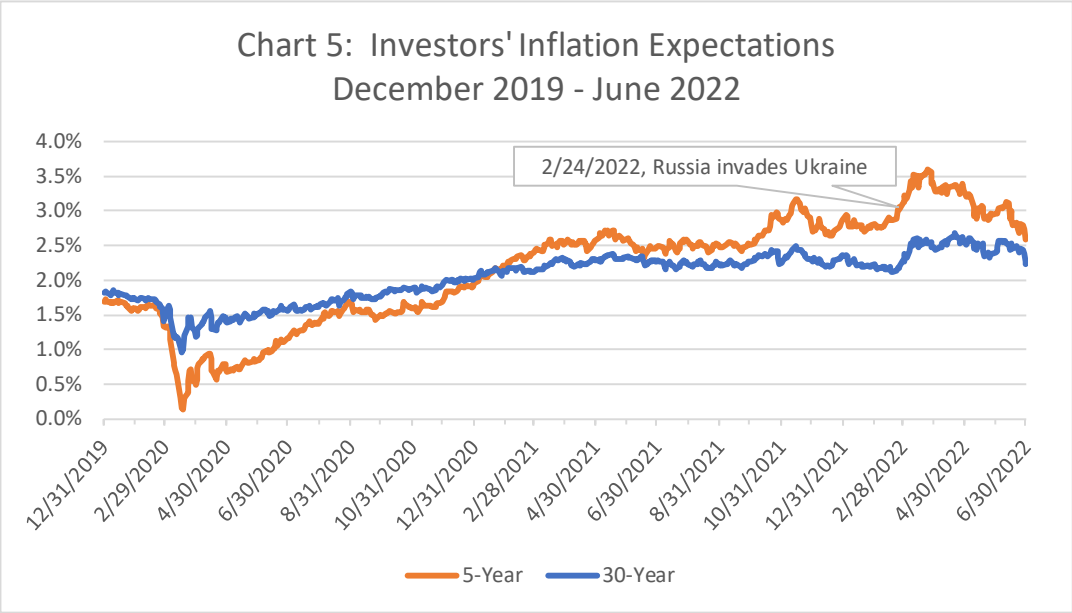
In this example, investors breakeven inflation rate is 1% (2.5% - 1.5%) = 1%

It makes sense that investors' inflation expectation is equal to the breakeven inflation rate because if investors, on average, believed that inflation was going to be 10%, in the example above, they would buy TIPS and expect to make exceptional profits. The investor who purchases TIPS would earn 1.5% + 10% inflation = 11.5%. The investor who purchased the nominal Treasury would lose 7.5% (2.5% yield - 10% inflation rate). With such large relative returns to be made buying TIPS in this hypothetical example, investors would bid up the price of TIPS and drive down the yield until investors expect the same real return on nominal Treasuries and TIPS. And in this way the relationship between the market yields on TIPS vs. nominal Treasury bonds is a self-balancing safe measurement of investors' expectation of inflation.

**Q30. WHAT DOES MARKET DATA INDICATE REGARDING INVESTORS' CURRENT INFLATION EXPECTATIONS?**

A30. As indicated by the difference between nominal-treasures and TIPS, investors' inflation expectations decreased substantially during the height of COVID's impact on capital markets. See Chart 5 on page 34. 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. On 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. Investors' inflation expectations started to increase on February 24, 2022, when the war in Ukraine began. As of March 24, 2022, investors expected the inflation rate over the next 5-years to be 3.57% and 2.53% over the 30-year timeframe. Inflation may or may not increase more than expected by investors, but if it does, SCE can apply for a rate increase at that time. Consumers should not be asked to pay a premium on their utility rates now based on the possibility that inflation will remain elevated because the financial data used in my market-based cost of equity models already reflects investors' expectations regarding inflation.



## B. Volatility Expectations

**Q31. PLEASE DISCUSS CURRENT STOCK PRICE VOLATILITY EXPECTATIONS AND WHAT THEY INDICATE REGARDING THE COST OF EQUITY.**

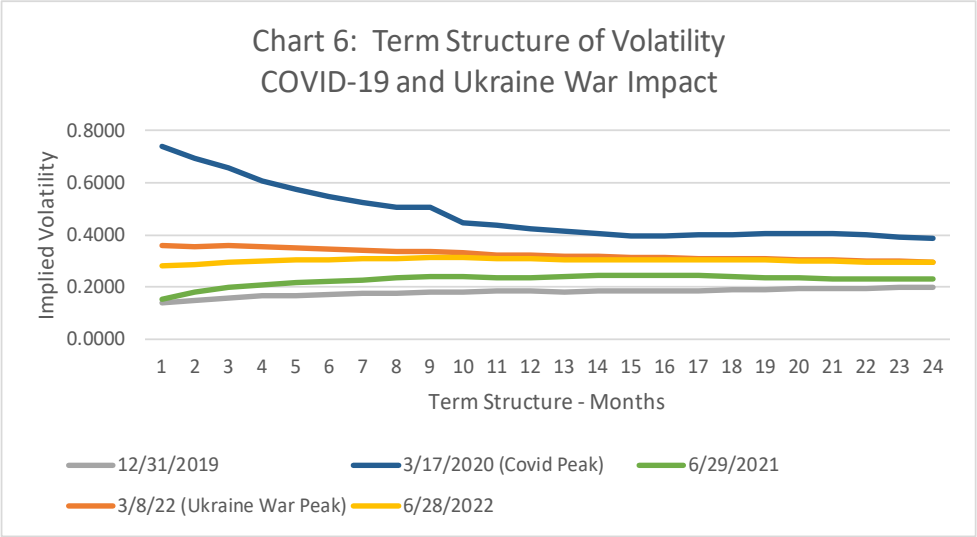
A31. Volatility, uncertainty, and risk are synonymous. There are two primary types of volatility: "realized volatility" and "implied volatility." The former is based on historical returns, which may or may not represent future volatility. On the other hand, implied volatility is calculated from options 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 (i.e., 1 month, 1 year, etc.).

**Q32. PLEASE EXPLAIN THE "TERM STRUCTURE OF VOLATILITY."**

A32. Investors can expect volatility to increase or decrease over time. 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 to be greater than the chance of a 10% (annualized) move over the next 30 days. 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 height of a crisis, when volatility generally tends to rise in the short-term, investors often expect volatility to decrease in coming months or years. During the peak of implied volatility 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 6 below, 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' volatility expectations peaked in March 2020. At that 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 6 also shows that investors' volatility expectations were higher for all time frames when Russia invaded Ukraine as compared to 2021 and remain elevated as of 6/30/2022.



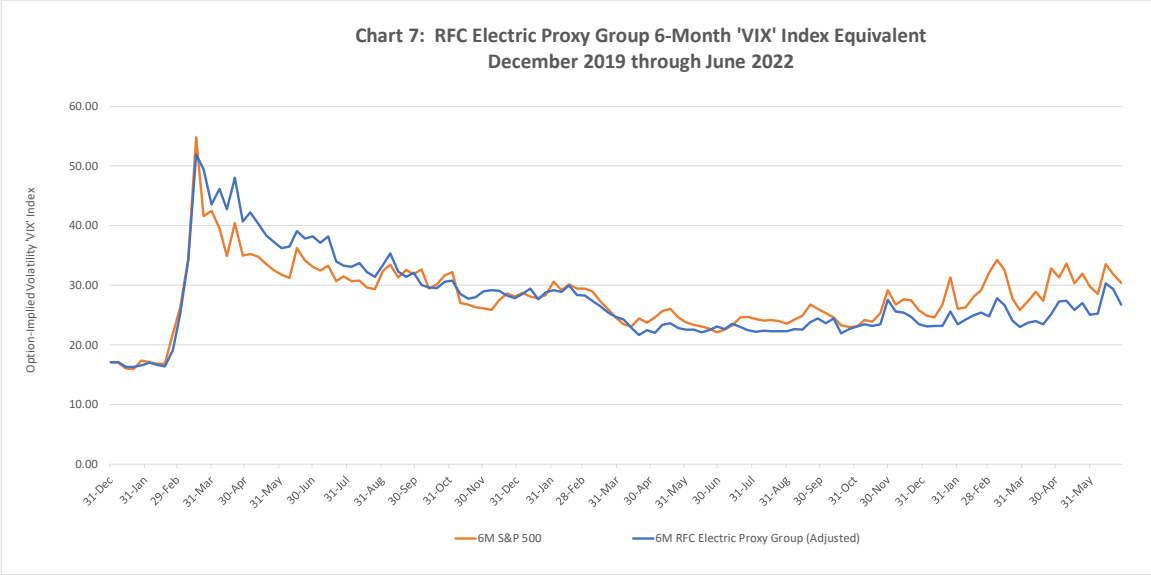

Implied volatility increased as the COVID Omicron variant rapidly spread throughout the world, but by the end of December 2021, implied volatility returned to pre-Omicron levels.

**Q33. HOW HAVE VOLATILITY EXPECTATIONS FOR ELECTRIC UTILITY COMPANIES COMPARED TO VOLATILITY EXPECTATIONS FOR THE S&P 500?**

A33. The solid orange line in Chart 7 on page 38 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 solid orange line show volatility expectations over the next 6 months. In 12/31/2019, 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 6/28/2022, investors expect an annualized change of 28.36%.

The blue line in Chart 7 shows that investors' adjusted[29] 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 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 6/28/2022.

[29] 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 7 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 12/31/2019 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). Investors' expectations regarding the covariance can be done by calculating option-implied betas based on the price of stock options. As discussed below, I use option-implied betas in my CAPM analysis to as part of my cost of equity calculations.

## C. Option-Implied Skewness (Investor-Perceived Downside Risk)

**Q34. YOU EXPLAINED EARLIER THAT STOCK OPTION PRICES REVEALED THAT INVESTORS FOUND THAT THE SYSTEMATIC RISK (AS MEASURED BY OPTION-IMPLIED BETAS) FOR ELECTRIC UTILITY COMPANIES IS LOWER THAN BEFORE THE PANDEMIC AND THAT THIS RELATIONSHIP HAS REMAINED STABLE SINCE THE ONSET OF THE WAR IN UKRAINE. DO STOCK**

**OPTION PRICES PROVIDE ADDITIONAL EVIDENCE THAT THE COST OF EQUITY FOR ELECTRIC UTILITY COMPANIES RELATIVE TO THE OVERALL MARKET HAS DECLINED?**

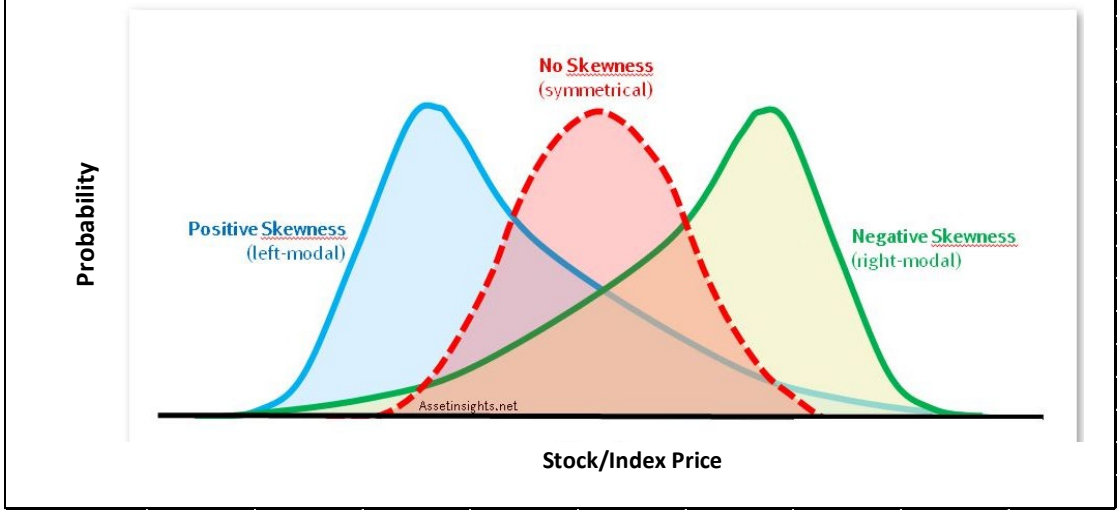
A34. Yes. Option-implied Skewness indicates that the cost of equity for electric utilities has declined relative to the overall stock market during the pandemic. Stock option prices provide considerable information regarding investors' expectations. The most well-known measure of investors' expectations 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 third moment in statistics) is skewness. Option-Implied skewness reflects investors' expectations regarding the asymmetry of the probability distribution.

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. The CBOE also publishes an index based on option-implied skewness referred to as the SKEW Index.

As shown in Chart 8 on page 40, the probability distribution that is negatively skewed has a tail that is longer on the left. A probability distribution with positive skewness has a longer tail on the right. The right and left tails of a probability distribution with no skewness are symmetrical. If the option-implied skewness looked like the red

probability distribution in Chart 8 below it would mean that investors believed there was an equal chance that stock prices would move up or down by a certain amount.

Chart 8: Probability Distributions with and without Skewness

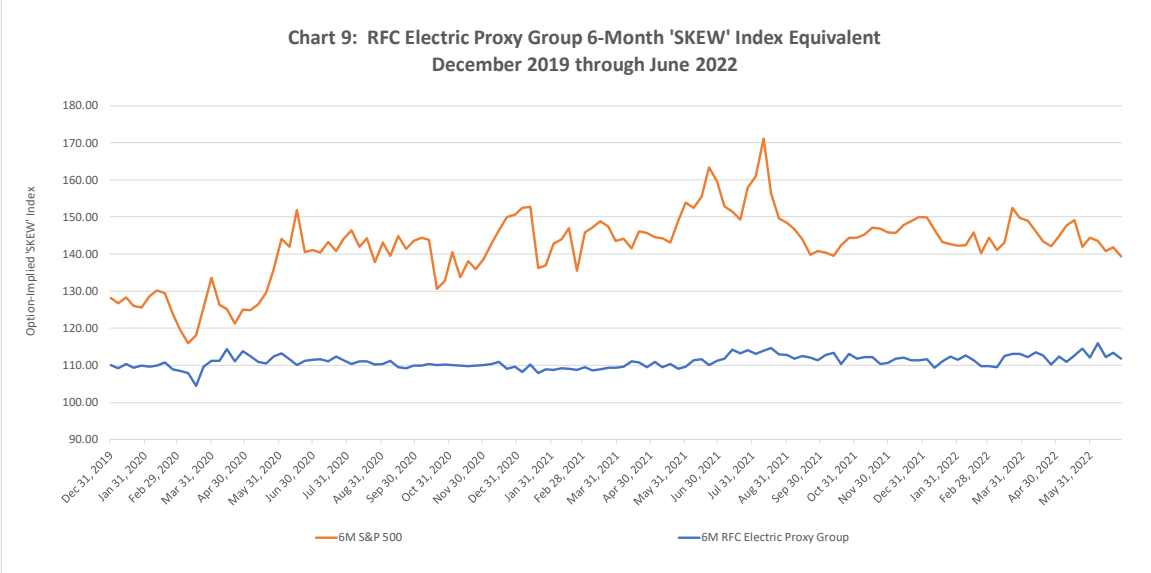



The CBOE also publishes an index based on option-implied skewness referred to as the SKEW Index.

**Q35. WHAT DOES THE SKEW INDEX REVEAL REGARDING THE IMPACT OF THE COVID PANDEMIC AND THE WAR IN UKRAINE ON SCE'S COST OF EQUITY?**

A35. As shown in Chart 9 on page 41, comparing the SKEW Index to an equivalent metric based on electric utility company stock options indicates that since January 2020, investors have expected the chance of electric utility stocks suffering from a large drop in investment is much lower than their expectations the overall market will experience a large drop. This indicates the cost of equity for electric utility companies has likely decreased relative to the overall

market since the onset of the COVID pandemic and this same relationship has remained since Russia invaded Ukraine in February 2022.




Dr. Vilbert claims that the SKEW Index for the entire US equity market "implies that investors perceive higher-than-average tail risk under current market conditions" and "all else equal, investors demand higher risk premiums during more volatile periods.[30] Dr. Villadsen also claims, "SKEW shows that investors expect volatility to continue (for at least a year) and that they are worried about downside risks (as indicated by the very high SKEW level)."[31] These claims are both based upon the SKEW for the entire market which is not the relevant measure in determining investor perceived risk of electric utility companies. No utility witness has provided any analysis of skewness for the electric utilities in this proceeding. Analysis of SKEW for electric utilities, shown on Chart 14 on

[30] Dr. Vilbert's Direct Testimony, Page 35, lines 8-11.

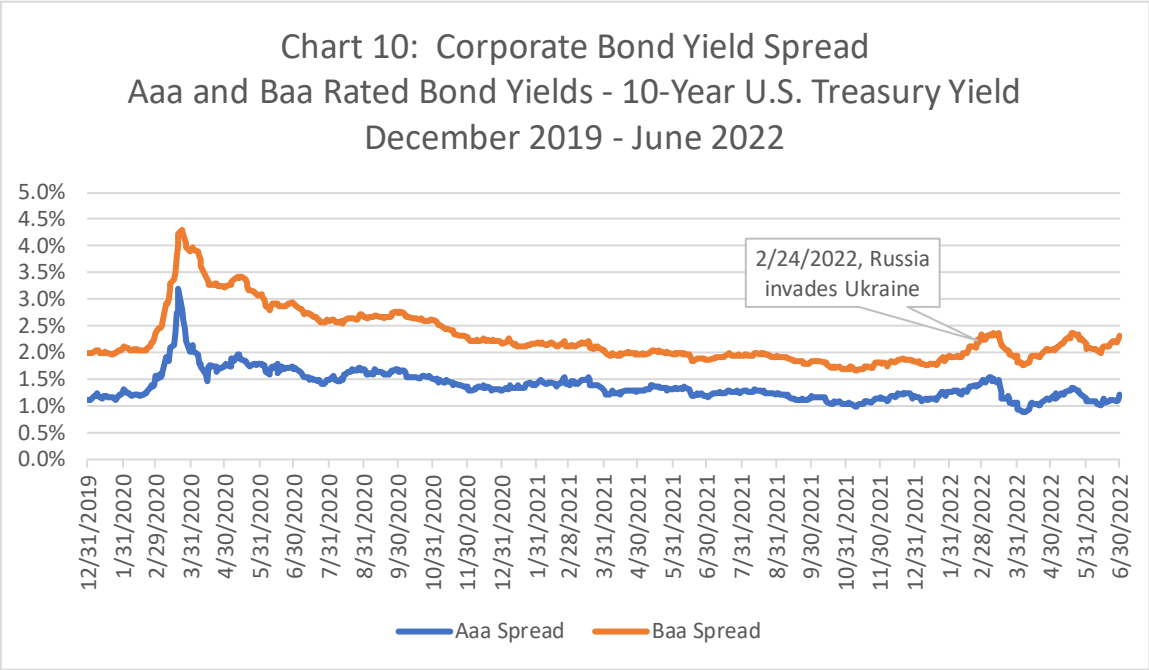
[31] Dr. Villadsen's Direct Testimony, Page 21, lines 2-3.

page 98, tells a very different story than that for the market a whole and it is the SKEW for electric utilities and the comparison between the electric utilities and the market that provides relevant data.

## D. Credit Spreads

**Q36. WHAT DOES AN INCREASING CREDIT SPREAD MEAN FOR THE COST OF EQUITY?**

A36. The yield spread between corporate bonds and U.S. Treasuries can be used as a 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 corporate bonds, they are likely also demanding a higher return to take on the risk of investing in stocks. As shown in Chart 10 on page 43, 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 and are currently about the same as before the pandemic. As of June 30, 2022, the yield spread between Baa Corp bonds and 10-year U.S. Treasuries is 2.31%, about 200 basis points lower than the peak reached in March 2020 and about 30 basis points higher than before the pandemic. The movement of the yield spread indicates that the cost of equity for the overall market is significantly lower than during the peak of the pandemic in 2020, but slightly higher than before the pandemic.




## IV. CAPITAL STRUCTURE AND COST OF DEBT

**Q37. SCE AND PG&E ARE BOTH REQUESTING CAPITAL STRUCTURES WITH A 52% COMMON EQUITY RATIO. SDG&E IS REQUESTING A CAPITAL STRUCTURE WITH A 54% COMMON EQUITY RATIO. ARE THESE REQUESTS APPROPRIATE?**

A37. No. The Utilities' requested capital structures are not appropriate for setting rates in this proceeding for at least two reasons. First, SCE and PG&E are requesting capital structure ratios with significantly more common equity than their holding companies are using to raise

capital. SCE's holding company (EIX) has a common equity ratio of 32%.[32] PG&E's parent has a common equity ratio of about 39%.[33] PG&E's financial risk is higher than it would be if it had a higher common equity ratio. SRE's requested capital structure is relatively reasonable because its holding company (SRE) has a common equity ratio of 52%, only 2% less than its request. Second, the Utilities' requests contain a significantly higher common equity ratio than the average common equity ratio used by other electric utility companies in the country (45.4%).[34]

**Q38. WHAT CAPITAL STRUCTURE DO YOU RECOMMEND BE USED FOR THE UTILITIES' OVERALL COST OF CAPITAL?**

A38. My capital structure recommendations for the Utilities are shown in Table 2 through Table 4 on page 8 and are elaborated upon in the following sections.

**SCE**

**Q39. IS SCE'S REQUESTED REGULATORY CAPITAL STRUCTURE WITH A 52% COMMON EQUITY RATIO APPROPRIATE?**

A39. No. SCE's requested capital structure is not appropriate because (1) it contains a significantly higher percentage of common equity (52%) than is being used to fund its operations (32%) and (2) it contains a significantly higher common equity ratio than is being used by other electric utility companies on average (45.4%). Since equity has a higher cost

[32] Edison International Value Line Report, July 2022.

[33] PG&E's 10Q, July 2022.

[34] Exhibit ALR-5, page 5.

rate than debt, if SCE's requested capital structure is used to set rates, its consumers will be significantly overcharged.

**Q40. PLEASE EXPLAIN HOW YOU DETERMINED THAT SCE'S REQUESTED CAPITAL STRUCTURE CONTAINS A SIGNIFICANTLY HIGHER COMMON EQUITY RATIO THAN IS BEING USED TO FUND ITS OPERATIONS.**

A40. EIX's capital structure, with a common equity ratio of 32%, is highly indictive of the percentage of debt and equity being used to fund SCE's operations. SCE's financial condition and associated bond ratings are highly impacted by EIX. This makes sense because EIX raises equity capital for SCE. The financial relationship between SCE and EIX is evident by comparing the credit ratings and capital structures of EIX and SCE to the credit ratings and capital structure ratios of other electric utilities.

EIX's common equity ratio of only 32% is low by industry standards. The average common equity ratio of the electric utilities in the RFC Electric Proxy Group is 45.4%.

**Q41. DOES EIX'S CAPITAL STRUCTURE IMPACT THE CREDIT RATING OF SCE?**

A41. Yes. The relatively low common equity ratio of EIX is an integral part of why EIX and SCE have relatively low credit ratings. EIX has a BBB credit rating from S&P and a Baa3 rating from Moody's. Just about all the electric companies in Dr. Villadsen's proxy group have higher credit ratings than both EIX and SCE. Eight of the companies in her proxy group have an S&P credit rating of A- or higher and most of the rest have S&P credit ratings of

BBB+.[35] Despite SCE's 52% regulatory capital structure, it has a BBB credit rating from S&P, just like EIX, and a slightly higher credit rating of Baa2 from Moody's. It is therefore apparent that the lower credit rating of SCE is due to the capital structure of EIX.

**Q42. WHY WOULD IT BE UNFAIR TO SCE'S CONSUMERS TO SET A REGULATORY CAPITAL STRUCTURE WITH A 52% COMMON EQUITY RATIO?**

A42. It would be unfair to ratepayers to burden them with the revenue requirement associated with a 52% common equity ratio because EIX's 32% common equity is suppressing its credit rating and therefore increasing SCE's cost of debt. In other words, consumers would be charged for both the high cost SCE's conservative capital structure and the higher cost of debt resulting from EIX's highly-leveraged capital structure. This is neither consistent nor fair to consumers.

**Q43. WHAT REGULATORY CAPITAL STRUCTURE DO YOU RECOMMEND FOR SCE?**

A43. Given these facts, the common equity ratio that should be used to compute the overall cost of capital of SCE should be no higher than the 45.4% average common equity of the RFC Electric Proxy Group. If EIX were to improve its common equity ratio to this level, both its credit rating and the credit rating of SCE would be in line with the credit ratings of the comparative electric companies.

[35] Dr. Villadson's Direct Testimony, Page 31, Figure 8.

**PG&E**

**Q44. PLEASE EXPLAIN WHY PG&E'S REQUESTED CAPITAL STRUCTURE WITH A 52% COMMON EQUITY RATIO IS NOT APPROPRIATE.**

A44. There are huge problems with the capital structure PG&E proposes to use to compute its overall cost of capital in this proceeding. What the Company has proposed to use as the capital structure to compute the overall cost of capital should not be tolerated by the Commission. Instead, the Commission should set policy that maximizes the Company's incentive to lower its financial risk. The biggest problem is as follows: as of June 30, 2022, PG&E had a consolidated capital structure that contained only 39% common equity, yet it wants its utility rates to be computed based on a capital structure containing 52% common equity. The financial risk associated with a 39% common equity ratio is substantially higher than that of a capital structure containing a 52% common equity ratio and no doubt significantly contributes to the higher beta of PG&E's publicly traded common stock. While it would be reasonable for PG&E to actually increase its consolidated common equity ratio up to 52%, using this higher common equity ratio to set rates without having a requirement for the company to first actually increase its consolidated common equity ratio would be wrong because 1) it would be forcing ratepayers to pay the higher revenues without benefiting from being served by a utility company with the materially lower financial risk associated with the higher common equity ratio, and 2) using a common equity ratio to compute the Company's revenue requirement would create a powerful disincentive for the Company to increase its common equity ratio from 39% to 52%.

**Q45. WHY WOULD USING A 52% COMMON EQUITY RATIO TO SET RATES WHEN THE CONSOLIDATED CAPITAL STRUCTURE IS ONLY 39% CREATE A POWERFUL DISINCENTIVE FOR THE COMPANY TO IMPROVE ITS COMMON EQUITY RATIO?**

A45. Using a common equity ratio for regulatory purposes that is materially higher than the consolidated common equity ratio allows the company to earn an equity return on what it is actually financing with debt. At the same time this increased return effectively provides a windfall gain to stockholders at the substantial expense of ratepayers, it puts the company in the position where it would lose the benefit of that excessive return if it really did increase its common equity ratio.

**Q46. WHAT DO YOU PROPOSE?**

A46. Rather than implementing regulatory policy that would provide PG&E with a disincentive to improve its common equity ratio and correspondingly lower its financial risk, I propose that the Commission implement a regulatory framework that would significantly increase the Company's incentive to improve its consolidated common equity ratio. The way to do this would be to set rates now by using the actual consolidated common equity ratio of 39% but providing the Company with a mechanism to increase its rates if and when it actually increases its common equity ratio up to as much as the 52% common equity ratio it has requested for ratemaking purposes. For example, the Commission could permit the Company to receive a rate increase that would be justified by an increase in the common equity ratio at two or three times of its choosing between now and the time of its next rate proceeding. If at those times

the Company can both prove that it has increased its consolidated common equity ratio and does not expect any forecasted bond issuances to lower that common equity ratio, it should be allowed to increase its rates accordingly.

**SDG&E**

**Q47. PLEASE EXPLAIN WHY YOU ARE RECOMMENDING A REGULATORY CAPITAL STRUCTURE WITH A 52% COMMON EQUITY RATIO FOR SDG&E.**

A47. I am recommending a regulatory capital structure with a common equity ratio of 52% based on the common equity ratio of SRE because that is the capital structure being used to raise capital for SDG&E.

# V. COST OF EQUITY CALCULATION

## A. Overview

**Q48. PLEASE PROVIDE AN OVERVIEW OF YOUR PERSPECTIVE REGARDING HOW CAPITAL MARKETS RELATE TO THE COE AND THE OVERALL COST OF CAPITAL.**

A48. The cost of capital is the return investors require to provide capital to the Utilities based on current capital markets. The war in Ukraine and COVID-19 have made it more challenging to determine the current cost of capital because these developments have increased the speed and intensity of capital market change. To measure the cost of equity accurately during rapid change, it is critical to use current market data.

As discussed above, my COE recommendation is my opinion of the return investors require to provide equity capital to the Utilities based on current capital markets. My recommendation is consistent with the following legal standards set by the United States Supreme Court for a fair rate of return that the return to the equity owner should be commensurate with returns on investments in other enterprises having corresponding risks[36] and should be sufficient to support the utility's credit and raise the money necessary for the proper discharge of its public duties.[37]

Because the cost of equity is not a published figure like a bond yield, some interpretation is required to determine the appropriate market price. My cost of equity recommendation is based on my computation of what the market indicates investors require (return on investment) to provide capital to companies with comparable risk to the Utilities.

As explained below, I use current market prices (e.g., stocks, bonds, options), which measure investors' expectations directly, instead of relying solely on historical data and analyst forecasts.

A COE based on market prices (market-based) is superior to a COE based on historical data (non-market-based) for two reasons:

1. The COE that the Utilities have to pay investors is based on capital markets. Interest rates remain at historical low levels after a persistent downtrend since the early 1980s. It is possible interest rates will increase, but if the

[36] *Fed. Power Comm'n v. Hope Nat. Gas Co.* v. Hope Nat. Gas Co., 320 U.S. 591, 603 (1944).

[37] *Bluefield Water Works & Improvement Co. v. Pub. Serv. Comm'n of the State of W. Va*, 262 U.S. 679, 692-693 (1923).

marketplace expected interest rates to change, then that would already be part of current prices.

2. Capital markets are unpredictable. Regarding capital markets' unpredictability, investment guru Warren Buffet recently gave the following advice to investors: "they should not listen to a lot of the jabbering about what the market is going to do tomorrow, or next week or next month because nobody knows."[38]

Current capital markets are our best source of investors' expectations regarding future capital markets. Current market prices of stocks and bonds reflect investors' forecasts for long-term interest rates and capital markets in general. If, indeed, investors in the aggregate should be expecting an increase in interest rates, adding a separate factor for this on top of what is already indicated in market prices would amount to a double count. As I will discuss below, SCE's witness Dr. Villadsen inflates her CAPM results by using interest rate forecasts as a proxy for the risk free rate component of this model. There is no reason to add this separate factor to current interest rates that already reflect investors' expectations.

**Q49. HOW DID YOU ARRIVE AT YOUR COE RECOMMENDATION?**

A49. To arrive at my recommendation, I applied the DCF, including a constant growth and a non-constant growth method and a CAPM analysis to a group of similar companies ("RFC

[38] PBS News Hour, June 26, 2017, *Part 1 – America should stand for more than just wealth, says Warren Buffett,* available at www.pbs.org/newshour/show/pbs-newshour-full-episode-june-26-2017.

Electric Proxy Group") using data available through June 30, 2022, as discussed below. In all of my models, I use both historical averages and the most recently available spot market data for the inputs wherever it is possible and applicable.

**Q50. CONSIDERING THAT STOCK AND OPTION PRICES AND BOND YIELDS CHANGE DAILY, WOULD IT NOT BE BETTER TO USE HISTORICAL AVERAGES EXCLUSIVELY FOR THE INPUTS IN YOUR MODELS?**

A50. Not necessarily. The use of spot market data, the value of a particular input on a particular day, can lead to COE results that can vary over short periods of time. It may therefore be tempting to find a more stable value based on historical averages that are not overly influenced by short-term fluctuations in capital markets. When doing a forward-looking analysis, however, it is equally important to look at the most recent market data as an indication of trends and where a given value is more likely to be in the future. This is a broad and generally accepted principle, as made clear in the following example.

> If Company A's stock price were to go up linearly over the course of one year from $50 to $100, its average stock price over that year would be $75. If Company B's stock price declined linearly from $100 to $50 over the same year, it would have the same exact average stock price of $75. But most people would agree that predicting both stock prices at $75 over the near future would be overly simplistic and leave readily accessible forecasting data unused. Without relying on any additional data, at the very least, it would stand to reason that in the near future, Company A's stock price is more likely to be between $75 and $100 than Company B's stock price, and that Company B's stock price

is more likely to be between $50 and $75 than Company A's stock price. These observations cannot be made by looking at the yearly averages alone and must take the most recent data into consideration.

It is important to consider both averages and recent market data for forward-looking analyses. That is precisely my approach when using market data that are expected to continue to fluctuate, such as stock prices, dividend yields, betas, and market risk premia.

**Q51. CAN A DIFFERENCE OF ONE DAY IN THE SELECTION OF SPOT MARKET DATA HAVE A SIGNIFICANT POSITIVE OR NEGATIVE EFFECT ON ROE RESULTS? IF SO, HOW DO YOU GO ABOUT CHOOSING WHICH DAY TO USE FOR MARKET-BASED SPOT MARKET DATA?**

A51. Daily fluctuations in stock prices, resulting dividend yields, betas, etc., all have an impact on resulting ROE calculations, especially when using recent spot values for market data. Such is the nature of market data, which changes from day to day. This is rightfully noted as a potential risk of using spot market data, but given the stated benefits of using recent spot market data for forward-looking analyses, there are ways to address such potential pitfalls.

For this reason, it is very important to establish consistent methodologies that eliminate the possibility of personal bias, especially when using spot market data. I consistently use the last trading day of the last full calendar month before my schedule preparations for all market-based spot market data and as the last day for all historical market-data averages.

It is important to keep in mind that even averages fluctuate over time, and all responsible data analysts must find a consistent and reproducible way to "freeze time" to work with such fluctuations while eliminating bias.

It is also important to point out once again that I use recent spot market-data to establish one benchmark for market-based inputs, which are balanced by the use of historical averages, as stated previously.

## B. Proxy Group Selection

**Q52. PLEASE EXPLAIN HOW YOU SELECTED THE COMPANIES IN YOUR COMPARABLE PROXY GROUP?**

A52. My comparable proxy group, shown in Table 9 on page 55 and referred to as the RFC Electric Proxy Group, consists of the following 26 publicly traded electric utility companies covered by Value Line:

**TABLE 9: RFC ELECTRIC PROXY GROUP COMPOSITION**

| | Company Name | Ticker |
|---|---|---|
| 1 | AMEREN | AEE |
| 2 | AMERICAN ELEC. PWR. | AEP |
| 3 | ALLETE | ALE |
| 4 | AVISTA CORP. | AVA |
| 5 | BLACK HILLS CORP. | BKH |
| 6 | CMS ENERGY CORP. | CMS |
| 7 | CENTERPOINT EN'RGY | CNP |
| 8 | DOMINION ENERGY | D |
| 9 | DUKE ENERGY | DUK |
| 10 | ENTERGY CORP. | ETR |
| 11 | EVERGY, INC. | EVRG |
| 12 | IDACORP, INC. | IDA |
| 13 | ALLIANT ENERGY | LNT |
| 14 | MGE ENERGY INC. | MGEE |
| 15 | NEXTERA ENERGY | NEE |
| 16 | NORTHWESTERN | NWE |
| 17 | OGE ENERGY CORP. | OGE |
| 18 | OTTER TAIL CORP. | OTTR |
| 19 | P.S. ENTERPRISE GP. | PEG |
| 20 | PINNACLE WEST | PNW |
| 21 | PORTLAND GENERAL | POR |
| 22 | PPL CORPORATION | PPL |
| 23 | SOUTHERN COMPANY | SO |
| 24 | SEMPRA ENERGY | SRE |
| 25 | WEC ENERGY GROUP | WEC |
| 26 | XCEL ENERGY | XEL |

I selected this proxy group to meet the Commission screens for selecting a comparable proxy group, excluding companies that: (1) do not have investment grade credit ratings; (2) do not have a history of paying dividends; and, (3) are undergoing a restructure or

merger.[39] These companies are all in the Value Line electric industry classification, have operational characteristics similar to the Applicant utilities, and are exposed to comparable risks. I also selected this proxy group to streamline the Commission's review by using a proxy group that is the same as one of the proxy groups used by Dr. Villadsen for SCE and Dr. Vilbert for PG&E.[40]

**Q53. HAVE THE UTILITIES WITNESSES SELECTED PROXY GROUPS BASED UPON THE COMMISSIONS STANDARDS?**

A53. No, the utilities witnesses have not selected proxy groups that meet the Commission standards. The Commission should disregard any conclusions that utility witnesses draw from proxy groups that do not meet the Commission screens or apply additional unjustified screens, including the groups designed by Dr. Villadsen and Dr. Vilbert and Dr. Coyne. While Dr. Vilbert and Dr. Villadsen do each use an appropriate proxy group, they also rely upon other inappropriate proxy groups.

Dr. Vilbert claims that "Two factors alone eliminate PG&E from the sample of comparable utilities: PG&E does not have an investment grade issuer credit rating and is not currently paying dividends (PG&E may be eligible to resume dividends in mid-2023)."[41] It is true

[39] See D.19-12-056 at p. 16.

[40] Like Dr. Villadsen, I do not include Edison International in my proxy group. Dr. Vilbert includes Edison International in his proxy group.

[41] Dr. Vilbert Testimony at p. 2-2.

that PG&E does not have an investment grade issuer credit rating but PG&E appears to have paid some dividends in 2022.[42] Dr. Vilbert describes an additional proxy group he created from "a sample of regulated companies from two additional industries: gas local distribution companies (LDC) and water distribution utilities (Gas LDC and Water Sample) to provide additional information on the cost of equity for highly regulated, capital-intensive companies."[43] In the last cost of capital decision, Dr. Vilbert made a similar attempt for PG&E to form a proxy group from "companies in capital intensive, network industries (CINI), and provided ROE estimates for subsets of the CINI Sample: regulated electric utilities; regulated water and gas local distribution utilities; non-electric utilities; and, a non-regulated group of CINI companies."[44] The Commission found, "We agree that PG&E's inclusion of CINI companies was inappropriate and counter to established policy for developing a proxy group of comparison companies."[45]

Dr. Villadsen also created an inappropriate proxy group for SCE composed of natural gas or water services companies. There was no support for her use of natural gas and water companies in the last cost of capital decision. Instead, the Commission concluded as a matter of law, that "Value Line electric industry

[42] PG&E Corp, *Shareholder Dividend Payments,* https://investor.pgecorp.com/shareholders/dividend-information/default.aspx .

[43] Dr. Vilbert Testimony at p. 2-2.

[44] D.19-12-056 at pp. 16-17.

[45] D.19-12-056 at pp. 16-17.

classifications should continue to be used in ROE proceedings where financial models require the use of a proxy group."[46]

Mr. Coyne relies entirely upon a proxy group of 20 companies subject to screening additional to the Commission's standards[47], as SDG&E did in the last cost of capital proceeding where the Commission found, "we agree that the applicants selectively established a proxy group of companies and will review the model results with this in mind."[48]

## C. Discounted Cash Flow

**Q54. PLEASE SUMMARIZE THE RESULTS OF YOUR DCF MODELS.**

A54. I used both the constant growth form of the DCF method, which determines growth based on the sustainable retention growth procedure, and a non-constant growth DCF method. My constant growth form DCF analysis indicates a COE range of between 7.92% and 8.02% for the RFC Electric Proxy Group.[49] The results of my non-constant growth DCF method indicate a COE of between 8.21% and 8.21% for the RFC Electric Proxy Group.[50]

[46] D.19-12-056 at p. 53 (Conclusion of Law 10).

[47]

[48] D.19-12-056 at p. 20

[49] Exhibit ALR-3, page 1.

[50] Exhibit ALR-3, page 3 and Exhibit ALR-3, page 4.

**Q55. WHAT IS THE DISCOUNTED CASH FLOW METHOD?**

A55. The DCF method is an approach to determining the COE. The method recognizes that investors purchase common stock to receive future cash payments. These payments come from: (a) current and future dividends, and (b) proceeds from selling stock. A rational investor will buy stock to receive dividends and to ultimately sell the stock to another investor at a gain. The price the new owner is willing to pay for stock is related to that buyer's expectation of future flow of dividends and the future expected selling price. The value of the stock is the discounted value of all future dividends until the stock is sold plus the value of proceeds from the sale of the stock.

**Q56. HAVE INVESTORS ALWAYS USED THE DCF METHOD?**

A56. While investors who buy stock have always done so for future cash flow, the DCF approach first appeared in the 1937 Harvard Ph.D. thesis of John Burr Williams titled *The Theory of Investment Value*. Author Peter L. Bernstein once stated that "Williams' model for valuing a security calls for the investor to make a long-run projection of a company's future dividend payments…"[51] The Williams DCF model separately discounts each and every future expected cash flow. Dividends and proceeds from the sale of stock are the expected cash flows. Its accuracy is therefore unaffected by non-constant growth rates. Myron Gordon and Eli Shapiro, who helped to make this method widely used, referred to Williams' work in their paper published in 1956 "*Equipment Analysis: The Required Rate of Profit*."

[51] P. BERNSTEIN, *Capital Ideas: The Improbable Origins of Modern Wall Street* (The Free Press, © 1992).

## D. Constant Growth Form of the DCF Model

**Q57. YOU STATE YOU USED THE CONSTANT GROWTH FORM OF THE DCF MODEL. WHAT IS THE CONSTANT GROWTH FORM OF THE DCF MODEL?**

A57. The constant growth form of the DCF model is a form of the DCF method that can be used in determining the COE when investors can reasonably expect that the growth of retained earnings and dividends will be constant.

Retained earnings are funds that a company keeps in its treasury, so that they are available for future needs, such as operating expenses, capital expenditures, debt payments, and new investments. These retained earnings show investors whether the company is growing, which, in turn, is a measure of the future indicator of dividends and the value of a company's stock.

**Q58. DESCRIBE HOW THE CONSTANT GROWTH MODEL WORKS.**

A58. The constant growth model is described by this equation k= D/P + g, where: [52]

k= cost of equity (COE);
D=Dividend; and
P=Market price of stock at time of the analysis

and where:

g=the growth rate, where g= br + sv;
b=the earnings retention rate;
r=return on common equity investment (referred to below as "book equity");
v=the fraction of funds raised by the sale of stock that increases the book value of the existing shareholders' common equity; and
s=the rate of continuous new stock financing

[52] M. GORDON, *Cost of Capital to a Public Utility*, p. 32-33 (MSU Public Utility Studies 1974).

The constant growth model is therefore correctly recognized to be:

$k=D/P + (br +sv)$

The COE demanded by investors is the sum of two factors. The first factor is the dividend yield. The second factor is growth (dividends and stock price). The logical relationship among these factors is as follows: the dividend yield is calculated based on current dividend payments while growth indicates what dividends and stock price will be in the future.

**Q59. WHAT OTHER FACTORS IMPACT HOW ONE USES THE CONSTANT GROWTH FORM OF THE DCF MODEL?**

A59. Sufficient care must be taken to be sure that the growth rate "g" is representative of the constant sustainable growth. To obtain an accurate constant growth DCF result, the mathematical relationship between earnings, dividends, book value and stock price must be respected.

The basic difference between the use of an analysts' earnings per share growth rate in the constant growth DCF formula and using the "br" (**b** (the earnings retention rate) X **r** (rate of return on common equity investment)) approach is that the "br" form, if properly applied, eliminates the mathematical error caused by an inconsistency between the expectations for earnings per share growth and dividends per share growth. Because it eliminates that error, the results of a properly applied "br" approach will be superior to the answer obtained from other approaches to the constant growth form of the DCF model. This is not to say that even a properly applied "br" approach will be perfect. The self-

correcting nature of a properly applied "br" to forecasted differences in earnings per share and dividends per share growth rates helps to mitigate the resultant error but should not be viewed as the perfect way to quantify the impact of expected non-constant growth rates.

**Q60. ARE YOU AWARE OF CLAIMS ALLEGING THAT THE "BR" APPROACH TO THE CONSTANT GROWTH DCF MODEL IS FLAWED BECAUSE IT RELIES ON THE VALUE OF THE FUTURE EXPECTED RETURN ON BOOK EQUITY "R" TO ESTIMATE WHAT THE EARNED RETURN ON EQUITY SHOULD BE?**

A60. Yes. One common criticism of the "br" approach to the constant growth DCF model is that it is not reasonable for the DCF to indicate a COE (market return) that is different (lower or higher) than the expected return on book equity (accounting). There are multiple reasons why this concern is unfounded:

1. The constant growth form of the equation using "br" is:

$$k = D/P + (br + sv)$$

In this equation, "k" is the variable for the COE, and "r" is the future expected return on equity. The COE, "k," is not the same variable as the future expected earned return on equity, "r." In fact, there often is a large difference between the two.

2. The correct value to use for "r" is the return on book equity expected by investors as of the time the stock price and dividend data are used to quantify the D/P term in the equation. Therefore, even if future events occur

that may change what investors expect for "r," the computation of the COE "k" remains correct as of the time the computation was made.

3. The ability of a commission's ROE decision to influence future cash flow expectations is not unique to the retention growth DCF approach. The five-year analysts' earnings per share growth rate is a computation that is directly influenced by what earnings per share will be in 5 years. Allowed ROEs impact earning – higher allowed returns lead to higher earnings growth because the higher allowed returns the more earnings are available for reinvestment.

**Q61. CAN CHANGES IN THE ACTUAL EARNED RETURNS IMPACT GROWTH ABOVE AND BEYOND WHATEVER GROWTH RESULTS FROM EARNINGS RETENTION?**

A61. Yes, but large short-term changes in earnings per share caused by a perceived change in the future expected earned returns are unsustainable. The new perceived earned return on book equity should be part of the computation, but the one-time growth spurt to get there is no more indicative of the sustainable growth required in the constant growth DCF formula than the temporary negative growth that occurs when a company has a bad year.

**Q62. HOW HAVE YOU IMPLEMENTED THE CONSTANT GROWTH FORM OF THE DCF MODEL IN THIS CASE?**

A62. I have applied the constant growth form of the DCF model by staying true to the mathematically derived "k=D/P + (br + sv)" form of the DCF model. I have also taken care to

fully allocate all future expected earnings to either future cash flow in the form of dividends ("D") or to retained earnings (the retention rate, "b"). This extra accuracy is obtained only when the retention rate "b" is derived from the values used for "D" and "r," rather than independently.

**Q63. PLEASE EXPLAIN HOW YOU OBTAINED THE VALUES YOU USED IN THE CONSTANT GROWTH FORM OF THE DCF METHOD.**

A63. The DCF model generally calls for the use of the dividend expected over the next year. A reasonable way to estimate next year's dividend rate is to increase the quarterly dividend rate by half of the current actual quarterly dividend rate. This is a good approximation of the rate that would be obtained if the full prior year's dividend were escalated by the entire growth rate.[53]

I obtained the stock price—"P"—used in my DCF analysis from the closing prices of the stocks on June 30, 2022. I also obtained an average stock price for the 12 months ending June 30, 2022 by averaging the high and low stock prices for the year.

[53] For example, assume a company paid a dividend of $0.50 in the first quarter a year ago, and has a dividend growth rate of 4 % per year. This dividend growth rate equals (1.04)^4-1=0.00985 % per quarter. Thus, the dividend is $0.5049 in the second quarter, $0.5099 in the third quarter, and $0.5149 in the fourth quarter. If that 4 % per annum growth continues into the following year, then the dividend would be $0.5199 in the 1st quarter, $0.5251 in the 2nd quarter, $0.5303 in the 3rd quarter, and $0.5355 in the 4th quarter. Thus, the total dividends for the following year equal $2.111 (0.5199 + 0.5251 + 0.5303 + 0.5355). I computed the dividend yield by taking the current quarter (the $0.5149 in the 4th quarter in this example) and multiplying it by 4 to get an annual rate of $2.06. I then escalated this $2.06 by half the 4 % growth rate, which means it is increased by 2 %. $2.06 x 1.02= $2.101, which is within one cent of the $2.111 obtained in the example.

I based the value of the future expected return on equity— "r" —on the average return on book equity expected by Value Line, adjusted in consideration of recent returns. I also made a computation that was based on a review of both the earned return on equity consistent with analysts' consensus earnings growth rate expectations and on the actual earned returns on equity. For a stable industry such as utility companies, investors will typically look at actual earned returns on equity as one meaningful input into what can be expected for future earned returns on book equity. See Exhibit ALR-3, page 1.

This return on book equity expectation used in the DCF method to compute growth must *not* be confused with the COE. Since the stock prices for the comparative companies are substantially higher than their book value, the return investors expect to receive on their market price investment is considerably less than the anticipated return on book value. If the market price is low relative to book value, the COE will be higher than the future expected return on book equity, and if the market price is high, then the return on book equity will be less than the COE.

In addition to growing through the retention of earnings, utility companies also grow by selling new common stock. Selling new common stock increases a company's growth. I quantified this growth caused by the sale of new common stock by multiplying the amount that the actual market-to-book ratio exceeds 1.0, by the compound annual growth rate of stock that Value Line forecasts. The results of that computation are shown on line 4 of Exhibit ALR-3, page 1.

Pure financial theory prefers concentrating on the results from the most current price because investors cannot purchase stock at historical prices. There is a legitimate

concern, however, about the potential distortion of using just a single price. I present DCF results based on the most recent stock pricing data (June 30, 2022) as well as the average of the high and low stock price over the past 12 months to obtain a range of reasonable values. As shown in Exhibit ALR-3, page 1, the DCF result based on the average of the high and low stock price for the year ending June 30, 2022 is 7.92%. The DCF result based on the stock price as of June 30, 2022 is 8.02%. Exhibit ALR-3, page 1, shows more of the specifics of how I implemented the constant growth form of the DCF model for the RFC Electric Proxy Group.

**Q64. PLEASE EXPLAIN HOW YOU DETERMINED WHAT VALUE TO USE FOR "R" WHEN COMPUTING GROWTH IN YOUR CONSTANT GROWTH FORM OF THE DCF MODEL.**

A64. The inputs I considered are shown in Footnote [C] of Exhibit ALR-3, page 1. The value of "r" that is appropriate to use in the DCF formula is the value anticipated by investors to be maintained on average in the future. This Exhibit shows that the average future return on equity forecasted by Value Line for the RFC Electric Proxy Group between 2022 and 2025-27 is 10.68%. The same footnote also shows that the future expected return on equity derived from the Zacks consensus forecast is 10.41%, and that the actual returns on equity earned by the RFC Electric Proxy Group on average were 10.55% in 2019, 9.92% in 2020, and 9.93% in 2021. Based on the combination of the forecasted return on equity derived from the Zacks

consensus, the recent historical actual earned returns, and Value Line's forecast, I made the DCF growth computation using a 10.40%[54] value of "r".

**Q65. WHAT COE IS INDICATED BY THE CONSTANT GROWTH FORM OF THE DCF METHOD THAT YOU RELY ON FOR YOUR RECOMMENDATION?**

A65. The result of my DCF analysis using the constant growth form of the DCF indicates a COE range of between 7.92% and 8.02% for the RFC Electric Proxy Group.[55] Since these DCF findings use analysts' forecasts to derive sustainable growth (in part) and on analysts' forecasts of dividend growth and book value growth in the non-constant form of the DCF method, the results should be considered as conservatively high. This is because, as previously mentioned above, analysts' forecasts of such growth have been notoriously overstated.

My results are not as influenced by overly-optimistic analysts' forecasts as would have been the case had I merely used analysts' five-year earnings growth rate forecasts as a proxy for long-term growth, like Dr. Villadsen did. This is because the DCF methods I use compute sustainable growth rates, rather than growth rates that can exaggerate the growth rate due to assuming that a relatively short-term forecast (5 years) will remain indefinitely.

[54] I used 10.40% in consideration of historical returns, Zacks's projections, and Value Line projected returns for the RFC Electric Proxy Group.

[55] Exhibit ALR-3, page 1.

## E. Non-Constant Growth Form of the DCF Model

**Q66. PLEASE EXPLAIN HOW YOU IMPLEMENTED THE NON-CONSTANT GROWTH FORM OF THE DCF MODEL.**

A66. The non-constant growth form of the DCF model determines the return on investment expected by investors based on an estimate of each separate annual cash flow the investor expects to receive. For the purpose of this computation, I have incorporated Value Line's detailed annual forecasts to arrive at the specific non-constant growth expectations that an investor who trusts Value Line would expect. This implementation is shown on Exhibit ALR-3, page 3 and Exhibit ALR-3, page 4. In the first stage, cash flow entry is the cash outflow an investor would experience when buying a share of stock at the market price. The subsequent years of cash flow are equal to the dividends per share that Value Line forecasts. For the intermediate years of the forecast period in which Value Line does not provide a specific dividend, the annual dividends were obtained by estimating that dividend growth would persist at a compound annual rate. The cash flow at the end of the forecast period consists of both the last year's dividend forecast by Value Line, and the proceeds from the sale of the stock. The stock price used to determine the proceeds from selling the stock was obtained by estimating that the stock price would grow at the same rate at which Value Line forecasts book value to grow.

**Q67. WHY DID YOU USE BOOK VALUE GROWTH TO PROVIDE THE ESTIMATE OF THE FUTURE STOCK PRICE?**

A67. For any given earned return on book equity, earnings are directly proportional to the book value. Furthermore, book value growth is the net result after the company produces earnings, pays a dividend and also, perhaps, either sells new common stock at market price or repurchases its own common stock at market price.

Once these cash flows are entered into an Excel spreadsheet, the compound annual return an investor would achieve as a result of making this investment was obtained by using the Internal Rate of Return (IRR) function built into the spreadsheet. As shown on Exhibit ALR-3, page 3 and Exhibit ALR-3, page 4, this multi-stage DCF model produced an average indicated COE of 8.21% based on the year-end stock price, and 8.21% based on average prices for the year ending June 30, 2022 for the RFC Electric Proxy Group.

**Q68. YOUR NON-CONSTANT GROWTH DCF MODEL USES ANNUAL EXPECTED CASH FLOWS. SINCE DIVIDENDS ARE PAID QUARTERLY RATHER THAN ANNUALLY, HOW DOES THIS SIMPLIFICATION IMPACT YOUR RESULTS?**

A68. I used the annual model because it is easier for observers to visualize what is happening. By modeling cash flows to be annual rather than when they are actually expected to occur causes a small overstatement of the COE.

**Q69. WHY IS IT A SMALL OVERSTATEMENT OF THE COE IF YOU HAVE MODELED DIVIDENDS TO BE RECEIVED SOME MONTHS AFTER INVESTORS ACTUALLY EXPECT TO RECEIVE THEM?**

A69. The process of changing from an annual model to a quarterly model would require two changes, not just one. A quarterly model would show dividends being paid sooner and would also show earnings being available sooner. A company that receives its earnings sooner, rather than at the end of the year, has the opportunity to compound them. Since revenues, and therefore earnings, are essentially received every day, a company that is supposed to earn an annual rate of 9.00% on equity would have to earn only 8.62% if the return were compounded daily.[56] This reduction from 9.00% to 8.62% would then be partially offset by the impact of the quarterly dividend payment to bring the result of switching from the simplifying annual model closer to, but still a bit below 9.00%.

**Q70. BY USING CASH FLOW EXPECTATIONS AS THE VALUATION PARAMETER, DOES THE NON-CONSTANT DCF MODEL STILL RELY ON EARNINGS?**

A70. Yes. It relies on an expectation of future cash flows. Future cash flows come from dividends during the time the stock is owned and capital gains from the sale of the stock once it is sold. Since earnings impact both dividends and stock price, the non-constant DCF model still relies on earnings.

[56] (1+.0862/365)^365=1.09=9.00 %.

Every dollar of earnings is used for the benefit of stockholders, either in the form of a dividend payment, or earnings reinvested for future growth in earnings and/or dividends. Earnings paid out as a dividend have a different value to investors than earnings retained in the business. Recognizing this difference and properly considering it in the quantification process is a major strength of the DCF model and is why the non-constant DCF model as I have set forth is an improvement over either the price-to-earnings ratio (P/E ratio) or dividend/price (D/P) methods. Comparing the P/E ratios and the dividend yield (D/P) are helpful as a rule of thumb, but they must be used with caution because, among other reasons, two companies with the same dividend yield can have a different COE if they have different retention rates. A DCF model is more reliable than these rules of thumb because it can account for different retention rates, among other factors.

**Q71. WHY IS THERE A DIFFERENCE TO INVESTORS IN THE VALUE OF EARNINGS PAID OUT AS A DIVIDEND COMPARED TO THE VALUE OF EARNINGS RETAINED IN THE BUSINESS?**

A71. The return on earnings retained in the business depends upon the opportunities available to that company. If a regulated utility reinvests earnings in needed "used and useful" utility assets, then those reinvested earnings have the potential to earn at whatever return is consistent with ratemaking procedures allowed and the skill of management in prudently operating the system.

When an investor receives a dividend, she can either reinvest it in the same or another company or use it for other things, such as paying down debt or paying living

expenses. Although an investor could theoretically use the proceeds from any dividend payments to simply buy more stock in the same company, when an investor increases her investment in a company by purchasing more stock, the transaction occurs at market price. However, when the same investor sees her investment in a company increase because earnings are retained rather than paid as a dividend, the reinvestment occurs at book value. Stated within the context of the DCF terminology: earnings retained in the business earn at the future expected return on book equity "r," and dividends used to purchase new stock earn at the rate "k." When the market price exceeds book value (that is, the market-to-book ratio exceeds 1.0), retained earnings are worth more than earnings paid out as a dividend because "r" will be higher than "k." Conversely, when the market price is below book value, "k" will be higher than "r," meaning that earnings paid out as a dividend earn a higher rate than retained earnings.

**Q72. IF RETAINED EARNINGS WERE MORE VALUABLE WHEN THE MARKET-TO-BOOK RATIO IS ABOVE 1.0, WHY WOULD A COMPANY WITH A MARKET-TO-BOOK RATIO ABOVE 1.0 PAY A DIVIDEND RATHER THAN RETAIN ALL OF THE EARNINGS?**

A72. Retained earnings are more valuable than dividends only if there are sufficient opportunities to profitably reinvest those earnings. Regulated utility companies are allowed to earn the cost of capital only on assets that are used and useful in providing utility service. Investing in assets that are not needed may not produce any return at all. For unregulated

companies, opportunities to reinvest funds are limited by the demands of the business. For example, how many new computer chips can Intel profitably develop at the same time?

**Q73. UNDER THE NON-CONSTANT DCF MODEL, IS IT NECESSARY FOR EARNINGS AND DIVIDENDS TO GROW AT A CONSTANT RATE FOR THE MODEL TO BE ABLE TO ACCURATELY DETERMINE THE COST OF EQUITY?**

A73. No. Because the non-constant form of the DCF model separately discounts each and every future expected cash flow, it does *not* rely on any assumptions of constant growth. The dividend yield can be different from period to period, and growth can bounce around in any imaginable pattern without harming the accuracy of the answer obtained from quantifying those expectations. When the non-constant DCF model is correctly used, the answer obtained is as accurate as the estimates of future cash flow.

**Q74. WHAT COST OF EQUITY DOES YOUR NON-CONSTANT GROWTH DCF METHOD INDICATE?**

A74. My non-constant growth DCF method indicates a cost of equity of between 8.21% and 8.21%.[57]

[57] Exhibit ALR-3, page 3 and Exhibit ALR-3, page 4.

## F. Capital Asset Pricing Model

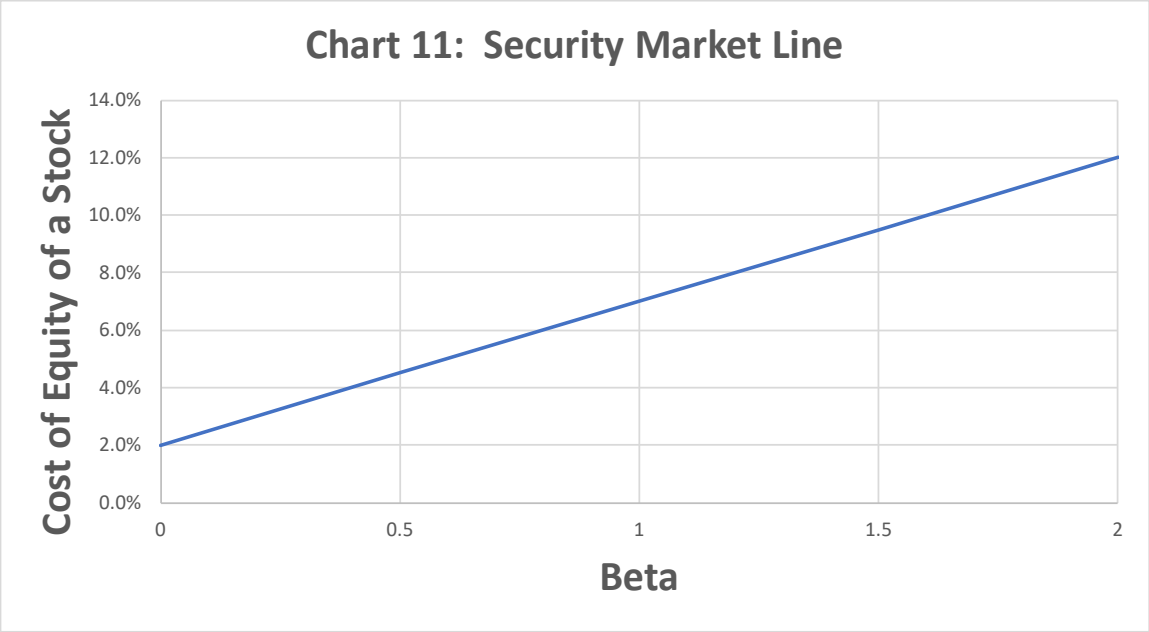
**Q75. PLEASE DESCRIBE THE CAPM.**

A75. CAPM stands for "Capital Asset Pricing Model." The CAPM relates return to risk; specifically, it relates the expected return on an investment in a security to the risk of investing in that security. The riskier the investment, the greater the expected return (i.e., the cost of equity) investors require to make that investment.

Investors in a firm's equity face two types of risks: (1) firm-specific risk and (2) market risk (financial analysts refer to this market risk as systematic risk). Firm-specific risk refers to risks unique to the firm, such as management performance and losing market share to a new competitor. Investors can reduce firm-specific risk by purchasing stocks as part of a diverse portfolio of companies if they construct the portfolio to cause the firm-specific risk of individual companies to balance out. Market-related risk refers to potential impacts from the overall market, such as a recession or interest rate changes. This risk cannot be removed by diversification, so the investor must bear it no matter what. Because the investor has no option but to bear market risk, the investor's cost of equity will reflect that risk. The CAPM predicts that for a given equity security, the cost of equity has a positive linear relationship to how sensitive the stock's returns are to movements in the overall market (e.g., S&P 500). A security's market sensitivity is measured by its beta.[58]

[58] The covariation of the return on an individual security with the return on the market portfolio.

As shown in Chart 11 below, the higher the beta of a stock, the higher the company's cost of equity—the return required by the investor to invest in the stock.




Here is the standard CAPM formula:

$$K = Rf + \beta i * (Rm - Rf)$$

Where:

K is the cost of equity;
Rf is the risk-free interest rate;
Rm is the expected return on the overall market (e.g., S&P 500);
[Rm – Rf] is the premium investors expect to earn above the risk-free rate for investing in the overall market ("equity risk premium" or "market risk premium"); and
βi (Beta) is a measure of non-diversifiable, or systematic, risk.

**Q76. PLEASE EXPLAIN HOW YOU IMPLEMENTED THE CAPM.**

A76. First, I determined appropriate values or ranges for each of the three model inputs: (a) Risk-Free Rate, (b) Beta, and (c) Equity Risk Premium. Second, I used the equation above to calculate the cost of equity implied by the model. Below I will explain how I calculated the

three model inputs and summarize the CAPM cost of equity numbers resulting from those inputs. Table 10 and Table 11 on page 88 show the results of my CAPM.

## Risk-Free Rate

**Q77. WHAT RISK-FREE RATE DID YOU USE IN YOUR CAPM?**

A77. It is generally preferable to use the market yield on short-term U.S. Treasury yields as the risk-free rate because these bonds have a beta close to zero. *Principles of Corporate Finance* states "The CAPM… calls for a short-term interest rate."[59] I chose to use a risk-free rate based on both long- and short-term Treasury yields, however, because, as indicated by the steepness of the yield curve,[60] investors with a longer investment horizon would likely use a higher risk-free rate as an opportunity cost for their investment decisions. My short-term risk-free rate is based on the yield of 3-month U.S. Treasury bills and my long-term risk-free rate is based on the yield of 30-year U.S. Treasury bonds. In line with my Spot and Weighted Average CAPM approaches, I use both spot market values as of June 30, 2022 and weighted averages over the 3 months ending on that date for these two yields.

As outlined in Exhibit ALR-4, page 2, my spot and weighted average short-term risk-free rates are 1.72% and 1.32%, respectively. My spot and weighted average long-term risk-free rates are 3.14% and 3.07%, respectively.

[59] BREALEY, MYERS, AND ALLEN, *Principles of Corporate Finance*, p. 228, (McGraw-Hill Irwin, New York, 12th ed. 2017).

[60] The yield curve on U.S. Treasury bonds relates the yield to its time to maturity. We say the current yield curve is steep because the difference in yield between short-term (near 0%) and long-term (over 1%) bonds is large in percentage terms.

U.S. government bonds are reasonable to use as a risk-free rate because they have a negligible risk of default. The value of short-term U.S. Treasury bills has a relatively low exposure to swings in the overall market. The value of long-term U.S. Treasury bonds is relatively more exposed to the market and therefore must be used with caution. I considered using a risk-free rate based on subtracting the historical spread between long-term and short-term U.S. Treasury bills from current long-term yields, as recommended by some financial textbooks.[61] I did not use this method because in the current capital markets, this method results in an unreasonably low risk-free rate (under 0%).

Regarding my weighted average risk-free rates, it is worth noting that any form of averaging or weighting approach applied to the last 12 months of historical yield data would not have any significant effect on my CAPM results.

**Q78. WHAT IS YOUR RESPONSE TO ANALYSTS WHO CLAIM THAT THE CAPM MUST BE IMPLEMENTED WITH A LONG-TERM INTEREST RATE (E.G., YIELD ON 30-YEAR TREASURY BOND) AS AN ESTIMATE OF THE RISK-FREE RATE COMPONENT OF THE CAPM?**

A78. When looking for a security to calculate an estimate of the risk-free rate, it could be argued that it is appropriate to find one with a term or maturity that best matches the life of the asset being financed. In that sense, the 30-year Treasury bond yield can be argued to be ideal for this specific application. However, it is equally important to find a security that has a beta

[61] BREALEY, MYERS, AND ALLEN, *Principles of Corporate Finance*, p. 228 (McGraw-Hill Irwin, New York, 12th ed. 2017).

coefficient with the overall market as close to zero as possible, because by the very definition of the risk-free rate in the CAPM model, its movements should have no correlation to the movements of the market. And this is where the problem with the 30-year Treasury bond yield arises, as it has an established non-zero beta. The 3-month Treasury bill yield has a considerably lower beta, and therefore is superior in that respect to the 30-year Treasury bond yield. Neither one is a perfect fit on both fronts, which is why I have chosen to consider both as proxies for the risk-free rate to establish a range for my CAPM results.

## Beta

**Q79. WHAT BETA DID YOU USE IN YOUR CAPM?**

A79. Most published betas are based exclusively on historical return data. For example, Value Line publishes a 5-year historical beta for each of the companies it covers. However, it is also possible to calculate betas based on investors' expectations of the probability distribution of future returns. This probability distribution of future returns expected by investors can be calculated based on the market prices of stock options.

Since the cost of equity should be based on investor expectations, I chose to use two betas. My "Historical Blended Beta" takes into consideration short- (6-month), medium- (2-year), and long-term (5-year) time historical horizons, with a weighing of 50%, 30%, and 20%, respectively. My "Forward Beta" is based on forward-looking investor expectations of non-diversifiable risk. 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. I use the term "Hybrid Betas" to refer to a 50% weighing of Historical Blended Betas with a 50% weighing of Forward Betas.

Please see Appendix C for a detailed description of how I calculated my betas.

**Q80. AS SHOWN IN CHART 3, STOCK OPTION PRICES INDICATE THAT INVESTORS LIKELY EXPECT THAT HISTORICAL BETAS FOR THE RFC ELECTRIC PROXY GROUP WIL BE LOWER IN THE FUTURE. WHAT ARE SOME OF THE BENEFITS OF CALCULATING YOUR OWN BETAS?**

A80. Traditionally, the betas used in CAPM calculations are calculated from historical returns. An alternative way to calculate betas is to incorporate investors' return expectations by calculating option-implied betas as explained in the previous paragraph. As discussed below, I have chosen to use both historical and option-implied betas in my CAPM analysis. I chose to use option-implied betas in my CAPM analysis because, among other reasons, studies have found that betas calculated based on investor expectations (option-implied) provide information regarding future perceived risks and expectations.[62] The betas published by Value Line are not only backward looking, they can be more than 3 months old.

**Q81. PLEASE EXPLAIN HOW YOU CALCULATED OPTION-IMPLIED BETAS.**

A81. 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-

[62] Bo-Young Chang & Peter Christoffersen & Kris Jacobs & Gregory Vainberg. Option-Implied Measures of Equity Risk, *Review of Finance*, Vol. 16, Issue 2, pp. 385-428 (April 2012) available at https://academic.oup.com/rof/article/16/2/385/1584560.

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[63] and skewness[64] 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 guidelines described in more detail in Appendix C.

**Q82. ARE YOUR OPTION-IMPLIED BETAS BASED ON ESTABLISHED METHODOLOGIES?**

A82. 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 and

[63] CBOE Volatility Index White Paper (2018) available at https://cdn.cboe.com/resources/indices/srvix-white-paper.pdf. Please note that the cover page says, "proprietary information." However, this document has been in the public domain for over 3 years.

[64] The CBOE SKEW Index (2010) available at https://cdn.cboe.com/resources/indices/documents/SKEWwhitepaperjan2011.pdf. Please note that the cover page says, "proprietary information." However, this document has been in the public domain for over 3 years.

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.[65]

This decision, which adopted my ROE recommendation based on option-implied betas, was subsequently upheld by the South Carolina Supreme Court in September 2021.[66]

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

[65] 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.

[66] *In re Blue Granite Water Co.* (S.C. 2021) 434 S.C. 180.

> 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 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.[67]

**Market Risk Premium**

**Q83. PLEASE EXPLAIN HOW YOU CALCULATED THE EQUITY RISK PREMIUM USED IN YOUR CAPM.**

A83. Traditionally, the risk premium used in CAPM calculations is derived from historical returns and/or equity analyst projections. The former approach is historically accurate but does not take into account investors' expectations for future market risks and returns. The latter approach is based on analyst projections, which are not market-based and do not reflect current investor expectations. A superior market-based way to calculate the equity risk premium is to use option-implied return expectations, which is the approach I have used.

My equity risk premium is the expected return on the S&P 500 minus the risk-free rate. I calculate an expected return on the S&P 500 by using stock options traded on this

[67] Connecticut Utilities Regulatory Authority, *Proposed Interim Decision of the Connecticut Utilities Regulatory Authority, Docket No. 17-10-03RE11* (September 14, 2021) at p. 21. (Note, this case was ultimately settled).

index. To begin with, I use exactly the same methodology used by the Chicago Board of Options Exchange to filter stock option data and calculate option-implied volatility and skewness,[68] as described in detail in Appendix C. The volatility and skewness calculated in this way describe a probability function representing the possible trajectories for the S&P 500 implied by the options market. The resulting skewed probability function can be closely approximated by a log-normal function using established statistical formulas, which then make it straightforward to calculate the expected growth for the S&P 500 for any given cumulative probability. A cumulative probability of 50% represents the median of the probability distribution, or the option-implied market consensus, which is how I arrive at my calculation of expected market growth.

Once the option-implied growth rate of the S&P 500 has been estimated as described above, I add the dividend yield and subtract the risk-free rate to arrive at the market risk premium, as laid out in Exhibit ALR-4, page 4 and Exhibit ALR-4, page 6. In line with my Spot and Weighted Average CAPM approaches, I use both spot market values as of June 30, 2022 and weighted averages over the 3 months ending on that date for option-implied growth, dividend yields, and short- and long-term risk-free rates in these calculations to arrive at a total of 4 estimated values for the market risk premium. The market risk premium I use in my Weighted Average CAPM analysis with short- and long-term risk-free rates is 9.89% and 8.14%, respectively. The market risk premium I use in

[68] As used in the calculation of their widely-used VIX (or Volatility Index) and SKEW Index, respectively.

my Spot CAPM analysis with short- and long-term risk-free rates is 9.50% and 8.08%, respectively.

**Q84. DID YOU TAKE INTO CONSIDERATION THE DIFFERENCE IN VOLATILITIES ACROSS EXPIRATION PERIODS IN THE OPTIONS TRADED ON THE S&P 500?**

A84. Yes. The volatility implied by the options market changes over time as investors' perception of risk changes. For example, during a crisis, implied volatility generally increases as investors expect that stock market prices have a greater chance of large swings compared to times when there is no crisis. As discussed earlier, investors also often have different volatility expectations over different time periods. For example, on any given day, investors might expect volatility to be relatively high over the next 30 days and to decrease over the next year or longer. The same holds true for skewness, even though it is less intuitive to understand changes in skewness than in volatility. Because of these changes across option expiration periods, I take a weighted average of the entire term structure of the option-implied volatility and skewness, which for the S&P 500 typically goes out to 24 to 36 months, interpolating where necessary, and giving the most weight to the option expiration period of 12 months.

**Q85. WHICH CUMULATIVE PROBABILITY DID YOU USE TO ESTIMATE THE OPTION-IMPLIED GROWTH OF THE S&P 500 IN THE CALCULATION OF YOUR MARKET RISK PREMIUM AND WHY?**

A85. I used a cumulative probability of 50.0% in the calculation of my option-implied growth for the S&P 500, which results in a value of 9.71% as of June 30, 2022 and a value of 9.75%

for the weighted average of the 3 months ending on that date. As stated above, a cumulative probability of 50% represents the median of the probability distribution, or in this case the option-implied market consensus, which is why I have chosen to use this level.

As a matter of fact, using the same probability distribution derived from the options market described above, one can also calculate the cumulative probability implied by a given cost of capital. For instance, using the same risk-free rates and betas in my CAPM analysis, SCE's requested rate of return on equity of 10.53% implies an average market risk premium of 12.9%, an average overall market return of 15.2%, average growth for the S&P 500 of 13.7%, and a cumulative probability of 58.8%. In other words, to achieve the required market growth of 13.7%, reality would have to exceed 58.8% of the scenarios investors currently see as plausible for the market in aggregate, considerably more than the median market consensus at 50%. To put this into perspective, it is important to note that values on the tails of the probability function get increasingly separated, requiring an ever-increasing growth rate for every additional percentage in the cumulative probability, and making it impossible to ever arrive at 100%.

Using exactly the same methodology, my 8.08% recommended cost of equity for SCE implies an average market risk premium of 9.0%, an average overall market return of 11.3%, average growth for the S&P 500 of 9.9%, and a cumulative probability of 50.3%.

Similarly for PG&E, the company's requested ROE of 11.00% implies an average market risk premium of 13.6%, an average overall market return of 15.9%, average growth for the S&P 500 of 14.5%, and a cumulative probability of 60.5%. In contrast, my 8.08% recommended ROE for PG&E implies an average market risk premium of 9.0%, an

average overall market return of 11.3%, average growth for the S&P 500 of 9.9%, and a cumulative probability of 50.3%.

For SDG&E, the company's requested ROE of 10.55% implies an average market risk premium of 12.9%, an average overall market return of 15.2%, average growth for the S&P 500 of 13.8%, and a cumulative probability of 58.9%. In contrast, my 7.81% recommended ROE for SDG&E implies an average market risk premium of 8.6%, an average overall market return of 10.9%, average growth for the S&P 500 of 9.5%, and a cumulative probability of 49.5%.

**Q86. ARE THE CUMULATIVE PROBABILITIES YOU REFER TO IN THIS CASE DIRECTLY COMPARABLE TO THE CUMULATIVE PROBABILITIES YOU HAVE USED OR REFERRED TO IN PRIOR TESTIMONIES YOU HAVE FILED?**

A86. In late 2020, after significant efforts related to the complexities in processing extremely large volumes of option data, I was finally able to use option-implied volatility and option-implied skewness to come up with a log-normal function that approximates the probability distribution of the possible trajectories for the S&P 500 implied by the options market as of any given day, as explained above. All of the testimonies I have filed since then, starting in 2021, have used this complete and superior approach along with a cumulative probability of 50%, representing the median of the probability distribution, or the option-implied market consensus, to estimate expected market growth. Any references to cumulative probability in these testimonies are directly comparable.

Prior to incorporating skewness into the approximation, I used a normal function to estimate the same probability distribution referred to above. Using a normal distribution as an approximation is a simplification used commonly in economics, including in the Black-Scholes formula for a single option. However, unlike a skewed log-normal function, a normal function has the same median and mean, meaning that when applied in this case, the option-implied market consensus of this simplified approximation implies market growth of 0%. As a result, before using log-normal functions, I had to resort to finding an adequate level of cumulative probability above 50% to estimate market growth, which is admittedly somewhat subjective. To be conservative, I often used a cumulative probability of 68.3%, which is the probability found within one standard deviation of the mean of a normal distribution, which I understood would lead to a conservatively high estimate for market growth. It is important to point out that the cumulative probabilities of the simplified normal function approximation I used in cases before 2021 cannot be directly compared to the cumulative probabilities of the superior log-normal function approximation, which takes skewness into account. The considerably improved approximation based on a log-normal function eliminates all subjectivity in arriving at the implied market consensus and allows a much better measure of implied cumulative probabilities of deviations from that market consensus.

## CAPM Results

**Q87. PLEASE SUMMARIZE THE RESULTS OF YOUR CAPM.**

A87. Table 10 and Table 11 below show the results of my Weighted Average CAPM and Spot CAPM Analyses, respectively.

Weighted Average CAPM

**TABLE 10: CAPITAL ASSET PRICING MODEL (CAPM) - INDICATED COST OF EQUITY**
**WEIGHTED MARKET DATA - All Inputs Weighted From April to June 2022**

| | 3-Month Treasury Bill | | 30-Year Treasury Bond | |
|---|---|---|---|---|
| | Historical Blended Beta | Forward Beta | Historical Blended Beta | Forward Beta |
| Risk-Free Rate | 1.32% | 1.32% | 3.07% | 3.07% |
| Beta | 0.66 | 0.58 | 0.66 | 0.58 |
| Risk Premium | 9.89% | 9.89% | 8.14% | 8.14% |
| CAPM | 7.86% | 7.10% | 8.45% | 7.83% |

Source: Exhibit ALR-4, page 1

Spot CAPM

**TABLE 11: CAPITAL ASSET PRICING MODEL (CAPM) - INDICATED COST OF EQUITY (SPOT)**
**SPOT MARKET DATA - All Inputs Based on Last Available Data as of June 30, 2022**

| | 3-Month Treasury Bill | | 30-Year Treasury Bond | |
|---|---|---|---|---|
| | Historical Blended Beta | Forward Beta | Historical Blended Beta | Forward Beta |
| Risk-Free Rate | 1.72% | 1.72% | 3.14% | 3.14% |
| Beta | 0.72 | 0.60 | 0.72 | 0.60 |
| Risk Premium | 9.50% | 9.50% | 8.08% | 8.08% |
| CAPM | 8.59% | 7.41% | 8.99% | 7.98% |

Source: Exhibit ALR-4, page 5

# VI. PG&E'S MANAGEMENT PERFORMANCE AND ITS IMPACT ON AUTHORIZED ROE

**Q88. SHOULD PG&E RECEIVE A HIGHER AUTHORIZED ROE / RATE OF RETURN TO ACCOUNT FOR INCREASED RISK THAT WAS CAUSED BY IMPRUDENT AND CRIMINAL BEHAVIOR OF ITS MANAGEMENT?**

A88. No. According to the United States Supreme Court, utility rates of return are to be determined based upon "efficient and economical management" of the utility:

> The return should be reasonably sufficient to assure confidence in the financial soundness of the utility and should be adequate, *under efficient and economical management,* to maintain and support its credit and enable it to raise the money necessary for the proper discharge of its public duties. A rate of return may be reasonable at one time and become too high or too low by changes affecting opportunities for investment, the money market and business conditions generally.[69]

The Commission has also made it clear that utilities should not be awarded an increased authorized ROE based on risk that is associated with imprudent management:

> "However, in applying these [Hope and Bluefield] parameters, we must not lose sight of our duty to utility ratepayers to protect them from unreasonable risks including risks of imprudent management."[70]

> "Undisputed in this proceeding is the notion that the investor owned utilities should not be awarded with an increased ROE based on risk that is associated with imprudent management. . .The standard set in Bluefield and

[69] *Bluefield Water Works & Improvement Co. v. Pub. Serv. Comm'n of the State of W. Va*. 262 U.S. 679, 692-693 (1923) (emphasis added).

[70] D.19-12-056 at p. 16.

> Hope is that investor owned utilities should not be rewarded with an ROE that is inflated due to imprudent actions."[71]

**Q89. CAN RISK THAT IS ASSOCIATED WITH IMPRUDENT MANAGEMENT BE MEASURED?**

A89. In normal circumstances, it can be difficult to separate out the impact of risk attributed to imprudent management from other risks. But, when the imprudent management is extreme, such as PG&E igniting multiple catastrophic and deadly fires, stock option prices can show investors changing risk perceptions in real time as investors learn about potential financial impacts of PG&E's imprudent management.

**Q90. DO CAPITAL MARKET DATA SHOW THAT INVESTORS' RISK PERCEPTION OF PG&E INCREASED AS A RESULT OF THEIR POOR MANAGEMENT?**

A90. Yes. PG&E submitted an "electric incident report" to the CPUC on November 8, 2018, at 6:15 a.m. PST that reported a power failure on a transmission line in Butte County at 6:15 a.m. PST. A fire was reported at approximately 6:30 a.m. PST. PG&E stock price started to fall shortly after the Camp Fire started and was down over 60% by November 15, 2018. PG&E stock option prices show that investors quickly perceived PG&E as a much riskier company.

As discussed in my CAPM section starting on page 74, beta coefficients are a measure of the type of risk that impacts COE. A higher beta indicates a higher COE. In utility proceedings, betas are usually calculated with historical data, but stock options can be used to calculate "option-implied" betas. Option-implied betas are an immediate

[71] D.19-12-056 at p. 36.

reflection of investor sentiment and risk perception. They don't carry the weight of historical data and will change immediately if investors' risk perceptions change. Option-implied betas are especially effective at measuring investors changing risk perceptions after a significant event, such as the Paradise Camp Fire, that fundamentally change a company's risk characteristics in a short period of time. As shown on Chart 12 below, option-implied betas shot up from below 1.00 in the weeks before the fire to a peak of almost 5.0 on November 20, 2018 after the fire. By December 2018, PG&E's option-implied betas settled to about 3.0, indicating that investors' risk perceptions remained significantly elevated compared to other electric utilities which almost always have option-implied and historical betas of less than 1.0.

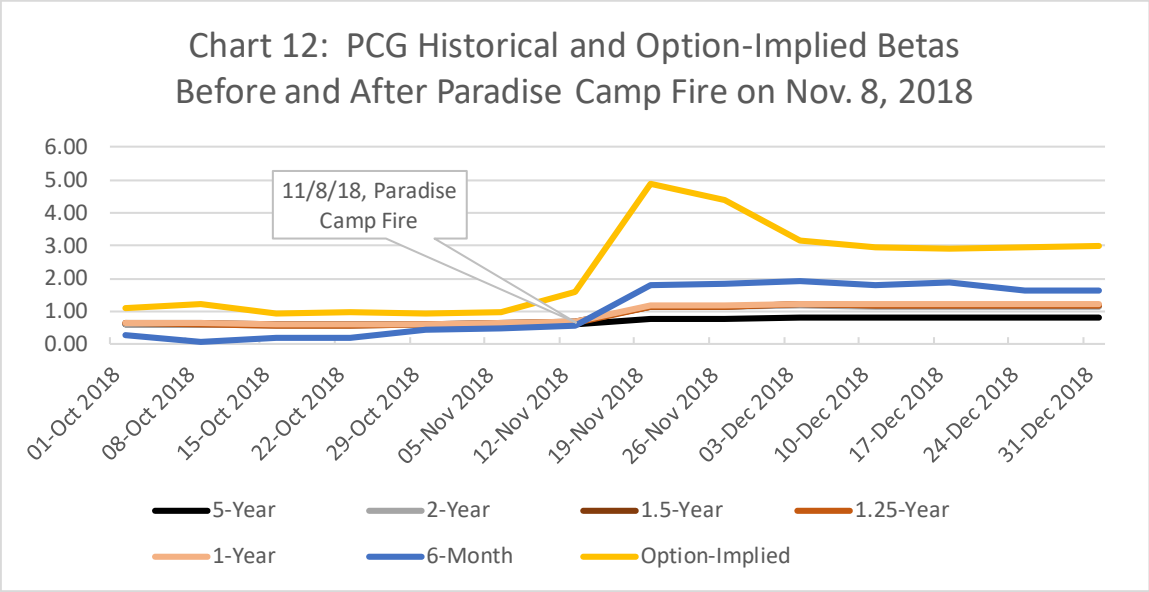



Chart 12 above clearly shows that all of PG&E's beta coefficients increased considerably in the immediate aftermath of the Paradise Camp Fire as it became clear to investors that the fire was a result of poor company management.

Historical beta coefficients with longer horizons (e.g., five years) change more slowly than those with shorter time horizons (e.g., six months), but after the fire, all historical beta coefficients showed a significant increase. In the six weeks before the fire, the average of PG&E's historical beta coefficients ranged between 0.53 and 0.65, very much in line with its proxy group peers. In the six weeks after the fire, the average of PG&E's historical beta coefficients ranged between 1.20 and 1.26, practically doubling.

The significant increase in all of PG&E's beta coefficients around the Paradise Camp Fire did not occur for the RFC Electric Proxy group on average. This indicates that the elevated betas are a direct result of the fire and the poor management that was determined to be its cause as opposed to broad underlying market conditions.

**Q91. PG&E'S BETA COEFFICIENTS REMAIN SIGNIFICANTLY ABOVE THOSE OF EIX, SRE, AND THE REST OF THE RFC ELECTRIC PROXY GROUP, INDICATING THAT ITS RISK PROFILE IS HIGHER THAN THE AVERAGE OF THE PROXY GROUP. DOES THIS MEAN ITS AUTHORIZED ROE SHOULD BE HIGHER THAN OTHER ELECTRIC UTILITY COMPANIES?**

A91. No. While PG&E's beta coefficients remain elevated, indicating a higher risk profile and therefore a higher COE, PG&E's elevated beta coefficients are a direct result of imprudent management and therefore do not warrant a higher authorized ROE. As elaborated upon above, the Supreme Court and the Commission have made clear that consumers should not have to pay for increased capital costs caused by inadequate company management.

Market data shows that investors considered PG&E to be a much riskier company shortly after the Paradise camp fire broke out on November 8, 2022. As shown on Chart 12 on page 91, increased betas can be attributed to imprudent management beginning in the Fall 2018 when it caused dozens of deadly and catastrophic fires and has continued through it pleading guilty to 84 charges of manslaughter for the 2018 Camp Fire, January 2019 voluntary bankruptcy protection filing, Winter 2019 public safety power shut off debacle, and igniting the deadly Zogg (2019), Kincade (2020), and deadly Dixie (2021) Fires. Most recently, on June 10, 2022, Cal Fire made public its findings that PG&E's failed vegetation management and an "excessively delayed response" were causes of the ignition and spreading of the Dixie Fire to almost 1 million acres, becoming the single biggest fire in California history. Ratepayers should not be forced to pay for PG&E's imprudent management.

**Q92. CAN YOU PROVIDE AN EXAMPLE WHERE RATE OR RETURN WAS SET AT A LOWER LEVEL BASED UPON IMPRUDENT MANAGEMENT?**

A92. Yes. For example, in 2021, the Supreme Court of South Carolina upheld the decision of the South Carolina Public Service Commission to set a lower ROE than requested by The Blue Granite Water Company, a water and sewer services utility due to problematic business practices.[72]

[72] In re Blue Granite Water Co. (S.C. 2021) 434 S.C. 180.

"[I]n an effort to incentivize Blue Granite to improve its business practices, the PSC set a lower return on equity (ROE) than requested and allowed only certain portions of Blue Granite's requested costs, citing to the utility's known, poor reputation and service problems."[73] The problematic business practices included poor water quality, unresponsive customer service, inaccurate meter readings, billing errors, unwarranted cut-offs, and raw sewage flooding homes and, in one instance, running through an entire neighborhood, including the community park and pool.[74]

In 2020, the State of Maine Public Utilities Commission (MPUC) reduced the Central Maine Power Company's ROE due to management inefficiency demonstrated by poor customer service. Finding that under the U.S. Constitution and state law, it has "broad authority to disallow costs or adjust rates when the Commission finds that a utility has not acted prudently," the MPUC acted on customers complaints to lower the ROE:

> [T]he Commission imposes a substantial reduction to the Company's return on common equity—100 basis points—which alone is equivalent to a $6.6 million reduction to CMP's annual distribution revenues, and $9.9 million over the 18-month period during which the reduction will be in effect. This reduction exceeds any prior adjustment by the Commission to a transmission and distribution utility's return on equity due to poor management and results in an allowed return considerably below the common-equity return of any other electric utility in the country. This reduction is supported by substantial evidence of failures by CMP's management to provide reasonable and adequate customer service over recent years, and especially following the transition to its new billing system, which lead us to find that this service has been imprudent. This ROE reduction is directly tied to CMP's service quality; the adjustment will remain in place until CMP improves

[73] In re Blue Granite Water Co. (S.C. 2021) 434 S.C. 180, 186.

[74] In re Blue Granite Water Co. (S.C. 2021) 434 S.C. 180.

its performance in several specified areas of customer service over a rolling period of 18 consecutive months (measured beginning March 1, 2020).[75]

# VII. RELATIVE RISK OF EIX AND SRE

**Q93. DOES MARKET DATA INDICATE THAT EIX AND SRE ARE RISKIER THAN THE AVERAGE ELECTRIC UTILITY COMPANY?**

A93. No. EIX and SRE's witnesses use their own speculations to claim that investors perceive unique risks related to EIX and SRE and that they should therefore receive a higher authorized ROE. This is problematic because investors may or may not see these risks the way the witnesses claim. The best way to measure the risks perceived by investors is to look directly at market data such as stock and stock option prices.

**Q94. WHAT DO STOCK OPTIONS INDICATE ABOUT THE RISK INVESTORS PERCEIVE FOR EIX AND SRE AS COMPARED TO THE RFC ELECTRIC PROXY GROUP?**

A94. Option-implied betas and skewness both reflect all publicly-available information and elements that affect risk, positively or negatively, whether specific to a particular company or related to overarching market conditions, making them ideal for measuring true investor sentiment. While many utility witnesses attempt to rationalize or guess at how specific factors

[75] Maine Public Utilities Commission, Docket No. 2018-00194, *Order* (February 19, 2020), available at: https://mpuc-cms.maine.gov/CQM.Public.WebUI/MatterManagement/MatterFilingItem.aspx?FilingSeq=105431&CaseNumber=2018-00194.

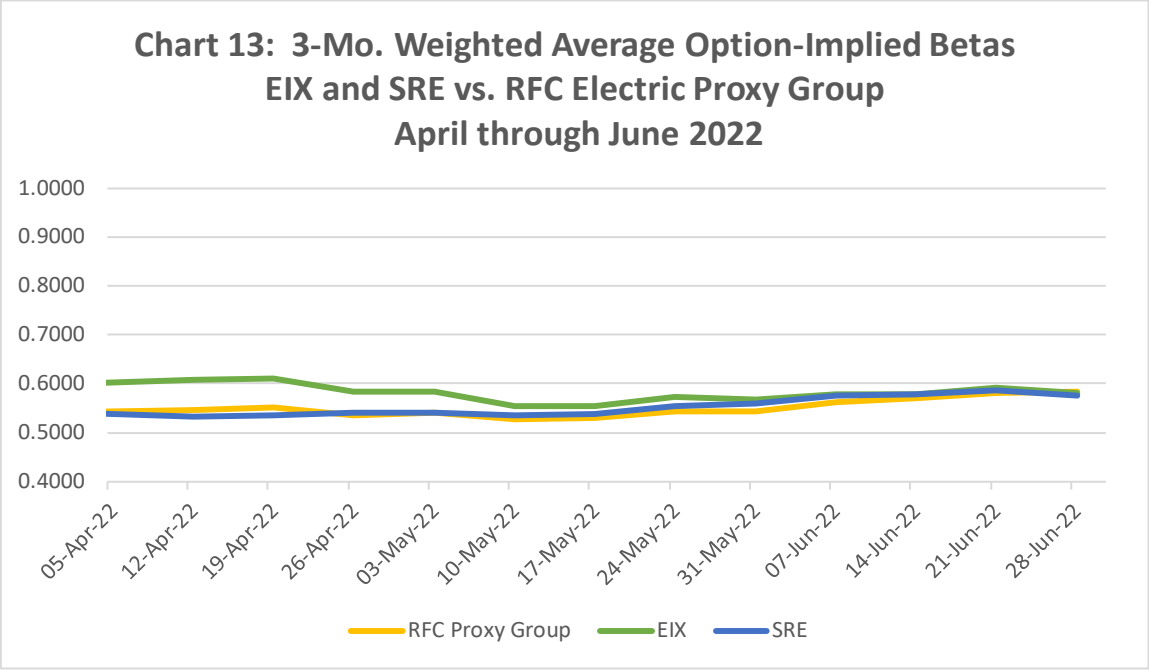
may affect investor sentiment positively or negatively, using these all-encompassing measures of risk eliminates the guesswork and allows one to measure the net risk perceived by investors when all publicly-available information is considered. As discussed elsewhere in my testimony, options provide two different measures of risk. Option-implied betas measure the expected correlation of future movements of a stock as compared to the market at large. Option-implied skewness measures investor-perceived downside risk for the underlying security, be it a particular stock or a market index.

The options market indicates that investors do not currently perceive a higher level of risk for EIX or SRE as compared to the RFC Electric Proxy Group on average.

**Q95. HOW DO OPTION-IMPLIED BETAS FOR EIX AND SRE CURRENTLY COMPARE TO THOSE OF THE RFC ELECTRIC PROXY GROUP?**

A95. Chart 13 on page 97 shows 3-month weighted average option-implied betas for EIX, SRE, and the RFC Electric Proxy Group from April to June 2022, the three-month period used as a basis for my COE recommendation in this proceeding. As can be clearly seen on the chart, option-implied betas for all three remain mostly below 0.60 throughout the period. SRE's option-implied betas remain very much in line with those of the RFC Electric Proxy Group throughout the entire period. Even though EIX had slightly higher betas than SRE and the RFC Electric Proxy Group at the beginning of the period, the betas of EIX and SRE are practically indistinguishable throughout June 2022, both very much in line with the RFC Proxy Group. Both EIX and SRE had slightly lower option-implied betas than the RFC Proxy Group

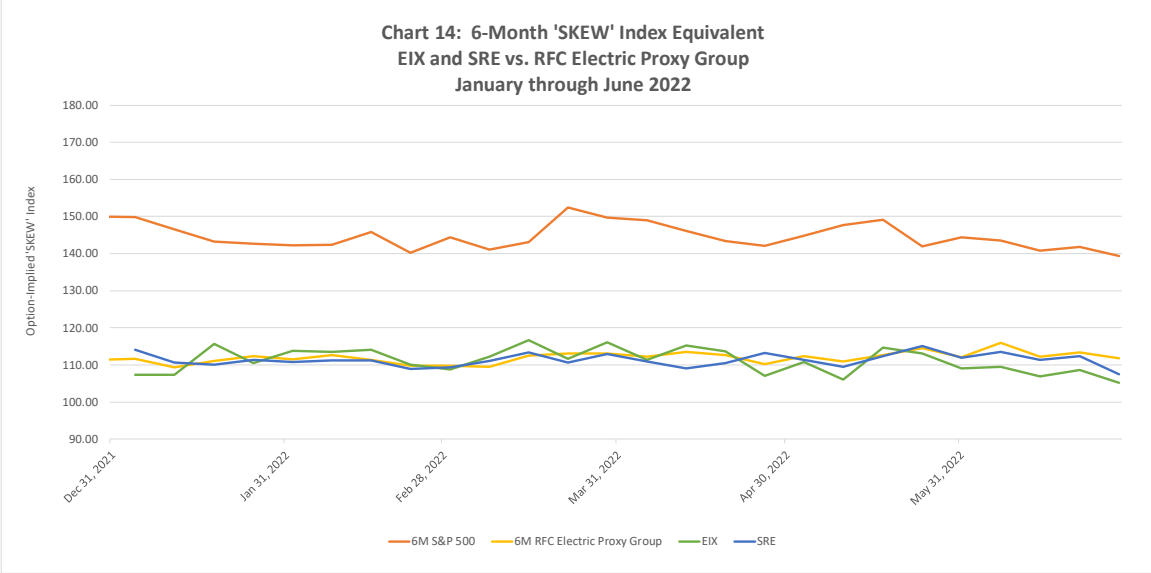
as of the end of June 2022. This comparative analysis indicates that there is no significant difference in risk profile between the two applicants and the average of the proxy group.




**Q96. WHAT DOES OPTION-IMPLIED SKEWNESS INDICATE ABOUT INVESTOR-PERCEIVED DOWNSIDE RISK FOR EIX AND SRE AS COMPARED TO THE RFC ELECTRIC PROXY GROUP?**

A96. Chart 14 on page 98 shows spot values for the option-implied SKEW Index equivalent for EIX, SRE, and the RFC Electric Proxy Group from January through June 2022, as well as that of the S&P 500 Index for comparison. The chart clearly shows that the skewness of EIX, SRE, and the RFC Electric Proxy Group remain very much in line with each other throughout these six months, all considerably below the skewness of the market overall. This indicates that investors perceive considerably lower downside risk for EIX, SRE, and the RFC Electric Proxy Group than for the overall market. This also indicates that there is no significant difference in

the downside risk perceived by investors for the two applicants as compared to the average of the proxy group. In fact, it should be noted that both EIX and SRE consistently had a lower SKEW Index than the RFC Electric Proxy Group through all of June 2022.




# VIII. CCM

**Q97. DO YOU CONSIDER THE CCM AN ADEQUATE TOOL FOR ADJUSTING THE COST OF CAPITAL AS CAPITAL MARKETS CHANGE BETWEEN ONE COST OF CAPITAL PROCEEDING AND THE NEXT?**

A97. The goal of a cost of capital proceeding is to take a snapshot of current capital markets as of a certain date and to use that snapshot to estimate the cost of capital looking forward from that moment on. But capital markets never truly stand still, making the exercise of determining the cost of capital a constant attempt to hit a moving target. The CCM is an excellent and

necessary tool to make adjustments in the cost of capital between one proceeding and the next, when capital markets change more significantly than expected.

However, I believe the current incarnation of the CCM, which is triggered only by extreme changes in interest rates, results in a blunt tool that doesn't adequately reflect changes in the cost of capital as markets evolve. Interest rates affect the cost of capital, but they are only one of several key factors that affect the cost of capital. Beta coefficients (a measure of risk based on the correlation between changes in the stock prices of utility companies and changes in the market a large) and the market risk premium (the additional return afforded by the stock market above the risk-free rate) are also key factors that affect the cost of capital – and they are also constantly changing. For instance, interest rates could go up over a certain period, but if beta coefficients decrease during that time, that could more than offset the increase in interest rates, resulting in a lower cost of equity. I have seen this happen at certain points in recent weeks. Setting rates exclusively based on changes in interest rates in such a case would be erroneous and result in overcharging consumers. As a result, I believe there is room to establish an improved version of the CCM based on these key factors and others.

Improving the CCM is beyond the scope of this proceeding, but I strongly encourage the Commission to open a new proceeding as soon as possible to explore the establishment of a new CCM that takes into consideration changes in beta coefficients and the market risk premium along with changes in interest rates in determining changes in the cost of capital as capital markets evolve.

# IX. EVALUATION OF THE UTILITIES' RATE OF RETURN TESTIMONY

## A. SCE

**Q98. PLEASE SUMMARIZE THE RATE OF RETURN TESTIMONIES OF THE UTILITIES' WITNESSES.**

A98. The witnesses testifying on behalf of the Utilities provided ROE recommendations of between 10.53% and 11.00%.[76] They arrived at their recommendations based on numerous methods including their own versions of the DCF, Risk Premium analyses, CAPM/ECAPM, Implied Equity Risk Premium and Comparable Earnings approaches. Although the Companies' witnesses define the cost of equity or COE as market-based or established using market data,[77] The ROE recommendations of the Utilities' three witnesses cannot be considered market-based. For example, they recommend using forecasted long-term government bond interest rates in their CAPM analyses instead of using market data to measure investors interest rate expectations directly. They ask for firm specific risk adjustments, in most cases, without the required market-based justification.

[76] Dr. Villadsen's Direct Testimony, Page 2, lines 3-5, Dr. Vilbert's Direct Testimony, Page 2, line 23, Mr. Coyne's Direct Testimony, Page 3, lines 14-16,

[77] Dr. Villadsen's Direct Testimony, Page 2, lines 30-30-33; Dr. Vilbert's Direct Testimony, Page 7, lines 21-22; Mr. Coyne's Direct Testimony, Page 7, footnote 4.

**Q99. PLEASE SUMMARIZE THE TESTIMONY OF DR. VILLADSEN**

A99. Dr. Villadsen claims that SCE's requested ROE of 10.53% is reasonable.[78] She arrived at her conclusion based upon her own modified versions of the following COE models: 1) two DCF (Single- and Multi-Stage) models, 2) CAPM, 3) ECAPM, and 4) two versions of the Equity Risk Premium Model.[79] However, her 10.53% recommendation is not based on her model results alone. As outlined in Schedule No. BV-C7, Panels A and B, the results of her DCF models range between 6.90% and 9.5% (averaging 8.42%), far below her 10.53% ROE recommendation. Dr. Villadsen claims it is necessary to make calculations that increase her cost of equity results to account for the difference between market value and book value capital structures.[80] This adjustment increases her model results from the range shown in Table 12 to between 9.30% and 10.75%.[81] Dr. Villadsen recommended that SCE's allowed ROE be placed in the upper end of the reasonable range because of its business risks and the inherent risks of California.[82] She claimed that her recommendation to award SCE an ROE in the upper end of the range is supported by risk related to the following: 1) wildfires, 2) AB 1054 implementation, 3) large deferral balances, and 4) relatively low credit metrics.[83]

[78] Dr. Villadsen's Direct Testimony, Page 4, lines 3-5.

[79] Dr. Villadsen's Direct Testimony, Page 3, lines 9-14

[80] Dr. Villadsen's Direct Testimony, Page 10 to 13.

[81] Dr. Villadsen's Direct Testimony, Page 5, Figure 16.

[82] Dr. Villadsen's Direct Testimony, Page 54, lines 9-13.

[83] Dr. Villadsen's Direct Testimony, Page 54, lines 13-18.

The results in Table 12 exclude the 10.1% result[84] of her so-called Implied Risk Premium method. As explained below, this method must be excluded from consideration because it is not market-based.

**TABLE 12: DR. VILLADSEN'S COST OF EQUITY RESULTS - CORE SAMPLE**
*Excluding Implied Equity Risk Premium Model and Financial Risk Adjustments*

| | Model Results | | |
|---|---|---|---|
| **METHOD** | **Full Sample** | **Electric Sample** | **Gas LDC/Water Sample** |
| **DCF - Single-stage [1]** | 9.50% | 9.40% | 9.20% |
| **DCF - Multi-stage [2]** | 7.90% | 7.60% | 6.90% |
| **CAPM** | | | |
| RP of 7.46% [3] | 9.80% | 10.00% | 9.30% |
| RP of 7.30% [4] | 9.60% | 9.90% | 9.20% |
| **ECAPM** | | | |
| RP of 7.46% [3] | 10.00% | 10.20% | 9.60% |
| RP of 7.30% [4] | 9.80% | 10.10% | 9.50% |
| | | | |
| **Dr. Villadsen's Average Cost of Equity Model Results** | | | |

[1] Dr. Villadsen'sDirect Testimony, Schedule BV-D7, Panel A
[2] Dr. Villadsen's Direct Testimony, Schedule BV-D7, Panel B
[3] Dr. Villadsen's Direct Testimony, Schedule BV-D11, Panel A
[4] Dr. Villadsen's Direct Testimony, Schedule BV-D11, Panel B

The unadjusted results of Dr. Villadsen's COE models are still higher than SCE's market-based cost of equity because of flaws in her application of those models, as discussed below.

**Q100. WHY IS IT INAPPROPRIATE TO CONSIDER DR. VILLADSEN'S LEVERAGE ADJUSTMENTS IN DETERMINING SCE'S AUTHORIZED ROE?**

A100. Financial leverage is a measure of the ratio of debt financing to equity financing. As a company takes on more debt, its financial risk increases because the higher the leverage, the higher the chance of financial stress and bankruptcy. Leverage is a concept that a Chief Financial Officer needs to consider when making sure the company's cost of equity calculations match its targeted capital structure. It is appropriate to consider financial leverage

[84] Dr. Villadsen's Direct Testimony, Page 51, Figure 15.

in general, as I do in my testimony. However, Dr. Villadsen's leverage adjustment in this proceeding has nothing to do with finance. Applying a market-based cost of equity to book value is the very definition of original cost ratemaking, but not a reason to make a leverage adjustment. Therefore, the financial leverage adjustment proposed by Dr. Villadsen is simply misplaced and should be removed from consideration in this proceeding.

**Q101. IS DR. VILLADSEN'S 10.53% COST OF EQUITY RECOMMENDATION MARKET-BASED?**

A101. No. Dr. Villadsen correctly states that "The cost of capital is defined as the expected rate of return in capital markets on alternative investments of equivalent risk."[85] She also correctly states that "[her] approach to estimating the cost of equity for SCE focuses on measuring the expected returns required by investors…"[86] However, when it comes time to make her computations, she fails to rely on the return expectations of investors as indicated by market data. Instead, she uses the speculations of economists and equity analysts, and other non-market expectations, even where market data is readily available. In other words, her cost of equity recommendation is inconsistent with the requirement of the U.S. Supreme Court that the cost of equity should be market-based.

[85] Dr. Villadsen's Direct Testimony, Page 5, Lines 4-5.

[86] Dr. Villadsen's Direct Testimony, Page 14, Lines 5-7.

**Q102. DO THE RESULTS OF DR. VILLADSEN'S COST OF EQUITY MODELS PROVIDE A RELIABLE INDICATION OF SCE'S COST OF EQUITY?**

A102. No. As discussed above, even the results of Dr. Villadsen's unadjusted models, ranging between 6.90% and 10.20%, results are inflated because her models are based on non-market-based methodology that violates the purpose of rate of return regulation. Additionally, each of her COE models has specific issues that contribute to her unreasonably high results. First, I will address how her constant growth DCF method is unreliable because it mechanically uses analyst 5-year EPS growth rates as a proxy for growth without considering the mathematical relationship between retention rates, dividend payments, and growth. A company cannot invest and grow with money it has paid out to investors as a dividend. Second, I will explain why the most significant flaw with Dr. Villadsen's multi-stage DCF methodology is her claim that a model assumption may underestimate how expected dividends will be valued.[87] Third, I will explain how her CAPM/ECAPM methodologies overstate the cost of equity. Finally, I will explain why her so-called Implied Risk Premium method should be disregarded because it is not a market-based method.

[87] Dr. Villadsen's Direct Testimony, Page 48, lines 5-11.

**Constant Growth DCF Method**

**Q103. DOES DR. VILLADSEN PROPERLY APPLY THE SIMPLIFIED OR CONSTANT GROWTH DCF METHOD?**

A103. No. Dr. Villadsen correctly explains that "The Gordon Growth / single-stage DCF models require forecast growth rates that reflect investor expectations about the pattern of dividend growth for the companies over a sufficiently long horizon"[88] but, her constant growth DCF method contradicts her own description of how the constant growth model should be implemented. Her growth rate component is based entirely on short-term EPS growth forecasts (three to five-year time frame).[89] The correct application of the DCF method requires that the dividend yield be computed properly, and that the growth rate used be derived from a careful study of the future *sustainable* growth in cash flow anticipated by investors. As discussed in Section II on page 7, major financial institutions like J.P. Morgan Chase do not use a growth rate based on analyst EPS growth rates, as Dr. Villadsen has done.

**Q104. CAN YOU PLEASE SUMMARIZE WHY A FUTURE-ORIENTED "B X R" METHOD IS SUPERIOR TO A FIVE-YEAR EARNINGS PER SHARE GROWTH**

[88] Dr. Villadsen's Direct Testimony, Page 47, lines 4-6.

[89] Dr. Villadsen's Direct Testimony, Page 47, lines 4-6.

**RATE FORECAST IN PROVIDING A LONG-TERM SUSTAINABLE GROWTH RATE?**

A104. The primary cause of sustainable earnings growth is the retention of earnings. A company is able to create higher future earnings by retaining a portion of the prior year's earnings in the business and purchasing new business assets with those retained earnings. There are many factors that can cause short-term swings in earnings growth rates, but the long-term sustainable growth is caused by retaining earnings and reinvesting those earnings. Factors that cause short-term swings include anything that causes a company to earn a return on book equity at a rate different from the long-term sustainable rate. Assume, for example, that a particular utility company is regulated so that it is provided with a reasonable opportunity to earn 9% on its equity. Should the company experience an event such as the loss of several key customers, or unfavorable weather conditions, which cause it to earn only 6% on equity in a given year, the drop from a 9% earned return on equity to a 6% earned return on equity would be concurrent with a very large drop in earnings per share. In fact, if a company did not issue any new shares of stock during the year, a drop from a 9% earned return on book equity to a 6% earned return on book equity would result in a 33.3% decline in earnings per share over the period.[90] However, such a drop in earnings would not be an indication of what is a long-term sustainable earnings per share growth rate. If the drop were caused by weather conditions, the drop in earnings would be immediately offset once normal weather conditions return. If the drop were

[90] By definition, earned return on equity is earnings divided by book value. Therefore, whatever level of earnings is required to produce earnings of 6% of book would have to be 33.3% lower than the level of earnings required to produce a return on book equity of 9%.

from the loss of some key customers, the company would replace the lost earnings by filing for a rate increase to bring revenues up to the level required for the company to be given a reasonable opportunity to recover its cost of equity.

For the reasons above, changes in earnings per share growth rates that are caused by non-recurring changes in the earned return on book equity are inconsistent with long-term sustainable growth, but changes in earnings per share because of the reinvestment of additional assets is a cause of sustainable earnings growth. The "b x r" term in the DCF equation computes sustainable growth because it measures only the growth which a company can expect to achieve when its earned return on book equity "r" remains in equilibrium. If analysts have sufficient data to be able to forecast varying values of "r" in future years, then a complex, or multi-stage DCF method must be used to accurately quantify the effect. Averaging growth rates over sub-periods, such as averaging growth over the first five years with a growth rate expected over the subsequent period, will not provide an appropriate representation of the cash flows expected by investors in the future and, therefore, will not provide an acceptable method of quantifying the cost of equity using the DCF method. The choices are either a constant growth DCF, in which one growth rate derived using "b x r" should be used, or a complex DCF method in which the cash flow anticipated in each future year is separately estimated.

**Q105. WHY ARE ANALYSTS' FIVE-YEAR CONSENSUS GROWTH RATES NOT INDICATIVE OF LONG-TERM SUSTAINABLE GROWTH RATES?**

A105. Analysts' five-year earnings per share growth rates are earnings per share growth rates that measure earnings growth from the most currently completed fiscal year to projected earnings five years into the future. These growth rates are not indicative of future sustainable growth rates in part because the sources of cash flow to an investor are dividends and stock price appreciation. While both stock price and dividends are impacted in the long run by the level of earnings a company is capable of achieving, earnings growth over a period as short as five years is rarely in synchronization with the cash flow growth from increases in dividends and stock prices. For example, if a company experiences a year in which investors perceive that earnings temporarily dipped below normal trend levels, stock prices generally do not decline at the same percentage that earnings decline, and dividends are usually not cut just because of a temporary decline in a company's earnings. Unless both the stock price and dividends mirror every down swing in earnings, they cannot be expected to recover at the same growth rate that earnings recover. Therefore, growth rates such as five-year projected growth in earnings per share are not indicative of long-term sustainable growth rates in cash flow. As a result, they are not applicable for direct use in the simplified DCF method.

**Q106. IS THE USE OF FIVE-YEAR EARNINGS PER SHARE GROWTH RATES IN THE DCF MODEL ALSO IMPROPER?**

A106. Yes. A raw, unadjusted, five-year earnings per share growth rate is usually a poor proxy for either short-term or long-term cash flow growth that an investor expects to receive. When

implementing the DCF method, the time value of money is considered by equating the current stock price of a company to the present value of the future cash flows that an investor expects to receive over the entire time that he or she owns the stock. The discount rate required to make the future cash flow stream, on a net present value basis, equal to the current stock price is the cost of equity. The only two sources of cash flow to an investor are dividends and the net proceeds from the sale of stock at whatever time in the future the investor finally sells. Therefore, the DCF method is discounting future cash flows that investors expect to receive from dividends and from the eventual sale of the stock. Five-year earnings growth rate forecasts are especially poor indicators of cash flow growth, even over the five years being measured by the five-year earnings per share growth rate number.

**Q107. WHY IS A FIVE-YEAR EARNINGS PER SHARE GROWTH RATE A POOR INDICATOR OF THE FIVE-YEAR CASH DIVIDEND GROWTH EXPECTATIONS?**

A107. The board of directors of a company changes dividend rates based upon long-term earnings expectations combined with the capital needs of a company. Most companies do not decrease dividends simply because a company has a year in which earnings were below sustainable trends, and similarly they do not increase dividends simply because earnings for one year happened to be above long-term sustainable trends. Therefore, over any given five-year period, earnings growth is frequently very different from dividend growth. In order for earnings growth to equal dividend growth, at a minimum, earnings per share in the first year of the five-year earnings growth rate period would have to be exactly on the long-term earnings trend line expected by investors. Since earnings in most years are above or below the trend

line, the earnings per share growth rate over most five-year periods is different from what is expected for dividend growth.

**Q108. WHY IS THE FIVE-YEAR EARNINGS PER SHARE GROWTH RATE A POOR INDICATION OF FUTURE STOCK PRICE GROWTH?**

A108. If a company happens to experience a year in which earnings decline below what investors believe is consistent with the long-term trend, then the stock price does not drop anywhere near as much as earnings drop. Similarly, if a company happens to experience a year in which earnings are higher than the investor-perceived long-term sustainable trend, the stock price will not increase as much as the earnings. In other words, the P/E ratio of a company will increase after a year in which investors believe earnings are below sustainable levels, and the P/E ratio will decline in a year in which investors believe earnings are higher than expected. Since stock price is one of the important cash flow sources to an investor, a five-year earnings growth rate is a poor indicator of cash flow, both because it is a poor indicator of stock price growth over the five years being examined, and because it is equally a poor predictor of dividend growth over the period.

**Q109. ARE YOU SAYING THAT ANALYSTS' CONSENSUS EARNINGS PER SHARE GROWTH RATES ARE USELESS AS AN AID TO PROJECTING THE FUTURE?**

A109. No. Analysts' EPS growth rates are, however, very dangerous if used in a simplified DCF without proper interpretation. While they are not useful if used in their "raw" form, they can be very useful in computing estimates of what earned return on equity investors expect will be

sustained in the future, and as such, are useful in developing long-term sustainable growth rates. This is exactly what I do in the application of my constant growth DCF Analysis.

**Multi-Stage DCF Method**

**Q110. DO YOU AGREE WITH DR. VILLADSEN THAT THE 6.9% RESULTS OF HER MULTI-STAGE DCF SHOULD BE GIVEN LIMITED WEIGHT AT THIS TIME?**

A110. No. Dr. Villadsen claims that "…the multi-stage DCF mode's assumption that current prices reflect investors' expectations that dividend growth will converge with the rate of GDP growth in the long term may understate how the pattern of expected dividends will be valued in the market throughout the period for which fates decided in this proceeding will be in effect (i.e., 2-23 onward)."[91]

It should also be pointed out that Dr. Villadsen has been making similar claims regarding the acuacy of her multi-stage DCF model. In SCE's 2017 rate case, Dr. Villadsen also claimed that the current high utility stock prices and unusually low GDP growth forecasts indicated that the results of her multi-stage DCF may be downward biased.[92]

[91] Dr. Villadsen's Direct Testimony, Page 48, lines 6-11.

[92] Application 17-04-003, Dr. Villadsen's Direct Testimony, Page 39, lines 809-816.

## CAPM / ECAPM

**Q111. PLEASE DESCRIBE DR. VILLADSEN'S CAPM METHOD.**

A111. Dr. Villadsen explains that the CAPM "posits a risk-return relationship known as the Security Market Line, in which the required expected return on an asset is proportional to the asset's relative risk as measured by that asset's so-called 'beta.'"[93] She says that this method is defined by the following formula and four components:

$$r_s = r_f + \beta s \text{ X MRP}$$

Where:

$r_s$ = the cost of capital for investment S;
$r_f$ = the risk-free interest rate;
$\beta$ = Beta risk measure for investment S; and
MRP = the market equity risk premium.[94]

She also uses an Empirical CAPM (ECAPM). Dr. Villadsen claims the ECAPM makes use of the empirical finding that low-beta stocks tend to have higher risk premiums than predicted by the CAPM.[95] This method includes the same four components as the CAPM, but also introduces a factor of alpha (α), which "has the effect of increasing the

[93] Dr. Villadsen's Direct Testimony, Appendix B, Page 4 of 17.

[94] Dr. Villadsen's Direct Testimony, Appendix B, Page 5 of 17.

[95] Dr. Villadsen's Direct Testimony, Appendix B, Page 8 of 17.

intercept, but reducing the slope of the Security Market Line,"[96] essentially increasing the risk-free rate of the CAPM.

Dr. Villadsen's ECAPM formula:

$$K_s = r_f + \alpha + \beta s \text{ x } (\text{MRP} - \alpha)$$ [97]

**Q112. WHAT RISK-FREE RATE DOES DR. VILLADSEN USE IN HER CAPM/ECAPM?**

A112. She uses a risk-free rate of 3.33% based on the forecasted yield on 10-year U.S. Treasury Bonds of 2.83% plus 50 basis points, which is her estimate of the historical maturity premium for 20-year over 10 year Government Bond.[98]

**Q113. WHAT RISK PREMIUM DOES DR. VILLADSEN USE IN HER CAPM/ECAPM?**

A113. Dr. Villadsen uses a Market Risk Premium based on historical data (7.46%) and "forward-looking measures" (7.30%).[99] Her historical MRP is based on the arithmetic average market risk premium of stocks over long-term government bonds from 1926 to the present (2021).[100] Dr. Villadsen's forward-looking MRP is based on Bloomberg's February 2021 forecast.[101] Both of these methodologies are based on the S&P 500 Index as a benchmark for the market.

[96] Dr. Villadsen's Direct Testimony, Appendix B, Page 8 of 17.

[97] Dr. Villadsen's Direct Testimony, Page 31, lines 638-642 and page 32, lines 643-644.

[98] Dr. Villadsen's Direct Testimony, Page 36, lines 1-10.

[99] Dr. Villadsen's Direct Testimony, Page 36, lines 11-20 and Page 37, lines 1-2.

[100] Dr. Villadsen's Direct Testimony, Page 36, lines 18-19.

[101] Dr. Villadsen's Direct Testimony, Page 36 line 20 and Page 37, line 1.

**Q114. WHAT BETA COEFFICIENT DOES DR. VILLADSEN USE IN HER CAPM/ECAPM?**

A114. She uses Value Line published betas, which are calculated only once every 3 months based on 5 years of historical weekly returns. The Value Line beta calculation methodology is based on the New York Stock Exchange Composite Index, which includes approximately 2,800 companies, as a benchmark for the market.[102]

**Q115. DOES DR. VILLADSEN USE AN APPROPRIATE RISK-FREE RATE IN HER CAPM?**

A115. The risk-free rate component of Dr. Villadsen's CAPM is not appropriate because it is based primarily on economists' published projections and not investors' expectations as indicated by current market yields. However, at this time her risk free rate of 3.33% happens to be reasonable because it not materially different than market yields. As of July 31, 2022, the yield on 20-year Treasury Bonds is 3.20%.

**Q116. DO DR. VILLADSEN'S BETA COEFFICIENTS OVERSTATE THE COST OF EQUITY?**

A116. Yes. Dr. Villadsen's historical beta coefficients are higher than forward measures of systematic risk currently anticipated by investors and therefore overstate the cost of equity. Dr. Villadsen herself agrees that relying on historical data could under (or over) state the cost

[102] Dr. Villadsen's Direct Testimony, Page 37, lines 4-5.

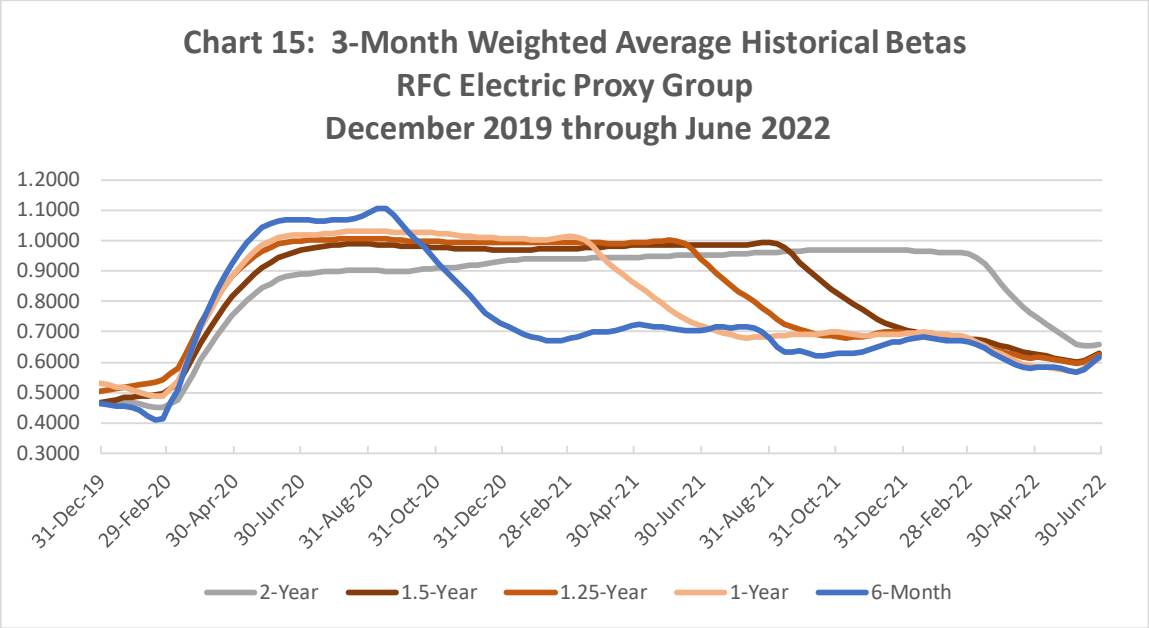
of equity.[103] This is the reason I rely on option-implied betas (explained on page 79) in addition to historical betas to estimate forward-looking systematic risk in the form of beta. Option-implied betas indicate that investors expect electric utility stock price movements to be less correlated with the overall market than before the pandemic. As of December 31, 2019, the 3-month average option-implied beta for my RFC Electric Proxy Group was 0.76. As of June 28, 2022, the 3-month average option-implied beta of these 26 electric utility companies was 0.58. In other words, investors expect electric utility stocks to move less than two-thirds of a percent for every one percent the market moves. Dr. Villadsen's CAPM results likely overstate the cost of equity because she uses stale 5-year historical betas (averaging 0.90 for her Electric Proxy Group[104]) instead of recently calculated betas based on current investor expectations. Dr. Villadsen's 5-year historical betas overstate SCE's cost of equity because they remain elevated from the short-term extreme market conditions that prevailed during the onset of the pandemic (March-April 2020). On the other hand, historical betas calculated with capital market data of 2-years or less are not impacted by the short-term market turmoil from March-April 2020. Therefore, in this proceeding, to determine a cost of equity for the Utilities that is reflective of current market conditions (i.e., not impacted by short-term market phenomena) it is required to consider historical beta coefficients that look back 2 years or less.

The short-term turmoil caused by the pandemic in March and April 2020 should be given little, if any, weight in COE models, and instead one should give more weight to

[103] Dr. Villadsen's Direct Testimony, Page 16, Page 11-12.

[104] Dr. Villadsen's Direct Testimony, Page 31, Figure 8.

historical beta coefficients that look back 2 years or less. As shown in Chart 15 below, historical beta coefficients calculated based on time horizons of two years or less are lower than 5-year historical betas, which Dr. Villadsen cites to be 0.90 according to Value Line in February 2022.[105] Historical beta coefficients calculated based on a 6-month time horizon came down significantly starting roughly 6 months after March 2020. The 1.5-year historical betas started to come down roughly 1.5-year later. And so on.




Another reason Dr. Villadsen's CAPM and ECAPM analyses likely overstate the cost of equity is because she uses a different market index for her beta calculations than she uses for her market risk premium. She uses 5-year historical betas published by Value Line which are based on the NYSE Composite Index, but her market risk premium is based on the S&P 500 Index. The most important aspect of selecting a market index for a CAPM

[105] Dr. Villadsen's Direct Testimony, Page 31, Figure 8.

analysis is to be consistent and use the same index for the calculation of beta as for the calculation of the market risk premium. Using exactly the same beta calculation methodology with a different market index will result in different values of beta for a given company or portfolio -- sometimes drastically different values.

**Q117. DO YOU AGREE WITH THE RESULTS OF DR. VILLADSEN'S CAPM/ECAPM ANALYSIS?**

A117. No, I do not agree with the results (9.20% - 10.0%)[106] of Dr. Villadsen's CAPM analysis because they are not based on investor expectations. My primary concern is that she uses analyst forecasts (e.g., interest rates, Bloomberg's forecasted equity returns) instead of investor expectations as revealed by market data. Dr. Villadsen's use of non-market-based data in her "forward-looking" CAPM analysis contradicts her statement that the cost of equity should rely on market-based data to quantify investor expectations.

Furthermore, even though historical betas are a decent way of estimating recent non-diversifiable risk, they are inherently backward looking. Dr. Villadsen herself agrees relied on historical data can under (or overstate) the cost of equity. This is the reason I rely on option-implied betas (explained on page 79) in addition to historical betas to estimate forward-looking systematic risk in the form of beta. As explained above, current stock option data indicates that investors expect betas for electric utility stocks to be lower than the 5-year historical betas relied upon by Dr. Villadsen.

[106] Table 12 on page 126.

## Implied Equity Risk Premium Method

**Q118. YOU MENTIONED ABOVE THAT DR. VILLADSEN'S SO-CALLED IMPLIED EQUITY RISK PREMIUM METHOD SHOULD NOT BE CONSIDERED BECAUSE IT IS NOT MARKET-BASED. PLEASE EXPLAIN.**

A118. As discussed above, the foundation of Dr. Villadsen's analytical methodology is flawed because it is not market-based. But in her DCF and CAPM method she at least includes some market data (e.g., stock prices). In the case of her Implied Market Risk Premium method, she does not use any market data at all. She does not even pretend it is market based. The overriding problem with Dr. Villadsen's Implied Equity Risk Premium method is that it does not address the cost of equity at all. It simply calculates the historical relationship between authorized ROEs and interest rates. Authorized ROEs are applied to book equity and therefore, in order to determine investors' return expectations, it is required to consider the market price investors are willing to pay for the companies with these authorized ROEs.

**Q119. PLEASE SUMMARIZE YOUR CONCERNS WITH DR. VILLADSEN'S RATE OF RETURN TESTIMONY.**

A119. I have the following primary concerns regarding the rate of return testimony of Dr. Villadsen:

1. Increasing her ROE recommendation based on her leverage adjustment calculations is inappropriate because it goes against original cost ratemaking;

2. Her claim that the 6.9% results of her multi-stage DCF are downward biased is opportunistic and non-market-based;
3. Her claim that SCE is riskier than the average company in her Electric Proxy Group proxy group is unjustified, and therefore their authorized ROE should be based on the midpoint of COE model results and not the high end, as she suggests;
4. Instead of using available forward-looking measures of systematic risk, she only uses backward looking historical beta coefficients in her CAPM/ECAPM. Furthermore, these historical betas are flawed because they are stale and based on a market index that is inconsistent with the risk premium portion of her methodology;
5. Her CAPM and ECAPM likely overstate the cost of equity is because she uses a different market index for her beta calculations than she uses for her market risk premium and
6. Her constant growth DCF overstates the cost of equity because she mechanically uses analyst 5-year EPS growth rates as a proxy for growth without considering the mathematical relationship between retention rates dividend payments, and growth.

## B. Pacific Gas and Electric Company

**Q120. PLEASE SUMMARIZE THE TESTIMONY OF DR. VILBERT**

A120. Dr. Vilbert recommended that PG&E be allowed an ROE of 11.00%.[107] Dr. Vilbert arrived at his recommendation based upon his own modified versions of the following COE models: 1) two DCF (Single- and Multi-Stage) models, 2) CAPM, 3) ECAPM, and 4) Implied Equity Risk Premium Model.[108] However, his 11.00% recommendation is not based on his model results alone. He claims it is necessary to add a so-called leverage adjustment to account for the difference between market value and book value capital structures. This adjustment increases his model results significantly.

The unadjusted results of Dr. Vilbert's COE models are still higher than PG&E's market-based cost of equity because of flaws in his application of those models, as discussed below.

**Q121. WHY IS IT INAPPROPRIATE TO CONSIDER DR. VILBERT'S LEVERAGE ADJUSTMENTS IN DETERMINING PG&E'S AUTHORIZED ROE?**

A121. Financial leverage is a measure of the ratio of debt financing to equity financing. As a company takes on more debt, its financial risk increases because the higher the leverage, the higher the chance of financial stress and bankruptcy. Leverage is a concept that a Chief Financial Officer needs to consider when making sure the company's cost of equity

[107] Dr. Vilbert's Direct Testimony, Page 52, Table 2-8, Page 54, Table 2-9, and Page 60, Table 2-10.

[108] Dr. Vilbert's Direct Testimony, Page 3, Table 1.

calculations match its targeted capital structure. It is appropriate to consider financial leverage in general, as I do in my testimony. However, Dr. Vilbert's leverage adjustment in this proceeding has nothing to do with finance. He is using complex financial concepts (e.g., after-tax weighted-average cost of capital) to distort the fundamental mechanics of original cost ratemaking. Applying a market-based cost of equity to book value is the very definition of original cost ratemaking, but not a reason to make a leverage adjustment. Therefore, the financial leverage adjustment proposed by Dr. Vilbert is simply misplaced and should be removed from consideration in this proceeding.

**Q122. DOES DR. VILBERT CLAIM THERE ARE ADDITIONAL RISK FACTORS THAT APPLY TO PG&E?**

A122. Yes. Dr. Vilbert claims that the following risk factors indicate that PG&E is riskier because it faces asymmetric risk associated with, among other things, residual wildfire liability and risk of disallowance, in particular from balancing and memorandum accounts and grid decarbonization."[109]Dr. Vilbert has not demonstrated that PG&E has greater non-diversifiable risk on average than other electric utility companies, therefore there is no reason for it to receive an authorized ROE as high as its requested 10.35%. PG&E should receive an authorized ROE no higher than the midpoint of properly applied model results.

[109] Dr. Vilbert's Direct Testimony, Page 2-4, Lines 11-13.

**Q123. IS DR. VILBERT'S 11.00% COST OF EQUITY RECOMMENDATION MARKET-BASED?**

A123. No. Dr. Vilbert correctly states that "The cost of capital is defined as the expected rate of return in capital markets on alternative investments of equivalent risk."[110] However, when it comes time to make his computations, he fails to rely on the return expectations of investors as indicated by market data. Instead, he uses the expectations of economists, equity analysts, and other non-market expectations, even where market data is readily available. In other words, his cost of equity recommendation is inconsistent with the requirement of the U.S. Supreme Court that the cost of equity should be market-based.

**Q124. DO THE RESULTS OF DR. VILBERT'S COST OF EQUITY MODELS PROVIDE A RELIABLE INDICATION OF PG&E'S COST OF EQUITY?**

A124. No. As discussed above, even the midpoint of Dr. Vilbert's unadjusted model results is inflated because his models are based on non-market-based methodology that violates the purpose of rate of return regulation. Additionally, each of his COE models has specific issues that contribute to his unreasonably high results. First, I will address how his constant growth DCF method is unreliable because it mechanically uses analyst 5-year EPS growth rates as a proxy for growth without considering the mathematical relationship between retention rates, dividend payments, and growth. A company cannot invest and grow with money it has paid out to investors as a dividend. Second, I will explain why the most significant flaw with Dr.

[110] Dr. Vilbert's Direct Testimony, Page 7, Lines 20-21.

Vilbert's multi-stage DCF methodology understates an appropriate return on equity in today's capital markets. Third, I will explain how his CAPM/ECAPM methodologies overstate the cost of equity. Finally, I will explain why his so-called Implied Risk Premium method should be disregarded because it is not a market-based method.

## Constant Growth DCF Method

**Q125. DOES DR. VILBERT PROPERLY APPLY THE SIMPLIFIED OR CONSTANT GROWTH DCF METHOD?**

A125. No. Dr. Vilbert correctly explains that "the constant growth rate DCF model requires that dividends and earnings grow at a constant rate…"[111] He further states that "If the dividend growth rates and earnings were expected to vary over some number of years before settling down into a constant growth period, then it would be appropriate to utilize a multi-stage DCF model."[112] His constant growth DCF method contradicts his own description of how the constant growth model should be implemented, however. His growth rate component is based entirely on short-term EPS growth forecasts.[113] The correct application of the DCF method requires that the dividend yield be computed properly, and that the growth rate used be derived from a careful study of the future *sustainable* growth in cash flow anticipated by investors. As discussed in Section II, major financial institutions like J.P. Morgan Chase do not use a growth

[111] Dr. Vilbert's Direct Testimony, Page 44, Lines 2-3.

[112] Dr. Vilbert's Direct Testimony, Page 44, Lines 5-7.

[113] Dr. Vilbert's Direct Testimony, Schedule No. AS-5.

rate based on analyst 5-year EPS growth rates, as Dr. Vilbert has done. From page 105 to page 111 above, I explain why a future-oriented "B X R" method is superior to a five-year earnings per share growth rate forecast in providing a long-term sustainable growth rate.

## C. San Diego Gas & Electric Company

**Q126. PLEASE SUMMARIZE THE TESTIMONY OF MR. COYNE.**

A126. Mr. Coyne has recommended that SDG&E be allowed an ROE of 10.55%.[114] Mr. Coyne arrived at his recommendation based upon his own modified versions of the following COE models: 1) DCF model, 2) CAPM, 3 Risk Premium, and 4) Expected Earnings Approach.[115] As outlined in Table 14 on page 125, these approaches provide equity cost rate estimates between 9.47% and 11.54%.

[114] Mr. Coyne's Direct Testimony, Page 3, lines 14-15.

[115] Mr. Coyne's Direct Testimony, Page 28, lines 1-3.

| TABLE 14: MR. COYNE'S COST OF EQUITY MODEL RESULTS | |
|---|---|
| **METHOD** | **Model Results** |
| **DCF** | 9.72% |
| **CAPM** | |
| Currnet Interest Rates | 10.84% |
| Projected Interest Rates | 11.54% |
| **Risk Premium** | |
| Currnet Interest Rates | 9.47% |
| Projected Interest Rates | 9.97% |
| **Expected Earnings** | 9.77% |
| | |
| **Four Model Average** | |
| Currnet Interest Rates | 9.47% - 10.84% |
| Projected Interest Rates | 9.72% - 11.54% |
| **Average ROE** | |
| Currnet Interest Rates | 9.95% |
| Projected Interest Rates | 10.25% |

Mr. Coyne's Direct Testimony, Figure 11, page 41.

**Q127. WHAT DID MR. COYNE CONCLUDE REGARDING SDG&E'S RELATIVE RISK COMPARED TO THE COMPANIES IN HIS PROXY GROUP?**

A127. Mr. Coyne considered various factors that he claims impact SDG&E's risk profile, including the Company's capital expenditure program, and regulatory risk.[116] He concluded that SDG&E has elevated risk relative to the utilities in his proxy group, supporting an authorized ROE above the mean. However, market data shows that investors do not view perceive SDG&E riskier than other electric utility companies.

[116] Mr. Coyne's Direct Testimony, Page 48, lines 6-10.

**Q128. IS MR. COYNE'S 10.55% COST OF EQUITY MARKET-BASED?**

A128. No. Mr. Coyne states that the ROE is a "market-based concept,"[117] but when applying his approaches, there are key places where he fails to use market data. For example, half of his CAPM results are based on projected interest rates (2023-2027) instead of directly observable market yields.[118] His claim that utility stocks are expected to decline and underperform the overall market[119] is problematic for at least the following two reasons. First, he does not base his claim regarding future utility stock price performance on market data. His claim is based on his own opinion and pure speculation. Even though he provides a chart showing that utilities underperformed the market between January 2020 and February 2022,[120] Chart 2 on page 14 shows that electric utility stocks have significantly outperformed the overall market since SDG&E's last rate case in April 2019. In the first 6-months of 2022, and particularly since Russia invaded Ukraine on February 24, 2022, electric utility stocks are up nearly 2% while the S&P 500 is down over 21%. Second, he does not use a multi-stage DCF model to directly measure how his claim that investors expect utility stocks to decline would impact the cost of equity.

[117] Mr. Coyne's Direct Testimony, Page 28, lines 7-9.

[118] Mr. Coyne's Direct Testimony, Page 38, lines 4-6.

[119] Mr. Coyne's Direct Testimony, Page 27, lines 18-19.

[120] Mr. Coyne's Direct Testimony, Page 20, Figure 5.

**Q129. DO THE RESULTS OF MR. COYNE'S COST OF EQUITY MODELS PROVIDE A RELIABLE INDICATION OF SDG&E'S COST OF EQUITY?**

A129. No. Mr. Coyne's 10.55% ROE recommendation is significantly higher than SDG&E's market-based cost of equity. If his recommendation is used to set rates, consumers will be significantly overcharged. Mr. Coyne's 10.55% ROE recommendation is excessive largely because: (1) his COE calculations are based on a flawed analytical approach and an inappropriate definition of the cost of equity, despite defining it correctly in considerable portions of his filed testimony, and (2) his interpretation of current capital markets includes unknowable and/or speculative predictions.

Additionally, each of his COE models has specific issues that contribute to his unreasonably high results. First, I will address how his constant growth DCF method is unreliable because it mechanically uses analyst 5-year EPS growth rates as a proxy for growth without considering the mathematical relationship between retention rates, dividend payments, and growth. A company cannot invest and grow with money it has paid out to investors as a dividend. Second, I will explain how his CAPM methodology overstates the cost of equity by relying exclusively on 5-year historical betas that remain inflated because they are still impacted by the market turmoil during the early stages of the pandemic (March – April 2020) that are no longer representative of SDG&E's cost of equity, among other reasons. Finally, I will explain why his so-called Expected Earnings method should be disregarded because, as FERC concluded, it is not a market-based method.

**DCF Method**

**Q130. WHAT FORMULA DOES MR. COYNE USE IN HIS DCF ANALYSIS?**

A130. $k = \frac{D_0(1+g)}{P_0} + \text{g}$ [121]

Where:

K: $required\ return$;
$P_0$: $stock\ price$;

$D_0$: current $dividend$;
$g$: expected $growth\ rate$.

**Q131. DOES MR. COYNE PROPERLY APPLY THE SIMPLIFIED OR CONSTANT GROWTH DCF METHOD?**

A131. No. Mr. Coyne explains correctly that the constant growth DCF model "assumes" dividends grow at a constant rate in perpetuity and that "one must assume a constant payout ratio, and that earnings per share, dividends per share, and book value per share all grow at the same constant rate."[122] His DCF method contradicts his own description of how the constant growth model should be implemented, however. His growth estimate relies entirely on analyst EPS growth forecasts.[123] The correct application of the DCF method requires that the dividend yield be computed properly, and that the growth rate used be derived from a careful study of what future *sustainable* growth in cash flow is anticipated by investors. As discussed above,

[121] Mr. Coyne's Direct Testimony, Page 27, lines 17-18.

[122] Mr. Coyne's Direct Testimony, Page 34, lines 7-9.

[123] Mr. Coyne's Direct Testimony, Exhibit JMC-4, pages 1-3.

major financial institutions like J.P. Morgan Chase do not use a growth rate based on analyst 5-year EPS growth rates as Mr. Coyne has done. From page 105 to page 111 above, I explain why a future-oriented "B X R" method is superior to a five-year 5 earnings per share growth rate forecast in providing a long-term sustainable growth rate..

## CAPM Method

**Q132. PLEASE DESCRIBE MR. COYNE'S CAPM METHOD.**

A132. Mr. Coyne explains that the CAPM method "is a risk premium approach that estimates the cost of equity for a given security as a function of a risk-free return plus a risk premium (to compensate investors for the non-diversifiable or 'systematic' risk of that security)."[124] He says that this method is defined by the following four components:

$$K_e = r_f + \beta\ (r_{m-}r_f)$$

Where:

$K_e$ = the required ROE for a given security;
$r_f$ = the risk-free rate of return;
$\beta$ = the Beta of an individual security; and
$r_m$ = the required return on the market as a whole.[125]

**Q133. WHAT RISK-FREE RATE DOES MR. COYNE USE IN HIS CAPM?**

A133. He uses the following two risk-free rates: (1) Current 30-day average of 30-year Treasury bond yields (2.20%), and (2) Projected 30-year U.S. Treasury Bond Yields (3.40%).[126]

[124] Mr. Coyne's Direct Testimony, Page 36, lines 11-13.

[125] Mr. Coyne's Direct Testimony, Page 36, lines 16-20 and Page 37, line 1.

[126] Mr. Coyne's Direct Testimony, Exhibit JMC-5.2, Pages 1-4.

**Q134. WHAT BETA COEFFICIENT DOES MR. COYNE USE IN HIS CAPM?**

A134. He uses the following two historical beta coefficients: (1) Bloomberg 5-year weekly return relative to the S&P 500 index, and (2) Value Line 5-year historical weekly return relative to the New York stock exchange composite index.[127]

**Q135. WHAT RISK PREMIUM DOES MR. COYNE USE IN HIS CAPM?**

A135. Mr. Coyne calculates his forward-looking market risk premium by mechanically using published earnings growth rate forecast and dividend yields from three sources (Bloomberg Professional, and Value Line) in his constant growth DCF model.[128] His market risk premium is 13.43% (based on the current 30-year Treasury bond yield) and to 12.22% (based on the projected Treasury bond yield).[129]

**Q136. DO YOU AGREE WITH THE WAY MR. COYNE DETERMINED THE RISK-FREE RATE COMPONENT OF HIS CAPM?**

A136. No, I do not. The way he determined the risk-free rate component of his CAPM is problematic because he uses interest rate forecasts instead of the market yield. The current yield on the 30-year U.S. Treasury bond by itself indicates market expectations. If investors believed that the yield on long-term U.S. Treasuries was going to increase over the time frames covered by the Blue Chip forecasts used by Mr. Coyne (the next 1-5 years) when he filed his

[127] Mr. Coyne's Direct Testimony, Page 39, lines 16-21.

[128] Mr. Coyne's Direct Testimony, Page 40 , lines 6-15.

[129] Mr. Coyne's Direct Testimony, Exhibit JMC-5.2, pages 1-4.

testimony (April 1, 2022), the price of 30-year U.S. Treasury bonds would have already dropped until the yield matched, or was at least close to, their expectations. The reason the current yield adjusts to investors' expectations is because the price of bonds and interest rates move in opposite directions. Buying a 30-year bond today expecting interest rates to increase would be the same as giving money away. Investors are not always rational, but I am comfortable stating that investors generally do not like to lose money.

Of course, investors' expectations are often inaccurate, and investors do lose money. In this case, long-term interest rates increased more than investors expected. Between the time Mr. Coyne filed his testimony (April 20, 2022) and July 31, 2022 the yield on 30-year Treasury Bonds has increased from 2.44% to 3.00%.

**Q137. DOESN'T THE FACT THAT INTEREST RATES INCREASED PROVE THAT MR. COYNE'S USE OF FORECASTED INTEREST RATES IS APPROPRIATE?**

A137. No. First, interest rate forecasts have been persistently inaccurate for decades. Just because they are relatively accurate for a brief period of time does not mean they will continue to be accurate. It is difficult to imagine a scenario in which utility rate of return witnesses know that Blue Chip has finally figured out how to predict interest rates, but investors do not also know this. This is in fact, what Mr. Coyne is claiming by using Blue Chip interest rate forecasts instead of the market yield on the 30-year U.S. Treasury bond as the risk free rate in his CAPM. Again, the current yield on the 30-year U.S. Treasury bond by itself indicates market expectations and using forecasts only inflates his results. Therefore Mr. Coyne's market

speculations, including his reliance on interest rate projections for the risk-free rate portion of her CAPM should not be used to set rates in this proceeding.

**Q138. DO MR. COYNE'S BETA COEFFICIENTS OVERSTATE THE COST OF EQUITY?**

A138. Yes. The historical beta coefficients used by Mr. Coyne are higher than a broader measure of recent historical and forward-looking beta coefficients indicate and therefore overstate the cost of equity. Mr. Coyne's CAPM results likely overstate the cost of equity because Mr. Coyne uses 5-year historical betas (average Value Line betas of 0.88 for and average Bloomberg beta of 0.873 for his proxy group[130]) instead of betas based on current investor expectations. Option-implied betas over the past three months average 0.59, indicating that investors expect electric utility stock price movements to be less correlated with the overall market than before the War in Ukraine and the pandemic – the average option-implied beta for my RFC Electric Proxy Group, which is based on current investor expectations as exemplified in actual current option prices, averaged 0.56 for the three months ending just before the War in Ukraine (February 22, 2022) and 0.76 for the three months ending before the start of the pandemic (December 31, 2019).

[130] Mr. Coyne's Direct Testimony, Page 18, Figure 4.

**Q139. DO YOU AGREE WITH THE RESULTS OF MR. COYNE'S CAPM ANALYSIS?**

A139. No, I do not agree with the results of Mr. Coyne's CAPM analysis (13.93% - 14.05%)[131] because they are not based on investor expectations. He uses historical data (e.g., betas) and analyst forecasts (e.g., interest rates, earnings growth) instead of investor expectations as revealed by market data. Mr. Coyne's use of historical and non-market-based data in his "forward-looking" CAPM analysis contradicts his statement that the cost of equity should rely on market-based data to quantify investor expectations. Stock option data indicates that investors expect betas for stocks to be lower than historical betas over the time periods used by Mr. Coyne (5 years). Mr. Coyne's CAPM analysis is certainly not market based and should therefore not be relied upon to determine SDG&E's authorized ROE.

**Risk Premium Analysis**

**Q140. PLEASE SUMMARIZE MR. COYNE'S BOND YIELD PLUS RISK PREMIUM ANALYSIS.**

A140. On pages 42-44 of his direct testimony, Mr. Coyne explains how his method is based on the difference between authorized returns and the long-term Treasury yield.

Mr. Coyne conducted a regression analysis to determine the relationship between allowed returns and interest rates. He used data from electric and natural gas utility company rate cases between January 1, 1991, and February 28, 2022, and the prevailing level of interest rates

[131] Mr. Coyne's Direct Testimony, Page 41, lines 8-15.

during the pendency of the proceedings. He concludes that the risk premium generally increases as bond yields decrease, and vice versa.[132] The results of his regression show a cost of equity for SDG&E is between 9.47% and 10.01%.[133]

**Q141. IS THIS METHOD VALID?**

A141. No. Mr. Coyne has attempted to determine the cost of equity that would be demanded by investors on the market price of a company comparable to SDG&E by comparing it to the historic relationship between allowed returns and interest rates. The overriding problem with Mr. Coyne's comparable earnings analysis is that it did not address the cost of equity at all. Historical allowed returns is an entirely different concept from the cost of equity.

**Expected Earnings Analysis**

**Q142. PLEASE EXPLAIN THE EXPECTED EARNINGS ANALYSIS PRESENTED BY MR. COYNE.**

**A142.** Mr. Coyne's expected earnings approach consists of estimating what investors expect to earn on the book value for the stocks of the companies in his proxy group. He claims that return on book equity is relevant to the cost of equity. In order to estimate investors' expected return on book equity, he relied exclusively on Value Line's projections. He starts with the

[132] Mr. Coyne's Direct Testimony, Page 44, lines 3-4

[133] Mr. Coyne's Direct Testimony, page 45, Figure 12.

publication's future expected return on book equity forecasts for the period from 2024-2026 for 20 companies in his proxy group. Then, he adjusts these forecasts to account for the fact that Value Line's ROEs are calculated based on common shares outstanding at the end of the period, instead of average shares outstanding over the period.[134]

**Q143. IS THE EXPECTED EARNINGS METHODOLOGY VALID?**

A143. No. The overriding problem with Mr. Coyne's expected earnings analysis is that it does not address the cost of equity at all. It simply considers the returns on book equity that were achieved and are expected to be achieved by Value Line in the next 3 to 5 years. The earned return on book equity is an entirely different concept from the cost of equity, which should be market-based. For this reason, this method has recently been discredited and eliminated from consideration in Federal Energy Regulatory Commission (FERC) ROE proceedings. FERC determined it is not appropriate to use the Expected Earnings model because "the record does not support departing from our traditional use of market-based approaches to determine base ROE."[135] FERC goes on to say:

> In Hope, the Supreme Court explained that 'the return to the equity owner should be commensurate with returns on investments in other enterprises having corresponding risks.' In order to determine this, we must analyze the returns that are earned on 'investments in other enterprises having corresponding risks,' but investors cannot invest in an enterprise at book value and must instead pay the prevailing market price for an enterprise's equity. As a result, the expected return on a utility's book value does not

[134] Mr. Coyne's Direct Testimony, Page 46, lines 17-23.

[135] FERC Opinion No. 569, Par 200.

> reflect 'returns on investments in other enterprises' because book value does not reflect the value of any investment that is available to an investor in the market, outside of the unlikely situation in which market value and book value are exactly equal. Accordingly, we find that relying on the Expected Earnings model would not satisfy the requirements of Hope.[136]

As explained clearly by FERC, the Expected Earnings model should be excluded from consideration in this proceeding because it violates regulatory principles that require the cost of equity to be market-based.

**Q144. PLEASE SUMMARIZE YOUR CONCERNS WITH MR. COYNE'S TESTIMONY?**

A144. Mr. Coyne's 10.55% ROE recommendation is significantly higher than SDG&E's market-based cost of equity. If his recommendations are used to set rates, consumers will be significantly overcharged. Mr. Coyne's 10.55% ROE recommendation is excessive largely because:

1. his COE calculations are based on a flawed analytical approach and an inappropriate definition of the cost of equity, despite defining it correctly in considerable portions of his filed testimony, and
2. his interpretation of current capital markets include unknowable and/or speculative predictions.

[136] FERC Opinion No. 569, Par 201.

# X. CONCLUSION

**Q145. PLEASE SUMMARIZE YOUR RECOMMENDATIONS IN THIS CASE.**

A145. As shown on Table 1 on page 7, I recommend the following specific ROEs from the ranges shown in parentheses for the Utilities for the years 2023 to 2025:

- Southern California Edison: 8.08% (7.41% to 8.74%)
- Pacific Gas and Electric Company: 8.08% (7.41% to 8.74%)
- San Diego Gas & Electric Company: 7.81% (7.15% to 8.48%)

**Q146. DOES THIS CONCLUDE YOUR DIRECT TESTIMONY?**

A146. Yes.

# APPENDIX A: 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 B: TESTIFYING EXPERIENCE OF AARON L. ROTHSCHILD

### Filed Rate of Return Testimonies:

### California

- California American Water Company, Application 21-05-001, Rate of Return, January 2022
- California Water Service Company, Application 21-05-002, Rate of Return, January 2022
- Golden State Water Company, Application 21-05-003, Rate of Return, January 2022
- San Jose Water Company, Application 21-05-004, Rate of Return, January 2022
- Southern California Edison, Application 21-08-013, Rate of Return/Cost of Capital Mechanism, January 2022
- San Diego Gas & Electric Company, Application 21-08-014, Rate of Return/Cost of Capital Mechanism, January 2022
- Pacific Gas and Electric Company, Application 21-08-015, Rate of Return/Cost of Capital Mechanism, January 2022
- 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**

- Pennsylvania American Water Company, Docket No. R-2022-3031672 and R-2022-3031673, Rate of Return, July 2022

- 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**

- Piedmont Natural Gas Company, Inc., Docket No. 2022-89-G, July 2022
- Kiawah Island Utility, Inc., Docket No. 2021-324-WS, Rate of Return, February 2022
- 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

**Tennessee**

- Kingsport Power Company D/B/A AEP Appalachian Power, Docket No. 21-00107, Rate of Return, March 2022

**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

# APPENDIX C: BETA CALCULATION TECHNICAL DETAILS

**Q. WHAT BETA DID YOU USE IN YOUR CAPM?**

**A.** Since the cost of equity should be based on investor expectations, I chose to use two betas. My "Historical Blended Beta" 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. My "Forward Beta" is based on forward-looking investor expectations of non-diversifiable risk. I use the term "Hybrid Betas" to refer to a 50% weighing of Historical Blended Betas with a 50% weighing of Forward Betas.Most published betas are based exclusively on historical return data. For example, Value Line publishes a 5-year historical beta for each of the companies it covers. However, it is also possible to calculate betas based on investors' expectations of the probability distribution of future returns. This probability distribution of future returns expected by investors can be calculated based on the market prices of stock options.

**Q. WHAT ARE SOME OF THE BENEFITS OF CALCULATING YOUR OWN BETAS?**

**A.** Traditionally, the betas used in CAPM calculations are calculated from historical returns. An alternative way to calculate betas is to incorporate investors' return expectations by calculating option-implied betas as explained in the previous paragraph. As discussed below, I have chosen to use both historical and option-implied betas in my CAPM analysis. I chose to use option-implied betas in my CAPM analysis because, among other reasons, studies have found that betas calculated based on investor expectations (option-implied)

provide information regarding future perceived risks and expectations.[137] Doing my own historical beta calculations allows me to see how beta values change from week to week and to use the most up-to-date beta calculations instead of relying on stale betas published by Value Line 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 Value Line betas as February 28, 2022 for her April 20, 2022 testimony.[138]

## Historical Betas

**Q. PLEASE EXPLAIN HOW YOU CALCULATE HISTORICAL BETAS.**

**A.** I calculate historical betas following the methodology used by Value Line, with some improvements. Specifically, Value Line adheres to the following guidelines:

1. Returns for each security are regressed against returns for the overall market in the following form:

$$Ln\left(p^{I}_{t} / p^{I}_{t-1}\right) = a_{I} + B_{I} * Ln\left(p^{m}_{t} / p^{m}_{t-1}\right)$$

Where:

[137] Bo-Young Chang & Peter Christoffersen & Kris Jacobs & Gregory Vainberg. Option-Implied Measures of Equity Risk, *Review of Finance*, Vol. 16, Issue 2, pp. 385-428 (April 2012) available at https://academic.oup.com/rof/article/16/2/385/1584560.

[138] Dr. Villadsen Testimony at p. Appendix D-67 – 69.

- $p^{I}_{t}$ is the price of the security I at time t
- $p^{I}_{t-1}$ is the price of the security I one week before time t
- $p^{m}_{t}$ and $p^{m}_{t-1}$ are the corresponding values of the market index
- $B_I$ is the regression estimate of Beta for the security against the market index

2. The natural log of the price ratio is used as an approximation of each return and no adjustment is made for dividends paid during the week.
3. Weekly returns are calculated on one day of the week, with a stated preference for Tuesdays to minimize the effect of holidays as much as possible.
4. Betas calculated using the regression method above are adjusted as per Blume (1971)[139] using the following formula:

$$\text{Adjusted } B_I = 0.35 + 0.67 * \text{Calculated } B_I$$

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.

[139] M. Blume, On the Assessment of Risk, *The Journal of Finance*, Vol. XXVI (March 1971) available at www.stat.ucla.edu/~nchristo/Fiatlux/blume2.pdf.

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 (April through June 2022).
4. Value Line always uses a 5-year period for the return regression,[140] whereas I calculate historical betas for periods of 6 months, 2 years, and 5 years, as shown in Chart 15 on page 116.

In the following pages, I explain my rationale for making the four modifications above to Value Line's beta calculation methodology.

**Q. WHY DO YOU CALCULATE YOUR HISTORICAL BETAS VERSUS THE S&P 500 INDEX INSTEAD OF THE NEW YORK STOCK EXCHANGE (NYSE) COMPOSITE INDEX, AS VALUE LINE DOES?**

**A.** A critical factor in the calculation of a beta coefficient is the choice of index to represent the overall market. Using exactly the same beta calculation methodology with a different market index will result in different values of beta for a given company or portfolio – sometimes drastically different values. It is easy to jump to the conclusion that this points to a flaw in CAPM theory, as different values of beta would result in a different implied cost of equity. However, another key component of the CAPM, the market risk premium, also depends on the choice of the market index, which in theory would have an offsetting

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

effect on the cost of equity calculation. This points to the most important aspect of selecting a market index for a CAPM analysis, which is to be consistent and use the same index for the calculation of beta as for the calculation of the market risk premium. This is a fundamental concept of the CAPM and using betas based on one index with a market risk premium based on a different index yields invalid results.

As stated above, Value Line calculates its published betas based on the NYSE Composite Index. Most methodologies used to calculate the market risk premium, including those I rely on, are based on the S&P 500 Index, so using them in the CAPM together with Value Line betas exactly as published would yield invalid results.

For this reason, I calculate my historical betas versus the S&P 500 Index, making my CAPM approach entirely consistent. This is in contrast to witnesses that use Value Line betas (based on NYSE) and a risk premium based on the S&P 500, which mixes betas based on a different index and renders the CAPM results unreliable.

As an aside related to my option-implied betas, using the S&P 500 Index consistently throughout my CAPM has the added benefit that this index has a much larger number of options traded, which makes the calculation of option-implied betas more reliable.

**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,[141] 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.

[141] 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.

**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.

**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.[142] SDG&E relied upon Value Line and Bloomberg betas which use a 5-year historical period.[143]

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

**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 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,

[142] 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 .

[143] Coyne Testimony at p. JMC-14:fn20.

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. 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. The weight of 10 years of data makes a beta coefficient react extremely slowly to market developments. Even pronounced permanent market changes can take more than 6 months to have a detectable effect on a 10-year beta.

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. DO YOU THINK IT IS A GOOD IDEA TO RELY ON 6-MONTH HISTORICAL BETAS DESPITE MARKET DEVELOPMENTS IN THE PAST YEAR THAT SOME WOULD CALL "MARKET DISLOCATIONS?"**

**A.** Financial markets are constantly in flux due to the influence of countless factors. What some people may refer to as "market dislocations," though arguably more significant, I would say are just some of the numerous factors that are constantly affecting markets. To

attempt to separate any one specific factor from "real" underlying market dynamics would be an exercise in futility.

Furthermore, it is very difficult if not impossible for anyone to predict how long any one influencing factor will be present or how long its effects will be felt by financial markets. When interest rates came down to historical lows in 2008, many analysts referred to it as an aberration that would be short-lived. Twelve years later, rates have not only remained low, but have come down even further due to yet another unexpected event. COVID-19 affected markets tumultuously, and though the initial wall of the tsunami has passed, no one can say for sure if its direct fallout and the effects of its reverberations or a resurgence will continue to affect financial markets for months or years to come.

So, in response, yes, I think it is a good idea to use 6-month historical betas to measure recent and current market dynamics regardless of recent developments. I use them as part of my hybrid betas in conjunction with longer-term historical betas and forward-looking, option-implied betas to achieve the most reasonable result.

Speaking specifically about the most significant initial impact caused of the onset of the COVID-19 pandemic in March 2020, it should be pointed out that 6-month betas calculated in the past 3 months no longer cover that period of time.

**Q. GIVEN THE SHORTER PERIOD COVERED BY 6-MONTH HISTORICAL BETAS, CAN THEY STILL BE CONSIDERED STATISTICALLY**

**SIGNIFICANT? HOW MANY DATA POINT PAIRS ARE USED IN THE CALCULATION OF YOUR 6-MONTH HISTORICAL BETA COEFFICIENTS?**

**A.** A 6-month historical beta based on weekly returns calculated weekly is calculated using 26 closing price points for a company and for its corresponding market index, in this case the S&P 500 Index. This translates into 25 pairs of return data that are then used in the regression analysis. This is most certainly enough data to achieve statistical significance as addressed further below.

Furthermore, as stated above, the recent improvement in my calculation of historical betas of using weekly returns on every day of the week as opposed to using only one day of the week, as Value Line does, has the added benefit of providing significantly more data pairs to be used in the regression analysis used to calculate beta. For 6-month historical betas, instead of relying on 25 return pairs, the regression is performed on 117 return pairs.

**Q. HOW MANY DATA POINT PAIRS ARE NECESSARY TO ESTABLISH A STATISTICALLY SIGNIFICANT CORRELATION BETWEEN TWO VARIABLES IN A REGRESSION ANALYSIS, SUCH AS THE ONE USED TO ESTABLISH BETA COEFFICIENTS?**

**A.** Establishing a minimum number is somewhat subjective, though various authorities on statistics argue the number is between 3 and 8 data pairs. While one can broadly correctly generalize that the more data point pairs one uses, the more certain one can be about the significance of the results of any correlation analysis, this is very different from stating that

one cannot achieve statistical significance with a relatively low number of data pairs. In fact, it is important to realize that one can achieve statistical significance with less than 10 data pairs, and that even hundreds of data pairs do not guarantee statistical significance. For precisely this reason, statisticians have developed a tool that helps determine statistical significance based on the number of data pairs in a regression analysis.

A "table of critical values" of Pearson's correlation, which can be readily found online[144] or in most statistics books, tells a statistician that for 25 data point pairs (implying N-2=23 "degrees of freedom"), a correlation, or beta, coefficient of 0.505 or higher will occur *by chance* with a probability of only 0.01.[145] As explained in more detail in the text regarding how to use the table of critical values,[146] any beta coefficient above this level, and certainly above the 0.615 3-month average for the recent 6-month betas for my RFC Electric Proxy Group, by definition are considered statistically significant. The threshold for statistical significance for 117 data point pairs (implying 115 "degrees of freedom"), is so low that it is not even included in the table of critical values. The maximum "degrees of freedom" listed is 100, with an already very low threshold of 0.254.

## Forward-Looking Option-Implied Betas

[144] University of Connecticut, *r Critical Value Table*, available at https://researchbasics.education.uconn.edu/r_critical_value_table/#

[145] In fact, many researchers use a more lenient "alpha level" of 0.05 for determinations of statistical significance.

[146] University of Connecticut, *Statistical Significance: Is there a relationship (difference) or isn't there a relationship (difference)?* available at https://researchbasics.education.uconn.edu/statistical_significance

**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[147] and skewness[148] 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 guidelines as follows:

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.

[147] CBOE Volatility Index White Paper (2018) available at https://cdn.cboe.com/resources/indices/srvix-white-paper.pdf. Please note that the cover page says, "proprietary information." However, this document has been in the public domain for over 3 years.

[148] The CBOE SKEW Index (2010) available at https://cdn.cboe.com/resources/indices/documents/SKEWwhitepaperjan2011.pdf. Please note that the cover page says, "proprietary information." However, this document has been in the public domain for over 3 years.

- 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.
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." 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.

The CBOE calculates Times to Expiration by the minute—as do I. The Time to Expiration of traded options cannot be changed and varies from day to day. For the sake of consistency, the CBOE calculates the VIX and SKEW indices on a "30-day" basis by

interpolating for two sets of options with Times to Expiration closest to the 30-day mark. I prefer to focus on as long of a time horizon as possible for forecasting purposes. Option Times to Expiration vary significantly for various stocks but can relatively consistently be found to go out to 6 months (180 days) for utility companies. Therefore, for the sake of consistency, I have chosen to calculate 6-month volatility and skewness where possible. Occasionally, Times to Expiration for a given stock do not go out to 180 days. If the greatest Time to Expiration available is 171 days (95%) or greater, I use the volatility and skewness for that group of options as a proxy for the 180-day volatility and skewness, respectively.

Finally, 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): [149]

$$\beta_i = \left(\frac{SKEW_i}{SKEW_m}\right)^{1/3} \quad \left(\frac{VAR_i}{VAR_m}\right)^{1/2}$$

Where:

$\beta_i$: $option - implied\ beta\ of\ security\ (e.g. stock, fund)$;
$SKEW_i$: $skewness\ of\ security$;
$SKEW_m$: $skewness\ of\ overall\ market\ (S\&P\ 500)$;
$VAR_i$: $variance\ of\ company$;
$VAR_m$: $variance\ of\ overall\ market\ (S\&P\ 500)$.

[149] Bo-Young Chang & Peter Christoffersen & Kris Jacobs & Gregory Vainberg, Option-Implied Measures of Equity Risk, *Review of Finance* Volume 16, Issue 2, pp. 385-428 (April 2012) available at https://academic.oup.com/rof/article/16/2/385/1584560.

**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 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[150] 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.

[150] $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.

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 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 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."

**Q. YOU CALCULATE YOUR OPTION-IMPLIED BETAS BASED ON A 6-MONTH HORIZON. WOULD IT NOT BE BETTER TO USE A LONGER FORECASTING HORIZON?**

**A.** The methodology I use to calculate my option-implied betas "allows for the computation of a complete term structure of beta for each company so long as the options data are available,"[151] so there is nothing inherent in the methodology that limits it to a certain time horizon.

For many applications, including cost of capital, one could argue that the longer the time horizon for the option-implied betas, the better. However, the limitation on the forecasting horizon is always set by the longest expiration period of the options currently

[151] Peter Christoffersen, Kris Jacobs, and Gregory Vainberg, *Forward-Looking Betas*, p. 24 (April 25, 2008) available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=891467.

traded in the market. Some companies trade options with expiration periods up to 2 or 3 years into the future. As evidenced by the exhaustive option data in my working papers, the maximum expiration period for the options of the companies in my RFC Electric Proxy Group is approximately 28 months.However, some of the companies in my proxy group only trade options with expiration periods of up to 8 months. For consistency across companies in my proxy group and across dates within the 3-month period on which my analysis is focused (April through June 2022), I chose to use 6 months for the time horizon of my option-implied betas. If the maximum expiration period for the options of a given company on a given day is less than 6 months (it is never less than 5 months), I use the maximum expiration period as an approximation for the target 6-month horizon.

Simply because some may argue that it may be preferable to use longer time horizons in place of or in addition to a 6-month horizon, it does not mean that a 6-month option-implied beta is of no relevance or cannot be used. That would be tantamount to saying you cannot use a 1-year Value Line Earnings Per Share estimate, or that the minimum relevant forecast is 2 or 3 years. In fact, for purposes of option-implied betas, it would be difficult to say if a time horizon of 1 year, for instance, is necessarily always better than a time horizon of 6 months. An option-implied forward-looking beta, even with a time horizon of less than 6 months, is still a useful tool in interpreting the current expectations of investors at any given time.

A final strong argument in support of using 6-month option-implied betas in a cost of capital calculation looking years into the future is that, as expanded upon on page 164, the authors of the paper on which I based my option-implied betas concluded that their

predictive powers are not limited to 6 months into the future. In fact, they conclude that 6-month option-implied betas have stronger predictive power than 6-month, 1-year, or 5-year historical betas when attempting to forecast betas 1 or 2 years into the future.

**Q. WHY DIDN'T YOU USE LONG-TERM EQUITY ANTICIPATION SECURITIES, WHICH ARE OPTIONS CONTRACTS WITH AN EXPIRATION DATE OF TYPICALLY MORE THAN 1 YEAR?**

**A.** It is not possible to use Long-Term Equity Anticipation Securities (LEAPS) to calculate option-implied betas for all utility companies because these contracts are not traded for many of them. As stated above, the maximum expiration period for the options of the 26 companies in my RFC Electric Proxy Group is approximately 28 months, but some of the companies have a maximum expiration period of 8 months, and so for consistency across companies and dates, I chose to use 6 months for the time horizon of my option-implied betas. As explained above, option-implied betas calculated from options contracts with expiration periods less than 1 year, in my case 6 months, are still a useful tool in interpreting investors' current expectations and are superior to the historical betas. As a further note, I use LEAPS in my CAPM when the data is available. The risk premium portion of my CAPM is based on options contracts with expiration periods exceeding 1 year, and as far out as 56 Months.

**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 *expost* 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.[152]

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]

[152] Peter Christoffersen, Kris Jacobs, and Gregory Vainberg, *Forward-Looking Betas*, p. 16 (April 25, 2008) available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=891467.

> 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-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.[153]

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. 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.

[153] *Id. at 17.*

## Hybrid Betas

**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 *expost* 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.[154]

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-

[154] Peter Christoffersen, Kris Jacobs, and Gregory Vainberg, *Forward-Looking Betas*, p. 16 (April 25, 2008) available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=891467.

> 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-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.[155]

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. 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.

[155] *Id. at 17.*

**EXHIBITS TO DIRECT TESTIMONY OF AARON L. ROTHSCHILD**

# OVERALL COST OF CAPITAL
## Southern California Edison

| | Ratios | | Cost Rate | | Weighted Cost Rate |
|---|---|---|---|---|---|
| | | | | | [D] |
| **Long-Term Debt** | 49.55% | [A] | 4.27% | [B] | 2.12% |
| **Short-Term Debt** | 0.00% | [B] | 0.00% | [B] | 0.00% |
| **Preferred Equity** | 5.00% | [B] | 5.72% | [B] | 0.29% |
| **Common Equity** | 45.45% | [A] | 8.08% | [C] | 3.67% |
| | 100.00% | | | | **6.07%** |

**RECOMMENDED RANGES**

| | Low | | High |
|---|---|---|---|
| **Proxy Group Cost of Equity Range** | 7.41% | | 8.74% |
| **Proxy Group Cost of Equity** | | 8.08% | |
| **Based on RFC Capital Structure Recommendation** | | | |
| **Capital Structure Risk Adjustment** [E] | | 0.00% | |
| **Adjusted Recommended Cost of Equity Range** | **7.41%** | | **8.74%** |
| **Company Specific Cost of Equity Recommendation** | | **8.08%** | |
| **Cost of Capital Range** | 5.77% | | 6.37% |
| **Based on Dr. Villadsen's Capital Structure Recommendation** | | | |
| **Capital Structure Risk Adjustment** [E] | | -0.26% | |
| **Adjusted Recommended Cost of Equity Range** | **7.15%** | | **8.48%** |
| **Company Specific Cost of Equity Recommendation** | | **7.81%** | |
| **Cost of Capital Range** | 5.84% | | 6.53% |
| **Comprehensive Cost of Capital Range** | | | |
| **Cost of Debt Range** | 4.27% | | 4.27% |
| **Common Equity Ratio Range** | 45.45% | | 42.77% |
| **Comprehensive Cost of Capital Range** | 5.77% | | 6.25% |

Sources:
[A] Recommendation based on Proxy Group capital structures
[B] SCE-01, page 5, lines 7-17.
[C] Company Specific Cost of Equity Recommendation based on RFC Capital Structure Recommendation
[D] Ratios times Cost Rate
[E] Based on estimate of 0.04% change in Cost of Equity for each 1% difference in Common Equity Ratio compared to the Proxy Group (Exhibit ALR-1, page 1 vs. Exhibit ALR-5, page 4).

## OVERALL COST OF CAPITAL
## Pacific Gas and Electric Company

| | Ratios | | Cost Rate | | Weighted Cost Rate |
|---|---|---|---|---|---|
| | | | | | [D] |
| **Long-Term Debt** | 54.05% | [A] | 4.27% | [B] | 2.31% |
| **Short-Term Debt** | 0.00% | [B] | 0.00% | [B] | 0.00% |
| **Preferred Equity** | 0.50% | [B] | 5.52% | [B] | 0.03% |
| **Common Equity** | 45.45% | [A] | 8.08% | [C] | 3.67% |
| | 100.00% | | | | **6.01%** |

**RECOMMENDED RANGES**

| | Low | | High |
|---|---|---|---|
| **Proxy Group Cost of Equity Range** | 7.41% | | 8.74% |
| **Proxy Group Cost of Equity** | | 8.08% | |
| **Based on RFC Capital Structure Recommendation** | | | |
| **Capital Structure Risk Adjustment** [E] | | 0.00% | |
| **Adjusted Recommended Cost of Equity Range** | **7.41%** | | **8.74%** |
| **Company Specific Cost of Equity Recommendation** | | **8.08%** | |
| **Cost of Capital Range** | 5.70% | | 6.31% |
| **Based on Dr. Vilbert's Capital Structure Recommendation** | | | |
| **Capital Structure Risk Adjustment** [E] | | -0.26% | |
| **Adjusted Recommended Cost of Equity Range** | **7.15%** | | **8.48%** |
| **Company Specific Cost of Equity Recommendation** | | **7.81%** | |
| **Cost of Capital Range** | 5.77% | | 6.46% |
| **Comprehensive Cost of Capital Range** | | | |
| **Cost of Debt Range** | 4.27% | | 4.27% |
| **Common Equity Ratio Range** | 45.45% | | 42.77% |
| **Comprehensive Cost of Capital Range** | 5.70% | | 6.19% |

Sources:
[A] Recommendation based on Proxy Group capital structures
[B] Pacific Gas and Electric Company, Chapter 1, page 1-2, Table 1-1.
[C] Company Specific Cost of Equity Recommendation based on RFC Capital Structure Recommendation
[D] Ratios times Cost Rate
[E] Based on estimate of 0.04% change in Cost of Equity for each 1% difference in Common Equity Ratio compared to the Proxy Group (Exhibit ALR-1, page 2 vs. Exhibit ALR-5, page 4).

## OVERALL COST OF CAPITAL
## San Diego Gas & Electric Company

| | Ratios | | Cost Rate | | Weighted Cost Rate |
|---|---|---|---|---|---|
| | | | | | [D] |
| **Long-Term Debt** | 48.00% | [A] | 3.87% | [B] | 1.86% |
| **Short-Term Debt** | 0.00% | [B] | 0.00% | [B] | 0.00% |
| **Preferred Equity** | 0.00% | [B] | 0.00% | [B] | 0.00% |
| **Common Equity** | 52.00% | [A] | 7.81% | [C] | 4.06% |
| | 100.00% | | | | **5.92%** |

| **RECOMMENDED RANGES** | Low | | High |
|---|---|---|---|
| **Proxy Group Cost of Equity Range** | 7.41% | | 8.74% |
| **Proxy Group Cost of Equity** | | 8.08% | |
| **Based on RFC Capital Structure Recommendation** | | | |
| **Capital Structure Risk Adjustment** [E] | | -0.26% | |
| **Adjusted Recommended Cost of Equity Range** | **7.15%** | | **8.48%** |
| **Company Specific Cost of Equity Recommendation** | | **7.81%** | |
| **Cost of Capital Range** | 5.58% | | 6.27% |
| **Based on Mr. Coyne's Capital Structure Recommendation** | | | |
| **Capital Structure Risk Adjustment** [E] | | -0.34% | |
| **Adjusted Recommended Cost of Equity Range** | **7.07%** | | **8.40%** |
| **Company Specific Cost of Equity Recommendation** | | **7.73%** | |
| **Cost of Capital Range** | 5.60% | | 6.31% |
| **Comprehensive Cost of Capital Range** | | | |
| **Cost of Debt Range** | 3.87% | | 3.87% |
| **Common Equity Ratio Range** | 52.00% | | 42.77% |
| **Comprehensive Cost of Capital Range** | 5.58% | | 5.84% |

Sources:
[A] Based on common equity ratio of consolidated parent capital structure.
[B] Direct Testimony of Maritza Mekitarian, page MM-1, Table 1.
[C] Company Specific Cost of Equity Recommendation based on RFC Capital Structure Recommendation
[D] Ratios times Cost Rate
[E] Based on estimate of 0.04% change in Cost of Equity for each 1% difference in Common Equity Ratio compared to the Proxy Group (Exhibit ALR-1, page 3 vs. Exhibit ALR-5, page 4).

# COST OF EQUITY SUMMARY

## RFC Electric Proxy Group (26 Companies)

| | | Low | | High |
|---|---|---|---|---|
| **DCF** | | | | |
| **Constant Growth - Sustainable Growth** | [A] | 7.92% | | 8.02% |
| **Constant Growth - Option-Implied Growth** | [B] | 8.48% | | 8.74% |
| **Non-Constant Growth** | [C] | 8.21% | | 8.21% |
| **CAPM** | | | | |
| **3-Mo. Weighted Average (Apr. to Jun. 2022)** | | | | |
| 3-Month Treasury Bill Risk-Free Rate | [D] | 7.10% | | 7.86% |
| 30-Year Treasury Bond Risk-Free Rate | [D] | 7.83% | | 8.45% |
| **Spot Market Values (Jun. 30, 2022)** | | | | |
| 3-Month Treasury Bill Risk-Free Rate | [E] | 7.41% | | 8.59% |
| 30-Year Treasury Bond Risk-Free Rate | [E] | 7.98% | | 8.99% |
| **Average** | | **7.85%** | | **8.41%** |
| **Outer Quartile Range** | | **7.41%** | | **8.74%** |
| **Proxy Group Cost of Equity** | | | **8.08%** | |

Sources:
[A] Exhibit ALR-3, page 1
[B] Exhibit ALR-3, page 2
[C] Exhibit ALR-3, page 3 and Exhibit ALR-3, page 4
[D] Exhibit ALR-4, page 1
[E] Exhibit ALR-4, page 5

# CONSTANT GROWTH DISCOUNTED CASH FLOW (DCF) - INDICATED COST OF EQUITY
## RFC Electric Proxy Group (26 Companies)

| | | | Based on Average Market Price For Year Ending 6/30/2022 | Based On Market Price As Of 6/30/2022 |
|---|---|---|---|---|
| 1 | Dividend Yield On Market Price | [A] | 3.31% | 3.31% |
| 2 | Retention Rate: | | | |
| | a) Market-to-Book Ratio | [A] | 2.12 | 2.08 |
| | b) Dividend Yield on Book | [B] | 7.04% | 6.89% |
| | c) Expected Return on Equity | [C] | 10.40% | 10.40% |
| | d) Retention Rate | [D] | 32.33% | 33.75% |
| 3 | Reinvestment Growth | [E] | 3.36% | 3.51% |
| 4 | New Financing Growth | [F] | 1.17% | 1.12% |
| 5 | Total Estimate of Investor Anticipated Growth | [G] | 4.53% | 4.63% |
| 6 | Increment to Dividend Yield for Growth to Next Year | [H] | 0.08% | 0.08% |
| **7** | **Indicated Cost of Equity** | **[I]** | **7.92%** | **8.02%** |

Sources:

[A] Exhibit ALR-5, page 1

[B] Line 1 x Line 2a

[C] Some of the considerations for determining Future Expected Return on Equity:

| | Median | Mean | From |
|---|---|---|---|
| Value Line Expectation | **10.50%** | **10.68%** | Exhibit ALR-5, page 2 |
| Return on Equity to Achieve Zacks Growth | 10.52% | 10.41% | Exhibit ALR-5, page 3 |
| Average Historical Growth | 10.31% | 10.14% | |
| Earned Return on Equity in 2021 | 9.72% | 9.93% | Exhibit ALR-5, page 2 |
| Earned Return on Equity in 2020 | 10.66% | 9.92% | Exhibit ALR-5, page 2 |
| Earned Return on Equity in 2019 | 10.55% | 10.55% | Exhibit ALR-5, page 2 |

[D] 1 - Line 2b / Line 2c

[E] Line 2c x Line 2d

[F] S x V = (Ext. Fin Rate) x (Line 2a - 1) Ext. Fin. Rate = 1.04% From Exhibit ALR-3, page 5

S = rate of continuous new stock financing

V = fraction of funds raised by sale of stock that increases the book value of existing shareholders' common equity

[G] Line 3 + Line 4

[H] Line 1 x one-half of Line 5

[I] Line 1 + Line 5 + Line 6

## CONSTANT GROWTH DISCOUNTED CASH FLOW (DCF) - INDICATED COST OF EQUITY
## RFC Electric Proxy Group (26 Companies)

| | | | Based On Weighted Averages As Of 6/30/2022 | Based On Spot Market Values As Of 6/30/2022 |
|---|---|---|---|---|
| 1 | Dividend Yield On Market Price | [A] | 3.31% | 3.31% |
| 2 | Total Estimate of Investor Anticipated Growth | [B] | 5.34% | 5.09% |
| 3 | Increment to Dividend Yield for Growth to Next Year | [C] | 0.09% | 0.08% |
| **4** | **Indicated Cost of Equity** | **[D]** | **8.74%** | **8.48%** |

Sources:
[A] Exhibit ALR-5, page 1
[B] 6-Month Option-Implied Growth
[C] Line 1 x one-half of Line 2
[D] Line 1 + Line 2 + Line 3

## NON-CONSTANT GROWTH DISCOUNTED CASH FLOW (DCF) - INDICATED COST OF EQUITY
### (BASED ON VALUE LINE FORECASTS AND CLOSING STOCK PRICE)
### RFC Electric Proxy Group

| | | [1] | [2] | [3] | [4] | [5] | [6] | [7] | [8] | [9] | [10] | [11] | [12] | [13] | [14] | [15] | [16] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Forecasted Dividends per Share | | | | | Growth | Book Value | | Closing Stock Price | | Cash Flow From Buying and Selling Stock (At Closing Price) | | | | | |
| | | 2022 | 2023 | 2024 | 2025 | 2026 | 2023-26 | 6/30/22 | 6/30/26 | 6/30/2022 | 6/30/2026 | 2022 | 2023 | 2024 | 2025 | 2026 | IRR / DCF |
| | | [A] | [A] | [B] | [B] | [A] | [B] | [C] | [C] | [D] | [E] | [F] | [F] | [F] | [F] | [F] | [G] |
| AMEREN | AEE | $2.36 | $2.52 | $2.70 | $2.89 | $3.10 | 7.15% | $38.92 | $49.62 | $90.36 | $115.20 | ($89.18) | $2.52 | $2.70 | $2.89 | $116.75 | 9.11% |
| AMERICAN ELEC. PWR. | AEP | $3.17 | $3.35 | $3.55 | $3.77 | $4.00 | 6.09% | $45.90 | $57.25 | $95.94 | $119.67 | ($94.36) | $3.35 | $3.55 | $3.77 | $121.67 | 9.25% |
| ALLETE | ALE | $2.60 | $2.70 | $2.80 | $2.90 | $3.00 | 3.57% | $46.41 | $52.81 | $58.78 | $66.89 | ($57.48) | $2.70 | $2.80 | $2.90 | $68.39 | 7.99% |
| AVISTA CORP. | AVA | $1.76 | $1.83 | $1.90 | $1.97 | $2.05 | 3.86% | $30.45 | $34.41 | $43.51 | $49.17 | ($42.63) | $1.83 | $1.90 | $1.97 | $50.19 | 7.43% |
| BLACK HILLS CORP. | BKH | $2.41 | $2.53 | $2.66 | $2.80 | $2.95 | 5.25% | $44.20 | $53.36 | $72.77 | $87.85 | ($71.57) | $2.53 | $2.66 | $2.80 | $89.33 | 8.37% |
| CMS ENERGY CORP. | CMS | $1.84 | $1.94 | $2.05 | $2.17 | $2.30 | 5.84% | $22.66 | $28.56 | $67.50 | $85.10 | ($66.58) | $1.94 | $2.05 | $2.17 | $86.25 | 8.88% |
| CENTERPOINT EN'RGY | CNP | $0.71 | $0.77 | $0.83 | $0.89 | $0.95 | 7.25% | $14.23 | $17.36 | $29.58 | $36.10 | ($29.23) | $0.77 | $0.83 | $0.89 | $36.57 | 7.79% |
| DOMINION ENERGY | D | $2.67 | $2.83 | $3.01 | $3.20 | $3.40 | 6.31% | $32.93 | $41.22 | $79.81 | $99.91 | ($78.48) | $2.83 | $3.01 | $3.20 | $101.61 | 9.40% |
| DUKE ENERGY | DUK | $3.98 | $4.06 | $4.15 | $4.25 | $4.35 | 2.33% | $62.13 | $69.36 | $107.21 | $119.69 | ($105.22) | $4.06 | $4.15 | $4.25 | $121.87 | 6.63% |
| ENTERGY CORP. | ETR | $4.09 | $4.30 | $4.55 | $4.82 | $5.10 | 5.85% | $58.86 | $72.23 | $112.64 | $138.23 | ($110.60) | $4.30 | $4.55 | $4.82 | $140.78 | 9.16% |
| EVERGY, INC. | EVRG | $2.33 | $2.48 | $2.66 | $2.85 | $3.05 | 7.14% | $40.84 | $46.66 | $65.25 | $74.56 | ($64.09) | $2.48 | $2.66 | $2.85 | $76.09 | 7.40% |
| IDACORP, INC. | IDA | $3.05 | $3.25 | $3.48 | $3.73 | $4.00 | 7.17% | $53.84 | $62.82 | $105.92 | $123.59 | ($104.40) | $3.25 | $3.48 | $3.73 | $125.59 | 7.15% |
| ALLIANT ENERGY | LNT | $1.71 | $1.81 | $1.92 | $2.03 | $2.15 | 5.91% | $24.48 | $29.56 | $58.61 | $70.78 | ($57.76) | $1.81 | $1.92 | $2.03 | $71.85 | 7.99% |
| MGE ENERGY INC. | MGEE | NA | NA | NA | NA | NA | NA | NA | NA | $77.83 | NA | | NA | NA | NA | NA | NA |
| NEXTERA ENERGY | NEE | $1.70 | $1.87 | $2.06 | $2.27 | $2.50 | 10.16% | $19.33 | $26.00 | $77.46 | $104.20 | ($76.61) | $1.87 | $2.06 | $2.27 | $105.45 | 10.19% |
| NORTHWESTERN | NWE | $2.52 | $2.56 | $2.61 | $2.65 | $2.70 | 1.79% | $43.92 | $48.79 | $58.93 | $65.48 | ($57.67) | $2.56 | $2.61 | $2.65 | $66.83 | 7.07% |
| OGE ENERGY CORP. | OGE | $1.66 | $1.70 | $1.75 | $1.80 | $1.85 | 2.86% | $21.24 | $25.83 | $38.15 | $46.40 | ($37.32) | $1.70 | $1.75 | $1.80 | $47.32 | 9.48% |
| OTTER TAIL CORP. | OTTR | $1.65 | $1.76 | $1.90 | $2.04 | $2.20 | 7.72% | $25.70 | $31.94 | $67.13 | $83.46 | ($66.31) | $1.76 | $1.90 | $2.04 | $84.56 | 8.30% |
| P.S. ENTERPRISE GP. | PEG | $2.16 | $2.28 | $2.40 | $2.52 | $2.65 | 5.14% | $28.40 | $35.56 | $63.28 | $79.24 | ($62.20) | $2.28 | $2.40 | $2.52 | $80.57 | 9.43% |
| PINNACLE WEST | PNW | $3.44 | $3.52 | $3.61 | $3.70 | $3.80 | 2.58% | $52.53 | $58.95 | $73.12 | $82.05 | ($71.40) | $3.52 | $3.61 | $3.70 | $83.95 | 7.84% |
| PORTLAND GENERAL | POR | $1.80 | $1.90 | $2.02 | $2.16 | $2.30 | 6.58% | $30.82 | $35.63 | $48.33 | $55.88 | ($47.43) | $1.90 | $2.02 | $2.16 | $57.03 | 7.82% |
| PPL CORPORATION | PPL | $0.80 | $0.84 | $0.89 | $0.94 | $1.00 | 5.98% | $18.94 | $21.45 | $27.13 | $30.73 | ($26.73) | $0.84 | $0.89 | $0.94 | $31.23 | 6.40% |
| SOUTHERN COMPANY | SO | $2.70 | $2.78 | $2.88 | $2.99 | $3.10 | 3.70% | $26.68 | $31.80 | $71.31 | $85.02 | ($69.96) | $2.78 | $2.88 | $2.99 | $86.57 | 8.44% |
| SEMPRA ENERGY | SRE | $4.58 | $4.76 | $5.02 | $5.30 | $5.60 | 5.57% | $81.01 | $98.76 | $149.10 | $181.76 | ($146.81) | $4.76 | $5.02 | $5.30 | $184.56 | 8.34% |
| WEC ENERGY GROUP | WEC | $2.91 | $3.11 | $3.32 | $3.55 | $3.80 | 6.91% | $35.25 | $41.24 | $100.64 | $117.74 | ($99.19) | $3.11 | $3.32 | $3.55 | $119.64 | 7.22% |
| XCEL ENERGY | XEL | $1.95 | $2.08 | $2.21 | $2.35 | $2.50 | 6.32% | $29.43 | $36.11 | $70.76 | $86.84 | ($69.79) | $2.08 | $2.21 | $2.35 | $88.09 | 8.26% |
| Maximum | | $4.58 | $4.76 | $5.02 | $5.30 | $5.60 | 10.16% | $81.01 | $98.76 | $149.10 | $181.76 | ($26.73) | $4.76 | $5.02 | $5.30 | $184.56 | 10.19% |
| Minimum | | $0.71 | $0.77 | $0.83 | $0.89 | $0.95 | 1.79% | $14.23 | $17.36 | $27.13 | $30.73 | ($146.81) | $0.77 | $0.83 | $0.89 | $31.23 | 6.40% |
| Median | | $2.36 | $2.52 | $2.66 | $2.80 | $2.95 | 5.91% | $32.93 | $41.22 | $71.04 | $85.02 | ($69.79) | $2.52 | $2.66 | $2.80 | $86.25 | 8.26% |
| **Average** | | $2.42 | $2.54 | $2.68 | $2.82 | $2.98 | 5.56% | $37.16 | $44.29 | $73.50 | $88.22 | ($72.12) | $2.54 | $2.68 | $2.82 | $89.71 | **8.21%** |

Sources:

[A] Value Line: Most current data available at time of schedule preparation. 2026 data is VL forecast for 2025-27.

[B] Straight line interpolation based on Value Line data, assuming constant dividend growth for 2023-26.

[C] Straight line interpolation based on Value Line data, assuming constant book value growth for 2023-26.

[D] EOD Data: Market Data as of June 30, 2022.

[E] Stock Price projected assuming constant Market to Book Ratio (Exhibit ALR-5, page 1) and using VL projected Book Value.

[F] Cash Flow from purchasing stock on July 1, 2022, receiving dividends through 2026, and selling on June 30, 2026.
Negative number in 2022 reflects cash outflow required to purchase stock.
Cash flow sources are 1) dividends and 2) proceeds of stock sale.
2 of 4 dividends assumed received in 2022 and 2 of 4 in 2026 based on purchase and sale date.

[G] Total return on equity to investor who purchased, held, and sold stock as described above,
assuming Value Line projections of Dividends and Book Value are correct and
assuming Stock Price grows at same rate as Book Value.
DCF result is an Internal Rate of Return computation made using the "IRR" function built into Microsoft Excel
based on projected cash flows from 2022 to 2026.

## NON-CONSTANT GROWTH DISCOUNTED CASH FLOW (DCF) - INDICATED COST OF EQUITY
### (BASED ON VALUE LINE FORECASTS AND LTM AVERAGE STOCK PRICE)
### RFC Electric Proxy Group

| | | [1] | [2] | [3] | [4] | [5] | [6] | [7] | [8] | [9] | [10] | [11] | [12] | [13] | [14] | [15] | [16] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Forecasted Dividends per Share | | | | | Growth | LTM Avg. Book Value | | LTM Avg. Stock Price | | Cash Flow From Buying and Selling Stock (At LTM Average Price) | | | | | |
| | | 2022 | 2023 | 2024 | 2025 | 2026 | 2023-26 | 2022 | 2026 | 6/30/22 | 6/30/26 | 2022 | 2023 | 2024 | 2025 | 2026 | IRR / DCF |
| | | [A] | [A] | [B] | [B] | [A] | [B] | [C] | [C] | [D] | [E] | [F] | [F] | [F] | [F] | [F] | [G] |
| AMEREN | AEE | $2.36 | $2.52 | $2.70 | $2.89 | $3.10 | 7.15% | $37.69 | $48.05 | $89.28 | $113.81 | ($88.10) | $2.52 | $2.70 | $2.89 | $115.36 | 9.14% |
| AMERICAN ELEC. PWR. | AEP | $3.17 | $3.35 | $3.55 | $3.77 | $4.00 | 6.09% | $44.42 | $55.40 | $92.52 | $115.40 | ($90.93) | $3.35 | $3.55 | $3.77 | $117.40 | 9.38% |
| ALLETE | ALE | $2.60 | $2.70 | $2.80 | $2.90 | $3.00 | 3.57% | $45.55 | $51.84 | $64.82 | $73.77 | ($63.52) | $2.70 | $2.80 | $2.90 | $75.27 | 7.55% |
| AVISTA CORP. | AVA | $1.76 | $1.83 | $1.90 | $1.97 | $2.05 | 3.86% | $30.09 | $34.00 | $42.32 | $47.82 | ($41.44) | $1.83 | $1.90 | $1.97 | $48.84 | 7.55% |
| BLACK HILLS CORP. | BKH | $2.41 | $2.53 | $2.66 | $2.80 | $2.95 | 5.25% | $43.06 | $51.99 | $71.45 | $86.26 | ($70.25) | $2.53 | $2.66 | $2.80 | $87.73 | 8.44% |
| CMS ENERGY CORP. | CMS | $1.84 | $1.94 | $2.05 | $2.17 | $2.30 | 5.84% | $21.61 | $27.25 | $66.14 | $83.38 | ($65.22) | $1.94 | $2.05 | $2.17 | $84.53 | 8.94% |
| CENTERPOINT EN'RGY | CNP | $0.71 | $0.77 | $0.83 | $0.89 | $0.95 | 7.25% | $13.23 | $16.15 | $28.62 | $34.92 | ($28.26) | $0.77 | $0.83 | $0.89 | $35.40 | 7.88% |
| DOMINION ENERGY | D | $2.67 | $2.83 | $3.01 | $3.20 | $3.40 | 6.31% | $31.70 | $39.69 | $79.58 | $99.61 | ($78.24) | $2.83 | $3.01 | $3.20 | $101.31 | 9.41% |
| DUKE ENERGY | DUK | $3.98 | $4.06 | $4.15 | $4.25 | $4.35 | 2.33% | $61.41 | $68.55 | $105.91 | $118.24 | ($103.92) | $4.06 | $4.15 | $4.25 | $120.41 | 6.68% |
| ENTERGY CORP. | ETR | $4.09 | $4.30 | $4.55 | $4.82 | $5.10 | 5.85% | $57.43 | $70.47 | $112.66 | $138.25 | ($110.61) | $4.30 | $4.55 | $4.82 | $140.80 | 9.16% |
| EVERGY, INC. | EVRG | $2.33 | $2.48 | $2.66 | $2.85 | $3.05 | 7.14% | $40.12 | $45.85 | $66.23 | $75.68 | ($65.07) | $2.48 | $2.66 | $2.85 | $77.21 | 7.34% |
| IDACORP, INC. | IDA | $3.05 | $3.25 | $3.48 | $3.73 | $4.00 | 7.17% | $52.81 | $61.61 | $107.09 | $124.95 | ($105.57) | $3.25 | $3.48 | $3.73 | $126.95 | 7.11% |
| ALLIANT ENERGY | LNT | $1.71 | $1.81 | $1.92 | $2.03 | $2.15 | 5.91% | $23.91 | $28.87 | $59.79 | $72.20 | ($58.93) | $1.81 | $1.92 | $2.03 | $73.27 | 7.93% |
| MGE ENERGY INC. | MGEE | NA | NA | NA | NA | NA | NA | $0.00 | NA | $77.10 | NA | | NA | NA | NA | NA | NA |
| NEXTERA ENERGY | NEE | $1.70 | $1.87 | $2.06 | $2.27 | $2.50 | 10.16% | $19.06 | $25.64 | $80.48 | $108.25 | ($79.63) | $1.87 | $2.06 | $2.27 | $109.50 | 10.10% |
| NORTHWESTERN | NWE | $2.52 | $2.56 | $2.61 | $2.65 | $2.70 | 1.79% | $43.05 | $47.84 | $59.64 | $66.27 | ($58.38) | $2.56 | $2.61 | $2.65 | $67.62 | 7.02% |
| OGE ENERGY CORP. | OGE | $1.66 | $1.70 | $1.75 | $1.80 | $1.85 | 2.86% | $20.22 | $24.59 | $37.61 | $45.75 | ($36.78) | $1.70 | $1.75 | $1.80 | $46.67 | 9.55% |
| OTTER TAIL CORP. | OTTR | $1.65 | $1.76 | $1.90 | $2.04 | $2.20 | 7.72% | $24.06 | $29.91 | $59.56 | $74.05 | ($58.74) | $1.76 | $1.90 | $2.04 | $75.15 | 8.65% |
| P.S. ENTERPRISE GP. | PEG | $2.16 | $2.28 | $2.40 | $2.52 | $2.65 | 5.14% | $29.29 | $36.68 | $66.90 | $83.77 | ($65.82) | $2.28 | $2.40 | $2.52 | $85.10 | 9.23% |
| PINNACLE WEST | PNW | $3.44 | $3.52 | $3.61 | $3.70 | $3.80 | 2.58% | $51.82 | $58.15 | $74.83 | $83.97 | ($73.11) | $3.52 | $3.61 | $3.70 | $85.87 | 7.72% |
| PORTLAND GENERAL | POR | $1.80 | $1.90 | $2.02 | $2.16 | $2.30 | 6.58% | $30.27 | $35.00 | $51.03 | $59.00 | ($50.13) | $1.90 | $2.02 | $2.16 | $60.15 | 7.60% |
| PPL CORPORATION | PPL | $0.80 | $0.84 | $0.89 | $0.94 | $1.00 | 5.98% | $18.48 | $20.94 | $27.85 | $31.54 | ($27.45) | $0.84 | $0.89 | $0.94 | $32.04 | 6.31% |
| SOUTHERN COMPANY | SO | $2.70 | $2.78 | $2.88 | $2.99 | $3.10 | 3.70% | $26.53 | $31.63 | $68.68 | $81.88 | ($67.33) | $2.78 | $2.88 | $2.99 | $83.43 | 8.60% |
| SEMPRA ENERGY | SRE | $4.58 | $4.76 | $5.02 | $5.30 | $5.60 | 5.57% | $77.83 | $94.87 | $146.42 | $178.50 | ($144.13) | $4.76 | $5.02 | $5.30 | $181.30 | 8.40% |
| WEC ENERGY GROUP | WEC | $2.91 | $3.11 | $3.32 | $3.55 | $3.80 | 6.91% | $34.57 | $40.45 | $97.62 | $114.20 | ($96.16) | $3.11 | $3.32 | $3.55 | $116.10 | 7.33% |
| XCEL ENERGY | XEL | $1.95 | $2.08 | $2.21 | $2.35 | $2.50 | 6.32% | $28.67 | $35.18 | $68.89 | $84.54 | ($67.92) | $2.08 | $2.21 | $2.35 | $85.79 | 8.34% |
| Maximum | | $4.58 | $4.76 | $5.02 | $5.30 | $5.60 | 10.16% | $77.83 | $94.87 | $146.42 | $178.50 | ($27.45) | $4.76 | $5.02 | $5.30 | $181.30 | 10.10% |
| Minimum | | $0.71 | $0.77 | $0.83 | $0.89 | $0.95 | 1.79% | $0.00 | $16.15 | $27.85 | $31.54 | ($144.13) | $0.77 | $0.83 | $0.89 | $32.04 | 6.31% |
| Median | | $2.36 | $2.52 | $2.66 | $2.80 | $2.95 | 5.91% | $30.99 | $39.69 | $68.78 | $83.77 | ($67.33) | $2.52 | $2.66 | $2.80 | $85.10 | 8.34% |
| **Average** | | $2.42 | $2.54 | $2.68 | $2.82 | $2.98 | 5.56% | $34.88 | $43.22 | $73.19 | $87.84 | ($71.82) | $2.54 | $2.68 | $2.82 | $89.33 | **8.21%** |

Sources:

[A] Value Line: Most current data available at time of schedule preparation. 2026 data is VL forecast for 2025-27.

[B] Straight line interpolation based on Value Line data, assuming constant dividend growth for 2023-26.

[C] Straight line interpolation based on Value Line data, assuming constant book value growth for 2023-26.

[D] EOD Data: Market Data as of June 30, 2022.

[E] Stock Price projected assuming constant Market to Book Ratio (Exhibit ALR-5, page 1) and using VL projected Book Value.

[F] Cash Flow from purchasing stock on July 1, 2022, receiving dividends through 2026, and selling on June 30, 2026.
Negative number in 2022 reflects cash outflow required to purchase stock.
Cash flow sources are 1) dividends and 2) proceeds of stock sale.
2 of 4 dividends assumed received in 2022 and 2 of 4 in 2026 based on purchase and sale date.

[G] Total return on equity to investor who purchased, held, and sold stock as described above,
assuming Value Line projections of Dividends and Book Value are correct and
assuming Stock Price grows at same rate as Book Value.
DCF result is an Internal Rate of Return computation made using the "IRR" function built into Microsoft Excel
based on projected cash flows from 2022 to 2026.

## COMMON SHARES OUTSTANDING AND EXTERNAL FINANCING RATE
## RFC Electric Proxy Group

| | | [1] | [2] | [3] | [4] | [5] | [6] | [7] | [8] | [9] | [10] | [11] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Common Stock Outstanding (Millions of Shares) | | | | | | | | Annual Growth Rate | | |
| | | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2026 | 2017-21 | 2021-26 | 2017-26 |
| | | [A] | [A] | [A] | [A] | [A] | [A] | [A] | [A] | [B] | [B] | [B] |
| AMEREN | AEE | 242.6 | 244.5 | 246.2 | 253.3 | 257.7 | 262.5 | 267.0 | 280.0 | 1.52% | 1.67% | 1.60% |
| AMERICAN ELEC. PWR. | AEP | 492.0 | 493.3 | 494.2 | 496.6 | 504.2 | 514.0 | 523.0 | 545.0 | 0.61% | 1.57% | 1.14% |
| ALLETE | ALE | 51.1 | 51.5 | 51.7 | 52.1 | 53.2 | 57.0 | 58.0 | 61.0 | 1.01% | 2.77% | 1.99% |
| AVISTA CORP. | AVA | 65.5 | 65.7 | 67.2 | 69.2 | 71.5 | 74.5 | 77.0 | 83.0 | 2.22% | 3.03% | 2.67% |
| BLACK HILLS CORP. | BKH | 53.5 | 60.0 | 61.5 | 62.8 | 64.7 | 66.5 | 67.5 | 71.0 | 4.86% | 1.86% | 3.19% |
| CMS ENERGY CORP. | CMS | 281.7 | 283.4 | 283.9 | 288.9 | 289.8 | 290.0 | 290.0 | 300.0 | 0.71% | 0.70% | 0.70% |
| CENTERPOINT EN'RGY | CNP | 431.0 | 501.2 | 502.2 | 551.4 | 628.9 | 630.0 | 631.0 | 634.0 | 9.91% | 0.16% | 4.38% |
| DOMINION ENERGY | D | 644.6 | 680.9 | 838.0 | 805.6 | 810.4 | 835.0 | 842.0 | 870.0 | 5.89% | 1.43% | 3.39% |
| DUKE ENERGY | DUK | 700.0 | 727.0 | 733.0 | 769.0 | 769.0 | 770.0 | 770.0 | 770.0 | 2.38% | 0.03% | 1.06% |
| ENTERGY CORP. | ETR | 180.5 | 189.1 | 199.2 | 200.2 | 202.7 | 206.0 | 209.0 | 214.0 | 2.93% | 1.10% | 1.91% |
| EVERGY, INC. | EVRG | -- | 255.3 | 226.6 | 226.8 | 229.3 | 230.0 | 230.0 | 230.0 | -3.52% | 0.06% | -1.30% |
| IDACORP, INC. | IDA | 50.4 | 50.4 | 50.4 | 50.5 | 50.5 | 50.5 | 50.5 | 52.0 | 0.05% | 0.58% | 0.34% |
| ALLIANT ENERGY | LNT | 231.4 | 236.1 | 245.0 | 249.9 | 250.5 | 251.0 | 251.5 | 253.0 | 2.01% | 0.20% | 1.00% |
| MGE ENERGY INC. | MGEE | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| NEXTERA ENERGY | NEE | 1,884.0 | 1,912.0 | 1,956.0 | 1,960.0 | 1,963.0 | 1,980.0 | 2,025.0 | 2,025.0 | 1.03% | 0.62% | 0.81% |
| NORTHWESTERN | NWE | 49.4 | 50.3 | 50.5 | 50.6 | 54.1 | 58.0 | 62.0 | 62.0 | 2.29% | 2.78% | 2.56% |
| OGE ENERGY CORP. | OGE | 199.7 | 199.7 | 200.1 | 200.1 | 200.1 | 200.1 | 200.1 | 200.1 | 0.05% | 0.00% | 0.02% |
| OTTER TAIL CORP. | OTTR | 39.6 | 39.7 | 40.2 | 41.5 | 41.6 | 41.8 | 41.9 | 42.5 | 1.23% | 0.45% | 0.80% |
| P.S. ENTERPRISE GP. | PEG | 505.0 | 504.0 | 504.0 | 504.0 | 504.0 | 496.0 | 496.0 | 496.0 | -0.05% | -0.32% | -0.20% |
| PINNACLE WEST | PNW | 111.8 | 112.1 | 112.4 | 112.8 | 113.0 | 113.0 | 113.0 | 118.0 | 0.28% | 0.87% | 0.61% |
| PORTLAND GENERAL | POR | 89.1 | 89.3 | 89.4 | 89.5 | 89.4 | 89.5 | 89.5 | 89.5 | 0.08% | 0.02% | 0.05% |
| PPL CORPORATION | PPL | 693.4 | 720.3 | 767.2 | 768.9 | 735.1 | 737.0 | 739.0 | 745.0 | 1.47% | 0.27% | 0.80% |
| SOUTHERN COMPANY | SO | 1,007.6 | 1,033.8 | 1,053.3 | 1,056.5 | 1,060.0 | 1,070.0 | 1,070.0 | 1,070.0 | 1.28% | 0.19% | 0.67% |
| SEMPRA ENERGY | SRE | 251.4 | 273.8 | 291.7 | 288.5 | 316.9 | 315.0 | 305.0 | 305.0 | 5.97% | -0.76% | 2.17% |
| WEC ENERGY GROUP | WEC | 315.6 | 315.5 | 315.4 | 315.4 | 315.4 | 315.4 | 315.4 | 315.4 | -0.01% | 0.00% | 0.00% |
| XCEL ENERGY | XEL | 507.8 | 514.0 | 524.5 | 537.4 | 544.0 | 547.0 | 550.0 | 561.0 | 1.74% | 0.62% | 1.11% |
| Maximum | | 1,884.0 | 1,912.0 | 1,956.0 | 1,960.0 | 1,963.0 | 1,980.0 | 2,025.0 | 2,025.0 | 9.91% | 3.03% | 4.38% |
| Minimum | | 39.6 | 39.7 | 40.2 | 41.5 | 41.6 | 41.8 | 41.9 | 42.5 | -3.52% | -0.76% | -1.30% |
| Median | | 247.0 | 255.3 | 246.2 | 253.3 | 257.7 | 262.5 | 267.0 | 280.0 | 1.28% | 0.58% | 1.00% |
| **Average** | | 378.3 | 384.1 | 396.2 | 400.1 | 404.8 | 408.0 | 410.9 | 415.7 | 1.84% | 0.80% | 1.26% |
| | | | | | | | | **Sustainable Growth [C]** | | | | **1.04%** |

Sources:
[A] Value Line: Most current data available at time of schedule preparation.
[B] Annualized Growth Rate calculation.
[C] Estimated Sustainable Growth in Common Stock based on analysis of historical and projected growth rates.

# CAPITAL ASSET PRICING MODEL (CAPM) - INDICATED COST OF EQUITY

WEIGHTED MARKET DATA - All Inputs Weighted From April to June 2022

RFC Electric Proxy Group

| | 3-Month Treasury Bill | | 30-Year Treasury Bond | |
|---|---|---|---|---|
| | Historical Blended Beta | Forward Beta | Historical Blended Beta | Forward Beta |
| Risk-Free Rate | 1.32% | 1.32% | 3.07% | 3.07% |
| Beta | 0.66 | 0.58 | 0.66 | 0.58 |
| Risk Premium | 9.89% | 9.89% | 8.14% | 8.14% |
| CAPM (Weighted) | 7.86% | 7.10% | 8.45% | 7.83% |

# CAPITAL ASSET PRICING MODEL (CAPM) - RISK-FREE RATE

| | |
|---|---|
| **Spot Market Values (Jun. 30, 2022)** | |
| 3-Month Treasury Bill | 1.72% |
| 30-Year Treasury Bond | 3.14% |
| | |
| **3-Mo. Weighted Average (Apr. to Jun. 2022)** | |
| 3-Month Treasury Bill | 1.32% |
| 30-Year Treasury Bond | 3.07% |

Source: www.treasury.gov

## CAPITAL ASSET PRICING MODEL (CAPM) - BETAS

(BASED ON HISTORICAL AND OPTION-IMPLIED RETURNS)
RFC Electric Proxy Group

| Betas | 03/29/2022 | 04/05/2022 | 04/12/2022 | 04/19/2022 | 04/26/2022 | 05/03/2022 | 05/10/2022 | 05/17/2022 | 05/24/2022 | 05/31/2022 | 06/07/2022 | 06/14/2022 | 06/21/2022 | 06/28/2022 | Average | Time Avg. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Forward (6 months) | 0.57 | 0.56 | 0.56 | 0.58 | 0.46 | 0.58 | 0.46 | 0.55 | 0.60 | 0.54 | 0.64 | 0.61 | 0.64 | 0.60 | 0.568 | 0.585 |
| Historical (6 months) | 0.56 | 0.56 | 0.54 | 0.54 | 0.57 | 0.62 | 0.60 | 0.59 | 0.57 | 0.55 | 0.54 | 0.63 | 0.69 | 0.72 | 0.591 | 0.615 |
| Historical (2 yrs) | 0.71 | 0.70 | 0.68 | 0.68 | 0.67 | 0.68 | 0.67 | 0.65 | 0.63 | 0.63 | 0.61 | 0.65 | 0.67 | 0.69 | 0.665 | 0.658 |
| Historical (5 yrs) | 0.79 | 0.79 | 0.78 | 0.78 | 0.78 | 0.78 | 0.78 | 0.77 | 0.77 | 0.77 | 0.77 | 0.78 | 0.78 | 0.79 | 0.780 | 0.779 |
| **Weighting** | | | | | | | | | | | | | | | | |
| Forward (6 months) | 50% | 50% | 50% | 50% | 50% | 50% | 50% | 50% | 50% | 50% | 50% | 50% | 50% | 50% | | |
| Historical (6 months) | 25% | 25% | 25% | 25% | 25% | 25% | 25% | 25% | 25% | 25% | 25% | 25% | 25% | 25% | | |
| Historical (2 yrs) | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | | |
| Historical (5 yrs) | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | | |
| **Historical Blended Beta** | **0.65** | **0.65** | **0.63** | **0.63** | **0.64** | **0.67** | **0.66** | **0.64** | **0.63** | **0.62** | **0.61** | **0.67** | **0.70** | **0.72** | 0.651 | 0.661 |
| **Slope** | 15% | | | | | | | | | | | | | | | |
| **Points** | 0.00 | 1.00 | 1.15 | 1.32 | 1.52 | 1.75 | 2.01 | 2.31 | 2.66 | 3.06 | 3.52 | 4.05 | 4.65 | 5.35 | | |
| **Time Weight** | 0.0% | 2.9% | 3.3% | 3.8% | 4.4% | 5.1% | 5.9% | 6.7% | 7.7% | 8.9% | 10.2% | 11.8% | 13.5% | 15.6% | | |

| CAPM Betas | Spot (Jun 28, 2022) | Weighted (Apr - Jun 2022) |
|---|---|---|
| Forward | 0.60 | 0.58 |
| Historical Blended | 0.72 | 0.66 |

Note: Historical betas are calculated on Tuesdays, following Value Line's methodology. Forward (option-implied) betas are also calculated on Tuesdays for the sake of compatibility.

# CAPITAL ASSET PRICING MODEL (CAPM) - MARKET RISK PREMIUM

WEIGHTED MARKET DATA - All Inputs Weighted From April to June 2022

| | | |
|---|---|---|
| Cumulative Probability | 50.00% | |
| S&P 500 Option-Implied Growth Rate | 9.75% | |
| S&P 500 Dividend Yield | 1.46% | |
| S&P 500 Market Return | 11.21% | |
| | **3-Month Treasury Bill** | **30-Year Treasury Bond** |
| Risk-Free Rate | 1.32% | 3.07% |
| Option-Implied Market Risk Premium (Weighted) | 9.89% | 8.14% |

# CAPITAL ASSET PRICING MODEL (CAPM) - INDICATED COST OF EQUITY

SPOT MARKET DATA - All Inputs Based on Last Available Data as of June 30, 2022

RFC Electric Proxy Group

| | 3-Month Treasury Bill | | 30-Year Treasury Bond | |
|---|---|---|---|---|
| | Historical Blended Beta | Forward Beta | Historical Blended Beta | Forward Beta |
| Risk-Free Rate | 1.72% | 1.72% | 3.14% | 3.14% |
| Beta | 0.72 | 0.60 | 0.72 | 0.60 |
| Risk Premium | 9.50% | 9.50% | 8.08% | 8.08% |
| CAPM (Spot) | 8.59% | 7.41% | 8.99% | 7.98% |

# CAPITAL ASSET PRICING MODEL (CAPM) - MARKET RISK PREMIUM

SPOT MARKET DATA - All Inputs Based on Last Available Data as of June 30, 2022

| | | |
|---|---|---|
| Cumulative Probability | 50.00% | |
| S&P 500 Option-Implied Growth Rate | 9.71% | |
| S&P 500 Dividend Yield | 1.51% | |
| S&P 500 Market Return | 11.22% | |
| | **3-Month Treasury Bill** | **30-Year Treasury Bond** |
| Risk-Free Rate | 1.72% | 3.14% |
| Option-Implied Market Risk Premium (Spot) | 9.50% | 8.08% |

# MARKET TO BOOK RATIO AND DIVIDEND YIELD

**RFC Electric Proxy Group**

| | | [1] | [2] | [3] | [4] | [5] | [6] | [7] | [8] | [9] | [10] | [11] | [12] | [13] | [14] | [15] | [16] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Book Value per Share | | | | | | | | | | | | | | | |
| | | Actual | | | | Estimated | | | Market Price | | | Mkt. to Book Ratio | | Dividend Rate | | Dividend Yield | |
| | | 12/31/18 | 12/31/19 | 12/31/20 | 12/31/21 | 6/30/21 | 6/30/22 | 12/31/22 | 6/30/22 | LTM High | LTM Low | 6/30/22 | LTM Avg. | MRQ | Annual | 6/30/22 | LTM Avg. |
| | | [A] | [A] | [A] | [A] | [B] | [B] | [A] | [C] | [C] | [C] | [D] | [D] | [A] | [E] | [F] | [F] |
| AMEREN | AEE | $31.21 | $32.73 | $35.29 | $37.64 | $36.47 | $38.92 | $40.20 | $90.36 | $99.20 | $79.35 | 2.32 | 2.37 | $0.590 | $2.360 | 2.61% | 2.64% |
| AMERICAN ELEC. PWR. | AEP | $38.58 | $39.73 | $41.38 | $44.49 | $42.94 | $45.90 | $47.30 | $95.94 | $104.81 | $80.22 | 2.09 | 2.08 | $0.780 | $3.120 | 3.25% | 3.37% |
| ALLETE | ALE | $41.86 | $43.17 | $44.04 | $45.36 | $44.70 | $46.41 | $47.45 | $58.78 | $73.10 | $56.55 | 1.27 | 1.42 | $0.650 | $2.600 | 4.42% | 4.01% |
| AVISTA CORP. | AVA | $26.99 | $28.87 | $29.31 | $30.14 | $29.73 | $30.45 | $30.75 | $43.51 | $46.90 | $37.73 | 1.43 | 1.41 | $0.440 | $1.760 | 4.05% | 4.16% |
| BLACK HILLS CORP. | BKH | $36.36 | $38.42 | $40.79 | $43.05 | $41.92 | $44.20 | $45.35 | $72.77 | $80.95 | $61.95 | 1.65 | 1.66 | $0.595 | $2.380 | 3.27% | 3.33% |
| CMS ENERGY CORP. | CMS | $16.78 | $17.68 | $19.02 | $22.11 | $20.57 | $22.66 | $23.20 | $67.50 | $73.76 | $58.51 | 2.98 | 3.06 | $0.460 | $1.840 | 2.73% | 2.78% |
| CENTERPOINT EN'RGY | CNP | $12.53 | $13.10 | $10.78 | $13.70 | $12.24 | $14.23 | $14.75 | $29.58 | $33.00 | $24.23 | 2.08 | 2.16 | $0.170 | $0.680 | 2.30% | 2.38% |
| DOMINION ENERGY | D | $29.53 | $35.33 | $29.46 | $31.50 | $30.48 | $32.93 | $34.35 | $79.81 | $88.78 | $70.37 | 2.42 | 2.51 | $0.668 | $2.670 | 3.35% | 3.36% |
| DUKE ENERGY | DUK | $60.27 | $61.20 | $59.82 | $61.55 | $60.69 | $62.13 | $62.70 | $107.21 | $116.33 | $95.48 | 1.73 | 1.72 | $0.985 | $3.940 | 3.68% | 3.72% |
| ENTERGY CORP. | ETR | $46.78 | $51.34 | $54.56 | $57.42 | $55.99 | $58.86 | $60.30 | $112.64 | $126.82 | $98.50 | 1.91 | 1.96 | $1.010 | $4.040 | 3.59% | 3.59% |
| EVERGY, INC. | EVRG | $39.28 | $37.82 | $38.50 | $40.32 | $39.41 | $40.84 | $41.35 | $65.25 | $73.13 | $59.34 | 1.60 | 1.65 | $0.573 | $2.290 | 3.51% | 3.46% |
| IDACORP, INC. | IDA | $47.01 | $48.88 | $50.73 | $52.82 | $51.78 | $53.84 | $54.85 | $105.92 | $118.92 | $95.26 | 1.97 | 2.03 | $0.750 | $3.000 | 2.83% | 2.80% |
| ALLIANT ENERGY | LNT | $19.43 | $21.24 | $22.76 | $23.91 | $23.34 | $24.48 | $25.05 | $58.61 | $65.37 | $54.20 | 2.39 | 2.50 | $0.428 | $1.710 | 2.92% | 2.86% |
| MGE ENERGY INC. | MGEE | NA | NA | NA | NA | NA | NA | NA | $77.83 | $84.97 | $69.23 | NA | NA | NA | NA | NA | NA |
| NEXTERA ENERGY | NEE | $17.86 | $18.92 | $18.63 | $18.95 | $18.79 | $19.33 | $19.70 | $77.46 | $93.73 | $67.22 | 4.01 | 4.22 | $0.425 | $1.700 | 2.19% | 2.11% |
| NORTHWESTERN | NWE | $38.60 | $40.42 | $41.10 | $43.28 | $42.19 | $43.92 | $44.55 | $58.93 | $65.62 | $53.66 | 1.34 | 1.39 | $0.630 | $2.520 | 4.28% | 4.23% |
| OGE ENERGY CORP. | OGE | $20.06 | $20.69 | $18.15 | $20.27 | $19.21 | $21.24 | $22.20 | $38.15 | $42.74 | $32.49 | 1.80 | 1.86 | $0.410 | $1.640 | 4.30% | 4.36% |
| OTTER TAIL CORP. | OTTR | $18.38 | $19.46 | $21.00 | $23.84 | $22.42 | $25.70 | $27.55 | $67.13 | $71.89 | $47.24 | 2.61 | 2.48 | $0.413 | $1.650 | 2.46% | 2.77% |
| P.S. ENTERPRISE GP. | PEG | $28.53 | $29.94 | $31.71 | $28.65 | $30.18 | $28.40 | $28.15 | $63.28 | $75.61 | $58.19 | 2.23 | 2.28 | $0.540 | $2.160 | 3.41% | 3.23% |
| PINNACLE WEST | PNW | $46.59 | $48.30 | $49.96 | $52.26 | $51.11 | $52.53 | $52.80 | $73.12 | $86.87 | $62.78 | 1.39 | 1.44 | $0.850 | $3.400 | 4.65% | 4.54% |
| PORTLAND GENERAL | POR | $28.07 | $28.99 | $29.18 | $30.28 | $29.73 | $30.82 | $31.35 | $48.33 | $57.03 | $45.02 | 1.57 | 1.69 | $0.430 | $1.720 | 3.56% | 3.37% |
| PPL CORPORATION | PPL | $16.18 | $16.93 | $17.39 | $18.67 | $18.03 | $18.94 | $19.20 | $27.13 | $30.72 | $24.98 | 1.43 | 1.51 | $0.200 | $0.800 | 2.95% | 2.87% |
| SOUTHERN COMPANY | SO | $23.92 | $26.11 | $26.48 | $26.30 | $26.39 | $26.68 | $27.05 | $71.31 | $77.24 | $60.12 | 2.67 | 2.59 | $0.680 | $2.720 | 3.81% | 3.96% |
| SEMPRA ENERGY | SRE | $54.35 | $60.58 | $70.11 | $79.17 | $74.64 | $81.01 | $82.85 | $149.10 | $173.28 | $119.56 | 1.84 | 1.88 | $1.145 | $4.580 | 3.07% | 3.13% |
| WEC ENERGY GROUP | WEC | $31.02 | $32.06 | $33.19 | $34.60 | $33.90 | $35.25 | $35.90 | $100.64 | $108.39 | $86.84 | 2.86 | 2.82 | $0.728 | $2.910 | 2.89% | 2.98% |
| XCEL ENERGY | XEL | $23.78 | $25.24 | $27.12 | $28.70 | $27.91 | $29.43 | $30.15 | $70.76 | $76.63 | $61.16 | 2.40 | 2.40 | $0.488 | $1.950 | 2.76% | 2.83% |
| Maximum | | $60.27 | $61.20 | $70.11 | $79.17 | $74.64 | $81.01 | $82.85 | $149.10 | $173.28 | $119.56 | 4.01 | 4.22 | $1.145 | $4.580 | 4.65% | 4.54% |
| Minimum | | $12.53 | $13.10 | $10.78 | $13.70 | $12.24 | $14.23 | $14.75 | $27.13 | $30.72 | $24.23 | 1.27 | 1.39 | $0.170 | $0.680 | 2.19% | 2.11% |
| Median | | $29.53 | $32.06 | $31.71 | $31.50 | $30.48 | $32.93 | $34.35 | $71.04 | $76.93 | $60.64 | 1.97 | 2.03 | $0.590 | $2.360 | 3.27% | 3.33% |
| **Average** | | $31.76 | $33.49 | $34.42 | $36.36 | $35.39 | $37.16 | $37.96 | $73.50 | $82.53 | $63.85 | 2.08 | 2.12 | $0.601 | $2.406 | 3.31% | 3.31% |

Sources:

[A] Value Line: Most current data available at time of schedule preparation.

[B] Straight-line interpolation of Actual and Estimated VL year-end values.

[C] EOD Data: Market Data as of June 30, 2022.

[D] Market Price divided by Book Value per Share.

[E] Most Recent Quarterly Dividend multiplied by 4.

[F] Dividend Rate divided by Market Price.

## EARNINGS PER SHARE AND RETURN ON EQUITY

**RFC Electric Proxy Group**

| | | [1] | [2] | [3] | [4] | [5] | [6] | [7] | [8] |
|---|---|---|---|---|---|---|---|---|---|
| | | Earnings per Share | | | | Return on Equity | | | |
| | | 2018 | 2019 | 2020 | 2021 | 2019 | 2020 | 2021 | VL Future Exp. |
| | | [A] | [A] | [A] | [A] | [B] | [B] | [B] | [A] |
| AMEREN | AEE | $3.32 | $3.35 | $3.50 | $3.84 | 10.48% | 10.29% | 10.53% | 10.00% |
| AMERICAN ELEC. PWR. | AEP | $3.90 | $4.08 | $4.42 | $4.96 | 10.42% | 10.90% | 11.55% | 11.00% |
| ALLETE | ALE | $3.38 | $3.33 | $3.35 | $3.23 | 7.83% | 7.68% | 7.23% | 9.00% |
| AVISTA CORP. | AVA | $2.07 | $2.97 | $1.90 | $2.10 | 10.63% | 6.53% | 7.06% | 8.00% |
| BLACK HILLS CORP. | BKH | $3.47 | $3.53 | $3.73 | $3.74 | 9.44% | 9.42% | 8.92% | 9.00% |
| CMS ENERGY CORP. | CMS | $2.32 | $2.39 | $2.64 | $2.58 | 13.87% | 14.39% | 12.55% | 12.50% |
| CENTERPOINT EN'RGY | CNP | $0.74 | $1.49 | $1.29 | $0.94 | 11.63% | 10.80% | 7.68% | 9.50% |
| DOMINION ENERGY | D | $3.25 | $2.19 | $1.82 | $3.19 | 6.75% | 5.62% | 10.47% | 12.00% |
| DUKE ENERGY | DUK | $4.13 | $5.07 | $3.92 | $4.93 | 8.35% | 6.48% | 8.12% | 9.00% |
| ENTERGY CORP. | ETR | $5.88 | $6.30 | $6.90 | $6.87 | 12.84% | 13.03% | 12.27% | 11.50% |
| EVERGY, INC. | EVRG | $2.50 | $2.79 | $2.72 | $3.83 | 7.24% | 7.13% | 9.72% | 10.00% |
| IDACORP, INC. | IDA | $4.49 | $4.61 | $4.69 | $4.85 | 9.62% | 9.42% | 9.37% | 9.50% |
| ALLIANT ENERGY | LNT | $2.19 | $2.33 | $2.47 | $2.63 | 11.46% | 11.23% | 11.27% | 11.50% |
| MGE ENERGY INC. | MGEE | NA | NA | NA | NA | NA | NA | NA | NA |
| NEXTERA ENERGY | NEE | $1.67 | $1.94 | $2.10 | $1.81 | 10.55% | 11.19% | 9.63% | 14.00% |
| NORTHWESTERN | NWE | $3.40 | $3.53 | $3.06 | $3.60 | 8.93% | 7.51% | 8.53% | 8.00% |
| OGE ENERGY CORP. | OGE | $2.12 | $2.24 | $2.08 | $2.36 | 10.99% | 10.71% | 12.29% | 12.50% |
| OTTER TAIL CORP. | OTTR | $2.06 | $2.17 | $2.34 | $4.23 | 11.47% | 11.57% | 18.87% | 11.50% |
| P.S. ENTERPRISE GP. | PEG | $2.76 | $3.90 | $3.61 | $2.55 | 13.34% | 11.71% | 8.45% | 12.50% |
| PINNACLE WEST | PNW | $4.54 | $4.77 | $4.87 | $5.47 | 10.05% | 9.91% | 10.70% | 9.50% |
| PORTLAND GENERAL | POR | $2.37 | $2.39 | $1.72 | $2.72 | 8.38% | 5.91% | 9.15% | 10.00% |
| PPL CORPORATION | PPL | $2.58 | $2.37 | $2.04 | $0.53 | 14.32% | 11.89% | 2.94% | 7.50% |
| SOUTHERN COMPANY | SO | $3.00 | $3.17 | $3.25 | $3.42 | 12.67% | 12.36% | 12.96% | 14.50% |
| SEMPRA ENERGY | SRE | $5.48 | $5.97 | $6.58 | $4.01 | 10.39% | 10.07% | 5.37% | 10.50% |
| WEC ENERGY GROUP | WEC | $3.34 | $3.58 | $3.79 | $4.11 | 11.35% | 11.62% | 12.13% | 13.00% |
| XCEL ENERGY | XEL | $2.47 | $2.64 | $2.79 | $2.96 | 10.77% | 10.66% | 10.61% | 11.00% |
| Maximum | | $5.88 | $6.30 | $6.90 | $6.87 | 14.32% | 14.39% | 18.87% | 14.50% |
| Minimum | | $0.74 | $1.49 | $1.29 | $0.53 | 6.75% | 5.62% | 2.94% | 7.50% |
| Median | | $3.00 | $3.17 | $3.06 | $3.42 | 10.55% | 10.66% | 9.72% | 10.50% |
| **Average** | | $3.10 | $3.32 | $3.26 | $3.42 | 10.55% | 9.92% | 9.93% | 10.68% |

Sources:

[A] Value Line: Most current data available at time of schedule preparation.

[B] Earnings per Share divded by average Book Value. Book Values shown on Exhibit ALR-5, page 1.

## RETURN ON EQUITY IMPLIED BY ZACKS GROWTH RATES

**RFC Electric Proxy Group**

| | | [1] | [2] | [3] | [4] | [5] | [6] | [7] | [8] | [9] | [10] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Annual | Analyst | Analyst-Implied | | Analyst-Implied | | Implied | Analyst- |
| | | Book Value | EPS | Dividend | 5 Year | Book Value before SV | | Book Value Incl. SV | | EPS | Implied |
| | | 12/31/21 | 2021 | Rate | Growth Rate | 12/31/2025 | 12/31/2026 | 12/31/2025 | 12/31/2026 | 2026 | ROE |
| | | [A] | [A] | [A] | [B] | [C] | [C] | [C] | [C] | [C] | [C] |
| AMEREN | AEE | $37.64 | $3.84 | $2.360 | 7.20% | $44.71 | $46.80 | $51.85 | $56.33 | $5.44 | 10.05% |
| AMERICAN ELEC. PWR. | AEP | $44.49 | $4.96 | $3.120 | 6.20% | $53.06 | $55.55 | $59.92 | $64.66 | $6.70 | 10.76% |
| ALLETE | ALE | $45.36 | $3.23 | $2.600 | 8.70% | $48.48 | $49.43 | $52.82 | $55.02 | $4.90 | 9.09% |
| AVISTA CORP. | AVA | $30.14 | $2.10 | $1.760 | 5.80% | $31.71 | $32.16 | $36.97 | $38.96 | $2.78 | 7.33% |
| BLACK HILLS CORP. | BKH | $43.05 | $3.74 | $2.380 | 6.30% | $49.40 | $51.25 | $54.99 | $58.60 | $5.08 | 8.94% |
| CMS ENERGY CORP. | CMS | $22.11 | $2.58 | $1.840 | 8.10% | $25.72 | $26.81 | $28.43 | $30.39 | $3.81 | 12.95% |
| CENTERPOINT EN'RGY | CNP | $13.70 | $0.94 | $0.680 | 3.90% | $14.85 | $15.16 | $15.04 | $15.41 | $1.14 | 7.47% |
| DOMINION ENERGY | D | $31.50 | $3.19 | $2.670 | 6.30% | $33.93 | $34.63 | $37.45 | $39.19 | $4.33 | 11.30% |
| DUKE ENERGY | DUK | $61.55 | $4.93 | $3.940 | 6.10% | $66.15 | $67.48 | $66.15 | $67.48 | $6.63 | 9.92% |
| ENTERGY CORP. | ETR | $57.42 | $6.87 | $4.040 | 6.70% | $70.77 | $74.68 | $76.10 | $81.78 | $9.50 | 12.04% |
| EVERGY, INC. | EVRG | $40.32 | $3.83 | $2.290 | 6.10% | $47.48 | $49.55 | $47.48 | $49.55 | $5.15 | 10.61% |
| IDACORP, INC. | IDA | $52.82 | $4.85 | $3.000 | 2.80% | $60.75 | $62.88 | $64.34 | $67.55 | $5.57 | 8.44% |
| ALLIANT ENERGY | LNT | $23.91 | $2.63 | $1.710 | 5.70% | $28.15 | $29.36 | $28.68 | $30.06 | $3.47 | 11.81% |
| MGE ENERGY INC. | MGEE | NA | NA | NA | 6.10% | NA | NA | NA | NA | NA | NA |
| NEXTERA ENERGY | NEE | $18.95 | $1.81 | $1.700 | 9.30% | $19.50 | $19.67 | $21.32 | $22.00 | $2.82 | 13.03% |
| NORTHWESTERN | NWE | $43.28 | $3.60 | $2.520 | 2.30% | $47.85 | $49.06 | $52.32 | $54.85 | $4.03 | 7.53% |
| OGE ENERGY CORP. | OGE | $20.27 | $2.36 | $1.640 | 3.50% | $23.41 | $24.27 | $23.41 | $24.27 | $2.80 | 11.76% |
| OTTER TAIL CORP. | OTTR | $23.84 | $4.23 | $1.650 | NA | NA | NA | NA | NA | NA | NA |
| P.S. ENTERPRISE GP. | PEG | $28.65 | $2.55 | $2.160 | 4.60% | $30.40 | $30.89 | $30.40 | $30.89 | $3.19 | 10.42% |
| PINNACLE WEST | PNW | $52.26 | $5.47 | $3.400 | NA | NA | NA | NA | NA | NA | NA |
| PORTLAND GENERAL | POR | $30.28 | $2.72 | $1.720 | 4.40% | $34.74 | $35.98 | $34.74 | $35.98 | $3.37 | 9.54% |
| PPL CORPORATION | PPL | $18.67 | $0.53 | $0.800 | NA | NA | NA | NA | NA | NA | NA |
| SOUTHERN COMPANY | SO | $26.30 | $3.42 | $2.720 | 4.00% | $29.39 | $30.24 | $29.39 | $30.24 | $4.16 | 13.95% |
| SEMPRA ENERGY | SRE | $79.17 | $4.01 | $4.580 | 5.80% | $76.54 | $75.78 | $72.11 | $70.35 | $5.32 | 7.46% |
| WEC ENERGY GROUP | WEC | $34.60 | $4.11 | $2.910 | 6.10% | $40.18 | $41.79 | $40.18 | $41.79 | $5.53 | 13.48% |
| XCEL ENERGY | XEL | $28.70 | $2.96 | $1.950 | 6.40% | $33.43 | $34.81 | $35.51 | $37.54 | $4.04 | 11.05% |
| Maximum | | $79.17 | $6.87 | $4.580 | 9.30% | $76.54 | $75.78 | $76.10 | $81.78 | $9.50 | 13.95% |
| Minimum | | $13.70 | $0.53 | $0.680 | 2.30% | $14.85 | $15.16 | $15.04 | $15.41 | $1.14 | 7.33% |
| Median | | $31.50 | $3.42 | $2.360 | 6.10% | $37.46 | $38.89 | $38.82 | $40.49 | $4.25 | 10.52% |
| **Average** | | $36.36 | $3.42 | $2.406 | 5.76% | $41.39 | $42.65 | $43.62 | $45.59 | $4.53 | 10.41% |

Sources:

[A] Value Line: Most current data available at time of schedule preparation.

[B] Zacks: Data as of July 19, 2022.

[C] Analyst-Implied Book Value and Return on Equity is obtained by escalating both Dividends and Earnings per Share by the stated Analyst Growth Rate and adding Earnings and subtracting Dividends for each projected year.

"SV" = S X V, where S = rate of continuous new stock financing and V = rate of return on common equity investment.

**CAPITAL STRUCTURE WITH SHORT TERM DEBT**
**RFC Electric Proxy Group**

| | | [1] | [2] | [3] | [4] | [5] | [6] | [7] | [8] | [9] | [10] | [11] | [12] | [13] | [14] | [15] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | % Common Equity | | | | | ($ millions) | | | | | | Percentage | | | |
| | | 2017 | 2018 | 2019 | 2020 | 2021 | Total Debt | LT Debt | ST Debt | Pfd Stock | Equity | Total Capital | LT Debt | ST Debt | Pfd Stock | Equity Ratio |
| | | [A] | [A] | [A] | [A] | [A] | [A] | [A] | [A] | [A] | [A] | [A] | [B] | [B] | [B] | [B] |
| AMEREN | AEE | 49.8% | 48.8% | 47.1% | 44.3% | 43.3% | $ 14,169.0 | $ 12,563.0 | $ 1,606.0 | $ 129.0 | $ 9,692.5 | $ 23,990.5 | 52.4% | 6.7% | 0.5% | 40.4% |
| AMERICAN ELEC. PWR. | AEP | 48.5% | 46.8% | 43.9% | 41.5% | 41.7% | $ 37,244.0 | $ 30,856.0 | $ 6,388.0 | $ - | $ 22,070.2 | $ 59,314.2 | 52.0% | 10.8% | 0.0% | 37.2% |
| ALLETE | ALE | 59.0% | 60.1% | 61.4% | 59.0% | 57.8% | $ 1,947.5 | $ 1,669.4 | $ 278.1 | $ - | $ 2,286.5 | $ 4,234.0 | 39.4% | 6.6% | 0.0% | 54.0% |
| AVISTA CORP. | AVA | 52.8% | 49.5% | 50.6% | 49.6% | 52.5% | $ 2,483.9 | $ 1,949.9 | $ 534.0 | $ - | $ 2,155.2 | $ 4,639.1 | 42.0% | 11.5% | 0.0% | 46.5% |
| BLACK HILLS CORP. | BKH | 35.5% | 42.5% | 42.9% | 42.1% | 40.3% | $ 4,547.1 | $ 4,126.9 | $ 420.2 | $ - | $ 2,785.8 | $ 7,332.9 | 56.3% | 5.7% | 0.0% | 38.0% |
| CMS ENERGY CORP. | CMS | 32.4% | 30.7% | 29.4% | 28.6% | 34.2% | $ 12,473.0 | $ 12,091.0 | $ 382.0 | $ 261.0 | $ 6,420.0 | $ 19,154.0 | 63.1% | 2.0% | 1.4% | 33.5% |
| CENTERPOINT EN'RGY | CNP | 36.4% | 37.5% | 29.1% | 29.9% | 34.5% | $ 13,879.0 | $ 12,106.0 | $ 1,773.0 | $ 790.0 | $ 6,792.5 | $ 21,461.5 | 56.4% | 8.3% | 3.7% | 31.6% |
| DOMINION ENERGY | D | 35.6% | 39.2% | 45.0% | 39.5% | 38.5% | $ 40,581.0 | $ 37,426.0 | $ 3,155.0 | $ 3,393.0 | $ 25,553.4 | $ 69,527.4 | 53.8% | 4.5% | 4.9% | 36.8% |
| DUKE ENERGY | DUK | 46.0% | 46.2% | 44.1% | 44.4% | 43.1% | $ 67,139.0 | $ 60,448.0 | $ 6,691.0 | $ 1,962.0 | $ 47,273.7 | $ 116,374.7 | 51.9% | 5.7% | 1.7% | 40.6% |
| ENTERGY CORP. | ETR | 35.5% | 35.9% | 37.1% | 33.7% | 31.7% | $ 28,559.0 | $ 26,176.0 | $ 2,383.0 | $ 254.4 | $ 12,267.1 | $ 41,080.5 | 63.7% | 5.8% | 0.6% | 29.9% |
| EVERGY, INC. | EVRG | -- | 60.0% | 49.4% | 48.7% | 49.9% | $ 11,565.0 | $ 9,247.1 | $ 2,317.9 | $ - | $ 9,210.2 | $ 20,775.2 | 44.5% | 11.2% | 0.0% | 44.3% |
| IDACORP, INC. | IDA | 56.3% | 56.4% | 58.7% | 56.1% | 57.2% | $ 2,000.6 | $ 2,000.6 | $ - | $ - | $ 2,673.7 | $ 4,674.3 | 42.8% | 0.0% | 0.0% | 57.2% |
| ALLIANT ENERGY | LNT | 49.8% | 45.7% | 47.6% | 44.9% | 47.1% | $ 7,992.0 | $ 7,383.0 | $ 609.0 | $ - | $ 6,573.5 | $ 14,565.5 | 50.7% | 4.2% | 0.0% | 45.1% |
| MGE ENERGY INC. | MGEE | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | $ - | NA | NA | NA | NA |
| NEXTERA ENERGY | NEE | 47.3% | 56.0% | 49.6% | 46.5% | 42.2% | $ 59,693.0 | $ 50,974.0 | $ 8,719.0 | $ - | $ 37,216.3 | $ 96,909.3 | 52.6% | 9.0% | 0.0% | 38.4% |
| NORTHWESTERN | NWE | 49.8% | 47.8% | 47.5% | 47.2% | 47.8% | $ 2,556.2 | $ 2,553.4 | $ 2.8 | $ - | $ 2,338.2 | $ 4,894.4 | 52.2% | 0.1% | 0.0% | 47.8% |
| OGE ENERGY CORP. | OGE | 58.3% | 58.0% | 56.4% | 51.0% | 47.4% | $ 5,228.5 | $ 4,497.0 | $ 731.5 | $ - | $ 4,052.4 | $ 9,280.9 | 48.5% | 7.9% | 0.0% | 43.7% |
| OTTER TAIL CORP. | OTTR | 58.7% | 55.3% | 53.1% | 58.2% | 57.4% | $ 861.8 | $ 734.1 | $ 127.7 | $ - | $ 989.1 | $ 1,850.9 | 39.7% | 6.9% | 0.0% | 53.4% |
| P.S. ENTERPRISE GP. | PEG | 53.4% | 52.2% | 52.3% | 52.4% | 48.7% | $ 19,438.0 | $ 15,219.0 | $ 4,219.0 | $ - | $ 14,447.7 | $ 33,885.7 | 44.9% | 12.5% | 0.0% | 42.6% |
| PINNACLE WEST | PNW | 51.1% | 53.0% | 52.9% | 47.2% | 46.1% | $ 7,355.7 | $ 6,913.7 | $ 442.0 | $ - | $ 5,913.2 | $ 13,268.9 | 52.1% | 3.3% | 0.0% | 44.6% |
| PORTLAND GENERAL | POR | 49.9% | 53.5% | 48.7% | 46.4% | 43.2% | $ 3,578.0 | $ 3,558.0 | $ 20.0 | $ - | $ 2,706.1 | $ 6,284.1 | 56.6% | 0.3% | 0.0% | 43.1% |
| PPL CORPORATION | PPL | 35.2% | 36.7% | 38.5% | 38.3% | 56.3% | $ 11,209.0 | $ 10,666.0 | $ 543.0 | $ - | $ 13,741.3 | $ 24,950.3 | 42.7% | 2.2% | 0.0% | 55.1% |
| SOUTHERN COMPANY | SO | 35.0% | 37.6% | 39.5% | 38.1% | 35.6% | $ 54,156.0 | $ 50,633.0 | $ 3,523.0 | $ 291.0 | $ 28,150.5 | $ 82,597.5 | 61.3% | 4.3% | 0.4% | 34.1% |
| SEMPRA ENERGY | SRE | 43.5% | 38.4% | 43.4% | 44.8% | 53.3% | $ 24,645.0 | $ 21,068.0 | $ 3,577.0 | $ 889.0 | $ 25,060.1 | $ 50,594.1 | 41.6% | 7.1% | 1.8% | 49.5% |
| WEC ENERGY GROUP | WEC | 51.9% | 49.4% | 47.4% | 47.1% | 44.6% | $ 15,128.0 | $ 13,514.0 | $ 1,614.0 | $ 30.4 | $ 10,904.0 | $ 26,062.4 | 51.9% | 6.2% | 0.1% | 41.8% |
| XCEL ENERGY | XEL | 44.1% | 43.6% | 43.2% | 42.6% | 41.8% | $ 23,385.0 | $ 21,779.0 | $ 1,606.0 | $ - | $ 15,642.0 | $ 39,027.0 | 55.8% | 4.1% | 0.0% | 40.1% |
| Maximum | | 59.0% | 60.1% | 61.4% | 59.0% | 57.8% | $ 67,139.0 | $ 60,448.0 | $ 8,719.0 | $ 3,393.0 | $ 47,273.7 | $ 116,374.7 | 63.7% | 12.5% | 4.9% | 57.2% |
| Minimum | | 32.4% | 30.7% | 29.1% | 28.6% | 31.7% | $ 861.8 | $ 734.1 | $ - | $ - | $ 989.1 | $ - | 39.4% | 0.0% | 0.0% | 29.9% |
| Median | | 49.2% | 47.8% | 47.4% | 44.9% | 44.6% | $ 12,473.0 | $ 12,091.0 | $ 1,606.0 | $ - | $ 9,210.2 | $ 21,118.4 | 52.0% | 5.8% | 0.0% | 42.6% |
| **Average** | | 46.5% | 47.2% | 46.4% | 44.9% | 45.4% | $ 18,872.6 | $ 16,806.1 | $ 2,066.5 | $ 320.0 | $ 12,676.6 | $ 30,643.4 | 50.8% | 5.9% | 0.6% | **42.8%** |

Sources:
[A] Value Line: Most current data available at time of schedule preparation.
[B] Percentage calculated on Total Capital including Short Term Debt.

**CAPITAL STRUCTURE WITHOUT SHORT TERM DEBT**
**RFC Electric Proxy Group**

| | | [1] | [2] | [3] | [4] | [5] | [6] | [7] | [8] | [9] | [10] | [11] | [12] | [13] | [14] | [15] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | % Common Equity | | | | | ($ millions) | | | | | | Percentage | | | |
| | | 2017 | 2018 | 2019 | 2020 | 2021 | Total Debt | LT Debt | ST Debt | Pfd Stock | Equity | Total Capital | LT Debt | ST Debt | Pfd Stock | Equity Ratio |
| | | [A] | [A] | [A] | [A] | [A] | [A] | [A] | [B] | [A] | [A] | [A] | [B] | [B] | [B] | [B] |
| AMEREN | AEE | 49.8% | 48.8% | 47.1% | 44.3% | 43.3% | $ 14,169.0 | $ 12,563.0 | | $ 129.0 | $ 9,692.5 | $ 22,384.5 | 56.1% | 0.0% | 0.6% | 43.3% |
| AMERICAN ELEC. PWR. | AEP | 48.5% | 46.8% | 43.9% | 41.5% | 41.7% | $ 37,244.0 | $ 30,856.0 | | $ - | $ 22,070.2 | $ 52,926.2 | 58.3% | 0.0% | 0.0% | 41.7% |
| ALLETE | ALE | 59.0% | 60.1% | 61.4% | 59.0% | 57.8% | $ 1,947.5 | $ 1,669.4 | | $ - | $ 2,286.5 | $ 3,955.9 | 42.2% | 0.0% | 0.0% | 57.8% |
| AVISTA CORP. | AVA | 52.8% | 49.5% | 50.6% | 49.6% | 52.5% | $ 2,483.9 | $ 1,949.9 | | $ - | $ 2,155.2 | $ 4,105.1 | 47.5% | 0.0% | 0.0% | 52.5% |
| BLACK HILLS CORP. | BKH | 35.5% | 42.5% | 42.9% | 42.1% | 40.3% | $ 4,547.1 | $ 4,126.9 | | $ - | $ 2,785.8 | $ 6,912.7 | 59.7% | 0.0% | 0.0% | 40.3% |
| CMS ENERGY CORP. | CMS | 32.4% | 30.7% | 29.4% | 28.6% | 34.2% | $ 12,473.0 | $ 12,091.0 | | $ 261.0 | $ 6,420.0 | $ 18,772.0 | 64.4% | 0.0% | 1.4% | 34.2% |
| CENTERPOINT EN'RGY | CNP | 36.4% | 37.5% | 29.1% | 29.9% | 34.5% | $ 13,879.0 | $ 12,106.0 | | $ 790.0 | $ 6,792.5 | $ 19,688.5 | 61.5% | 0.0% | 4.0% | 34.5% |
| DOMINION ENERGY | D | 35.6% | 39.2% | 45.0% | 39.5% | 38.5% | $ 40,581.0 | $ 37,426.0 | | $ 3,393.0 | $ 25,553.4 | $ 66,372.4 | 56.4% | 0.0% | 5.1% | 38.5% |
| DUKE ENERGY | DUK | 46.0% | 46.2% | 44.1% | 44.4% | 43.1% | $ 67,139.0 | $ 60,448.0 | | $ 1,962.0 | $ 47,273.7 | $ 109,683.7 | 55.1% | 0.0% | 1.8% | 43.1% |
| ENTERGY CORP. | ETR | 35.5% | 35.9% | 37.1% | 33.7% | 31.7% | $ 28,559.0 | $ 26,176.0 | | $ 254.4 | $ 12,267.1 | $ 38,697.5 | 67.6% | 0.0% | 0.7% | 31.7% |
| EVERGY, INC. | EVRG | -- | 60.0% | 49.4% | 48.7% | 49.9% | $ 11,565.0 | $ 9,247.1 | | $ - | $ 9,210.2 | $ 18,457.3 | 50.1% | 0.0% | 0.0% | 49.9% |
| IDACORP, INC. | IDA | 56.3% | 56.4% | 58.7% | 56.1% | 57.2% | $ 2,000.6 | $ 2,000.6 | | $ - | $ 2,673.7 | $ 4,674.3 | 42.8% | 0.0% | 0.0% | 57.2% |
| ALLIANT ENERGY | LNT | 49.8% | 45.7% | 47.6% | 44.9% | 47.1% | $ 7,992.0 | $ 7,383.0 | | $ - | $ 6,573.5 | $ 13,956.5 | 52.9% | 0.0% | 0.0% | 47.1% |
| MGE ENERGY INC. | MGEE | NA | NA | NA | NA | NA | NA | NA | | NA | NA | $ - | NA | NA | NA | NA |
| NEXTERA ENERGY | NEE | 47.3% | 56.0% | 49.6% | 46.5% | 42.2% | $ 59,693.0 | $ 50,974.0 | | $ - | $ 37,216.3 | $ 88,190.3 | 57.8% | 0.0% | 0.0% | 42.2% |
| NORTHWESTERN | NWE | 49.8% | 47.8% | 47.5% | 47.2% | 47.8% | $ 2,556.2 | $ 2,553.4 | | $ - | $ 2,338.2 | $ 4,891.6 | 52.2% | 0.0% | 0.0% | 47.8% |
| OGE ENERGY CORP. | OGE | 58.3% | 58.0% | 56.4% | 51.0% | 47.4% | $ 5,228.5 | $ 4,497.0 | | $ - | $ 4,052.4 | $ 8,549.4 | 52.6% | 0.0% | 0.0% | 47.4% |
| OTTER TAIL CORP. | OTTR | 58.7% | 55.3% | 53.1% | 58.2% | 57.4% | $ 861.8 | $ 734.1 | | $ - | $ 989.1 | $ 1,723.2 | 42.6% | 0.0% | 0.0% | 57.4% |
| P.S. ENTERPRISE GP. | PEG | 53.4% | 52.2% | 52.3% | 52.4% | 48.7% | $ 19,438.0 | $ 15,219.0 | | $ - | $ 14,447.7 | $ 29,666.7 | 51.3% | 0.0% | 0.0% | 48.7% |
| PINNACLE WEST | PNW | 51.1% | 53.0% | 52.9% | 47.2% | 46.1% | $ 7,355.7 | $ 6,913.7 | | $ - | $ 5,913.2 | $ 12,826.9 | 53.9% | 0.0% | 0.0% | 46.1% |
| PORTLAND GENERAL | POR | 49.9% | 53.5% | 48.7% | 46.4% | 43.2% | $ 3,578.0 | $ 3,558.0 | | $ - | $ 2,706.1 | $ 6,264.1 | 56.8% | 0.0% | 0.0% | 43.2% |
| PPL CORPORATION | PPL | 35.2% | 36.7% | 38.5% | 38.3% | 56.3% | $ 11,209.0 | $ 10,666.0 | | $ - | $ 13,741.3 | $ 24,407.3 | 43.7% | 0.0% | 0.0% | 56.3% |
| SOUTHERN COMPANY | SO | 35.0% | 37.6% | 39.5% | 38.1% | 35.6% | $ 54,156.0 | $ 50,633.0 | | $ 291.0 | $ 28,150.5 | $ 79,074.5 | 64.0% | 0.0% | 0.4% | 35.6% |
| SEMPRA ENERGY | SRE | 43.5% | 38.4% | 43.4% | 44.8% | 53.3% | $ 24,645.0 | $ 21,068.0 | | $ 889.0 | $ 25,060.1 | $ 47,017.1 | 44.8% | 0.0% | 1.9% | 53.3% |
| WEC ENERGY GROUP | WEC | 51.9% | 49.4% | 47.4% | 47.1% | 44.6% | $ 15,128.0 | $ 13,514.0 | | $ 30.4 | $ 10,904.0 | $ 24,448.4 | 55.3% | 0.0% | 0.1% | 44.6% |
| XCEL ENERGY | XEL | 44.1% | 43.6% | 43.2% | 42.6% | 41.8% | $ 23,385.0 | $ 21,779.0 | | $ - | $ 15,642.0 | $ 37,421.0 | 58.2% | 0.0% | 0.0% | 41.8% |
| Maximum | | 59.0% | 60.1% | 61.4% | 59.0% | 57.8% | $ 67,139.0 | $ 60,448.0 | | $ 3,393.0 | $ 47,273.7 | $ 109,683.7 | 67.6% | 0.0% | 5.1% | 57.8% |
| Minimum | | 32.4% | 30.7% | 29.1% | 28.6% | 31.7% | $ 861.8 | $ 734.1 | | $ - | $ 989.1 | $ - | 42.2% | 0.0% | 0.0% | 31.7% |
| Median | | 49.2% | 47.8% | 47.4% | 44.9% | 44.6% | $ 12,473.0 | $ 12,091.0 | | $ - | $ 9,210.2 | $ 19,230.3 | 55.1% | 0.0% | 0.0% | 44.6% |
| **Average** | | 46.5% | 47.2% | 46.4% | 44.9% | 45.4% | $ 18,872.6 | $ 16,806.1 | | $ 320.0 | $ 12,676.6 | $ 28,656.4 | 53.9% | 0.0% | 0.6% | **45.4%** |

Sources:
[A] Value Line: Most current data available at time of schedule preparation.
[B] Percentage calculated on Total Capital excluding Short Term Debt.