BEFORE THE
NEW HAMPSHIRE PUBLIC UTILITIES COMMISSION

APPLICATION OF
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
FOR ADJUSTMENT OF RATES AND CHARGES

DOCKET NO. DE 24-070

DIRECT TESTIMONY
OF
AARON L. ROTHSCHILD

COST OF CAPITAL

ON BEHALF OF THE
NEW HAMPSHIRE OFFICE OF CONSUMER ADVOCATE

January 23, 2025

Contents

I. STATEMENT OF QUALIFICATIONS

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

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

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

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

Q. PLEASE STATE YOUR EDUCATIONAL ACHIEVEMENTS AND PROFESSIONAL DESIGNATIONS.

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

Q. PLEASE DESCRIBE YOUR BUSINESS EXPERIENCE.

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

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

A. Yes. I have testified before the New Hampshire Public Utilities Commission. My expert witness experience also includes testifying in over 75 cost of capital proceedings before

the following additional state commissions: California; Colorado; Connecticut; Delaware; District of Columbia; Florida; New Jersey; Maryland; North Dakota; Pennsylvania; South Carolina; Tennessee and Vermont. See Appendix G for the list of dockets for each of my testimonies.

Q. ON WHOSE BEHALF ARE YOU PROVIDING THIS TESTIMONY?

A. I am testifying on behalf of the New Hampshire Office of Consumer Advocate ("OCA").

II. PURPOSE

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

A. The purpose of my testimony is to address the cost of capital for Public Service Company of New Hampshire ("PSNH" or the "Company") which includes the following three components:

1. Cost of Equity ("COE")
2. Cost of Debt
3. Capital Structure

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

Q. PLEASE DEFINE THE COE, COST OF DEBT, AND CAPITAL STRUCTURE.

A.

1. **COE:** My COE recommendation is my opinion of the return investors require to provide equity capital to PSNH 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, PSNH's COE is forward-looking and "market-based." 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.[1]

And

> [S]ufficient to . . . support its credit and . . . raise the money necessary for the proper discharge of its public duties.[2]

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 credit. For example, if a utility has issued a bond with a 3% 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

[1] *Fed. Power Comm'n v. Hope Nat. Gas Co.*, 320 U.S. 591, 603 (1944).
[2] *Bluefield Water Works & Improvement Co. v. Pub. Serv. Comm'n of the State of W. Va.* 262 U.S. 679, 692-693 (1923).

capital structure for regulatory purposes produces the lowest, reasonable overall cost of capital. My capital structure recommendation is based on my review of PSNH's justification for its requested regulatory capital structure, the capital structure ratios of other electric utility companies, and the capital structure of PSNH's parent, Eversource Energy. As discussed below, the reported capital structure of a regulated subsidiary is often not representative of how the regulated utility was financed. For example, the parent of a regulated utility can report funds raised through debt financing at the holding company level as equity financing on the books of its regulated utility subsidiary. Therefore, it is important to make sure PSNH's requested capital structure would not overcharge consumers by including a higher common equity ratio than is appropriate.[3]

Q. WHAT IS THE DIFFERENCE BETWEEN PSNH'S COST OF EQUITY AND ITS AUTHORIZED ROE?

A. 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 on proxies for what investors would require to provide equity capital to PSNH. 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

[3] A higher common equity ratio, all else equal, results in higher rates for consumers because equity is more expensive than debt.

fluctuate as capital markets inevitably continue to change. The authorized ROE is based on a snapshot of the COE, which is constantly changing.

Q. PLEASE DEFINE THE APPROPRIATE RATE OF RETURN.

A. The appropriate Rate of Return (ROR) is based upon the weighted overall cost of capital (WACC) of the current costs of debt and 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 common equity) times their respective cost rates.

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

Q. CALCULATING THE COST OF EQUITY IS A HIGHLY TECHNICAL TOPIC. HOW CAN A DECISION MAKER WHO IS NOT SPECIALIZED IN FINANCE BEST USE THE CONTENT OF THIS TESTIMONY?

A. My testimony includes a thorough technical analysis, including the use of specialized mathematical models. Models are required to determine the cost of equity like a map is required to plan a road trip. Maps and models are useful because they simplify the complexity and vastness of reality into a form that is understandable and useful. A map of New Hampshire that left out no details would be the same size as the state and thus unusable. A model that included every detail of financial markets (e.g., the trading activity of every single stock investor on earth) would be unusable as well. It is critical to remember that models are simplifications of reality and there are arguably as many "models" as there are investors. My ROE recommendation is based on the best tools I am aware of to calculate PSNH's COE; however, I urge the Commission to test the reasonableness of my model results by comparing them to model results from sources that have nothing to do

with this proceeding. For example, I recommend that the Commission consider the long-term equity return expectations of pension funds and leading financial institutions like the ones shown in Table 4 on page 17.

Q. HAVE YOU REVIEWED PSNH'S RATE CASE FILING AND DIRECT TESTIMONY?

A. Yes.

III. INTRODUCTION AND SUMMARY OF CONCLUSIONS

Q. PLEASE SUMMARIZE YOUR MAIN CONCLUSIONS.

A. The Commission should reject (1) Mr. Rea's recommended return on equity ("ROE") of 10.30% because it is higher than PSNH's market-based cost of equity ("COE') and (2) PSNH's requested capital structure consisting of 53.85% equity and 46.15% debt, because they have a significantly higher common equity ratio (53.85%) than the average common equity ratio (47.2%) used by other electric distribution utility companies in the country and the consolidated capital structure being used by PSNH's parent Eversource Energy (about 37.5%).[4]

As a regulated monopoly, PSNH's authorized ROE should be consistent with the following legal standards set by the United States Supreme Court for a fair rate of return: (1) "The return to the equity owner should be commensurate with returns on investments in other enterprises having corresponding risks"[1] and (2) "[S]ufficient to . . . support its

[4] Eversource Energy Value Line Company Report, November 8, 2024.

credit and . . . raise the money necessary for the proper discharge of its public duties."[5] In my testimony, I explain why Mr. Rea's recommendations fail to meet these standards. My ROE recommendation of up to 8.13% is at the high end of my cost of equity recommended range (6.60% - 8.13% with a midpoint of 7.36%) and is more than sufficient to meet these standards.[6]

To arrive at my recommendation, I conducted a thorough technical analysis to determine the equity return investors require to provide capital to enterprises having corresponding risks to PSNH. I also cross-referenced the results of my analysis with the model results of leading financial institutions so the Commission can better judge the reasonableness of my model results and 8.13% ROE recommendation.

Additionally, the U.S. Supreme Court established that when determining the fairness or reasonableness of a utility's authorized ROE it is the result reached, as opposed to the methodology employed, that matters.[7] Therefore, in addition to my thorough technical analysis, I provide evidence to help the Commission evaluate the result reached by Mr. Rea (10.30% ROE recommendation) independent of his methods. Aside from the issues with his methods, Mr. Rea's 10.30% ROE recommendation is significantly higher than the equity return expectations of major financial institutions shown in Table 4 on page 17 which range between 6.0% and 8.5% for large capitalization companies (e.g., Amazon, Apple, Tesla)[8]. There is no good reason for PSNH's authorized ROE to be hundreds of

[5] Bluefield Water Works & Improvement Co. v. Pub. Serv. Comm'n of the State of W. Va. 262 U.S. 679, 692-693 (1923).
[6] As I will explain further, this 6.60% - 8.13% range does not include an adjustment to account for the difference between my recommended capital structure, containing a 50% common equity ratio, and the average capital structure ratio of the companies in my proxy group, which contain an average common equity ratio of 49.2%.
[7] *Federal Power Commission v. Hope Natural Gas Co.,* 320 U.S. 591, 602 (1944).
[8] Table 4slo shows an 8.5% cost of equity from Duff & Phelps / Kroll, a financial advisor and data provider.

basis points higher than the equity return expectations for large cap unregulated companies that operate in extremely competitive markets. If there is one, I have not seen it.

Q. HOW IS YOUR TESTIMONY ORGANIZED?

A. First, I provide a summary of my recommendations, an overview of cost of equity concepts, and explanation of how current capital markets relate to my cost of equity calculations. Second, I will provide a more detailed discussion of current capital markets and how key parameters are impacting equity costs. Third, I will provide my capital structure and cost of debt recommendation. Fourth, I will provide an explanation of the various models I use in my cost of equity calculations. Lastly, I will provide an evaluation of PSNH's rate of return testimony.

Q. PLEASE PROVIDE A SUMMARY OF YOUR RECOMMENDATIONS.

A. I recommend the following cost of capital for PSNH's electric distribution operations:

- An overall cost of capital of 6.00% (5.28% - 6.00%)
- An ROE of 8.13% (6.60% - 8.13%)
- A capital structure containing 47.24% common equity and 52.76% long-term debt
- A long-term debt cost rate of 4.10%

A summary of my cost of capital recommendations for PSNH's electric distribution operations is presented in Table 1 on page 11.

TABLE 1: ALR RECOMMENDED RANGE MIDPOINT - PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
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	Capital Structure Ratios	Cost Rate	Weighted Cost Rate
Long-Term Debt	52.76%	4.10%	2.16%
Short-Term Debt	0.00%	0.00%	0.00%
Preferred Equity	0.00%	0.00%	0.00%
Common Equity	47.24%	8.13%	3.84%
Rate of Return			6.00%

Exhibit ALR-1

If the Commission decides to use PSNH's requested capital structure instead of my recommended capital structure, it would be appropriate to reduce PSNH's authorized ROE because it has lower financial risk. A higher common equity ratio means less debt, a lower chance of financial stress (financial risk), and therefore a lower cost of equity. On the other hand, a lower common equity ratio means more debt, a higher chance of financial stress (financial risk), and therefore a higher cost of equity. Based on a regression analysis of dozens of utility companies, I found a 0.04% reduction in the cost of equity for every 1% increase in the common equity ratio. Applying the results of this regression analysis, I determined that PSNH's authorized ROE should be reduced from 8.13% (6.60% - 8.13%) to 7.86% (6.33% - 7.86%) if their requested regulatory capital structure is used to set rates.

Q. ARE YOU RECOMMENDING A SPECIFIC ROE OF 8.13% OR AN ROE RANGE OF 6.60% TO 8.13%?

A. I recommend both a range of appropriate ROEs and a specific point within that range that I consider to be the most appropriate. It is not possible to measure PSNH's COE with the precision of measuring temperature with a thermometer. However, my recommended ROE range of 6.60% to 8.13% already eliminates the extreme ends of the results of my models and provides the Commission with a range of ROEs I feel confident will allow PSNH to

raise the capital it needs to provide safe and reliable service. I also recommend a specific point of 8.13% which is at the high end of that range.

Q. PLEASE SUMMARIZE HOW YOU DETERMINED YOUR 8.13% COST OF EQUITY RECOMMENDATION FOR PSNH.

A. To arrive at my recommendation, I applied the Constant Growth[9] and Non-Constant Growth versions of the DCF and 8 variations of the CAPM methodologies to a proxy group of 11 publicly traded electric utility companies ("RFC Electric Proxy Group")[10] using data available through November 30, 2024. As discussed below, I utilize capital market data and cross-reference the model results of leading financial institutions as an additional check on the reasonableness of my model results.

I use a proxy group to calculate PSNH's cost of equity because PSNH does not have publicly traded stock data specific to itself.[11] Additionally, using a proxy group provides more reliable results because it is less likely to be skewed by specific circumstances or anomalies faced by any individual company during the time when I take a snapshot of the COE.

As shown in Table 2 below, Cost of Equity Model Results, the results of my cost of equity models, including eight variations of the CAPM[12] and three variations of the

[9] The constant growth DCF model is a variant, or version, of the single-stage DCF model that uses a consistent, never-changing growth rate component in perpetuity.
[10] Rothschild Financial Consulting ("RFC")
[11] PSNH's parent Eversource Energy has publicly traded stocks, but it owns several utility companies in different states. Therefore, Eversource Energy' stock is not the same as PSNH. OCA witness Marc Vatter analyzes panel data on authorized and realized ROEs for the three subsidiaries of Eversource who distribute electricity and natural gas, focusing on PSNH.
[12] That the COE's derived in the CAPM using the rate on three-month T-bills exceed those using the rate on 30-year Treasury bonds results from an inversion of the yield curve that ended in December. When the yield curve is inverted, short-term rates exceed long-term rates, but this is not normal. From September 9, 1981, to January 6, 2025, the rate on thirty-year Treasuries exceeded that on three-month Treasuries 90% of the time, and the average difference was two percentage points. https://fred.stlouisfed.org/series/DAAA#0, accessed January 8, 2025.

DCF, range between 6.16% and 8.90%. Eliminating the top and bottom 28.0% of my results,[13] leads me to a reduced Recommended Cost of Equity range of 6.60% to 8.13%.

TABLE 2: COST OF EQUITY MODEL RESULTS		
DCF	**Low**	**High**
Constant Growth - Sustainable Growth	8.25%	8.35%
Constant Growth - Option-Implied Growth	8.59%	8.90%
Non-Constant Growth	7.24%	7.63%
CAPM		
Spot (Nov. 30, 2024)		
Risk Free Rate - 3-Month T Bill	6.27%	6.99%
Risk Free Rate - 30-Yr T Bond	6.16%	6.93%
3-Mo. Weighted Average (Sep. to Nov. 2024)		
Risk Free Rate - 3-Month T Bill	6.51%	7.09%
Risk Free Rate - 30-Yr T Bond	6.37%	6.99%
Outer Percentile Range	**6.60%**	**8.13%**
Midpoint of Range	**7.36%**	

Exhibit ALR-2

Q. ARE YOUR COE MODELS BASED ON ESTABLISHED METHODOLOGIES?

A. Yes. 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.[14] *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.[15] As discussed in Section V - F. Capital Asset Pricing Model on page 58, my CAPM is based on methodologies used by Value Line, the Chicago Board of

[13] My preferred approach is to eliminate "outer quartiles," which is to say values below the lower 25th percentile and above the higher 25th percentile of the overall range, thus resulting in an "Inner 50 Percentile Range." However, if this approach results in a range that is too wide, I use higher percentiles to eliminate values from both ends. In this case, I eliminated the top and bottom 28.0% of results.

[14] 23rd Annual Edition, Long-Term Capital Market Assumptions - Time-tested projections to build stronger portfolios, pp. 62-63.

[15] Brealey, Myers, and Allen, Principles of Corporate Finance, pp. 86-87 (12th ed. 2017).

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 state utility 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 presented, the Commission therefore adopts the recommended ROE of 7.46% proposed by witness Rothschild.[16]

In California's 2017 Water Cost of Capital proceedings, a company witness acknowledged the validity of RFC's method. California Administrative Law Judge Bemesderfer stated the following:

> [O]n cross-examination Vilbert [California Water Service Company witness] admitted that Rothschild's use of the method [b x r method] was "reasonable" and that Rothschild had "implemented the methodology correctly" in arriving at his Water Proxy Group ROE of 8.25%.[17]

In a 2024 decision, California Commissioner John Reynolds found merit in my analysis and used my cost of equity methodology, including the CAPM and DCF methods I use in this proceeding, to determine the authorized ROEs for California's ten Independent Small Telephone Companies (ILECs).[18]

[16] Order Ruling on Application for Adjustment in Rates, p. 43, SC PSC Docket No. 2019-290-WS, Order No. 2020-306 (April 9, 2020).
[17] Proposed Decision of ALJ Bemesderfer, p.19, CPUC Application No. 17-04-001 (February 6, 2018).
[18] Alternative Proposed Decision of Commissioner John Reynolds, p.19, CPUC Application No. 22-09-003 (August 5, 2024).

Q. HOW DO YOUR RECOMMENDATIONS COMPARE TO THE RECOMMENDATIONS OF PSNH'S WITNESS, MR. REA?

A. As shown in Table 3 below, my 8.13% cost of equity and capital structure recommendations result in a 6.00% overall rate of return. Mr. Rea's 10.30% cost of equity and capital structure recommendations result in an overall rate of return of 7.44%.

TABLE 3: RECOMMENDATION COMPARISON - ROTHSCHILD AND REA

	Cost of Equity	Cost of Debt	Common Equity %	Debt %	Rate of Return
Rothschild [1]	8.13%	4.10%	47.24%	52.76%	6.00%
Rea [2]	10.30%	4.10%	53.85%	46.15%	7.44%

[1] Exhibit ALR-1
[2] Direct Testimony of Asheley Botelho and Yi-An Chen-permAttachment ES-REVREQ-
Note: Capital Structure Percentages may not add up to 100% due to Short-Term Debt and/or Preferred Equity, if any.

I recommend a different ROE[19] for PSNH than its witnesses Mr. Rea for many reasons.

A key difference is that we have different analytical approaches. As discussed above, my COE recommendation is market-based; I use capital market data (e.g., stock prices, bond yields, stock option prices) to calculate the cost of equity. I use capital market data because they reveal investors' expectations, including their expectations regarding future capital market conditions. Current capital markets are forward-looking. On the other hand, Mr. Rea rejects the collective information revealed by the behavior of millions of investors participating in capital markets in portions of his analysis. For example, he uses interest rate forecasts instead of market yields as a proxy for the risk-free rate component of his CAPM analysis. But investors' expectations regarding future capital

[19] My ROE recommendation is based on PSNH's current market-based COE. As stated previously, the authorized ROE is based on a snapshot of the COE which is constantly changing. In the context of this case my recommended COE and ROE are synonymous.

market conditions are revealed in current capital market data because when investors buy a stock or a bond they care what price they will be able to sell those securities for in the future. Mr. Rea's method is to prioritize the opinions of a few analysts over the expectations of millions of investors. My market-based methodology is superior to Mr. Rea's non market-based method because it relies on a much larger sample size of data, but also because it is based on the expectations of those who provide PSNH the capital it needs, investors.

Q. PLEASE PROVIDE A SUMMARY OF HOW YOUR COST OF EQUITY RECOMMENDATION COMPARES TO THE RETURN EXPECTATIONS OF MAJOR FINANCIAL INSTITUTIONS.

A. As shown in Table 4 on page 17, major financial institutions are informing their clients to expect returns on the overall market (S&P 500) of 6.0% to 8.5%. Even a source relied upon by Mr. Rea, Kroll, determined that the cost of equity for the overall market is 8.5%.[20] As stated above, PSNH's authorized ROE should be based investors' expectations as indicated by capital market data, not the opinions of small groups of people including those of major financial institutions. However, I chose to include the equity return expectations of major financial institutions to encourage the Commission to consider why Mr. Rea's 10.30% ROE is significantly higher than financial mainstream. If there is a good reason for PSNH's COE to be hundreds of basis points higher than the equity return expectations of major financial institutions, I have not seen it.

[20] While Mr. Rea does not cites Kroll's cost of equity for the overall market of 8.5%, throughout his testimony, he uses other data from Kroll to justify the market risk premium portion of his CAPM analysis.

TABLE 4: U.S. EQUITY RETURN EXPECTATIONS AMONG MAJOR FINANCIAL INSTITUTIONS	
J.P. Morgan Asset Management - Equity Long-Term Returns (2025) [1]	**6.7%**
Charles Schwab - 10-year U.S. Large Cap Returns (January 2025) [2]	**6.0%**
Horizon Actuarial Services, LLC Survey - 20 Year Horizon (August 2024) [3]	
U.S. Equity - Large Cap (5.6-10.2%, 50% Percentile - 7.3%)	**7.3%**
U.S. Equity - Small / Mid Cap (5.1-10.9%, 50% Percentile - 7.6%)	**7.6%**
Duff & Phelps / Kroll (June 2024) [4]	**8.5%**

Sources:
[1] J.P. Morgan Asset Management - 2025 Long-Term Capital Market Assumptions, 2024, page 30.
https://am.jpmorgan.com/us/en/asset-management/adv/insights/portfolio-insights/ltcma/
[2] Schwab's 2025 Long-Term Capital Market Expectations, January 3, 2025.
https://www.schwab.com/learn/story/schwabs-long-term-capital-market-expectations
[3] Horizon Actuarial Services, LLC, Survey of Capital Market Assumptions Survey, August 2024, page 19.
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.
[4] Kroll Recommended U.S. ERP and Corresponding RFR to be Used in Computing Cost of Capital: January 2008 - Present,
https://www.kroll.com/en/insights/publications/cost-of-capital/recommended-us-equity-risk-premium-and-corresponding-risk-free-rates
Note: Duff & Phelps acquired Kroll in 2021 and rebranded itself as Kroll.
Note: J.P. Morgan's 2025 Long-Term Capital Market Assumptions is an annual report.

The equity return expectations, shown in Table 4 above, are for the overall stock market (e.g., US Large Cap, S&P 500[21]), which should be higher than the return expectations for utility stocks because regulated monopoly utilities are lower risk than most, if not all, unregulated companies in the S&P 500, like Tesla and Amazon. Therefore, Mr. Rea's 10.30% ROE recommendation is even more out of line with the financial mainstream than it appears from the numbers presented in this table.

Even my cost of equity recommendation of 8.13% (6.60% to 8.13%) for PSNH is in the middle to upper part of the range of these expectations, which should give the Commission more confidence that if they adopt my recommendation PSNH will be able to raise the capital it needs to provide safe and reliable service.

[21] S&P 500 is a stock market index that includes 500 of the largest U.S. companies, including 11 sectors to show the health of the U.S. stock market and broader economy. The Dow Jones Industrial Average, 30 of the largest U.S. companies, is another commonly used measure of equity markets in general.

Q. PLEASE COMPARE PSNH'S REVENUE REQUIREMENT IF YOUR RECOMMENDATIONS ARE ADOPTED INSTEAD OF MR. REA'S.

A. If my 8.13% cost of equity recommendation and capital structure recommendation are used to set rates for PSNH, the rate of return portion of the revenue requirement will be about $116.3 million. On the other hand, if Mr. Rea's 10.30% cost of equity recommendation and capital structure recommendation are used to set rates, the rate of return portion of the annual revenue requirement will be $159.1 million.

TABLE 5: ANNUAL REVENUE IMPACT VS. ROTHSCHILD RECOMMENDATION - PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
($ million)

	Rate of Return Portion of Revenue Requirement	Difference versus Rothschild Recommendation
Rothschild ROE & Cap Structure	$124.5	
Rothschild ROE with Rea Cap Structure	$132.3	$7.7
Rea ROE & Cap Structure	$159.1	$34.5

Source/Inputs:

Requested Rate Base [1]	$1,692.0
Federal income tax rate	21.00%
State income tax rate	6.50%
Uncollectable Expense	0.00%

[1] Direct Testimony of Asley N. Botelho and Yi-An Chen, Page 19, lines 15-17

Q. YOU RECOMMEND THAT PSNH SHOULD BE AUTHORIZED TO EARN AN ROE EQUAL TO ITS MARKET-BASED COST OF EQUITY OF 8.13% (6.60% TO 8.13%). PLEASE EXPLAIN MORE REGARDING THE IMPORTANCE OF DETERMINING THE MARKET-BASED COE AS ACCURATELY AS POSSIBLE.

A. As discussed above, PSNH's authorized ROE should be in line with its market-based COE. In other words, the cost of equity is the return investors expect to earn when they purchase the equity (or stock) of a company. The return investors expect can come in the form of capital gains (stock price appreciation) or dividend payments. As investors buy and sell stock in the market, they convey information about their return expectations and, therefore, the underlying cost of equity. Companies with different risk profiles will have different

costs of equity. It is impossible to determine the cost of equity based on accounting information alone (e.g., revenue, net income, equity book value, or return on book equity) as it can only be established by capital market prices (e.g., stocks, stock options).

It is important that the cost of equity used to set rates for PSNH in this proceeding be market-based. This makes sense because investor-owned utility companies ("IOUs") raise money from investors. It is thus critical that the authorized ROE be consistent with the market return expectations of investors.

Q. DO ANY ROE WITNESSES USE A DIFFERENT DEFINITION FOR THE COST OF EQUITY?

A. All the ROE witnesses I have encountered over my more than 20 years in the industry, including Mr. Rea, define the cost of equity as market-based somewhere in their testimony. Mr. Rea describes the cost of equity as "an opportunity cost concept, which is determined in the financial market based upon the relative risk assessments of investors."[22] However, as discussed above, Mr. Rea's approach relies significantly on the personal opinions of equity analysts in both his CAPM and DCF analysis instead of the supply and demand of stocks and bonds as indicated by market data. Calculating the cost of equity should be an interpretive approach (i.e., using market data to measure investors' expectations as Mr. Rea did in some parts of his testimony) rather than a speculative one (i.e., using interest rate forecasts instead of investors' expectations as revealed in the market yield).

[22] Mr. Rea's Direct Testimony at 21:12-13.

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

A. 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 interpretation 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 analyst forecasts to estimate the market-based cost of equity in my Discounted Cash Flow (DCF) analyses. However, I do not use them mechanically and I go to great lengths to distill the sustainable growth component to ensure it is in line with investors' long-term expectations, including using a DCF model that is based only on market data (stock option prices). 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. McKinsey & Company found that analysts have been over optimistic for decades.[23]

Q. YOU STATED ABOVE THAT ROES AUTHORIZED IN OTHER PROCEEDINGS SHOULD NOT BE USED TO SET THE AUTHORIZED ROE IN THIS

[23] Marc Goedhart, Rishi Raj, & Abshishek Saxena, Equity Analysts: Still too bullish (April 1, 2010) at https://www.mckinsey.com/capabilities/strategy-and-corporate-finance/our-insights/equity-analysts-still-too-bullish. This is also discussed later in testimony at p. 96.

PROCEEDING. CAN YOU ELABORATE ON WHY PREVIOUS PROCEEDINGS' ROES ARE NOT AN APPROPRIATE GAUGE FOR PSNH'S COE?

A. Past authorized ROEs are applied to the portion of rate base financed by equity, which is nearly identical to the book value of equity. In other words, they are accounting returns. We are not trying to determine what investors expect the return on book value to be. We are trying to determine the return investors expect/require on the market price of stock.

As discussed in Appendix A, when an electric utility company's market-to-book ratio[24] is significantly above one (as it is now),[25] it indicates that its cost of equity is lower than its authorized return on equity.[26] Eversource's market-to-book ratio has remained above one since 2010.[27]

In his 1970 book *The Economics of Regulation: Principles and Institutions*, regulatory economist Alfred Kahn wrote on why the cost of equity is lower than authorized returns when market-to-book ratios are significantly above one, saying:[28]

> [T]he sharp appreciation in the prices of public utility stocks, to one and half and then two times their book value during this period, reflected ... a growing recognition that the companies in question were in fact being permitted to earn considerably more than their cost of capital. ... The source of the discrepancy between market and book value has been that commissions have been allowing r's [returns on equity] in excess of k [market cost of equity]; if instead they had set r equal to k, or proceeded at some point to do so ... the discrepancy between market and book value ... would have disappeared, or would never have arisen.

[24] For simplicity, 'market-to-book ratio' refers to the ratio of the market value of equity to book value of equity unless otherwise noted.
[25] See Exhibit ALR-3, page 1. The market-to-book ratios of the companies in my proxy group averaged 1.68 over the year ending November 30, 2024.
[26] An authorized ROE is applied to rate base, which is nearly identical to the return on the book value of equity; therefore, authorized ROEs are nearly identical to return on book equity.
[27] https://www.capitaliq.spglobal.com/web/client#company/stock?id=4057052&mode=1, accessed January 6, 2025.
[28] Alfred Kahn, *The Economics of Regulation: Principles and Institutions*, Mass. Inst. Tech. at 48 (fn. 69), 50 (1970).

A utility company's COE should not be based on authorized ROEs, which are accounting returns. The COE is set based on what investors in the market expect for a given risk profile. In the case of a utility stock, an increasing market value results in a lower return on market for the same expected return on book, all else equal.

IV. COST OF EQUITY IN TODAY'S FINANCIAL MARKETS

Q. WHY DO YOU CONSIDER CAPITAL MARKETS IN GENERAL?

A. My COE models are designed to reflect capital market conditions. However, it is important to "cross-check" the model results because capital markets are complicated. I consider capital market data in general like a ship captain might use visual landmarks, by comparing them with electronic navigation aids like GPS, and cross-referencing with nautical charts to confirm their position. This process of cross-checking helps to identify and correct any discrepancies or errors in any single source.

Q. PLEASE SUMMARIZE YOUR CONCLUSIONS REGARDING CURRENT CAPITAL MARKET CONDITIONS.

A. The capital market data discussed below indicate that an authorized ROE of 8.13% is sufficient for a regulated utility like PSNH to raise capital from investors.

There are many cross currents in today's capital markets. However, I would like to emphasize that since the end of 2022 there has been a downward trend in the cost of equity in both the overall market and electric utility stocks, specifically. My conclusion that an 8.13% authorized ROE is sufficient for PSNH to be able to raise capital is based primarily on the interplay between the following four capital market factors: (A) inflation

and interest rates, B) the relative risk/cost of equity for electric utility companies (including PSNH), (C) the cost of equity for the overall market, and (D) investors' volatility expectations. I will discuss each of these components in detail below. First, however, I will provide a summary of the individual issues.

Q. PLEASE SUMMARIZE WHY THESE FOUR CAPITAL MARKET FACTORS SUPPORT YOUR 8.13% ROE RECOMMENDATION FOR PSNH.

A. I elaborate on each of the points in the following sections. However, the following summary of each of these market factors or developments shows how they impact the COE:

A. Inflation and Interest Rates. Inflation and interest rates significantly influence the cost of equity, particularly for electric utility companies, which investors often view as alternatives to fixed-income investments. Generally, higher interest rates lead to a higher cost of equity. However, capital markets are complex, and many other factors beyond inflation and interest rates can affect the cost of equity. The Federal Reserve (the Fed) increased short-term interest rates (the Federal Funds Rate) from near 0% as recently as February 2022 to a range of 4.50%–4.75% as of November 30, 2024[29], to fight inflation. Since then, the Fed has reduced the rate further to 4.25%–4.50%. Yet, inflation has declined a little slower than investors and many economists expected earlier in 2024, driven more by strong economic growth than by cost-side pressures. As shown on Chart 2 on page 29, investors expect the Federal Reserve to start lowering the Federal Funds Rate next year. Long-

[29] Federal Reserve Bank of New York, Effective Federal Funds Rate at https://www.newyorkfed.org/markets/reference-rates/effr.
https://www.newyorkfed.org/markets/reference-rates/effr

term interest rates have decreased since October 31, 2023, as well, with the yield on the 30-year U.S. Treasury bond decreasing from about 5.04% to about 4.4% as of November 30, 2024. Chart 2 shows that as of July 9, 2024, investors expected the Fed to reduce the Federal Funds Rate to about 3.65% by mid-March 2027. As of August 2024, investors expected the Fed to reduce this rate to about 3.2%. As shown on Chart 3 on page 31, investors expect inflation to decrease sharply over the next few years. As of November, year-over-year CPI inflation was running at 2.73%, much closer to Fed's target of 2.00% than the peak of 8.99% in June 2022[30], suggesting that short-term rates will decline and stabilize early in the DE 24-070 rate period. The five-year expected inflation rate published by the Federal Reserve Bank of St. Louis is 2.34%.[31] These recent changes in inflation and interest rate expectations are likely putting more downward pressure on PSNH's cost of equity.

B. Relative risk/cost of equity of electric utility stocks. As shown in Chart 12 on page 44, despite relatively high volatility expectations for the companies in the RFC Electric Proxy Group, investors' expectations regarding the chance of a large drop in utility stock prices, or investors' perceived downside risk, remain significantly below those for the overall market, which indicates that the relative cost of equity for electric utility companies remains below the

[30] Consumer Price Index for All Urban Consumers: All Items in U.S. City Average (CPIAUCSL) | FRED | St. Louis Fed, accessed January 14, 2025.
[31] https://fred.stlouisfed.org/series/EXPINF5YR, accessed January 13, 2025.

overall market.[32] The volatility expectations for the companies in the RFC Electric Proxy Group have not declined as much as the overall market over the past year and remain higher than for the overall market.[33]

C. Cost of equity for the overall market. Global stock markets have been appreciating in recent years, with the S&P 500 rising about 34% since December 2023.[34] An *Economist* article published in July reported that "[a]ll around the world, stock markets have been rising at a breakneck pace" and "[v]aluations, or the multiples by which underlying earnings are scaled up to generate share prices, have risen from expensive to alarming."[35] Since, this article was published, the S&P 500 has continued to surge, up about 20% between July and November 2024. Stock prices have increased at a faster clip than earnings, leading to higher price-to-earnings ratios. In other words, investors have been willing to pay a higher premium for earnings. This rise in price-to-earnings ratios (among other market data) indicates that the cost of equity for the overall market (e.g. S&P 500) has been declining over the last two years and is at historical lows. J.P. Morgan's 1Q 2025 Guide to the Markets reported that the forward price-to-earnings ratio of the S&P 500 is significantly higher today[36] (21.5) than over the 20-year average (15.9). The

[32] Option-implied skewness represents investors' expectations regarding the asymmetry of the probability distribution for stock price movements. Option-implied skewness is further discussed in Section IV. D. Investor-Perceived Downside Risk (Option-Implied Skewness).

[33] As discussed more below, volatility, uncertainty and risk are synonymous. Higher volatility expectations mean higher uncertainty regarding future stock prices, higher risk and generally, all else equal, and a higher cost of equity.

[34] S&P 500 index was 547,839.5 on the first trading day of December 2023 and $6,090 on the last trading day of November,2024. (6,090-4,547)/4,547 = 33.93%.

[35] "Stocks are on an astonishing run. Yet threats lurk", *The Economist* (published July 16, 2024), https://www.economist.com/finance-and-economics/2024/07/16/stocks-are-on-an-astonishing-run-yet-threats-lurk

[36] As of December 31, 2024.

utility section, according to J.P. Morgan, has as higher than average price-to-earnings ratio, 17.3 currently compared to a 20-year average of only 15.8.[37]

D. Stock price volatility. As shown on Chart 10 on page 41, investors' volatility expectations for the overall market decreased considerably between October 2022 and December 2023, nearing historical lows in June 2023. Despite a spike in late September and early October 2023, market volatility expectations remain significantly lower than the highs of October 2022. Like high price-to-earnings ratios, the relatively low market volatility expectations of investors indicate a lower cost of equity. However, as discussed above, the volatility expectations for the companies in the RFC Electric Proxy Group have declined in recent months but as of November 30, 2024, they remain higher than those for the overall market.

E. Investor-Perceived Downside Risk (Option-Implied Skewness). Investors' expectations regarding the chance of a large drop in utility stock prices remain significantly below those for the overall market, and by a significantly increasing margin in recent months, which indicates that the relative cost of equity for electric utility companies remains low and has been decreasing relative to the overall market.

[37] J.P. Morgan Asset Management, U.S. 1Q 2025 Guide to The Markets, As of December 31, 2024, page 15.

A. Inflation and Interest Rates

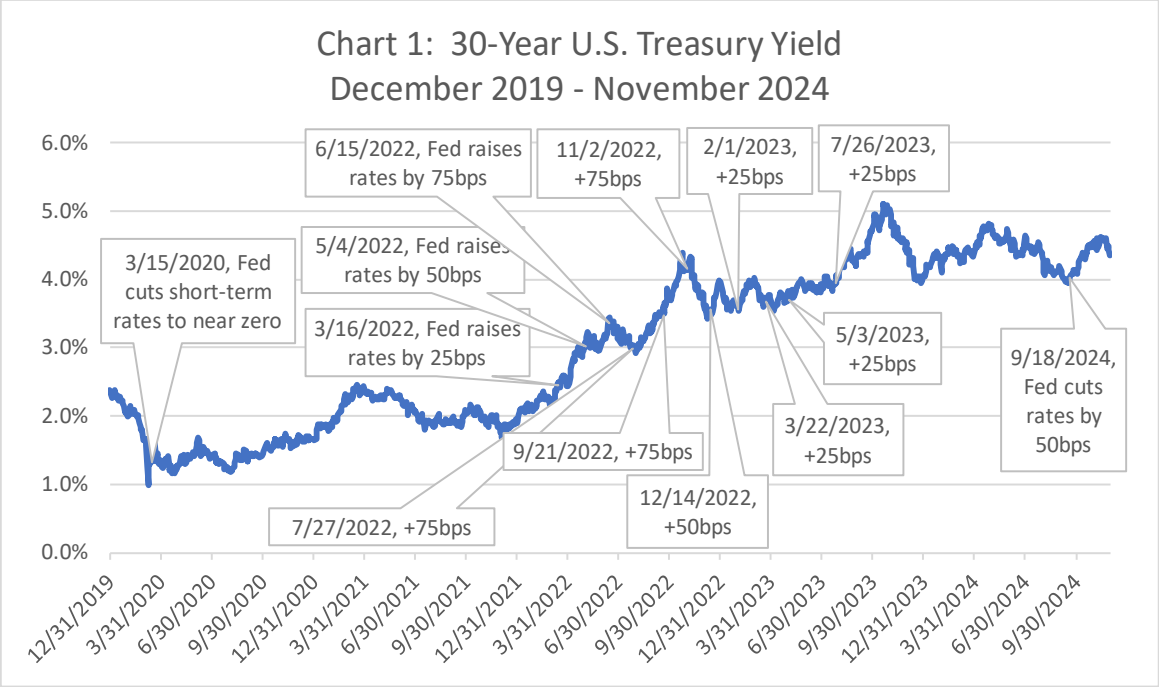
Q. PLEASE DISCUSS THE CURRENT INFLATION AND INTEREST RATE ENVIRONMENT AND WHAT IT INDICATES REGARDING THE COST OF EQUITY.

A. The Federal Funds rate is important because it can impact the cost of long-term borrowing and the cost of equity. As shown in Chart 1 on page 28, the yield on the 30-year U.S. Treasury bond increased along with the Federal Funds rate, from 2% at the start of 2022 to a high of over 5% between August 2023 and August 2024.[38] The cost of equity increased along with the Federal Funds Rate and the yield on Treasury Bonds initially, but not one for one. However, the cost of equity for electric utility stocks has been mostly trending down since reaching highs at the end of 2022. Additionally, the market-based COE for electric utility stocks is below authorized ROEs because the market-to-book ratios of these stocks is above one (1.68 to 1.82).[39] See Appendix A for an explanation of why a market-to-book ratio above one indicates that the cost of equity for electric utility stocks is lower than authorized ROEs.

Q. PLEASE EXPLAIN THE IMPORTANCE OF, AND THE RELATIONSHIP BETWEEN, THE FEDERAL FUNDS RATE AND THE COST OF EQUITY.

A. The Federal Funds rate is important because it can impact the cost of long-term borrowing and the cost of equity. As shown in Chart 1 on page 28, the yield on the 30-year U.S. Treasury bond has increased along with the Federal Funds rate, from 2% at the start of 2022 to 4.20% as of August 30, 2024.

[38] https://fred.stlouisfed.org/series/FEDFUNDS.
[39] See Exhibit ALR-3, page 1.



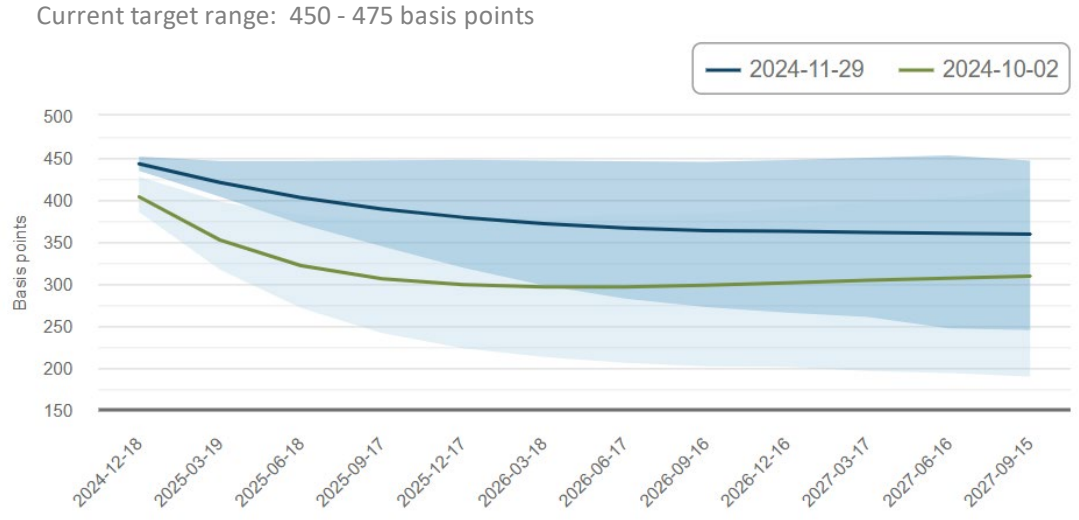
Q. WHAT IMPACT CAN HIGHER INFLATION HAVE ON THE COST OF EQUITY?

A. Higher inflation can impact the cost of equity because it can impact interest rates; the Fed will raise interest rates to reduce inflation. 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, as discussed above, the cost of equity for utility companies has likely been decreasing because the cost of equity for the overall market has been declining. Additionally, the Commission can be confident that the 8.13% ROE recommendation is sufficient because it is higher than my calculations that reflect interest rate changes. My calculations reflect interest rate changes because they are based on market data, including the changing market yields on government bonds.

Q. WHAT DO MARKET DATA INDICATE REGARDING INVESTORS' CURRENT INFLATION AND INTEREST RATE EXPECTATIONS?

A. As shown in Chart 2 below, the Federal Reserve Bank of Atlanta estimated that as of November 30, 2024, investors expected that the three-month average Federal Funds rate[40] would most likely decrease from a range of 4.5%-4.75% to an expected value of about 3.6% in 2026 and into 2027. As of January 2025, the Federal Funds Rate is 4.25%-4.50%. The same chart shows that about two months prior (October 2, 2024), investors expected the Federal Funds rate would decrease to be about 3.2% by 2026. This chart is consistent with the findings in the recent Morningstar article discussed above regarding inflationary expectations.

Chart 2: Investors' Federal Funds Rate Expectations
Three-Month Average SOFR Path as of Nov. 30, 2024



Source: Federal Reserve Bank of Atlanta (latest available date compared to oldest available date)

[40] The Federal Funds rate guides overnight lending among U.S. banks, but this short-term rate impacts the interest rates on debt with longer maturities.

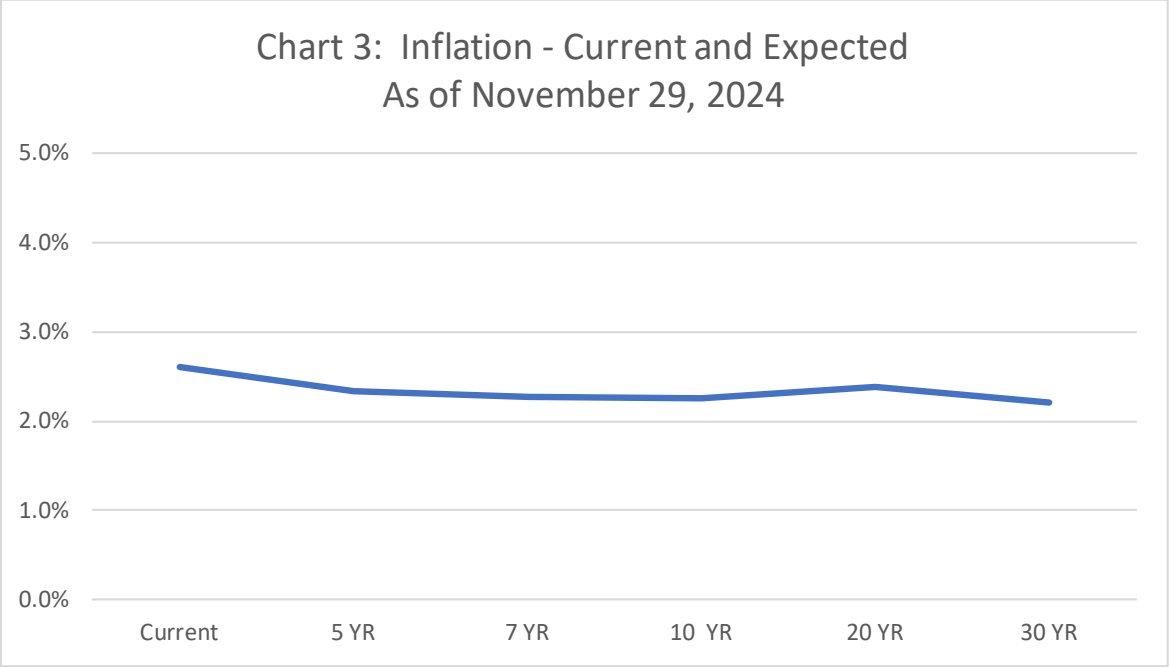
I use the Federal Reserve Bank of Atlanta's market-implied probabilities because they are based on investors' expectations as indicated by option prices, futures prices, and swap spreads. As discussed considerably above, market-based expectations like those provided by the Federal Reserve Bank are more appropriate to consider when calculating the cost of equity than economist/analyst projections for many reasons, primarily because market data like that used by the Federal Reserve Bank provides a direct observation of investor expectations.

Q. YOU STATED THAT THE FEDERAL RESERVE BANK OF ATLANTA USES MARKET DATA TO CALCULATE INVESTORS' EXPECTATIONS REGARDING THE FEDERAL FUNDS RATE. IS THERE A WAY TO MEASURE INVESTORS' INFLATION AND LONG-TERM INTEREST RATE EXPECTATIONS AS WELL?

A. Yes. Regarding inflation, it is possible to measure investors' 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.[41]

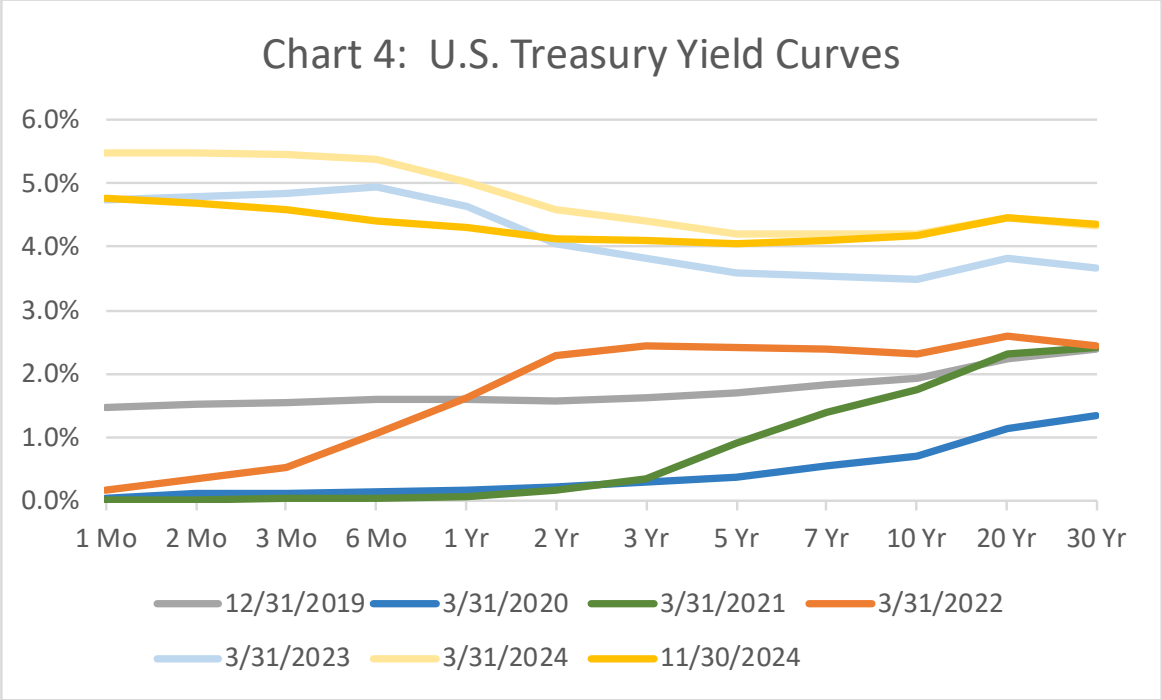
[41] For example, if the yield on a nominal 10-year Treasury is 2.5% and TIPS of the same duration are 1.5%, an investor would make the same real return on both bonds if the inflation rate is 1% over the next 10 years. (Nominal yield – real yield = breakeven inflation rate) In this case, investors' breakeven 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 expected 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.

As indicated by the difference between nominal-treasuries and TIPS, Investors expect the Fed's actions will reduce the inflation rate substantially in the coming years. As shown on Chart 3 below, the relative market price of inflation-protected bonds as compared to regular Treasury bonds as of November 30, 2024, indicates that investors expected the inflation rate to decline from the current 2.60% to only 2.33% over the next 5 years and to about 2.21% over the 30-year horizon.



Regarding interest rates, it is possible to use the yield curve to calculate investors' expectations regarding future interest rates. An upward sloping yield curve indicates investors expect higher interest rates and a downward sloping yield curve indicates investors expect lower interest rates in the future. As shown in Chart 4 above, the yield curve went from being significantly upward sloping on March 31, 2021, to slightly downward sloping as of November 30, 2024. This supports a downward investor expectation for short-term interest rates. This makes sense because if investors expected

short-term interest rates to remain the same there would be no reason to purchase long-term bonds that pay a lower interest rate.



B. Relative Risk/Cost of Equity of Electric Utility Stocks

Q. SINCE THE MIDDLE OF AUGUST THE VOLAITLITY EXPECTATIONS OF THE COMPANIES IN THE RFC ELECTRIC PROXY GROUP HAVE DECLINED SHARPLY, WHILE THE BETA COEFFICIENTS[42] OF ELECTRIC UTILITY STOCKS REMAIN SOMEWHAT ELEVATED. WHAT DOES THIS INDICATE?

A. Given that the volatility expectations of the companies in the RFC Electric Proxy Group have declined sharply since the middle of August, and that the beta coefficients of electric

[42] As discussed in Section F. Capital Asset Pricing Model on page 58, a beta coefficient measures the type of risk that most impacts a firm's cost of equity, i.e., systematic risk. As also equal, the higher the beta the higher the cost of equity.

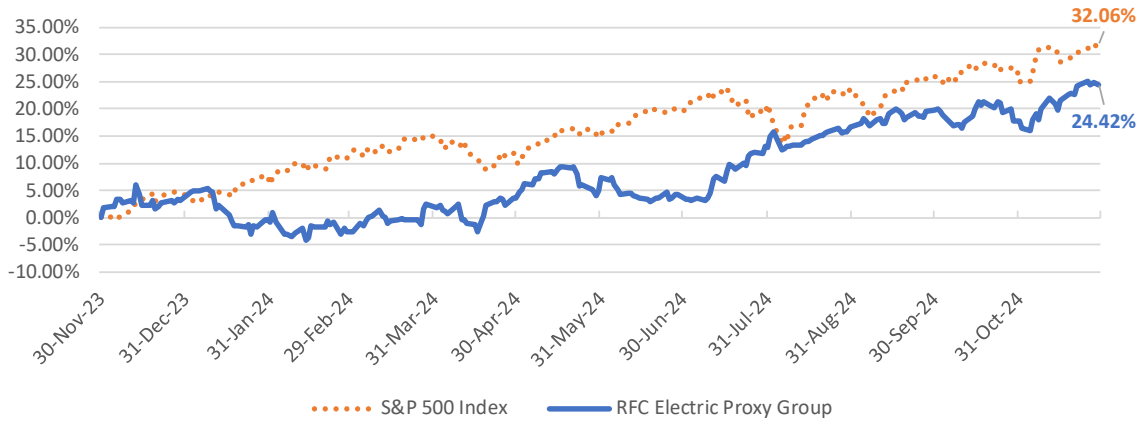
utility stocks have declined in recent months, this indicates that the cost of equity for electric utility stocks has become lower compared to the overall market.

C. The Cost of Equity for the Overall Market

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

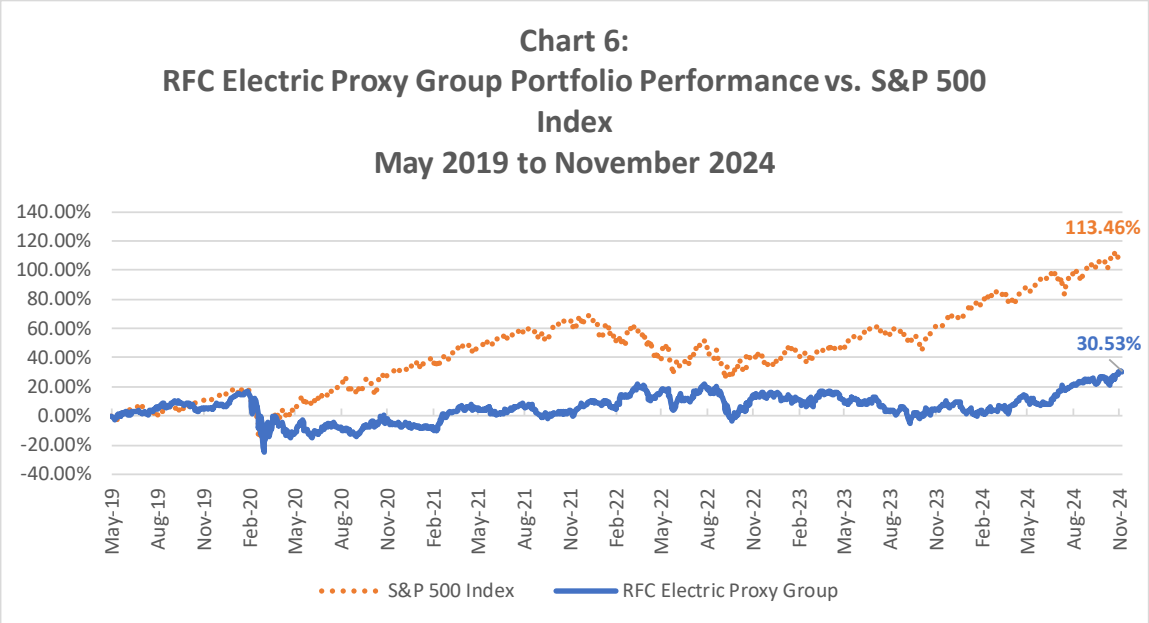
A. As discussed above, increasing stock prices have in recent years led to higher price-to-earnings ratios. All else equal, higher price-to-earnings ratios indicate that the cost of equity may be decreasing.[43] As show in Chart 5 below, stock prices for the S&P 500 have increased in recent months, up 32.06% between November 30, 2023 and November 29, 2024. The electric utility stocks in the RFC Proxy Group were up 24.42% over the same time period.

Chart 5:
RFC Electric Proxy Group Portfolio Performance vs. S&P 500 Index
November 2023 to November 2024



[43] When investors pay a higher price today for the same earnings, the immediate yield or return on investment (ROI) is lower. Using our real estate investment analogy, if you spend more on a rental property, the rental income is a smaller return relative to your investment.

As shown in Chart 6 below, since PSNH's last rate case in 2019, electric utility stocks have increased less than the overall market, up about 30% compared to S&P 500's increase of about 113%.



Regarding electric utility stock prices, Value Line reported that "[l]argely due to the rise in utility stock prices this year, total annual return potential through late decade for electrics has diminished."[44] In other words, in Value Line's opinion electric utility stock prices indicate a relatively low cost of equity for electric utility stocks.

As stated above, the forward price-to-earnings ratio of the S&P 500 of 21.5 is significantly higher than the twenty-year average of 15.9; the same dynamic can be seen with utilities, where the current forward price-to earnings ratio, of 17.3, which is higher than the twenty-year average, which is 15.8 for utilities.[45] The price-to-earnings ratio indicates that equity costs for the overall market have been declining in recent years. The

[44] Value Line Electric Utility (East) Industry Report, November 8, 2024.
[45] J.P. Morgan Asset Management, U.S. 1Q 2025 Guide to The Markets, slide 15.

price-to-earnings ratio for electric utility stocks has increased less than for the S&P 500, which indicates that the cost of equiy for electric utility stocks may have declined less relative to the overall market over this time period.

Q. DOES ADDITIONAL EVIDENCE INDICATE THAT THE COST OF EQUITY IS RELATIVELY LOW BY HISTORICAL STANDARDS?

A. Yes. I discussed that increasing stock price and price-to-earning ratios show that the cost of equity for the overall market and for electric utility stocks indicates that the cost of equity has been trending down and is likely low by historical standards. Another common way to think about the cost of equity is the following:

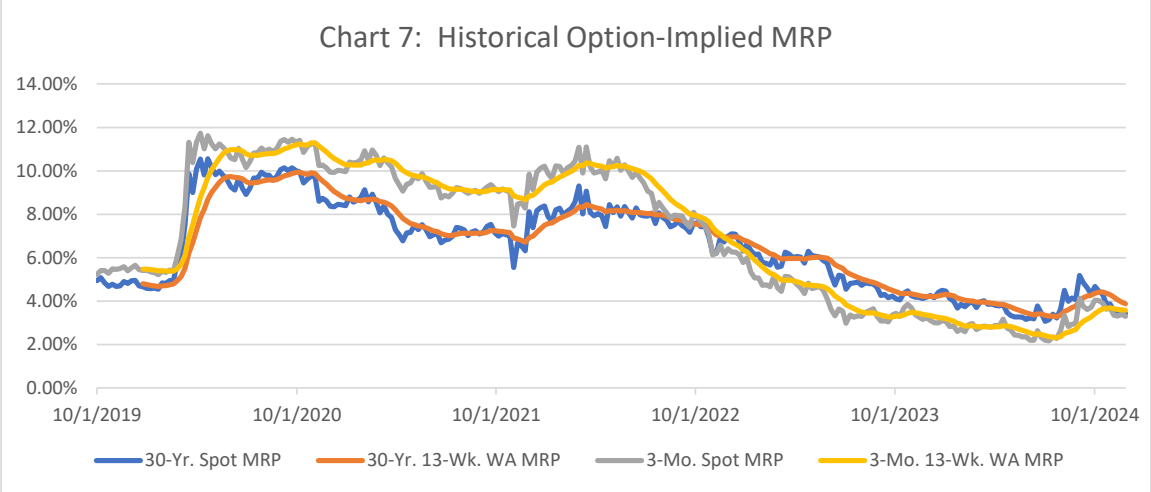
COE = risk-free interest rate + market risk premium

As the equation above indicates, investors require a premium (i.e., higher return on investment) to invest in equity over debt. This makes sense because investors face more risk when they buy equity than when they buy debt. Debt holders are paid first. We often refer to this premium as the equity risk premium or market risk premium ("MRP"). Leading scholars on the topic have determined that investors generally demand an MRP of 4.0% on average, when using the rate on ten-year Treasuries as the risk-free rate. However, the MRP for utilities is not always 4%; it can be higher or lower depending on current market conditions.

Q. HOW HAS THE MRP CHANGED OVER TIME?

A. As shown in the Chart 7 below, the market risk premium mostly declined since peaking in 2020 and as the COVID-19 pandemic spread around the world in 2020. The market risk premium over the 3-month U.S. Treasury bill exceeded 10% for portions of February 2022 and declined to just over 3% by November 2023. The market risk premium over the 30-

year U.S. Treasury bond was about 8% in February 2022, declining to just over 4% by January 2023, and is 3.31% as of November 26, 2024. These calculations are discussed in more detail in the portion of my testimony regarding my CAPM analysis.



D. Stock Price Volatility

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

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

Q. WHAT IS A STOCK OPTION, AND HOW DOES IT IMPLY VOLATILITY?

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 100 shares of 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[46] 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.

Options can be used to assess future expectations for volatility because they track the type of variation in market price that investors bet will occur within the time frame during which an option can be exercised based on what type of option is purchased and what the difference is between the market price of stock and the option price, or the price that the option bets the stock will reach. As the distance between the market price and

[46] $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.

option price grows, more volatility is implied in the value of the stock over time. I used these option data to create an "implied volatility" value.

Q. PLEASE EXPLAIN WHAT THE TERM "STRUCTURE OF VOLATILITY" MEANS AND DISCUSS ITS SIGNIFICANCE FOR ANALYZING FINANCIAL MARKETS.

A. 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 that 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 farther into the future you look.

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. In other words, investors expect the current capital market hurricane to pass and the winds to die down. 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 8 on page 39, before the COVID-19 outbreak, investors expected volatility to increase from less than 15% annually at the 1-month time frame to about 20% annually at the 24-month time frame. Investors' 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 8 also shows that investors' volatility expectations

were higher for all time frames when Russia invaded Ukraine as compared to 2021, but as of November 30, 2024 volatility expectations have dropped back to only slightly higher than 2019 levels over the full term structure of volatility.

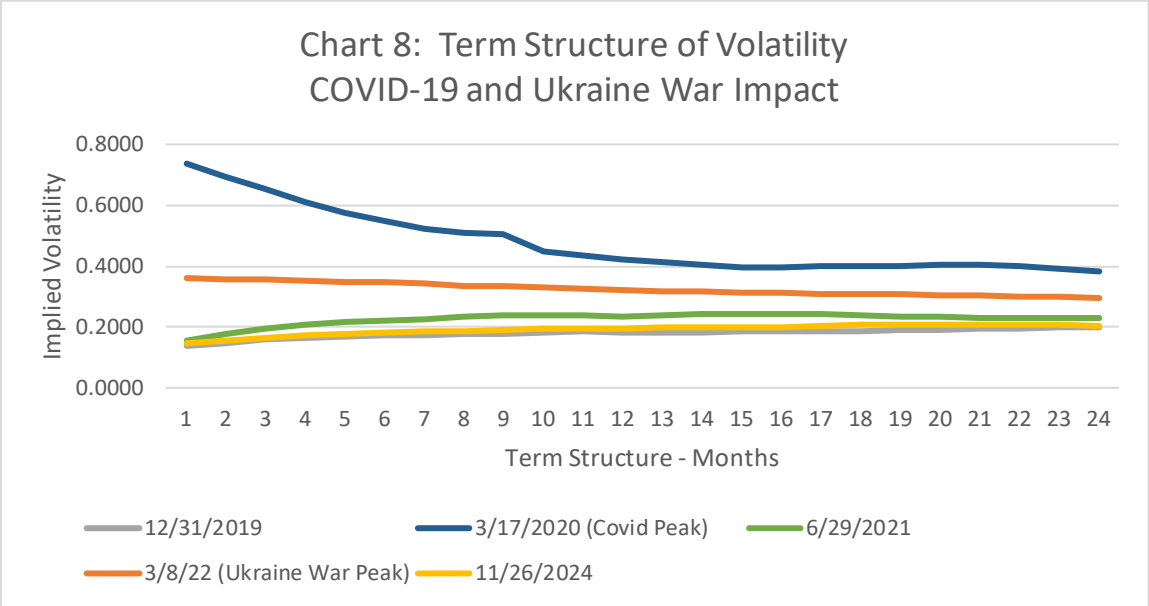
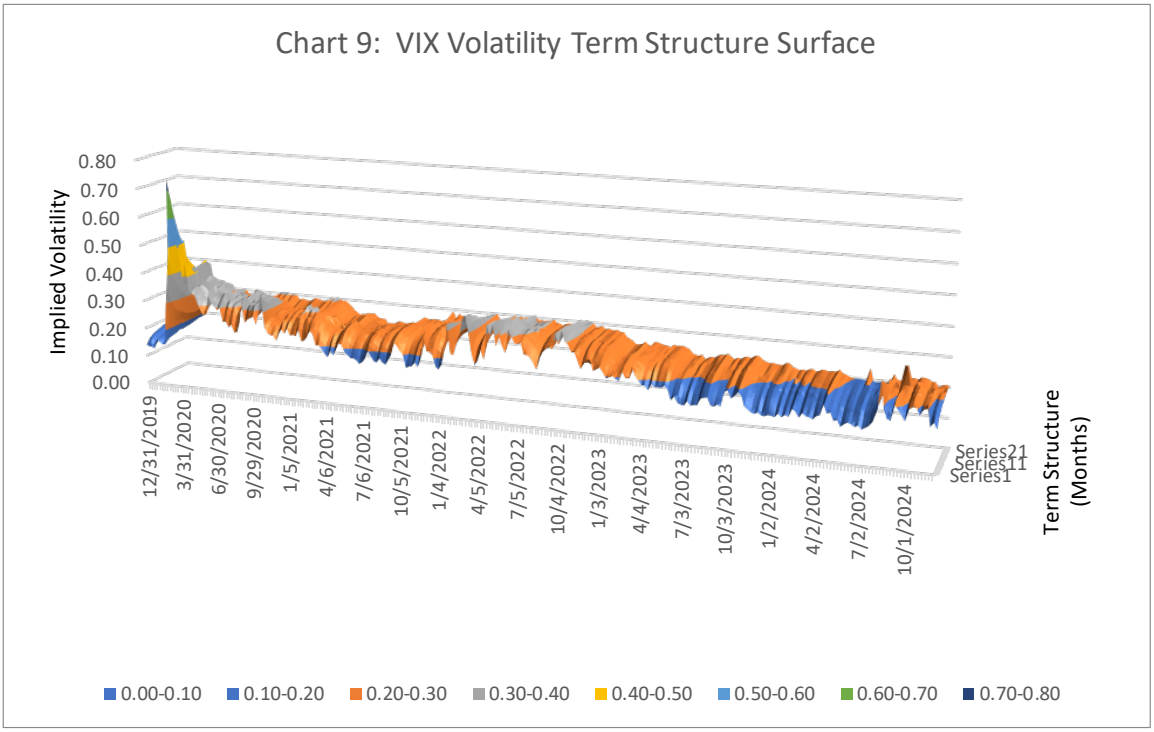


Chart 9 on page 40 provides a 3-dimensional surface[47] to show how the term structure of volatility has evolved since before the COVID-19 outbreak and how it has changed during and since the outbreak. As seen above in Chart 8 above, which shows five cross-sections of these data, during periods of low implied volatility – such as before the COVID-19 outbreak and at present – the slope of volatility expectations over time gently curves upwards, indicating lesser expectations of volatility in the short-term and greater in the long term. In Chart 9, this is represented by the surface of the line curving up and away during times of low volatility, while appearing to move downwards along the z-axis during the period of high volatility in March-April 2020 during the initial outbreak of the

[47] The X axis shows the implied volatility. The Y axis shows the data. The Z axis shows market expectation of future implied volatility of different time frames. Series1 = 1 month, Series11 = 11 months, and Series24 = 24 months.

pandemic. Implied volatility can be seen to peak for both 1-month and 24-month time frames in mid-March 2020, with less dramatic spikes in February through October of 2022. As of the end of November 2024, the term structure of volatility has returned to near pre-COVID levels.

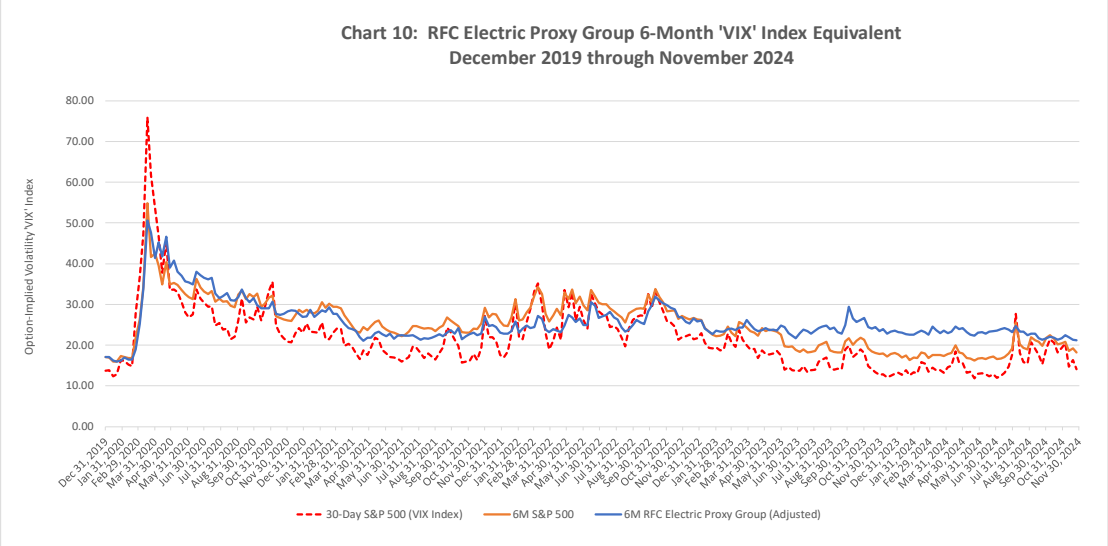


Q. HOW HAVE VOLATILITY EXPECTATIONS FOR ELECTRIC UTILITY COMPANIES COMPARED TO VOLATILITY EXPECTATIONS FOR THE S&P 500?

A. Chart 10 on page 41 shows 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 shows volatility expectations over the next 6 months, while the dashed red line shows volatility expectations over the next 30 days. On December 31, 2019, investors expected an annualized change of 13.78% over the next 30 days. In mid-March 2020, investors' volatility expectations

peaked at over 80%. As of the end of November 26, 2024, investors expected an annualized change of only about 14%.

The solid blue line in Chart 10 shows that investors' adjusted[48] 6-month volatility expectations for my RFC Electric Proxy Group, as indicated by their stock option prices, increased along with the market in mid-March 2020, but to a significantly lesser degree. Investors' 6-month adjusted volatility expectations for electric utility companies were for the most part higher than for the S&P 500 from May through August 2020, remained very comparable through March 2020, and have increased above the expectations for the market since then through the end of November 2024.



Changes in implied volatility do not paint the full cost of equity picture, however. We must consider other implied investor expectations, including how likely investors.

[48] 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 10 adjusts the 6-month expected volatility for the RFC Electric Proxy Group by the difference with the 6-month expected volatility for the S&P 500 Index on December 31, 2019 to facilitate the comparison throughout the chart.

E. Investor-Perceived Downside Risk (Option-Implied Skewness)

Q. YOU EXPLAINED EARLIER THAT ELECTRIC UTILITY STOCKS HAVE INCREASED 24.42% FOR THE YEAR ENDING NOVEMBER 29, 2024. WHAT DO STOCK OPTION DATA SHOW REGARDING INVESTORS' CONCERN THAT ELECTRIC UTILITY STOCKS WILL HAVE A LARGE DROP COMPARED TO THAT OF THE OVERALL MARKET?

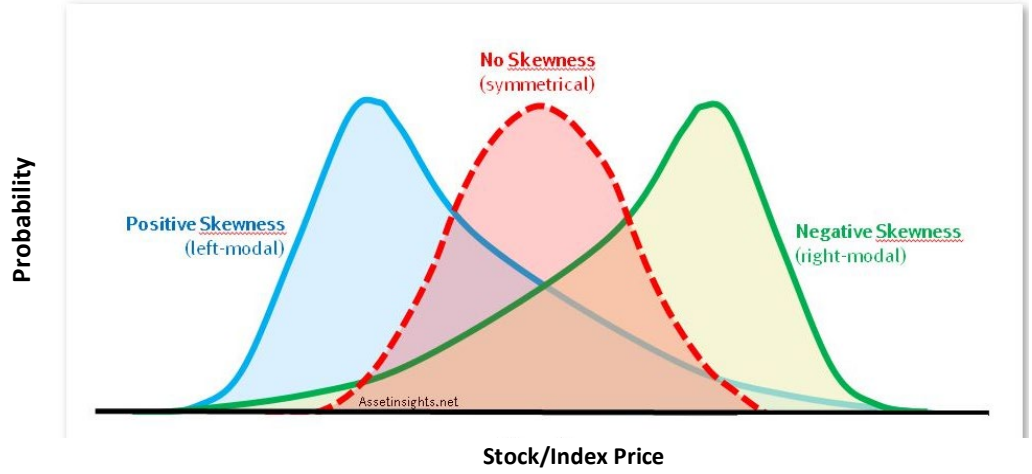
A. Stock option prices provide considerable information regarding investors' expectations. The most well-known measure of investors' expectations as measured by stock option prices is the VIX Index (or Volatility Index). The VIX Index is a measure of investors' volatility expectations and is referred to as the "fear index" because, all else equal, higher volatility expectations indicate higher uncertainty, risk, and scared investors.[49] 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 indices (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 Chicago Board of Options Exchange ("CBOE") also publishes an index based on option-implied skewness referred to as the SKEW Index.

[49] Some investors like high volatility because it provides the opportunity to earn a lot of money quickly if the market moves in their favor. For example, an investor that shorts Microsoft, will make a lot of money if the stock drops by a large amount. However, investors who buy utility stocks generally prefer low volatility and low risk.

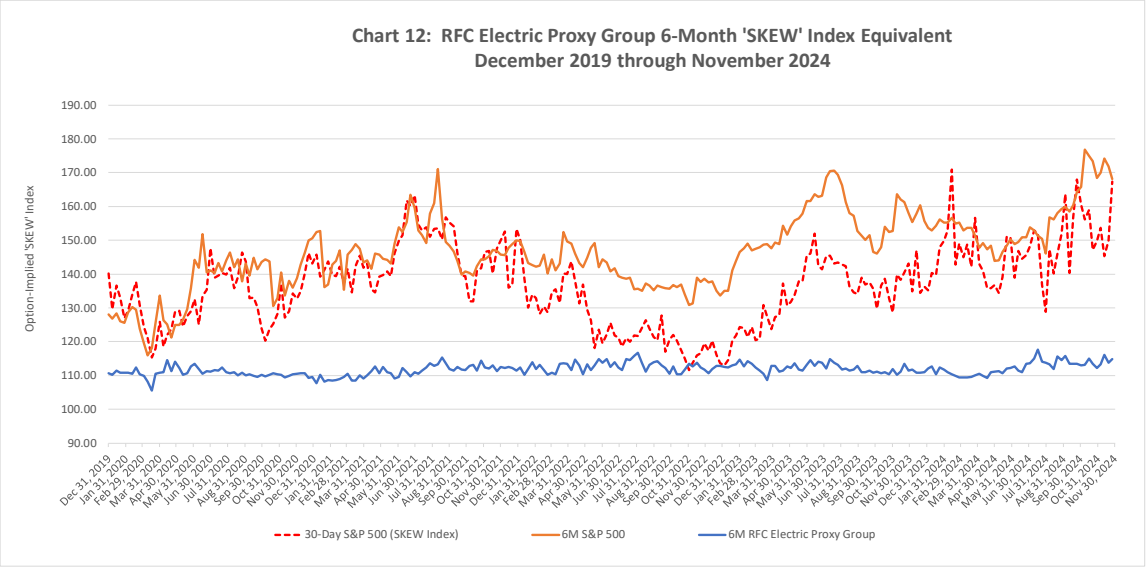
As shown in Chart 11 below, the probability distribution that is negatively skewed has a tail that is longer on the left. A probability distribution with positive skewness has a longer tail on the right. The right and left tails of a probability distribution with no skewness are symmetrical. If the option-implied skewness looked like the red probability distribution in Chart 11 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 11: Probability Distributions with and without Skewness



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

A. As shown in Chart 12 on page 44, comparing the SKEW Index to an equivalent metric based on electric utility company stock options indicates that, as 2023 came to a close, investors expected the chance of electric utility stocks suffering from a large drop in investment to be much lower than the chance that the overall market would experience a large drop. This indicates the cost of equity for electric utility companies has likely remained low relative to the overall market.



V. COST OF EQUITY CALCULATION

A. Overview

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

A. The cost of capital is the return investors require to provide capital to PSNH based on current capital markets. To measure the cost of equity accurately, it is critical to use current market data because it increases that chance that the authorized ROE will match PSNH's market-based COE when it needs to raise equity capital.

As discussed above, my COE recommendation is my opinion of the return investors require to provide equity capital to PSNH 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: "[t]he return to the equity owner should be

commensurate with returns on investments in other enterprises having corresponding risks"[50] and "sufficient to… support its credit and… raise the money necessary for the proper discharge of its public duties."[51]

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 PSNH.

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 current market prices (market-based) is superior to a COE based on historical data in two respects:

1. The COE that PSNH has to pay investors is based on capital markets. Recent high inflation and increases in interest rates are not a secret and therefore market-based COE models will reflect investors' changing expectations.
2. Capital markets are unpredictable. Regarding capital markets' unpredictability, investment guru Warren Buffet recently gave the following advice to investors: "[t]hey should not listen to a lot of the

[50] *Fed. Power Comm'n v. Hope Nat. Gas Co.* v. Hope Nat. Gas Co., 320 U.S. 591, 603 (1944).
[51] *Bluefield Water Works & Improvement Co. v. Pub. Serv. Comm'n of the State of W. Va*, 262 U.S. 679, 692-693 (1923).

jabbering about what the market is going to do tomorrow, or next week or next month because nobody knows."[52]

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.

Q. HOW DID YOU ARRIVE AT YOUR COE RECOMMENDATION?

A. To arrive at my recommendation, I applied the DCF model, 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 November 30, 2024, as discussed below. In all of my models, I use both historical averages and the most recently available spot data for the inputs wherever it is possible and applicable.

Q. 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?

A. Not necessarily. Most people would agree that 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

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

in the future. This is a broad and generally accepted principle, as made clear in the following example.

As a simple example using historical stock prices to make the point clear, 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 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 special consideration.

This does not eliminate concerns regarding the effect of daily fluctuations in market data, especially during periods of volatility. As a result, it is important to consider both historical averages and recent spot values when using 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.

Q. CAN A DIFFERENCE OF ONE DAY IN THE SELECTION OF SPOT 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 DATA?

A. 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 change from day to day. This is rightfully noted as a potential risk of using spot data, but, given the stated benefits of using recent spot 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 month as the reference point for all market-based spot data. Additionally, this day serves as the cutoff for calculating 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

Q. WHAT PROXY GROUPS DID YOU USE TO CALCULATE PSNH'S COE?

A. My comparable proxy group, shown on Table 6 below and referred as the RFC Electric Proxy Group, consists of the following 11 publicly traded electric utility companies covered by Value Line:

TABLE 6: RFC ELECTRIC PROXY GROUP COMPOSITION

	Company Name	Ticker
1	ALLETE	ALE
2	AVISTA CORP.	AVA
3	CMS ENERGY CORP.	CMS
4	CON. EDISON	ED
5	IDA CORP, INC.	IDA
6	ALLIANT ENERGY	LNT
7	NORTHWESTERN	NWE
8	OGE ENERGY CORP.	OGE
9	PORTLAND GENERAL	POR
10	SEMPRA ENERGY	SRE
11	WEC ENERGY GROUP	WEC

I chose this proxy group because I believe it contains companies that are relatively comparable in risk to PSNH. However, model results based on this proxy group should be viewed as a conservative estimate of PSNH's COE because these companies have some unregulated operations which are risky than electric distribution.

C. Discounted Cash Flow

Q. PLEASE SUMMARIZE THE RESULTS OF YOUR DCF MODELS.

A. 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.

The results of my constant growth DCF model range between 8.25% and 8.35% when using a sustainable growth rate and between 8.59% and 8.90% when using an option-implied growth rate.[53] The results of my non-constant growth DCF method indicate a COE of between 7.24% and 7.63% for the RFC Electric Proxy Group.[54]

Q. WHAT IS THE DISCOUNTED CASH FLOW METHOD?

A. The DCF method is an approach to determine 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 ultimately to 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.

D. Constant Growth Form of the DCF Model

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

A. 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.

53 Exhibit ALR-3, page 1.
54 Exhibit ALR-3, page 3 and Exhibit ALR-3, page 4.

Retained earnings are funds that a company keeps in its treasury, so that they are available for future needs, such aa 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.

Q. DESCRIBE HOW THE CONSTANT GROWTH MODEL WORKS.

A. The constant growth model is described by the equation k= D/P + g, where: [55]

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

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.

[55] Myron J. Gordon, *Cost of Capital to a Public Utility*, p. 32-33 (MSU Public Utility Studies 1974).

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

A. 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 analyst's 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.

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

A. 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.

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

A. 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.[56]

I obtained the stock price—"P"—used in my DCF analysis from the closing prices of the stocks on November 30, 2024. I also obtained an average stock price for the 12 months ending November 30, 2024 by averaging the high and low stock prices for the year.

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

[56] 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 first quarter, $0.5251 in the second quarter, $0.5303 in the third quarter, and $0.5355 in the fourth 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 fourth 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.

typically look at actual earned returns on equity as one meaningful input into what can be expected for future earned returns on book equity.[57]

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 greater 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 (November 30, 2024) as well as the average of the high and low stock price over the past 12 months to obtain a range of reasonable values. The DCF result based on the average of the high and low stock price for the year ending November 30, 2024 is 8.35%. As shown in Exhibit ALR-3, page 1, the

[57] Exhibit ALR-3, page 1.

DCF result based on the stock price as of November 30, 2024 is 8.25%. 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.

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

A. 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 2024 and 2027-29 is 10.36%. The same footnote also shows that the future expected return on equity derived from the Zacks consensus forecast is 10.96%, and that the actual returns on equity earned by the RFC Electric Proxy Group on average were 9.86% in 2021, 9.64% in 2022, and 9.46% in 2023. 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 10.10%[58] value of "r".

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

A. The result of my DCF analysis using the Constant Growth form of the DCF indicates a COE range of between 8.25% and 8.35% for the RFC Electric Proxy Group.[59] Since these

[58] I used 10.10% in consideration of historical returns, Zacks's projections, and Value Line projected returns for the RFC Electric Proxy Group.
[59] Exhibit ALR-3, page 1.

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, and because, as noted, the COE in general is declining.

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. 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.

E. Non-Constant Growth Form of the DCF Model

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

A. 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.

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

A. 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 calculating the Internal Rate of Return (IRR)[60]. This multi-stage DCF model produced an average indicated COE of 7.24% based on the year-end stock price, and 7.63% based on average prices for the year ending November 30, 2024 for the RFC Electric Proxy Group as shown on Exhibit ALR-3, page 3 and Exhibit ALR-3, page 4.

[60] The IRR is the rate of return that an investment is expected to generate. On the other hand, the cost of capital is the minimum return an investment needs to make for it to be worthwhile.

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

A. My non-constant growth DCF method indicates a cost of equity of between 7.24% and 7.63%.[61]

F. Capital Asset Pricing Model

Q. PLEASE DESCRIBE THE CAPM.

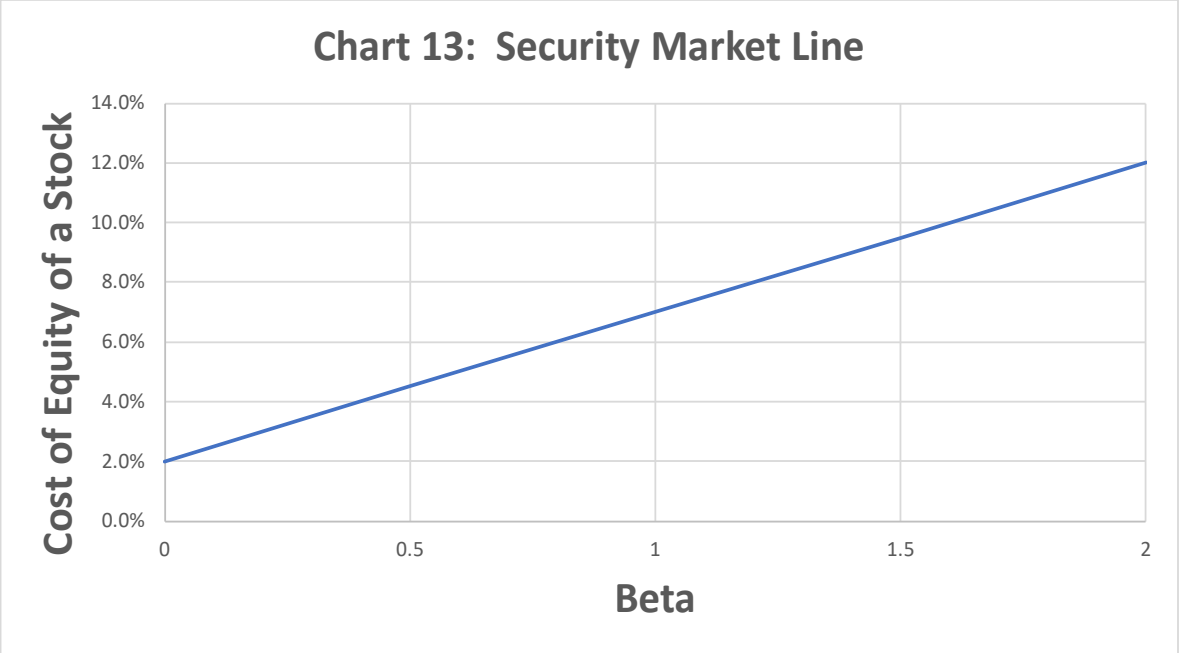
A. CAPM stands for "Capital Asset Pricing Model." The CAPM relates return to risk; specifically, it relates the expected return on an investment in a security to the risk of investing in that security. The riskier the investment, the greater the expected return (i.e., the cost of equity) investors require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

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

The price of a stock with a beta of 1 tends to move with the market. If the market increases by 1%, the stock is also expected to increase by about 1%, and vice versa. The price of a stock with a beta greater than 1 tends to be more volatile than the market. For example, a stock with a beta of 1.5 will on average be 50% more volatile than the market. If the market rises by 1%, the price of a stock with a beta of 1.5 is expected to rise by 1.5%, and if the market falls by 1%, the stock price is expected to decrease by 1.5%. The price of a stock with a beta less than 1 tends to be less volatile than the market.

The CAPM predicts that for a given equity security, the cost of equity has a 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. As shown in Chart 13 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 βί (Beta) is a specific asset's share of non-diversifiable, or systematic, risk.

Q. PLEASE EXPLAIN HOW YOU IMPLEMENTED THE CAPM.

A. 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 7 and Table 8 on page 74 show the results of my CAPM.

Risk-Free Rate

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

A. It is generally preferable to use the market yield on short-term U.S. Treasury securities as the risk-free rate because these assets have a beta close to zero. *Principles of Corporate Finance* states "The CAPM… calls for a short-term interest rate."[62] I chose to use a risk-free rate based on both long- and short-term Treasury yields, however, because, as indicated by the recent inverted yield curve,[63] investors with a longer investment horizon would likely use a lower risk-free rate as an opportunity cost for their investment decisions. It is commonplace in utility rate case proceedings to consider a risk-free rate based on long-

[62] RICHARD BREALEY, STEWART MYERS, & FRANKLIN ALLEN, *Principles of Corporate Finance*, p. 228, (McGraw-Hill Irwin, New York, 12th ed. 2017).
[63] 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.

term investments. 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 values as of November 30, 2024 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 4.58% and 4.64%, respectively. My spot and weighted average long-term risk-free rates are 4.36% and 4.34%, respectively.

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.

Q. WHAT IS YOUR RESPONSE TO ANALYSTS WHO CLAIM THAT THE CAPM SHOULD BE IMPLEMENTED WITH A RISK-FREE RATE BASED ON A LONG-TERM INTEREST RATE (E.G., YIELD ON 30-YEAR TREASURY BOND) AND/OR BASED ON INTEREST RATE FORECASTS INSTEAD OF MARKET YIELDS.

A. As discussed in Appendix D, a CAPM analysis that uses a risk-free rate based only on long-term interest rates may overstate the COE because these bonds do not have a zero beta. It is not appropriate to use a risk-free rate based on interest rate forecasts because it often does not represent investors' expectations.

Beta

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 "forward beta" is based on forward-looking investor expectations of non-diversifiable risk. My "historical blended" beta is based on historical return data over 6-month, 2-year, and 5-year periods.

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 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 100 shares of 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[64] at expiry on January 17, 2020. On the other hand, the investor who purchased an Apple put option with the same expiration date and strike price on July 31, 2019, would have lost the price of the option ($2,248) and gained nothing on the expiration date because the right to sell Apple stock for $230 when the price is over $300 is worthless.

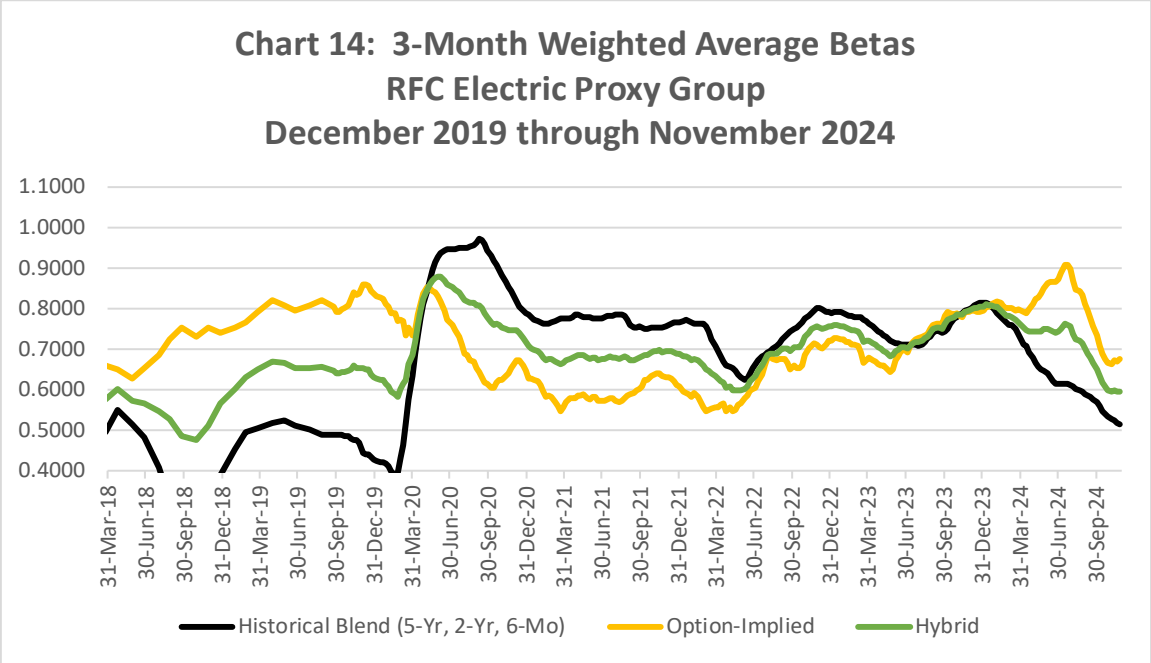
The market prices of put options and call options provide information regarding the probability distribution of future stock prices expected by investors. Using established techniques, I am able to use price data for stock options of my RFC Electric Proxy Group companies and the S&P 500 Index to determine 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. PLEASE EXPLAIN HOW YOU CALCULATED THE BETAS USED IN YOUR CAPM.

A. Traditionally, the betas used in CAPM calculations are calculated from historical returns. This approach has strengths and weaknesses. 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

[64] $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.

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.[65]



As shown in Chart 14 above, stock option prices indicate that investors likely expect lower betas for the RFC Electric Proxy Group in the future.

Exhibit ALR-4, page 3 contains the last three months of data used in creating Chart 14 above, which is what I use in my CAPM analysis. Specifically, I use the following two betas in my CAPM analysis:

1. **Historical Blend:** 50% (6 months) + 30% (2 years) + 20% (5 years).
2. **Forward Beta:** 100% Option-Implied Beta (6 months).

[65] 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. .

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

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

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 near-term 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 not to use *either* 6-month historical betas or historical betas with longer horizons, but to consider *both*. For this reason, I have created my historical blended betas, which take into consideration 6-month, 2-year, and 5-year historical 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. So-called "market dislocations," 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, predicting the duration and impact of any single influencing factor on financial markets is extremely challenging, if not impossible. In 2008, when interest rates plummeted to unprecedented lows, numerous analysts deemed this a temporary anomaly. Contrary to these expectations, rates not only persisted at these low levels for more than ten years but dropped even further in response to the unforeseen COVID-19 pandemic, which significantly affected the global economy and financial markets.

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 historical blended betas in conjunction with longer-term historical betas and forward-looking, option-implied betas to achieve the most reasonable result.

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. 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[66] and skewness[67] following exactly the same methodology used by the Chicago Board of Options Exchange (CBOE) in the calculation of their widely-used VIX (or Volatility Index) and SKEW Index, respectively.

I start my process with publicly available trading information for all the options for a given security (company or index) for a complete trading day. I then filter the option data as described by the CBOE using the following guidelines:

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

[66] 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.

[67] 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.

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 implied volatility changes for strike prices that are closer to and further from 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 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): [68]

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

Where:

β_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: $variance\ of\ security$;
VAR_m: $variance\ of\ overall\ market\ (S\&P\ 500)$.

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,"[69] 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 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,

[68] 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) at https://academic.oup.com/rof/article/16/2/385/1584560

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

the maximum expiration period for the options of the companies in my RFC Electric Proxy Group is approximately 8 months. None of the 11 companies ever trade options with expiration periods of more than 8 months. New options are issued roughly every 3 months for all of these companies, so the maximum expiration period on any given trading day is somewhere between 5 and 8 months. For consistency across companies in my proxy group and across dates within the 3-month period on which my analysis is focused (September through November 2024), 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, 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 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.[70] 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.

Market Risk Premium

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

A. 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 appropriate since they 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 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,[71] as described in detail in the Beta section on page 67. The volatility and skewness calculated in this way describe a probability distribution representing the possible trajectories for the S&P 500 implied by the options market. The resulting skewed probability distribution can be closely approximated by a log-normal distribution using

[70] This is further expanded upon in my testimony starting on page 114
[71] As used in the calculation of their widely-used VIX (or Volatility Index) and SKEW Index, respectively.

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 values as of November 30, 2024 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 premia I use in my Weighted Average CAPM analysis with short- and long-term risk-free rates are 3.64% and 3.93%, respectively. The market risk premia I use in my Spot CAPM analysis with short- and long-term risk-free rates are 3.34% and 3.56%, respectively.

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

A. 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 54 to 61 months[72], interpolating where necessary, and giving the most weight to the option expiration period of 12 months.

CAPM Results

Q. PLEASE SUMMARIZE THE RESULTS OF YOUR CAPM.

A. Table 7 and Table 8 below show the results of my Weighted Average CAPM and Spot CAPM Analyses, respectively.

Weighted Average CAPM

TABLE 7: CAPITAL ASSET PRICING MODEL (CAPM) - INDICATED COST OF EQUITY
WEIGHTED - All Inputs Weighted From September to November 2024

	3-Month Treasury Bill		30-Year Treasury Bond	
	Historical Blended Beta	Forward Beta	Historical Blended Beta	Forward Beta
Risk-Free Rate	4.64%	4.64%	4.34%	4.34%
Beta	0.52	0.67	0.52	0.67
Risk Premium	3.64%	3.64%	3.93%	3.93%
CAPM	6.51%	7.09%	6.37%	6.99%

Source: Exhibit ALR-4, page 1

[72] Prior to November 2021, the longest expiration period for stock options traded on the S&P 500 was 36 months.

Spot CAPM

TABLE 8: CAPITAL ASSET PRICING MODEL (CAPM) - INDICATED COST OF EQUITY (SPOT)
SPOT - All Inputs Based on Last Available Data as of November 30, 2024

	3-Month Treasury Bill		30-Year Treasury Bond	
	Historical Blended Beta	Forward Beta	Historical Blended Beta	Forward Beta
Risk-Free Rate	4.58%	4.58%	4.36%	4.36%
Beta	0.51	0.72	0.51	0.72
Risk Premium	3.34%	3.34%	3.56%	3.56%
CAPM	6.27%	6.99%	6.16%	6.93%

Source: Exhibit ALR-4, page 5

Please see Appendix E for a chart showing how the results of my CAPM analysis applied to the RFC Electric Proxy Group have changed over time since the onset of the Covid pandemic.

VI. CAPITAL STRUCTURE AND COST OF DEBT

Q. IS PSNH'S REQUESTED CAPITAL STRUCTURE OF 53.85% COMMON EQUITY AND 46.15% APPROPRIATE?

A. No. PSNH's requested capital structures are not appropriate for setting rates in this proceeding. It has a higher common equity ratio (53.85%) than the average common equity ratio used by other electric utility companies in the country (44.5%).[73]

[73] Exhibit ALR-5, page 5.

Q. WHAT CAPITAL STRUCTURE DO YOU RECOMMEND BE USED FOR PSNH'S OVERALL COST OF CAPITAL?

A. I recommend using a capital structure consisting of 47.24% equity and 52.76% debt, based on the average common equity ratios of the companies in my proxy group. Absent evidence from PSNH in support of the need for a different capital structure, using the average capital structure of the proxy group is consistent with the Commission's duty to set reasonable rates because otherwise, using a common equity ratio higher than other companies creates unreasonably higher rates. My recommendations, including my capital structure recommendation, result in an overall rate of return of 6.00% as shown in Table 3 on page 15. Mr. Rea's recommendations result in an overall rate of return of 7.44%. And, as discussed above, capital structure has a major impact on revenue requirement. If the Commission adopts an equity component of the capital structure ratio that is higher than I have recommended, there should be a corresponding reduction to ROE.

It can be overlooked that the authorized capital structure can have a large impact on the utility company's revenue requirement. If my cost of equity recommendation is applied to Mr. Rea's recommended capital structure it will require an approximately $7.7 million larger revenue requirement.

If Mr. Rea's capital structure recommendations are adopted it is important to make an adjustment the overall ROR to account for the financial risk difference between his capital structure recommendation and that of the companies in the RFC Electric Proxy Group, which have a significantly lower average common equity ratio (44.5%) than the common equity ratios recommend by Mr. Rea. A higher common equity ratio means less debt, a lower chance of financial stress (financial risk), and therefore a lower COE. On the

other hand, a lower common equity ratio means more debt, a higher chance of financial stress (financial risk), and therefore a higher COE. Based on a regression analysis of dozens of utility companies, I found a 0.04% reduction in the cost of equity results from every 1% increase in the common equity ratio. Therefore, if the Commission authorizes a capital structure with a higher common equity ratio for a specific applicant, then the authorized ROE for that applicant should be reduced by 0.04% for every 1% its authorized common equity ratio exceeds that of the proxy group.[74]

Q. WHAT COST OF DEBT DO YOU RECOMMEND?

A. I recommend adopting PSNH's requested cost of long-term debt of 4.10%.

VII. EVALUATION OF PSNH'S RATE OF RETURN TESTIMONY

Q. PLEASE SUMMARIZE THE TESTIMONY OF MR. REA.

A. As stated above, Mr. Rea claimed that the appropriate cost of equity for PSNH in this proceeding is 10.80% based a cost of equity between 10.30% and 11.30%.[75] However, the Company has decided to request an 10.30% ROE.[76] His 10.30% to 11.30% cost of equity results is based on the results of his own modified versions of the following COE models to a proxy group applied to three proxy groups: 1) Discounted Cash Flow ("DCF"), 2) Capital Asset Pricing Model ("CAPM"), and 3) Risk Premium Method ("RPM").[77] In addition, he used two other model variants of the CAPM, specifically, the "CAPM with

[74] Earlier in testimony I provide the specific adjustments required if Mr. Rea's capital structure recommendation is used to set rates.
[75] Mr. Rea's Direct Testimony, page 4, lines 2-7.
[76] *Id*, page 4, lines 7-10.
[77] *Id*, page 5, lines 12-15.

size adjustment", and the Empirical CAPM ("ECAPM").[78] His three proxy groups are **Electric Group** of 11 electric utility companies[79], a **Gas LDC Group** with 6 gas utility companies[80] and a **Non-Regulated Group** with 10 non-regulated companies[81].

Mr. Rea also conducted a "comparative risk assessment" where he concluded that PSNH has a similar investment risk profile to the Electric Group.[82] He therefore made no adjustments to his COE results.

As outlined in Table 9 below, Mr. Rea's COE models provide equity cost rate estimates between 10.44% and 11.28%.

TABLE 9: MR. REA'S COST OF EQUITY RESULTS

METHOD	Model Results
DCF Method	10.44% - 10.90%
Traditional CAPM	10.47% - 10.67%
CAPM (w/size adj.)	10.55% - 11.28%
ECAPM	10.68% - 10.83%
Risk Premium Method	10.74% - 11.11%
Mr. Rea's Average Cost of Equity Model Results	**10.44% - 11.28%**

[1] Mr. Rea's Direct Testimony, Table 2, Page 7.

Q. DO THE RESULTS OF MR. REA'S COST OF EQUITY MODELS PROVIDE A RELIABLE INDICATION OF PSNH'S COST OF EQUITY?

A. No. PSNH's proposed 10.30% ROE is significantly higher than PSNH's market-based cost of equity. If PSNH's proposed is used to set rates, consumers will be significantly overcharged. Mr. Rea's estimated cost of equity of 10.30% - 11.30% is excessive largely

78 *Id*, page 5, lines 15-17.
79 *Id*, Attachment ES-VVR-4, page 1.
80 *Id*, Attachment ES-VVR-5, page 1.
81 *Id*, Attachment ES-VVR-6, page 1.
82 *Id*, page 5,

because his COE calculations are based on a flawed analytical approach. 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/ECAPM methodologies overstate the cost of equity by using an inflated equity risk premium component.

DCF Method

Q. WHAT FORMULA DOES MR. REA USE IN HIS DCF ANALYSIS?

A. $$K = D_1 / P_0 + g$$ [83]

Where:

P_0: current market price of the $stock$;

D_1: expected $dividends\ over\ the\ next\ year$;

k: investors′expected return on common equity (the discount rate);

g: expected dividend $growth\ rate\ into\ perpetuity$. [84]

[83] *Id*, page 56, line 6.
[84] *Id*, page 55, line 13-16.

Q. DOES MR. REA PROPERLY APPLY THE SIMPLIFIED OR CONSTANT GROWTH DCF METHOD?

A. No. Mr. Rea explains correctly that the assumptions underlying the constant growth DCF method is that dividends and earnings grow at the same constant growth rate.[85] (or constant average growth trend) and book value per share and the stock price also grow at the same constant growth rate. However, his DCF method contradicts his own description of how the constant growth model should be implemented. His growth estimate relies primarily on earnings per share growth (analyst five-year EPS growth forecasts and 5-10 year historical).[86] 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, major financial institutions like J.P. Morgan Chase do not use a growth rate based on analyst 5-year EPS growth rates as Mr. Rea has done. Please see Appendix B for explanation of why a future-oriented "B X R" method is superior to Mr. Rea's DCF method.

85 *Id*, page 56, footnote 31.
86 *Id*, page 58, Table 8.

Q. ARE THERE ADDITIONAL REASONS WHY IT IS NOT APPROPRIATE TO USE ANALYSTS' EARNINGS GROWTH RATE PROJECTIONS AS A PROXY FOR GROWTH IN THE DCF MODEL?

A. Yes. A study conducted by McKinsey & Company in 2010 found that "analysts have been persistently over optimistic for the past 25 years with estimates ranging from 10 to 12 percent a year, compared with actual earnings growth."[87]

On average, analysts' forecasts have been almost 100 percent too high.[88] Capital markets, on the other hand, are notably less giddy in their predictions. Except during the market bubble of 1999-2001, actual price-to-earnings (P/E) ratios have been 25 percent lower than implied P/E ratios based on analyst forecasts.

To my knowledge, financial publications do not recommend using EPS growth rates to calculate the cost of equity in a DCF model. McKinsey & Company continues to advise its clients to be cautious about the reliability of analysts' forecasts. On May 16, 2022, McKinsey stated that "analysts' near-term forecasts are often overly optimistic and don't always correctly reflect operating performance."[89]

Even if equity analysts' forecasts were not upwardly biased, as discussed above, adding earnings per share growth forecasts to a dividend yield without considering the retention rate produces a flawed result. Using an earnings per share growth forecast as the growth component in a DCF model is like measuring how much money you will have in

[87] Marc Goedhart, Rishi Raj and Abhishek Saxena, Equity Analysts: Still too bullish (April 1, 2010) at. https://www.mckinsey.com/capabilities/strategy-and-corporate-finance/our-insights/equity-analysts-still-too-bullish.
[88] *Id.*
[89] David Kohn, Vartika Gupta, Tim Koller & Werner Rehm, *Do consensus estimates accurately reflect operating performance?* (May 16, 2022) at https://www.mckinsey.com/capabilities/strategy-and-corporate-finance/our-insights/the-strategy-and-corporate-finance-blog/do-consensus-estimates-accurately-reflect-operating-performance

your bank account by simply adding up your paychecks. This only works if you spend no money. If you do not consider what percentage of your paycheck you will retain in your account and what percentage you will spend, your calculations will be wildly optimistic and inaccurate, similar to using earnings per share growth in a DCF.

Q. WHY DOES MR. REA'S DCF MODEL PRODUCE A HIGHER RESULT THAN YOUR CONSTANT GROWTH DCF METHODS?

A. The primary reason our DCF models produce different COE results is because of the growth rate component. Mr. Rea's DCF analysis using analyst 5-year EPS and DPS growth rate projections produces a cost of equity result of between 9.2% and 11.00%.[90] My sustainable growth DCF and option-implied growth DCF methods produce cost of equity results of 8.25% - 8.35% and 8.59% - 8.90% respectively.[91] Mr. Rea uses an average growth rate component of between 4.9% and 5.6%[92] for his Electric Group. I use growth rate components of 4.26% to 4.86%.[93] The low end of Mr. Rea's DCF results for individual companies in his proxy group (as low as 7.2% for Consolidated Edison) are within range of my results, lower in some cases, but the high end of his DCF results (17.3% for Portland General Electric) is so high because he use unsustainable growth rates as high as 12.50%.[94]

90 Mr. Rea's Direct Testimony, Attachment ES-VVR-4, page 1.
91 Exhibit ALR-2.
92 Mr. Rea's Direct Testimony, Attachment ES-VVR-4, page 1.
93 Exhibit ALR-3, page 1 and 2.
94 Mr. Rea's Direct Testimony, Attachment ES-VVR-4, page 1.

CAPM Method

Q. PLEASE DESCRIBE MR. REA'S CAPM METHOD.

A. Mr. Rea explains that the CAPM method is a market-based, forward-looking model that recognizes that investors demand higher returns to taking on more risk.[95] He says that the traditional CAPM equation is expressed as follows:

$$K = R_F + \beta\,(R_M - R_F)$$

Where:

K	=	Required rate of return for a stock;
R_F	=	Expected risk-free rate of return; and
β	=	Beta or systematic risk of a stock;
R_M	=	Expected return for the overall market.[96]

He also considers an Empirical CAPM (ECAPM). Mr. Rea claims the ECAPM is based on empirical evidence that the risk-return relationship between beta and stock returns is flatter than predicted by the traditional CAPM.[97] This method includes the same four components as the CAPM, but he applies a 75% weighting to the beta coefficient and the market risk premium portion of the equation and a 25% weighting to the market risk premium, without the beta coefficient impact. ECAPM formula:

$$\mathrm{K} = R_F + 0.25\,(R_M - R_F) + 0.75\beta\,(R_M - R_F)$$[98]

The specific weightings (0.75 and 0.25) in the formula above flatten the security market line to be consistent with historical return data. In other words, these weightings make the cost of equity for a company with a beta under one higher and the cost of equity

95 Mr. Rea's Direct Testimony at page 62, lines 4-9.
96 *Id*, page 62, lines 11-16.
97 *Id*., page 72, lines 14-17.
98 *Id*., page 73, line 4.

for a company with a beta above 1 lower. The effect of this adjustment is to increase the cost of equity for regulated utility companies because they almost always have a beta less than one.

Q. WHAT RISK-FREE RATE DOES MR. REA USE IN HIS CAPM?

A. He used a risk-free rate of 4.21% based upon an evaluation of interest rate forecasts available from the Blue Chip Financial.[99]

Q. WHAT BETA COEFFICIENT DOES MR. REA USE IN HIS CAPM?

A. He used Value Line 5-year historical weekly return relative to the New York stock exchange composite index.[100] The average betas for his three proxy groups are as follows:

Electric Group is 0.91;

Gas LDC Group: 0.88;

Non-Regulated Group: 0.90.[101]

Q. WHAT RISK PREMIUM DOES MR. REA USE IN HIS CAPM?

A. The market risk premium in Mr. Rea's CAPM analysis is based on a blended approach combining prospective and historical market risk premium estimates. He determined a prospective market risk premium of 6.82% by subtracting a risk-free rate of 4.21% from a prospective market return of 11.03%. He derived the prospective market return using a DCF model applied to the S&P 500 Index and the Value Line 1,700 stock universe, averaging expected returns of 11.91% and 10.14%, respectively. [102] He also referenced the

99 *Id*, page 68, lines 1-2.
100 *Id.*, page 45.
101 *Id.*, page 70, Table 11.
102 *Id.*, page 69, lines 3-11.

historical market risk premium of 7.17% from the Kroll Cost of Capital Navigator, covering the 1926-2023 period. [103] Taking the average of these two estimates, he applied a market risk premium of 7.00% in his CAPM analysis.[104]

Q. DOES MR. REA USE AN APPROPRIATE RISK-FREE RATE IN HIS CAPM?

A. In principle, no. The risk-free rate component of Mr. Rea's CAPM is not appropriate because it is based considerably on economist published projections and not investors' expectations as indicated by current market yields. Interest rates have decreased since Mr. Rea filed his testimony, and the forecasted yields he used in his CAPM are now lower than the market-based risk-free rates that I used in my CAPM analysis. As outlined in Exhibit ALR-4, page 2, my spot and weighted average short-term risk-free rates are 4.58% and 4.64%, respectively. My spot and weighted average long-term risk-free rates are 4.36% and 4.34%, respectively. These four rates average 4.48%. The risk-free rate component of Mr. Rea's CAPM analysis is 4.21%, which is only slightly lower than my risk-free component.

Mr. Rea's use of interest rate forecasts is problematic in principle because current market yields on U.S. Treasury bonds indicate market expectations. As discussed above, PSNH's authorized ROE should be market-based because investors provide the capital. In this case, Mr. Rea's use of interest rate forecasts to determine the risk-free rate component does not inflate his CAPM result. However, his CAPM method should not be used to set rates in future New Hampshire proceedings because it could produce inaccurate cost of equity results (too high or too low) in different capital market conditions.

[103] *Id*, page 69, lines 12-15.
[104] *Id*, page 70, lines 4-6.

Q. DOES MR. REA'S BETA COEFFICIENTS CONTRIBUTE TO HIS EXCESSIVE CAPM RESULT?

A. Yes. Mr. Rea' beta coefficients contribute to an overstatement of the cost of equity because he relies on anomalous historical data. Specifically, his analysis uses five-year historical beta coefficients from Value Line, averaging between 0.88 and 0.91. These betas are based on data still influenced by the financial turmoil caused by the COVID-19 pandemic when utility betas spiked, rendering them less reflective of current market conditions.

It would have been more appropriate for Mr. Rea to use forward-looking beta coefficients as I have done or to use historical betas based on longer or shorter time periods so that the impact of the COVID pandemic would be diluted. Over the past 3 months, my forward-looking option-implied betas have had a weighted average of 0.67[105] and my 6-month and 2-year historical betas for the RFC Electric Proxy Group have had a weighted average of 0.338 and 0.606, respectively, over the past 3 months.[106]

Q. UPON CLOSER EXAMINATION OF MR. REA'S SOURCES AND OTHER PROMINENT SOURCES, DO YOU BELIEVE THAT THE EQUITY RISK PREMIUM PORTION OF MR. REA'S CAPM ANALYSIS IS REASONABLE?

A. No, I believe Mr. Rea's equity risk premium component of between 8.32% and 8.60% is excessive and leads to an inflated CAPM result. The CAPM indicates a COE averaging under 8% using a reasonable equity risk premium component. As explained in the CAPM section starting on page 58, I determined that investors are demanding a significantly lower equity risk premium of between 2.71% and 3.99%. Closer examination shows that Mr.

105 Exhibit ALR-4, page 3.
106 *Id.*

Rea's own sources (Kroll and Bloomberg) and other prominent sources arrive at substantially lower numbers than Mr. Rea.

Kroll

As stated earlier, Mr. Rea uses data from Kroll SBBI Yearbook as part of his CAPM analysis. However, it is not reasonable to conclude that investors expect that equity returns will be as high in the future as in the past. Kroll calculates a supply-side equity risk premium to account for evidence that equity returns may be lower in the future than they were since 1926.

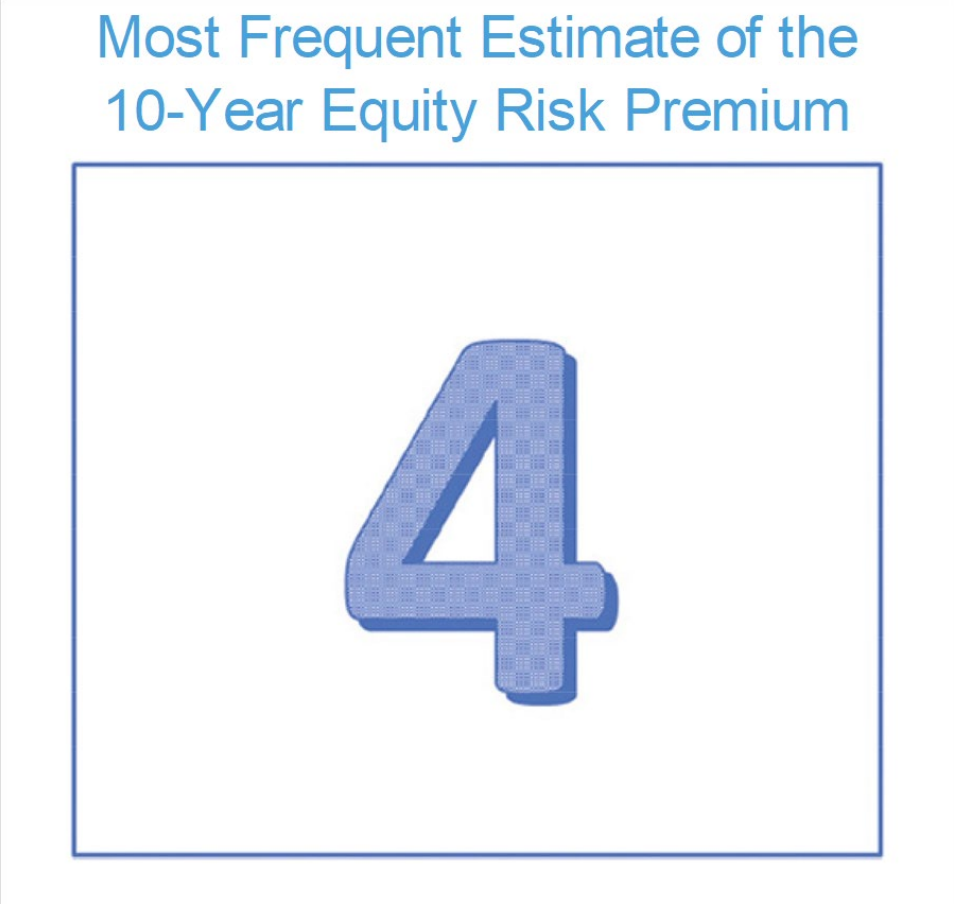
Mr. Rea's equity risk premium is inflated because he does not conduct a comprehensive analysis to consider if historical equity premia are sustainable or not. Second, Mr. Rea bases his analysis on a one-year timeframe, which is problematic. The ROE authorized in DE 24-070 will remain in effect much longer. The cost of equity should be measured over long periods, not just yearly returns. A one-year view is arbitrary and inconsistent with the long-term perspective needed, especially when juxtaposed with the 30-year treasury bonds used as a risk-free rate benchmark. Ideally, a five-year rolling return average, or better yet, a 30-year period, should be used to align with the long-term investment horizon we are trying to measure.

Other Prominent Sources

This discrepancy is evident even when consulting other respected sources, like Professor Aswath Damodaran from NYU (who finds an equity risk premium of 4.06% as of September 2024),[107] and further supports the argument that Mr. Rea equity risk premium estimation is excessively high.

[107] Aswath Damodaran, PhD., Stern School of Business, New York University, *Damodaram Online*, at https://pages.stern.nyu.edu/~adamodar/.

Additionally, based on calculations by P. Brett Hammond and Martin L. Leibowitz, which were based on a literature survey and estimates from participants in the 2021 Equity Risk Premium Forum, they found the most frequent estimate of the 10-year equity risk premium to be 4. Some attendees at the Equity Risk Premium Forum in 2021found the following slide regarding the equity risk premium to be most memorable.



The authors of *Revisiting the Equity Risk Premium* noted "Despite radically different market environments, it is striking that the estimates in all three forums were so similar. They tended to be in the 3%–5% range, and notably, in comparison to historical

returns, none of them included estimates above 7% or below zero." The three forums were in 2001, 2011, and 2021.[108]

Q. WHY DOES MR. REA'S CAPM RESULTS OVERSTATE THE COE?

A. Mr. Rea's CAPM results are unreasonably high for two primary reasons. First, his equity risk premium component is above current market-based indicators. This conclusion is supported by my own analysis using stock option prices, the conclusions of Mr. Rea's own sources (Kroll) and the conclusions of other prominent research discussed above. The market risk premia I use in my Weighted Average CAPM analysis with short- and long-term risk-free rates are 3.64% and 3.93%, respectively.[109] The market risk premia I use in my Spot CAPM analysis with short- and long-term risk-free rates are 3.34% and 3.56%, respectively.[110] Second, Mr. Rea's beta coefficients are inflated because they remain impacted by the capital market turmoil during the initial phase of the COVID pandemic in March to April of 2020.

Comparative Risk Assessment

Q. PLEASE SUMMARIZE MR. REA'S COMPARATIVE RISK ASSESSMENT CONDUCTED FOR PSNH.

A. Mr. Rea conducted a comprehensive comparative risk assessment between PSNH and his Electric Group using business, financial, and regulatory risk factors. He assessed regulatory risks by referencing Regulatory Research Associates' (RRA) rankings and

[108] P. Brett Hammond & Martin L. Leibowitz, CFA Institute Research Foundation, Revisiting the Equity Risk Premium*, Introduction: Three Decades of Equity Risk Premium Forums, p. vi, (2023)* available at https://www.cfainstitute.org/-/media/documents/article/rf-brief/Revisiting-the-Equity-Risk-Premium.pdf.
[109] Exhibit ALR-4, page 1.
[110] Exhibit ALR-4, page 5.

evaluating test-year policies, authorized ROEs, and revenue decoupling and infrastructure cost recovery mechanisms.[111]

He found PSNH faces higher regulatory risk due to its lower RRA ranking (5.00 vs. 4.70 for the Electric Group)[112], reliance on historical test years, and limited decoupling mechanisms. He claims that "it is reasonable to expect that on this basis alone, investors would ascribe a higher level of business risk to PSNH as compared to the Electric Group."[113]

Mr. Rea also considered PSNH's relative size and the volatility of returns on book equity relative to the companies in his proxy group. He stated that PSNH's book capitalization of $4.0 billion is significantly smaller than the Electric Group's $19.9 billion average, indicating higher risk.[114] However, PSNH's had slightly lower Return on equity volatility from 2019-2023 than the companies in his Electric group. Additionally, He stated the results of his analysis suggest that "the achieved ROEs for both PSNH and the Electric Group reflect low levels of relative volatility."[115]

Regarding financial risk, he compared the equity capitalization ratios, EBITDA-to-interest coverage, and FFO-to-debt ratios of PSNH and the companies in his Electric Group. He concluded that PSNH has somewhat lower financial risk than the Electric Group.[116]

111 Mr. Rea's Direct Testimony, page 36, lines 15-23.
112 RRA ranks the regulatory climates with ranking between 1 and 9, with a 1 indicating a more constructive rating higher numbers indicating a less constructure regulatory climate.
113 *Id.,* page 36, lines 12-14.
114 *Id.,* page 40, lines 1-9.
115 *Id.*, page 41, lines 1-2.
116 *Id.,* page 41, lines 4-7.

Q. WHAT DOES MR. REA CONCLUDE REGARDING PSNH RISK RELATIVE TO HIS PROXY GROUPS?

A. Mr. Rea concluded that PSNH has an investment risk profile similar to that of the Electric Group.[117] While he determined that PSNH faces higher regulatory risk compared to the companies in his proxy group, this risk is offset by lower financial risk. As a result, he utilized the Electric Group's cost of equity estimates without making additional adjustments in his analysis.[118]

Q. DO YOU AGREE WITH MR. REA THAT PSNH IS SIMILAR IN RISK TO THE COMPANIES IN HIS PROXY GROUPS?

A. No. The companies in his Non-Regulated Group have unregulated operations, which almost certainly make them riskier than PSNH. Consequently, a COE analysis based on these companies is likely to yield a COE estimate higher than PSNH's. The companies in his Electric Group and Gas LDC Group are closer in risk to PSNH because they have significant rate-of-return regulated electric and gas distribution operations, which share relatively similar risk characteristics with PSNH. However, even the 11 companies in Mr. Rea's Gas Group include some relatively risky unregulated operations. Therefore, the Commission should treat COE model results based on this proxy group, including my own, as an upper bound.

[117] *Id.,* page 43, lines 13-14.
[118] *Id.,* page 44, lines 4-7.

VIII. CONCLUSION

Q. PLEASE SUMMARIZE YOUR RECOMMENDATIONS IN THIS CASE.

A. Based on the evidence presented in my testimony, I conclude that the cost of equity allowed for PSNH should be between 6.60% and 8.13% (recommended at 8.13%). Based on my recommended common equity ratio of 47.24%, that results in an overall cost of capital of between 5.28% and 6.00% (recommended at 6.00%).

If the Commission decides to use PSNH's requested capital structure of 53.85% common equity and 46.15% debt instead of my recommended capital structure, I recommend a reduced authorized ROE of 7.86% (6.33% - 7.86%) to account for the lower financial risk of a capital structure with more equity.

My recommendations satisfy the requirements of *Hope* and *Bluefield* that regulated utility companies should have the opportunity to earn a return commensurate with returns on investments in other enterprises having corresponding risks. My recommendations are consistent with legal standards set by the United States Supreme Court and market data and will allow PSNH to raise capital on reasonable terms while fulfilling its obligation to provide safe and reliable service.

Q. DOES THIS CONCLUDE YOUR DIRECT TESTIMONY?

A. Yes.

APPENDIX A. MARKET-TO-BOOK RATIOS AND THE MARKET-BASED COE

Q. PLEASE EXPLAIN WHY A MARKET-TO-BOOK RATIO OF SIGNIFICANTLY ABOVE ONE INDICATES THAT THE COST OF EQUITY FOR ELECTRIC UTILITY COMPANIES IS LOWER THAN THE EXPECTED RETURN ON BOOK EQUITY?

A. Calculating the cost of equity (investors' equity return expectations) is more complicated than calculating the return on a rental property, but the same concept applies regarding the relationship between market returns and book returns. If an investor purchases an apartment for $100,000 and expects to receive $500 per month ($500 X 12 = $6,000 per year) in rent, he or she will expect an annual return of 6% ($6,000/$100,000) on their investment. When the investor purchases the apartment, he would record the book value as $100,000 and the market value as $100,000 unless he determined that the purchase price was higher or lower than the market value. If the value of the apartment increases to $350,000, for example, the market-to-book ratio would increase to approximately 3.5, and therefore, his return on book value would remain at about 6% while his return on the market value of the apartment would decrease to about 1.7%.

In this rental property example, an increasing market value results in a lower expected return on market (1.7%) compared to expected return on book (6%) if the rent price remains constant. Rent prices do not increase to maintain an expected 6% return on book value; they are set by what the rental market reasonably can bear. The same is true of utility stocks. You do not establish an ROE based on a constant return on book (accounting) returns, it is set based on what investors in the market expect that market to return. In the case of a utility stock, an increasing market value results in a lower return on

market for the same expected return on book. As this rental property example demonstrates, there is nothing inconsistent about investors expecting a lower return on the market price of an investment than on the book value of an investment. In fact, with market-to-book ratios of electric utility companies significantly above one it would be surprising if investors expected a return on market equal, or anywhere close, to return on book.

APPENDIX B. FUTURE-ORIENTED "B X R" METHOD

Q. 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?

A. Yes. One common criticism 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.

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

A. 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.

Q. CAN YOU PLEASE SUMMARIZE 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?

A. 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.[119] 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 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

[119] 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%.

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. Mr. Rea has done neither. Instead, he mechanically adds analysts' five-year earnings per share growth rate to the dividend yield.

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

A. 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 downswing 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.

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

A. 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.

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

A. 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.

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

A. 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.

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

A. 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.

APPENDIX C. NON-CONSTANT GROWTH FORM OF THE DCF MODEL

Q. 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?

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

Q. 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?

A. 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.[120] 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%.

[120] (1+.0862/365)^365=1.09=9.00%.

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

A. 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.

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 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.

Q. 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?

A. 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 rate of return

is consistent with ratemaking procedures allowed and the skill of management in prudently operating the system.

When an investor receives a dividend, he 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 his investment in a company by purchasing more stock, the transaction occurs at market price. However, when the same investor sees his 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.

Q. 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?

A. 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?

Q. 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?

A. 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.

APPENDIX D. CAPITAL ASSET PRICING MODEL

Risk-Free Rate

Q. 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?

A. 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 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.

Q. HOW DO YOU RESPOND TO ANALYSTS WHO CLAIM THAT THE RISK-FREE RATE SHOULD BE BASED ON INTEREST RATE FORECASTS FROM FIRMS SUCH AS BLUE CHIP FINANCIAL?

A. 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 the appropriate risk-free rate to use in a CAPM analysis or any other cost of equity calculations.

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.[121]

Historical Beta

Q. PLEASE EXPLAIN HOW YOU CALCULATE HISTORICAL BETAS.

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

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

Where:

- 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

[121] DANIEL KAHNEMAN, *Thinking Fast and Slow*, p. 212(New York: Farrar, Straus, and Giroux, 2011).

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)[122] using the following formula:[123]

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

There are four differences between my historical beta calculations and Value Line's calculations:

1. The first significant difference is that whereas Value Line uses the New York Stock Exchange Composite Index as the market index, I use the S&P 500 Index.
2. Another important difference is that whereas Value Line calculates weekly returns on one day of the week, with a stated preference for Tuesdays, I calculate weekly returns on all days of the week.
3. Value Line only calculates betas every 3 months in their quarterly company reports, whereas I use the same consistent methodology to calculate betas

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

[123] Michelfelder and Theodossiou (2013) have discredited the Blume adjustment for regulated public utility stocks, but Gombola and Kahl (1990) found that, while their betas do not approach unity, they are nonstationary. My use of the Blume adjustment, then, is "conservative", from the perspective of the OCA.

Michelfelder, R.A. & Theodossiou, P. (2013). Public utility beta adjustment and biased costs of capital in public utility rate proceedings, *Electricity Journal* 26(9), 60 68. https://doi.org/10.1016/j.tej.2013.09.017

Gombola, M. & Kahl, D. (1990). Time-series processes for utility betas: implications for forecasting systematic risk, *Financial Management* 19(3), 84–93. https://www.jstor.org/stable/3665827

every week during the most recent 3 complete months (September through November 2024).

4. Value Line always uses a 5-year period for the return regression,[124] whereas I calculate historical betas for periods of 6 months, 2 years, and 5 years, as shown in Chart 14 on page 64.

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 VS. 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 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

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

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.

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.

I only became aware of this side-effect recently, but it is easy to understand why it happens. 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,[125] 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

[125] 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.

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 benefit of providing more data pairs to be used in historical beta calculations for shorter periods, such as for 6-month historical betas, where instead of 25 return pairs, the regression is performed on 117 return pairs.

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

A. Doing my own historical beta calculations using Value Line's established methodology allows me to see how beta values change from week to week and to use the most up-to-date beta calculations instead of relying on stale beta values that can be more than 3 months old, inappropriate for the up-to-date snapshot of the market that I am taking.

Q. HOW MANY DATA POINT PAIRS ARE NECESSARY TO ESTIMATE THE RELATIONSHIP 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 fewer 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[126] 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.[127] As explained in more detail in the text regarding how to use the table of critical values,[128] any beta coefficient above this level, and certainly above the 0.338 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.

Historical Blended Beta

Q. HOW DID YOU DECIDE ON THE RELATIVE WEIGHTS YOU ALLOCATE TO EACH COMPONENT OF YOUR HISTORICAL BLENDED 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

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

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

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

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.[129]

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

> Somewhat unexpectedly, the performance of the forward-looking beta compared to that of the 180-day historical beta is much better [for the one-year prediction] than [for the six-month prediction], and this conclusion carries over to [the two-year prediction]. The mixed beta also perform [sic] well. It is perhaps not surprising that the performance of the 180-day historical beta [for the one- and two-year predictions] is poorer than [for the six-month prediction], because the horizons used in the construction of realized betas are no longer equal to 180 days. What is harder to explain is why the correlation between realized beta and forward-looking beta is in many cases higher [for the one- and two-year predictions] than [for the six-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.[130]

[129] Peter Christoffersen, Kris Jacobs, & Gregory Vainberg, *Forward-Looking Betas*, p. 16 (April 25, 2008) at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=891467.
[130] *Id. at 17.*

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. Therefore, considering a historical blended beta in conjunction with option-implied betas to calculate the cost of equity is consistent with research findings that coming historical and option-implied betas is the best predictor of future betas.

I decided on the composition of my historical blended betas primarily based on the conclusions of the authors above. 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 historical blended betas, I chose incorporate 5-year historical betas.

Market Risk Premium

Q. 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?

A. 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 6.64% as of November 30, 2024 and a value of 6.98% 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 for the RFC

Electric Proxy Group in my CAPM analysis, Mr. Rea's 10.30% ROE recommendation[131] implies an average market risk premium of 9.9%, an average overall market return of 14.3%, average growth for the S&P 500 of 13.0%, and a cumulative probability of 74.3%. In other words, to achieve the required market growth of 13.0%, reality would have to exceed 74.3% 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 using the betas of the RFC Electric Proxy Group, my recommended 8.13% authorized ROE implies an average market risk premium of 6.2%, an average overall market return of 10.6%, average growth for the S&P 500 of 9.3%, and a cumulative probability of 58.4%.

Q. 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?

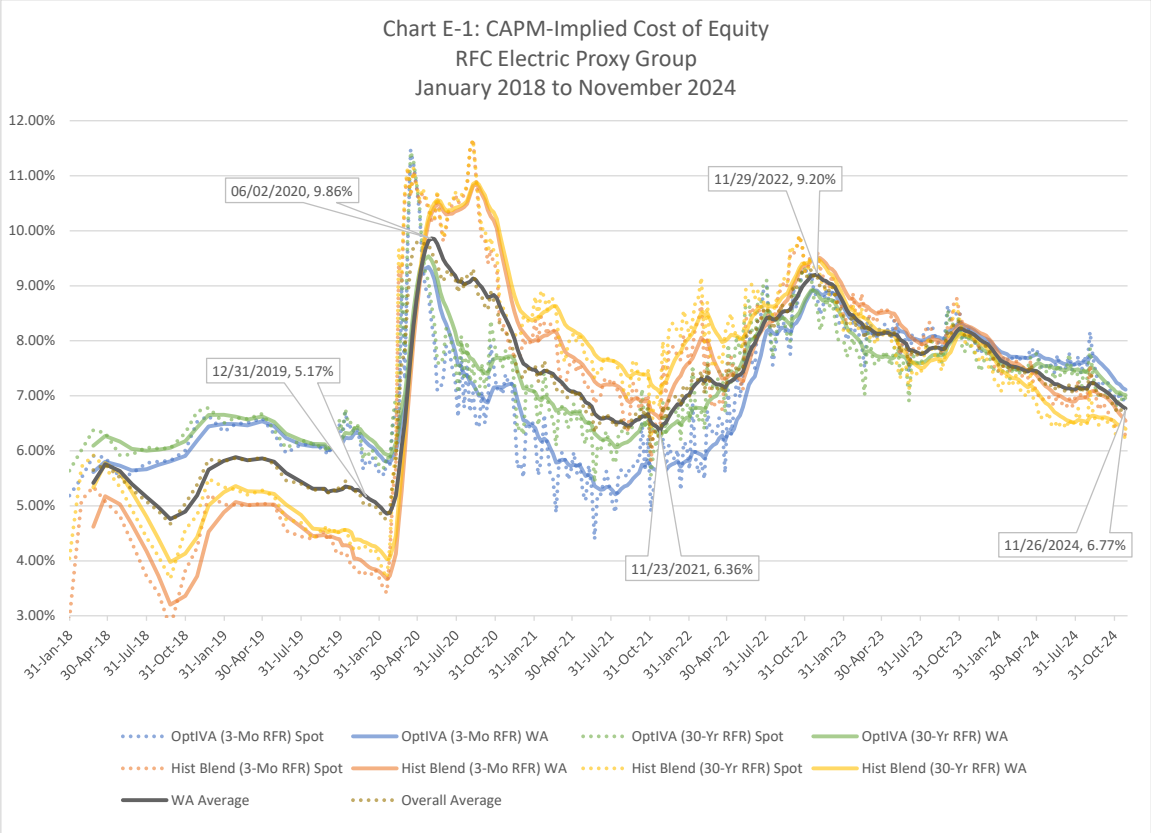
A. In late 2020, after significant efforts related to the complexities in processing extremely large volumes of option data, I was finally able to use option-implied volatility and option-implied skewness to come up with a log-normal distribution that approximates the probability distribution of the 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

[131] Direct Testimony of Vincent V. Rea at 10:1-3.

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 distribution, a normal distribution 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 distributions, 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 distribution approximation I used in cases before 2021 cannot be directly compared to the cumulative probabilities of the superior log-normal distribution approximation, which takes skewness into account. The considerably improved approximation based on a log-normal distribution 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.

APPENDIX E. CAPM-IMPLIED COST OF EQUITY FOR RFC ELECTRIC PROXY GROUP OVER TIME SINCE ONSET OF COVID PANDEMIC



Notes regarding the content of this chart:

- *The information in this chart is the property of Rothschild Financial Consulting ("RFC") and may not be used for any purpose without the express written consent of RFC. Even when the underlying data are publicly available from another source, the results of analyses performed by RFC and the way of presenting the data are and remain the property of RFC.*

- *The data presented herein may not agree 100% with past recommendations by RFC for numerous reasons, including differences in the underlying proxy group and the fact that this chart represents only results based on the CAPM, whereas RFC usually bases recommendations on the CAPM and other models, such as various forms of the DCF.*

APPENDIX F. 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 Utilities 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 G. TESTIFYING EXPERIENCE OF AARON L. ROTHSCHILD

Filed Rate of Return Testimonies:

California

- Pacific Gas and Electric, Application 22-04-008 et al, Rate of Return/Cost of Capital Mechanism, January 2024
- Liberty Utilities, Application A.23-05-004, Rate of Return, August 2023
- San Gabriel Water Company, Application 23-05-001, Rate of Return, August 2023
- Suburban Water Company, Application 23-05-003, Rate of Return, August 2023
- Great Oaks Water Company, Application 23-05-002, Rate of Return, August 2023
- Incumbent Local Exchange Carriers (ILECs), Application 22-09-003, Rate of Return, May 2023
- Pacific Gas and Electric Company, Application 22-04-008, Rate of Return, August 2022
- Southern California Edison, Application 22-04-009, Rate of Return, August 2022
- San Diego Gas & Electric Company, Application 22-04-012, Rate of Return, August 2022
- 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
- Connecticut Natural Gas Corporation, Docket No. 23-11-02, February 2024
- The Southern Connecticut Gas Company, Docket No. 23-11-02, February 2024
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