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CHRIS SPROWLS
Speaker of the House of Representatives

August 26, 2022

Adam J. Teitzman, Commission Clerk
Florida Public Service Commission
2540 Shumard Oak Boulevard
Tallahassee, Florida 32399-0850

Re: Docket No. 20220069-GU

Dear Mr. Teitzman,

Please find enclosed for filing in the above referenced docket the Direct Testimony and Exhibits of David J. Garrett. This filing is being made via the Florida Public Service Commission's Web Based Electronic Filing portal.

If you have any questions or concerns; please do not hesitate to contact me. Thank you for your assistance in this matter.

Sincerely,

Richard Gentry
Public Counsel

/s/ Mary A. Wessling
Mary A. Wessling
Associate Public Counsel
Florida Bar No. 093590

CERTIFICATE OF SERVICE
DOCKET NO. 20220069-GU

I HEREBY CERTIFY that a true and correct copy of the foregoing has been furnished by electronic mail on this 26th day of August 2022, to the following:

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BEFORE THE FLORIDA PUBLIC SERVICE COMMISSION

In re: Petition for rate increase by Florida City Gas.

DOCKET NO. 20220069-GU

FILED: August 26, 2022

DIRECT TESTIMONY

OF

DAVID J. GARRETT

ON BEHALF OF THE FLORIDA OFFICE OF PUBLIC COUNSEL

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I. INTRODUCTION

Q. STATE YOUR NAME AND OCCUPATION.

A. My name is David J. Garrett. I am a consultant specializing in public utility regulation. I am the managing member of Resolve Utility Consulting PLLC.

Q. SUMMARIZE YOUR EDUCATIONAL BACKGROUND AND PROFESSIONAL EXPERIENCE.

A. I received a B.B.A. with a major in Finance, an M.B.A., and a Juris Doctor from the University of Oklahoma. I worked in private legal practice for several years before accepting a position as assistant general counsel at the Oklahoma Corporation Commission in 2011. At the commission, I worked in the Office of General Counsel in regulatory proceedings. In 2012, I began working for the Public Utility Division as a regulatory analyst providing testimony in regulatory proceedings. After leaving the commission, I formed Resolve Utility Consulting PLLC, where I have represented various consumer groups and state agencies in utility regulatory proceedings, primarily in the areas of cost of capital and depreciation. I am a Certified Depreciation Professional with the Society of Depreciation Professionals. I am also a Certified Rate of Return Analyst with the Society of Utility and Regulatory Financial Analysts. A more complete description of my qualifications and regulatory experience is included in my curriculum vitae.[1]

[1] Exhibit DJG-1.

Q. DESCRIBE THE PURPOSE AND SCOPE OF YOUR TESTIMONY IN THIS PROCEEDING.

A. I am testifying on behalf of the Florida Office of Public Counsel ("OPC") in response to the petition for rate increase by Florida City Gas ("FCG" or the "Company"). I address the cost of capital and fair rate of return for FCG in response to the direct testimony of Company witness Jennifer Nelson. I also address the appropriate proposed capital structure for FCG. I also address the Company's proposed depreciation rates in response to the direct testimony of Company witness Ned Allis, who sponsors the Company's depreciation study.

II. EXECUTIVE SUMMARY – COST OF CAPITAL

Q. PLEASE SUMMARIZE YOUR RECOMMENDATION TO THE COMMISSION.

A. My cost of capital testimony can be distilled to the following recommendations:

- The Commission should reject the Company's proposed return on equity ("ROE") of 10.75% as excessive and unsupported. An objective cost of equity analysis shows that FCG's cost of equity is about 8.0%, based upon review of the Company's proxy group.

- The legal standards governing this issue do not mandate that the awarded ROE equate to the result of a particular financial model, but rather that it be reasonable under the circumstances. In my opinion, it is not appropriate to consider an awarded ROE that is significantly higher than a regulated utility's cost of equity. Accordingly, I recommend the Commission award FCG an authorized ROE of 9.25%. Although 9.25% is still clearly above FCG's market-based cost of equity estimate of 8.0%, it represents a gradual yet meaningful move towards market-based cost of equity.

- I recommend the Commission reject FCG's proposed capital structure consisting of 40.4% long-term debt and 59.6% common equity from investor-supplied sources. This equates to a debt-equity ratio of only 0.68. The Company's proposed capital structure is entirely inconsistent with the capital structures of the proxy group used to estimate FCG's cost of equity. The average debt ratio of the proxy group is 53.1%, which equates to a debt-equity ratio of 1.13. The Company's proposed capital structure has the effect of increasing capital costs far beyond a reasonable level for customers because it does not contain enough low-cost debt relative to high-cost equity.

- My recommended ROE of 9.25% coupled with adjustments to the Company's proposed capital structure are summarized in the following table.[2]

Figure 1:
OPC'S Weighted Average Rate of Return Proposal

Capital Component	Proposed Ratio	Cost Rate	Weighted Cost
Common Equity	39.38%	9.25%	3.64%
Long Term Debt	44.67%	4.28%	1.91%
Short Term Debt	4.13%	1.78%	0.07%
Customer Deposits	0.78%	2.64%	0.02%
Deferred Taxes	11.03%	0.00%	0.00%
Tax Credit	0.01%	0.00%	0.00%
Total	100.00%		5.65%

Adopting my proposed adjustments would result in an overall weighted average authorized rate of return of 5.65%. The details supporting my proposed adjustments are discussed further in my testimony.[3]

[2] *See also* Exhibit DJG-17.

[3] See also the direct testimony of OPC witness Helmuth W. Schultz.

A. Overview

Q. PLEASE EXPLAIN THE CONCEPT AND SIGNIFICANCE OF THE COST OF CAPITAL.

A. The term cost of capital, or Weighted Average Cost of Capital (WACC),[4] refers to the weighted average cost of the components within a company's capital structure, including the costs of both debt and equity. The three primary components of a company's WACC include the following:

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

Determining the cost of debt is relatively straight-forward. Interest payments on bonds are contractual, embedded costs that are generally calculated by dividing total interest payments by the book value of outstanding debt. Determining the cost of equity, on the other hand, is more complex. Unlike the known, contractual, and embedded cost of debt, there is not any explicitly quantifiable "cost" of equity. Instead, the cost of equity must be estimated through various financial models. Cost of capital is expressed as a weighted average because it is based upon a company's relative levels of debt and equity, as defined by the particular capital structure of that company. The basic WACC equation used in regulatory proceedings is presented as follows:

[4] The terms cost of capital and WACC are synonymous and used interchangeably throughout this testimony.

Equation 1:
Weighted Average Cost of Capital

$$WACC = \left(\frac{D}{D+E}\right)C_D + \left(\frac{E}{D+E}\right)C_E$$

where: $WACC$ = *weighted average cost of capital*
D = *book value of debt*
C_D = *embedded cost of debt capital*
E = *book value of equity*
C_E = *market-based cost of equity capital*

Companies in the competitive market often use their WACC as the discount rate to determine the value of capital projects, so it is important that this figure be estimated accurately.

Q. HOW DO EXPERTS AND REGULATORS TYPICALLY ASSESS THE ROES AWARDED TO UTILITIES AND THE CORRESPONDING OPPORTUNITY FOR SHAREHOLDERS?

A. Investors, company managers, and academics around the world have used models, such as the Capital Asset Pricing Model ("CAPM") and Discounted Cash Flow ("DCF") to closely estimate cost of equity for many years, and weigh the results achieved against the results from proxy groups. Each of these concepts will be discussed in more detail later in my testimony.

Q. HAVE YOU CONSIDERED THE EFFECTS OF INFLATION IN YOUR COST OF EQUITY ESTIMATE?

A. Yes. The recent increase in inflation has affected the entire U.S. market, including utility customers. Arguably the negative impacts of inflation disproportionately affect utility customers relative to utility shareholders. Regardless, I have taken an objective approach when considering the impacts of inflation on the cost of equity. Specifically, in cost of equity modeling, we are primarily concerned with the yield on U.S. Treasury securities (which can fluctuate given the Federal Reserve's response to inflation) more directly than the current level of inflation. I have directly considered the yields on 30-year Treasury bonds as a proxy for the risk-free rate in my CAPM analysis, which is discussed in more detail later in my testimony.

B. Recommendation

Q. PLEASE SUMMARIZE YOUR ROE RECOMMENDATION TO THE FLORIDA PUBLIC SERVICE COMMISSION (COMMISSION).

A. Pursuant to the legal and technical standards guiding this issue, the awarded ROE should be based on, or reflective of, the utility's cost of equity. FCG's estimated cost of equity is about 8.0%, when using reasonable inputs. However, legal standards do not mandate the awarded ROE be set exactly equal to the cost of equity. Rather, in *Federal Power Commission v. Hope Natural Gas Co.*, the U.S. Supreme Court found that, although the awarded return should be based on a utility's cost of equity, the "end result" should be just and reasonable.[5] Therefore, I recommend the Commission award FCG an ROE of 9.25%. In my opinion, an awarded ROE that is set too far above a regulated utility's cost of equity (which in this case is only about 8.0%) runs the risk of being at odds with the standards set forth in *Hope*[6] and *Bluefield Water Works & Improvement Co. v. Public Service*

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[5] *See Federal Power Commission v. Hope Natural Gas Co.*, 320 U.S. 591, 603 (1944). Here, the Court states that it is not mandating the various permissible ways in which the rate of return may be determined, but instead indicates that the end result should be just and reasonable. This is sometimes called the "end result" doctrine.

[6] *Id*.

Commission of West Virginia.[7] In other words, setting the awarded ROE far above the cost of equity results in an excess transfer of wealth from customers to the utility, which is never appropriate.

III. EXECUTIVE SUMMARY – DEPRECIATION

Q. SUMMARIZE THE KEY POINTS OF YOUR TESTIMONY REGARDING DEPRECIATION.

A. In the context of utility ratemaking, "depreciation" refers to a cost allocation system designed to measure the rate by which a utility may recover its capital investments in a systematic and rational manner. I employed a well-established depreciation system and used actuarial techniques to analyze the Company's depreciable assets statistically and develop reasonable depreciation rates in this case. I applied my estimates of average service life and salvage to the same balances utilized in the depreciation study. My proposed adjustments would reduce the Company's proposed annual depreciation accrual by $1.6 million.[8]

Q. PLEASE SUMMARIZE THE PRIMARY FACTORS DRIVING YOUR PROPOSED ADJUSTMENTS.

A: I propose adjustments to the depreciation rates of several of the Company's mass property accounts. These adjustments include longer average service life estimates than those Mr.

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[7] *Bluefield Water Works & Improvement Co. v. Public Service Commission of West Virginia*, 262 U.S. 679, 692–93 (1923).

[8] Exhibit DJG-18. The accrual amounts presented in Exhibit DJG-18 and my other exhibits and figures are based on plant balances utilized in the depreciation study; they do not necessarily represent depreciation expense.

Allis proposed. The following table compares my proposed service lives, depreciation rates, and accrual amounts with those Mr. Allis proposed for the accounts at issue.

Figure 2:
Depreciation Parameter Comparison

Account No.	Description	Company Position: Iowa Curve Type	Iowa Curve AL	Depr Rate	Annual Accrual	Public Counsel Position: Iowa Curve Type	Iowa Curve AL	Depr Rate	Annual Accrual
376.10	MAINS - STEEL	R4	65	2.66%	3,973,578	R3	70	2.40%	3,533,252
376.20	MAINS - PLASTIC	R4	65	2.42%	4,662,977	R3	70	2.20%	4,241,835
378.00	M&R STATION EQUIPMENT - GENERAL	S3	35	2.94%	79,760	S3	45	2.20%	60,315
379.00	M&R STATION EQUIPMENT - CITY GATE	S3	35	3.03%	594,062	S3	45	2.20%	430,929
380.10	SERVICES - STEEL	R2.5	50	4.92%	766,100	R2.5	55	4.10%	641,366
380.20	SERVICES - PLASTIC	R2.5	50	3.32%	3,449,035	R2.5	55	3.00%	3,074,090
383.00	HOUSE REGULATORS	R2.5	40	2.60%	196,454	R2	47	2.10%	158,853

For each of these accounts, I propose a longer average service life than does Mr. Allis, which results in adjustments reducing the Company's proposed depreciation rates. My testimony will discuss these adjustments in more detail later.[9]

Q. PLEASE DESCRIBE WHY IT IS IMPORTANT NOT TO OVERESTIMATE DEPRECIATION RATES.

A: Average service lives that are too short result in depreciation rates that overestimate the Company's actual depreciation expense. Under the rate base rate of return model, the utility is allowed to recover the original cost of its prudent investments required to provide service. Depreciation systems are designed to allocate those costs in a systematic and rational manner—specifically, over the service lives of the utility's assets. Overestimating depreciation rates (i.e., underestimating service lives), encourages economic inefficiency. Unlike competitive firms, natural market forces do not always incentivize regulated utility

[9] *See* Exhibit DJG-4.

companies to make the most economically efficient decisions. If a utility is allowed to recover the cost of an asset before the end of its useful life, this could incentivize the utility to replace the asset unnecessarily in order to increase rate base, which results in economic waste. Thus, from a public policy perspective, it is preferable for regulators to ensure that utilities do not depreciate assets before the end of their economic, useful lives.

PART ONE: COST OF CAPITAL

IV. LEGAL STANDARDS

Q. DISCUSS THE LEGAL STANDARDS GOVERNING THE AWARDED RATE OF RETURN ON CAPITAL INVESTMENTS FOR REGULATED UTILITIES.

A. In *Wilcox v. Consolidated Gas Co. of New York*, the U.S. Supreme Court first addressed the meaning of a fair rate of return for public utilities.[10] The Court found that "the amount of risk in the business is a most important factor" in determining the appropriate allowed rate of return.[11] As referenced earlier, in two subsequent landmark cases, the Court set forth the standards by which public utilities are allowed to earn a return on capital investments. First, in *Bluefield*, the Court held:

> A public utility is entitled to such rates as will permit it to earn a return on the value of the property which it employs for the convenience of the public. . . but it has no constitutional right to profits such as are realized or anticipated in highly profitable enterprises or speculative ventures. The return should be reasonably sufficient to assure confidence in the financial soundness of the utility and should be adequate, under efficient and economical management, to maintain and support its credit and enable it to raise the money necessary for the proper discharge of its public duties.[12]

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[10] *Wilcox v. Consolidated Gas Co. of New York*, 212 U.S. 19 (1909).

[11] *Id.* at 48.

[12] *Bluefield* at 692–93.

Then, in *Hope*, the Court expanded on the guidelines set forth in *Bluefield* and stated:

> From the investor or company point of view, it is important that there be enough revenue not only for operating expenses, <u>but also for the capital costs of the business.</u> These include service on the debt and dividends on the stock. By that standard, the return to the equity owner should be commensurate with returns on investments in other enterprises having corresponding risks. That return, moreover, should be sufficient to assure confidence in the financial integrity of the enterprise, so as to maintain its credit and to attract capital.[13]

The cost of capital models I have employed in this case are designed to be in accordance with the foregoing legal standards.

Q. IS IT IMPORTANT THAT THE AWARDED RATE OF RETURN BE BASED ON THE COMPANY'S ACTUAL COST OF CAPITAL?

A. Yes. The U.S. Supreme Court in *Hope* makes it clear that the allowed return should be based on the actual cost of capital.[14] Moreover, the awarded return must also be fair, just, and reasonable under the circumstances of each case. Among the circumstances that must be considered in each case are the broad economic and financial impacts to the cost of equity and awarded return caused by market forces and other factors. As a starting point, however, scholars agree that the actual cost of capital must be considered:

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[13] *Federal Power Commission v. Hope Natural Gas Co*., 320 U.S. 591, 603 (1944) (emphasis added) (internal citations omitted).

[14] The term "cost of capital" includes both debt and equity. The overall awarded rate of return should be based on the utility's cost of capital, which the awarded ROE should be based in the utility's cost of equity.

> Since by definition the cost of capital of a regulated firm represents precisely the expected return that investors could anticipate from other investments while bearing no more or less risk, and since investors will not provide capital unless the investment is expected to yield its opportunity cost of capital, the correspondence of the definition of the cost of capital with the court's definition of legally required earnings appears clear.[15]

The models I have employed in this case closely estimate the Company's true cost of equity. If the Commission sets the awarded return based on my lower and more reasonable rate of return, it will better comply with the U.S. Supreme Court's standards, allow the Company to maintain its financial integrity, and achieve reasonable returns for its investors. On the other hand, if the Commission sets the allowed rate of return much higher than the true cost of capital, as requested by FCG, it will result in an inappropriate transfer of wealth from ratepayers to shareholders.[16]

Q. WHAT DOES THIS LEGAL STANDARD MEAN FOR DETERMINING THE AWARDED RETURN AND THE COST OF CAPITAL?

A. The awarded return and the cost of capital are different but related concepts. On the one hand, the legal and technical standards encompassing this issue require that the awarded return reflect the true cost of capital. Yet on the other hand, the two concepts differ in that the legal standards do not mandate that awarded returns exactly match the cost of capital. Instead, awarded returns are set through the regulatory process and may be influenced by various factors other than objective market drivers. By contrast, the cost of capital should

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[15] A Lawrence Kolbe, James A. Read, Jr. & George R. Hall, *The Cost of Capital: Estimating the Rate of Return for Public Utilities* 21 (The MIT Press 1984).

[16] Roger A. Morin, *New Regulatory Finance* 23–24 (Public Utilities Reports, Inc. 2006) (1994) ("[I]f the allowed rate of return is greater than the cost of capital, capital investments are undertaken and investors' opportunity costs are more than achieved. Any excess earnings over and above those required to service debt capital accrue to the equity holders, and the stock price increases. In this case, the wealth transfer occurs from ratepayers to shareholders.").

be evaluated objectively and be closely tied to economic realities, such as stock prices, dividends, growth rates, and, most importantly, risk. The cost of capital can be estimated by financial models used by firms, investors, and academics around the world for decades. The problem is, with respect to regulated utilities, there has been a trend in which awarded returns fail to closely track with market-based cost of capital, as further discussed below. To the extent this occurs, the results are detrimental to ratepayers and the state's economy.

Q. DESCRIBE THE ECONOMIC IMPACT THAT OCCURS WHEN THE AWARDED RETURN STRAYS TOO FAR FROM THE U.S. SUPREME COURT'S COST OF EQUITY STANDARDS.

A. When the awarded ROE is set far above the cost of equity, it runs the risk of violating the U.S. Supreme Court's standards. This has the effect of diverting dollars from ratepayers for their internal or business uses that would otherwise support the local or state economy to the utility's shareholders at large. Moreover, establishing an awarded return that far exceeds true cost of capital effectively prevents the awarded returns from changing along with economic conditions. This is especially true given the fact that regulators tend to be influenced by the awarded returns in other jurisdictions, regardless of the various unknown factors influencing those awarded returns. If regulators rely too heavily on the awarded returns from other jurisdictions, they can create a cycle over time that bears little relation to the market-based cost of equity. In fact, this is exactly what we have observed since 1990. This is yet another reason why it is crucial for regulators to put more emphasis on the target utility's actual cost of equity than on the awarded returns from other jurisdictions. Awarded returns may be influenced by settlements and other political factors not based on true market conditions. In contrast, the true cost of equity as estimated through objective models is not influenced by these factors but is instead driven by market-based factors.

Q. CAN YOU ILLUSTRATE AND PROVIDE A COMPARISON OF THE RELATIONSHIP BETWEEN AWARDED UTILITY RETURNS AND MARKET COST OF EQUITY SINCE 1990?

A. Yes. As shown in the figure below, awarded returns for electric and gas utilities have been above the average required market return since 1990.[17] Because utility stocks are consistently far less risky than the average stock in the marketplace, the cost of equity for utility companies is less than the market cost of equity.

To illustrate this fact, the graph in the figure below shows two trend lines. The top line is the average annual awarded returns since 1990 for U.S. regulated gas utilities. The bottom line is the required market return over the same period. As discussed in more detail later in my testimony, the required market return is essentially the return that investors would require if they invested in the entire market and, as such, the required market return is essentially the cost of equity of the entire market. It is undisputed that utility stocks are less risky than the average stock in the market. Accordingly, the utilities' cost of equity must be less than the market cost of equity.[18] Thus, awarded returns (the solid line) should generally be below the market cost of equity (the dotted line), since awarded returns are supposed to be based on true cost of equity.

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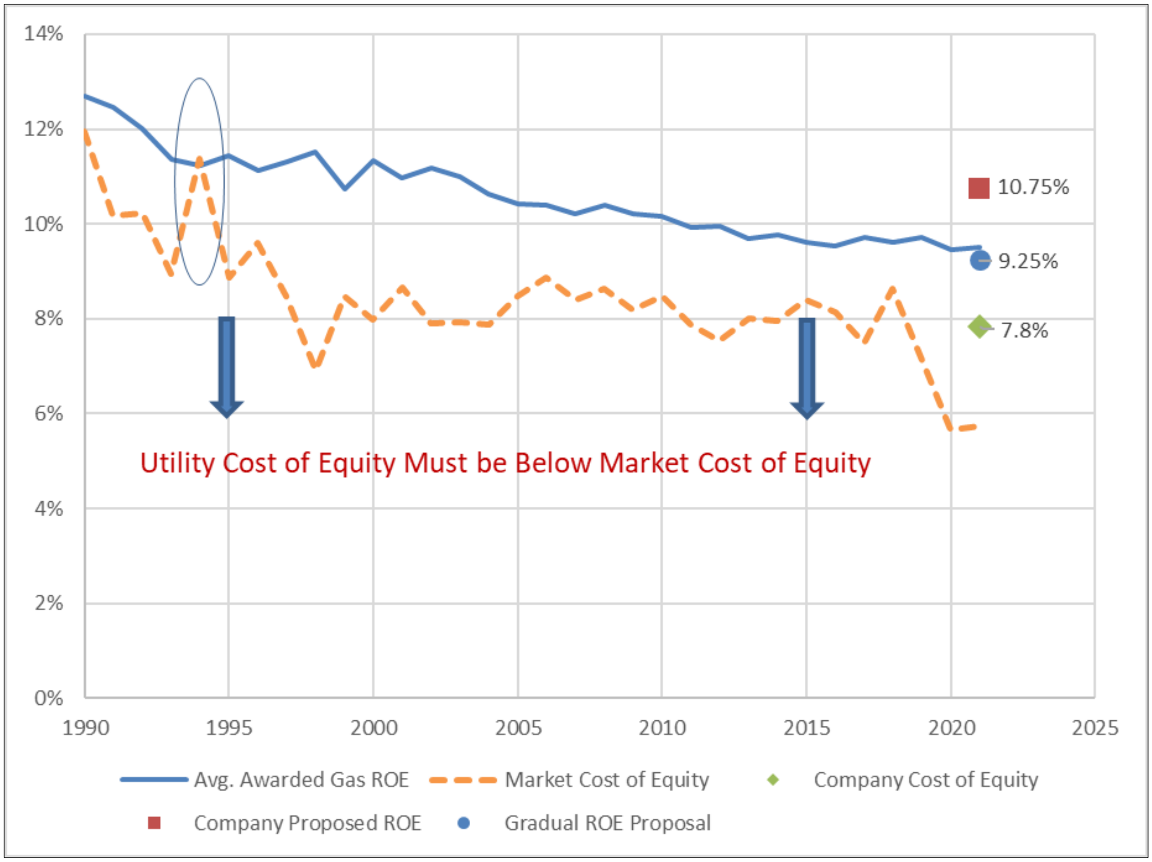
[17] Exhibit DJG-13.

[18] This fact can be objectively measured through a term called "beta," as discussed later in the testimony. Utility betas are less than one, which means utility stocks are less risky than the "average" stock in the market.

Figure 3:
Awarded ROEs vs. Market Cost of Equity



Notwithstanding the data in this graph, awarded ROEs have been consistently above the market cost of equity for many years. Also as shown in this graph, since 1990, there was only one year in which the average awarded ROE was below the market cost of equity. In 1994, regulators awarded ROEs that were the closest to utilities' market-based cost of equity. In my opinion, when awarded ROEs for utilities are below the market cost of equity, regulators more closely conform to the standards set forth by *Hope* and *Bluefield* and minimize the excess wealth transfer from ratepayers to shareholders.

Q. HAVE OTHER ANALYSTS COMMENTED ON THIS NATIONAL PHENOMENON OF AWARDED ROES EXCEEDING MARKET-BASED COST EQUITY FOR UTILITIES?

A. Yes. In his article published in Public Utilities Fortnightly in 2016, Steve Huntoon observed that even though utility stocks are less risky than the stocks of competitive industries, utility stocks have nonetheless outperformed the broader market.[19] Specifically, Mr. Huntoon notes the following three points which lead to a problematic conclusion:

> 1. Jack Bogle, the founder of Vanguard Group and a Wall Street legend, provides rigorous analysis that the long-term total return for the broader market will be around 7 percent going forward. Another Wall Street legend, Professor Burton Malkiel, corroborates that 7 percent in the latest edition of his seminal work, A Random Walk Down Wall Street.
>
> 2. Institutions like pension funds are validating the first point by piling on risky investments to try and get to a 7.5 percent total return, as reported by the Wall Street Journal.
>
> 3. Utilities are being granted returns on equity around 10 percent.[20]

Other scholars have also observed that awarded ROEs have not appropriately tracked with declining interest rates over the years, and that excessive awarded ROEs have negative economic impacts. In a white paper issued in 2017, Charles S. Griffey stated:

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[19] Steve Huntoon, "Nice Work If you can Get It," Public Utilities Fortnightly (Aug. 2016).

[20] *Id*.

> The "risk premium" being granted to utility shareholders is now higher than it has ever been over the last 35 years. Excessive utility ROEs are detrimental to utility customers and the economy as a whole. From a societal standpoint, granting ROEs that are higher than necessary to attract investment creates an inefficient allocation of capital, diverting available funds away from more efficient investments. From the utility customer perspective, if a utility's awarded and/or achieved ROE is higher than necessary to attract capital, customers pay higher rates without receiving any corresponding benefit.[21]

It is interesting that both Mr. Huntoon and Mr. Griffey use the word "sticky" in their articles to describe the fact that awarded ROEs have declined at a much slower rate than interest rates and other economic factors resulting in a decline in capital costs and expected returns on the market. It is not hard to see why this phenomenon of "sticky" ROEs has occurred. Because awarded ROEs are often based primarily on a comparison with other awarded ROEs around the country, the average awarded returns effectively fail to adapt to true market conditions, and regulators seem reluctant to deviate from the average. Once utilities and regulatory commissions become accustomed to awarding rates of return higher than market conditions actually require, this trend becomes difficult to reverse. The fact is, utility stocks are less risky than the average stock in the market, and thus, awarded ROEs should be less than the expected return on the market. However, that is rarely the case. My proposal assists the Commission in "see[ing] the gap between allowed returns and cost of capital,"[22] and reconciling this issue in an equitable manner.

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[21] Charles S. Griffey, "When 'What Goes Up' Does Not Come Down: Recent Trends in Utility Returns," White Paper (February 2017).

[22] Leonard Hyman & William Tilles, "Don't Cry for Utility Shareholders, America," Public Utilities Fortnightly (October 2016).

Q. SUMMARIZE THE LEGAL STANDARDS GOVERNING THE AWARDED ROE ISSUE.

A. The Commission should strive to move the awarded return to a level more closely aligned with the Company's actual, market-derived cost of capital while keeping in mind the following two legal principles outlined below.

1. Risk is the most important factor when determining the awarded return. The awarded return should be commensurate with those returns on investments of corresponding risk.

The legal standards articulated in *Hope* and *Bluefield* demonstrate that the U.S. Supreme Court understands one of the most basic, fundamental concepts in financial theory: the more (or less) risk an investor assumes, the more (or less) return the investor requires. Since utility stocks are low risk, the return required by equity investors should be relatively low. I have used financial models to closely estimate the Company's cost of equity, and these financial models account for risk. The cost of equity models confirm the industry experiences relatively low levels of risk by producing relatively low cost of equity results. In turn, the awarded ROE in this case should reflect FCG's relatively low market risk.

2. The awarded return should be sufficient to assure financial soundness and integrity under efficient management.

Because awarded returns in the regulatory environment have not closely tracked market-based trends and commensurate risk, utility companies have been able to remain more than financially sound, perhaps despite management inefficiencies. In fact, the transfer of wealth from ratepayers to shareholders has been so far removed from actual cost-based drivers that a utility could remain financially sound even under relatively inefficient management. Therefore, regulatory commissions should strive to set utilities' returns based on actual market conditions to promote prudent and efficient management and minimize economic waste.

V. GENERAL CONCEPTS AND METHODOLOGY

Q. DISCUSS YOUR APPROACH TO ESTIMATING THE COST OF EQUITY IN THIS CASE.

A. While a competitive firm must estimate its own cost of capital to assess the profitability of competing capital projects, regulators determine a utility's cost of capital to establish a fair rate of return. The legal standards set forth above do not include specific guidelines regarding the models that must be used to estimate the cost of equity for utilities. Over the years, however, regulatory commissions have consistently relied on several models. The models I have employed in this case have been the two most widely used and accepted in regulatory proceedings for many years. The specific inputs and calculations for these models are described in more detail below.

Q. PLEASE EXPLAIN WHY YOU USED MULTIPLE MODELS TO ESTIMATE THE COST OF EQUITY.

A. These models attempt to measure the return on equity required by investors by estimating several different inputs. It is preferable to use multiple models because the results of any one model may contain a degree of imprecision, especially depending on the reliability of the inputs used at the time of conducting the model. By using multiple models, the analyst can compare the results of the models and look for outlying results and inconsistencies. Likewise, if multiple models produce a similar result, it may indicate a narrower range for the cost of equity estimate.

Q. PLEASE DISCUSS THE BENEFITS OF CHOOSING A PROXY GROUP OF COMPANIES IN CONDUCTING COST OF CAPITAL ANALYSES.

A. The cost of equity models in this case can be used to estimate the cost of capital of any individual, publicly traded company. There are advantages, however, to conducting cost of capital analysis on a proxy group of companies that are comparable to the target company. First, it is better to assess the financial soundness of a utility by comparing it to a group of other financially sound utilities. Second, using a proxy group provides more reliability and confidence in the overall results because there is a larger sample size. Finally, the use of a proxy group is often a pure necessity when the target company is a subsidiary that is not publicly traded, as is the case here. This is because the financial models used to estimate the cost of equity require information from publicly traded firms, such as stock prices and dividends.

Q. DESCRIBE THE PROXY GROUP YOU SELECTED IN THIS CASE.

A. In this case, I chose to use the same proxy group used by Ms. Nelson. There could be reasonable arguments made for the inclusion or exclusion of a particular company in a proxy group; however, the cost of equity results are influenced far more by the underlying assumptions and inputs to the various financial models than the composition of the proxy group.[23] By using the same proxy group, we can remove a relatively insignificant variable from the equation and focus on the primary factors driving FCG's cost of equity estimate.

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[23] Exhibit DJG-2.

VI. RISK AND RETURN CONCEPTS

Q. DISCUSS THE GENERAL RELATIONSHIP BETWEEN RISK AND RETURN.

A. Risk is among the most important factors for the Commission to consider when determining the allowed return. Thus, it is necessary to understand the relationship between risk and return. There is a direct relationship between risk and return: the more (or less) risk an investor assumes, the larger (or smaller) return the investor will demand. There are two primary types of risk: firm-specific risk and market risk. Firm-specific risk affects individual companies, while market risk affects all companies in the market to varying degrees.

Q. DISCUSS THE DIFFERENCES BETWEEN FIRM-SPECIFIC RISK AND MARKET RISK.

A. Firm-specific risk affects individual companies, rather than the entire market. For example, a competitive firm might overestimate customer demand for a new product, resulting in reduced sales revenue. This is an example of a firm-specific risk called "project risk."[24] There are several other types of firm-specific risks, including: (1) "financial risk" – the risk that equity investors of leveraged firms face as residual claimants on earnings; (2) "default risk" – the risk that a firm will default on its debt securities; and (3) "business risk" – which encompasses all other operating and managerial factors that may result in investors realizing less than their expected return in that particular company. While firm-specific risk affects individual companies, market risk affects all companies in the market to

[24] Aswath Damodaran, *Investment Valuation: Tools and Techniques for Determining the Value of Any Asset* 62–63 (3rd ed., John Wiley & Sons, Inc. 2012).

varying degrees. Examples of market risk include interest rate risk, inflation risk, and the risk of major socio-economic events. When there are changes in these risk factors, they affect all firms in the market to some extent.[25]

Analysis of the U.S. market in 2001 provides a good example for contrasting firm-specific risk and market risk. During that year, Enron Corp.'s stock fell from $80 per share to its low when the company filed bankruptcy at the end of the year. If an investor's portfolio had held only Enron stock at the beginning of 2001, this irrational investor would have lost the entire investment by the end of the year due to assuming the full exposure of Enron's firm-specific risk (in that case, imprudent management). On the other hand, a rational, diversified investor who invested the same amount of capital in a portfolio holding every stock in the S&P 500 would have had a much different result that year. The rational investor would have been relatively unaffected by the fall of Enron because his or her portfolio included about 499 other stocks. Each of those stocks, however, would have been affected by various market risk factors that occurred that year. Thus, the rational investor would have incurred a relatively minor loss due to market risk factors, while the irrational investor would have lost everything due to firm-specific risk factors.

Q. CAN EQUITY INVESTORS REASONABLY MINIMIZE FIRM-SPECIFIC RISK?

A. Yes. A fundamental concept in finance is that firm-specific risk can be eliminated through diversification.[26] If someone irrationally invested all his or her funds in one firm, he or she would be exposed to all the firm-specific risk and the market risk inherent in that single

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[25] *See* Zvi Bodie, Alex Kane & Alan J. Marcus, *Essentials of Investments* 149 (9th ed., McGraw-Hill/Irwin 2013).

[26] *See* John R. Graham, Scott B. Smart & William L. Megginson, *Corporate Finance: Linking Theory to What Companies Do* 179–80 (3rd ed., South Western Cengage Learning 2010).

firm. Rational investors, however, are risk-averse and seek to eliminate risk they can control. Investors can eliminate firm-specific risk by adding more stocks to their portfolio through a process called "diversification." There are two reasons why diversification eliminates firm-specific risk.

First, each stock in a diversified portfolio represents a much smaller percentage of the overall portfolio than it would in a portfolio of just one or a few stocks. Thus, any firm-specific action that changes the stock price of one stock in the diversified portfolio will have only a small impact on the entire portfolio.[27]

The second reason why diversification eliminates firm-specific risk is that the effects of firm-specific actions on stock prices can be either positive or negative for each stock. Thus, in large, diversified portfolios, the net effect of these positive and negative firm-specific risk factors will be essentially zero and will not affect the value of the overall portfolio.[28] Firm-specific risk is also called "diversifiable risk" because it can be easily eliminated through diversification.

Q. IS IT WELL-KNOWN AND ACCEPTED THAT, BECAUSE FIRM-SPECIFIC RISK CAN BE EASILY ELIMINATED THROUGH DIVERSIFICATION, THE MARKET DOES NOT REWARD SUCH RISK THROUGH HIGHER RETURNS?

A. Yes. Because investors eliminate firm-specific risk through diversification, they know they cannot expect a higher return for assuming the firm-specific risk in any one company.

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[27] *See* Aswath Damodaran, *Investment Valuation: Tools and Techniques for Determining the Value of Any Asset* 64 (3rd ed., John Wiley & Sons, Inc. 2012).

[28] *See* Aswath Damodaran, *Investment Valuation: Tools and Techniques for Determining the Value of Any Asset* 64 (3rd ed., John Wiley & Sons, Inc. 2012).

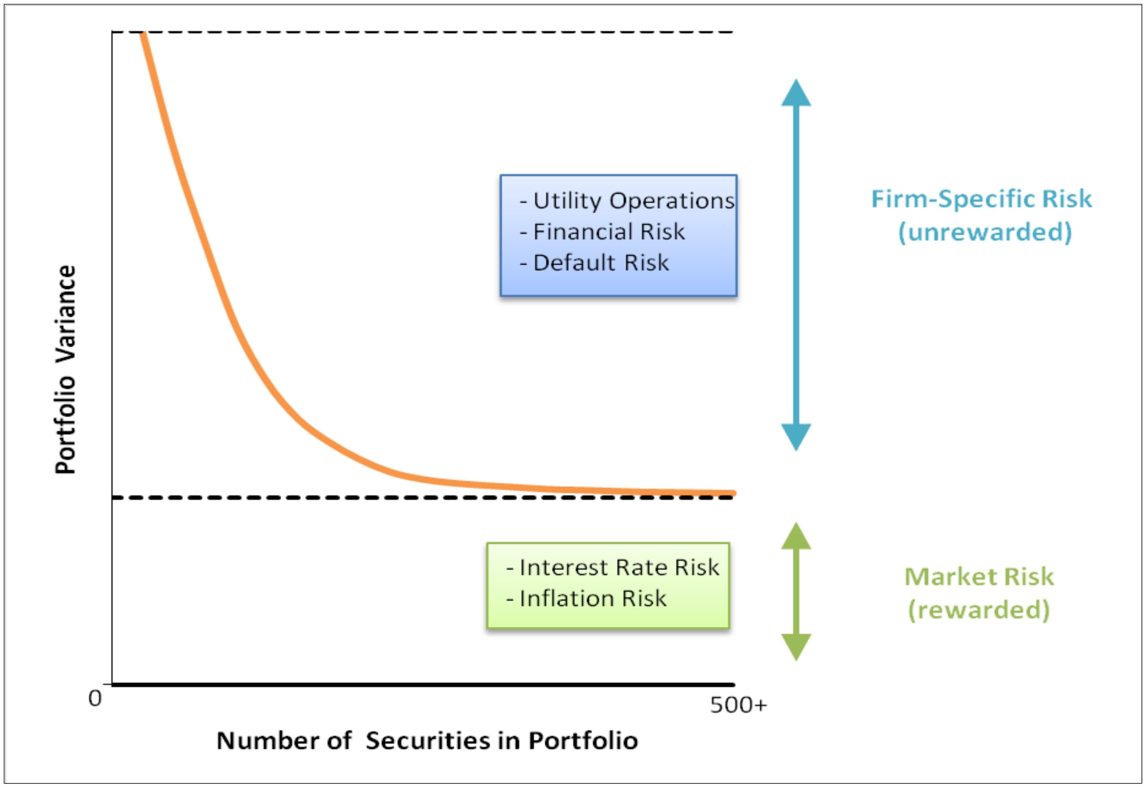
Thus, the risks associated with an individual firm's operations are not rewarded by the market. In fact, firm-specific risk is also called "unrewarded" risk for this reason. Market risk, on the other hand, cannot be eliminated through diversification. Because market risk cannot be eliminated through diversification, investors expect a return for assuming this type of risk. Market risk is also called "systematic risk." Scholars recognize the fact that market risk, or systematic risk, is the only type of risk for which investors expect a return for bearing:

> If investors can cheaply eliminate some risks through diversification, then we should not expect a security to earn higher returns for risks that can be eliminated through diversification. Investors can expect compensation only for bearing systematic risk (i.e., risk that cannot be diversified away).[29]

These important concepts are illustrated in the figure below. Some form of this figure is found in many financial textbooks.

[29] *See* John R. Graham, Scott B. Smart & William L. Megginson, *Corporate Finance: Linking Theory to What Companies Do* 180 (3rd ed., South Western Cengage Learning 2010) (emphasis added).

Figure 4:
Effects of Portfolio Diversification



This figure shows that as stocks are added to a portfolio, the amount of firm-specific risk is reduced until it is essentially eliminated. No matter how many stocks are added, however, there remains a certain level of fixed market risk. The level of market risk will vary from firm to firm. Market risk is the only type of risk that is rewarded by the market and is thus the primary type of risk the Commission should consider when determining the allowed return.

Q. DESCRIBE HOW MARKET RISK IS MEASURED.

A. Investors who want to eliminate firm-specific risk must hold a fully diversified portfolio. To determine the amount of risk that a single stock adds to the overall market portfolio, investors measure the covariance between a single stock and the market portfolio. The result of this calculation is called "beta."[30] Beta represents the sensitivity of a given security to the market as a whole. The market portfolio of all stocks has a beta equal to one. Stocks with betas greater than 1.0 are relatively more sensitive to market risk than the average stock. For example, if the market increases (or decreases) by 1.0%, a stock with a beta of 1.5 will, on average, increase (or decrease) by 1.5%. In contrast, stocks with betas of less than 1.0 are less sensitive to market risk, such that if the market increases (or decreases) by 1.0%, a stock with a beta of 0.5 will, on average, only increase (or decrease) by 0.5%. Thus, stocks with low betas are relatively insulated from market conditions. The beta term is used in the CAPM to estimate the cost of equity, which is discussed in more detail later.[31]

Q. ARE PUBLIC UTILITIES CHARACTERIZED AS DEFENSIVE FIRMS THAT HAVE LOW BETAS, HAVE LOW MARKET RISK, AND ARE RELATIVELY INSULATED FROM OVERALL MARKET CONDITIONS?

A. Yes. Although market risk affects all firms in the market, it affects different firms to varying degrees. Firms with high betas are affected more than firms with low betas, which is why firms with high betas are riskier. Stocks with betas greater than one are generally known as "cyclical stocks." Firms in cyclical industries are sensitive to recurring patterns of recession and recovery known as the "business cycle."[32] Thus, cyclical firms are

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[30] *See* John R. Graham, Scott B. Smart & William L. Megginson, *Corporate Finance: Linking Theory to What Companies Do* 180–81 (3rd ed., South Western Cengage Learning 2010).

[31] Though it will be discussed in more detail later, Exhibit DJG-8 shows that the average beta of the proxy group was less than 1.0. This confirms the well-known concept that utilities are relatively low-risk firms.

[32] *See* Zvi Bodie, Alex Kane & Alan J. Marcus, *Essentials of Investments* 382 (9th ed., McGraw-Hill/Irwin 2013).

exposed to a greater level of market risk. Securities with betas less than one, on the other hand, are known as "defensive stocks." Companies in defensive industries, such as public utility companies, "will have low betas and performance that is comparatively unaffected by overall market conditions."[33] In fact, financial textbooks often use utility companies as prime examples of low-risk, defensive firms.[34] The figure below compares the betas of several industries and illustrates that the utility industry is one of the least risky industries in the U.S. market.[35]

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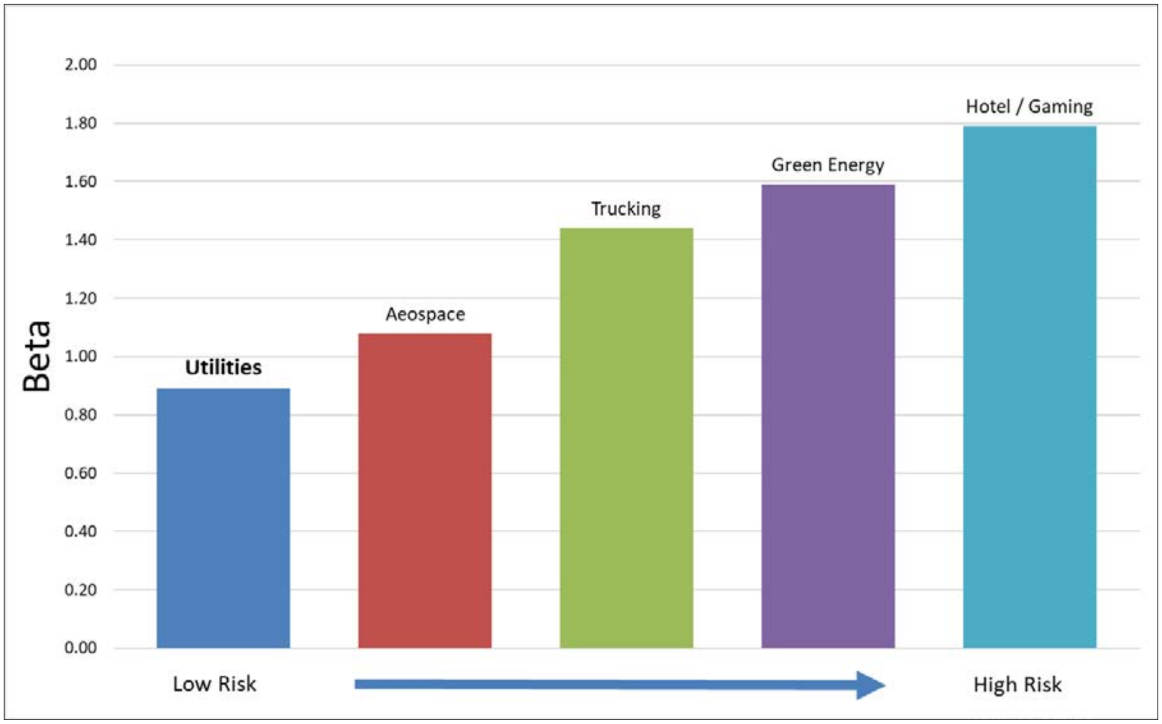
[33] Zvi Bodie, Alex Kane & Alan J. Marcus, *Essentials of Investments* 383 (9th ed., McGraw-Hill/Irwin 2013).

[34] *See e.g.*, Zvi Bodie, Alex Kane & Alan J. Marcus, *Essentials of Investments* 382 (9th ed., McGraw-Hill/Irwin 2013); *see also* Aswath Damodaran, Investment Valuation: Tools and Techniques for Determining the Value of Any Asset 196 (3rd ed., John Wiley & Sons, Inc. 2012).

[35] *See* Betas by Sector (US) at http://pages.stern.nyu.edu/~adamodar/. The exact beta calculations are not as important as illustrating the well-known fact that utilities are low-risk companies. The fact that the utility industry is one of the lowest risk industries in the country should not change from year to year.

Figure 5:
Beta by Industry



The fact that utilities are defensive firms that are exposed to little market risk is beneficial to society. When the business cycle enters a recession, consumers can be assured that their utility companies will be able to maintain normal business operations and provide safe and reliable service under prudent management. Likewise, utility investors can be confident that utility stock prices will not fluctuate widely. So, while it is preferable for utilities to be defensive firms that experience little market risk and relatively insulated from market conditions, this should also be appropriately reflected in FCG's awarded return.

VII. DCF ANALYSIS

Q. DESCRIBE THE DCF MODEL.

A. The DCF Model is based on a fundamental financial model called the "dividend discount model," which maintains that the value of a security is equal to the present value of the future cash flows it generates. Cash flows from common stock are paid to investors in the form of dividends. There are several variations of the DCF Model. These versions, along with other formulas and theories related to the DCF Model are discussed in more detail in Appendix A.

Q. DESCRIBE THE INPUTS TO THE DCF MODEL.

A. There are three primary inputs in the DCF Model: (1) stock price; (2) dividend; and (3) the sustainable growth rate. The stock prices and dividends are known inputs based on recorded data, while the growth rate projection must be estimated. I discuss each of these inputs separately below.

A. Stock Prices and Dividends

Q. HOW DID YOU DETERMINE THE STOCK PRICE INPUT OF THE DCF MODEL?

A. For the stock price (P_0), I used a 30-day average of stock prices for each company in the proxy group.[36] Analysts sometimes rely on average stock prices for longer periods (e.g., 60, 90, or 180 days). According to the efficient market hypothesis, however, markets reflect all relevant information available at a particular time, and prices adjust instantaneously to the arrival of new information.[37] Past stock prices, in essence, reflect outdated information. The DCF Model used in utility rate cases is a derivation of the dividend discount model, which is used to determine the current value of an asset. Thus, according to the dividend discount model and the efficient market hypothesis, the value for

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[36] Exhibit DJG-3.

[37] *See* Eugene F. Fama, *Efficient Capital Markets: A Review of Theory and Empirical Work,* Vol. 25, No. 2 The Journal of Finance 383 (1970).

the "P_0" term in the DCF Model should technically be the current stock price, rather than an average.

Q. WHY DID YOU USE A 30-DAY AVERAGE FOR THE CURRENT STOCK PRICE INPUT?

A. Using a short-term average of stock prices for the current stock price input adheres to market efficiency principles while avoiding any irregularities that may arise from using a single current stock price. In the context of a utility rate proceeding, there is a significant length of time from when an application is filed and testimony is due. Choosing a current stock price for one particular day could raise a separate issue concerning which day was chosen to be used in the analysis. In addition, a single stock price on a particular day may be unusually high or low. It is arguably ill-advised to use a single stock price in a model that is ultimately used to set rates for several years, especially if a stock is experiencing some volatility. Thus, it is preferable to use a short-term average of stock prices, which represents a good balance between adhering to well-established principles of market efficiency while avoiding any unnecessary contentions that may arise from using a single stock price on a given day. The stock prices I used in my DCF analysis are based on 30-day averages of adjusted closing stock prices for each company in the proxy group.[38]

[38] Exhibit DJG-3. Adjusted closing prices, rather than actual closing prices, are ideal for analyzing historical stock prices. The adjusted price provides an accurate representation of the firm's equity value beyond the mere market price because it accounts for stock splits and dividends.

Q. DESCRIBE HOW YOU DETERMINED THE DIVIDEND INPUT OF THE DCF MODEL.

A. The dividend term in the DCF Model represents dividends per share (d_0). I obtained the most recent quarterly dividend paid for each proxy company and annualized those dividends.[39]

Q. ARE THE STOCK PRICE AND DIVIDEND INPUTS FOR EACH PROXY COMPANY A SIGNIFICANT ISSUE IN THIS CASE?

A. No. Although my stock price and dividend inputs are more recent than those used by Ms. Nelson, there is not a statistically significant difference between them because utility stock prices and dividends are generally quite stable. This is another reason that cost of capital models such as the CAPM and the DCF Model are well-suited to be used for utilities. The differences between my DCF Model and Ms. Nelson's DCF Model are primarily driven by differences in our growth rate estimates, which are further discussed below.

B. Growth Rate

Q. SUMMARIZE THE GROWTH RATE INPUT IN THE DCF MODEL.

A. The most critical input in the DCF Model is the growth rate. Unlike the stock price and dividend inputs, the growth rate input (g) must be estimated. As a result, the growth rate is often the most contentious DCF input in utility rate cases. The DCF model used in this case is based on the sustainable growth valuation model. Under this model, a stock is valued by the present value of its future cash flows in the form of dividends. Before future cash flows are discounted by the cost of equity, however, they must be "grown" into the

[39] Exhibit DJG-4. Nasdaq Dividend History, http://www.nasdaq.com/quotes/dividend-history.aspx.

future by a sustainable growth rate. As stated above, one of the inherent assumptions of this model is that these cash flows in the form of dividends grow at a sustainable rate forever. For young, high-growth firms, estimating the growth rate to be used in the model can be especially difficult, and may require the use of multi-stage growth models. For mature, low-growth firms such as utilities, however, estimating the sustainable growth rate is more transparent. The growth term of the DCF Model is one of the most important, yet apparently most misunderstood, aspects of cost of equity estimations in utility regulatory proceedings. Therefore, I have devoted a more detailed explanation of this issue in the following sections, which are organized as follows:

(1) The Various Determinants of Growth;

(2) Reasonable Estimates for Long-Term Growth;

(3) Quantitative vs. Qualitative Determinants of Utility Growth: Circular References, "Flatworm" Growth, and the Problem with Analysts' Growth Rates; and

(4) Growth Rate Recommendation.

1. <u>The Various Determinants of Growth</u>

Q. DESCRIBE THE VARIOUS DETERMINANTS OF GROWTH.

A. Although the DCF Model directly considers the growth of dividends, there are a variety of growth determinants that should be considered when estimating growth rates. It should be noted that these various growth determinants are used primarily to determine the short-term growth rates in multi-stage DCF models. For utility companies, it is necessary to focus primarily on a long-term growth rate in dividends. This is also known as a "sustainable" growth rate, since this is the growth rate assumed for the company's dividends in perpetuity. That is not to say that these growth determinants cannot be considered when estimating sustainable growth; however, as discussed below, sustainable growth must be constrained much more than short-term growth, especially for young firms with high growth opportunities. Additionally, I briefly discuss these growth determinants here because it may reveal some of the source of confusion in this area.

A. Historical Growth

Looking at a firm's actual historical experience may theoretically provide a good starting point for estimating short-term growth. However, past growth is not always a good indicator of future growth. Some metrics that might be considered here are a historical growth in revenues, operating income, and net income. Since dividends are paid from earnings, estimating historical earnings growth may provide an indication of future earnings and dividend growth. In general, however, revenue growth tends to be more consistent and predictable than earnings growth because it is less likely to be influenced by accounting adjustments.[40]

B. Analyst Growth Rates

Analyst growth rates refer to short-term projections of earnings growth published by institutional research analysts such as Value Line and Bloomberg. A more detailed discussion of analyst growth rates, including the problems with using them in the DCF Model to estimate utility cost of equity, is provided in a later section.

[40] *See* Aswath Damodaran, *Investment Valuation: Tools and Techniques for Determining the Value of Any Asset* 279 (3rd ed., John Wiley & Sons, Inc. 2012).

C. Fundamental Determinants of Growth

Fundamental growth determinants refer to firm-specific financial metrics that arguably provide better indications of near-term sustainable growth. One such metric for fundamental growth considers the return on equity and the retention ratio. The idea behind this metric is that firms with high ROEs and retention ratios should have greater opportunities for growth.[41]

Q. DID YOU USE ANY OF THESE GROWTH DETERMINANTS IN YOUR DCF MODEL?

A. No. Primarily, these growth determinants discussed above would provide better indications of short- to mid-term growth for firms with average to high growth opportunities. Utilities, however, are mature, low-growth firms. While it may not be unreasonable on its face to use any of these growth determinants for the growth input in the DCF Model, we must keep in mind that the stable growth DCF Model considers only sustainable growth rates, which are constrained by certain economic factors, as discussed further below.

2. Reasonable Estimates for Sustainable Growth

Q. DESCRIBE WHAT IS MEANT BY SUSTAINABLE GROWTH.

A. In order to make the DCF Model a viable, practical model, an infinite stream of future cash flows must be estimated and then discounted back to the present. Otherwise, each annual cash flow would have to be estimated separately. Some analysts use "multi-stage" DCF

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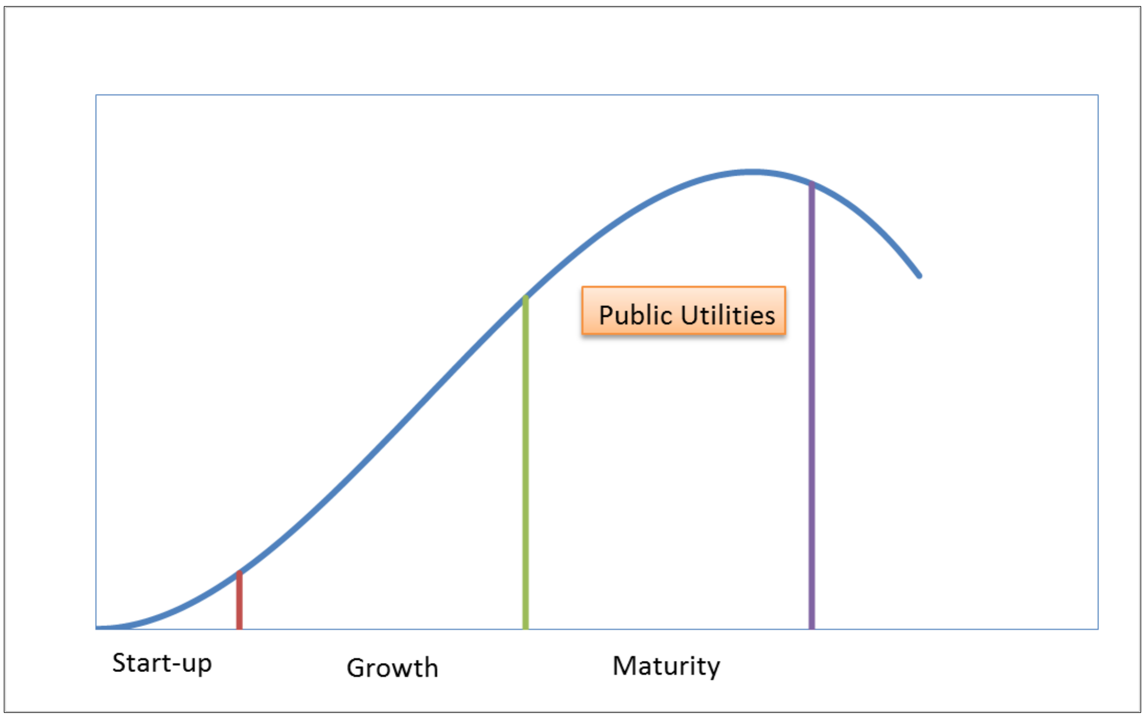
[41] Aswath Damodaran, *Investment Valuation: Tools and Techniques for Determining the Value of Any Asset* 279 (3rd ed., John Wiley & Sons, Inc. 2012).

Models to estimate the value of high-growth firms through two or more stages of growth, with the final stage of growth being sustainable. However, it is not necessary to use multi-stage DCF Models to analyze the cost of equity of regulated utility companies. This is because regulated utilities are already in their "sustainable," low growth stage. Unlike most competitive firms, the growth of regulated utilities is constrained by physical service territories and limited primarily by ratepayer and load growth within those territories. The figure below illustrates the well-known business/industry life-cycle pattern.

Figure 6:
Industry Life Cycle



In an industry's early stages, there are ample opportunities for growth and profitable reinvestment. In the maturity stage however, growth opportunities diminish, and firms choose to pay out a larger portion of their earnings in the form of dividends instead of reinvesting them in operations to pursue further growth opportunities. Once a firm is in the maturity stage, it is not necessary to consider higher short-term growth metrics in multi-stage DCF Models; rather, it is sufficient to analyze the cost of equity using a stable growth DCF Model with one sustainable, sustainable growth rate.

Q. IS IT TRUE THAT THE SUSTAINABLE GROWTH RATE CANNOT EXCEED THE GROWTH RATE OF THE ECONOMY, ESPECIALLY FOR A REGULATED UTILITY COMPANY?

A. Yes. A fundamental concept in finance is that no firm can grow forever at a rate higher than the growth rate of the economy in which it operates.[42] Thus, the sustainable growth rate used in the DCF Model should not exceed the aggregate economic growth rate. This is especially true when the DCF Model is conducted on public utilities because these firms have defined service territories. As stated by Dr. Damodaran: "[i]f a firm is a purely domestic company, either because of internal constraints . . . or external constraints (such as those imposed by a government), the growth rate in the domestic economy will be the limiting value."[43]

In fact, it is reasonable to assume that a regulated utility would grow at a rate that is <u>less</u> than the U.S. economic growth rate. Unlike competitive firms, which might increase their growth by launching a new product line, franchising, or expanding into new and developing markets, utility operating companies with defined service territories cannot do any of these things to grow. Gross Domestic Product ("GDP") is one of the most widely used measures

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[42] *See* Aswath Damodaran, *Investment Valuation: Tools and Techniques for Determining the Value of Any Asset* 306 (3rd ed., John Wiley & Sons, Inc. 2012).

[43] Aswath Damodaran, *Investment Valuation: Tools and Techniques for Determining the Value of Any Asset* 306 (3rd ed., John Wiley & Sons, Inc. 2012).

of economic production and is used to measure aggregate economic growth. According to the Congressional Budget Office's 2021 Long-Term Budget Outlook, the long-term forecast for nominal U.S. GDP growth is 3.8%.[44]

Q. IS IT REASONABLE TO ASSUME THAT THE SUSTAINABLE GROWTH RATE WILL NOT EXCEED THE RISK-FREE RATE?

A. Yes. In the long term, the risk-free rate will converge on the growth rate of the economy. For this reason, financial analysts sometimes use the risk-free rate for the sustainable growth rate value in the DCF model.[45] I discuss the risk-free rate in further detail later in this testimony.

Q. PLEASE SUMMARIZE THE VARIOUS SUSTAINABLE GROWTH RATE ESTIMATES THAT CAN BE USED AS THE SUSTAINABLE GROWTH RATE IN THE DCF MODEL.

A. The reasonable sustainable growth rate determinants are summarized as follows:

1. Nominal GDP Growth;
2. Real GDP Growth; and
3. Current Risk-Free Rate.

Any of the foregoing growth determinants could provide a basis for a reasonable input for the sustainable growth rate in the DCF Model for a utility company, including FCG.

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[44] Congressional Budget Office, The 2021 Long-Term Budget Outlook, https://www.cbo.gov/publication/56977.

[45] Aswath Damodaran, *Investment Valuation: Tools and Techniques for Determining the Value of Any Asset* 307 (3rd ed., John Wiley & Sons, Inc. 2012).

3. <u>Qualitative Growth: The Problem with Analysts' Growth Rates</u>

Q. DESCRIBE THE DIFFERENCES BETWEEN "QUANTITATIVE" AND "QUALITATIVE" GROWTH DETERMINANTS.

A. Assessing "quantitative" growth simply involves mathematically calculating a historic metric for growth (such as revenues or earnings) or calculating various fundamental growth determinants using certain figures from a firm's financial statements (such as ROE and the retention ratio). However, any thorough assessment of company growth should be based upon a "qualitative" analysis. Such an analysis would consider specific strategies that company management will implement to achieve real sustainable growth in earnings. Therefore, it is important to begin the analysis of FCG's growth rate with this simple, qualitative question: how is this regulated utility going to achieve a real sustained growth in earnings? If this question were asked of a competitive firm, there could be several answers depending on the type of business model, such as launching a new product line, franchising, rebranding to target a new demographic, or expanding into a developing market. Regulated utilities, however, cannot engage in these potential growth opportunities.

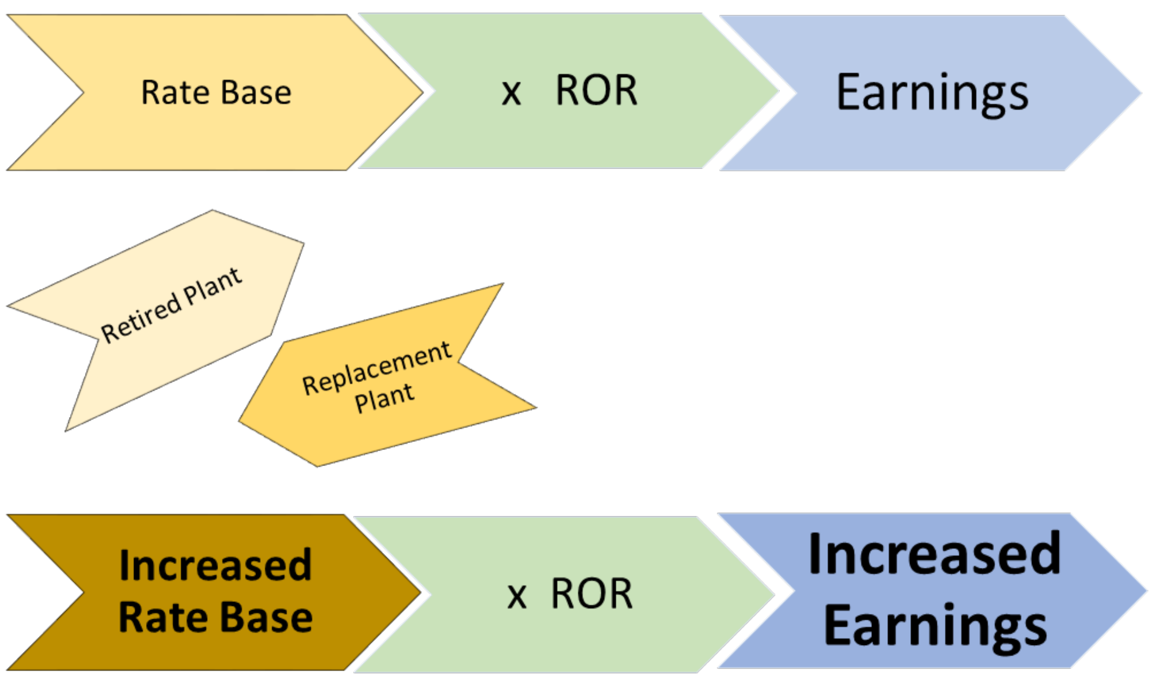
Q. WHY IS IT ESPECIALLY IMPORTANT TO EMPHASIZE REAL, QUALITATIVE GROWTH DETERMINANTS WHEN ANALYZING WHETHER A GROWTH RATE IS FAIR FOR A REGULATED UTILITY?

A. While qualitative growth analysis is important regardless of the entity being analyzed, it is especially important in the context of utility ratemaking. This is because the rate base rate of return model inherently possesses two factors that can contribute to distorted views of utility growth when considered exclusively from a quantitative perspective. These two factors are: (1) rate base and (2) the awarded ROE. I will discuss each factor further below. It is important to keep in mind that the ultimate objective of this analysis is to provide a foundation upon which to base the fair rate of return for the utility. Thus, we should strive to ensure that each individual component of the financial models used to estimate the cost of equity are also fair. If we consider only quantitative growth determinants, it may lead to projected growth rates that are overstated and ultimately unfair, because they result in inflated cost of equity estimates.

Q. HOW DOES RATE BASE RELATE TO GROWTH DETERMINANTS FOR UTILITIES?

A. Under the rate base rate of return model, a utility's rate base is multiplied by its awarded rate of return to produce the required level of operating income. Therefore, increases to rate base generally result in increased earnings. Thus, utilities have a natural financial incentive to increase rate base. In short, utilities have a financial incentive to increase rate base regardless of whether such increases are driven by a corresponding increase in demand. A good, relevant example of this is seen in the early retirement of old, but otherwise functional coal plants in response to environmental regulations and replacing them with new generation assets. Under these circumstances, utilities have been able to increase their rate base by a far greater extent than what any concurrent increase in demand would have required. In other words, utilities grew their earnings by simply retiring old assets and replacing them with new assets. This is not "real" or "sustainable" growth. If the tail of a flatworm is removed and regenerated, it does not mean the flatworm actually grew. Likewise, if a competitive, unregulated firm announced plans to close production plants and replace them with new plants, it would not be considered a real determinant of growth unless analysts believed this decision would directly result in increased market share for the company and a real opportunity for sustained increases in revenues and earnings. In the case of utilities, the mere replacement of "old plant" with "new plant" does not increase market share, attract new ratepayers, create franchising opportunities, or allow utilities to penetrate developing markets, but may result in short-term, quantitative earnings growth. However, this "flatworm growth" in earnings was merely the quantitative byproduct of the rate base rate of return model, and not an indication of real or qualitative growth. Therefore, using that data alone to estimate a growth rate is not fair. The following diagram in the figure below illustrates this concept.

Figure 7:
Analysts' Earnings Growth Projections: The "Flatworm Growth" Problem

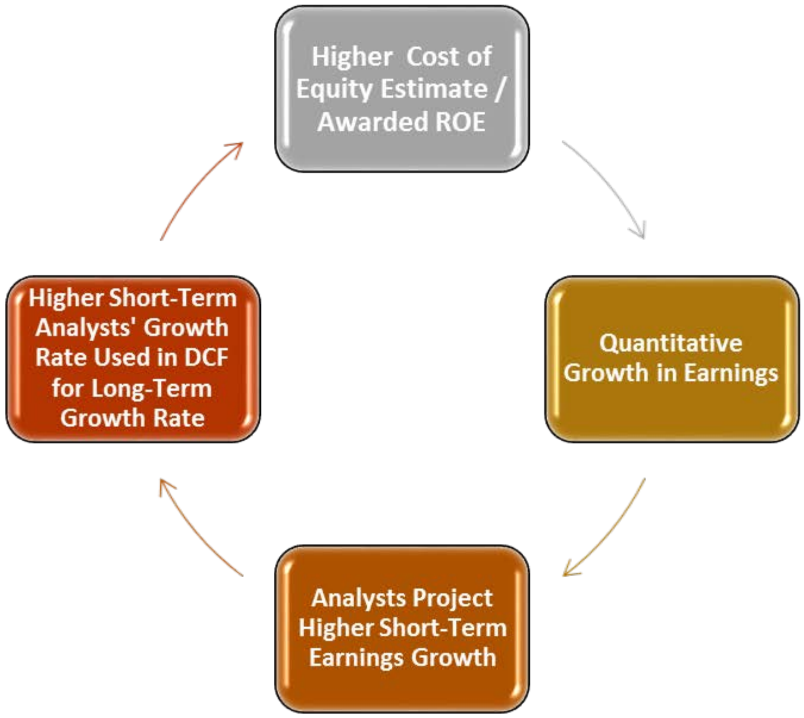


Of course, utilities might sometimes add "new plant" to meet a modest growth in ratepayer demand. However, as the foregoing discussion demonstrates, it would be more appropriate to consider load growth projections and other qualitative indicators, rather than mere increases to rate base or earnings, to attain a fair assessment of growth.

Q. PLEASE DISCUSS THE OTHER WAY IN WHICH ANALYSTS' EARNINGS GROWTH PROJECTIONS DO NOT PROVIDE INDICATIONS OF REAL, QUALITATIVE GROWTH FOR REGULATED UTILITIES.

A. If we give undue weight to analysts' projections for utilities' earnings growth, it will not provide an accurate reflection of real, qualitative growth because a utility's earnings are heavily influenced by the ultimate figure that all this analysis is supposed to help us estimate: the awarded return on equity. This creates a circular reference problem or feedback loop. In other words, if a regulator awards an ROE that is above market-based cost of capital (which is often the case, as discussed above), this could lead to higher short-term growth rate projections from analysts. If these same inflated, short-term growth rate estimates are used in the DCF Model (as they often are by utility witnesses), it could lead to higher awarded ROEs; and the cycle continues, as illustrated in the figure below.

Figure 8:
Analysts' Earnings Growth Projections: The "Circular Reference" Problem



Therefore, it is not advisable to simply consider the quantitative growth projections published by analysts, as this practice will not necessarily provide fair indications of real, sustainable utility growth.

Q. ARE THERE ANY OTHER PROBLEMS WITH RELYING ON ANALYSTS' GROWTH PROJECTIONS?

A. Yes. While the foregoing discussion shows two reasons why we cannot rely on analysts' growth rate projections to provide fair, qualitative indicators of utility growth in a stable growth DCF Model, the third reason is perhaps the most obvious and undisputable. Various institutional analysts—such as Zacks, Value Line, and Bloomberg—publish estimated projections of earnings growth for utilities. These estimates are short-term growth rate projections, ranging from 3 to 10 years. However, many utility ROE analysts inappropriately insert these short-term growth projections into the DCF Model as if they were *long-term* growth rate projections. For example, assume that an analyst at Bloomberg estimates that a utility's earnings will grow by 7% per year over the next 3 years. This analyst may have based this short-term forecast on a utility's plans to replace depreciated rate base (*i.e.*, "flatworm" growth) or on an anticipated awarded return that is above market-based cost of equity (*i.e.*, the "circular reference" problem). When a utility witness uses this figure in a DCF Model, however, it is the witness, not the Bloomberg analyst, who is testifying to the regulator that the utility's earnings will qualitatively grow by 7% per year over the long-term, which is an unrealistic assumption and a fundamentally different conclusion than that of the Bloomberg analyst.

Q. DO THE LIMITED GROWTH OPPORTUNITIES YOU DISCUSSED APPLY TO BOTH ELECTRIC AND GAS UTILITIES?

A. Yes. I have conducted cost of capital analyses on many gas and electric utilities, which always include a growth rate analysis under the DCF model. In my experience, the growth rates of firm-specific growth indicators, such as load growth and customer growth for both gas and electric utilities, have annual growth rates that are typically less than 1%, and are sometimes even negative.

4. <u>Sustainable Growth Rate Recommendation</u>

Q. DESCRIBE THE GROWTH RATE INPUT USED IN YOUR DCF MODEL.

A. I considered various qualitative determinants of growth for FCG, along with the maximum allowed growth rate under basic principles of finance and economics. The following chart in the figure below summarizes the sustainable growth determinants discussed in this section.[46]

Figure 9:
Sustainable Growth Rate Determinants[47]

Sustainable Growth Determinants	Rate
Nominal GDP	3.8%
Real GDP	1.8%
Risk Free Rate	3.2%
Highest	**3.8%**

For the sustainable growth rate in my DCF model, I selected the maximum, reasonable sustainable growth rate of 3.8%, which means my model assumes that FCG's qualitative growth in earnings will qualitatively match the nominal growth rate of the entire U.S. economy over the long run – a charitable assumption.

Q. WHAT ARE THE RESULTS OF YOUR DCF MODEL USING A SUSTAINABLE GROWTH RATE?

A. Using a sustainable growth rate equal to long-term GDP growth projections, the DCF indicates of cost of equity of 7.1% for FCG.[48]

[46] Exhibit DJG-5.

[47] Exhibit DJG-5.

[48] Exhibit DJG-6.

Q. DID YOU ALSO CONDUCT A DCF ANALYSIS THAT CONSIDERS ANALYSTS' SHORT-TERM GROWTH RATE ESTIMATES FOR THE SUSTAINABLE GROWTH RATE INPUT?

A. Yes. Despite my criticisms of using short-term analysts' growth rate projections for the sustainable growth rate input of the DCF Model, I also conducted a DCF analysis with such an assumption in the event the Commission would like to understand the sensitivity impact of this variable on the results.

Q. WHAT ARE THE RESULTS OF YOUR DCF MODEL USING ANALYSTS' SHORT-TERM GROWTH RATES?

A. Using analysts' unreasonably high short-term growth rates in the DCF model, I calculate a result of 8.0% for information purposes only as I do not recommend this result should be considered at all.[49]

C. Response to Ms. Nelson's DCF Model

Q. MS. NELSON'S DCF MODEL YIELDED A NOTABLY HIGHER RESULT. DID YOU FIND ANY PROBLEMS WITH HER ANALYSIS?

A. Yes. Ms. Nelson's DCF Model produced cost of equity result as high as 11.2%.[50] The results of Ms. Nelson's DCF Model are overstated primarily because of her use of non-sustainable and unreasonably high growth rates.

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[49] Exhibit DJG-6.

[50] Exhibit JEN-2.

Q. DESCRIBE THE PROBLEMS WITH MS. NELSON'S ASSUMED SUSTAINABLE GROWTH INPUT.

A. Ms. Nelson assumes long-term growth rates as high as 10.5% in her DCF Model.[51] This is more than two times the projected annual long-term nominal U.S. GDP growth. This means Ms. Nelson's growth rate assumption violates the basic principle that no company can grow at a greater rate than the economy in which it operates *over the long-term*, especially a regulated utility company with a defined service territory. Furthermore, Ms. Nelson relies on short-term, quantitative growth estimates published by analysts to support her assumptions. A short-term period, such as the 3-5 year period often assumed in analysts' growth rate projections, is not sufficient for a sustainable growth estimate. As discussed above, these analysts' estimates are inappropriate to use in the DCF Model as sustainable growth rates because they are estimates for short-term growth. For example, Ms. Nelson assumes a sustainable growth rate estimate of 10.5% for NiSource Inc. (among other estimates), as reported by Value Line Investment Survey.[52] This means that an analyst at Value Line apparently thinks that NiSource's earnings will quantitatively increase by 10.5% each year over the next several years (*i.e.*, the short-term). However, it is Ms. Nelson, not the commercial analyst, who is suggesting to the Commission that NiSource's earnings will increase by 10.5% (more than twice the level of projected U.S. GDP growth) each year, every year, in perpetuity. Again, Ms. Nelson is extrapolating the analyst's conclusions well beyond what the analyst actually projects. Furthermore, this

[51] *Id*.

[52] Exhibit JEN-2.

assumption is simply not realistic, and it contradicts fundamental concepts of sustainable growth. Many of Ms. Nelson's other short-term growth rate estimates also exceed projected U.S. GDP growth.

VIII. <u>CAPM ANALYSIS</u>

Q. DESCRIBE THE CAPM.

A. The CAPM is a market-based model founded on the principle that investors expect higher returns for incurring additional risk.[53] The CAPM estimates this expected return. The various assumptions, theories, and equations involved in the CAPM are discussed further in Appendix B. Using the CAPM to estimate the cost of equity of a regulated utility is consistent with the legal standards governing the fair rate of return. The U.S. Supreme Court has recognized that "the amount of risk in the business is a most important factor" in determining the allowed rate of return,[54] and that "the return to the equity owner should be commensurate with returns on investments in other enterprises having corresponding risks."[55] The CAPM is a useful model because it directly considers the amount of risk inherent in a business.

Q. DESCRIBE THE INPUTS FOR THE CAPM.

A. The basic CAPM equation requires only three inputs to estimate the cost of equity: (1) the risk-free rate; (2) the beta coefficient; and (3) the equity risk premium. Here is the CAPM formula:

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[53] William F. Sharpe, *A Simplified Model for Portfolio Analysis* 277–93 (Management Science IX 1963).

[54] *Wilcox*, 212 U.S. at 48.

[55] *Hope Natural Gas Co.*, 320 U.S. at 603.

Equation 2:
Basic CAPM

$$\textbf{Cost of Equity} = \textbf{Risk-free Rate} + (\textbf{Beta} \times \textbf{Equity Risk Premium})$$

Each input is discussed separately below.

A. <u>The Risk-Free Rate</u>

Q. EXPLAIN THE RISK-FREE RATE.

A. The first term in the CAPM is the risk-free rate (R_F). The risk-free rate is simply the level of return investors can achieve without assuming any risk. The risk-free rate represents the bare minimum return that any investor would require on a risky asset. Even though no investment is technically void of risk, investors often use U.S. Treasury securities to represent the risk-free rate because they accept that those securities essentially contain no default risk. The Treasury issues securities with different maturities, including short-term Treasury bills, intermediate-term Treasury notes, and long-term Treasury bonds.

Q. IS IT PREFERABLE TO USE THE YIELD ON LONG-TERM TREASURY BONDS FOR THE RISK-FREE RATE IN THE CAPM?

A. Yes. In valuing an asset, investors estimate cash flows over long periods of time. Common stock is viewed as a long-term investment, and the cash flows from dividends are assumed to last indefinitely. Thus, short-term Treasury bill yields are rarely used in the CAPM to represent the risk-free rate. Short-term rates are subject to greater volatility and thus can lead to unreliable estimates. Instead, long-term Treasury bonds are usually used to represent the risk-free rate in the CAPM. I considered a 30-day average of daily Treasury yield curve rates on 30-year Treasury bonds in my risk-free rate estimate, which resulted in a risk-free rate of 3.2%.[56]

B. The Beta Coefficient

Q. HOW IS THE BETA COEFFICIENT USED IN THIS MODEL?

A. As discussed above, beta represents the sensitivity of a given security to movements in the overall market. The CAPM states that in efficient capital markets, the expected risk premium on each investment is proportional to its beta. Recall that a security with a beta greater (or less) than one is more (or less) risky than the market portfolio. An index such as the S&P 500 Index is used as a proxy for the market portfolio. The historical betas for publicly traded firms are published by various institutional analysts. Beta may also be calculated through a linear regression analysis, which provides additional statistical information about the relationship between a single stock and the market portfolio. As discussed above, beta also represents the sensitivity of a given security to the market as a whole. The market portfolio of all stocks has a beta equal to one. Stocks with betas greater than 1.0 are relatively more sensitive to market risk than the average stock. For example, if the market increases (or decreases) by 1.0%, a stock with a beta of 1.5 will, on average, increase (or decrease) by 1.5%. In contrast, stocks with betas of less than 1.0 are less sensitive to market risk. For example, if the market increases (or decreases) by 1.0%, a stock with a beta of 0.5 will, on average, only increase (or decrease) by 0.5%.

[56] Exhibit DJG-7.

Q. DESCRIBE THE SOURCE FOR THE BETAS YOU USED IN YOUR CAPM ANALYSIS.

A. I used betas recently published by Value Line Investment Survey. The average beta for the proxy group is less than 1.0. Thus, this is an objective measure to prove the well-known concept that utility stocks are generally less risky than the average stock in the market. While there is evidence suggesting that betas published by sources such as Value Line may actually overestimate the risk of utilities (and thus overestimate the CAPM), I used the betas published by Value Line to be conservative.[57]

C. The Equity Risk Premium

Q. DESCRIBE THE EQUITY RISK PREMIUM (ERP).

A. The final term of the CAPM is the ERP, which is the required return on the market portfolio less the risk-free rate ($R_M – R_F$). In other words, the ERP is the level of return investors expect above the risk-free rate in exchange for investing in risky securities. Many experts would agree that "the single most important variable for making investment decisions is the equity risk premium."[58] Likewise, the ERP is arguably the single most important factor in estimating the cost of capital in this matter. There are three basic methods that can be used to estimate the ERP: (1) calculating a historical average; (2) taking a survey of experts; and (3) calculating the implied ERP. I will discuss each method in turn, noting advantages and disadvantages of these methods.

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[57] Exhibit DJG-8; *see also* Appendix B for a more detailed discussion of raw beta calculations and adjustments.

[58] Elroy Dimson, Paul Marsh & Mike Staunton, *Triumph of the Optimists: 101 Years of Global Investment Returns* 4 (Princeton University Press 2002).

1. Historical Average

Q. DESCRIBE THE HISTORICAL ERP.

A. The historical ERP may be calculated by simply taking the difference between returns on stocks and returns on government bonds over a certain period of time. Many practitioners rely on the historical ERP as an estimate for the forward-looking ERP because it is easy to obtain. However, there are disadvantages to relying on the historical ERP.

Q. WHAT ARE THE LIMITATIONS OF RELYING SOLELY ON A HISTORICAL AVERAGE TO ESTIMATE THE CURRENT OR FORWARD-LOOKING ERP?

A. Many investors use the historic ERP because it is convenient and easy to calculate. What matters in the CAPM model, however, is not the actual risk premium from the past, but rather the current and forward-looking risk premium.[59] Some investors may think that a historic ERP provides some indication of the prospective risk premium; however, there is empirical evidence to suggest the prospective, forward-looking ERP is actually lower than the historical ERP. In a landmark publication on risk premiums around the world, *Triumph of the Optimists*, the authors suggest through extensive empirical research that the prospective ERP is lower than the historical ERP.[60] This is due in large part to what is known as "survivorship bias" or "success bias" – a tendency for failed companies to be excluded from historical indices.[61] From their extensive analysis, the authors make the

[59] *See* John R. Graham, Scott B. Smart & William L. Megginson, *Corporate Finance: Linking Theory to What Companies Do* 330 (3rd ed., South Western Cengage Learning 2010).

[60] *See* John R. Graham, Scott B. Smart & William L. Megginson, *Corporate Finance: Linking Theory to What Companies Do* 194 (3rd ed., South Western Cengage Learning 2010).

[61] Elroy Dimson, Paul Marsh & Mike Staunton, *Triumph of the Optimists: 101 Years of Global Investment Returns* 34 (Princeton University Press 2002).

following conclusion regarding the prospective ERP: "[t]he result is a forward-looking, geometric mean risk premium for the United States . . . of around 2½ to 4 percent and an arithmetic mean risk premium . . . that falls within a range from a little below 4 to a little above 5 percent."[62] Indeed, these results are lower than many reported historical risk premiums. Other noted experts agree:

> The historical risk premium obtained by looking at U.S. data is biased upwards because of survivor bias. . . . The true premium, it is argued, is much lower. This view is backed up by a study of large equity markets over the twentieth century (*Triumph of the Optimists*), which concluded that the historical risk premium is closer to 4%.[63]

Regardless of the variations in historic ERP estimates, many scholars and practitioners agree that simply relying on a historic ERP to estimate the risk premium going forward is not ideal. Fortunately, "a naïve reliance on long-run historical averages is not the only approach for estimating the expected risk premium."[64]

Q. DID YOU RELY ON THE HISTORICAL ERP AS PART OF YOUR CAPM ANALYSIS IN THIS CASE?

A. No. Due to the limitations of this approach, I relied on the ERP reported in expert surveys and the implied ERP method discussed below.

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[62] Elroy Dimson, Paul Marsh & Mike Staunton, *Triumph of the Optimists: 101 Years of Global Investment Returns* 194 (Princeton University Press 2002).

[63] Aswath Damodaran, *Equity Risk Premiums: Determinants, Estimation and Implications – The 2015 Edition* 17 (New York University 2015).

[64] *See* John R. Graham, Scott B. Smart & William L. Megginson, *Corporate Finance: Linking Theory to What Companies Do* 330 (3rd ed., South Western Cengage Learning 2010).

2. **Expert Surveys**

Q. DESCRIBE THE EXPERT SURVEY APPROACH TO ESTIMATING THE ERP.

A. As its name implies, the expert survey approach to estimating the ERP involves conducting a survey of experts including professors, analysts, chief financial officers, and other executives around the country and asking them what they think the ERP is. The IESE Business School conducts such a survey each year. Their 2022 expert survey reported an average ERP of 5.6%.[65]

3. **Implied ERP**

Q. DESCRIBE THE IMPLIED ERP APPROACH.

A. The third method of estimating the ERP is arguably the best. The implied ERP relies on the stable growth model proposed by Gordon, often called the "Gordon Growth Model," which is a basic stock valuation model widely used in finance for many years.[66] This model is a mathematical derivation of the DCF Model. In fact, the underlying concept in both models is the same: the current value of an asset is equal to the present value of its future cash flows. Instead of using this model to determine the discount rate of one company, one can use it to determine the discount rate for the entire market by substituting the inputs of the model. Specifically, instead of using the current stock price (P_0), one will use the current value of the S&P 500 (V_{500}). Similarly, instead of using the dividends of a single

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[65] Pablo Fernandez, Pablo Linares & Isabel F. Acin, *Market Risk Premium used in 171 Countries in 2016: A Survey with 6,932 Answers*, at 3 (IESE Business School 2015), copy available at http://www.valumonics.com/wp-content/uploads/2017/06/Discount-rate-Pablo-Fern%C3%A1ndez.pdf. IESE Business School is the graduate business school of the University of Navarra. IESE offers Master of Business Administration (MBA), Executive MBA and Executive Education programs. IESE is consistently ranked among the leading business schools in the world.

[66] Myron J. Gordon and Eli Shapiro, *Capital Equipment Analysis: The Required Rate of Profit* 102–10 (Management Science Vol. 3, No. 1 Oct. 1956).

firm, one will consider the dividends paid by the entire market. Additionally, one should consider potential dividends. In other words, stock buybacks should be considered in addition to paid dividends, as stock buybacks represent another way for the firm to transfer free cash flow to shareholders. Focusing on dividends alone without considering stock buybacks could understate the cash flow component of the model, and ultimately understate the implied ERP. The market dividend yield plus the market buyback yield gives us the gross cash yield to use as our cash flow in the numerator of the discount model. This gross cash yield is increased each year over the next five years by the growth rate. These cash flows must be discounted to determine their present value. The discount rate in each denominator is the risk-free rate (R_F) plus the discount rate (K). The following formula shows how the implied return is calculated. Since the current value of the S&P is known, one can solve for K: the implied market return.[67]

Equation 3:
Implied Market Return

$$V_{500} = \frac{CY_1(1+g)^1}{(1+R_F+K)^1} + \frac{CY_2(1+g)^2}{(1+R_F+K)^2} + \cdots + \frac{CY_5(1+g)^5 + TV}{(1+R_F+K)^5}$$

where:

where:	V_{500}	=	*current value of index (S&P 500)*
	$CY_{1\text{-}5}$	=	*average cash yield over last ten years (includes dividends and buybacks)*
	g	=	*compound growth rate in earnings over last five years*
	R_F	=	*risk-free rate*
	K	=	*implied market return (this is what we are solving for)*
	TV	=	*terminal value* $= CY_5\,(1+R_F)\,/\,K$

The discount rate is called the "implied" return here because it is based on the current value of the index as well as the value of free cash flow to investors projected over the next five years. Thus, based on these inputs, the market is "implying" the expected return; or in

[67] *See* Exhibit DJG-9 for detailed calculation.

other words, based on the current value of all stocks (the index price), and the projected value of future cash flows, the market is telling us the return expected by investors for investing in the market portfolio. After solving for the implied market return (K), one simply subtracts the risk-free rate from it to arrive at the implied ERP.

Equation 4:
Implied Equity Risk Premium

$$Implied\ Expected\ Market\ Return - R_F = Implied\ ERP$$

Q. DISCUSS THE RESULTS OF YOUR IMPLIED ERP CALCULATION.

A. After collecting data for the index value, operating earnings, dividends, and buybacks for the S&P 500 over the past six years, I calculated the dividend yield, buyback yield, and gross cash yield for each year. I also calculated the compound annual growth rate (g) from operating earnings. I used these inputs, along with the risk-free rate and current value of the index to calculate a current expected return on the entire market of 9.0%. I subtracted the risk-free rate to arrive at the implied equity risk premium of 5.8%.[68] Dr. Damodaran, one of the world's leading experts on the ERP, promotes the implied ERP method discussed above. He calculates monthly and annual implied ERPs with this method and publishes his results. Dr. Damodaran's average ERP estimate for May 2022 using several implied ERP variations was 5.6%.[69]

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[68] Exhibit DJG-9.

[69] Aswath Damodaran, *Implied Equity Risk Premium Update,* DAMODARAN ONLINE http://pages.stern.nyu.edu/~adamodar/.

Q. WHAT ARE THE RESULTS OF YOUR FINAL ERP ESTIMATE?

A. For the final ERP estimate I used in my CAPM analysis, I considered the results of the ERP surveys along with the implied ERP calculations and the ERP reported by Kroll (formerly Duff & Phelps).[70] The results are presented in the following figure:

Figure 10:
Equity Risk Premium Results

IESE Business School Survey	5.6%
Duff & Phelps Report	5.5%
Damodaran (average)	5.6%
Garrett	5.8%
Average	**5.6%**

The average ERP from these sources is 5.6%.

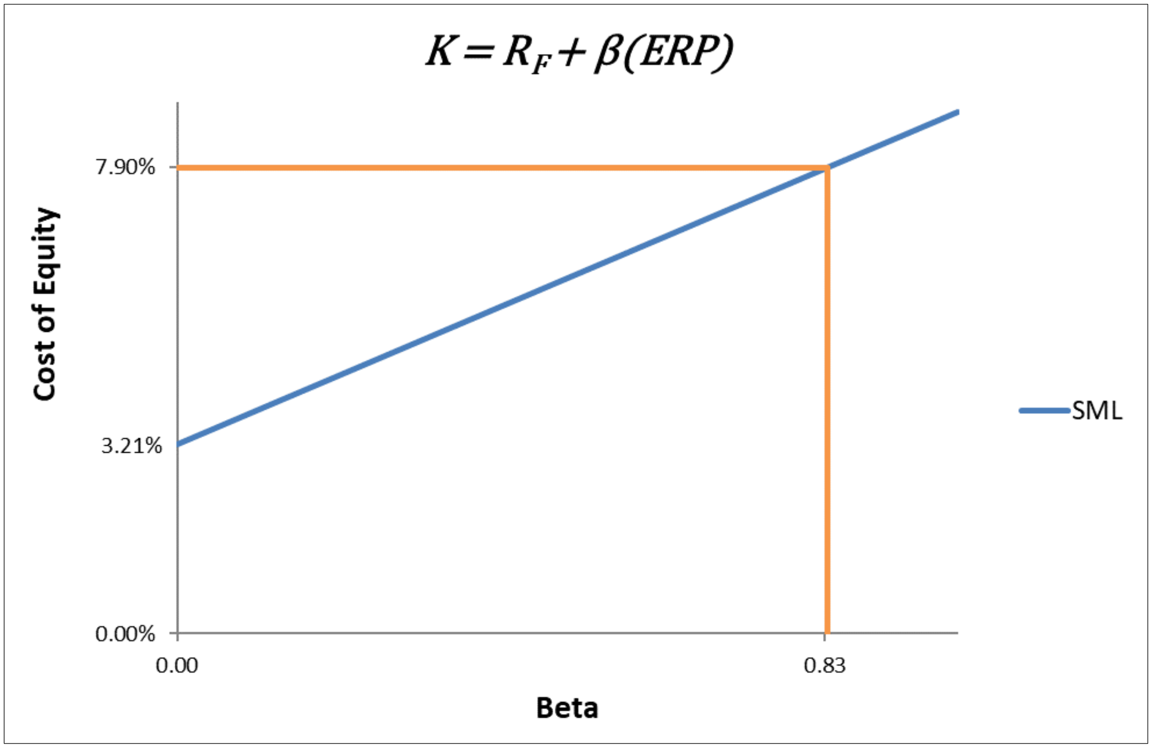
Q. PLEASE EXPLAIN THE FINAL RESULTS OF YOUR CAPM ANALYSIS.

A. Using the inputs for the risk-free rate, beta coefficient, and ERP discussed above, I estimate that FCG's CAPM cost of equity is 7.9%.[71] The CAPM may be displayed graphically through what is known as the Security Market Line ("SML"). The following figure shows the expected return (cost of equity) on the y-axis, and the average beta for the proxy group on the x-axis. The SML intercepts the y-axis at the level of the risk-free rate. The slope of the SML is the equity risk premium.

[70] Exhibit DJG-10.

[71] Exhibit DJG-11.

Figure 11:
CAPM Graph



The SML provides the rate of return that will compensate investors for the beta risk of that investment. Thus, at an average beta of 0.83 for the proxy group, the estimated CAPM cost of equity for FCG is 7.9%.

D. <u>Response to Ms. Nelson's CAPM Analysis</u>

Q. MS. NELSON'S CAPM ANALYSIS YIELDS NOTABLY HIGHER RESULTS. DID YOU FIND SPECIFIC PROBLEMS WITH MS. NELSON'S CAPM ASSUMPTIONS AND INPUTS?

A. Yes, I did. Ms. Nelson estimates a CAPM cost of equity as high as 12.9%.[72] The results of Ms. Nelson's CAPM are unreasonably high primarily due to her overestimation of the ERP. In addition, Ms. Nelson conducts an empirical CAPM analysis, which is based on a questionable premise and also suffers from the same unrealistic ERP input.

1. <u>Equity Risk Premium</u>

Q. DID MS. NELSON RELY ON A REASONABLE MEASURE FOR THE ERP?

A. No, she did not. Ms. Nelson used an input of as high as 12.27% for the ERP, which is not realistic.[73] The ERP is one of three inputs in the CAPM equation, and it is one of the most important factors for estimating the cost of equity in this case. As discussed above, I used three widely accepted methods for estimating the ERP, including consulting expert surveys, calculating the implied ERP based on aggregate market data, and considering the ERPs published by reputable analysts. The <u>highest</u> ERP found from my research and analysis is only 5.8%.

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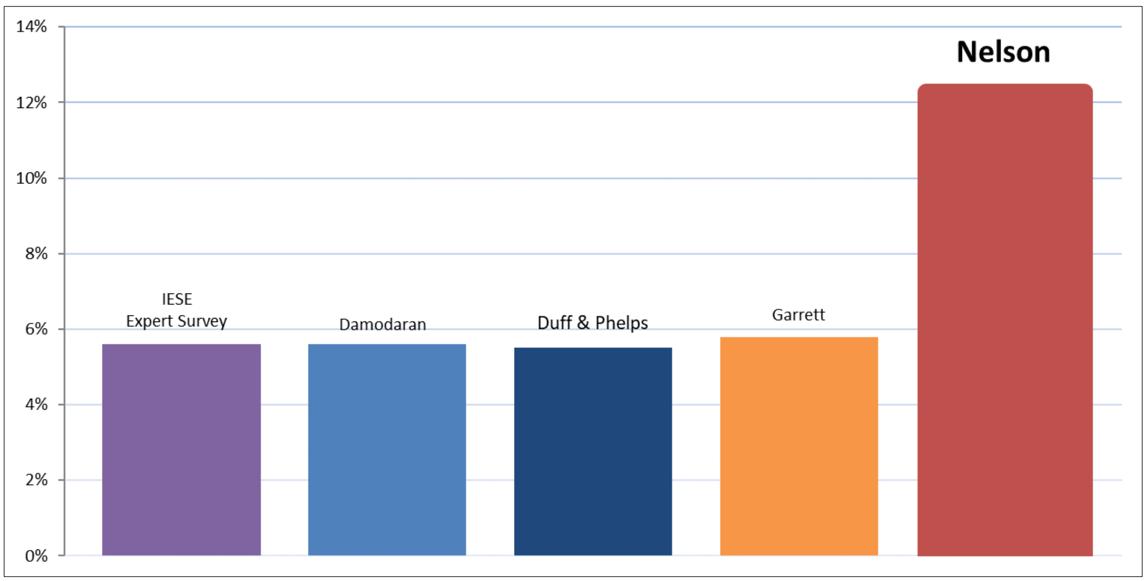
[72] Direct Testimony of Jennifer E. Nelson, p. 37, Figure 11.

[73] *Id*. at p. 36, Figure 10.

Q. PLEASE DISCUSS AND ILLUSTRATE HOW MS. NELSON'S ERP COMPARES WITH OTHER ESTIMATES FOR THE ERP.

A. The 2022 IESE Business School expert survey reports an average ERP of 5.6%. Similarly, Kroll recently estimated an ERP of 5.5%. Dr. Damodaran, a leading expert on the ERP, recently estimated an average ERP of only 5.6%.[74] The chart in the following figure illustrates that Ms. Nelson's ERP estimate is far out of line with other reasonable, objective estimates for the ERP.[75]

Figure 12:
Equity Risk Premium Comparison



When compared with other independent sources for the ERP, as well as my estimate, Ms. Nelson's ERP estimate is clearly not within the range of reasonableness. As a result, her CAPM cost of equity estimate is overstated.

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[74] Aswath Damodaran, *Implied Equity Risk Premium Update*, DAMODARAN ONLINE, http://pages.stern.nyu.edu/~adamodar/. Dr. Damodaran estimates several ERPs using various assumptions.

[75] The ERP estimated by Dr. Damodaran is the average of several ERP estimates using different assumptions.

2. Empirical CAPM

Q. DESCRIBE MS. NELSON'S EMPIRICAL CAPM ANALYSIS.

A. Ms. Nelson offers another version of the CAPM that she calls the "empirical CAPM" ("ECAPM").[76] The premise of Ms. Nelson's ECAPM is that the real CAPM underestimates the return required from low-beta securities, such as those of the proxy group.[77]

Q. DO YOU AGREE WITH MS. NELSON'S ECAPM RESULTS?

A. No. The premise of Ms. Nelson's E-CAPM is that the real CAPM underestimates the return required from low-beta securities, such as those of the proxy group. There are several problems with this concept, however. First, the betas that both Ms. Nelson and I used in the real CAPM already account for the theory that low-beta stocks might tend to be underestimated. In other words, the raw betas for each of the utility stocks in the proxy groups have already been adjusted by Value Line to be higher. Second, there is empirical evidence suggesting that the type of beta-adjustment method used by Value Line actually <u>overstates</u> betas from consistently low-beta industries like utilities. According to this research, it is better to employ an adjustment method that adjusts raw betas toward an industry average, rather than the market average, which ultimately would result in betas that are <u>lower</u> than those published in Value Line.[78] Finally, Ms. Nelson's ECAPM still suffers from the same overestimated risk-free rate and ERP inputs discussed above. Thus,

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[76] Direct Testimony of Jennifer E. Nelson, p. 37.

[77] *Id*.

[78] *See* Appendix B for further discussion on these theories.

regardless of the differing theories regarding the mean reversion tendencies of low-beta securities, Ms. Nelson's ECAPM should be disregarded for its ERP input alone.

3. <u>Risk Premium Analysis</u>

Q. DESCRIBE MS. NELSON'S OTHER RISK PREMIUM ANALYSIS.

A. I am addressing Ms. Nelson's other risk premium analyses in this section because the CAPM itself is a risk premium model. Many utility ROE witnesses, including Ms. Nelson in this case, conduct what they call a "historical risk premium analysis," "bond yield plus risk premium analysis" or "allowed return premium analysis." In short, this analysis simply compares the difference between awarded ROEs in the past with bond yields.

Q. DO YOU AGREE WITH THE RESULTS OF MS. NELSON'S RISK PREMIUM ANALYSIS?

A. No. Not only do I disagree with the results of Ms. Nelson's risk premium analysis, but I also disagree with the entire premise of the analysis. Ms. Nelson's risk premium model considers ROEs allowed by regulatory commissions for electric utilities dating back more than 40 years[79] – which contradicts Ms. Nelson's acknowledgement that cost of equity estimation is a "forward-looking" process.[80] This decision is especially problematic considering the fact that capital costs and awarded ROEs were much higher several decades ago than they are currently. As discussed earlier in this testimony, it is clear that awarded ROEs are consistently higher than market-based cost of equity, and they have been for many years. Thus, these types of risk premium "models" seem to be clever devices used

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[79] Exhibit JEN-6.

[80] Direct Testimony of Jennifer E. Nelson, p. 10, line 18.

to perpetuate the discrepancy between awarded ROEs and market-based cost of equity. In other words, since awarded ROEs are consistently higher than market-based cost, a model that simply compares the discrepancy between awarded ROEs and any market-based factor (such as bond yields) will simply ensure that discrepancy continues.

Furthermore, the risk premium analysis offered by Ms. Nelson is completely unnecessary when we already have a real risk premium model to use: the CAPM. The CAPM itself is a "risk premium" model; it takes the bare minimum return any investor would require for buying a stock (the risk-free rate), then adds a *premium* to compensate the investor for the extra risk he or she assumes by buying a stock rather than a riskless U.S. Treasury security. The CAPM has been utilized by companies around the world for decades for the same purpose we are using it in this case – to estimate cost of equity.

In stark contrast to the Nobel-prize-winning CAPM, the risk premium models relied upon by utility witnesses are not market-based, and therefore have no value in helping us estimate the market-based cost of equity. Unlike the CAPM, which is found in almost every comprehensive financial textbook, the risk premium models used by utility witnesses are almost exclusively found in the texts and testimonies of such witnesses. Specifically, these risk premium models attempt to create an inappropriate link between market-based factors, such as interest rates, with awarded returns on equity. Inevitably, this type of model is used to justify a cost of equity that is much higher than one that would be dictated by market forces.

IX. OTHER COST OF EQUITY ISSUES

Q. ARE THERE ANY OTHER ISSUES RAISED IN THE COMPANY'S TESTIMONY TO WHICH YOU WOULD LIKE TO RESPOND?

A. Yes. In her testimony, Ms. Nelson suggests that the Company's size should have an increasing effect on the awarded ROE. Ms. Nelson also suggests that flotation costs should have an increasing effect on FCG's awarded ROE.

A. Size Premium

Q. DESCRIBE MS. NELSON'S SIZE PREMIUM ADJUSTMENT TO HER CAPM.

A. Ms. Nelson suggests that the Company's size should have an increasing effect on the awarded ROE, although she does not propose a specific premium for the small size effect.[81]

Q. DO YOU AGREE WITH MS. NELSON'S POSITION REGARDING THE SMALL SIZE EFFECT?

A. No. The "size effect" phenomenon arose from a 1981 study conducted by Banz, which found that "in the 1936 – 1975 period, the common stock of small firms had, on average, higher risk-adjusted returns than the common stock of large firms."[82] According to Ibbotson, Banz's size effect study was "[o]ne of the most remarkable discoveries of modern finance."[83] Perhaps there was some merit to this idea at the time, but the size effect phenomenon was short lived. Banz's 1981 publication generated much interest in the size

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[81] Direct Testimony of Jennifer E. Nelson, p. 48, lines 18-23.

[82] Rolf W. Banz, *The Relationship Between Return and Market Value of Common Stocks* 3-18 (Journal of Financial Economics 9 (1981)).

[83] 2015 Ibbotson Stocks, Bonds, Bills, and Inflation Classic Yearbook 99 (Morningstar 2015).

effect and spurred the launch of significant new small cap investment funds. However, this "honeymoon period lasted for approximately two years. . . ." [84] After 1983, U.S. small-cap stocks actually underperformed relative to large cap stocks. In other words, the size effect essentially reversed. In *Triumph of the Optimists*, the authors conducted an extensive empirical study of the size effect phenomenon around the world. They found that after the size effect phenomenon was discovered in 1981, it disappeared within a few years:

> It is clear . . . that there was a global reversal of the size effect in virtually every country, with the size premium not just disappearing but going into reverse. Researchers around the world universally fell victim to Murphy's Law, with the very effect they were documenting – and inventing explanations for – promptly reversing itself shortly after their studies were published.[85]

In other words, the authors assert that the very discovery of the size effect phenomenon likely caused its own demise. The authors ultimately concluded that it is "inappropriate to use the term 'size effect' to imply that we should automatically expect there to be a small-cap premium," yet, this is exactly what utility witnesses often do in attempting to artificially inflate the cost of equity with a size premium. Other prominent sources have agreed that the size premium is a dead phenomenon. According to Ibbotson:

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[84] Elroy Dimson, Paul Marsh & Mike Staunton, *Triumph of the Optimists: 101 Years of Global Investment Returns* 131 (Princeton University Press 2002).

[85] *Id*. at 133.

> The unpredictability of small-cap returns has given rise to another argument against the existence of a size premium: that markets have changed so that the size premium no longer exists. As evidence, one might observe the last 20 years of market data to see that the performance of large-cap stocks was basically equal to that of small cap stocks. In fact, large-cap stocks have outperformed small-cap stocks in five of the last 10 years.[86]

In addition to the studies discussed above, other scholars have concluded similar results.

According to Kalesnik and Beck:

> Today, more than 30 years after the initial publication of Banz's paper, the empirical evidence is extremely weak even before adjusting for possible biases. . . . The U.S. long-term size premium is driven by the extreme outliers, which occurred three-quarters of a century ago. . . . Finally, adjusting for biases . . . makes the size premium vanish. If the size premium were discovered today, rather than in the 1980s, it would be challenging to even publish a paper documenting that small stocks outperform large ones.[87]

For all of these reasons, the Commission should reject the notion that the Company's size should automatically have an increasing effect on its cost of equity as estimated through the CAPM and DCF Model.

B. Flotation Costs

Q. PLEASE SUMMARIZE MS. NELSON'S POSITION REGARDING FLOTATION COSTS.

A. Ms. Nelson suggests that flotation costs should have an increasing effect on the Company's awarded ROE; however, as with the small size effect discussed above, Ms. Nelson does not propose a specific premium for flotation costs.[88]

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[86] 2015 Ibbotson Stocks, Bonds, Bills, and Inflation Classic Yearbook 112 (Morningstar 2015).

[87] Vitali Kalesnik and Noah Beck, *Busting the Myth About Size* (Research Affiliates 2014), available at https://www.researchaffiliates.com/Our%20Ideas/Insights/Fundamentals/Pages/284_Busting_the_Myth_About_Size .aspx (emphasis added).

[88] Direct Testimony of Jenifer E. Nelson, p. 58, lines 10-13.

Q. DO YOU AGREE WITH MS. NELSON'S POSITION REGARDING FLOTATION COSTS?

A. No. When companies issue equity securities, they typically hire at least one investment bank as an underwriter for the securities. "Flotation costs" generally refer to the underwriter's compensation for the services it provides in connection with the securities offering. Ms. Nelson's flotation cost allowance is inappropriate for several reasons, as discussed further below.

1. <u>Flotation costs are not actual "out-of-pocket" costs</u>.

The Company has not experienced any out-of-pocket costs for flotation. Underwriters are not compensated in this fashion. Instead, underwriters are compensated through an "underwriting spread." An underwriting spread is the difference between the price at which the underwriter purchases the shares from the firm, and the price at which the underwriter sells the shares to investors.[89] Furthermore, FCG is not a publicly traded company, which means it does not issue securities to the public and thus would have no need to retain an underwriter. Accordingly, the Company has not experienced any out-of-pocket flotation costs, and if it has, those costs should be included in the Company's expense schedules.

2. <u>The market already accounts for flotation costs</u>.

When an underwriter markets a firm's securities to investors, the investors are well aware of the underwriter's fees. In other words, the investors know that a portion of the price

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[89] *See* John R. Graham, Scott B. Smart & William L. Megginson, *Corporate Finance: Linking Theory to What Companies Do* 509 (3rd ed., South Western Cengage Learning 2010).

they are paying for the shares does not go directly to the company, but instead goes to compensate the underwriter for its services. In fact, federal law requires that the underwriter's compensation be disclosed on the front page of the prospectus.[90] Thus, investors have already considered and accounted for flotation costs when making their decision to purchase shares at the quoted price. As a result, there is no need for FCG' shareholders to receive additional compensation to account for costs they have already considered and agreed to. Similar compensation structures are in other kinds of business transactions. For example, a homeowner may hire a realtor and sell a home for $100,000. After the realtor takes a six percent commission, the seller nets $94,000. The buyer and seller agreed to the transaction notwithstanding the realtor's commission. Obviously, it would be unreasonable for the buyer or seller to demand additional funds from anyone after the deal is completed to reimburse them for the realtor's fees. Likewise, investors of competitive firms do not expect additional compensation for flotation costs. Thus, it would not be appropriate for a commission standing in the place of competition to award a utility's investors with this additional compensation.

3. <u>It is inappropriate to add any additional basis points to an awarded ROE proposal that is already far above the Company's cost of equity.</u>

For the reasons discussed above, flotation costs should be disallowed from a technical standpoint; they should also be disallowed from a practical standpoint. FCG is asking this Commission to award it a cost of equity that is nearly 300 basis points above its market-

[90] *See* Regulation S-K, 17 C.F.R. § 229.501(b)(3) (requiring that the underwriter's discounts and commissions be disclosed on the outside cover page of the prospectus). A prospectus is a legal document that provides details about an investment offering.

based cost of equity. Under these circumstances, it is especially inappropriate to suggest that flotation costs should be considered in any way to increase an already inflated ROE proposal.

X. COST OF EQUITY SUMMARY

Q. PLEASE SUMMARIZE THE RESULTS OF THE CAPM AND DCF MODEL DISCUSSED ABOVE.

A. The following figure shows the cost of equity results from each model I employed in this case.[91]

Figure 13:
Cost of Equity Summary

Cost of Equity Model	Result
DCF (Sustainable Growth)	7.1%
DCF (Analyst Growth)	8.0%
Capital Asset Pricing Model	7.9%
Hamada (at proposed debt ratio)	9.0%
Average	**8.0%**
Highest	**9.0%**

The average cost of equity resulting from these various models is 8.0%.

[91] Exhibit DJG-12.

XI. CAPITAL STRUCTURE

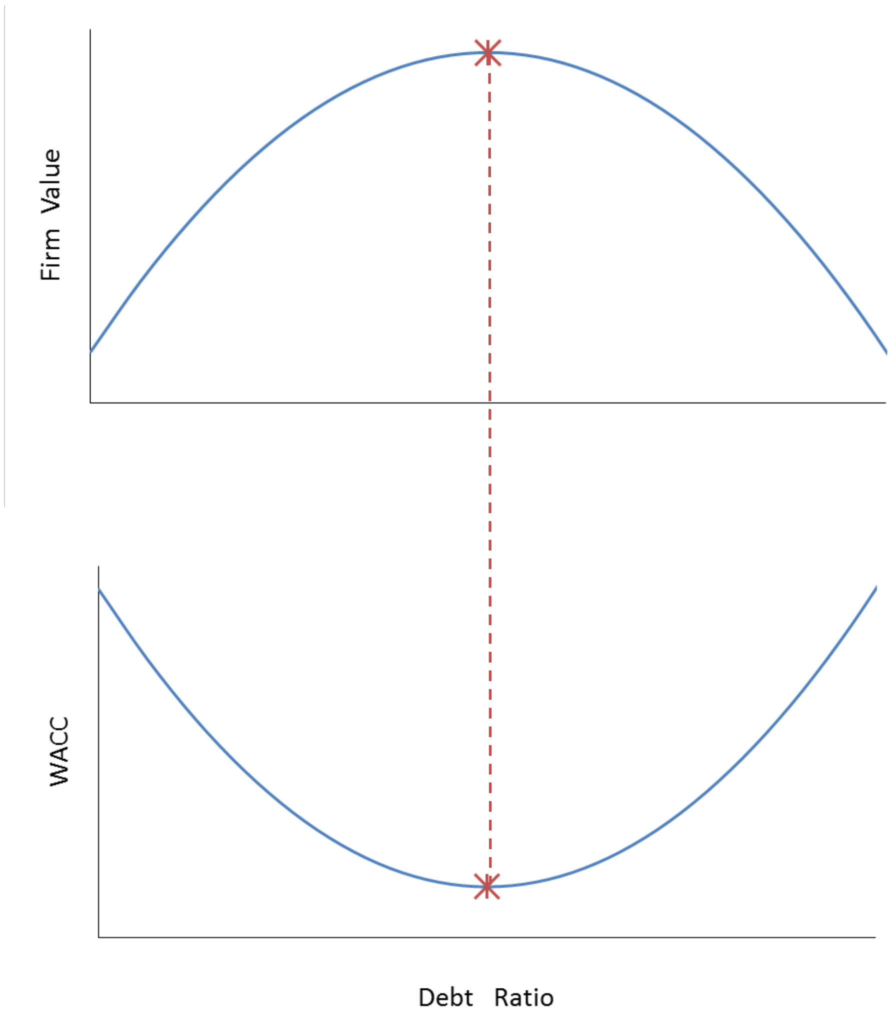
Q. DESCRIBE IN GENERAL THE CONCEPT OF A COMPANY'S CAPITAL STRUCTURE.

A. "Capital structure" refers to the way a company finances its overall operations through external financing. The primary sources of long-term, external financing are debt capital and equity capital. Debt capital usually comes in the form of contractual bond issues that require the firm to make payments, while equity capital represents an ownership interest in the form of stock. Because a firm cannot pay dividends on common stock until it satisfies its debt obligations to bondholders, stockholders are referred to as "residual claimants." The fact that stockholders have a lower priority to claims on company assets increases their risk and the required return relative to bondholders. Thus, equity capital has a higher cost than debt capital. Firms can reduce their WACC by recapitalizing and increasing their debt financing. In addition, because interest expense is deductible, increasing debt also adds value to the firm by reducing the firm's tax obligation.

Q. IS IT TRUE THAT, BY INCREASING DEBT, COMPETITIVE FIRMS CAN ADD VALUE AND REDUCE THEIR WACC?

A. Yes, it is. A competitive firm can add value by increasing debt. After a certain point, however, the marginal cost of additional debt outweighs its marginal benefit. This is because the more debt the firm uses, the higher interest expense it must pay, and the likelihood of loss increases. This also increases the risk of non-recovery for both bondholders and shareholders, causing both groups of investors to demand a greater return on their investment. Thus, if debt financing is too high, the firm's WACC will increase instead of decrease. The following figure illustrates these concepts.

Figure 14:
Optimal Debt Ratio



As shown in this figure, a competitive firm's value is maximized when the WACC is minimized. In both graphs, the debt ratio is shown on the x-axis. By increasing its debt ratio, a competitive firm can minimize its WACC and maximize its value. At a certain point, however, the benefits of increasing debt do not outweigh the costs of the additional risks to both bondholders and shareholders, as each type of investor will demand higher returns for the additional risk they have assumed.[92]

Q. DOES THE RATE BASE RATE OF RETURN MODEL EFFECTIVELY INCENTIVIZE UTILITIES TO OPERATE AT THE OPTIMAL CAPITAL STRUCTURE?

A. No. While it is true that competitive firms maximize their value by minimizing their WACC, this is not the case for regulated utilities. Under the rate base rate of return model, a higher WACC results in higher rates, all else held constant. The basic revenue requirement equation is as follows:

Equation 5:
Revenue Requirement for Regulated Utilities

$$RR = O + d + T + \boldsymbol{r}(A - D)$$

where:	RR	=	*revenue requirement*
	O	=	*operating expenses*
	d	=	*depreciation expense*
	T	=	*corporate tax*
	$\boldsymbol{r}$	=	***weighted average cost of capital (WACC)***
	A	=	*plant investments*
	D	=	*accumulated depreciation*

As shown in this equation, utilities can increase their revenue requirement by <u>increasing</u> their WACC, not by minimizing it. Thus, because there is no incentive for a regulated utility to minimize its WACC, a commission standing in the place of competition must ensure that the regulated utility is operating at the lowest reasonable WACC.

[92] *See* John R. Graham, Scott B. Smart & William L. Megginson, *Corporate Finance: Linking Theory to What Companies Do* 440-41 (3rd ed., South Western Cengage Learning 2010).

Q. CAN UTILITIES GENERALLY AFFORD TO HAVE HIGHER DEBT LEVELS THAN OTHER INDUSTRIES?

A. Yes. Because regulated utilities have large amounts of fixed assets, stable earnings, and low risk relative to other industries, they can afford to have relatively higher debt ratios (or "leverage"). As aptly stated by Dr. Damodaran:

> Since financial leverage multiplies the underlying business risk, it stands to reason that firms that have high business risk should be reluctant to take on financial leverage. It also stands to reason that firms that operate in stable businesses should be much more willing to take on financial leverage. Utilities, for instance, have historically had high debt ratios but have not had high betas, mostly because their underlying businesses have been stable and fairly predictable.[93]

Note that the author explicitly contrasts utilities with firms that have high underlying business risk. Because utilities have low levels of risk and operate a stable business, they should generally operate with relatively high levels of debt to achieve their optimal capital structure.

Q. ARE THE CAPITAL STRUCTURES OF THE PROXY GROUP A SOURCE THAT CAN BE USED TO ASSESS A PRUDENT CAPITAL STRUCTURE?

A. Yes. Since we consider other metrics of the proxy group when estimating cost of equity, it is also appropriate to consider the financing mix of these companies when assessing a fair ratemaking debt ratio for FCG.

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[93] Aswath Damodaran, *Investment Valuation: Tools and Techniques for Determining the Value of Any Asset* 196 (3rd ed., John Wiley & Sons, Inc. 2012) (emphasis added).

Q. HOW CAN UTILITY REGULATORY COMMISSIONS HELP OVERCOME THE FACT THAT UTILITIES DO NOT HAVE A NATURAL FINANCIAL INCENTIVE TO MINIMIZE THEIR COST OF CAPITAL?

A. While under the rate base rate of return model utilities do not have a natural financial incentive to minimize their cost of capital, competitive firms, in contrast, can and do maximize their value by minimizing their cost of capital. Competitive firms minimize their cost of capital by including a sufficient amount of debt in their capital structures. They do not do this because it is required by a regulatory body, but rather because their shareholders demand it in order to maximize value. The Commission can provide this incentive to FCG by acting as a surrogate for competition and setting rates consistent with a capital structure that is similar to what would be appropriate in a competitive, as opposed to a regulated, environment.

Q. PLEASE DESCRIBE HOW YOU ASSESSED THE REASONABLENESS OF FCG'S PROPOSED CAPITAL STRUCTURE IN THIS CASE.

A. FCG proposed capital structure consists of 40.4% long-term debt and 59.6% common equity from investor-supplied sources, which equates to a debt-equity ratio of only 0.68. In this case, I examined the capital structures of the proxy group, as well as the capital structures observed in other competitive industries to assess the overall reasonableness of my recommendation compared to FCG's proposed capital structure.

Q. PLEASE DESCRIBE THE DEBT RATIOS OF THE PROXY GROUP.

A. Again, Ms. Nelson and I used the same proxy group of utilities for our cost of capital analyses. The proxy group of utilities reported an average debt ratio of 53.1, which equates to a debt-equity ratio of 1.13. This is a significantly higher debt-equity ratio than the one proposed by the Company.[94]

Q. DID YOU ALSO LOOK AT OTHER COMPETITIVE FIRMS AROUND THE COUNTRY TO COMPARE THEIR DEBT RATIOS?

A. Yes. In fact, there are currently nearly 2,000 firms in various industries across the country with debt ratios of 50% or greater, with an average debt ratio of 61 percent.[95] The following figure shows a sample of these industries, with debt ratios of at least 56%.

[94] Exhibit DJG-14.

[95] Exhibit DJG-15.

Figure 15:
Industries with Debt Ratios of 56% or Greater

Industry	# Firms	Debt Ratio
Air Transport	21	85%
Hospitals/Healthcare Facilities	31	80%
Hotel/Gaming	66	77%
Brokerage & Investment Banking	31	76%
Retail (Automotive)	32	72%
Food Wholesalers	15	68%
Retail (Grocery and Food)	15	68%
Rubber& Tires	2	67%
Bank (Money Center)	7	67%
Advertising	49	67%
Computers/Peripherals	46	67%
Auto & Truck	26	66%
Real Estate (Operations & Services)	51	66%
Retail (Special Lines)	76	64%
Cable TV	11	63%
Oil/Gas Distribution	21	63%
Packaging & Container	26	62%
Telecom. Services	42	61%
Recreation	60	61%
Broadcasting	28	60%
Transportation (Railroads)	4	60%
R.E.I.T.	238	60%
Power	50	60%
Telecom (Wireless)	17	59%
Transportation	17	59%
Beverage (Soft)	32	58%
Utility (Water)	14	57%
Retail (Distributors)	68	57%
Office Equipment & Services	18	57%
Aerospace/Defense	73	57%
Household Products	118	56%
Computer Services	83	56%
Green & Renewable Energy	20	56%
Total / Average	**1,408**	**64%**

Many of the industries shown here, like public utilities, are generally well-established industries with large amounts of capital assets. The shareholders of these industries demand higher debt ratios in order to maximize their profits. There are several notable industries that are relatively comparable to public utilities in some respects. These debt ratios, as well as the average debt ratio of the utility proxy group, are notably higher than FCG's proposed debt ratio.

Q. HAVE YOU CONSIDERED THE IMPACT THAT YOUR CAPITAL STRUCTURE RECOMMENDATION COULD HAVE ON THE COMPANY'S INDICATED COST OF EQUITY?

A. Yes. I assessed the impact of my capital structure proposal on the Company's cost of equity estimate by using the Hamada formula.

Q. WHAT IS THE PREMISE OF THE HAMADA FORMULA?

A. The Hamada formula can be used to analyze changes in a firm's cost of capital as it adds or reduces financial leverage, or debt, in its capital structure by starting with an "unlevered" beta and then "relevering" the beta at different debt ratios. As leverage increases, equity investors bear increasing amounts of risk, leading to higher betas. Before the effects of financial leverage can be accounted for, however, the effects of leverage must first be removed, which is accomplished through the Hamada formula. The Hamada formula for unlevering beta is stated as follows:[96]

[96] Damodaran *supra* n. 18, at 197. This formula was originally developed by Hamada in 1972.

Equation 6:
Hamada Formula

$$\beta_U = \frac{\beta_L}{\left[1 + (1 - T_c)\left(\frac{D}{E}\right)\right]}$$

where:	β_U	=	*unlevered beta (or "asset" beta)*
	β_L	=	*average levered beta of proxy group*
	T_C	=	*corporate tax rate*
	D	=	*book value of debt*
	E	=	*book value of equity*

Using this equation, the beta for the firm can be unlevered, and then "relevered" based on various debt ratios (by rearranging this equation to solve for β_L).

Q. PLEASE SUMMARIZE THE RESULTS OF THE HAMADA FORMULA BASED ON YOUR PROPOSED CAPITAL STRUCTURE FOR THE COMPANY.

A. Based on investor-supplied sources of financing, the Company's proposed debt ratio is 40.4%, and my proposed debt ratio is 53.1%. The increased amount of leverage proposed in my ratemaking capital structure has an increasing effect on the Company's indicated cost of equity. The results of my Hamada model are presented in the following figure.

Figure 16:
Industries with Debt Ratios of 56% or Greater

Unlevering Beta		
Proposed Debt Ratio	40.4%	[1]
Proposed Equity Ratio	59.6%	[2]
Debt / Equity Ratio	68%	[3]
Tax Rate	21%	[4]
Equity Risk Premium	5.6%	[5]
Risk-free Rate	3.2%	[6]
Proxy Group Beta	0.83	[7]
Unlevered Beta	0.54	[8]

Relevered Betas and Cost of Equity Estimates

[9] Debt Ratio	[10] D/E Ratio	[11] Levered Beta	[12] Cost of Equity
0.0%	0%	0.543	6.26%
20.0%	25%	0.650	6.87%
30.0%	43%	0.726	7.30%
40.4%	68%	0.833	7.90%
53.1%	113%	1.028	8.99%
55.0%	122%	1.067	9.21%
60.0%	150%	1.186	9.88%

According to the results of the Hamada model, if the Commission were to adopt my capital structure recommendation, the Company's indicated cost of equity (under the CAPM) would increase from 7.9% to 9.0%. However, a cost of equity of 9.0% is still less than my awarded return recommendation of 9.25%.

Q. DO YOU AGREE WITH THE COMPANY POSITION THAT A 59.6% EQUITY RATIO SHOULD BE USED FOR FCG BECAUSE THAT IS THE EQUITY RATIO OF FPL AND THUS THE SOURCE OF ITS FINANCING?

A. No. There is no merit to this assertion. I am not aware that the Florida Commission utilizes such a predicate for establishing the equity ratio of a gas subsidiary of an electric company or a subsidiary in general. Regulators generally establish capital structures for utilities based on the operational and market risk factors that apply to the individual utility.

I would also note that in the FPL 2021 rate case, FPL witness and Vice-President of Finance, Robert Barrett, urged the Commission to allow it to retain the 59.6% equity ratio:

> I recommend the Commission approve the continuation of FPL's regulatory capital structure that includes a 59.6 percent equity ratio based on investor sources (48.04 percent based on all sources in the 2022 Test Year). FPL has maintained its equity ratio generally around the 59-60 percent level for more than two decades, and this has been an important underpinning of the overall financial strength that has served customers well.
>
> ***
>
> As mentioned previously, investors expect FPL's capital structure to be relatively stable over time and to reflect the unique risk profile and underlying financial policies of the company. FPL has maintained the current equity ratio for more than twenty years, and it is foundational to FPL's current credit rating, financial strength and flexibility to raise capital when needed and to provide customers with long-term benefits.[97]

No such history of using 59.6% applies to FCG. The current equity ratio is 48%.[98] It has only maintained this equity ratio since 2018, when it was a subsidiary of the Southern

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[97] Prefiled Direct Testimony of Robert E. Barrett, Florida Power & Light Vice president of Finance, at pp 45-46. March 12, 2021, Docket No. 20210015-EI.

[98] Direct Testimony of Mark Campbell, p. 30, line 11.

Company. Before that negotiated capital structure, the equity ratio for the company was established in 2004 at 43.35%[99]. In 2001 the FCG equity ratio was established at 43.38%.[100] This means that for the past twenty years, FCG has maintained an equity ratio of less than 44%. I would also note that Gulf Power Co., which was also a Southern Company subsidiary had an equity ratio of 52.5% established in 2017.[101] As subsidiaries of the same ultimate parent, these electric (Gulf) and gas (FCG) affiliates maintained different equity ratios, in part because they faced unique risk profiles.

I would also note that Peoples Gas Company, until recently a division of Tampa Electric Company, has never had its equity ratio established with respect to the equity ratio or financial attributes of Tampa Electric Co. Based on a review of orders since 2009, it appears that the equity ratios of the two companies are similar but not identical and were never established with reference to the capitalization of either company.

Q. WHAT IS YOUR RECOMMENDATION REGARDING THE COMPANY'S CAPITAL STRUCTURE?

A. The analysis strongly indicates that FCG's proposed long-term debt ratio of 40.4% is too low to be considered fair for ratemaking. An insufficiently low debt ratio causes the weighted average cost of capital to be unreasonably high. Based on my findings, I recommend the Commission impute a capital structure for ratemaking purposes consisting

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[99] Order No. 2004-0128, Issued February 9, 2004 in Docket No. 20030569-GU, at 23.

[100] Order No. 2001-0316, Issued February 5, 2001 in Docket No. 20000768-GU, at 15-16.

[101] Order No. PSC-2017-0178-S-EI at 13. (Issued May 16, 2017 in Docket No. 20160170)

of long-term 51.3% debt, which is in between the Company's proposed debt ratio that adopts a debt-equity ratio of 1.13. Along with my proposed return on equity of 9.25%, this equates to an overall awarded rate of return of 5.65%.[102]

PART TWO: DEPRECIATION

XII. LEGAL STANDARDS

Q. DISCUSS THE STANDARD BY WHICH REGULATED UTILITIES ARE ALLOWED TO RECOVER DEPRECIATION EXPENSE.

A. In *Lindheimer v. Illinois Bell Telephone Co.*, the U.S. Supreme Court stated that "depreciation is the loss, not restored by current maintenance, which is due to all the factors causing the ultimate retirement of the property. These factors embrace wear and tear, decay, inadequacy, and obsolescence."[103] The *Lindheimer* Court also recognized that the original cost of plant assets, rather than present value or some other measure, is the proper basis for calculating depreciation expense.[104] Moreover, the *Lindheimer* Court found:

> [T]he company has the burden of making a convincing showing that the amounts it has charged to operating expenses for depreciation have not been excessive. That burden is not sustained by proof that its general accounting system has been correct. The calculations are mathematical, but the predictions underlying them are essentially matters of opinion.[105]

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[102] Exhibit DJG-17.

[103] *Lindheimer v. Illinois Bell Tel. Co.*, 292 U.S. 151, 167 (1934).

[104] *Id*. Referring to the straight-line method, the *Lindheimer* Court stated that "[a]ccording to the principle of this accounting practice, the loss is computed upon the actual cost of the property as entered upon the books, less the expected salvage, and the amount charged each year is one year's pro rata share of the total amount.". The original cost standard was reaffirmed by the Court in *Federal Power Commission v. Hope Natural Gas Co.*, 320 U.S. 591, 606 (1944). The *Hope* Court stated: "Moreover, this Court recognized in [*Lindheimer*], supra, the propriety of basing annual depreciation on cost. By such a procedure the utility is made whole and the integrity of its investment maintained. No more is required." (footnotes omitted).

[105] *Id*. at 169.

Thus, the Commission must ultimately determine if the Company has met its burden of proof by making a convincing showing that its proposed depreciation rates are not excessive.

Q. SHOULD DEPRECIATION REPRESENT AN ALLOCATED COST OF CAPITAL TO OPERATION, RATHER THAN A MECHANISM TO DETERMINE LOSS OF VALUE?

A. Yes. While the *Lindheimer* case and other early literature recognized depreciation as a necessary expense, the language indicated that depreciation was primarily a mechanism to determine loss of value.[106] Adoption of this "value concept" would require annual appraisals of extensive utility plant, and thus, is not practical in this context. Rather, the "cost allocation concept" recognizes that depreciation is a cost of providing service, and that in addition to receiving a "return on" invested capital through the allowed rate of return, a utility should also receive a "return of" its invested capital in the form of recovered depreciation expense. The cost allocation concept also satisfies several fundamental accounting principles, including verifiability, neutrality, and the matching principle.[107] The definition of "depreciation accounting" published by the American Institute of Certified Public Accountants ("AICPA") properly reflects the cost allocation concept:

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[106] *See* Frank K. Wolf & W. Chester Fitch, *Depreciation Systems* 71 (Iowa State University Press 1994).

[107] National Association of Regulatory Utility Commissioners, *Public Utility Depreciation Practices* 12 (NARUC 1996).

> Depreciation accounting is a system of accounting that aims to distribute cost or other basic value of tangible capital assets, less salvage (if any), over the estimated useful life of the unit (which may be a group of assets) in a systematic and rational manner. It is a process of allocation, not of valuation.[108]

Thus, the concept of depreciation as "the allocation of cost has proven to be the most useful and most widely used concept."[109]

Q. DESCRIBE WHY IT IS IMPORTANT NOT TO OVERESTIMATE DEPRECIATION RATES.

A. Under the rate base rate of return model, the utility is allowed to recover the original cost of its prudent investments required to provide service. Depreciation systems are designed to allocate those costs in a systematic and rational manner – specifically, over the service life of the utility's assets. If depreciation rates are overestimated (i.e., service lives are underestimated), it encourages economic inefficiency. Unlike competitive firms, regulated utility companies are not always incentivized by natural market forces to make the most economically efficient decisions. If a utility is allowed to recover the cost of an asset before the end of its useful life, this could incentivize the utility to unnecessarily replace the asset in order to increase its rate base, which results in economic waste. Thus, from a public policy perspective, it is preferable for regulators to ensure that assets are not depreciated before the end of their true useful lives. While underestimating the useful lives of depreciable assets could financially harm current ratepayers and encourage economic waste, unintentionally overestimating depreciable lives (i.e., underestimating depreciation

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[108] American Institute of Accountants, *Accounting Terminology Bulletins Number 1: Review and Résumé* 25 (American Institute of Accountants 1953).

[109] Wolf *supra* n. 118, at 73.

rates) does not necessarily harm the Company financially. This is because if an asset's life is overestimated, there are a variety of measures that regulators can use to ensure the utility is not financially harmed. One such measure would be the use of a regulatory asset account. In that case, the Company's original cost investment in these assets would remain in the Company's rate base until they are recovered. Thus, the process of depreciation strives for a perfect match between actual and estimated useful life. When these estimates are not exact, however, it is better that useful lives are not underestimated for these reasons concept."[110]

XIII. ANALYTIC METHODS

Q. DISCUSS YOUR APPROACH TO ANALYZING THE COMPANY'S DEPRECIABLE ASSETS IN THIS CASE.

A. I obtained and reviewed the same historical property data that was used to conduct Piedmont's depreciation study, including plant retirement and net salvage data. I analyzed the data and calculated my proposed rates under a depreciation system designed to conform to the legal and technical standards discussed above. I then applied my proposed service life and net salvage parameters in order to calculate Piedmont's adjusted depreciation rates. My adjustments to service life and net salvage are discussed further in the sections below.

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[110] Wolf *supra* n. 6, at 73.

Q. DISCUSS THE DEFINITION AND GENERAL PURPOSE OF A DEPRECIATION SYSTEM, AS WELL AS THE SPECIFIC DEPRECIATION SYSTEM YOU EMPLOYED FOR THIS PROJECT.

A. The legal standards set forth above do not mandate a specific procedure for conducting depreciation analysis. These standards, however, direct that analysts use a system for estimating depreciation rates that will result in the "systematic and rational" allocation of capital recovery for the utility. Over the years, analysts have developed "depreciation systems" designed to analyze grouped property in accordance with this standard. A depreciation system may be defined by several primary parameters: 1) a <u>method</u> of allocation; 2) a <u>procedure</u> for applying the method of allocation; 3) a <u>technique</u> of applying the depreciation rate; and 4) a <u>model</u> for analyzing the characteristics of vintage property groups.[111] In this case, I used the straight-line method, the average life procedure, the remaining life technique, and the broad group model; this system would be denoted as an "SL-AL-RL-BG" system. This depreciation system conforms to the legal standards set forth above and is commonly used by depreciation analysts in regulatory proceedings. I provide a more detailed discussion of depreciation system parameters, theories, and equations in Appendix C.

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[111] *See* Wolf *supra* n. 6, at 70, 140.

XIV. SERVICE LIFE ANALYSIS

Q. DESCRIBE THE METHODOLOGY USED TO ESTIMATE THE SERVICE LIVES OF GROUPED DEPRECIABLE ASSETS.

A. The process used to study the industrial property retirement is rooted in the actuarial process used to study human mortality. Just as actuarial analysts study historical human mortality data to predict how long a group of people will live, depreciation analysts study historical plant data to estimate the average lives of property groups. The most common actuarial method used by depreciation analysts is called the "retirement rate method." In the retirement rate method, original property data, including additions, retirements, transfers, and other transactions, are organized by vintage and transaction year.[112] The retirement rate method is ultimately used to develop an "observed life table" ("OLT"), which shows the percentage of property surviving at each age interval. This pattern of property retirement is described as a "survivor curve." The survivor curve derived from the observed life table, however, must be fitted and smoothed with a complete curve in order to determine the ultimate average life of the group.[113] The most widely used survivor curves for this curve fitting process were developed at Iowa State University in the early 1900s and are commonly known as the "Iowa curves."[114] A more detailed explanation of

[112] The "vintage" year refers to the year that a group of property was placed in service (aka "placement" year). The "transaction" year refers to the accounting year in which a property transaction occurred, such as an addition, retirement, or transfer (aka "experience" year).

[113] *See* Appendix E for a more detailed discussion of the actuarial analysis used to determine the average lives of grouped industrial property.

[114] *See* Appendix D for a more detailed discussion of the Iowa curves.

how the Iowa curves are used in the actuarial analysis of depreciable property is set forth in Appendix D.

Q. DESCRIBE HOW YOU STATISTICALLY ANALYZED PIEDMONT'S HISTORICAL RETIREMENT DATA IN ORDER TO DETERMINE THE MOST REASONABLE IOWA CURVE TO APPLY TO EACH ACCOUNT.

A. I used the aged property data provided by the Company to create an OLT for each account. The data points on the OLT can be plotted to form a curve (the "OLT curve"). The OLT curve is not a theoretical curve, rather, it is actual observed data from the Company's records that indicate the rate of retirement for each property group. An OLT curve by itself, however, is rarely a smooth curve, and is often not a "complete" curve (i.e., it does not end at zero percent surviving). In order to calculate average life (the area under a curve), a complete survivor curve is required. The Iowa curves are empirically derived curves based on the extensive studies of the actual mortality patterns of many different types of industrial property. The curve-fitting process involves selecting the best Iowa curve to fit the OLT curve. This can be accomplished through a combination of visual and mathematical curve-fitting techniques, as well as professional judgment. The first step of my approach to curve-fitting involves visually inspecting the OLT curve for any irregularities. For example, if the "tail" end of the curve is erratic and shows a sharp decline over a short period of time, it may indicate that this portion of the data is less reliable, as further discussed below. After inspecting the OLT curve, I use a mathematical curve-fitting technique which essentially involves measuring the distance between the OLT curve and the selected Iowa curve to get an objective, mathematical assessment of how well the curve fits. As part of my analysis, I may repeat this process several times for any given account to ensure that the most reasonable Iowa curve is selected.

Q. IN THIS PARTICULAR CASE, WERE ANY OF THE MATHEMATICAL RESULTS AFFECTED BY THE OLT "TAIL" TRUNCATION YOU DESCRIBED?

A. No. For each of the accounts to which I propose service life adjustments in this case, the Iowa curves I propose result in a better mathematical fit to the OLT curve regardless of whether the entire OLT curve or the truncated OLT curve is analyzed.

Q. DO YOU ALWAYS SELECT THE MATHEMATICAL BEST-FITTING CURVE?

A. Not necessarily. Mathematical fitting is an important part of the curve-fitting process because it promotes objective, unbiased results. While mathematical curve-fitting is important, however, it may not always yield the optimum result. For example, if there is insufficient historical data in a particular account and the OLT curve derived from that data is relatively short and flat, the mathematically "best" curve may be one with a very long average life. However, when there is sufficient data available, mathematical curve fitting can be used as part of an objective service life analysis.

Q. SHOULD EVERY PORTION OF THE OLT CURVE BE GIVEN EQUAL WEIGHT?

A. Not necessarily. Many analysts have observed that the points comprising the "tail end" of the OLT curve may often have less analytical value than other portions of the curve. In fact, "[p]oints at the end of the curve are often based on fewer exposures and may be given less weight than points based on larger samples. The weight placed on those points will depend on the size of the exposures."[115] In accordance with this standard, an analyst may decide to truncate the tail end of the OLT curve at a certain percent of initial exposures, such as one percent. Using this approach puts greater emphasis on the most valuable portions of the curve. For my analysis in this case, I not only considered the entirety of the OLT curve, but also conducted further analyses that involved fitting Iowa curves to the most significant part of the OLT curve for certain accounts. In other words, to verify the accuracy of my curve selection, I narrowed the focus of my additional calculation to consider approximately the top 99% of the "exposures" (i.e., dollars exposed to retirement) and to eliminate the tail end of the curve representing the bottom 1% of exposures for some accounts, if necessary. I will illustrate an example of this approach in the discussion below.

Q. GENERALLY, DESCRIBE THE DIFFERENCES BETWEEN THE COMPANY'S SERVICE LIFE PROPOSALS AND YOUR SERVICE LIFE PROPOSALS.

A. For each of the accounts to which I propose adjustments, the Company's proposed average service life, as estimated through an Iowa curve, is too short to provide the most reasonable mortality characteristics of the account. Generally, for the accounts in which I propose a longer service life, that proposal is based on the objective approach of choosing an Iowa curve that provides a better mathematical fit to the observed historical retirement pattern derived from the Company's plant data.

[115] Wolf *supra* n. 6, at 46.

Q. DO YOU ALSO USE PROFESSIONAL JUDGMENT IN SELECTING THE BEST IOWA CURVE AS PART OF YOUR SERVICE LIFE ANALYSIS?

A. Yes. The amount of judgment I use relative to the empirical data depends primarily on the sufficiency and quality of the statistical data provided by the Company. That is, to the extent the historical data provided by the Company is sufficient to develop adequate OLT curves upon which conventional Iowa curve fitting techniques may be employed, it is preferable to focus primarily on the empirical analysis and evidence inherent in the curve fitting process rather than on subjective elements such as judgment. Another factor that should be taken into account when determining how much judgment should be used in the process of curve fitting are the legal and ratemaking standards discussed above. It is important to keep in mind that the Company bears the burden to make a convincing showing that its proposed rates are not excessive. Thus, if the Company fails to provide adequate historical data for a particular account such that it is not ideal for empirical Iowa curve fitting, it does not mean that the Company's position should be accepted merely based on the subjective elements of "judgment" used by its witnesses to justify its proposed depreciation rate for that account. Judgment is a process; it does not take the place of evidence.

Q. DO YOU HAVE ANY OTHER GENERAL CRITICISMS OF THE BASES OF COMPANY WITNESS WATSON'S SERVICE LIFE ESTIMATES?

A. Yes. In discussing his service life estimates for many of Piedmont's accounts, Company Mr. Allis has apparently relied heavily upon the expectations of Company personnel with regard to how long the assets will be in service.[116] Piedmont is the applicant in this case, and it has hired an independent expert in Mr. Allis to develop service life estimates based on specialized, statistical analysis of the Company's historical retirement data for an issue that heavily affects the Company's cash flow. To the extent Piedmont employees have simply told the Company's independent depreciation expert how long they think the Company's assets will survive, I believe that is problematic and calls into question the objectivity and accuracy of Piedmont's proposed depreciation rates. It also highlights the importance of putting more emphasis on the historical, factual data used to derive the retirement rates in each of the accounts discussed below, rather than factors that may be influenced by biases (even if unintentionally).

A. Accounts 376.10 and 376.20 – Mains

Q. DESCRIBE YOUR SERVICE LIFE ESTIMATE FOR THIS ACCOUNT AND COMPARE IT WITH THE COMPANY'S ESTIMATE.

A. The OLT curve derived from the Company's data for this account is presented in the graph below. The graph also shows the Iowa curves the Company and I selected to represent the average remaining life of the assets in this account. For this account, the Company selected the R4-65 Iowa curve, and I selected the R3-70 Iowa curve, which represent average lives of 65 years and 70 years, respectively. Both of these Iowa curves are shown in the graph below along with the OLT curve.[117]

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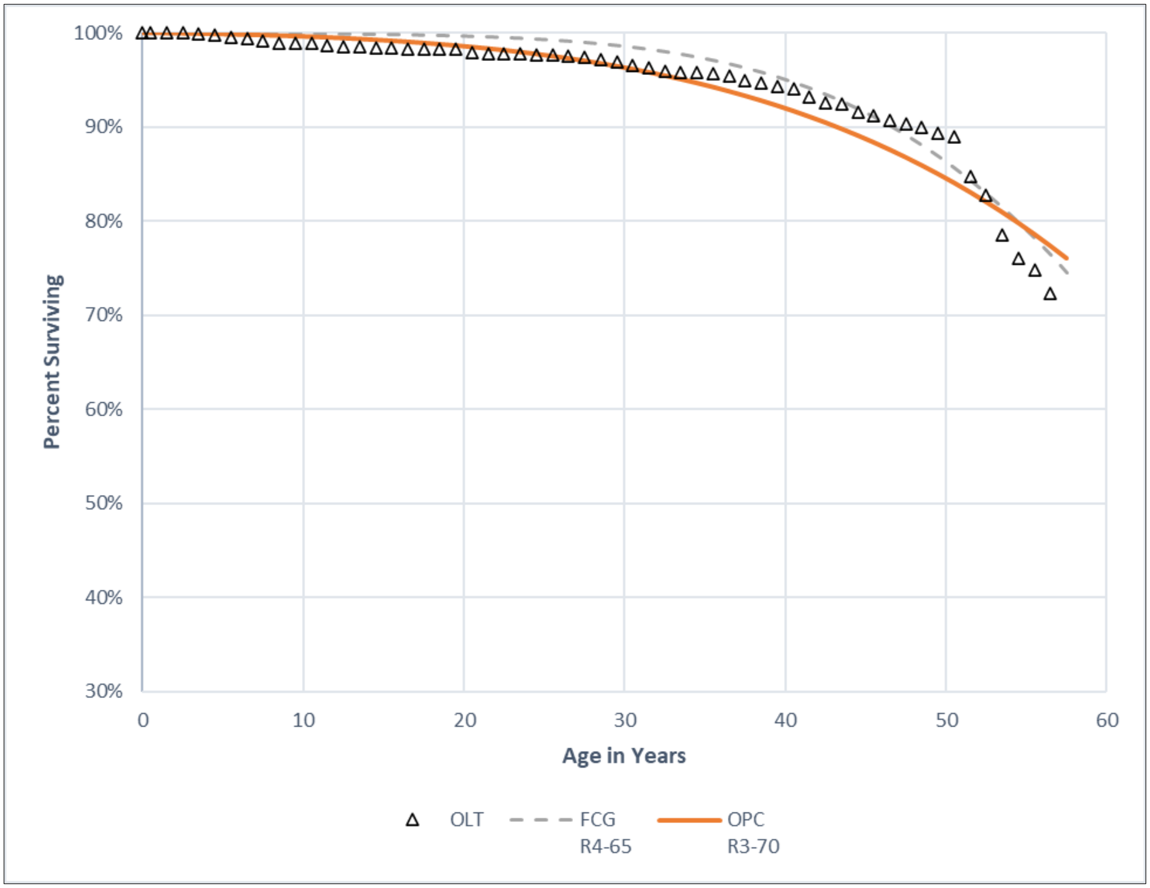
[116] *See generally* Petition to Request Approval and Authorization to Implement New Depreciation Rates. Docket No. 2019-191-G, pp. 22 – 70.

[117] *See also* Exhibit DJG-22.

Figure 17:
Accounts 376.10 and 376.20 – Mains



As shown in the graph, both selected Iowa curves provide relatively close fits to the observed data from a visual perspective. Although there is a visual "drop off" towards the tail end of this OLT curve, based on the 1% truncation benchmark discussed above, these tail-end data points are nonetheless statistically relevant. Regardless, The more significant data points (in quantity and quality) in the upper and middle portions of the OLT curve indicate a flatter trajectory than what is otherwise displayed in the higher-modal R4 curve shape selected by Mr. Allis. Going forward, I would not be surprise to see a flatter trajectory than what is indicated by the R4 dispersion.

Q. WHAT IS YOUR RECOMMENDATION FOR THIS ACCOUNT?

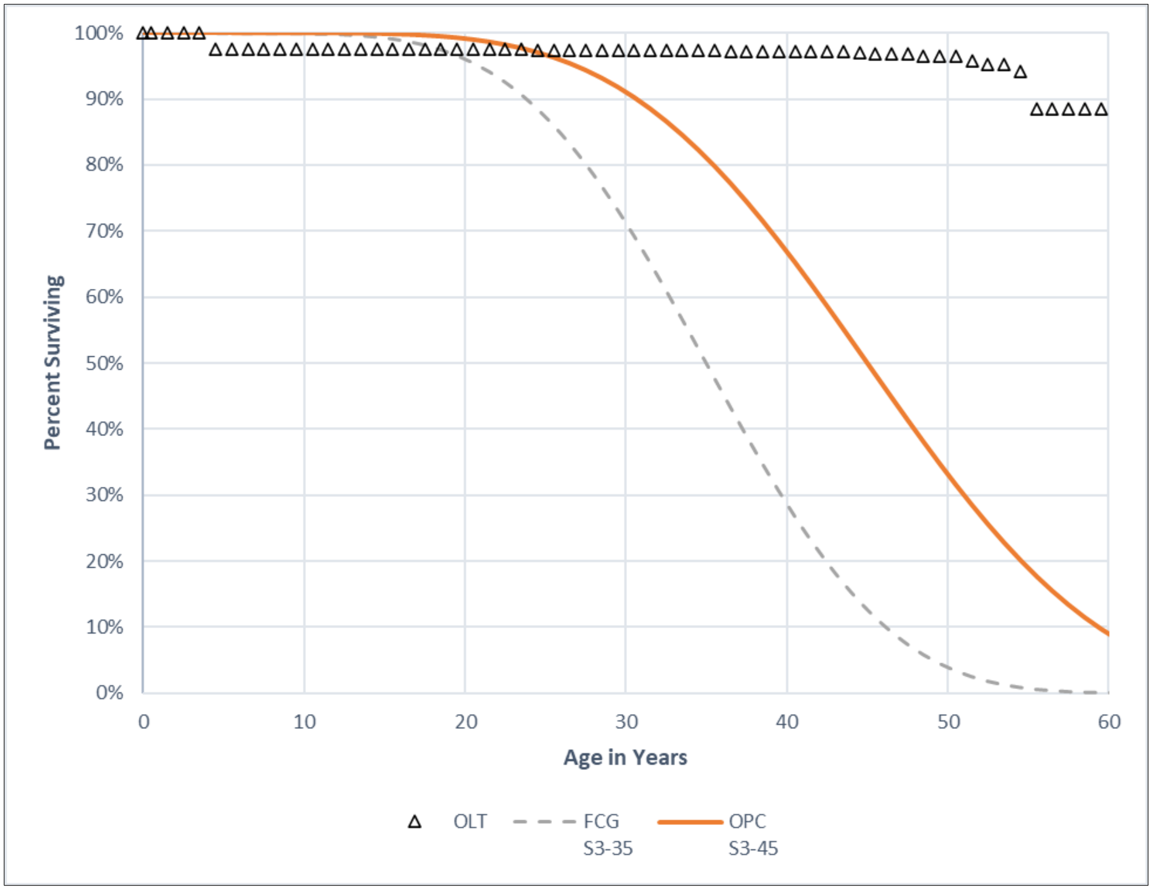
A. I would propose the R3-70 Iowa curve be applied to this account for purposes of calculating the remaining life and depreciation rate. In a pending proceeding before the Commission, Florida Public Utilities proposed a 75-year service life for its plastic mains account, and a 65-year service life for its steel mains account, which equates to an average of 70 years. In this case, FCG has consolidated its plastic and steel mains for purposes of life analysis. The R4-65 curve proposed by the Company is not necessarily unreasonable given the historical data. However, the Commission could consider adopting a 70-year service life for this account as another reasonable approach.

B. <u>Accounts 378.00 and 379.00 – Measuring and Regulating Station Equipment</u>

Q. DESCRIBE YOUR SERVICE LIFE ESTIMATE FOR THIS ACCOUNT AND COMPARE IT WITH THE COMPANY'S ESTIMATE.

A. For these accounts, Mr. Allis selected the S3-35 curve, and I selected the S3-45 curve. Both of these Iowa curves are illustrated in the graph below along with the OLT curve.

Figure 18:
Accounts 378.00 and 379.00 – Measuring and Regulating Station Equipment



As shown in the graph, there has not been enough retirement activity in this account to derive an accurate indication of the retirement pattern that might be observed going forward. Nonetheless, the data show that asset reaching 60 years old have a survival rate of nearly 90%. Both of the selected Iowa curves are essentially suggesting that the retirement rate going forward in this account will be greater than the retirement rate experienced thus far. However, I believe a 35-year service life is simply too short given the actual evidence presented for this account, and it results in an unreasonably high depreciation rate.

Q. DOES YOUR SELECTED IOWA CURVE PROVIDE A BETTER MATHEMATICAL FIT TO THE RELEVANT PORTION OF THE OLT CURVE?

A. Yes. While it is clear from a mere visual inspection that the Iowa curve I selected for this account provides a better fit to the observed data, we can confirm this result mathematically. Visual curve-fitting techniques can help an analyst identify the most statistically relevant portions of the OLT curve for this account, but mathematical curve-fitting techniques can help determine which of the two Iowa curves provides the better fit (especially in cases where it is not obvious from a visual standpoint which curve provides the better fit). Mathematical curve-fitting essentially involves measuring the "distance" between the OLT curve and the selected Iowa curve. The best fitting curve from a mathematical standpoint is the one that minimizes the distance between the OLT curve and the Iowa curve, thus providing the closest fit. The distance between the curves is calculated using the "sum-of-squared differences" ("SSD") technique. In this account, the total SSD, or distance between the Company's curve and the OLT curve, is 18.5589, while the total SSD between the S3-45 curve I selected and the OLT curve is 8.5355, which means it is a closer fit.[118]

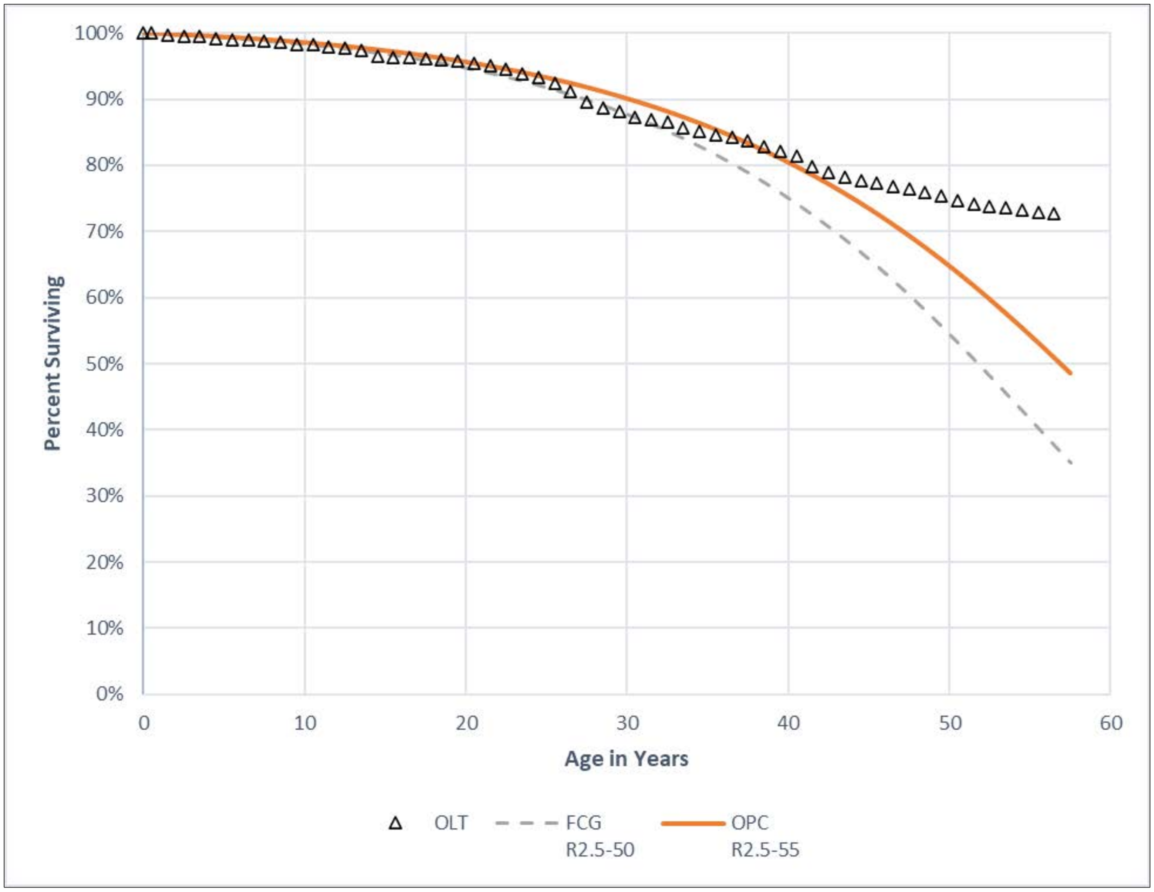
C. <u>Accounts 380.10 and 380.20 – Services</u>

Q. DESCRIBE YOUR SERVICE LIFE ESTIMATE FOR THIS ACCOUNT AND COMPARE IT WITH THE COMPANY'S ESTIMATE.

A. Mr. Allis selected the R2.5-50 curve for this account, and I selected the R2.5-55 curve. Both of these Iowa curves are illustrated in the graph below along with the OLT curve.

[118] Exhibit DJG-23.

Figure 19:
Accounts 380.10 and 380.20 – Services



As shown in this graph, the R2.5-50 curve ignores a significant and relevant portion of the historical retirement data for these accounts, as displayed in the OLT curve. The R2.5-55 curve I selected provides a better fit to the observed data and results in a more reasonable and accurate depreciation rate for these accounts.

Q. DOES YOUR SELECTED IOWA CURVE PROVIDE A BETTER MATHEMATICAL FIT TO THE RELEVANT PORTION OF THE OLT CURVE?

A. Yes. The total SSD for the Company's curve is 0.7540, and the SSD for the R2.5-55 curve I selected is 0.2217, which means it results in the better mathematical fit.[119]

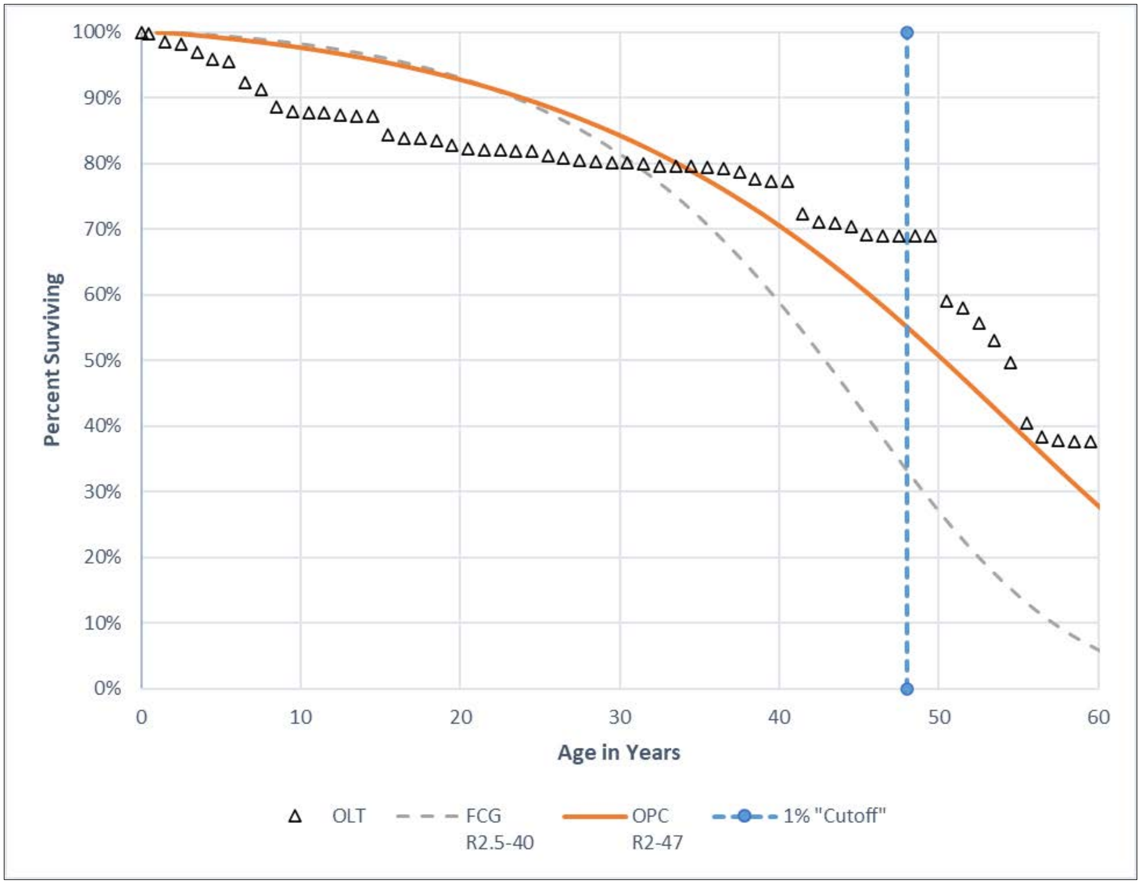
D. <u>Account 383 – House Regulators</u>

Q. DESCRIBE YOUR SERVICE LIFE ESTIMATE FOR THIS ACCOUNT AND COMPARE IT WITH THE COMPANY'S ESTIMATE.

A. Mr. Allis selected the R2.5-40 curve for this account, and I selected the R2-47 curve. Both of these Iowa curves are illustrated in the graph below along with the OLT curve.

[119] Exhibit DJG-24.

Figure 20:
Account 383 – House Regulators



The dispersion pattern displayed in the OLT curve for this account is relatively atypical, nonetheless, there is an adequate amount of retirement history to rely on the historical data as an indication of remaining life. The vertical dotted line represents the truncation benchmark discussed above. The data points occurring to the right of the vertical line are statistically irrelevant based on this benchmark. Both Iowa curves correctly ignore the irrelevant tail-end of the OLT curve. However, the R2.5-40 curve selected by Mr. Allis ignores relevant data points occurring between the 30-45 year age intervals. The OLT curve thus far is displaying a flatter trajectory than is otherwise indicated in the R2.5 curve shape selected by Mr. Allis. At this time, it would be more reasonable to utilize an R2 curve shape with a longer average service life, such as the R2-47 curve I selected.

Q. DOES YOUR SELECTED IOWA CURVE PROVIDE A BETTER MATHEMATICAL FIT TO THE RELEVANT PORTION OF THE OLT CURVE?

A. Yes. The total SSD for the Company's curve is 2.7569, and the SSD for the R2-47 curve I selected is 0.5052, which means it results in the better mathematical fit.[120]

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes. I reserve the right to supplement this testimony as needed with any additional information that has been requested from the Company but not yet provided. To the extent I have not addressed an issue, method, calculation, account, or other matter relevant to the Company's proposals in this proceeding, it should not be construed that I am in agreement with the same.

[120] Exhibit DJG-25.

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EDUCATION

University of Oklahoma — Norman, OK
Master of Business Administration — 2014
Areas of Concentration: Finance, Energy

University of Oklahoma College of Law — Norman, OK
Juris Doctor — 2007
Member, American Indian Law Review

University of Oklahoma — Norman, OK
Bachelor of Business Administration — 2003
Major: Finance

PROFESSIONAL DESIGNATIONS

Society of Depreciation Professionals
Certified Depreciation Professional (CDP)

Society of Utility and Regulatory Financial Analysts
Certified Rate of Return Analyst (CRRA)

The Mediation Institute
Certified Civil / Commercial & Employment Mediator

WORK EXPERIENCE

Resolve Utility Consulting PLLC — Oklahoma City, OK
Managing Member — 2016 – Present
Provide expert analysis and testimony specializing in depreciation and cost of capital issues for clients in utility regulatory proceedings.

Oklahoma Corporation Commission — Oklahoma City, OK
Public Utility Regulatory Analyst — 2012 – 2016
Assistant General Counsel — 2011 – 2012
Represented commission staff in utility regulatory proceedings and provided legal opinions to commissioners. Provided expert analysis and testimony in depreciation, cost of capital, incentive compensation, payroll and other issues.

Perebus Counsel, PLLC — Oklahoma City, OK
Managing Member — 2009 – 2011
Represented clients in the areas of family law, estate planning, debt negotiations, business organization, and utility regulation.

Moricoli & Schovanec, P.C. — Oklahoma City, OK
Associate Attorney — 2007 – 2009
Represented clients in the areas of contracts, oil and gas, business structures and estate administration.

TEACHING EXPERIENCE

University of Oklahoma — Norman, OK
Adjunct Instructor – "Conflict Resolution" — 2014 – 2021
Adjunct Instructor – "Ethics in Leadership"

Rose State College — Midwest City, OK
Adjunct Instructor – "Legal Research" — 2013 – 2015
Adjunct Instructor – "Oil & Gas Law"

PUBLICATIONS

American Indian Law Review — Norman, OK
"Vine of the Dead: Reviving Equal Protection Rites for Religious Drug Use" — 2006
(31 Am. Indian L. Rev. 143)

PROFESSIONAL ASSOCIATIONS

Oklahoma Bar Association — 2007 – Present

Society of Depreciation Professionals — 2014 – Present
Board Member – President — 2017
Participate in management of operations, attend meetings, review performance, organize presentation agenda.

Society of Utility Regulatory Financial Analysts — 2014 – Present

Utility Regulatory Proceedings

Regulatory Agency	Utility Applicant	Docket Number	Issues Addressed	Parties Represented
Pennsylvania Public Utility Commission	Columbia Gas of Pennsylvania, Inc.	R-2022-3031211	Cost of capital, awarded rate of return, capital structure	Pennsylvania Office of Consumer Advocate
Public Service Commission of South Carolina	Piedmont Natural Gas Company	2022-89-G	Depreciation rates, service lives, net salvage	South Carolina Office of Regulatory Staff
Pennsylvania Public Utility Commission	UGI Utilities, Inc. - Gas Division	R-2021-3030218	Cost of capital, awarded rate of return, capital structure	Pennsylvania Office of Consumer Advocate
Public Utilities Commission of the State of California	Pacific Gas & Electric Company	A.21-06-021	Depreciation rates, service lives, net salvage	The Utility Reform Network
Pennsylvania Public Utility Commission	PECO Energy Company - Gas Division	R-2022-3031113	Cost of capital, awarded rate of return, capital structure	Pennsylvania Office of Consumer Advocate
Oklahoma Corporation Commission	Oklahoma Gas & Electric Company	PUD 202100164	Cost of capital, depreciation rates, net salvage	Oklahoma Industrial Energy Consumers
Massachusetts Department of Public Utilities	NSTAR Electric Company D/B/A Eversource Energy	D.P.U. 22-22	Depreciation rates, service lives, net salvage	Massachusetts Office of the Attorney General, Office of Ratepayer Advocacy
Michigan Public Service Company	DTE Electric Company	U-20836	Cost of capital, awarded rate of return, capital structure	Michigan Environmental Council and Citizens Utility Board of Michigan
New York State Public Service Commission	Consolidated Edison Company of New York, Inc.	22-E-0064 22-G-0065	Depreciation rates, service lives, net salvage, depreciation reserve	The City of New York
Pennsylvania Public Utility Commission	Aqua Pennsylvania Wastewater / East Whiteland Township	A-2021-3026132	Fair market value estimates for wastewater assets	Pennsylvania Office of Consumer Advocate
Public Service Commission of South Carolina	Kiawah Island Utility, Inc.	2021-324-WS	Cost of capital, awarded rate of return, capital structure	South Carolina Office of Regulatory Staff
Pennsylvania Public Utility Commission	Aqua Pennsylvania Wastewater / Willistown Township	A-2021-3027268	Fair market value estimates for wastewater assets	Pennsylvania Office of Consumer Advocate
Indiana Utility Regulatory Commission	Northern Indiana Public Service Company	45621	Depreciation rates, service lives, net salvage	Indiana Office of Utility Consumer Counselor
Arkansas Public Service Commission	Southwestern Electric Power Company	21-070-U	Cost of capital, depreciation rates, net salvage	Western Arkansas Large Energy Consumers

Utility Regulatory Proceedings

Regulatory Agency	Utility Applicant	Docket Number	Issues Addressed	Parties Represented
Federal Energy Regulatory Commission	Southern Star Central Gas Pipeline	RP21-778-002	Depreciation rates, service lives, net salvage	Consumer-Owned Shippers
Railroad Commission of Texas	Participating Texas gas utilities in consolidated proceeding	OS-21-00007061	Securitization of extraordinary gas costs arising from winter storms	The City of El Paso
Public Service Commission of South Carolina	Palmetto Wastewater Reclamation, Inc.	2021-153-S	Cost of capital, awarded rate of return, capital structure, ring-fencing	South Carolina Office of Regulatory Staff
Public Utilties Commission of the State of Colorado	Public Service Company of Colorado	21AL-0317E	Cost of capital, depreciation rates, net salvage	Colorado Energy Consumers
Pennsylvania Public Utility Commission	City of Lancaster - Water Department	R-2021-3026682	Cost of capital, awarded rate of return, capital structure	Pennsylvania Office of Consumer Advocate
Public Utility Commission of Texas	Southwestern Public Service Company	PUC 51802	Depreciation rates, service lives, net salvage	The Alliance of Xcel Municipalities
Pennsylvania Public Utility Commission	The Borough of Hanover - Hanover Municipal Waterworks	R-2021-3026116	Cost of capital, awarded rate of return, capital structure	Pennsylvania Office of Consumer Advocate
Maryland Public Service Commission	Delmarva Power & Light Company	9670	Cost of capital and authorized rate of return	Maryland Office of People's Counsel
Oklahoma Corporation Commission	Oklahoma Natural Gas Company	PUD 202100063	Cost of capital, awarded rate of return, capital structure	Oklahoma Industrial Energy Consumers
Indiana Utility Regulatory Commission	Indiana Michigan Power Company	45576	Depreciation rates, service lives, net salvage	Indiana Office of Utility Consumer Counselor
Public Utility Commission of Texas	El Paso Electric Company	PUC 52195	Depreciation rates, service lives, net salvage	The City of El Paso
Pennsylvania Public Utility Commission	Aqua Pennsylvania	R-2021-3027385	Cost of capital, awarded rate of return, capital structure	Pennsylvania Office of Consumer Advocate
Public Service Commission of the State of Montana	NorthWestern Energy	D2021.02.022	Cost of capital, awarded rate of return, capital structure	Montana Consumer Counsel
Pennsylvania Public Utility Commission	PECO Energy Company	R-2021-3024601	Cost of capital, awarded rate of return, capital structure	Pennsylvania Office of Consumer Advocate

Utility Regulatory Proceedings

Regulatory Agency	Utility Applicant	Docket Number	Issues Addressed	Parties Represented
New Mexico Public Regulation Commission	Southwestern Public Service Company	20-00238-UT	Cost of capital and authorized rate of return	The New Mexico Large Customer Group; Occidental Permian
Oklahoma Corporation Commission	Public Service Company of Oklahoma	PUD 202100055	Cost of capital, depreciation rates, net salvage	Oklahoma Industrial Energy Consumers
Pennsylvania Public Utility Commission	Duquesne Light Company	R-2021-3024750	Cost of capital, awarded rate of return, capital structure	Pennsylvania Office of Consumer Advocate
Maryland Public Service Commission	Columbia Gas of Maryland	9664	Cost of capital and authorized rate of return	Maryland Office of People's Counsel
Indiana Utility Regulatory Commission	Southern Indiana Gas Company, d/b/a Vectren Energy Delivery of Indiana, Inc.	45447	Depreciation rates, service lives, net salvage	Indiana Office of Utility Consumer Counselor
Public Utility Commission of Texas	Southwestern Electric Power Company	PUC 51415	Depreciation rates, service lives, net salvage	Cities Advocating Reasonable Deregulation
New Mexico Public Regulatory Commission	Avangrid, Inc., Avangrid Networks, Inc., NM Green Holdings, Inc., PNM, and PNM Resources	20-00222-UT	Ring fencing and capital structure	The Albuquerque Bernalillo County Water Utility Authority
Indiana Utility Regulatory Commission	Indiana Gas Company, d/b/a Vectren Energy Delivery of Indiana, Inc.	45468	Depreciation rates, service lives, net salvage	Indiana Office of Utility Consumer Counselor
Public Utilities Commission of Nevada	Nevada Power Company and Sierra Pacific Power Company, d/b/a NV Energy	20-07023	Construction work in progress	MGM Resorts International, Caesars Enterprise Services, LLC, and the Southern Nevada Water Authority
Massachusetts Department of Public Utilities	Boston Gas Company, d/b/a National Grid	D.P.U. 20-120	Depreciation rates, service lives, net salvage	Massachusetts Office of the Attorney General, Office of Ratepayer Advocacy
Public Service Commission of the State of Montana	ABACO Energy Services, LLC	D2020.07.082	Cost of capital and authorized rate of return	Montana Consumer Counsel
Maryland Public Service Commission	Washington Gas Light Company	9651	Cost of capital and authorized rate of return	Maryland Office of People's Counsel
Florida Public Service Commission	Utilities, Inc. of Florida	20200139-WS	Cost of capital and authorized rate of return	Florida Office of Public Counsel
New Mexico Public Regulatory Commission	El Paso Electric Company	20-00104-UT	Cost of capital, depreciation rates, net salvage	City of Las Cruces and Doña Ana County

Utility Regulatory Proceedings

Regulatory Agency	Utility Applicant	Docket Number	Issues Addressed	Parties Represented
Public Utilities Commission of Nevada	Nevada Power Company	20-06003	Cost of capital, awarded rate of return, capital structure, earnings sharing	MGM Resorts International, Caesars Enterprise Services, LLC, Wynn Las Vegas, LLC, Smart Energy Alliance, and Circus Circus Las Vegas, LLC
Wyoming Public Service Commission	Rocky Mountain Power	20000-578-ER-20	Cost of capital and authorized rate of return	Wyoming Industrial Energy Consumers
Florida Public Service Commission	Peoples Gas System	20200051-GU 20200166-GU	Cost of capital, depreciation rates, net salvage	Florida Office of Public Counsel
Wyoming Public Service Commission	Rocky Mountain Power	20000-539-EA-18	Depreciation rates, service lives, net salvage	Wyoming Industrial Energy Consumers
Public Service Commission of South Carolina	Dominion Energy South Carolina	2020-125-E	Depreciation rates, service lives, net salvage	South Carolina Office of Regulatory Staff
Pennsylvania Public Utility Commission	The City of Bethlehem	2020-3020256	Cost of capital, awarded rate of return, capital structure	Pennsylvania Office of Consumer Advocate
Railroad Commission of Texas	Texas Gas Services Company	GUD 10928	Depreciation rates, service lives, net salvage	Gulf Coast Service Area Steering Committee
Public Utilities Commission of the State of California	Southern California Edison	A.19-08-013	Depreciation rates, service lives, net salvage	The Utility Reform Network
Massachusetts Department of Public Utilities	NSTAR Gas Company	D.P.U. 19-120	Depreciation rates, service lives, net salvage	Massachusetts Office of the Attorney General, Office of Ratepayer Advocacy
Georgia Public Service Commission	Liberty Utilities (Peach State Natural Gas)	42959	Depreciation rates, service lives, net salvage	Public Interest Advocacy Staff
Florida Public Service Commission	Florida Public Utilities Company	20190155-El 20190156-El 20190174-El	Depreciation rates, service lives, net salvage	Florida Office of Public Counsel
Illinois Commerce Commission	Commonwealth Edison Company	20-0393	Depreciation rates, service lives, net salvage	The Office of the Illinois Attorney General
Public Utility Commission of Texas	Southwestern Public Service Company	PUC 49831	Depreciation rates, service lives, net salvage	Alliance of Xcel Municipalities
Public Service Commission of South Carolina	Blue Granite Water Company	2019-290-WS	Depreciation rates, service lives, net salvage	South Carolina Office of Regulatory Staff

Utility Regulatory Proceedings

Regulatory Agency	Utility Applicant	Docket Number	Issues Addressed	Parties Represented
Railroad Commission of Texas	CenterPoint Energy Resources	GUD 10920	Depreciation rates and grouping procedure	Alliance of CenterPoint Municipalities
Pennsylvania Public Utility Commission	Aqua Pennsylvania Wastewater / East Norriton Township	A-2019-3009052	Fair market value estimates for wastewater assets	Pennsylvania Office of Consumer Advocate
New Mexico Public Regulation Commission	Southwestern Public Service Company	19-00170-UT	Cost of capital and authorized rate of return	The New Mexico Large Customer Group; Occidental Permian
Indiana Utility Regulatory Commission	Duke Energy Indiana	45253	Cost of capital, depreciation rates, net salvage	Indiana Office of Utility Consumer Counselor
Maryland Public Service Commission	Columbia Gas of Maryland	9609	Depreciation rates, service lives, net salvage	Maryland Office of People's Counsel
Washington Utilities & Transportation Commission	Avista Corporation	UE-190334	Cost of capital, awarded rate of return, capital structure	Washington Office of Attorney General
Indiana Utility Regulatory Commission	Indiana Michigan Power Company	45235	Cost of capital, depreciation rates, net salvage	Indiana Office of Utility Consumer Counselor
Public Utilities Commission of the State of California	Pacific Gas & Electric Company	18-12-009	Depreciation rates, service lives, net salvage	The Utility Reform Network
Oklahoma Corporation Commission	The Empire District Electric Company	PUD 201800133	Cost of capital, authorized ROE, depreciation rates	Oklahoma Industrial Energy Consumers and Oklahoma Energy Results
Arkansas Public Service Commission	Southwestern Electric Power Company	19-008-U	Cost of capital, depreciation rates, net salvage	Western Arkansas Large Energy Consumers
Public Utility Commission of Texas	CenterPoint Energy Houston Electric	PUC 49421	Depreciation rates, service lives, net salvage	Texas Coast Utilities Coalition
Massachusetts Department of Public Utilities	Massachusetts Electric Company and Nantucket Electric Company	D.P.U. 18-150	Depreciation rates, service lives, net salvage	Massachusetts Office of the Attorney General, Office of Ratepayer Advocacy
Oklahoma Corporation Commission	Oklahoma Gas & Electric Company	PUD 201800140	Cost of capital, authorized ROE, depreciation rates	Oklahoma Industrial Energy Consumers and Oklahoma Energy Results
Public Service Commission of the State of Montana	Montana-Dakota Utilities Company	D2018.9.60	Depreciation rates, service lives, net salvage	Montana Consumer Counsel and Denbury Onshore

Utility Regulatory Proceedings

Regulatory Agency	Utility Applicant	Docket Number	Issues Addressed	Parties Represented
Indiana Utility Regulatory Commission	Northern Indiana Public Service Company	45159	Depreciation rates, grouping procedure, demolition costs	Indiana Office of Utility Consumer Counselor
Public Service Commission of the State of Montana	NorthWestern Energy	D2018.2.12	Depreciation rates, service lives, net salvage	Montana Consumer Counsel
Oklahoma Corporation Commission	Public Service Company of Oklahoma	PUD 201800097	Depreciation rates, service lives, net salvage	Oklahoma Industrial Energy Consumers and Wal-Mart
Nevada Public Utilities Commission	Southwest Gas Corporation	18-05031	Depreciation rates, service lives, net salvage	Nevada Bureau of Consumer Protection
Public Utility Commission of Texas	Texas-New Mexico Power Company	PUC 48401	Depreciation rates, service lives, net salvage	Alliance of Texas-New Mexico Power Municipalities
Oklahoma Corporation Commission	Oklahoma Gas & Electric Company	PUD 201700496	Depreciation rates, service lives, net salvage	Oklahoma Industrial Energy Consumers and Oklahoma Energy Results
Maryland Public Service Commission	Washington Gas Light Company	9481	Depreciation rates, service lives, net salvage	Maryland Office of People's Counsel
Indiana Utility Regulatory Commission	Citizens Energy Group	45039	Depreciation rates, service lives, net salvage	Indiana Office of Utility Consumer Counselor
Public Utility Commission of Texas	Entergy Texas, Inc.	PUC 48371	Depreciation rates, decommissioning costs	Texas Municipal Group
Washington Utilities & Transportation Commission	Avista Corporation	UE-180167	Depreciation rates, service lives, net salvage	Washington Office of Attorney General
New Mexico Public Regulation Commission	Southwestern Public Service Company	17-00255-UT	Cost of capital and authorized rate of return	HollyFrontier Navajo Refining; Occidental Permian
Public Utility Commission of Texas	Southwestern Public Service Company	PUC 47527	Depreciation rates, plant service lives	Alliance of Xcel Municipalities
Public Service Commission of the State of Montana	Montana-Dakota Utilities Company	D2017.9.79	Depreciation rates, service lives, net salvage	Montana Consumer Counsel
Florida Public Service Commission	Florida City Gas	20170179-GU	Cost of capital, depreciation rates	Florida Office of Public Counsel

Utility Regulatory Proceedings

Regulatory Agency	Utility Applicant	Docket Number	Issues Addressed	Parties Represented
Washington Utilities & Transportation Commission	Avista Corporation	UE-170485	Cost of capital and authorized rate of return	Washington Office of Attorney General
Wyoming Public Service Commission	Powder River Energy Corporation	10014-182-CA-17	Credit analysis, cost of capital	Private customer
Oklahoma Corporation Commission	Public Service Co. of Oklahoma	PUD 201700151	Depreciation, terminal salvage, risk analysis	Oklahoma Industrial Energy Consumers
Public Utility Commission of Texas	Oncor Electric Delivery Company	PUC 46957	Depreciation rates, simulated analysis	Alliance of Oncor Cities
Nevada Public Utilities Commission	Nevada Power Company	17-06004	Depreciation rates, service lives, net salvage	Nevada Bureau of Consumer Protection
Public Utility Commission of Texas	El Paso Electric Company	PUC 46831	Depreciation rates, interim retirements	City of El Paso
Idaho Public Utilities Commission	Idaho Power Company	IPC-E-16-24	Accelerated depreciation of North Valmy plant	Micron Technology, Inc.
Idaho Public Utilities Commission	Idaho Power Company	IPC-E-16-23	Depreciation rates, service lives, net salvage	Micron Technology, Inc.
Public Utility Commission of Texas	Southwestern Electric Power Company	PUC 46449	Depreciation rates, decommissioning costs	Cities Advocating Reasonable Deregulation
Massachusetts Department of Public Utilities	Eversource Energy	D.P.U. 17-05	Cost of capital, capital structure, and rate of return	Sunrun Inc.; Energy Freedom Coalition of America
Railroad Commission of Texas	Atmos Pipeline - Texas	GUD 10580	Depreciation rates, grouping procedure	City of Dallas
Public Utility Commission of Texas	Sharyland Utility Company	PUC 45414	Depreciation rates, simulated analysis	City of Mission
Oklahoma Corporation Commission	Empire District Electric Company	PUD 201600468	Cost of capital, depreciation rates	Oklahoma Industrial Energy Consumers
Railroad Commission of Texas	CenterPoint Energy Texas Gas	GUD 10567	Depreciation rates, simulated plant analysis	Texas Coast Utilities Coalition

Utility Regulatory Proceedings

Regulatory Agency	Utility Applicant	Docket Number	Issues Addressed	Parties Represented
Arkansas Public Service Commission	Oklahoma Gas & Electric Company	160-159-GU	Cost of capital, depreciation rates, terminal salvage	Arkansas River Valley Energy Consumers; Wal-Mart
Florida Public Service Commission	Peoples Gas	160-159-GU	Depreciation rates, service lives, net salvage	Florida Office of Public Counsel
Arizona Corporation Commission	Arizona Public Service Company	E-01345A-16-0036	Cost of capital, depreciation rates, terminal salvage	Energy Freedom Coalition of America
Nevada Public Utilities Commission	Sierra Pacific Power Company	16-06008	Depreciation rates, net salvage, theoretical reserve	Northern Nevada Utility Customers
Oklahoma Corporation Commission	Oklahoma Gas & Electric Co.	PUD 201500273	Cost of capital, depreciation rates, terminal salvage	Public Utility Division
Oklahoma Corporation Commission	Public Service Co. of Oklahoma	PUD 201500208	Cost of capital, depreciation rates, terminal salvage	Public Utility Division
Oklahoma Corporation Commission	Oklahoma Natural Gas Company	PUD 201500213	Cost of capital, depreciation rates, net salvage	Public Utility Division

Proxy Group Summary

Company	Ticker	Market Cap. ($ millions)	Market Category	Value Line Safety Rank	Financial Strength
Atmos Energy Corp	ATO	15,700	Large Cap	1	A+
New Jersey Resources Corporation	NJR	4,300	Mid Cap	2	A+
NiSource Inc	NI	12,400	Large Cap	3	B+
Northwest Natural Holding Company	NWN	1,600	Small Cap	3	A
ONE Gas Inc	OGS	4,600	Mid Cap	2	B++
Spire Inc.	SR	3,900	Mid Cap	2	B++

Value Line Investment Survey

DCF Stock and Index Prices

Ticker	^GSPC	ATO	NJR	NI	NWN	OGS	SR
30-day Average	3882	111.04	44.14	29.15	52.99	81.61	73.71
Standard Deviation	145.4	3.97	1.39	1.46	1.42	3.36	2.56
06/01/22	4101	116.43	45.52	31.34	54.62	86.76	77.11
06/02/22	4177	116.60	46.19	31.41	55.72	86.74	77.51
06/03/22	4109	116.11	45.76	31.42	55.18	87.15	76.93
06/06/22	4121	116.76	46.31	31.76	55.45	87.44	77.59
06/07/22	4161	117.43	46.48	31.77	55.32	88.16	77.98
06/08/22	4116	115.22	46.06	31.03	54.70	86.53	77.01
06/09/22	4018	112.95	45.66	30.23	53.42	85.00	75.99
06/10/22	3901	111.97	45.66	30.05	54.09	85.11	76.96
06/13/22	3750	107.01	43.67	28.54	51.51	80.16	73.66
06/14/22	3735	105.54	42.61	27.60	50.81	78.82	72.97
06/15/22	3790	106.09	42.92	27.72	50.81	79.00	72.26
06/16/22	3667	104.58	42.35	27.17	50.86	78.08	71.69
06/17/22	3675	103.51	41.33	26.66	51.69	77.44	70.67
06/21/22	3765	105.47	42.21	26.98	51.76	78.42	71.89
06/22/22	3760	105.66	42.69	27.39	52.08	78.38	71.93
06/23/22	3796	107.04	42.67	27.81	52.12	78.19	72.13
06/24/22	3912	109.24	43.71	28.62	52.39	78.46	73.25
06/27/22	3900	110.75	44.56	29.16	53.48	81.10	74.99
06/28/22	3822	110.65	44.72	29.35	53.14	80.93	74.39
06/29/22	3819	110.90	44.20	29.46	52.95	80.81	74.19
06/30/22	3785	112.10	44.53	29.49	53.10	81.19	74.37
07/01/22	3825	115.15	45.49	30.05	54.58	84.15	76.32
07/05/22	3831	110.61	43.12	28.55	51.85	79.30	72.36
07/06/22	3845	113.00	43.96	29.07	52.96	80.85	72.81
07/07/22	3903	112.34	43.86	28.50	52.72	80.31	71.90
07/08/22	3899	112.05	43.70	28.47	52.06	79.67	71.39
07/11/22	3854	112.12	43.79	28.80	52.44	79.82	70.98
07/12/22	3819	111.85	43.48	28.68	52.15	79.79	70.37
07/13/22	3802	111.08	43.53	28.61	52.58	80.02	69.97
07/14/22	3790	110.92	43.51	28.71	53.23	80.40	69.81

All prices are adjusted closing prices reported by Yahoo! Finance, http://finance.yahoo.com

DCF Dividend Yields

		[1]	[2]	[3]	[4]
Company	Ticker	Quarterly Dividend	Annualized Dividend	Stock Price	Dividend Yield
Atmos Energy Corp	ATO	0.680	2.720	111.04	2.4%
New Jersey Resources Corporation	NJR	0.363	1.452	44.14	3.3%
NiSource Inc	NI	0.235	0.940	29.15	3.2%
Northwest Natural Holding Company	NWN	0.482	1.928	52.99	3.6%
ONE Gas Inc	OGS	0.620	2.480	81.61	3.0%
Spire Inc.	SR	0.685	2.740	73.71	3.7%
Average		**$0.51**	**$2.04**	**$65.44**	**3.2%**

[1] 2022 Q2 reported quarterly dividends per share. Nasdaq.com
[2] = [1] * 4
[3] Average stock price from Exhibit DJG-3
[4] = [2] / [3]

DCF Sustainable Growth Rate Determinants

Sustainable Growth Determinants	Rate	
Nominal GDP	3.8%	[1]
Real GDP	1.8%	[2]
Risk Free Rate	3.2%	[3]
Highest	**3.8%**	

[1],[2] CBO, The 2021 Long-Term Budget Outlook, p. 34
[3] From Exhibit DJG-7

DCF Results

Company	Ticker	[1] Dividend Yield	[2] Analyst Growth	[3] Sustainable Growth	[4] DCF Result (Analyst Growth)	[5] DCF Result (Sustainable Growth)
Atmos Energy Corp	ATO	2.4%	7.0%	3.8%	9.6%	6.4%
New Jersey Resources Corporation	NJR	3.3%	5.0%	3.8%	8.5%	7.3%
NiSource Inc	NI	3.2%	4.5%	3.8%	7.9%	7.2%
Northwest Natural Holding Company	NWN	3.6%	0.5%	3.8%	4.2%	7.5%
ONE Gas Inc	OGS	3.0%	6.5%	3.8%	9.7%	7.0%
Spire Inc.	SR	3.7%	5.0%	3.8%	8.9%	7.7%
Average		**3.2%**	**4.8%**	**3.8%**	**8.0%**	**7.1%**

[1] Dividend Yield from Exhibit DJG-4
[2] Forecasted dividend growth rates - Value Line
[3] Sustainable growth rate from Exhibit DJG-5
[4] Annual Compounding DCF = D_0 (1 + g) / P_0 + g (using sustainable growth rate)
[5] Annual Compounding DCF = D_0 (1 + g) / P_0 + g (using analyst growth rate)

CAPM Risk-Free Rate

Date	Rate
06/01/22	3.1%
06/02/22	3.1%
06/03/22	3.1%
06/06/22	3.2%
06/07/22	3.1%
06/08/22	3.2%
06/09/22	3.2%
06/10/22	3.2%
06/13/22	3.4%
06/14/22	3.5%
06/15/22	3.4%
06/16/22	3.4%
06/17/22	3.3%
06/21/22	3.4%
06/22/22	3.3%
06/23/22	3.2%
06/24/22	3.3%
06/27/22	3.3%
06/28/22	3.3%
06/29/22	3.2%
06/30/22	3.1%
07/01/22	3.1%
07/05/22	3.1%
07/06/22	3.1%
07/07/22	3.2%
07/08/22	3.3%
07/11/22	3.2%
07/12/22	3.1%
07/13/22	3.1%
07/14/22	3.1%
Average	**3.2%**

*Daily Treasury Yield Curve Rates on 30-year T-bonds, http://www.treasury.gov/resources-center/data-chart-center/interest-rates/

CAPM Beta Coefficient

Company	Ticker	Beta
Atmos Energy Corp	ATO	0.80
New Jersey Resources Corporation	NJR	0.95
NiSource Inc	NI	0.85
Northwest Natural Holding Company	NWN	0.80
ONE Gas Inc	OGS	0.80
Spire Inc.	SR	0.80
Average		0.83

Betas from Value Line Investment Survey

CAPM Implied Equity Risk Premium Estimate

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Year	Market Value	Operating Earnings	Dividends	Buybacks	Earnings Yield	Dividend Yield	Buyback Yield	Gross Cash Yield
2011	11,385	877	240	405	7.70%	2.11%	3.56%	5.67%
2012	12,742	870	281	399	6.83%	2.20%	3.13%	5.33%
2013	16,495	956	312	476	5.80%	1.89%	2.88%	4.77%
2014	18,245	1,004	350	553	5.50%	1.92%	3.03%	4.95%
2015	17,900	885	382	572	4.95%	2.14%	3.20%	5.33%
2016	19,268	920	397	536	4.77%	2.06%	2.78%	4.85%
2017	22,821	1,066	420	519	4.67%	1.84%	2.28%	4.12%
2018	21,027	1,282	456	806	6.10%	2.17%	3.84%	6.01%
2019	26,760	1,305	485	729	4.88%	1.81%	2.72%	4.54%
2020	31,659	1,019	480	520	3.22%	1.52%	1.64%	3.16%
2021	40,356	1,739	511	882	4.31%	1.27%	2.18%	3.45%

Cash Yield	4.74%	[9]
Growth Rate	7.09%	[10]
Risk-free Rate	3.21%	[11]
Current Index Value	3,882	[12]

	[13]	[14]	[15]	[16]	[17]
Year	1	2	3	4	5
Expected Dividends	197	211	226	242	259
Expected Terminal Value					4628
Present Value	181	178	175	172	3177
Intrinsic Index Value	3882	[18]			
Required Return on Market	9.0%	[19]			
Implied Equity Risk Premium	**5.8%**	[20]			

[1-4] S&P Quarterly Press Releases, data found at https://us.spindices.com/indices/equity/sp-500 (additional info tab) (all dollar figures are in $ billions)
[1] Market value of S&P 500
[5] = [2] / [1]
[6] = [3] / [1]
[7] = [4] / [1]
[8] = [6] + [7]
[9] = Average of [8]
[10] = Compund annual growth rate of [2] = (end value / beginning value)^$^{1/10}$-1
[11] Risk-free rate from DJG risk-free rate exhibit
[12] 30-day average of closing index prices from DJG stock price exhibit
[13-16] Expected dividends = [9]*[12]*(1+[10])^{n} ; Present value = expected dividend / (1+[11]+[19])^{n}
[17] Expected terminal value = expected dividend * (1+[11]) / [19] ; Present value = (expected dividend + expected terminal value) / (1+[11]+[19])^{n}
[18] = Sum([13-17]) present values.
[19] = [20] + [11]
[20] Internal rate of return calculation setting [18] equal to [12] and solving for the discount rate

CAPM Equity Risk Premium Results

IESE Business School Survey	5.6%	[1]
Duff & Phelps Report	5.5%	[2]
Damodaran (average)	5.6%	[3]
Garrett	5.8%	[4]
Average	**5.6%**	

[1] IESE Business School Survey 2022
[2] Duff & Phelps, 12-9-2020
[3] http://pages.stern.nyu.edu/~adamodar/ , 7-1-22
[4] ERP estimation from Exhibit DJG-9

CAPM Final Result

[1]	[2]	[3]	[4]
Risk-Free Rate	Proxy Beta	Risk Premium	**CAPM Result**
3.21%	0.833	5.6%	**7.9%**

[1] From DJG-7, risk-free rate exhibit
[2] From DJG-8, beta exhibit (avg. beta of proxy group)
[3] From DJG-10, equity risk premium exhibit
[4] = [1] + [2] * [3]

Cost of Equity Summary

Cost of Equity Model	Result
DCF (Sustainable Growth)	7.1%
DCF (Analyst Growth)	8.0%
Capital Asset Pricing Model	7.9%
Hamada (at proposed debt ratio)	9.0%
Average	**8.0%**
Highest	**9.0%**

Market Cost of Equity vs. Awarded Returns

	[1]		[2]		[3]		[4]	[5]	[6]	[7]
	Electric Utilities		Gas Utilities		Total Utilities		S&P 500	T-Bond	Risk	Market
Year	ROE	#	ROE	#	ROE	#	Returns	Rate	Premium	COE
1990	12.70%	38	12.68%	33	12.69%	71	-3.06%	8.07%	3.89%	11.96%
1991	12.54%	42	12.45%	31	12.50%	73	30.23%	6.70%	3.48%	10.18%
1992	12.09%	45	12.02%	28	12.06%	73	7.49%	6.68%	3.55%	10.23%
1993	11.46%	28	11.37%	40	11.41%	68	9.97%	5.79%	3.17%	8.96%
1994	11.21%	28	11.24%	24	11.22%	52	1.33%	7.82%	3.55%	11.37%
1995	11.58%	28	11.44%	13	11.54%	41	37.20%	5.57%	3.29%	8.86%
1996	11.40%	18	11.12%	17	11.26%	35	22.68%	6.41%	3.20%	9.61%
1997	11.33%	10	11.30%	12	11.31%	22	33.10%	5.74%	2.73%	8.47%
1998	11.77%	10	11.51%	10	11.64%	20	28.34%	4.65%	2.26%	6.91%
1999	10.72%	6	10.74%	6	10.73%	12	20.89%	6.44%	2.05%	8.49%
2000	11.58%	9	11.34%	13	11.44%	22	-9.03%	5.11%	2.87%	7.98%
2001	11.07%	15	10.96%	5	11.04%	20	-11.85%	5.05%	3.62%	8.67%
2002	11.21%	14	11.17%	19	11.19%	33	-21.97%	3.81%	4.10%	7.91%
2003	10.96%	20	10.99%	25	10.98%	45	28.36%	4.25%	3.69%	7.94%
2004	10.81%	21	10.63%	22	10.72%	43	10.74%	4.22%	3.65%	7.87%
2005	10.51%	24	10.41%	26	10.46%	50	4.83%	4.39%	4.08%	8.47%
2006	10.32%	26	10.40%	15	10.35%	41	15.61%	4.70%	4.16%	8.86%
2007	10.30%	38	10.22%	35	10.26%	73	5.48%	4.02%	4.37%	8.39%
2008	10.41%	37	10.39%	32	10.40%	69	-36.55%	2.21%	6.43%	8.64%
2009	10.52%	40	10.22%	30	10.39%	70	25.94%	3.84%	4.36%	8.20%
2010	10.37%	61	10.15%	39	10.28%	100	14.82%	3.29%	5.20%	8.49%
2011	10.29%	42	9.92%	16	10.19%	58	2.10%	1.88%	6.01%	7.89%
2012	10.17%	58	9.94%	35	10.08%	93	15.89%	1.76%	5.78%	7.54%
2013	10.03%	49	9.68%	21	9.93%	70	32.15%	3.04%	4.96%	8.00%
2014	9.91%	38	9.78%	26	9.86%	64	13.52%	2.17%	5.78%	7.95%
2015	9.85%	30	9.60%	16	9.76%	46	1.38%	2.27%	6.12%	8.39%
2016	9.77%	42	9.54%	26	9.68%	68	11.77%	2.45%	5.69%	8.14%
2017	9.74%	53	9.72%	24	9.73%	77	21.61%	2.41%	5.08%	7.49%
2018	9.64%	37	9.62%	26	9.63%	63	-4.23%	2.68%	5.96%	8.64%
2019	9.66%	67	9.71%	32	9.68%	99	31.22%	1.92%	5.20%	7.12%
2020	9.44%	43	9.46%	34	9.45%	77	18.01%	0.93%	4.72%	5.65%
2021	9.40%	55	9.52%	29	9.44%	84	18.01%	1.51%	4.24%	5.75%

[1], [2], [3] Average annual authorized ROE for electric and gas utilities, RRA Regulatory Focus: Major Rate Case Decisions; EEI Rate Review

[3] = [1] + [2]

[4], [5], [6] Annual S&P 500 return, 10-year T-bond Rate, and equity risk premium published by NYU Stern School of Business

[7] = [5] + [6] ; Market cost of equity represents the required return for investing in all stocks in the market for a given year

Proxy Company Debt Ratios

Company	Ticker	Debt Ratio
Atmos Energy Corp	ATO	38%
New Jersey Resources Corporation	NJR	57%
NiSource Inc	NI	57%
Northwest Natural Holding Company	NWN	53%
ONE Gas Inc	OGS	61%
Spire Inc.	SR	53%
Average		53%

Debt ratios from Value Line Investment Survey - Year End 2021

Competitive Industry Debt Ratios

Industry	# Firms	Debt Ratio
Air Transport	21	85%
Hospitals/Healthcare Facilities	31	80%
Hotel/Gaming	66	77%
Brokerage & Investment Banking	31	76%
Retail (Automotive)	32	72%
Food Wholesalers	15	68%
Retail (Grocery and Food)	15	68%
Rubber& Tires	2	67%
Bank (Money Center)	7	67%
Advertising	49	67%
Computers/Peripherals	46	67%
Auto & Truck	26	66%
Real Estate (Operations & Services)	51	66%
Retail (Special Lines)	76	64%
Cable TV	11	63%
Oil/Gas Distribution	21	63%
Packaging & Container	26	62%
Telecom. Services	42	61%
Recreation	60	61%
Broadcasting	28	60%
Transportation (Railroads)	4	60%
R.E.I.T.	238	60%
Power	50	60%
Telecom (Wireless)	17	59%
Transportation	17	59%
Beverage (Soft)	32	58%
Utility (Water)	14	57%
Retail (Distributors)	68	57%
Office Equipment & Services	18	57%
Aerospace/Defense	73	57%
Household Products	118	56%
Computer Services	83	56%
Green & Renewable Energy	20	56%
Chemical (Diversified)	4	55%
Trucking	34	55%
Farming/Agriculture	36	54%
Environmental & Waste Services	58	54%
Apparel	39	54%
Paper/Forest Products	11	54%
Retail (Online)	60	53%
Chemical (Basic)	35	53%
Real Estate (Development)	19	52%
Business & Consumer Services	160	52%
Coal & Related Energy	18	52%
Construction Supplies	48	51%
Total / Average	**1,930**	**61%**

http://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/dbtfund.htm

Hamada Model

Unlevering Beta

Proposed Debt Ratio	40.4%	[1]
Proposed Equity Ratio	59.6%	[2]
Debt / Equity Ratio	68%	[3]
Tax Rate	21%	[4]
Equity Risk Premium	5.6%	[5]
Risk-free Rate	3.2%	[6]
Proxy Group Beta	0.83	[7]
Unlevered Beta	0.54	[8]

Relevered Betas and Cost of Equity Estimates

[9] Debt Ratio	[10] D/E Ratio	[11] Levered Beta	[12] Cost of Equity
0.0%	0%	0.543	6.26%
20.0%	25%	0.650	6.87%
30.0%	43%	0.726	7.30%
40.4%	68%	0.833	7.90%
53.1%	113%	1.028	8.99%
55.0%	122%	1.067	9.21%
60.0%	150%	1.186	9.88%

[1] Company proposed debt ratio
[2] Company proposed equity ratio
[3] = [1] / [2]
[4] Tax rate
[5] Equity risk premium from Exhibit DJG-11
[6] Risk-free rate from Exhibit DJG-11
[7] Average proxy beta from Exhibit DJG-11
[8] = [7] / (1 + (1 - [4]) * [3])
[9] Various debt ratios (Garrett proposed highlighted)
[10] = [9] / (1 - [9])
[11] = [8] * (1 + (1 - [4]) * [10])
[12] = [6] + [11] * [5]

Weighted Average Rate of Return Proposal

OPC Proposed

Capital Component	Proposed Ratio	Cost Rate	Weighted Cost
Common Equity	41.35%	9.25%	3.82%
Long Term Debt	42.70%	4.28%	1.83%
Short Term Debt	4.13%	1.78%	0.07%
Customer Deposits	0.78%	2.64%	0.02%
Deferred Taxes	11.03%	0.00%	0.00%
Tax Credit	0.01%	0.00%	0.00%
Total	100.00%		5.75%

Company Proposed

Capital Component	Proposed Ratio	Cost Rate	Weighted Cost
Common Equity	52.56%	10.75%	5.65%
Long Term Debt	31.50%	4.28%	1.35%
Short Term Debt	4.13%	1.78%	0.07%
Customer Deposits	0.78%	2.64%	0.02%
Deferred Taxes	11.03%	0.00%	0.00%
Tax Credit	0.00%	0.00%	0.00%
Total	100.0%		7.09%

Summary Depreciation
Accrual Adjustment

Plant Function	Plant Balance	FCG Proposed Accrual	OPC Proposed Accrual	**OPC Accrual Adjustment**
Distribution	529,328,283	15,488,552	13,907,225	(1,581,327)
General	19,000,463	967,918	967,918	(0)
Total Plant Studied	$ 548,328,746	$ 16,456,470	$ 14,875,143	**$ (1,581,327)**

Mass Property Parameter Comparison

Account No.	Description	Company Position Iowa Curve Type	Company Position Iowa Curve AL	Company Position Depr Rate	Company Position Annual Accrual	Public Counsel Position Iowa Curve Type	Public Counsel Position Iowa Curve AL	Public Counsel Position Depr Rate	Public Counsel Position Annual Accrual
376.10	MAINS - STEEL	R4	65	2.66%	3,973,578	R3	70	2.40%	3,533,252
376.20	MAINS - PLASTIC	R4	65	2.42%	4,662,977	R3	70	2.20%	4,241,835
378.00	M&R STATION EQUIPMENT - GENERAL	S3	35	2.94%	79,760	S3	45	2.20%	60,315
379.00	M&R STATION EQUIPMENT - CITY GATE	S3	35	3.03%	594,062	S3	45	2.20%	430,929
380.10	SERVICES - STEEL	R2.5	50	4.92%	766,100	R2.5	55	4.10%	641,366
380.20	SERVICES - PLASTIC	R2.5	50	3.32%	3,449,035	R2.5	55	3.00%	3,074,090
383.00	HOUSE REGULATORS	R2.5	40	2.60%	196,454	R2	47	2.10%	158,853

Detailed Rate Comparison

		[1]	[2]		[3]		[4]	
			FCG Proposal		OPC Proposal		Difference	
Account No.	Description	Original Cost 12/31/2022	Rate	Annual Accrual	Rate	Annual Accrual	Rate	Annual Accrual
	DISTRIBUTION PLANT							
375.00	STRUCTURES AND IMPROVEMENTS	209,627	2.87%	6,009	2.90%	6,009	0.03%	0
376.10	MAINS - STEEL	149,385,025	2.66%	3,973,578	2.40%	3,533,252	-0.26%	-440,326
376.20	MAINS - PLASTIC	192,615,831	2.42%	4,662,977	2.20%	4,241,835	-0.22%	-421,142
378.00	MEASURING AND REGULATING STATION EQUIPMENT - GENERAL	2,715,950	2.94%	79,760	2.20%	60,315	-0.74%	-19,445
379.00	MEASURING AND REGULATING STATION EQUIPMENT - CITY GATE	19,606,557	3.03%	594,062	2.20%	430,929	-0.83%	-163,133
380.10	SERVICES - STEEL	15,577,540	4.92%	766,100	4.10%	641,366	-0.82%	-124,734
380.20	SERVICES - PLASTIC	103,791,092	3.32%	3,449,035	3.00%	3,074,090	-0.32%	-374,945
381.00	METERS	21,907,441	5.55%	1,216,049	5.60%	1,216,049	0.05%	0
381.10	METERS - ERT	1,791,693	5.33%	95,495	5.30%	95,496	-0.03%	1
382.00	METER INSTALLATIONS	5,818,611	3.28%	191,126	3.30%	191,126	0.02%	0
382.10	METER INSTALLATIONS - ERT	533,909	5.64%	30,127	5.60%	30,127	-0.04%	0
383.00	HOUSE REGULATORS	7,565,636	2.60%	196,454	2.10%	158,853	-0.50%	-37,601
384.00	HOUSE REGULATOR INSTALLATIONS	2,122,289	3.71%	78,750	3.70%	78,750	-0.01%	0
385.00	INDUSTRIAL MEASURING AND REGULATING STATION EQUIPMENT	3,725,563	2.53%	94,181	2.50%	94,181	-0.03%	0
387.00	OTHER EQUIPMENT	1,961,519	2.80%	54,849	2.80%	54,849	0.00%	0
	Total Distribution Plant	**529,328,283**	**2.93%**	**15,488,552**	**2.63%**	**13,907,225**	**-0.30%**	**-1,581,327**
	GENERAL PLANT							
390.00	STRUCTURES AND IMPROVEMENTS	9,127,408	3.58%	326,605	3.60%	326,605	0.02%	0
392.00	TRANSPORTATION EQUIPMENT	303,332	18.84%	57,133	18.80%	57,133	-0.04%	0
392.10	TRANSPORTATION EQUIPMENT - AUTOS AND LIGHT TRUCKS	1,723,037	6.80%	117,185	6.80%	117,185	0.00%	0
392.20	TRANSPORTATION EQUIPMENT - SERVICE TRUCKS	5,236,069	6.75%	353,693	6.80%	353,693	0.05%	0
392.30	TRANSPORTATION EQUIPMENT - HEAVY TRUCKS	776,644	6.57%	51,005	6.60%	51,005	0.03%	0
394.10	NATURAL GAS VEHICLE EQUIPMENT	1,564,203	2.95%	46,141	2.90%	46,141	-0.05%	0
396.00	POWER OPERATED EQUIPMENT	269,770	5.99%	16,156	6.00%	16,156	0.01%	0
	Total General Plant	**19,000,463**	**5.09%**	**967,918**	**5.09%**	**967,918**	**0.00%**	**0**
	TOTAL PLANT STUDIED	**$ 548,328,746**	**3.00%**	**$ 16,456,470**	**2.71%**	**$ 14,875,143**	**-0.29%**	**$ (1,581,327)**

[1], [2] From depreciation study
[3] From Exhibit DJG-21
[4] = [3] - [2]

Depreciation Rate Development

		[1]	[2]		[3]	[4]	[5]	[6]	[7]	[8]	[9]
Account No.	Description	Original Cost 12/31/2022	Iowa Curve Type	AL	Net Salvage	Depreciable Base	Book Reserve	Future Accruals	Remaining Life	Total Accrual	Rate
	DISTRIBUTION PLANT										
375.00	STRUCTURES AND IMPROVEMENTS	209,627	R4	35	0.0%	209,627	19,014	190,613	31.7	6,009	**2.90%**
376.10	MAINS - STEEL	149,385,025	R3	70	-75.0%	261,423,793	76,811,351	184,612,442	52.3	3,533,252	**2.40%**
376.20	MAINS - PLASTIC	192,615,831	R3	70	-60.0%	308,185,330	54,566,030	253,619,300	59.8	4,241,835	**2.20%**
378.00	MEASURING AND REGULATING STATION EQUIPMENT - GENERAL	2,715,950	S3	45	-5.0%	2,851,747	370,403	2,481,344	41.1	60,315	**2.20%**
379.00	MEASURING AND REGULATING STATION EQUIPMENT - CITY GATE	19,606,557	S3	45	-5.0%	20,586,885	5,568,998	15,017,887	34.9	430,929	**2.20%**
380.10	SERVICES - STEEL	15,577,540	R2.5	55	-100.0%	31,155,081	13,940,822	17,214,259	26.8	641,366	**4.10%**
380.20	SERVICES - PLASTIC	103,791,092	R2.5	55	-60.0%	166,065,747	26,655,757	139,409,990	45.4	3,074,090	**3.00%**
381.00	METERS	21,907,441	S2.5	20	0.0%	21,907,441	6,597,386	15,310,055	12.6	1,216,049	**5.60%**
381.10	METERS - ERT	1,791,693	S2.5	20	0.0%	1,791,693	380,269	1,411,423	14.8	95,496	**5.30%**
382.00	METER INSTALLATIONS	5,818,611	R3	35	-5.0%	6,109,542	1,660,136	4,449,406	23.3	191,126	**3.30%**
382.10	METER INSTALLATIONS - ERT	533,909	R1.5	20	0.0%	533,909	176,606	357,303	11.9	30,127	**5.60%**
383.00	HOUSE REGULATORS	7,565,636	R2	47	-5.0%	7,943,918	1,885,273	6,058,645	38.1	158,853	**2.10%**
384.00	HOUSE REGULATOR INSTALLATIONS	2,122,289	R2.5	40	0.0%	2,122,289	109,448	2,012,841	25.6	78,750	**3.70%**
385.00	INDUSTRIAL MEASURING AND REGULATING STATION EQUIPMENT	3,725,563	S3	35	0.0%	3,725,563	2,269,526	1,456,037	15.5	94,181	**2.50%**
387.00	OTHER EQUIPMENT	1,961,519	R3	35	0.0%	1,961,519	398,885	1,562,634	28.5	54,849	**2.80%**
	Total Distribution Plant	**529,328,283**			**-58.0%**	**836,574,083**	**191,409,904**	**645,164,179**	**46.4**	**13,907,225**	**2.63%**
	GENERAL PLANT										
390.00	STRUCTURES AND IMPROVEMENTS	9,127,408	S0.5	30	0.0%	9,127,408	1,667,746	7,459,663	22.8	326,605	**3.60%**
392.00	TRANSPORTATION EQUIPMENT	303,332	L2.5	10	10.0%	272,999	102,172	170,827	3.0	57,133	**18.80%**
392.10	TRANSPORTATION EQUIPMENT - AUTOS AND LIGHT TRUCKS	1,723,037	S2	9	10.0%	1,550,734	1,098,401	452,333	3.9	117,185	**6.80%**
392.20	TRANSPORTATION EQUIPMENT - SERVICE TRUCKS	5,236,069	L3	10	10.0%	4,712,462	2,572,619	2,139,843	6.1	353,693	**6.80%**
392.30	TRANSPORTATION EQUIPMENT - HEAVY TRUCKS	776,644	L3	13	10.0%	698,980	355,716	343,264	6.7	51,005	**6.60%**
394.10	NATURAL GAS VEHICLE EQUIPMENT	1,564,203	S4	20	0.0%	1,564,203	941,298	622,906	13.5	46,141	**2.90%**
396.00	POWER OPERATED EQUIPMENT	269,770	L2.5	15	10.0%	242,793	93,191	149,601	9.3	16,156	**6.00%**
	Total General Plant	**19,000,463**			**4.4%**	**18,169,578**	**6,831,142**	**11,338,437**	**11.7**	**967,918**	**5.09%**
	TOTAL PLANT STUDIED	**$ 548,328,746**			**-55.9%**	**$ 854,743,661**	**$ 198,241,045**	**$ 656,502,616**	**44.1**	**$ 14,875,143**	**2.71%**

[1] From depreciation study
[2] Iowa curves developed through statistical anaysis and professional judgment
[3] Mass net salvage rates developed through statistical analysis and professional judgment
[4] = [1]*(1-[3])
[5] From depreciation study
[6] = [4] - [5]
[7] Remaining life based on Iowa curve selected in [2]
[8] = [6] / [7]
[9] = [8] / [1]

Accounts 376.10 and 376.20 Curve Fitting

[1]	[2]	[3]	[4]	[5]	[6]	[7]
Age (Years)	**Exposures (Dollars)**	**Observed Life Table (OLT)**	**FCG R4-65**	**OPC R3-70**	**FCG SSD**	**OPC SSD**
0.0	182,100,094	100.00%	100.00%	100.00%	0.0000	0.0000
0.5	167,159,326	99.99%	100.00%	99.99%	0.0000	0.0000
1.5	145,583,570	99.99%	100.00%	99.97%	0.0000	0.0000
2.5	132,882,453	99.98%	100.00%	99.94%	0.0000	0.0000
3.5	126,453,375	99.94%	99.99%	99.91%	0.0000	0.0000
4.5	108,102,840	99.83%	99.99%	99.87%	0.0000	0.0000
5.5	98,788,283	99.48%	99.99%	99.84%	0.0000	0.0000
6.5	90,877,940	99.42%	99.98%	99.79%	0.0000	0.0000
7.5	89,163,013	99.10%	99.98%	99.75%	0.0001	0.0000
8.5	87,120,827	98.96%	99.97%	99.70%	0.0001	0.0001
9.5	87,068,578	98.96%	99.96%	99.64%	0.0001	0.0000
10.5	92,821,109	98.91%	99.95%	99.57%	0.0001	0.0000
11.5	90,350,833	98.66%	99.94%	99.50%	0.0002	0.0001
12.5	88,055,105	98.54%	99.93%	99.43%	0.0002	0.0001
13.5	86,443,669	98.52%	99.91%	99.34%	0.0002	0.0001
14.5	84,286,874	98.44%	99.89%	99.25%	0.0002	0.0001
15.5	71,588,647	98.43%	99.87%	99.15%	0.0002	0.0001
16.5	72,667,172	98.35%	99.84%	99.04%	0.0002	0.0000
17.5	71,987,522	98.32%	99.81%	98.92%	0.0002	0.0000
18.5	68,122,188	98.26%	99.77%	98.79%	0.0002	0.0000
19.5	62,255,137	98.24%	99.73%	98.65%	0.0002	0.0000
20.5	60,225,245	97.94%	99.68%	98.50%	0.0003	0.0000
21.5	57,263,130	97.82%	99.62%	98.33%	0.0003	0.0000
22.5	55,358,773	97.78%	99.55%	98.15%	0.0003	0.0000
23.5	55,713,552	97.75%	99.47%	97.96%	0.0003	0.0000
24.5	49,831,835	97.68%	99.38%	97.75%	0.0003	0.0000
25.5	46,181,505	97.63%	99.28%	97.53%	0.0003	0.0000
26.5	37,401,552	97.52%	99.16%	97.29%	0.0003	0.0000
27.5	34,669,346	97.41%	99.03%	97.03%	0.0003	0.0000
28.5	30,902,574	97.18%	98.87%	96.75%	0.0003	0.0000
29.5	29,449,779	96.92%	98.70%	96.46%	0.0003	0.0000
30.5	28,359,834	96.50%	98.51%	96.15%	0.0004	0.0000
31.5	27,083,101	96.25%	98.29%	95.81%	0.0004	0.0000
32.5	26,226,725	95.98%	98.04%	95.46%	0.0004	0.0000
33.5	23,947,123	95.81%	97.76%	95.08%	0.0004	0.0001
34.5	24,072,564	95.77%	97.46%	94.68%	0.0003	0.0001
35.5	23,954,388	95.69%	97.11%	94.25%	0.0002	0.0002
36.5	23,025,481	95.48%	96.73%	93.80%	0.0002	0.0003
37.5	21,316,238	94.88%	96.31%	93.32%	0.0002	0.0002
38.5	19,747,635	94.73%	95.84%	92.81%	0.0001	0.0004
39.5	19,281,528	94.30%	95.33%	92.27%	0.0001	0.0004
40.5	18,374,161	94.03%	94.77%	91.71%	0.0001	0.0005
41.5	19,459,100	93.22%	94.15%	91.11%	0.0001	0.0004
42.5	18,101,638	92.55%	93.47%	90.48%	0.0001	0.0004
43.5	16,845,503	92.40%	92.74%	89.82%	0.0000	0.0007
44.5	15,785,802	91.63%	91.94%	89.11%	0.0000	0.0006
45.5	14,468,938	91.26%	91.08%	88.38%	0.0000	0.0008

Accounts 376.10 and 376.20 Curve Fitting

[1]	[2]	[3]	[4]	[5]	[6]	[7]
Age (Years)	**Exposures (Dollars)**	**Observed Life Table (OLT)**	**FCG R4-65**	**OPC R3-70**	**FCG SSD**	**OPC SSD**
46.5	12,393,321	90.68%	90.14%	87.60%	0.0000	0.0009
47.5	11,184,811	90.29%	89.13%	86.79%	0.0001	0.0012
48.5	9,872,899	89.94%	88.04%	85.93%	0.0004	0.0016
49.5	9,000,676	89.39%	86.87%	85.04%	0.0006	0.0019
50.5	7,872,944	88.93%	85.63%	84.09%	0.0011	0.0023
51.5	6,578,997	84.78%	84.30%	83.10%	0.0000	0.0003
52.5	5,814,114	82.77%	82.88%	82.07%	0.0000	0.0000
53.5	4,791,363	78.55%	81.39%	80.98%	0.0008	0.0006
54.5	3,794,521	76.04%	79.80%	79.84%	0.0014	0.0014
55.5	2,225,671	74.80%	78.12%	78.64%	0.0011	0.0015
56.5	1,872,534	72.31%	76.34%	77.39%	0.0016	0.0026
57.5			74.44%	76.09%		
Sum of Squared Differences				[8]	0.0154	0.0205
Up to 1% of Beginning Exposures				[9]	0.0154	0.0205

[1] Age in years using half-year convention

[2] Dollars exposed to retirement at the beginning of each age interval

[3] Observed life table based on the Company's property records. These numbers form the original survivor curve.

[4] The Company's selected Iowa curve to be fitted to the OLT.

[5] My selected Iowa curve to be fitted to the OLT.

[6] = ([4] - [3])^2. This is the squared difference between each point on the Company's curve and the observed survivor curve.

[7] = ([5] - [3])^2. This is the squared difference between each point on my curve and the observed survivor curve.

[8] = Sum of squared differences. The smallest SSD represents the best mathematical fit.

Accounts 378.00 and 379.00 Curve Fitting

[1] Age (Years)	[2] Exposures (Dollars)	[3] Observed Life Table (OLT)	[4] FCG S3-35	[5] OPC S3-45	[6] FCG SSD	[7] OPC SSD
0.0	11,629,778	100.00%	100.00%	100.00%	0.0000	0.0000
0.5	10,511,224	100.00%	100.00%	100.00%	0.0000	0.0000
1.5	6,350,959	100.00%	100.00%	100.00%	0.0000	0.0000
2.5	6,677,394	100.00%	100.00%	100.00%	0.0000	0.0000
3.5	6,787,565	100.00%	100.00%	100.00%	0.0000	0.0000
4.5	3,271,814	97.61%	100.00%	100.00%	0.0006	0.0006
5.5	3,228,270	97.61%	100.00%	100.00%	0.0006	0.0006
6.5	2,980,246	97.61%	100.00%	100.00%	0.0006	0.0006
7.5	4,266,750	97.61%	99.99%	100.00%	0.0006	0.0006
8.5	4,328,537	97.61%	99.98%	100.00%	0.0006	0.0006
9.5	4,355,325	97.61%	99.97%	99.99%	0.0006	0.0006
10.5	5,090,780	97.61%	99.93%	99.99%	0.0005	0.0006
11.5	5,290,219	97.61%	99.88%	99.98%	0.0005	0.0006
12.5	5,336,627	97.61%	99.79%	99.96%	0.0005	0.0006
13.5	5,555,992	97.61%	99.65%	99.93%	0.0004	0.0005
14.5	5,712,642	97.61%	99.44%	99.89%	0.0003	0.0005
15.5	5,712,237	97.60%	99.15%	99.83%	0.0002	0.0005
16.5	5,085,077	97.60%	98.75%	99.75%	0.0001	0.0005
17.5	4,762,798	97.52%	98.21%	99.63%	0.0000	0.0004
18.5	4,509,807	97.52%	97.51%	99.47%	0.0000	0.0004
19.5	4,423,269	97.52%	96.63%	99.26%	0.0001	0.0003
20.5	4,113,068	97.47%	95.53%	98.99%	0.0004	0.0002
21.5	3,773,079	97.47%	94.19%	98.64%	0.0011	0.0001
22.5	3,176,285	97.47%	92.58%	98.21%	0.0024	0.0001
23.5	1,902,199	97.47%	90.70%	97.68%	0.0046	0.0000
24.5	1,838,300	97.34%	88.53%	97.05%	0.0078	0.0000
25.5	1,641,163	97.34%	86.05%	96.29%	0.0127	0.0001
26.5	903,055	97.34%	83.27%	95.39%	0.0198	0.0004
27.5	477,097	97.34%	80.19%	94.35%	0.0294	0.0009
28.5	521,821	97.34%	76.82%	93.15%	0.0421	0.0018
29.5	306,044	97.34%	73.19%	91.78%	0.0583	0.0031
30.5	180,464	97.34%	69.33%	90.25%	0.0785	0.0050
31.5	191,162	97.34%	65.26%	88.53%	0.1029	0.0078
32.5	211,675	97.34%	61.02%	86.63%	0.1319	0.0115
33.5	231,219	97.34%	56.66%	84.54%	0.1655	0.0164
34.5	249,558	97.34%	52.23%	82.27%	0.2035	0.0227
35.5	289,888	97.34%	47.77%	79.83%	0.2457	0.0307
36.5	289,708	97.18%	43.34%	77.21%	0.2899	0.0399
37.5	291,263	97.18%	38.98%	74.43%	0.3387	0.0517
38.5	297,738	97.18%	34.74%	71.50%	0.3899	0.0659
39.5	287,667	97.18%	30.67%	68.44%	0.4423	0.0826
40.5	285,655	97.12%	26.81%	65.26%	0.4944	0.1015
41.5	286,116	97.12%	23.18%	61.97%	0.5468	0.1235
42.5	289,835	97.12%	19.81%	58.61%	0.5976	0.1483
43.5	291,366	97.12%	16.73%	55.19%	0.6462	0.1758
44.5	166,203	96.94%	13.95%	51.73%	0.6887	0.2044
45.5	184,574	96.81%	11.47%	48.27%	0.7283	0.2357

Accounts 378.00 and 379.00 Curve Fitting

[1] Age (Years)	[2] Exposures (Dollars)	[3] Observed Life Table (OLT)	[4] FCG S3-35	[5] OPC S3-45	[6] FCG SSD	[7] OPC SSD
46.5	153,504	96.81%	9.30%	44.81%	0.7659	0.2704
47.5	143,329	96.81%	7.42%	41.39%	0.7991	0.3071
48.5	123,032	96.48%	5.81%	38.03%	0.8220	0.3417
49.5	102,125	96.48%	4.47%	34.74%	0.8465	0.3812
50.5	83,787	96.45%	3.37%	31.56%	0.8663	0.4211
51.5	42,924	95.84%	2.49%	28.50%	0.8715	0.4535
52.5	42,636	95.20%	1.79%	25.57%	0.8726	0.4849
53.5	41,081	95.20%	1.25%	22.79%	0.8826	0.5244
54.5	34,156	94.21%	0.85%	20.17%	0.8716	0.5482
55.5	27,758	88.59%	0.56%	17.73%	0.7750	0.5022
56.5	27,758	88.59%	0.35%	15.46%	0.7786	0.5348
57.5	27,297	88.59%	0.21%	13.37%	0.7811	0.5657
58.5	23,577	88.59%	0.12%	11.47%	0.7827	0.5948
59.5	21,726	88.59%	0.07%	9.75%	0.7837	0.6215
60.5	21,643	88.59%	0.03%	8.22%	0.7842	0.6460
61.5			0.02%	6.85%		
Sum of Squared Differences				[8]	18.5589	8.5355
Up to 1% of Beginning Exposures				[9]	8.6626	2.2575

[1] Age in years using half-year convention
[2] Dollars exposed to retirement at the beginning of each age interval
[3] Observed life table based on the Company's property records. These numbers form the original survivor curve.
[4] The Company's selected Iowa curve to be fitted to the OLT.
[5] My selected Iowa curve to be fitted to the OLT.
[6] = ([4] - [3])^2. This is the squared difference between each point on the Company's curve and the observed survivor curve.
[7] = ([5] - [3])^2. This is the squared difference between each point on my curve and the observed survivor curve.
[8] = Sum of squared differences. The smallest SSD represents the best mathematical fit.

Accounts 380.10 and 380.20 Curve Fitting

[1] Age (Years)	[2] Exposures (Dollars)	[3] Observed Life Table (OLT)	[4] FCG R2.5-50	[5] OPC R2.5-55	[6] FCG SSD	[7] OPC SSD
0.0	64,326,464	100.00%	100.00%	100.00%	0.0000	0.0000
0.5	52,418,510	100.00%	99.94%	99.95%	0.0000	0.0000
1.5	51,887,553	99.69%	99.83%	99.84%	0.0000	0.0000
2.5	47,111,127	99.53%	99.70%	99.73%	0.0000	0.0000
3.5	41,552,445	99.45%	99.56%	99.61%	0.0000	0.0000
4.5	33,797,564	99.11%	99.41%	99.47%	0.0000	0.0000
5.5	32,399,704	99.03%	99.25%	99.33%	0.0000	0.0000
6.5	30,808,915	98.98%	99.07%	99.18%	0.0000	0.0000
7.5	30,587,184	98.87%	98.88%	99.01%	0.0000	0.0000
8.5	29,429,960	98.61%	98.68%	98.84%	0.0000	0.0000
9.5	30,303,568	98.33%	98.45%	98.65%	0.0000	0.0000
10.5	30,507,051	98.20%	98.21%	98.44%	0.0000	0.0000
11.5	29,203,040	97.86%	97.95%	98.22%	0.0000	0.0000
12.5	28,596,584	97.75%	97.67%	97.99%	0.0000	0.0000
13.5	27,770,058	97.46%	97.37%	97.74%	0.0000	0.0000
14.5	27,277,949	96.58%	97.04%	97.47%	0.0000	0.0001
15.5	27,209,083	96.39%	96.69%	97.18%	0.0000	0.0001
16.5	27,920,233	96.27%	96.32%	96.87%	0.0000	0.0000
17.5	26,781,462	96.16%	95.91%	96.54%	0.0000	0.0000
18.5	25,915,520	96.02%	95.48%	96.19%	0.0000	0.0000
19.5	25,234,411	95.78%	95.01%	95.81%	0.0001	0.0000
20.5	22,929,801	95.43%	94.51%	95.41%	0.0001	0.0000
21.5	22,315,532	95.03%	93.97%	94.99%	0.0001	0.0000
22.5	20,939,627	94.51%	93.40%	94.53%	0.0001	0.0000
23.5	20,593,453	93.83%	92.79%	94.05%	0.0001	0.0000
24.5	18,455,380	93.21%	92.14%	93.53%	0.0001	0.0000
25.5	17,223,500	92.44%	91.44%	92.99%	0.0001	0.0000
26.5	15,370,796	91.10%	90.70%	92.41%	0.0000	0.0002
27.5	13,943,430	89.52%	89.92%	91.80%	0.0000	0.0005
28.5	12,516,488	88.75%	89.08%	91.15%	0.0000	0.0006
29.5	11,900,226	88.07%	88.19%	90.46%	0.0000	0.0006
30.5	11,362,274	87.29%	87.24%	89.73%	0.0000	0.0006
31.5	10,858,807	86.91%	86.24%	88.96%	0.0000	0.0004
32.5	10,216,786	86.49%	85.18%	88.15%	0.0002	0.0003
33.5	9,671,140	85.71%	84.06%	87.29%	0.0003	0.0002
34.5	8,943,637	85.11%	82.87%	86.38%	0.0005	0.0002
35.5	8,486,611	84.57%	81.62%	85.43%	0.0009	0.0001
36.5	7,856,546	84.18%	80.29%	84.42%	0.0015	0.0000
37.5	7,313,699	83.66%	78.89%	83.36%	0.0023	0.0000
38.5	6,553,074	82.74%	77.41%	82.25%	0.0028	0.0000
39.5	5,872,467	82.17%	75.85%	81.08%	0.0040	0.0001
40.5	5,296,284	81.32%	74.21%	79.85%	0.0051	0.0002
41.5	4,721,678	79.73%	72.49%	78.56%	0.0052	0.0001
42.5	4,251,549	78.95%	70.68%	77.20%	0.0068	0.0003
43.5	3,801,639	78.23%	68.78%	75.78%	0.0089	0.0006
44.5	3,208,280	77.73%	66.80%	74.29%	0.0120	0.0012
45.5	2,668,720	77.25%	64.72%	72.73%	0.0157	0.0020

Accounts 380.10 and 380.20 Curve Fitting

[1]	[2]	[3]	[4]	[5]	[6]	[7]
Age (Years)	**Exposures (Dollars)**	**Observed Life Table (OLT)**	**FCG R2.5-50**	**OPC R2.5-55**	**FCG SSD**	**OPC SSD**
46.5	2,073,249	76.84%	62.57%	71.10%	0.0204	0.0033
47.5	1,647,965	76.40%	60.32%	69.39%	0.0258	0.0049
48.5	1,139,190	75.83%	58.00%	67.62%	0.0318	0.0067
49.5	797,249	75.31%	55.61%	65.77%	0.0388	0.0091
50.5	733,891	74.67%	53.14%	63.85%	0.0463	0.0117
51.5	468,063	74.19%	50.62%	61.86%	0.0555	0.0152
52.5	335,121	73.81%	48.06%	59.80%	0.0663	0.0196
53.5	181,382	73.53%	45.45%	57.68%	0.0788	0.0251
54.5	37,759	73.26%	42.82%	55.50%	0.0926	0.0316
55.5	14,747	72.82%	40.19%	53.26%	0.1065	0.0383
56.5	12,318	72.78%	37.56%	50.97%	0.1240	0.0476
57.5			34.96%	48.64%		

Sum of Squared Differences	[8]	0.7540	0.2217
Up to 1% of Beginning Exposures	[9]	0.2302	0.0443

[1] Age in years using half-year convention

[2] Dollars exposed to retirement at the beginning of each age interval

[3] Observed life table based on the Company's property records. These numbers form the original survivor curve.

[4] The Company's selected Iowa curve to be fitted to the OLT.

[5] My selected Iowa curve to be fitted to the OLT.

[6] = ([4] - [3])^2. This is the squared difference between each point on the Company's curve and the observed survivor curve.

[7] = ([5] - [3])^2. This is the squared difference between each point on my curve and the observed survivor curve.

[8] = Sum of squared differences. The smallest SSD represents the best mathematical fit.

Account 383 Curve Fitting

[1] Age (Years)	[2] Exposures (Dollars)	[3] Observed Life Table (OLT)	[4] FCG R2.5-40	[5] OPC R2-47	[6] FCG SSD	[7] OPC SSD
0.0	5,965,765	100.00%	100.00%	100.00%	0.0000	0.0000
0.5	4,884,337	99.73%	99.93%	99.90%	0.0000	0.0000
1.5	5,201,544	98.51%	99.78%	99.69%	0.0002	0.0001
2.5	4,909,567	98.16%	99.61%	99.46%	0.0002	0.0002
3.5	4,232,936	96.94%	99.43%	99.21%	0.0006	0.0005
4.5	3,453,652	95.87%	99.23%	98.95%	0.0011	0.0009
5.5	3,080,648	95.50%	99.00%	98.67%	0.0012	0.0010
6.5	2,523,554	92.34%	98.76%	98.37%	0.0041	0.0036
7.5	2,385,284	91.32%	98.48%	98.04%	0.0051	0.0045
8.5	1,859,343	88.57%	98.18%	97.70%	0.0092	0.0083
9.5	1,879,654	87.86%	97.85%	97.34%	0.0100	0.0090
10.5	1,775,614	87.76%	97.49%	96.95%	0.0095	0.0084
11.5	1,459,371	87.70%	97.09%	96.53%	0.0088	0.0078
12.5	1,309,590	87.29%	96.65%	96.09%	0.0088	0.0077
13.5	1,429,679	87.27%	96.17%	95.62%	0.0079	0.0070
14.5	1,468,770	87.18%	95.64%	95.13%	0.0072	0.0063
15.5	1,446,093	84.44%	95.07%	94.60%	0.0113	0.0103
16.5	1,384,764	83.89%	94.44%	94.04%	0.0111	0.0103
17.5	1,051,683	83.75%	93.76%	93.45%	0.0100	0.0094
18.5	1,067,145	83.42%	93.02%	92.82%	0.0092	0.0088
19.5	1,048,801	82.85%	92.22%	92.16%	0.0088	0.0087
20.5	1,085,828	82.32%	91.35%	91.46%	0.0082	0.0084
21.5	1,224,877	82.07%	90.41%	90.73%	0.0070	0.0075
22.5	1,231,399	82.04%	89.40%	89.95%	0.0054	0.0063
23.5	1,212,060	81.96%	88.30%	89.13%	0.0040	0.0051
24.5	1,206,808	81.89%	87.12%	88.26%	0.0027	0.0041
25.5	1,029,337	81.22%	85.85%	87.35%	0.0021	0.0038
26.5	903,718	80.75%	84.49%	86.39%	0.0014	0.0032
27.5	834,530	80.47%	83.02%	85.38%	0.0007	0.0024
28.5	760,539	80.33%	81.45%	84.32%	0.0001	0.0016
29.5	579,944	80.19%	79.77%	83.21%	0.0000	0.0009
30.5	534,033	80.05%	77.97%	82.04%	0.0004	0.0004
31.5	513,436	80.01%	76.05%	80.82%	0.0016	0.0001
32.5	487,070	79.64%	74.00%	79.54%	0.0032	0.0000
33.5	470,175	79.64%	71.82%	78.20%	0.0061	0.0002
34.5	450,799	79.51%	69.50%	76.80%	0.0100	0.0007
35.5	369,008	79.34%	67.05%	75.33%	0.0151	0.0016
36.5	329,291	79.23%	64.46%	73.81%	0.0218	0.0029
37.5	299,339	78.77%	61.73%	72.22%	0.0290	0.0043
38.5	191,557	77.68%	58.88%	70.57%	0.0353	0.0051
39.5	143,871	77.21%	55.91%	68.85%	0.0454	0.0070
40.5	37,076	77.20%	52.83%	67.07%	0.0594	0.0103
41.5	31,144	72.25%	49.66%	65.22%	0.0510	0.0049
42.5	28,206	71.07%	46.43%	63.31%	0.0607	0.0060
43.5	17,355	71.00%	43.15%	61.34%	0.0775	0.0093
44.5	14,079	70.43%	39.86%	59.32%	0.0935	0.0123
45.5	60,901	69.08%	36.58%	57.24%	0.1056	0.0140

Account 383 Curve Fitting

[1]	[2]	[3]	[4]	[5]	[6]	[7]
Age (Years)	**Exposures (Dollars)**	**Observed Life Table (OLT)**	**FCG R2.5-40**	**OPC R2-47**	**FCG SSD**	**OPC SSD**
46.5	60,505	69.01%	33.35%	55.11%	0.1272	0.0193
47.5	59,878	68.98%	30.19%	52.93%	0.1505	0.0258
48.5	57,351	68.98%	27.14%	50.71%	0.1751	0.0334
49.5	57,239	68.98%	24.21%	48.45%	0.2004	0.0421
50.5	48,797	59.11%	21.45%	46.17%	0.1418	0.0168
51.5	45,538	58.07%	18.85%	43.86%	0.1538	0.0202
52.5	43,569	55.75%	16.44%	41.54%	0.1545	0.0202
53.5	40,130	52.97%	14.23%	39.21%	0.1501	0.0189
54.5	37,600	49.64%	12.21%	36.88%	0.1401	0.0163
55.5	30,631	40.56%	10.38%	34.57%	0.0911	0.0036
56.5	28,904	38.40%	8.75%	32.28%	0.0879	0.0037
57.5	28,464	37.82%	7.29%	30.03%	0.0932	0.0061
58.5	28,307	37.61%	6.01%	27.81%	0.0998	0.0096
59.5	28,274	37.56%	4.90%	25.65%	0.1067	0.0142
60.5	28,263	37.55%	3.94%	23.55%	0.1130	0.0196
61.5			3.12%	21.52%		
Sum of Squared Differences				[8]	2.7569	0.5052
Up to 1% of Beginning Exposures				[9]	1.0494	0.2805

[1] Age in years using half-year convention

[2] Dollars exposed to retirement at the beginning of each age interval

[3] Observed life table based on the Company's property records. These numbers form the original survivor curve.

[4] The Company's selected Iowa curve to be fitted to the OLT.

[5] My selected Iowa curve to be fitted to the OLT.

[6] = ([4] - [3])^2. This is the squared difference between each point on the Company's curve and the observed survivor curve.

[7] = ([5] - [3])^2. This is the squared difference between each point on my curve and the observed survivor curve.

[8] = Sum of squared differences. The smallest SSD represents the best mathematical fit.

FCG
Gas Division
376.10 Mains - Steel

Original Cost Of Utility Plant In Service
And Development Of Composite Remaining Life as of December 31, 2022
Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 70 *Survivor Curve:* R3

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
1963	1,639,858.55	70.00	23,426.55	19.79	463,696.56
1964	262,084.19	70.00	3,744.06	20.40	76,396.69
1965	1,427,008.43	70.00	20,385.83	21.03	428,776.80
1966	799,565.82	70.00	11,422.37	21.67	247,499.67
1967	688,601.34	70.00	9,837.16	22.32	219,548.11
1968	579,611.66	70.00	8,280.17	22.98	190,242.99
1969	884,559.50	70.00	12,636.56	23.65	298,814.31
1970	1,037,790.02	70.00	14,825.57	24.33	360,642.88
1971	778,287.69	70.00	11,118.39	25.01	278,109.60
1972	1,217,146.66	70.00	17,387.81	25.72	447,141.93
1973	1,111,737.21	70.00	15,881.96	26.42	419,654.57
1974	1,917,850.99	70.00	27,397.87	27.14	743,681.98
1975	1,210,897.61	70.00	17,298.54	27.87	482,111.71
1976	890,744.21	70.00	12,724.92	28.61	364,031.26
1977	1,193,700.42	70.00	17,052.86	29.35	500,534.51
1978	1,184,389.72	70.00	16,919.85	30.10	509,346.50
1979	1,207,012.75	70.00	17,243.04	30.87	532,248.57
1980	1,216,455.02	70.00	17,377.93	31.64	549,764.36
1981	2,285,284.22	70.00	32,646.91	32.42	1,058,255.70
1982	2,406,618.86	70.00	34,380.27	33.20	1,141,413.44
1983	2,295,764.66	70.00	32,796.64	33.99	1,114,888.76
1984	1,486,512.56	70.00	21,235.89	34.79	738,883.32
1985	1,019,001.59	70.00	14,557.16	35.60	518,244.80
1986	970,588.33	70.00	13,865.55	36.42	504,957.09
1987	1,465,445.63	70.00	20,934.94	37.24	779,608.41
1988	374,978.15	70.00	5,356.83	38.07	203,938.86
1989	360,265.45	70.00	5,146.65	38.91	200,239.06

FCG
Gas Division
376.10 Mains - Steel

Original Cost Of Utility Plant In Service
And Development Of Composite Remaining Life as of December 31, 2022
Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 70 *Survivor Curve:* R3

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
1990	389,448.23	70.00	5,563.55	39.75	221,158.08
1991	329,103.60	70.00	4,701.48	40.60	190,885.24
1992	2,408,204.43	70.00	34,402.92	41.46	1,426,234.09
1993	1,323,583.07	70.00	18,908.33	42.32	800,237.47
1994	5,795,296.26	70.00	82,789.94	43.19	3,575,768.68
1995	2,026,633.00	70.00	28,951.90	44.07	1,275,859.26
1996	3,808,547.48	70.00	54,407.82	44.95	2,445,621.63
1997	574,361.93	70.00	8,205.17	45.84	376,116.04
1998	962,788.73	70.00	13,754.12	46.73	642,765.76
1999	3,101,090.81	70.00	44,301.29	47.63	2,110,129.36
2000	907,443.78	70.00	12,963.48	48.54	629,221.69
2001	4,567,119.97	70.00	65,244.57	49.45	3,226,209.68
2002	980,851.71	70.00	14,012.17	50.36	705,720.50
2003	1,361,920.14	70.00	19,456.00	51.29	997,806.10
2004	97,093.12	70.00	1,387.04	52.21	72,420.00
2005	14,483,554.84	70.00	206,907.91	53.14	10,995,487.84
2006	871,241.62	70.00	12,446.31	54.08	673,049.09
2007	206,707.79	70.00	2,952.97	55.02	162,462.31
2008	1,094,191.60	70.00	15,631.31	55.96	874,721.66
2009	2,610,302.18	70.00	37,290.03	56.91	2,122,094.63
2010	1,518,889.49	70.00	21,698.42	57.86	1,255,443.97
2011	1,617,318.06	70.00	23,104.54	58.81	1,358,874.39
2012	6,290,032.95	70.00	89,857.61	59.77	5,370,997.81
2013	1,485,409.47	70.00	21,220.13	60.73	1,288,771.26
2014	2,925,214.09	70.00	41,788.77	61.70	2,578,318.64
2015	4,445,086.64	70.00	63,501.23	62.67	3,979,373.76
2016	8,611,013.00	70.00	123,014.46	63.64	7,828,262.13

FCG
Gas Division
376.10 Mains - Steel

Original Cost Of Utility Plant In Service
And Development Of Composite Remaining Life as of December 31, 2022
Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 70 *Survivor Curve:* R3

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
2017	1,658,807.26	70.00	23,697.24	64.61	1,531,069.96
2018	9,503,167.53	70.00	135,759.52	65.59	8,903,824.12
2019	11,069,519.13	70.00	158,135.97	66.56	10,525,962.65
2020	10,940,976.25	70.00	156,299.65	67.54	10,556,806.49
2021	285,118.39	70.00	4,073.12	68.52	279,107.24
2022	9,223,226.89	70.00	131,760.37	69.51	9,158,327.26
Total	149,385,024.68	70.00	2,134,071.60	52.25	111,511,781.20

Composite Average Remaining Life ... 52.25 Years

FCG
Gas Division
376.20 Mains - Plastic

Original Cost Of Utility Plant In Service
And Development Of Composite Remaining Life as of December 31, 2022
Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 70 *Survivor Curve:* R3

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
1985	20,480.78	70.00	292.58	35.60	10,416.13
1986	17,788.08	70.00	254.12	36.42	9,254.40
1987	1,408,001.97	70.00	20,114.31	37.24	749,048.73
1988	1,539,503.22	70.00	21,992.90	38.07	837,287.53
1989	1,849,907.41	70.00	26,427.25	38.91	1,028,196.60
1990	2,395,397.30	70.00	34,219.96	39.75	1,360,287.24
1991	2,169,215.27	70.00	30,988.79	40.60	1,258,178.84
1992	2,070,269.50	70.00	29,575.28	41.46	1,226,095.64
1993	2,568,850.94	70.00	36,697.87	42.32	1,553,125.61
1994	4,219,062.04	70.00	60,272.31	43.19	2,603,212.88
1995	2,843,208.25	70.00	40,617.26	44.07	1,789,931.17
1996	3,188,816.50	70.00	45,554.52	44.95	2,047,667.42
1997	1,352,541.37	70.00	19,322.02	45.84	885,700.24
1998	3,306,381.17	70.00	47,234.01	46.73	2,207,367.55
1999	2,096,757.59	70.00	29,953.68	47.63	1,426,733.37
2000	2,408,953.39	70.00	34,413.62	48.54	1,670,368.75
2001	2,375,925.16	70.00	33,941.79	49.45	1,678,351.52
2002	3,840,483.41	70.00	54,864.04	50.36	2,763,218.80
2003	2,593,763.91	70.00	37,053.77	51.29	1,900,312.19
2004	917,466.98	70.00	13,106.67	52.21	684,321.98
2005	622,237.20	70.00	8,889.10	53.14	472,384.14
2006	4,241,355.94	70.00	60,590.79	54.08	3,276,520.19
2007	4,074,604.54	70.00	58,208.63	55.02	3,202,441.76
2008	5,736,861.80	70.00	81,955.16	55.96	4,586,177.82
2009	3,765,357.01	70.00	53,790.81	56.91	3,061,118.34
2010	3,017,523.22	70.00	43,107.47	57.86	2,494,145.47
2011	3,500,476.04	70.00	50,006.80	58.81	2,941,108.10

FCG
Gas Division
376.20 Mains - Plastic

Original Cost Of Utility Plant In Service
And Development Of Composite Remaining Life as of December 31, 2022
Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 70 *Survivor Curve:* R3

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
2012	2,776,666.36	70.00	39,666.66	59.77	2,370,968.33
2013	1,946,506.46	70.00	27,807.23	60.73	1,688,828.32
2014	9,591,968.34	70.00	137,028.11	61.70	8,454,475.47
2015	9,945,686.73	70.00	142,081.23	62.67	8,903,674.54
2016	13,015,183.90	70.00	185,931.18	63.64	11,832,088.89
2017	12,811,883.45	70.00	183,026.89	64.61	11,825,297.84
2018	15,710,470.24	70.00	224,435.27	65.59	14,719,646.21
2019	17,868,512.73	70.00	255,264.45	66.56	16,991,099.20
2020	14,564,781.86	70.00	208,068.29	67.54	14,053,369.65
2021	6,788,949.90	70.00	96,984.99	68.52	6,645,818.56
2022	19,454,031.37	70.00	277,914.71	69.51	19,317,142.25
Total	192,615,831.33	70.00	2,751,654.50	59.79	164,525,381.68

Composite Average Remaining Life ... 59.79 Years

FCG
Gas Division
378.00 M&R Station Equipment - General

Original Cost Of Utility Plant In Service
And Development Of Composite Remaining Life as of December 31, 2022
Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 45 *Survivor Curve:* S3

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
2011	38,666.03	45.00	859.25	33.51	28,791.03
2014	260,634.95	45.00	5,791.89	36.50	211,409.27
2015	128,609.66	45.00	2,857.99	37.50	107,175.75
2016	557,188.88	45.00	12,381.98	38.50	476,707.76
2017	22,617.80	45.00	502.62	39.50	19,853.43
2018	32,176.28	45.00	715.03	40.50	28,958.66
2019	307,481.82	45.00	6,832.93	41.50	283,566.60
2020	604,694.81	45.00	13,437.66	42.50	571,100.62
2022	763,879.73	45.00	16,975.11	44.50	755,392.18
Total	2,715,949.96	45.00	60,354.45	41.14	2,482,955.29

Composite Average Remaining Life ... 41.14 Years

FCG
Gas Division
379.00 M&R Station Equipment - City Gate
Original Cost Of Utility Plant In Service
And Development Of Composite Remaining Life as of December 31, 2022
Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 45 *Survivor Curve:* S3

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
1959	14,737.97	45.00	327.51	3.85	1,261.42
1960	58.87	45.00	1.31	4.05	5.30
1961	1,335.11	45.00	29.67	4.26	126.32
1962	2,739.83	45.00	60.89	4.46	271.57
1963	346.40	45.00	7.70	4.68	36.01
1965	3,399.20	45.00	75.54	5.14	388.09
1966	5,156.83	45.00	114.60	5.38	616.44
1967	1,254.00	45.00	27.87	5.62	156.67
1968	3.41	45.00	0.08	5.88	0.45
1969	33,573.48	45.00	746.08	6.15	4,587.50
1970	15,463.85	45.00	343.64	6.43	2,208.65
1971	17,909.40	45.00	397.99	6.71	2,671.60
1972	17,191.58	45.00	382.04	7.01	2,679.12
1973	8,945.06	45.00	198.78	7.32	1,456.03
1974	27,646.93	45.00	614.38	7.65	4,699.78
1975	3,228.78	45.00	71.75	7.99	573.13
1976	113,453.89	45.00	2,521.20	8.34	21,023.84
1977	294.25	45.00	6.54	8.71	56.93
1980	1,735.23	45.00	38.56	9.91	381.97
1981	15,663.00	45.00	348.07	10.34	3,599.35
1982	431.39	45.00	9.59	10.80	103.49
1987	1,339.06	45.00	29.76	13.39	398.32
1989	19.60	45.00	0.44	14.59	6.35
1990	155,274.15	45.00	3,450.54	15.22	52,527.15
1991	217,879.30	45.00	4,841.76	15.88	76,909.83
1992	79,569.36	45.00	1,768.21	16.57	29,302.42
1993	424,832.10	45.00	9,440.71	17.28	163,177.13

FCG
Gas Division
379.00 M&R Station Equipment - City Gate

Original Cost Of Utility Plant In Service
And Development Of Composite Remaining Life as of December 31, 2022
Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 45 *Survivor Curve:* S3

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
1994	736,074.62	45.00	16,357.21	18.03	294,865.76
1995	196,751.04	45.00	4,372.25	18.79	82,157.97
1996	63,067.57	45.00	1,401.50	19.58	27,440.58
1997	1,289,839.98	45.00	28,663.11	20.39	584,493.51
1998	596,887.06	45.00	13,264.16	21.23	281,600.57
1999	339,859.81	45.00	7,552.44	22.09	166,819.47
2000	307,550.87	45.00	6,834.46	22.97	156,963.46
2001	86,526.54	45.00	1,922.81	23.86	45,885.32
2002	252,971.55	45.00	5,621.59	24.78	139,292.59
2003	319,783.48	45.00	7,106.30	25.71	182,706.38
2004	627,147.32	45.00	13,936.61	26.65	371,476.62
2008	33,571.26	45.00	746.03	30.53	22,779.69
2009	238,262.98	45.00	5,294.73	31.52	166,899.40
2010	2,653.24	45.00	58.96	32.51	1,917.00
2011	3,158.86	45.00	70.20	33.51	2,352.11
2012	1,366.02	45.00	30.36	34.50	1,047.41
2013	7,097.52	45.00	157.72	35.50	5,599.48
2014	422,415.36	45.00	9,387.01	36.50	342,634.48
2015	206,772.64	45.00	4,594.95	37.50	172,312.19
2016	2,991,461.05	45.00	66,476.92	38.50	2,559,370.34
2017	84,360.50	45.00	1,874.68	39.50	74,049.86
2018	396,403.57	45.00	8,808.97	40.50	356,763.28
2019	4,169,590.59	45.00	92,657.57	41.50	3,845,289.54
2020	1,757,303.75	45.00	39,051.20	42.50	1,659,675.67
2021	170,758.32	45.00	3,794.63	43.50	165,066.38
2022	3,141,439.49	45.00	69,809.77	44.50	3,106,534.60

FCG

Gas Division

379.00 M&R Station Equipment - City Gate

Original Cost Of Utility Plant In Service

And Development Of Composite Remaining Life as of December 31, 2022

Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 45 *Survivor Curve:* S3

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
Total	19,606,557.02	45.00	435,701.30	34.85	15,185,218.54

Composite Average Remaining Life ... 34.85 Years

FCG
Gas Division
380.10 Services - Steel

Original Cost Of Utility Plant In Service
And Development Of Composite Remaining Life as of December 31, 2022
Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 55 *Survivor Curve:* R2.5

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
1963	10,244.68	55.00	186.27	11.24	2,093.63
1964	2,100.09	55.00	38.18	11.64	444.30
1965	20,308.86	55.00	369.25	12.05	4,448.11
1966	131,212.19	55.00	2,385.67	12.47	29,757.84
1967	142,835.55	55.00	2,597.00	12.92	33,544.99
1968	124,158.65	55.00	2,257.43	13.38	30,195.20
1969	251,853.01	55.00	4,579.14	13.85	63,425.17
1970	55,075.31	55.00	1,001.37	14.34	14,361.15
1971	328,064.81	55.00	5,964.80	14.85	88,553.14
1972	490,094.73	55.00	8,910.80	15.37	136,943.57
1973	409,644.62	55.00	7,448.07	15.91	118,466.17
1974	578,102.42	55.00	10,510.93	16.46	172,985.10
1975	517,714.72	55.00	9,412.98	17.02	160,246.31
1976	568,277.01	55.00	10,332.29	17.60	181,867.76
1977	410,682.27	55.00	7,466.94	18.20	135,874.73
1978	423,446.26	55.00	7,699.01	18.80	144,779.37
1979	434,026.34	55.00	7,891.37	19.43	153,295.91
1980	522,220.53	55.00	9,494.90	20.06	190,457.40
1981	662,316.54	55.00	12,042.09	20.70	249,319.92
1982	844,395.18	55.00	15,352.61	21.36	327,915.73
1983	633,856.10	55.00	11,524.63	22.03	253,863.77
1984	623,249.58	55.00	11,331.79	22.71	257,319.15
1985	538,130.29	55.00	9,784.17	23.40	228,930.54
1986	758,987.38	55.00	13,799.74	24.10	332,555.05
1987	70,815.64	55.00	1,287.55	24.81	31,940.61
1988	51,193.73	55.00	930.79	25.53	23,761.67
1989	1,908.05	55.00	34.69	26.26	910.97

FCG

Gas Division

380.10 Services - Steel

Original Cost Of Utility Plant In Service

And Development Of Composite Remaining Life as of December 31, 2022

Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 55 *Survivor Curve:* R2.5

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
1990	22,159.96	55.00	402.91	27.00	10,878.07
1991	4,919.73	55.00	89.45	27.75	2,482.03
1992	786,110.40	55.00	14,292.89	28.51	407,427.01
1993	5,351.87	55.00	97.31	29.27	2,848.22
1994	26,977.90	55.00	490.51	30.05	14,737.90
1995	30,515.97	55.00	554.83	30.83	17,105.71
1996	1,466,939.39	55.00	26,671.57	31.62	843,419.42
1997	38,373.05	55.00	697.69	32.42	22,620.88
1998	46,756.44	55.00	850.12	33.23	28,248.39
1999	70,787.87	55.00	1,287.05	34.05	43,817.84
2000	52,138.09	55.00	947.96	34.87	33,054.47
2001	119,088.93	55.00	2,165.25	35.70	77,299.35
2002	129,100.26	55.00	2,347.27	36.54	85,765.04
2003	50,010.10	55.00	909.27	37.38	33,991.63
2004	2,252.71	55.00	40.96	38.23	1,566.01
2005	707,301.45	55.00	12,860.00	39.09	502,740.98
2006	15,901.80	55.00	289.12	39.96	11,553.04
2007	13,299.38	55.00	241.81	40.83	9,873.12
2008	105,563.34	55.00	1,919.33	41.71	80,052.22
2009	485,254.31	55.00	8,822.79	42.59	375,771.11
2010	82,838.82	55.00	1,506.16	43.48	65,488.80
2011	112,640.38	55.00	2,048.00	44.38	90,881.92
2012	116,799.44	55.00	2,123.62	45.28	96,149.67
2013	127,582.25	55.00	2,319.67	46.18	107,126.41
2014	130,143.30	55.00	2,366.24	47.09	111,430.75
2015	85,967.03	55.00	1,563.03	48.01	75,035.36
2016	137,618.49	55.00	2,502.15	48.93	122,420.14

FCG
Gas Division
380.10 Services - Steel

Original Cost Of Utility Plant In Service
And Development Of Composite Remaining Life as of December 31, 2022
Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 55 *Survivor Curve:* R2.5

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
2017	69,315.35	55.00	1,260.28	49.85	62,824.78
2018	56,822.43	55.00	1,033.13	50.78	52,460.50
2019	3,881.43	55.00	70.57	51.71	3,649.24
2020	639,135.25	55.00	11,620.62	52.65	611,768.15
2021	12,926.76	55.00	235.03	53.58	12,594.07
2022	218,151.93	55.00	3,966.39	54.53	216,277.25
Total	15,577,540.35	55.00	283,227.43	26.84	7,601,616.77

Composite Average Remaining Life ... 26.84 Years

FCG
Gas Division
380.20 Services - Plasic

Original Cost Of Utility Plant In Service
And Development Of Composite Remaining Life as of December 31, 2022
Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 55 **Survivor Curve:** R2.5

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
1979	47,758.61	55.00	868.34	19.43	16,868.10
1981	70.67	55.00	1.28	20.70	26.60
1983	23,587.14	55.00	428.86	22.03	9,446.81
1984	98,944.35	55.00	1,798.98	22.71	40,850.85
1985	140,139.71	55.00	2,547.99	23.40	59,618.01
1986	15,912.62	55.00	289.32	24.10	6,972.21
1987	719,861.85	55.00	13,088.37	24.81	324,685.68
1988	1,057,896.06	55.00	19,234.43	25.53	491,024.48
1989	883,388.37	55.00	16,061.57	26.26	421,761.73
1990	1,015,172.89	55.00	18,457.65	27.00	498,336.77
1991	1,038,897.86	55.00	18,889.01	27.75	524,129.09
1992	1,211,684.55	55.00	22,030.58	28.51	627,994.51
1993	1,571,070.16	55.00	28,564.85	29.27	836,110.32
1994	1,987,182.26	55.00	36,130.51	30.05	1,085,588.14
1995	1,715,054.80	55.00	31,182.75	30.83	961,373.28
1996	964,844.06	55.00	17,542.58	31.62	554,738.82
1997	838,417.82	55.00	15,243.93	32.42	494,246.50
1998	2,050,671.31	55.00	37,284.86	33.23	1,238,934.51
1999	1,147,281.09	55.00	20,859.61	34.05	710,169.47
2000	2,898,030.56	55.00	52,691.36	34.87	1,837,291.50
2001	1,336,323.62	55.00	24,296.74	35.70	867,393.32
2002	1,687,242.21	55.00	30,677.07	36.54	1,120,883.91
2003	2,015,082.78	55.00	36,637.79	37.38	1,369,642.41
2004	616,486.47	55.00	11,208.82	38.23	428,560.84
2005	360,265.93	55.00	6,550.28	39.09	256,072.50
2006	1,395,332.78	55.00	25,369.64	39.96	1,013,743.11
2007	1,918,378.80	55.00	34,879.54	40.83	1,424,154.78

FCG

Gas Division

380.20 Services - Plasic

Original Cost Of Utility Plant In Service

And Development Of Composite Remaining Life as of December 31, 2022

Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 55 *Survivor Curve:* R2.5

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
2008	2,572,426.06	55.00	46,771.29	41.71	1,950,757.01
2009	2,495,718.84	55.00	45,376.61	42.59	1,932,634.12
2010	1,873,396.75	55.00	34,061.69	43.48	1,481,026.70
2011	800,292.67	55.00	14,550.75	44.38	645,702.17
2012	3,548,612.74	55.00	64,520.10	45.28	2,921,229.40
2013	1,112,773.95	55.00	20,232.21	46.18	934,357.89
2014	3,872,802.83	55.00	70,414.45	47.09	3,315,954.94
2015	2,514,151.32	55.00	45,711.75	48.01	2,194,448.84
2016	10,472,114.57	55.00	190,401.69	48.93	9,315,592.14
2017	7,007,122.62	55.00	127,401.97	49.85	6,350,987.73
2018	6,435,145.25	55.00	117,002.40	50.78	5,941,155.79
2019	2,327,720.57	55.00	42,322.11	51.71	2,188,477.37
2020	14,162,799.39	55.00	257,504.92	52.65	13,556,363.28
2021	4,716,962.97	55.00	85,762.79	53.58	4,595,563.99
2022	11,124,071.87	55.00	202,255.44	54.53	11,028,477.63
Total	103,791,091.73	55.00	1,887,106.90	45.35	85,573,347.22

Composite Average Remaining Life ... 45.35 Years

FCG
Gas Division
383.00 House Regulators

Original Cost Of Utility Plant In Service
And Development Of Composite Remaining Life as of December 31, 2022
Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 47 *Survivor Curve:* R2

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
1967	422.51	47.00	8.99	9.41	84.57
1969	1,074.06	47.00	22.85	10.18	232.56
1970	27.00	47.00	0.57	10.58	6.08
1971	62.03	47.00	1.32	10.99	14.51
1972	1,392.14	47.00	29.62	11.42	338.18
1973	279.05	47.00	5.94	11.86	70.39
1974	140.60	47.00	2.99	12.31	36.81
1975	3,342.44	47.00	71.12	12.77	908.01
1976	1,708.48	47.00	36.35	13.24	481.41
1977	6,033.42	47.00	128.37	13.73	1,762.71
1978	1,444.71	47.00	30.74	14.23	437.47
1979	2,174.46	47.00	46.26	14.75	682.19
1980	61,583.16	47.00	1,310.27	15.27	20,011.80
1981	29,336.64	47.00	624.18	15.81	9,869.36
1982	65,468.30	47.00	1,392.94	16.36	22,792.33
1983	19,616.50	47.00	417.37	16.93	7,064.49
1984	27,684.25	47.00	589.02	17.50	10,308.91
1985	60,086.19	47.00	1,278.42	18.09	23,125.62
1986	15,226.71	47.00	323.97	18.69	6,054.52
1987	12,915.07	47.00	274.79	19.30	5,303.23
1988	20,389.03	47.00	433.81	19.92	8,643.10
1989	14,444.15	47.00	307.32	20.56	6,317.84
1990	33,951.88	47.00	722.38	21.20	15,316.39
1991	152,438.36	47.00	3,243.36	21.86	70,895.05
1992	62,533.73	47.00	1,330.50	22.52	29,969.45
1993	70,127.11	47.00	1,492.06	23.20	34,618.47
1994	103,124.77	47.00	2,194.13	23.89	52,415.35

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Gas Division

383.00 House Regulators

Original Cost Of Utility Plant In Service

And Development Of Composite Remaining Life as of December 31, 2022

Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 47 *Survivor Curve:* R2

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
1995	147,100.73	47.00	3,129.79	24.59	76,948.68
1996	96,910.63	47.00	2,061.92	25.29	52,155.66
1997	63,263.72	47.00	1,346.03	26.01	35,012.25
1998	81,848.32	47.00	1,741.45	26.74	46,562.15
2001	94,040.07	47.00	2,000.84	28.97	57,965.75
2003	371,386.23	47.00	7,901.80	30.50	241,039.39
2004	27,078.45	47.00	576.13	31.28	18,023.43
2006	6,803.09	47.00	144.75	32.87	4,757.17
2007	414.32	47.00	8.82	33.67	296.80
2008	130,900.31	47.00	2,785.10	34.48	96,027.92
2009	394,679.47	47.00	8,397.40	35.30	296,405.08
2010	159,104.67	47.00	3,385.19	36.12	122,282.19
2011	90,680.70	47.00	1,929.37	36.96	71,302.67
2012	375,649.92	47.00	7,992.52	37.80	302,088.03
2013	82,551.91	47.00	1,756.42	38.64	67,873.34
2014	433,635.43	47.00	9,226.25	39.50	364,404.59
2015	303,125.96	47.00	6,449.46	40.36	260,277.57
2016	626,316.63	47.00	13,325.83	41.22	549,328.61
2017	623,683.42	47.00	13,269.80	42.10	558,598.14
2018	324,146.28	47.00	6,896.70	42.97	296,379.37
2019	14,036.79	47.00	298.65	43.86	13,098.84
2020	939,313.52	47.00	19,985.31	44.75	894,343.76
2021	578,725.79	47.00	12,313.26	45.65	562,052.26
2022	833,213.17	47.00	17,727.86	46.55	825,188.03

FCG
Gas Division
383.00 House Regulators

Original Cost Of Utility Plant In Service
And Development Of Composite Remaining Life as of December 31, 2022
Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 47 *Survivor Curve:* R2

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
Total	7,565,636.28	47.00	160,970.29	38.14	6,140,172.49

Composite Average Remaining Life ... 38.14 Years

APPENDIX A:

DISCOUNTED CASH FLOW MODEL THEORY

The Discounted Cash Flow ("DCF") Model is based on a fundamental financial model called the "dividend discount model," which maintains that the value of a security is equal to the present value of the future cash flows it generates. Cash flows from common stock are paid to investors in the form of dividends. There are several variations of the DCF Model. In its most general form, the DCF Model is expressed as follows:[1]

Equation 1:
General Discounted Cash Flow Model

$$P_0 = \frac{D_1}{(1+k)} + \frac{D_2}{(1+k)^2} + \cdots + \frac{D_n}{(1+k)^n}$$

where: P_0 = *current stock price*
$D_1 \ldots D_n$ = *expected future dividends*
k = *discount rate / required return*

The General DCF Model would require an estimation of an infinite stream of dividends. Since this would be impractical, analysts use more feasible variations of the General DCF Model, which are discussed further below.

The DCF Models rely on the following four assumptions:

1. Investors evaluate common stocks in the classical valuation framework; that is, they trade securities rationally at prices reflecting their perceptions of value;

2. Investors discount the expected cash flows at the same rate (K) in every future period;

[1] *See* Zvi Bodie, Alex Kane & Alan J. Marcus, *Essentials of Investments* 410 (9th ed., McGraw-Hill/Irwin 2013).

3. The K obtained from the DCF equation corresponds to that specific stream of future cash flows alone; and

4. Dividends, rather than earnings, constitute the source of value.

The General DCF can be rearranged to make it more practical for estimating the cost of equity. Regulators typically rely on some variation of the Constant Growth DCF Model, which is expressed as follows:

Equation 2:
Constant Growth Discounted Cash Flow Model

$$K = \frac{D_1}{P_0} + g$$

where:	K	=	*discount rate / required return on equity*
	D_1	=	*expected dividend per share one year from now*
	P_0	=	*current stock price*
	g	=	*expected growth rate of future dividends*

Unlike the General DCF Model, the Constant Growth DCF Model solves directly for the required return (K). In addition, by assuming that dividends grow at a constant rate, the dividend stream from the General DCF Model may be essentially substituted with a term representing the expected constant growth rate of future dividends (g). The Constant Growth DCF Model may be considered in two parts. The first part is the dividend yield (D_1/P_0), and the second part is the growth rate (g). In other words, the required return in the DCF Model is equivalent to the dividend yield plus the growth rate.

In addition to the four assumptions listed above, the Constant Growth DCF Model relies on four additional assumptions as follows:[2]

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[2] *Id.* at 254-56.

1. The discount rate (K) must exceed the growth rate (g);
2. The dividend growth rate (g) is constant in every year to infinity;
3. Investors require the same return (K) in every year; and
4. There is no external financing; that is, growth is provided only by the retention of earnings.

Because the growth rate in this model is assumed to be constant, it is important not to use growth rates that are unreasonably high. In fact, the constant growth rate estimate for a regulated utility with a defined service territory should not exceed the growth rate for the economy in which it operates.

APPENDIX B:

CAPITAL ASSET PRICING MODEL THEORY

The Capital Asset Pricing Model ("CAPM") is a market-based model founded on the principle that investors demand higher returns for incurring additional risk.[3] The CAPM estimates this required return. The CAPM relies on the following assumptions:

1. Investors are rational, risk-adverse, and strive to maximize profit and terminal wealth;
2. Investors make choices based on risk and return. Return is measured by the mean returns expected from a portfolio of assets; risk is measured by the variance of these portfolio returns;
3. Investors have homogenous expectations of risk and return;
4. Investors have identical time horizons;
5. Information is freely and simultaneously available to investors.
6. There is a risk-free asset, and investors can borrow and lend unlimited amounts at the risk-free rate;
7. There are no taxes, transaction costs, restrictions on selling short, or other market imperfections; and,
8. Total asset quality is fixed, and all assets are marketable and divisible.[4]

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[3] William F. Sharpe, *A Simplified Model for Portfolio Analysis* 277-93 (Management Science IX 1963); *see also* John R. Graham, Scott B. Smart & William L. Megginson, *Corporate Finance: Linking Theory to What Companies Do* 208 (3rd ed., South Western Cengage Learning 2010).

[4] *Id*.

While some of these assumptions may appear to be restrictive, they do not outweigh the inherent value of the model. The CAPM has been widely used by firms, analysts, and regulators for decades to estimate the cost of equity capital.

The basic CAPM equation is expressed as follows:

Equation 3:
Capital Asset Pricing Model

$$K = R_F + \beta_i(R_M - R_F)$$

where:	K	=	*required return*
	R_F	=	*risk-free rate*
	β	=	*beta coefficient of asset i*
	R_M	=	*required return on the overall market*

There are essentially three terms within the CAPM equation that are required to calculate the required return (K): (1) the risk-free rate (R_F); (2) the beta coefficient (β); and (3) the equity risk premium ($R_M - R_F$), which is the required return on the overall market less the risk-free rate.

Raw Beta Calculations and Adjustments

A stock's beta equals the covariance of the asset's returns with the returns on a market portfolio, divided by the portfolio's variance, as expressed in the following formula:[5]

Equation 4:
Beta

$$\beta_i = \frac{\sigma_{im}}{\sigma_m^2}$$

where:	β_i	=	*beta of asset i*
	σ_{im}	=	*covariance of asset i returns with market portfolio returns*
	σ^2_m	=	*variance of market portfolio*

[5] John R. Graham, Scott B. Smart & William L. Megginson, *Corporate Finance: Linking Theory to What Companies Do* 180-81 (3rd ed., South Western Cengage Learning 2010).

Betas that are published by various research firms are typically calculated through a regression analysis that considers the movements in price of an individual stock and movements in the price of the overall market portfolio. The betas produced by this regression analysis are considered "raw" betas. There is empirical evidence that raw betas should be adjusted to account for beta's natural tendency to revert to an underlying mean.[6] Some analysts use an adjustment method proposed by Blume, which adjusts raw betas toward the market mean of one.[7] While the Blume adjustment method is popular due to its simplicity, it is arguably arbitrary, and some would say not useful at all. According to Dr. Damodaran: "While we agree with the notion that betas move toward 1.0 over time, the [Blume adjustment] strikes us as arbitrary and not particularly useful."[8] The Blume adjustment method is especially arbitrary when applied to industries with consistently low betas, such as the utility industry. For industries with consistently low betas, it is better to employ an adjustment method that adjusts raw betas toward an industry average, rather than the market average. Vasicek proposed such a method, which is preferable to the Blume adjustment method because it allows raw betas to be adjusted toward an industry average, and also accounts for the statistical accuracy of the raw beta calculation.[9] In other words, "[t]he Vasicek adjustment seeks to overcome one weakness of the Blume model by not applying the same adjustment to every security; rather, a security-specific adjustment is made depending on the

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[6] *See* Michael J. Gombola and Douglas R. Kahl, *Time-Series Processes of Utility Betas: Implications for Forecasting Systematic Risk* 84-92 (Financial Management Autumn 1990).

[7] See Marshall Blume, *On the Assessment of Risk*, Vol. 26, No. 1, The Journal of Finance 1 (1971).

[8] *See* Aswath Damodaran, *Investment Valuation: Tools and Techniques for Determining the Value of Any Asset* 187 (3rd ed., John Wiley & Sons, Inc. 2012).

[9] Oldrich A. Vasicek, *A Note on Using Cross-Sectional Information in Bayesian Estimation of Security Betas* 1233-1239 (Journal of Finance, Vol. 28, No. 5, December 1973).

statistical quality of the regression."[10] The Vasicek beta adjustment equation is expressed as follows:

Equation 5:
Vasicek Beta Adjustment

$$\beta_{i1} = \frac{\sigma^2_{\beta_{i0}}}{\sigma^2_{\beta 0} + \sigma^2_{\beta_{i0}}}\beta_0 + \frac{\sigma^2_{\beta 0}}{\sigma^2_{\beta 0} + \sigma^2_{\beta_{i0}}}\beta_{i0}$$

where:	β_{i1}	=	*Vasicek adjusted beta for security i*
	β_{i0}	=	*historical beta for security i*
	β_0	=	*beta of industry or proxy group*
	$\sigma^2_{\beta 0}$	=	*variance of betas in the industry or proxy group*
	$\sigma^2_{\beta i0}$	=	*square of standard error of the historical beta for security i*

The Vasicek beta adjustment is an improvement on the Blume model because the Vasicek model does not apply the same adjustment to every security. A higher standard error produced by the regression analysis indicates a lower statistical significance of the beta estimate. Thus, a beta with a high standard error should receive a greater adjustment than a beta with a low standard error. As stated in Ibbotson:

[10] 2012 Ibbotson Stocks, Bonds, Bills, and Inflation Valuation Yearbook 77-78 (Morningstar 2012).

> While the Vasicek formula looks intimidating, it is really quite simple. The adjusted beta for a company is a weighted average of the company's historical beta and the beta of the market, industry, or peer group. How much weight is given to the company and historical beta depends on the statistical significance of the company beta statistic. If a company beta has a low standard error, then it will have a higher weighting in the Vasicek formula. If a company beta has a high standard error, then it will have lower weighting in the Vasicek formula. An advantage of this adjustment methodology is that it does not force an adjustment to the market as a whole. Instead, the adjustment can be toward an industry or some other peer group. *This is most useful in looking at companies in industries that on average have high or low betas*.[11]

Thus, the Vasicek adjustment method is statistically more accurate, and is the preferred method to use when analyzing companies in an industry that has inherently low betas, such as the utility industry. The Vasicek method was also confirmed by Gombola, who conducted a study specifically related to utility companies. Gombola concluded that "[t]he strong evidence of auto-regressive tendencies in *utility* betas lends support to the application of adjustment procedures such as the . . . adjustment procedure presented by Vasicek."[12] Gombola also concluded that adjusting raw betas toward the market mean of 1.0 is *too high*, and that "[i]nstead, they should be adjusted toward a value that is less than one."[13] In conducting the Vasicek adjustment on betas in previous

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[11] *Id*. at 78 (emphasis added).

[12] Michael J. Gombola and Douglas R. Kahl, *Time-Series Processes of Utility Betas: Implications for Forecasting Systematic Risk* 92 (Financial Management Autumn 1990) (emphasis added).

[13] *Id*. at 91-92.

cases, it reveals that utility betas are even lower than those published by Value Line.[14] Gombola's findings are particular important here, because his study was conducted specifically on utility companies. This evidence indicates that using Value Line's betas in a CAPM cost of equity estimate for a utility company may lead to overestimated results. Regardless, adjusting betas to a level that is *higher* than Value Line's betas is not reasonable, and it would produce CAPM cost of equity results that are too high.

[14] *See e.g.* Responsive Testimony of David J. Garrett, filed March 21, 2016 in Cause No. PUD 201500273 before the Corporation Commission of Oklahoma (the Company's 2015 rate case), at pp. 56 – 59.

APPENDIX C:

THE DEPRECIATION SYSTEM

A depreciation accounting system may be thought of as a dynamic system in which estimates of life and salvage are inputs to the system, and the accumulated depreciation account is a measure of the state of the system at any given time.[15] The primary objective of the depreciation system is the timely recovery of capital. The process for calculating the annual accruals is determined by the factors required to define the system. A depreciation system should be defined by four primary factors: 1) a *method* of allocation; 2) a *procedure* for applying the method of allocation to a group of property; 3) a *technique* for applying the depreciation rate; and 4) a *model* for analyzing the characteristics of vintage groups comprising a continuous property group.[16] The figure below illustrates the basic concept of a depreciation system and includes some of the available parameters.[17]

There are hundreds of potential combinations of methods, procedures, techniques, and models, but in practice, analysts use only a few combinations. Ultimately, the system selected must result in the systematic and rational allocation of capital recovery for the utility. Each of the four primary factors defining the parameters of a depreciation system is discussed further below.

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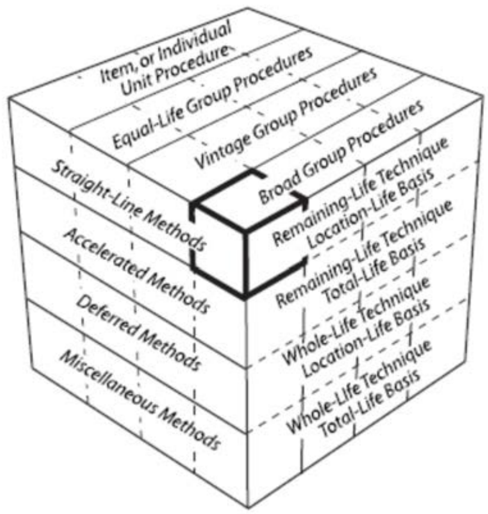
[15] *See* Frank K. Wolf & W. Chester Fitch, *Depreciation Systems* 69-70 (Iowa State University Press 1994).

[16] *Id.* at 70, 139-40.

[17] Edison Electric Institute, *Introduction to Depreciation* (inside cover) (EEI April 2013). Some definitions of the terms shown in this diagram are not consistent among depreciation practitioners and literature due to the fact that depreciation analysis is a relatively small and fragmented field. This diagram simply illustrates the some of the available parameters of a depreciation system.

Figure 1:
The Depreciation System Cube



1. <u>Allocation Methods</u>

The "method" refers to the pattern of depreciation in relation to the accounting periods. The method most commonly used in the regulatory context is the "straight-line method" — a type of age-life method in which the depreciable cost of plant is charged in equal amounts to each accounting period over the service life of plant.[18] Because group depreciation rates and plant balances often change, the amount of the annual accrual rarely remains the same, even when the straight-line method is employed.[19] The basic formula for the straight-line method is as follows:[20]

Equation 6:
Straight-Line Accrual

$$Annual\ Accrual = \frac{Gross\ Plant - Net\ Salavage}{Service\ Life}$$

[18] National Association of Regulatory Utility Commissioners, *Public Utility Depreciation Practices* 56 (NARUC 1996).

[19] *Id*.

[20] *Id*.

Gross plant is a known amount from the utility's records, while both net salvage and service life must be estimated in order to calculate the annual accrual. The straight-line method differs from accelerated methods of recovery, such as the "sum-of-the-years-digits" method and the "declining balance" method. Accelerated methods are primarily used for tax purposes and are rarely used in the regulatory context for determining annual accruals.[21] In practice, the annual accrual is expressed as a rate which is applied to the original cost of plant in order to determine the annual accrual in dollars. The formula for determining the straight-line rate is as follows:[22]

Equation 7:
Straight-Line Rate

$$Depreciation\ Rate\ \% = \frac{100 - Net\ Salvage\ \%}{Service\ Life}$$

2. Grouping Procedures

The "procedure" refers to the way the allocation method is applied through subdividing the total property into groups.[23] While single units may be analyzed for depreciation, a group plan of depreciation is particularly adaptable to utility property. Employing a grouping procedure allows for a composite application of depreciation rates to groups of similar property, rather than excessively conducting calculations for each unit. Whereas an individual unit of property has a single life, a group of property displays a dispersion of lives and the life characteristics of the group must be described statistically.[24] When analyzing mass property categories, it is important that

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[21] *Id*. at 57.

[22] *Id*. at 56.

[23] Wolf *supra* n. 15, at 74-75.

[24] *Id*. at 74.

each group contains homogenous units of plant that are used in the same general manner throughout the plant and operated under the same general conditions.[25]

The "average life" and "equal life" grouping procedures are the two most common. In the average life procedure, a constant annual accrual rate based on the average life of all property in the group is applied to the surviving property. While property having shorter lives than the group average will not be fully depreciated, and likewise, property having longer lives than the group average will be over-depreciated, the ultimate result is that the group will be fully depreciated by the time of the final retirement.[26] Thus, the average life procedure treats each unit as though its life is equal to the average life of the group. In contrast, the equal life procedure treats each unit in the group as though its life was known.[27] Under the equal life procedure the property is divided into subgroups that each has a common life.[28]

3. Application Techniques

The third factor of a depreciation system is the "technique" for applying the depreciation rate. There are two commonly used techniques: "whole life" and "remaining life." The whole life technique applies the depreciation rate on the estimated average service life of a group, while the remaining life technique seeks to recover undepreciated costs over the remaining life of the plant.[29]

In choosing the application technique, consideration should be given to the proper level of the accumulated depreciation account. Depreciation accrual rates are calculated using estimates of service life and salvage. Periodically these estimates must be revised due to changing

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[25] NARUC *supra* n. 119, at 61-62.

[26] *See* Wolf *supr*a n. 15, at 74-75.

[27] *Id*. at 75.

[28] *Id*.

[29] NARUC *supra* n. 119, at 63-64.

conditions, which cause the accumulated depreciation account to be higher or lower than necessary. Unless some corrective action is taken, the annual accruals will not equal the original cost of the plant at the time of final retirement.[30] Analysts can calculate the level of imbalance in the accumulated depreciation account by determining the "calculated accumulated depreciation," (a.k.a. "theoretical reserve" and referred to in these appendices as "CAD"). The CAD is the calculated balance that would be in the accumulated depreciation account at a point in time using *current* depreciation parameters.[31] An imbalance exists when the actual accumulated depreciation account does not equal the CAD. The choice of application technique will affect how the imbalance is dealt with.

Use of the whole life technique requires that an adjustment be made to accumulated depreciation after calculation of the CAD. The adjustment can be made in a lump sum or over a period of time. With use of the remaining life technique, however, adjustments to accumulated depreciation are amortized over the remaining life of the property and are automatically included in the annual accrual.[32] This is one reason that the remaining life technique is popular among practitioners and regulators. The basic formula for the remaining life technique is as follows:[33]

[30] Wolf *supra* n. 15, at 83.

[31] NARUC *supra* n. 119, at 325.

[32] NARUC *supra* n. 119, at 65 ("The desirability of using the remaining life technique is that any necessary adjustments of [accumulated depreciation] . . . are accrued automatically over the remaining life of the property. Once commenced, adjustments to the depreciation reserve, outside of those inherent in the remaining life rate would require regulatory approval.").

[33] *Id*. at 64.

Equation 8:
Remaining Life Accrual

$$Annual\ Accrual = \frac{Gross\ Plant - Accumulated\ Depreciation - Net\ Salvage}{Average\ Remaining\ Life}$$

The remaining life accrual formula is similar to the basic straight-line accrual formula above with two notable exceptions. First, the numerator has an additional factor in the remaining life formula: the accumulated depreciation. Second, the denominator is "average remaining life" instead of "average life." Essentially, the future accrual of plant (gross plant less accumulated depreciation) is allocated over the remaining life of plant. Thus, the adjustment to accumulated depreciation is "automatic" in the sense that it is built into the remaining life calculation.[34]

4. <u>Analysis Model</u>

The fourth parameter of a depreciation system, the "model," relates to the way of viewing the life and salvage characteristics of the vintage groups that have been combined to form a continuous property group for depreciation purposes.[35] A continuous property group is created when vintage groups are combined to form a common group. Over time, the characteristics of the property may change, but the continuous property group will continue. The two analysis models used among practitioners, the "broad group" and the "vintage group," are two ways of viewing the life and salvage characteristics of the vintage groups that have been combined to from a continuous property group.

The broad group model views the continuous property group as a collection of vintage groups that each has the same life and salvage characteristics. Thus, a single survivor curve and a

[34] Wolf *supra* n. 15, at 178.

[35] *See* Wolf *supra* n. 15, at 139 (I added the term "model" to distinguish this fourth depreciation system parameter from the other three parameters).

single salvage schedule are chosen to describe all the vintages in the continuous property group. In contrast, the vintage group model views the continuous property group as a collection of vintage groups that may have different life and salvage characteristics. Typically, there is not a significant difference between vintage group and broad group results unless vintages within the applicable property group experienced dramatically different retirement levels than anticipated in the overall estimated life for the group. For this reason, many analysts utilize the broad group procedure because it is more efficient.

APPENDIX D:

IOWA CURVES

Early work in the analysis of the service life of industrial property was based on models that described the life characteristics of human populations.[36] This explains why the word "mortality" is often used in the context of depreciation analysis. In fact, a group of property installed during the same accounting period is analogous to a group of humans born during the same calendar year. Each period the group will incur a certain fraction of deaths / retirements until there are no survivors. Describing this pattern of mortality is part of actuarial analysis and is regularly used by insurance companies to determine life insurance premiums. The pattern of mortality may be described by several mathematical functions, particularly the survivor curve and frequency curve. Each curve may be derived from the other so that if one curve is known, the other may be obtained. A survivor curve is a graph of the percent of units remaining in service expressed as a function of age.[37] A frequency curve is a graph of the frequency of retirements as a function of age. Several types of survivor and frequency curves are illustrated in the figures below.

1. Development

The survivor curves used by analysts today were developed over several decades from extensive analysis of utility and industrial property. In 1931 Edwin Kurtz and Robley Winfrey used extensive data from a range of 65 industrial property groups to create survivor curves representing the life characteristics of each group of property.[38] They generalized the 65 curves

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[36] Wolf *supra* n. 15, at 276.

[37] *Id*. at 23.

[38] *Id*. at 34.

into 13 survivor curve types and published their results in *Bulletin 103: Life Characteristics of Physical Property*. The 13 type curves were designed to be used as valuable aids in forecasting probable future service lives of industrial property. Over the next few years, Winfrey continued gathering additional data, particularly from public utility property, and expanded the examined property groups from 65 to 176.[39] This resulted in 5 additional survivor curve types for a total of 18 curves. In 1935, Winfrey published *Bulletin 125: Statistical Analysis of Industrial Property Retirements*. According to Winfrey, "[t]he 18 type curves are expected to represent quite well all survivor curves commonly encountered in utility and industrial practices."[40] These curves are known as the "Iowa curves" and are used extensively in depreciation analysis in order to obtain the average service lives of property groups. (Use of Iowa curves in actuarial analysis is further discussed in Exhibit DJG-23, Appendix E.)

In 1942, Winfrey published *Bulletin 155: Depreciation of Group Properties*. In Bulletin 155, Winfrey made some slight revisions to a few of the 18 curve types, and published the equations, tables of the percent surviving, and probable life of each curve at five-percent intervals.[41] Rather than using the original formulas, analysts typically rely on the published tables containing the percentages surviving. This is because absent knowledge of the integration technique applied to each age interval, it is not possible to recreate the exact original published table values. In the 1970s, John Russo collected data from over 2,000 property accounts reflecting

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[39] *Id*.

[40] Robley Winfrey, *Bulletin 125: Statistical Analyses of Industrial Property Retirements* 85, Vol. XXXIV, No. 23 (Iowa State College of Agriculture and Mechanic Arts 1935).

[41] Robley Winfrey, Bulletin 155: Depreciation of Group Properties 121-28, Vol XLI, No. 1 (The Iowa State College Bulletin 1942); see also Wolf supra n. 15, at 305-38 (publishing the percent surviving for each Iowa curve, including "O" type curve, at one percent intervals).

observations during the period 1965 – 1975 as part of his Ph.D. dissertation at Iowa State. Russo essentially repeated Winfrey's data collection, testing, and analysis methods used to develop the original Iowa curves, except that Russo studied industrial property in service several decades after Winfrey published the original Iowa curves. Russo drew three major conclusions from his research:[42]

1. No evidence was found to conclude that the Iowa curve set, as it stands, is not a valid system of standard curves;

2. No evidence was found to conclude that new curve shapes could be produced at this time that would add to the validity of the Iowa curve set; and

3. No evidence was found to suggest that the number of curves within the Iowa curve set should be reduced.

Prior to Russo's study, some had criticized the Iowa curves as being potentially obsolete because their development was rooted in the study of industrial property in existence during the early 1900s. Russo's research, however, negated this criticism by confirming that the Iowa curves represent a sufficiently wide range of life patterns, and that though technology will change over time, the underlying patterns of retirements remain constant and can be adequately described by the Iowa curves.[43]

Over the years, several more curve types have been added to Winfrey's 18 Iowa curves. In 1967, Harold Cowles added four origin-modal curves. In addition, a square curve is sometimes used to depict retirements which are all planned to occur at a given age. Finally, analysts

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[42] *See* Wolf *supra* n. 15, at 37.

[43] *Id*.

commonly rely on several "half curves" derived from the original Iowa curves. Thus, the term "Iowa curves" could be said to describe up to 31 standardized survivor curves.

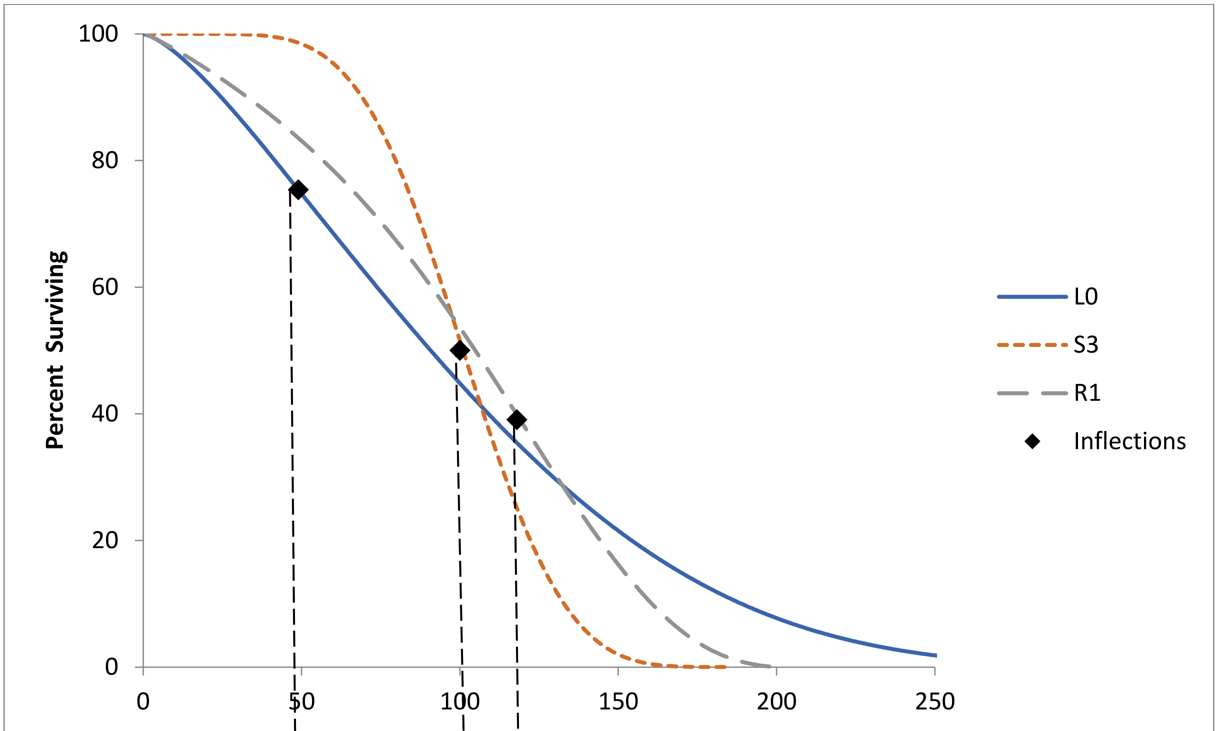
2. Classification

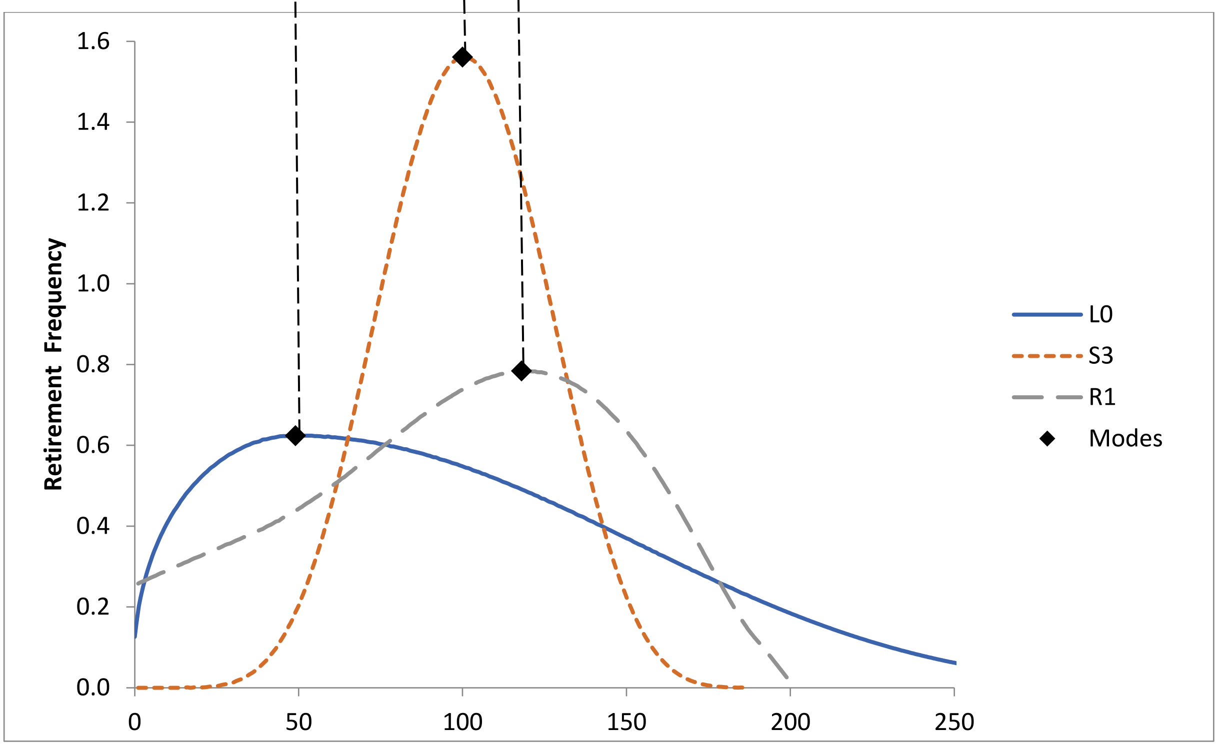
The Iowa curves are classified by three variables: modal location, average life, and variation of life. First, the mode is the percent life that results in the highest point of the frequency curve and the "inflection point" on the survivor curve. The modal age is the age at which the greatest rate of retirement occurs. As illustrated in the figure below, the modes appear at the steepest point of each survivor curve in the top graph, as well as the highest point of each corresponding frequency curve in the bottom graph.

The classification of the survivor curves was made according to whether the mode of the retirement frequency curves was to the left, to the right, or coincident with average service life. There are three modal "families" of curves: six left modal curves (L0, L1, L2, L3, L4, L5); five right modal curves (R1, R2, R3, R4, R5); and seven symmetrical curves (S0, S1, S2, S3, S4, S5, S6).[44] In the figure below, one curve from each family is shown: L0, S3 and R1, with average life at 100 on the x-axis. It is clear from the graphs that the modes for the L0 and R1 curves appear to the left and right of average life respectively, while the S3 mode is coincident with average life.

[44] In 1967, Harold A. Cowles added four origin-modal curves known as "O type" curves. There are also several "half" curves and a square curve, so the total amount of survivor curves commonly called "Iowa" curves is about 31 (see NARUC supra n. 119, at 68).

Figure 2:
Modal Age Illustration





The second Iowa curve classification variable is average life. The Iowa curves were designed using a single parameter of age expressed as a percent of average life instead of actual age. This was necessary in order for the curves to be of practical value. As Winfrey notes:

> Since the location of a particular survivor on a graph is affected by both its span in years and the shape of the curve, it is difficult to classify a group of curves unless one of these variables can be controlled. This is easily done by expressing the age in percent of average life."[45]

Because age is expressed in terms of percent of average life, any particular Iowa curve type can be modified to forecast property groups with various average lives.

The third variable, variation of life, is represented by the numbers next to each letter. A lower number (e.g., L1) indicates a relatively low mode, large variation, and large maximum life; a higher number (e.g., L5) indicates a relatively high mode, small variation, and small maximum life. All three classification variables – modal location, average life, and variation of life — are used to describe each Iowa curve. For example, a 13-L1 Iowa curve describes a group of property with a 13-year average life, with the greatest number of retirements occurring before (or to the left of) the average life, and a relatively low mode. The graphs below show these 18 survivor curves, organized by modal family.

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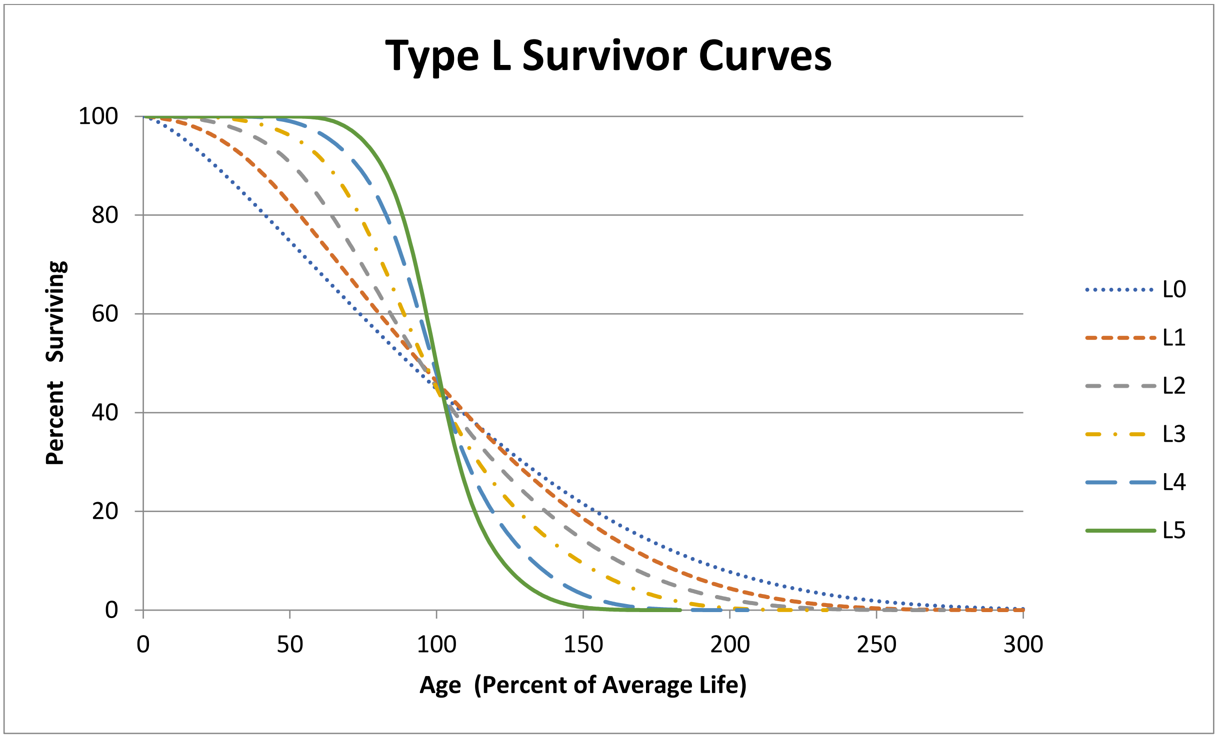
[45] Winfrey *supra* n. 166, at 60.

Figure 3:
Type L Survivor and Frequency Curves



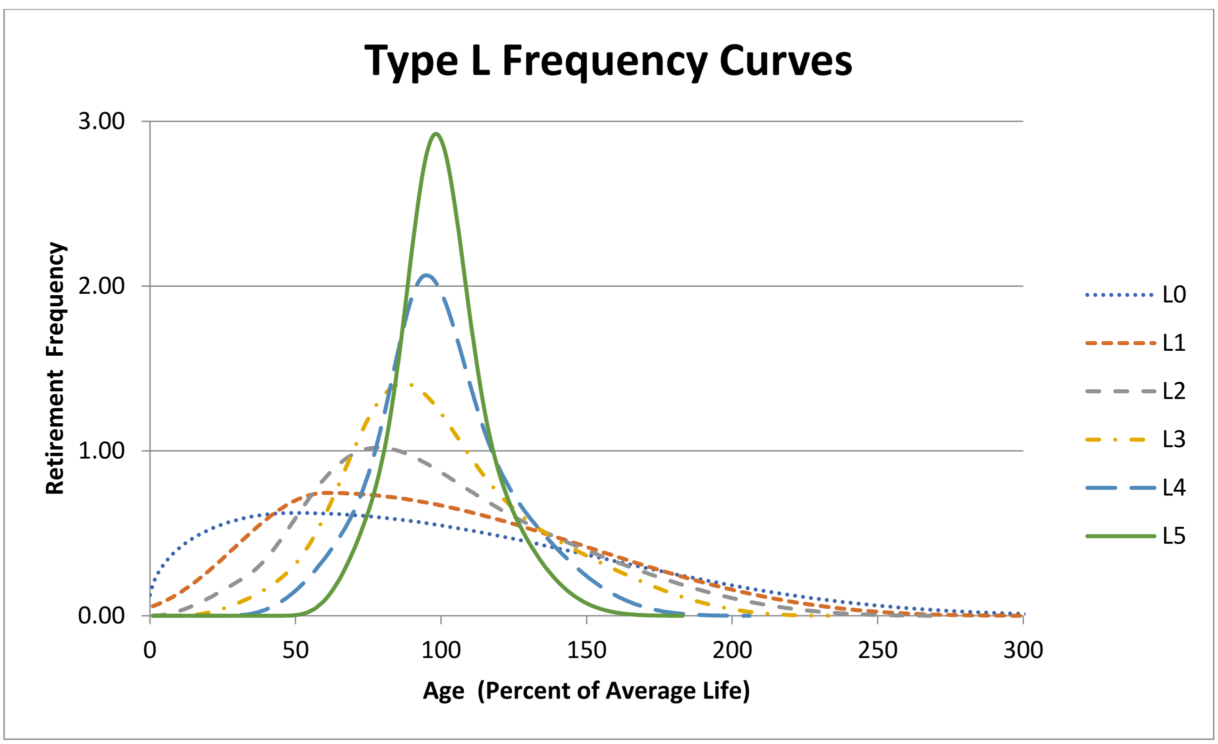
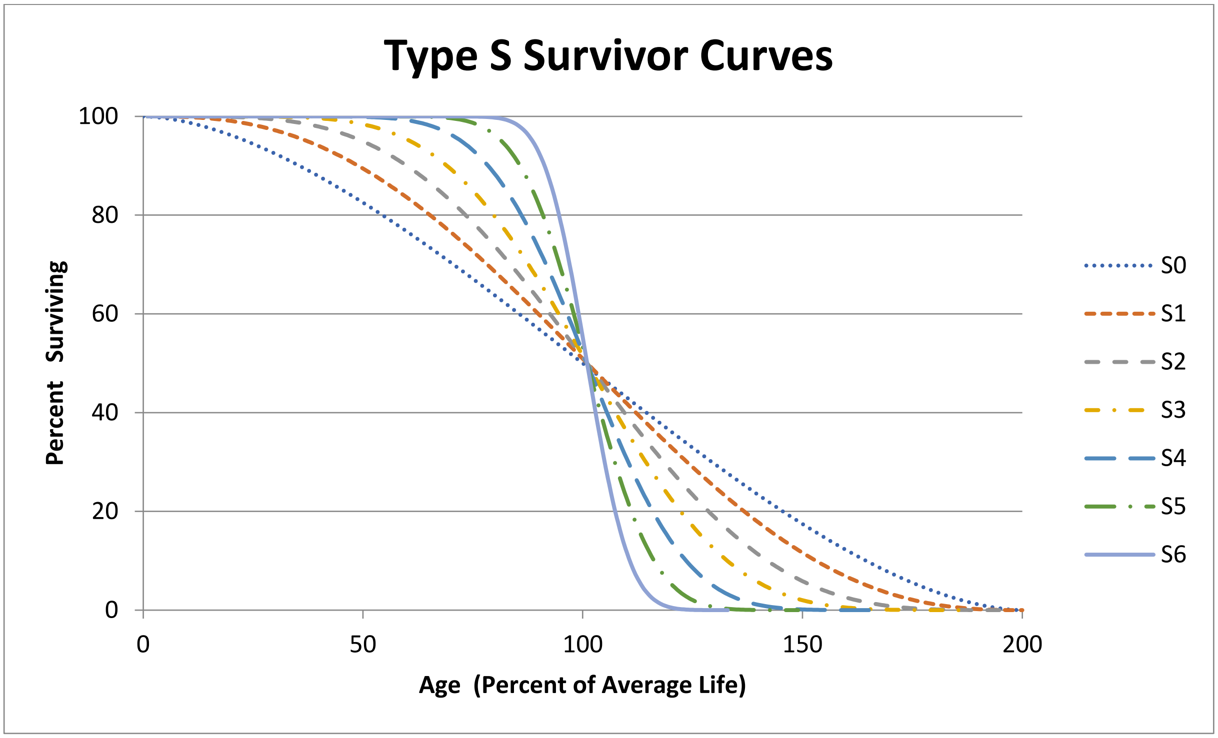


**Figure 4:
Type S Survivor and Frequency Curves**



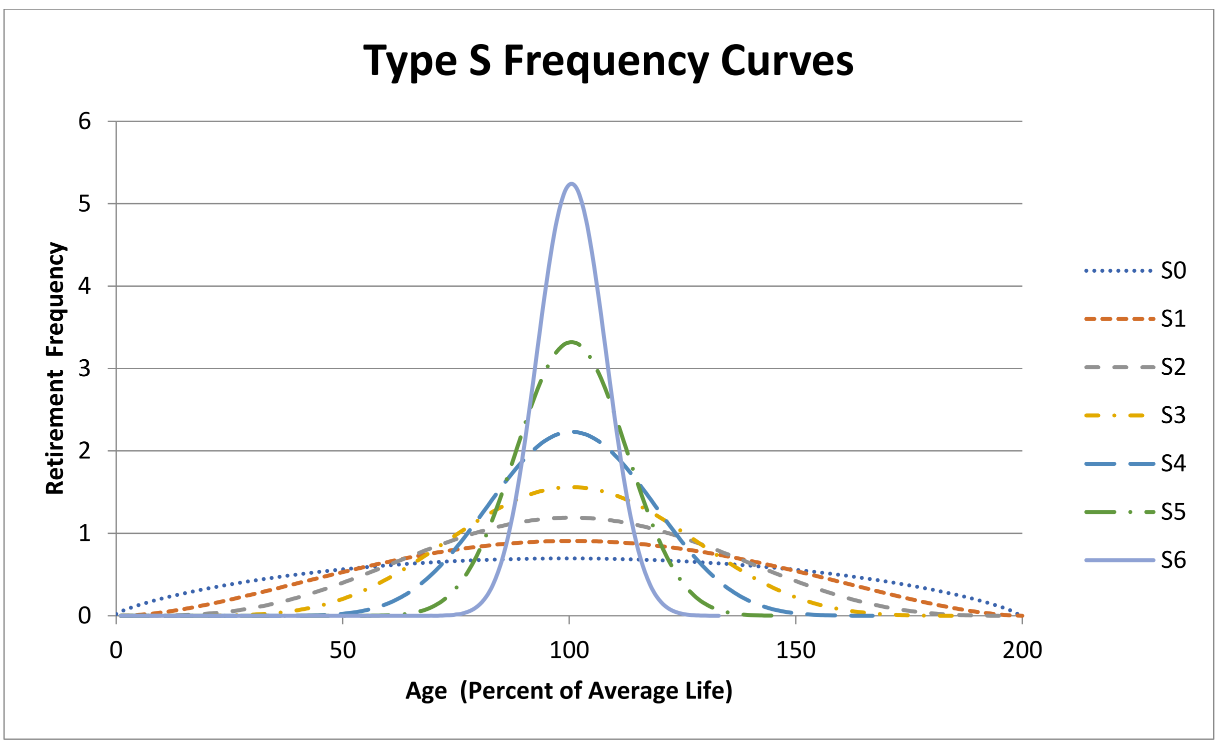
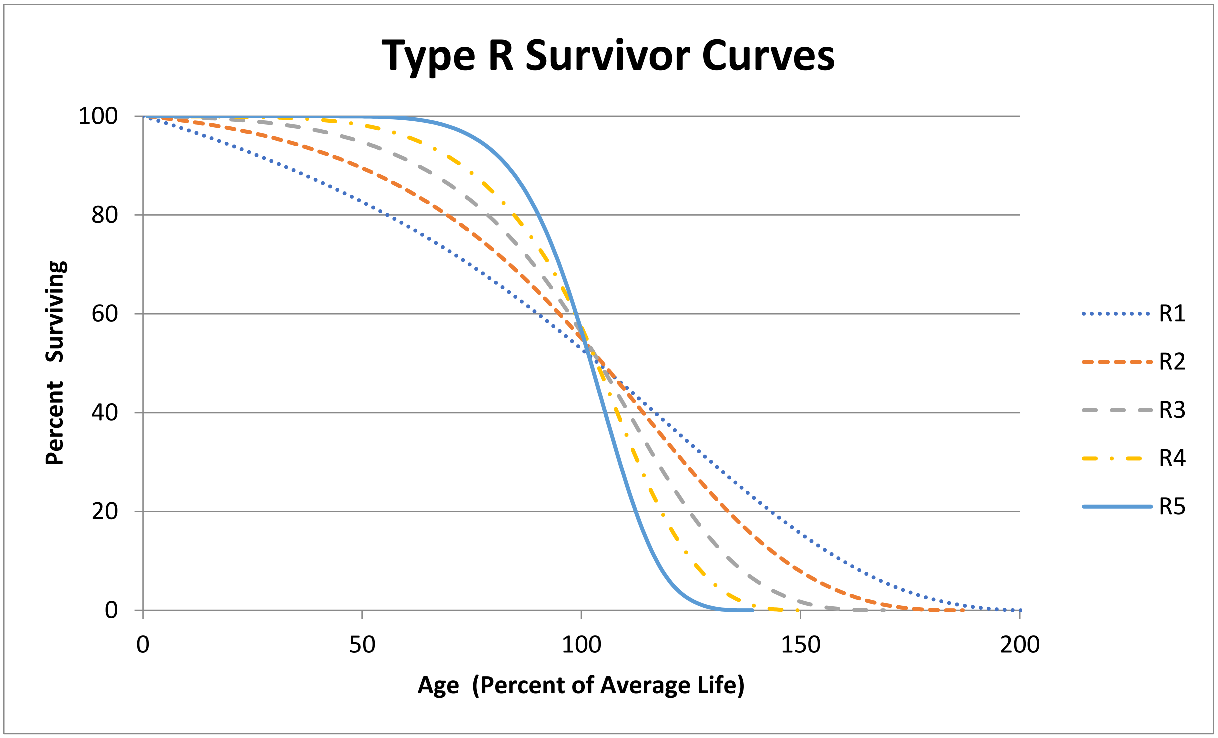
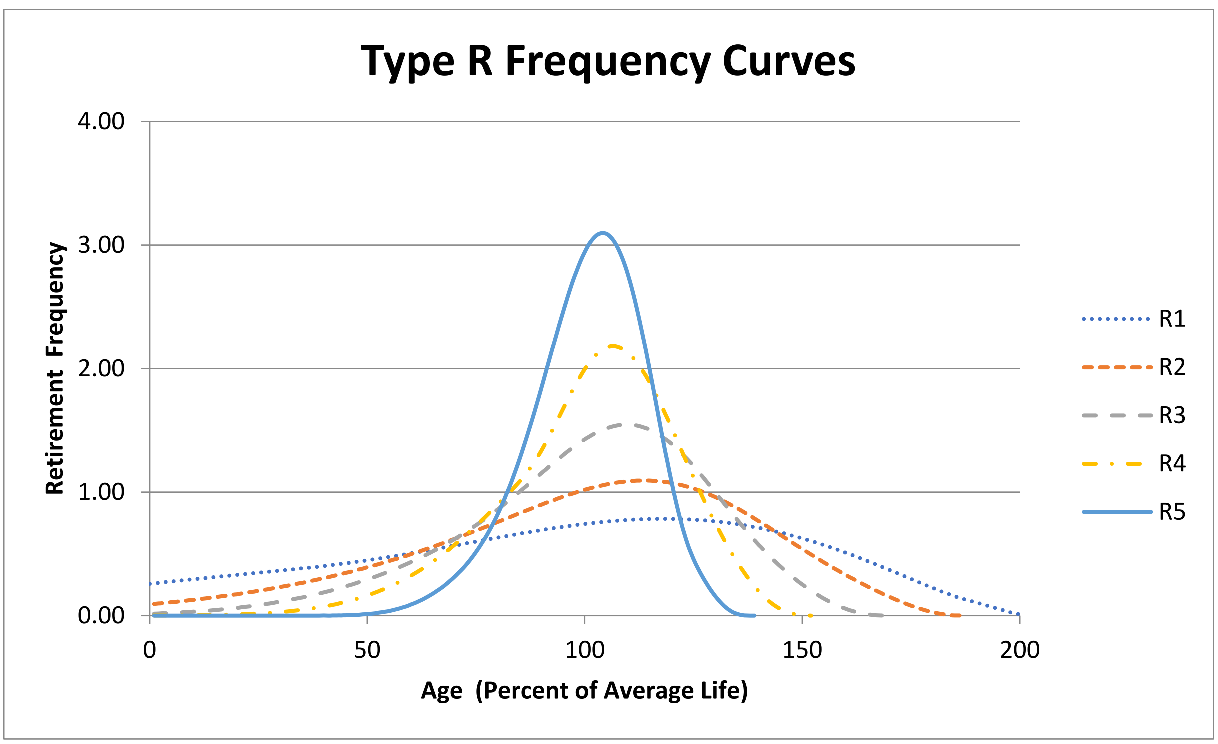


Figure 5:
Type R Survivor and Frequency Curves





As shown in the graphs above, the modes for the L family frequency curves occur to the left of average life (100% on the x-axis), while the S family modes occur at the average, and the R family modes occur after the average.

3. <u>Types of Lives</u>

Several other important statistical analyses and types of lives may be derived from an Iowa curve. These include: 1) average life; 2) realized life; 3) remaining life; and 4) probable life. The figure below illustrates these concepts. It shows the frequency curve, survivor curve, and probable life curve. Age M_x on the x-axis represents the modal age, while age AL_x represents the average age. Thus, this figure illustrates an "L type" Iowa curve since the mode occurs before the average.[46]

First, average life is the area under the survivor curve from age zero to maximum life. Because the survivor curve is measured in percent, the area under the curve must be divided by 100% to convert it from percent-years to years. The formula for average life is as follows:[47]

Equation 9:
Average Life

$$Average\ Life = \frac{Area\ Under\ Survivor\ Curve\ from\ Age\ 0\ to\ Max\ Life}{100\%}$$

Thus, average life may not be determined without a complete survivor curve. Many property groups being analyzed will not have experienced full retirement. This results in a "stub" survivor

[46] From age zero to age M_x on the survivor curve, it could be said that the percent surviving from this property group is decreasing at an increasing rate. Conversely, from point M_x to maximum on the survivor curve, the percent surviving is decreasing at a decreasing rate.

[47] *See* NARUC *supra* n. 119, at 71.

curve. Iowa curves are used to extend stub curves to maximum life in order for the average life calculation to be made (see Exhibit DJG-23, Appendix E).

Realized life is similar to average life, except that realized life is the average years of service experienced to date from the vintage's original installations.[48] As shown in the figure below, realized life is the area under the survivor curve from zero to age RL_X. Likewise, unrealized life is the area under the survivor curve from age RL_X to maximum life. Thus, it could be said that average life equals realized life plus unrealized life.

Average remaining life represents the future years of service expected from the surviving property.[49] Remaining life is sometimes referred to as "average remaining life" and "life expectancy." To calculate average remaining life at age x, the area under the estimated future potion of the survivor curve is divided by the percent surviving at age x (denoted S_X). Thus, the average remaining life formula is:

Equation 10:
Average Remaining Life

$$Average\ Remaining\ Life\ = \frac{Area\ Under\ Survivor\ Curve\ from\ Age\ x\ to\ Max\ Life}{S_X}$$

It is necessary to determine average remaining life in order to calculate the annual accrual under the remaining life technique.

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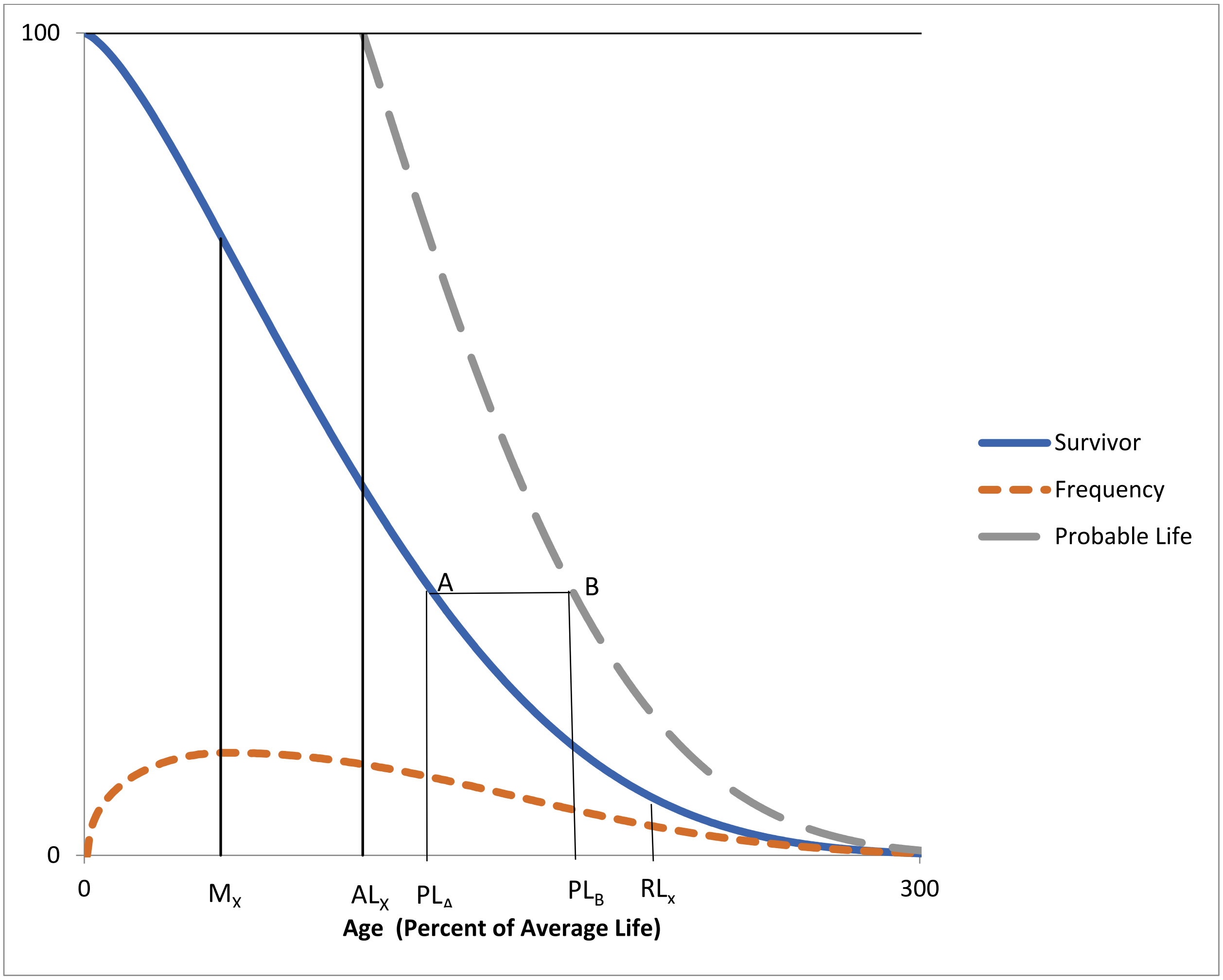
[48] *Id*. at 73.

[49] *Id*. at 74.

Figure 6:
Iowa Curve Derivations



Finally, the probable life may also be determined from the Iowa curve. The probable life of a property group is the total life expectancy of the property surviving at any age and is equal to the remaining life plus the current age.[50] The probable life is also illustrated in this figure. The probable life at age PL_A is the age at point PL_B. Thus, to read the probable life at age PL_A, see the corresponding point on the survivor curve above at point "A," then horizontally to point "B" on

[50] Wolf *supra* n. 15, at 28.

the probable life curve, and back down to the age corresponding to point "B." It is no coincidence that the vertical line from AL_X connects at the top of the probable life curve. This is because at age zero, probable life equals average life.

APPENDIX E:

ACTUARIAL ANALYSIS

Actuarial science is a discipline that applies various statistical methods to assess risk probabilities and other related functions. Actuaries often study human mortality. The results from historical mortality data are used to predict how long similar groups of people who are alive will live today. Insurance companies rely of actuarial analysis in determining premiums for life insurance policies.

The study of human mortality is analogous to estimating service lives of industrial property groups. While some humans die solely from chance, most deaths are related to age; that is, death rates generally increase as age increases. Similarly, physical plant is also subject to forces of retirement. These forces include physical, functional, and contingent factors, as shown in the table below.[51]

Figure 7:
Forces of Retirement

Physical Factors	Functional Factors	Contingent Factors
Wear and tear Decay or deterioration Action of the elements	Inadequacy Obsolescence Changes in technology Regulations Managerial discretion	Casualties or disasters Extraordinary obsolescence

While actuaries study historical mortality data in order to predict how long a group of people will live, depreciation analysts must look at a utility's historical data in order to estimate the average lives of property groups. A utility's historical data is often contained in the Continuing Property Records ("CPR"). Generally, a CPR should contain 1) an inventory of property record

[51] NARUC *supra* n. 119, at 14-15.

units; 2) the association of costs with such units; and 3) the dates of installation and removal of plant. Since actuarial analysis includes the examination of historical data to forecast future retirements, the historical data used in the analysis should not contain events that are anomalous or unlikely to recur.[52] Historical data is used in the retirement rate actuarial method, which is discussed further below.

The Retirement Rate Method

There are several systematic actuarial methods that use historical data in order to calculate observed survivor curves for property groups. Of these methods, the retirement rate method is superior, and is widely employed by depreciation analysts.[53] The retirement rate method is ultimately used to develop an observed survivor curve, which can be fitted with an Iowa curve discussed in Exhibit DJG-23, Appendix D in order to forecast average life. The observed survivor curve is calculated by using an observed life table ("OLT"). The figures below illustrate how the OLT is developed. First, historical property data are organized in a matrix format, with placement years on the left forming rows, and experience years on the top forming columns. The placement year (a.k.a. "vintage year" or "installation year") is the year of placement of a group of property. The experience year (a.k.a. "activity year") refers to the accounting data for a particular calendar year. The two matrices below use aged data — that is, data for which the dates of placements, retirements, transfers, and other transactions are known. Without aged data, the retirement rate actuarial method may not be employed. The first matrix is the exposure matrix, which shows the

[52] *Id*. at 112-13.

[53] Anson Marston, Robley Winfrey & Jean C. Hempstead, *Engineering Valuation and Depreciation* 154 (2nd ed., McGraw-Hill Book Company, Inc. 1953).

exposures at the beginning of each year.[54] An exposure is simply the depreciable property subject to retirement during a period. The second matrix is the retirement matrix, which shows the annual retirements during each year. Each matrix covers placement years 2003–2015, and experience years 2008-2015. In the exposure matrix, the number in the 2009 experience column and the 2003 placement row is $192,000. This means at the beginning of 2012, there was $192,000 still exposed to retirement from the vintage group placed in 2003. Likewise, in the retirement matrix, $19,000 of the dollars invested in 2003 was retired during 2012.

Figure 8:
Exposure Matrix

	Experience Years Exposures at January 1 of Each Year (Dollars in 000's)									
Placement Years	2008	2009	2010	2011	2012	2013	2014	2015	Total at Start of Age Interval	Age Interval
2003	261	245	228	211	**192**	173	152	131	131	11.5 - 12.5
2004	267	252	236	220	202	**184**	165	145	297	10.5 - 11.5
2005	304	291	277	263	248	232	**216**	198	536	9.5 - 10.5
2006	345	334	322	310	298	284	270	**255**	**847**	8.5 - 9.5
2007	367	357	347	335	324	312	299	286	1,201	7.5 - 8.5
2008	375	366	357	347	336	325	314	302	1,581	6.5 - 7.5
2009		377	366	356	346	336	327	319	1,986	5.5 - 6.5
2010			381	369	358	347	336	327	2,404	4.5 - 5.5
2011				386	372	359	346	334	2,559	3.5 - 4.5
2012					395	380	366	352	2,722	2.5 - 3.5
2013						401	385	370	2,866	1.5 - 2.5
2014							410	393	2,998	0.5 - 1.5
2015								416	3,141	0.0 - 0.5
Total	1919	2222	2514	2796	3070	3333	3586	3827	23,268	

[54] Technically, the last numbers in each column are "gross additions" rather than exposures. Gross additions do not include adjustments and transfers applicable to plant placed in a previous year. Once retirements, adjustments, and transfers are factored in, the balance at the beginning of the next account period is called an "exposure" rather than an addition.

Figure 9:
Retirement Matrix

	Experience Years Retirments During the Year (Dollars in 000's)									
Placement Years	2008	2009	2010	2011	2012	2013	2014	2015	Total During Age Interval	Age Interval
2003	16	17	18	19	**19**	20	21	23	23	11.5 - 12.5
2004	15	16	17	17	18	**19**	20	21	43	10.5 - 11.5
2005	13	14	14	15	16	17	**17**	18	59	9.5 - 10.5
2006	11	12	12	13	13	14	15	**15**	**71**	8.5 - 9.5
2007	10	11	11	12	12	13	13	14	82	7.5 - 8.5
2008	9	9	10	10	11	11	12	13	91	6.5 - 7.5
2009		11	10	10	9	9	9	8	95	5.5 - 6.5
2010			12	11	11	10	10	9	100	4.5 - 5.5
2011				14	13	13	12	11	93	3.5 - 4.5
2012					15	14	14	13	91	2.5 - 3.5
2013						16	15	14	93	1.5 - 2.5
2014							17	16	100	0.5 - 1.5
2015								18	112	0.0 - 0.5
Total	74	89	104	121	139	157	175	194	1,052	

These matrices help visualize how exposure and retirement data are calculated for each age interval. An age interval is typically one year. A common convention is to assume that any unit installed during the year is installed in the middle of the calendar year (i.e., July 1st). This convention is called the "half-year convention" and effectively assumes that all units are installed uniformly during the year.[55] Adoption of the half-year convention leads to age intervals of 0-0.5 years, 0.5-1.5 years, etc., as shown in the matrices.

The purpose of the matrices is to calculate the totals for each age interval, which are shown in the second column from the right in each matrix. This column is calculated by adding each number from the corresponding age interval in the matrix. For example, in the exposure matrix, the total amount of exposures at the beginning of the 8.5-9.5 age interval is $847,000. This number was calculated by adding the numbers shown on the "stairs" to the left (192+184+216+255=847).

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[55] Wolf *supra* n. 15, at 22.

The same calculation is applied to each number in the column. The amounts retired during the year in the retirements matrix affect the exposures at the beginning of each year in the exposures matrix. For example, the amount exposed to retirement in 2008 from the 2003 vintage is $261,000. The amount retired during 2008 from the 2003 vintage is $16,000. Thus, the amount exposed to retirement in 2009 from the 2003 vintage is $245,000 ($261,000 - $16,000). The company's property records may contain other transactions which affect the property, including sales, transfers, and adjusting entries. Although these transactions are not shown in the matrices above, they would nonetheless affect the amount exposed to retirement at the beginning of each year.

The totaled amounts for each age interval in both matrices are used to form the exposure and retirement columns in the OLT, as shown in the chart below. This chart also shows the retirement ratio and the survivor ratio for each age interval. The retirement ratio for an age interval is the ratio of retirements during the interval to the property exposed to retirement at the beginning of the interval. The retirement ratio represents the probability that the property surviving at the beginning of an age interval will be retired during the interval. The survivor ratio is simply the complement to the retirement ratio (1 – retirement ratio). The survivor ratio represents the probability that the property surviving at the beginning of an age interval will survive to the next age interval.

**Figure 10:
Observed Life Table**

Age at Start of Interval	Exposures at Start of Age Interval	Retirements During Age Interval	Retirement Ratio	Survivor Ratio	Percent Surviving at Start of Age Interval
A	B	C	D = C / B	E = 1 - D	F
0.0	3,141	112	0.036	0.964	**100.00**
0.5	2,998	100	0.033	0.967	**96.43**
1.5	2,866	93	0.032	0.968	**93.21**
2.5	2,722	91	0.033	0.967	**90.19**
3.5	2,559	93	0.037	0.963	**87.19**
4.5	2,404	100	0.042	0.958	**84.01**
5.5	1,986	95	0.048	0.952	**80.50**
6.5	1,581	91	0.058	0.942	**76.67**
7.5	1,201	82	0.068	0.932	**72.26**
8.5	847	71	0.084	0.916	**67.31**
9.5	536	59	0.110	0.890	**61.63**
10.5	297	43	0.143	0.857	**54.87**
11.5	131	23	0.172	0.828	**47.01**
					38.91
Total	23,268	1,052			

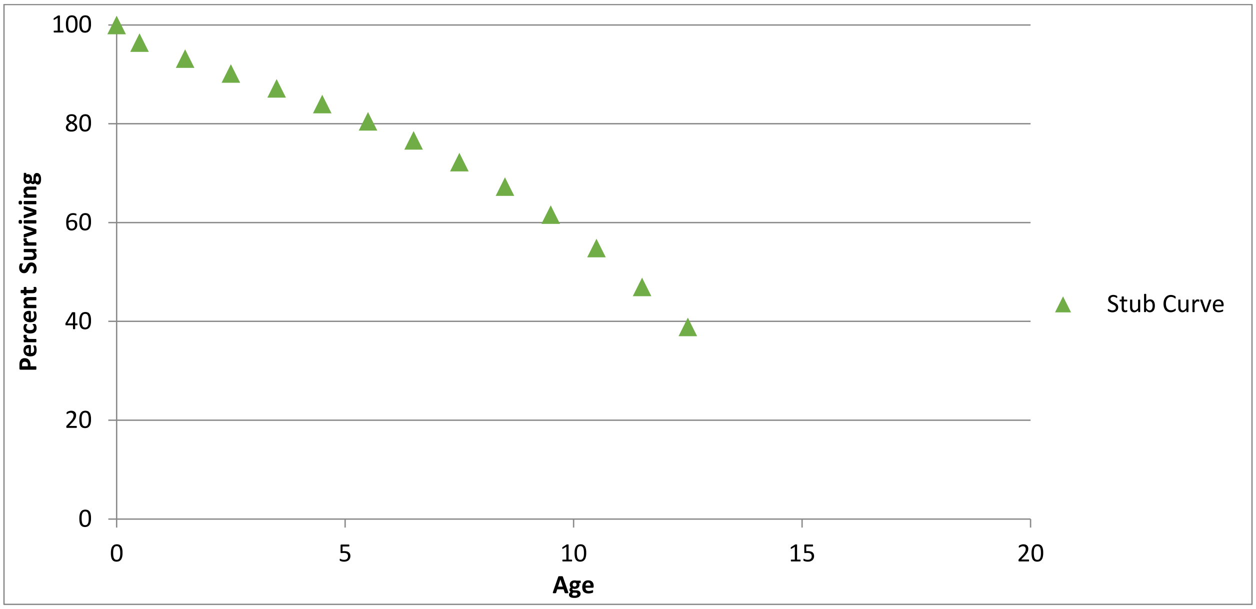
Column F on the right shows the percentages surviving at the beginning of each age interval. This column starts at 100% surviving. Each consecutive number below is calculated by multiplying the percent surviving from the previous age interval by the corresponding survivor ratio for that age interval. For example, the percent surviving at the start of age interval 1.5 is 93.21%, which was calculated by multiplying the percent surviving for age interval 0.5 (96.43%) by the survivor ratio for age interval 0.5 (0.967)[56].

The percentages surviving in Column F are the numbers that are used to form the original survivor curve. This particular curve starts at 100% surviving and ends at 38.91% surviving. An

[56] Multiplying 96.43 by 0.967 does not equal 93.21 exactly due to rounding.

observed survivor curve such as this that does not reach zero percent surviving is called a "stub" curve. The figure below illustrates the stub survivor curve derived from the OLT table above.

Figure 11:
Original "Stub" Survivor Curve



The matrices used to develop the basic OLT and stub survivor curve provide a basic illustration of the retirement rate method in that only a few placement and experience years were used. In reality, analysts may have several decades of aged property data to analyze. In that case, it may be useful to use a technique called "banding" in order to identify trends in the data.

<u>Banding</u>

The forces of retirement and characteristics of industrial property are constantly changing. A depreciation analyst may examine the magnitude of these changes. Analysts often use a technique called "banding" to assist with this process. Banding refers to the merging of several years of data into a single data set for further analysis, and it is a common technique associated with the retirement rate method.[57] There are three primary benefits of using bands in depreciation analysis:

1. Increasing the sample size. In statistical analyses, the larger the sample size in relation to the body of total data, the greater the reliability of the result;
2. Smooth the observed data. Generally, the data obtained from a single activity or vintage year will not produce an observed life table that can be easily fit; and
3. Identify trends. By looking at successive bands, the analyst may identify broad trends in the data that may be useful in projecting the future life characteristics of the property.[58]

Two common types of banding methods are the "placement band" method and the "experience band" method." A placement band, as the name implies, isolates selected placement years for analysis. The figure below illustrates the same exposure matrix shown above, except that only the placement years 2005-2008 are considered in calculating the total exposures at the beginning of each age interval.

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[57] NARUC *supra* n. 119, at 113.

[58] *Id*.

Figure 12:
Placement Bands

Placement Years	Experience Years: Exposures at January 1 of Each Year (Dollars in 000's)								Total at Start of Age Interval	Age Interval
	2008	2009	2010	2011	2012	2013	2014	2015		
2003	261	245	228	211	192	173	152	131		11.5 - 12.5
2004	267	252	236	220	202	184	165	145		10.5 - 11.5
2005	304	291	277	263	248	232	216	198	198	9.5 - 10.5
2006	345	334	322	310	298	284	270	255	471	8.5 - 9.5
2007	367	357	347	335	324	312	299	286	788	7.5 - 8.5
2008	375	366	357	347	336	325	314	302	1,133	6.5 - 7.5
2009		377	366	356	346	336	327	319	1,186	5.5 - 6.5
2010			381	369	358	347	336	327	1,237	4.5 - 5.5
2011				386	372	359	346	334	1,285	3.5 - 4.5
2012					395	380	366	352	1,331	2.5 - 3.5
2013						401	385	370	1,059	1.5 - 2.5
2014							410	393	733	0.5 - 1.5
2015								416	375	0.0 - 0.5
Total	1919	2222	2514	2796	3070	3333	3586	3827	9,796	

The shaded cells within the placement band equal the total exposures at the beginning of age interval 4.5–5.5 ($1,237). The same placement band would be used for the retirement matrix covering the same placement years of 2005 – 2008. This of course would result in a different OLT and original stub survivor curve than those that were calculated above without the restriction of a placement band.

Analysts often use placement bands for comparing the survivor characteristics of properties with different physical characteristics.[59] Placement bands allow analysts to isolate the effects of changes in technology and materials that occur in successive generations of plant. For example, if in 2005 an electric utility began placing transmission poles with a special chemical treatment that extended the service lives of the poles, an analyst could use placement bands to isolate and analyze the effect of that change in the property group's physical characteristics. While placement

[59] Wolf *supra* n. 15, at 182.

bands are very useful in depreciation analysis, they also possess an intrinsic dilemma. A fundamental characteristic of placement bands is that they yield fairly complete survivor curves for older vintages. However, with newer vintages, which are arguably more valuable for forecasting, placement bands yield shorter survivor curves. Longer "stub" curves are considered more valuable for forecasting average life. Thus, an analyst must select a band width broad enough to provide confidence in the reliability of the resulting curve fit yet narrow enough so that an emerging trend may be observed.[60]

Analysts also use "experience bands." Experience bands show the composite retirement history for all vintages during a select set of activity years. The figure below shows the same data presented in the previous exposure matrices, except that the experience band from 2011 – 2013 is isolated, resulting in different interval totals.

[60] NARUC *supra* n. 119, at 114.

Figure 13:
Experience Bands

Placement Years	2008	2009	2010	2011	2012	2013	2014	2015	Total at Start of Age Interval	Age Interval
	Experience Years Exposures at January 1 of Each Year (Dollars in 000's)									
2003	261	245	228	211	192	173	152	131		11.5 - 12.5
2004	267	252	236	220	202	184	165	145		10.5 - 11.5
2005	304	291	277	263	248	232	216	198	173	9.5 - 10.5
2006	345	334	322	310	298	284	270	255	376	8.5 - 9.5
2007	367	357	347	335	324	312	299	286	645	7.5 - 8.5
2008	375	366	357	347	336	325	314	302	752	6.5 - 7.5
2009		377	366	356	346	336	327	319	872	5.5 - 6.5
2010			381	369	358	347	336	327	959	4.5 - 5.5
2011				386	372	359	346	334	1,008	3.5 - 4.5
2012					395	380	366	352	1,039	2.5 - 3.5
2013						401	385	370	1,072	1.5 - 2.5
2014							410	393	1,121	0.5 - 1.5
2015								416	1,182	0.0 - 0.5
Total	1919	2222	2514	2796	3070	3333	3586	3827	9,199	

The shaded cells within the experience band equal the total exposures at the beginning of age interval 4.5–5.5 ($1,237). The same experience band would be used for the retirement matrix covering the same experience years of 2011 – 2013. This of course would result in a different OLT and original stub survivor than if the band had not been used. Analysts often use experience bands to isolate and analyze the effects of an operating environment over time.[61] Likewise, the use of experience bands allows analysis of the effects of an unusual environmental event. For example, if an unusually severe ice storm occurred in 2013, destruction from that storm would affect an electric utility's line transformers of all ages. That is, each of the line transformers from each placement year would be affected, including those recently installed in 2012, as well as those installed in 2003. Using experience bands, an analyst could isolate or even eliminate the 2013 experience year from the analysis. In contrast, a placement band would not effectively isolate the

[61] *Id.*

ice storm's effect on life characteristics. Rather, the placement band would show an unusually large rate of retirement during 2013, making it more difficult to accurately fit the data with a smooth Iowa curve. Experience bands tend to yield the most complete stub curves for recent bands because they have the greatest number of vintages included. Longer stub curves are better for forecasting. The experience bands, however, may also result in more erratic retirement dispersion making the curve fitting process more difficult.

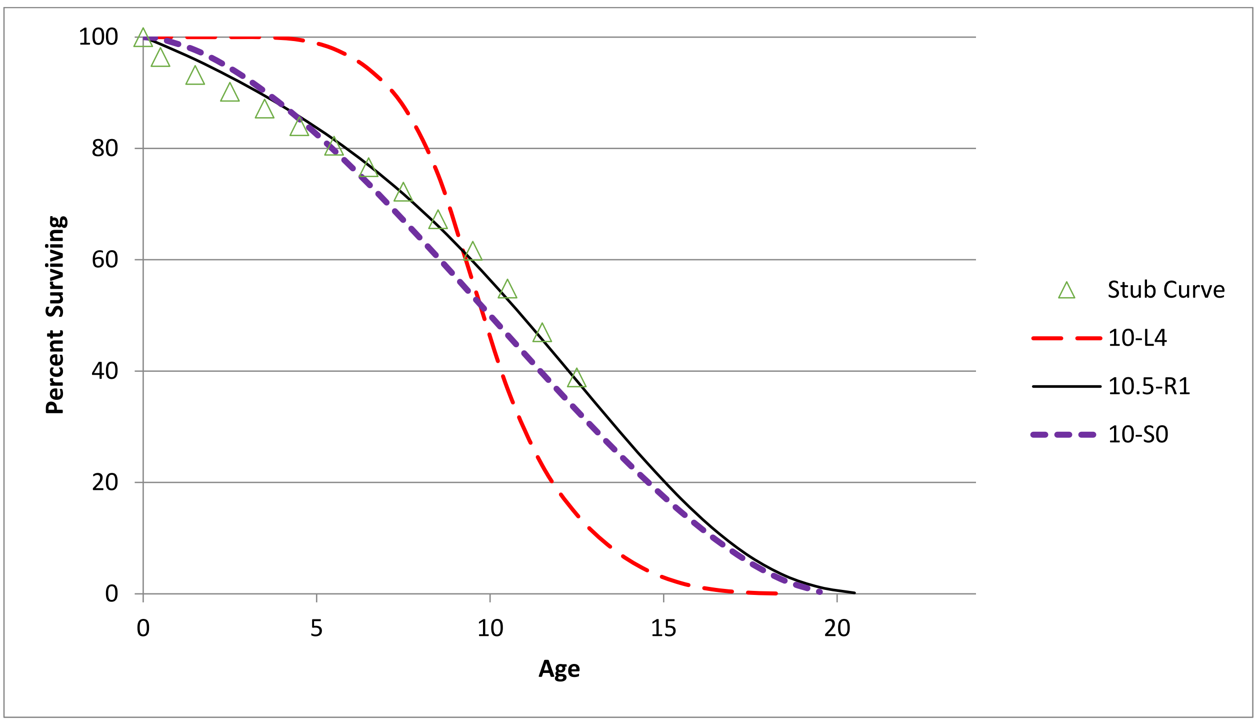
Depreciation analysts must use professional judgment in determining the types of bands to use and the band widths. In practice, analysts may use various combinations of placement and experience bands in order to increase the data sample size, identify trends and changes in life characteristics, and isolate unusual events. Regardless of which bands are used, observed survivor curves in depreciation analysis rarely reach zero percent. This is because, as seen in the OLT above, relatively newer vintage groups have not yet been fully retired at the time the property is studied. An analyst could confine the analysis to older, fully retired vintage groups in order to get complete survivor curves, but such analysis would ignore some the property currently in service and would arguably not provide an accurate description of life characteristics for current plant in service. Because a complete curve is necessary to calculate the average life of the property group, however, curve fitting techniques using Iowa curves or other standardized curves may be employed in order to complete the stub curve.

Curve Fitting

Depreciation analysts typically use the survivor curve rather than the frequency curve to fit the observed stub curves. The most commonly used generalized survivor curves used in the curve fitting process are the Iowa curves discussed above. As Wolf notes, if "the Iowa curves are adopted as a model, an underlying assumption is that the process describing the retirement pattern is one of the 22 [or more] processes described by the Iowa curves."[62]

Curve fitting may be done through visual matching or mathematical matching. In visual curve fitting, the analyst visually examines the plotted data to make an initial judgment about the Iowa curves that may be a good fit. The figure below illustrates the stub survivor curve shown above. It also shows three different Iowa curves: the 10-L4, the 10.5-R1, and the 10-S0. Visually, it is clear that the 10.5-R1 curve is a better fit than the other two curves.

Figure 14:
Visual Curve Fitting



In mathematical fitting, the least squares method is used to calculate the best fit. This mathematical method would be excessively time consuming if done by hand. With the use of

[62] Wolf *supra* n. 15, at 46 (22 curves includes Winfrey's 18 original curves plus Cowles's four "O" type curves).

modern computer software however, mathematical fitting is an efficient and useful process. The typical logic for a computer program, as well as the software employed for the analysis in this testimony is as follows:

> First (an Iowa curve) curve is arbitrarily selected. . . . If the observed curve is a stub curve, . . . calculate the area under the curve and up to the age at final data point. Call this area the realized life. Then systematically vary the average life of the theoretical survivor curve and calculate its realized life at the age corresponding to the study date. This trial and error procedure ends when you find an average life such that the realized life of the theoretical curve equals the realized life of the observed curve. Call this the average life.
>
> Once the average life is found, calculate the difference between each percent surviving point on the observed survivor curve and the corresponding point on the Iowa curve. Square each difference and sum them. The sum of squares is used as a measure of goodness of fit for that particular Iowa type curve. This procedure is repeated for the remaining 21 Iowa type curves. The "best fit" is declared to be the type of curve that minimizes the sum of differences squared.[63]

Mathematical fitting requires less judgment from the analyst and is thus less subjective. Blind reliance on mathematical fitting, however, may lead to poor estimates. Thus, analysts should employ both mathematical and visual curve fitting in reaching their final estimates. This way, analysts may utilize the objective nature of mathematical fitting while still employing professional judgment. As Wolf notes: "The results of mathematical curve fitting serve as a guide for the analyst and speed the visual fitting process. But the results of the mathematical fitting should be checked visually and the final determination of the best fit be made by the analyst."[64]

In the graph above, visual fitting was sufficient to determine that the 10.5-R1 Iowa curve was a better fit than the 10-L4 and the 10-S0 curves. Using the sum of least squares method, mathematical fitting confirms the same result. In the chart below, the percentages surviving from

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[63] Wolf *supra* n. 15, at 47.

[64] *Id*. at 48.

the OLT that formed the original stub curve are shown in the left column, while the corresponding percentages surviving for each age interval are shown for the three Iowa curves. The right portion of the chart shows the differences between the points on each Iowa curve and the stub curve. These differences are summed at the bottom. Curve 10.5-R1 is the best fit because the sum of the squared differences for this curve is less than the same sum of the other two curves. Curve 10-L4 is the worst fit, which was also confirmed visually.

Figure 15:
Mathematical Fitting

Age	Stub	Iowa Curves			Squared Differences		
Interval	Curve	10-L4	10-S0	10.5-R1	10-L4	10-S0	10.5-R1
0.0	100.0	100.0	100.0	100.0	0.0	0.0	0.0
0.5	96.4	100.0	99.7	98.7	12.7	10.3	5.3
1.5	93.2	100.0	97.7	96.0	46.1	19.8	7.6
2.5	90.2	100.0	94.4	92.9	96.2	18.0	7.2
3.5	87.2	100.0	90.2	89.5	162.9	9.3	5.2
4.5	84.0	99.5	85.3	85.7	239.9	1.6	2.9
5.5	80.5	97.9	79.7	81.6	301.1	0.7	1.2
6.5	76.7	94.2	73.6	77.0	308.5	9.5	0.1
7.5	72.3	87.6	67.1	71.8	235.2	26.5	0.2
8.5	67.3	75.2	60.4	66.1	62.7	48.2	1.6
9.5	61.6	56.0	53.5	59.7	31.4	66.6	3.6
10.5	54.9	36.8	46.5	52.9	325.4	69.6	3.9
11.5	47.0	23.1	39.6	45.7	572.6	54.4	1.8
12.5	38.9	14.2	32.9	38.2	609.6	36.2	0.4
SUM					**3004.2**	**371.0**	**41.0**